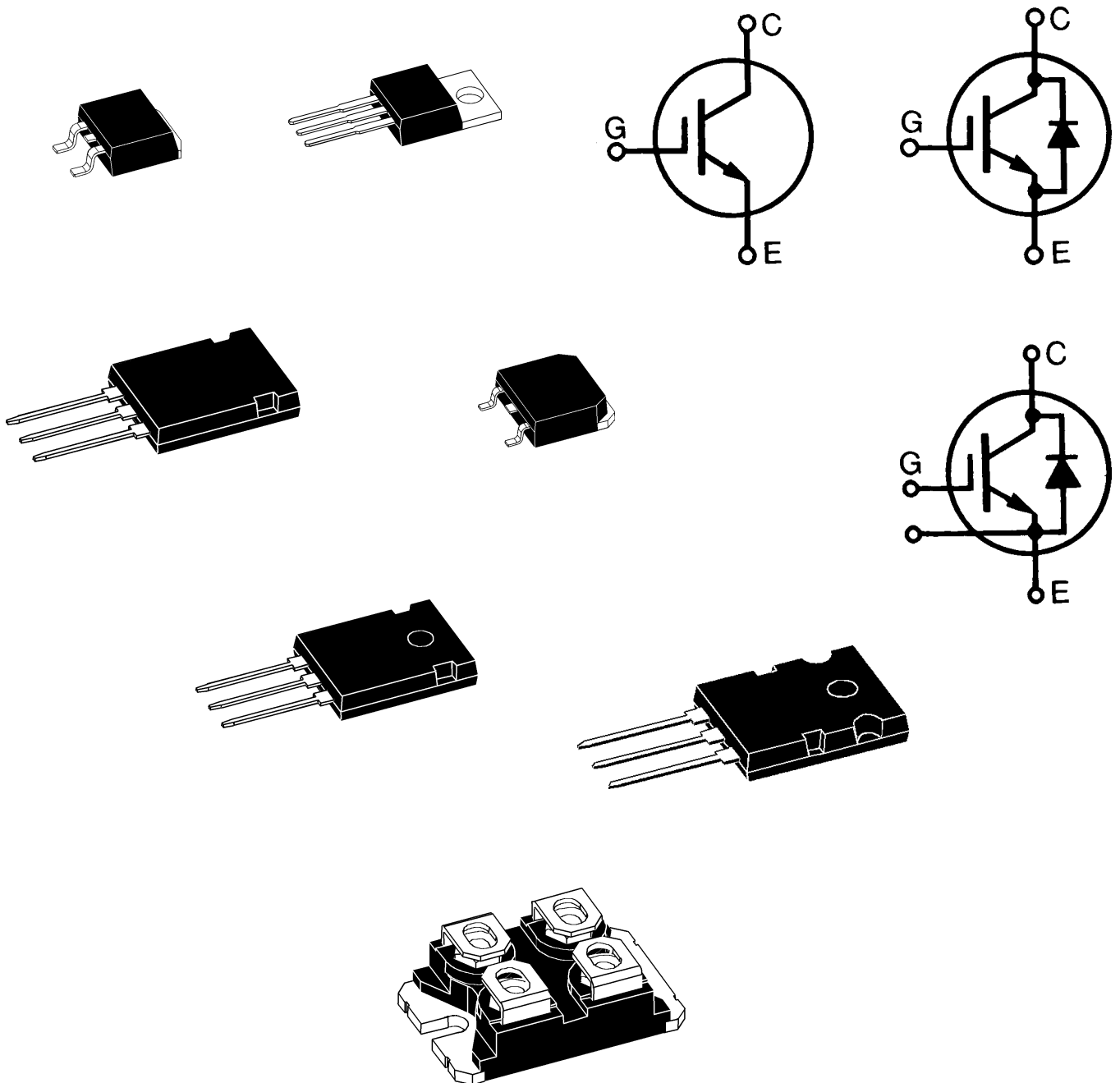


***Insulated Gate
Bipolar Transistors (IGBT)
IGBT with Fast Diode***



Contents



	V_{CES} V	I_C $T_C = 25^\circ C$ A	$V_{CE(sat)max}$ $T_C = 25^\circ C$ V	TO-220 (IXGP)	TO-263 (IXGA)	TO-247 (IXGH)	PLUS247 (IXGX)	TO-268 (IXGT)	ISOPLUS247™ (IXGR)	TO-264 (IXGK)	miniBLOC (IXGN)	Page
Low $V_{CE(sat)}$	300	40	1.6			➤ IXGH 20N30		➤ IXGT 28N30				B2-6
		56	1.8			➤ IXGH 28N30						B2-8
	600	60	1.6			IXGH 30N30						B2-14
			1.8			IXGH 40N30						B2-20
		40	1.7			IXGH 31N60		IXGT 31N60				B2-105
		75 ①	1.6			➤ IXGH 41N60						B2-141
		75 ①	1.6			IXGH 60N60		IXGT 60N60		IXGK 60N60		B2-161
			1.8							IXGN 60N60		B2-165
		200	2.5							IXGN 200N60		B2-174
	1000	3	3.5	IXGP 2N100								B2-184
		16	2.7	IXGA 8N100 IXGP 8N100								B2-186
		24	3.5	IXGA 12N100 IXGP 12N100								B2-188
			3.5			IXGH 12N100						B2-188
		40	3.0			IXGH 20N100		IXGT 20N100				B2-205
			3.0	IXGA 20N100 IXGP 20N100								B2-207
	1200	40	2.5			IXGH 20N120		IXGT 20N120				B2-219
		75	2.5			IXGH 45N120		IXGT 45N120				B2-225
High Speed	300	56	2.1			IXGH 28N30A		IXGT 28N30A				B2-10
			2.4			IXGH 28N30B		IXGT 28N30B				B2-12
		60	2.1 2.4			IXGH 40N30A IXGH 40N30B						B2-20 B2-20
	500	48	2.3			IXGH 24N50B						B2-26
	600	14	1.8	IXGA 7N60B IXGP 7N60B								B2-42 B2-42
			2.5	IXGA 7N60C IXGP 7N60C								B2-44 B2-44
		15	2.1					IXGR 12N60C				B2-64
		24	2.1			IXGH 12N60B						B2-48
			2.1	IXGA 12N60C IXGP 12N60C								B2-60 B2-60
			2.1			IXGH 12N60C						B2-54

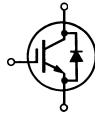
Contents



	V_{CES} V	I_C $T_C = 25^\circ C$ A	$V_{CE(sat)}$ $T_C = 25^\circ C$ V	TO-220 (IXGP)	TO-263 (IXGA)	TO-247 (IXGH)	PLUS247 (IXGX)	TO-268 (IXGT)	ISOPLUS247™ (IXGR)	TO-264 (IXGK)	miniBLOC (IXGN)	Page
High Speed	600	40	2.0	IXGA 20N60B IXGP 20N60B								B2-70
		40	2.0			IXGH 20N60B		IXGT 20N60B				B2-66
		42	2.5					IXGR 24N60C				B2-85
		48	2.5			IXGH 24N60B						B2-26
			2.5			IXGH 24N60C		IXGT 24N60C				B2-78
		40	2.0			IXGH 28N60B		IXGT 28N60B				B2-89
		45	2.5					IXGR 32N60C				B2-128
		60	1.8			IXGH 30N60B		IXGT 30N60B				B2-93
			2.5			IXGH 32N60B						B2-109
			2.1			IXGH 32N60C		IXGT 32N60C				B2-119
		76	1.7			IXGH 39N60B						B2-137
			2.5			IXGH 50N60B		IXGT 50N60B		IXGK 50N60B		B2-143
			2.5							IXGN 50N60B		B2-147
		76 ①	2.1			IXGX 120N60B				IXGK 120N60B		B2-172
		200	2.7							IXGN 200N60A		B2-174
			2.1							IXGN 200N60B		B2-178
	900	24 51	3.0 1.8			IXGH 12N90C IXGH 28N90B		IXGT 28N90B				B2-180
	1000	24	3.0			IXGH 12N100A						B2-188
		30	3.5			IXGH 12N100C		IXGT 12N100C				B2-203
		24	4.0	IXGA 12N100A IXGP 12N100A								B2-194
		30	3.5	IXGA 15N100C IXGP 15N100C								B2-203
	1200	30	3.2			IXGH 15N120B		IXGT 15N120B				B2-213
			3.8			IXGH 15N120C		IXGT 15N120C				B2-209
			3.2	IXGA 15N120B IXGP 15N120B								B2-215
			3.8	IXGA 15N120C IXGP 15N120C								B2-211
		70	3.3			IXGH 35N120B		IXGT 35N120B				B2-221
			3.3			IXGH 35N120C		IXGT 35N120C				B2-223

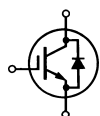
Contents

IGBT with Fast Diode



	V_{CES} V	$I_C =$ $T_C = 25^\circ C$ A	$V_{CE(sat)max}$ $T_C = 25^\circ C$ V	TO-220 (IXGP)	TO-263 (IXGA)	TO-247 (IXGH)	PLUS247 (IXGX)	TO-268 (IXGT)	ISOPLUS247™ (IXGR)	TO-264 (IXGK)	miniBLOC (IXGN)	Page
Low $V_{CE(sat)}$	600	60	1.7			IXGH 31N60D1		IXGT 31N60D1				B2-107
		75	1.7					IXGR 60N60U1				B2-167
	1000	24	3.5	IXGP 12N100U1 IXGA 12N100U1								B2-197
			3.5			IXGH 12N100U1						B2-190
High Speed	300	60	2.4			IXGH 40N30BD1						B2-22
	500	48	2.3			IXGH 24N50BU1						B2-30
		75	2.3							IXGK 50N50BU1		B2-36
	600	14	2.0	IXGA 7N60CD1 IXGP 7N60CD1								B2-46
		24	2.1			IXGH 12N60BD1						B2-50
			2.1	IXGA 12N60BD1 IXGP 12N60BD1								B2-52
			2.1			IXGH 12N60CD1						B2-56
			2.7	IXGP 12N60CD1 IXGA 12N60CD1								B2-58
		40	2.1			IXGH 20N60BD1		IXGT 20N60BD1				B2-76
			2.0			IXGH 20N60BU1						B2-74
		42	2.5					IXGR 32N60CD1				B2-87
		48	2.5			IXGH 24N60BU1						B2-30
		48	2.5			IXGH 24N60CD1		IXGT 24N60CD1				B2-80
		40	2.0			IXGH 28N60BD1		IXGT 28N60BD1				B2-91
		45	2.6					IXGR 32N60CD1				B2-132
		60	1.8			IXGH 30N60BU1		IXGT 30N60CD1				B2-100
			1.8			IXGH 30N60BD1		IXGT 30N60BD1				B2-95
			2.5			IXGH 32N60BU1						B2-111
			2.2			IXGH 32N60BD1						B2-117
			2.5			IXGH 32N60CD1						B2-123
	76	1.7				IXGH 39N60BD1						B2-139

Contents



IGBT with Fast Diode

	V_{CES} V	I_C $T_C = 25^\circ C$ A	$V_{CE(sat)}$ $T_C = 25^\circ C$ max V	TO-220 (IXGP)	TO-263 (IXGA)	TO-247 (IXGH)	PLUS247 (IXGX)	TO-268 (IXGT)	ISOPLUS247™ (IXGR)	TO-264 (IXGK)	miniBLOC (IXGN)	Page
High Speed	600	75	2.3									B1-151
			2.3							IXGK 50N60BU1		B2-36
			2.7							IXGN 50N60BD2*	IXGN 50N60BD3*	B2-156
	1000	24	4.0	IXGP 12N100AU1	IXGA 12N100AU1							B2-197
			4.0			IXGH 12N100AU1						B2-190
	1200	30	3.2 3.8			IXGH 15N120BD1 IXGH 15N120CD1		IXGT 15N120BD1 IXGT 15N120CD1				B2-217

① limited by leads * buck configuration

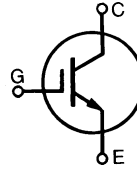
IXGH.....A.. = Fast IGBT, IXGH.....B.. = SuperFast IGBT, IXGH.....C.. = HiPerFast IGBT

HiPerFAST™ IGBT

IXGH20N30

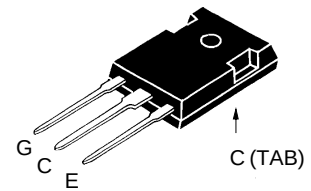
$$\begin{aligned} V_{CES} &= 300 \text{ V} \\ I_{C25} &= 40 \text{ A} \\ V_{CE(sat)typ} &= 1.45 \text{ V} \\ t_{fi(typ)} &= 180 \text{ ns} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_c	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g

TO-247 AD



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

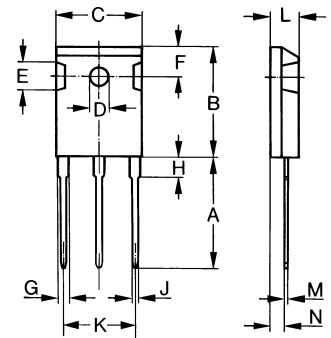
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		5 V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.45	1.6	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	18	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
Q_{ge}			15	nC
Q_{gc}			35	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			30	ns
$t_{d(off)}$			100	ns
t_{fi}			180	ns
E_{off}			0.6	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			30	ns
E_{on}			0.3	mJ
$t_{d(off)}$			250	420 ns
t_{fi}			300	450 ns
E_{off}			1.0	1.6 mJ
R_{thJC}				0.83 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



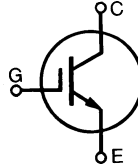
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT

IXGH 28N30
IXGT 28N30

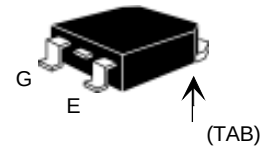
$V_{CES} = 300 \text{ V}$
 $I_{C25} = 56 \text{ A}$
 $V_{CE(sat)typ} = 1.6 \text{ V}$
 $t_{fi(typ)} = 180 \text{ ns}$

Preliminary data

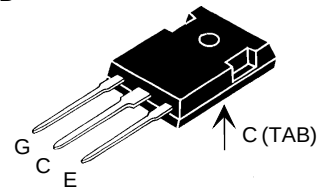


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	56	A
I_{C90}	$T_C = 90^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	112	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 56$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-268
(IXGT)



TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface and
JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™
process
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode
power supplies

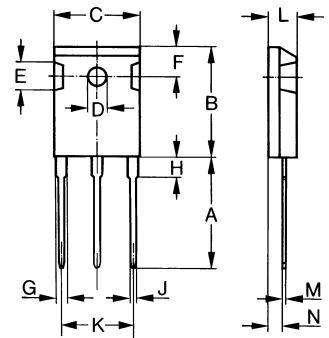
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency
applications
- Easy to mount with 1 screw,
(isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		5
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 1
				μA mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			± 100
				nA
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.6	1.8	
				V

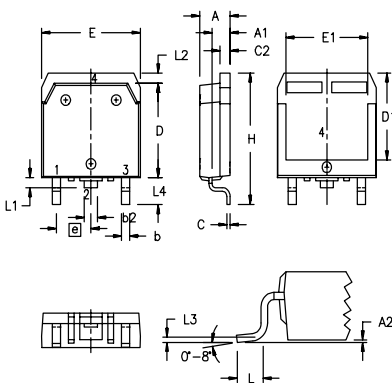
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	18	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
Q_{ge}			15	nC
Q_{gc}			35	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			30	ns
$t_{d(off)}$			130	ns
t_{fi}			180	ns
E_{off}			0.8	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			30	ns
E_{on}			0.3	mJ
$t_{d(off)}$			250	500 ns
t_{fi}			250	600 ns
E_{off}			1.5	3.0 mJ
R_{thJC}				0.83 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



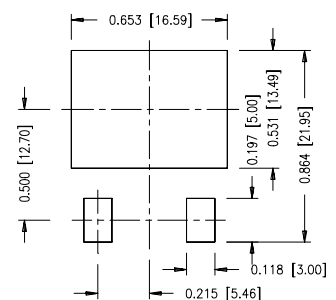
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

Min. Recommended Footprint

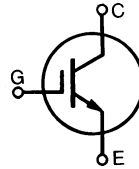


HiPerFAST™ IGBT

IXGH 28N30A
IXGT 28N30A

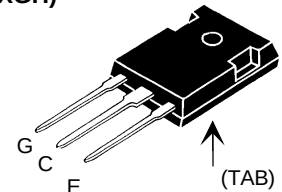
$V_{CES} = 300 \text{ V}$
 $I_{C25} = 56 \text{ A}$
 $V_{CE(sat)typ} = 1.85 \text{ V}$
 $t_{fi(typ)} = 120 \text{ ns}$

Preliminary data

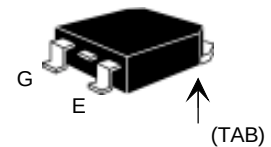


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	56	A
I_{C90}	$T_C = 90^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	112	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 56$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-247 AD (IXGH)



TO-268
(IXGT)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-247 SMD surface mountable and JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

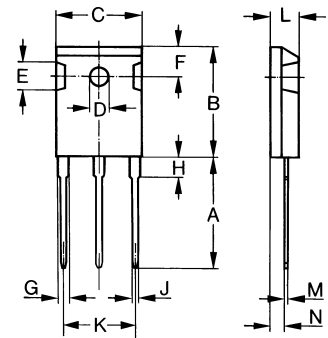
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.85	2.1	V

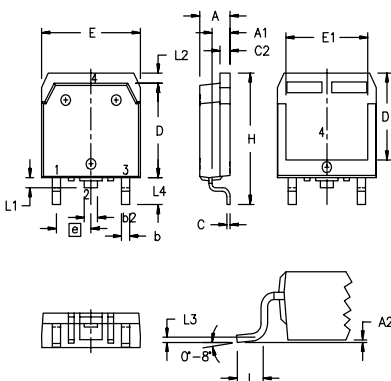
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	18	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
Q_{ge}			15	nC
Q_{gc}			35	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			30	ns
$t_{d(off)}$			80	ns
t_{fi}			120	ns
E_{off}			0.5	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			30	ns
E_{on}			0.3	mJ
$t_{d(off)}$			150	300 ns
t_{fi}			180	330 ns
E_{off}			0.8	1.6 mJ
R_{thJC}				0.83 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



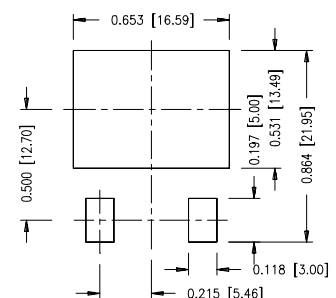
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

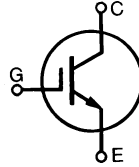
Min. Recommended Footprint



HiPerFAST™ IGBT

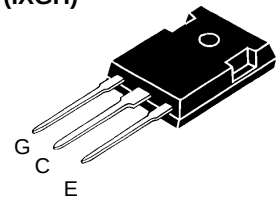
IXGH 28N30B
IXGT 28N30B

$$\begin{aligned} V_{CES} &= 300 \text{ V} \\ I_{C25} &= 56 \text{ A} \\ V_{CE(sat)typ} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$

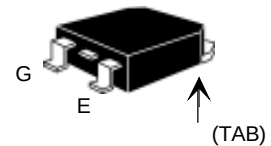


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	56	A
I_{C90}	$T_C = 90^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	112	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 56$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-247 AD (IXGH)



TO-268
(IXGT)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface and JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

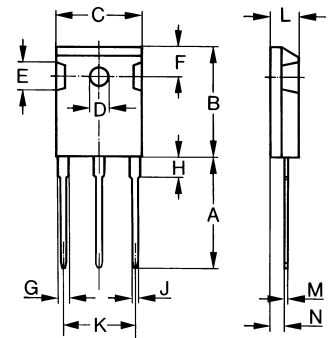
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw,
(isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	2.1	2.4	V

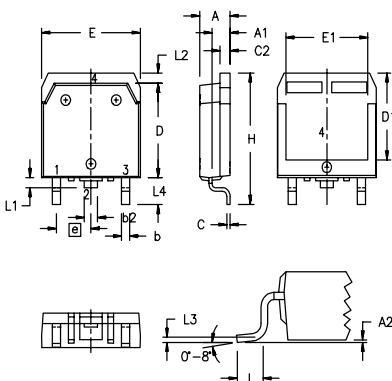
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	18	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
Q_{ge}			15	nC
Q_{gc}			35	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			30	ns
$t_{d(off)}$			50	ns
t_{fi}			55	ns
E_{off}			0.3	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			30	ns
E_{on}			0.3	mJ
$t_{d(off)}$			90	180 ns
t_{fi}			110	230 ns
E_{off}			0.6	1.4 mJ
R_{thJC}				0.83 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



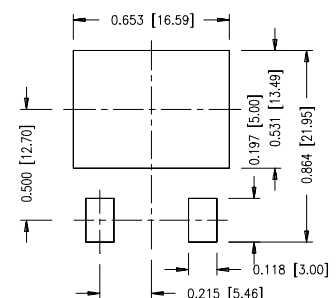
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

Min. Recommended Footprint

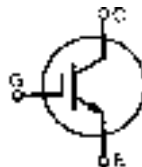


HiPerFAST™ IGBT

IXGH30N30

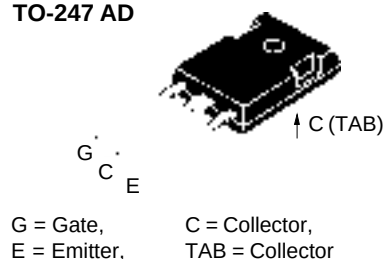
$V_{CES} = 300 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 1.6 \text{ V}$
 $t_{fi} = 180 \text{ ns}$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	300	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	30	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$, $I_{CM} = 60$ Clamped inductive load, $L = 100 \mu\text{H}$ @ $0.8 V_{CES}$	A	
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g

TO-247 AD



Features

- International standard package JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

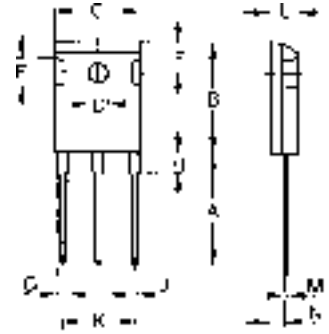
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	300		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$, $T_J = 25^\circ\text{C}$ $V_{GE} = 0 \text{ V}$, $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			1.6 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$, $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	20	28	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2500	pF
C_{oes}			210	pF
C_{res}			60	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		145	nC
Q_{ge}			23	nC
Q_{gc}			50	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 1.0\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			40	ns
$t_{d(off)}$			170	ns
t_{fi}			180	ns
E_{off}			1.0	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 1.0\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			40	ns
E_{on}			0.3	mJ
$t_{d(off)}$			250	420 ns
t_{fi}			300	450 ns
E_{off}			1.6	2.4 mJ
R_{thJC}				0.62 K/W
R_{thCK}		0.25		K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

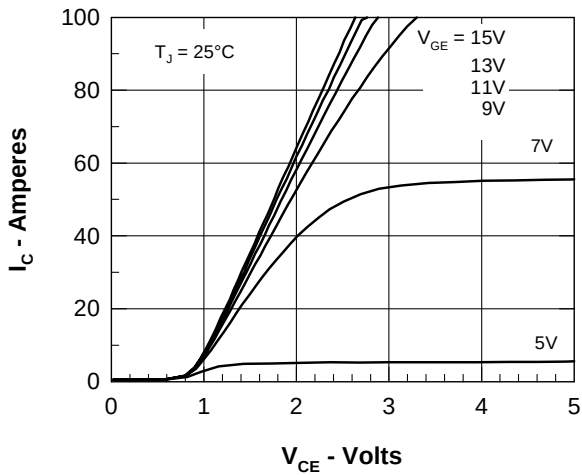


Fig. 1. Output Characteristics

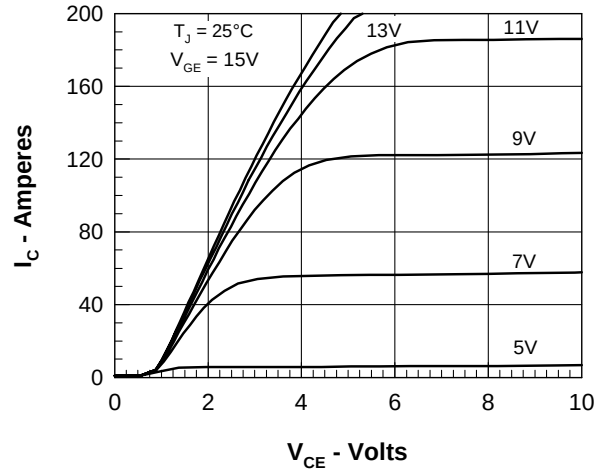


Fig. 2. Extended Output Characteristics

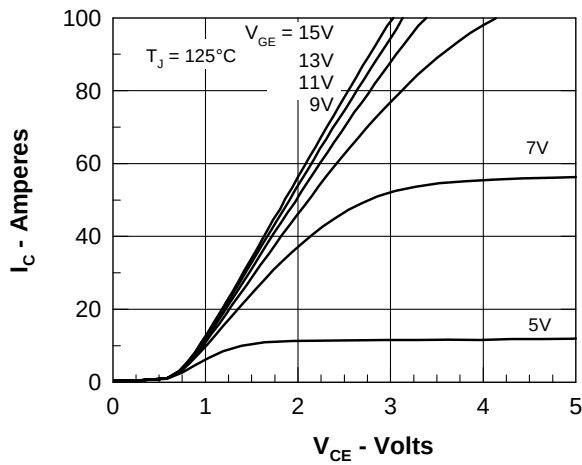


Fig. 3. High Temperature Output Characteristics

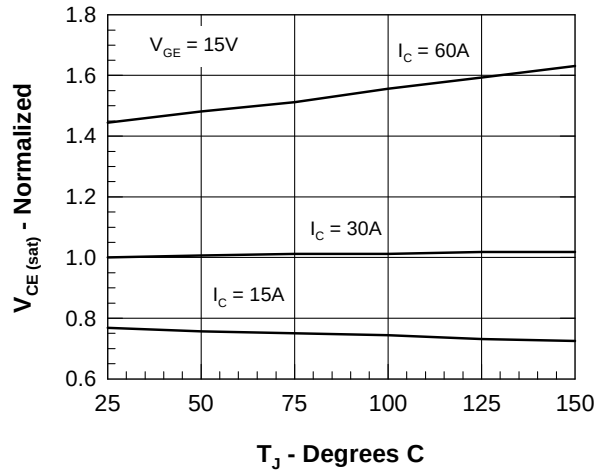


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

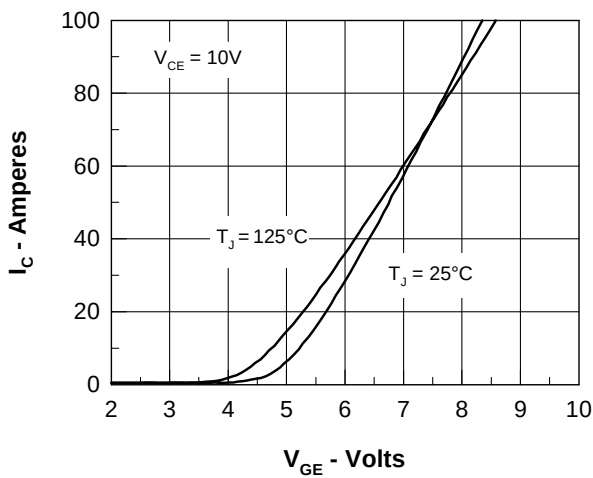


Fig. 5. Admittance Curves

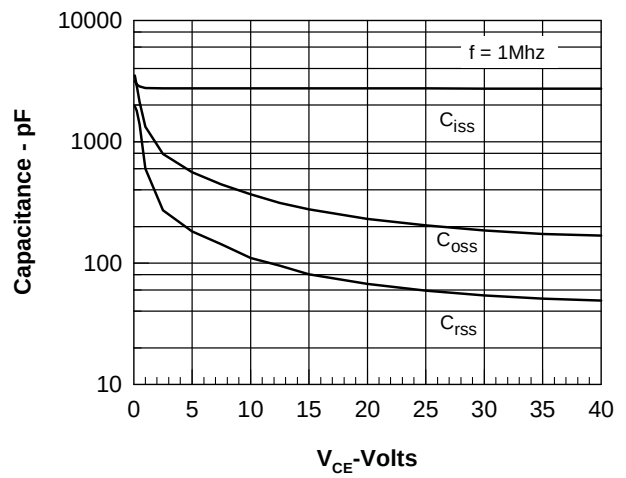


Fig. 6. Capacitance Curves,

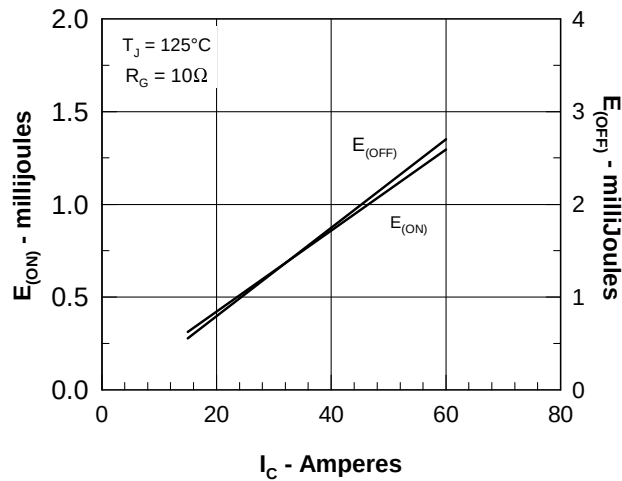


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

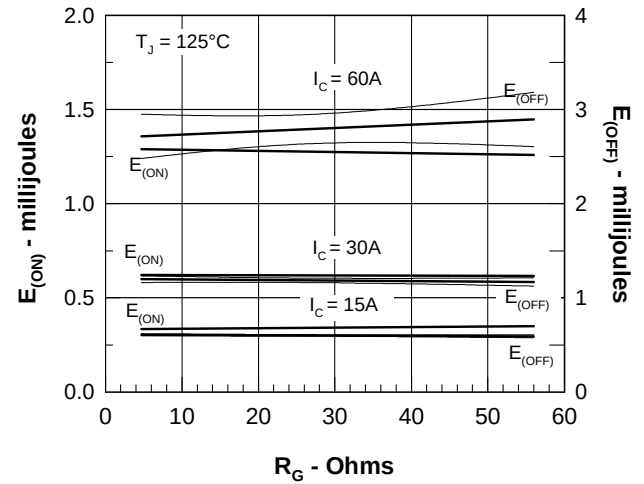


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

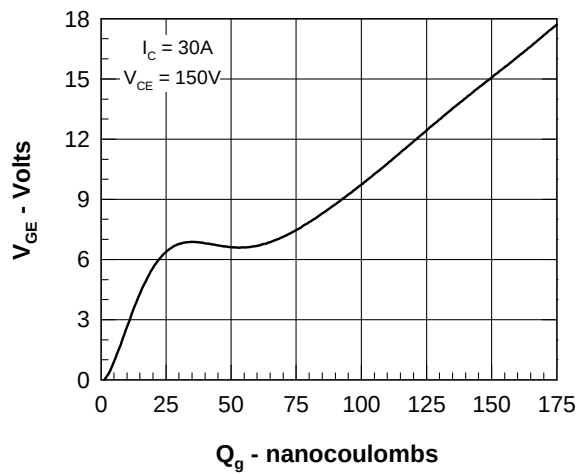


Fig. 9. Gate Charge

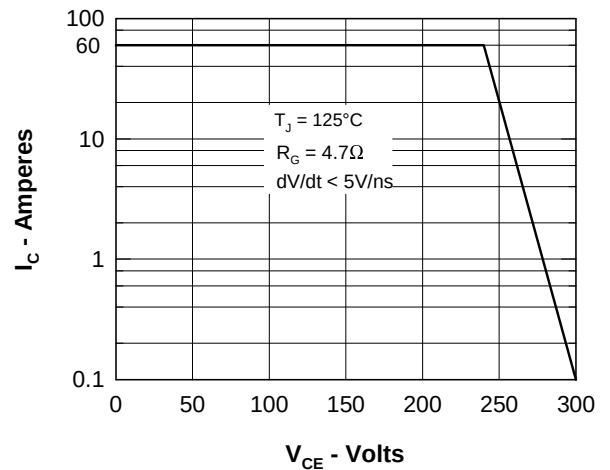


Fig. 10. Turn-off Safe Operating Area

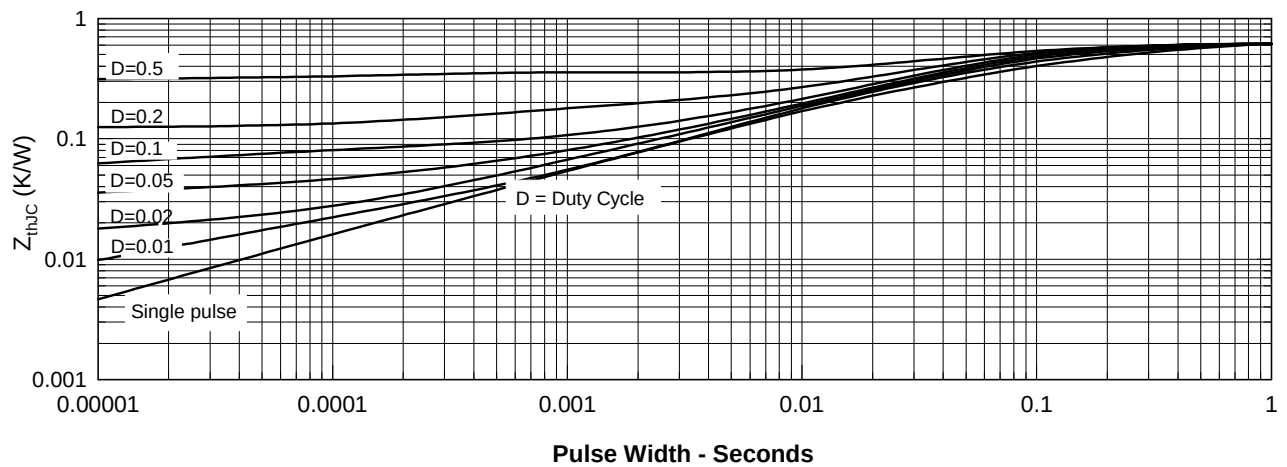
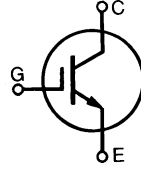


Fig. 11. Transient Thermal Resistance

HiPerFAST™ IGBT

IXGH40N30A

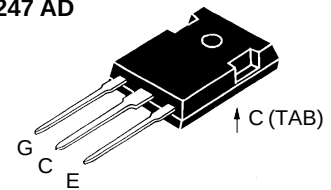
$$\begin{aligned} V_{CES} &= 300 \text{ V} \\ I_{C25} &= 60 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \\ t_{fi} &= 120 \text{ ns} \end{aligned}$$



Preliminary data

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	40	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	160	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 80$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

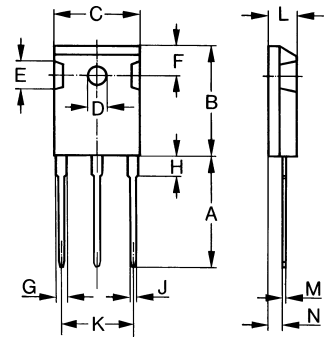
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.1 V

Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	20	28	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2500	pF
C_{oes}			210	pF
C_{res}			60	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		145	170 nC
Q_{ge}			23	35 nC
Q_{gc}			50	75 nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		25	ns
t_{ri}			45	ns
$t_{d(off)}$			100	ns
t_{fi}			120	ns
E_{off}			0.75	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		25	ns
t_{ri}			45	ns
E_{on}			0.3	mJ
$t_{d(off)}$			150	300 ns
t_{fi}			220	330 ns
E_{off}			1.6	2.4 mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT

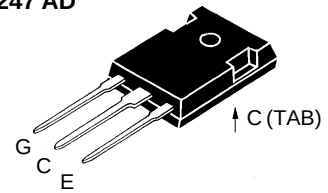
IXGH 40N30
IXGH 40N30A
IXGH 40N30B

V_{CES}	I_{C25}	$V_{CE(sat)}$	t_{fi}
600 V	60 A	1.8 V	220ns
600 V	60 A	2.1 V	120ns
600 V	60 A	2.4 V	75 ns

Preliminary data

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	40	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	160	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 80$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g

TO-247 AD



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

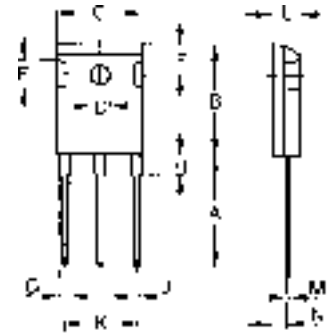
Advantages

- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			1.8 V 2.1 V 2.4 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	20	28	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2500	pF
C_{oes}			210	pF
C_{res}			60	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		145	170 nC
Q_{ge}			23	35 nC
Q_{gc}			50	75 nC
$t_{d(on)}$	Inductive load, $T_J = 25^{\circ}\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			40	ns
$t_{d(off)}$			170	ns
t_{fi}			100	ns
			75	ns
			230	ns
E_{off}			120	ns
			75	ns
			1.6	mJ
			0.75	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^{\circ}\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
			40	ns
			0.3	mJ
			250	ns
			150	ns
			90	ns
			350	ns
			220	ns
			130	ns
			3.3	mJ
E_{off}	1.6	mJ		
	0.6	mJ		
	0.6	mJ		
R_{thJC}			0.62	K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline

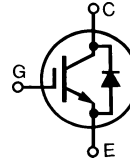


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT

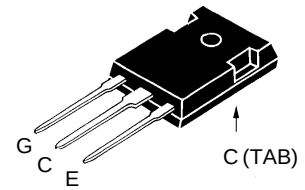
IXGH40N30BD1

$$\begin{aligned} V_{CES} &= 300 \text{ V} \\ I_{C25} &= 60 \text{ A} \\ V_{CE(sat)} &= 2.4 \text{ V} \\ t_{fi} &= 75 \text{ ns} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	300	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	300	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	40	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	160	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 80$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	

TO-247 AD



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High current IGBT and paralld FRED in one package
- Low leakage current FRED
- Newest generation HDMOST™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

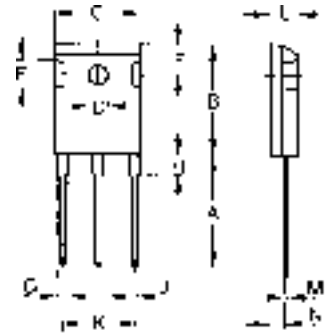
Advantages

- High power density (two devices in one package)
- Switching speed for high frequency applications
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	300		
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.4

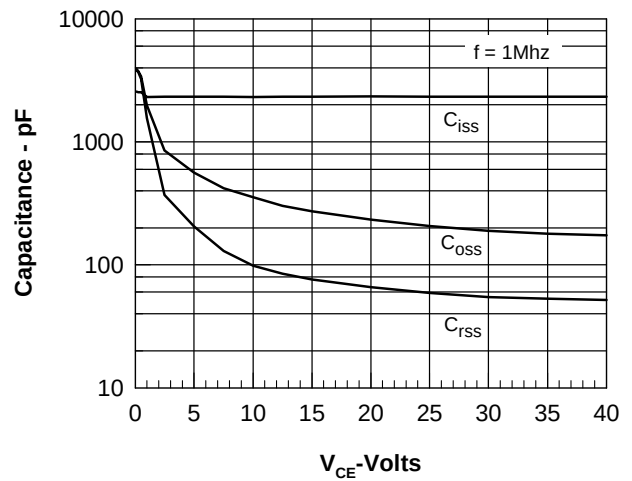
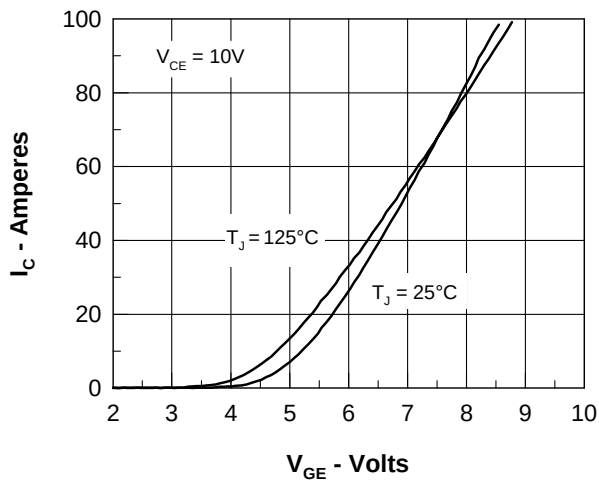
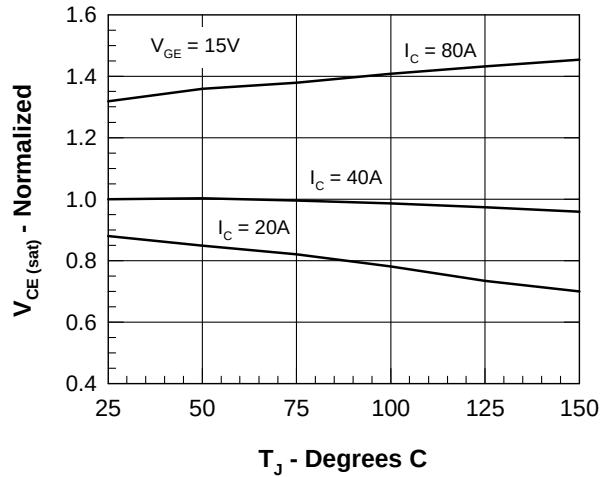
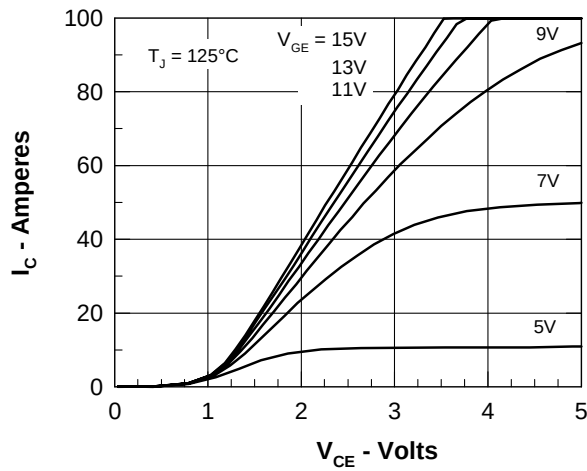
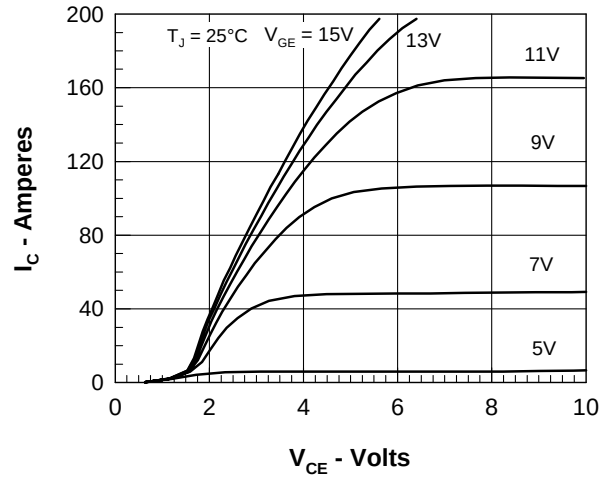
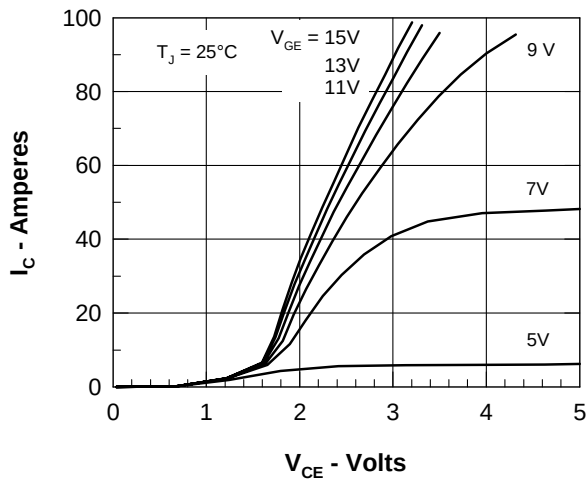
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}, V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	20	28	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2500	pF
C_{oes}			210	pF
C_{res}			60	pF
Q_g	$I_C = I_{C90}, V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		145	170 nC
Q_{ge}			23	35 nC
Q_{gc}			50	75 nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			45	ns
$t_{d(off)}$			75	ns
t_{fi}			75	ns
E_{off}			0.3	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			45	ns
E_{on}			0.5	mJ
$t_{d(off)}$			90	180 ns
t_{fi}			130	230 ns
E_{off}			0.6	1.4 mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_{C90}, V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$			1.8 V
I_{RM}	$I_F = I_{C90}, V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$; $T_J = 100^\circ\text{C}$ $I_F = 1\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		1.5	1.8 A
t_{rr}			30	ns
R_{thJC}				1 K/W



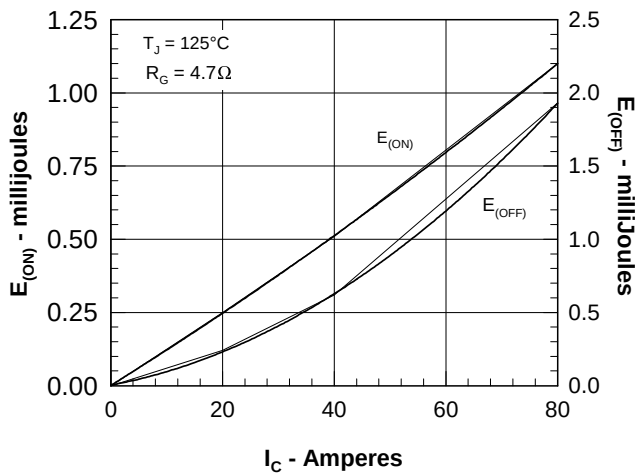


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

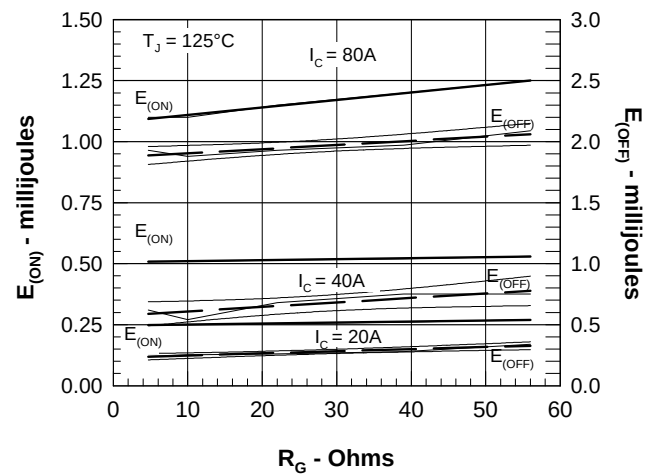


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

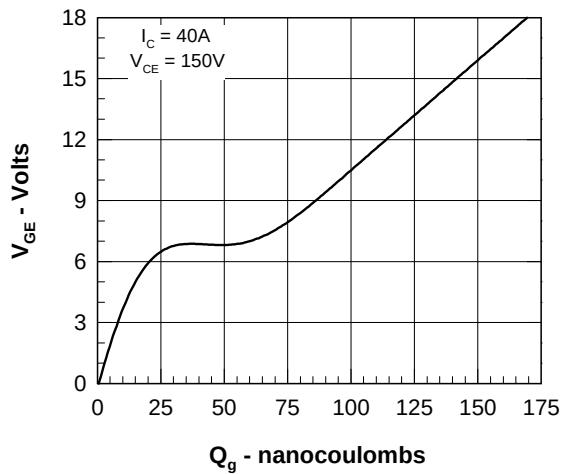


Fig. 9. Gate Charge

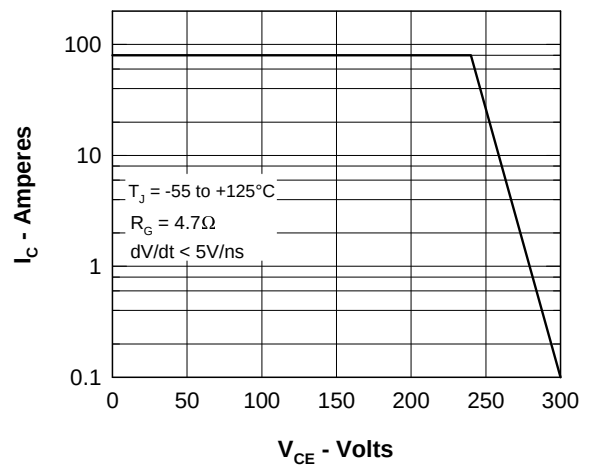


Fig. 10. Turn-off Safe Operating Area

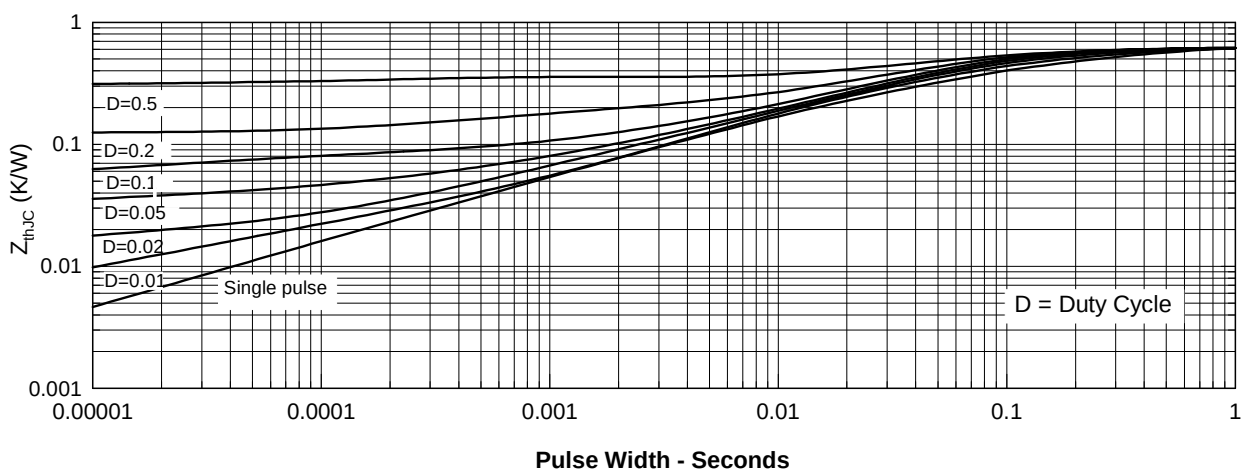


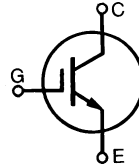
Fig. 11. Transient Thermal Resistance

HiPerFAST™ IGBT

IXGH24N50B
IXGH24N60B

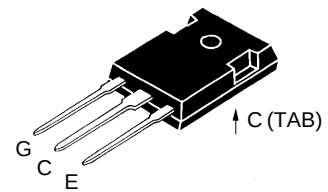
V_{CES}	$I_{C(25)}$	$V_{CE(sat)}$	t_{fi}
500 V	48 A	2.3 V	80 ns
600 V	48 A	2.5 V	80 ns

Preliminary data



Symbol	Test Conditions	Maximum Ratings		
		24N50	24N60	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	500	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	500	600	V
V_{GES}	Continuous		± 20	V
V_{GEM}	Transient		± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$		48	A
I_{C90}	$T_C = 90^\circ\text{C}$		24	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms		96	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22\text{ }\Omega$ Clamped inductive load, $L = 100\text{ }\mu\text{H}$		$I_{CM} = 48$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$		150	W
T_J		-55 ... +150		$^\circ\text{C}$
T_{JM}			150	$^\circ\text{C}$
T_{stg}		-55 ... +150		$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s			300	$^\circ\text{C}$
M_d	Mounting torque (M3)		1.13/10	Nm/lb.in.
Weight			6	g

TO-247 AD



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- International standard packages JEDEC TO-247 AD
- High frequency IGBT
- High current handling capability
- 3rd generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

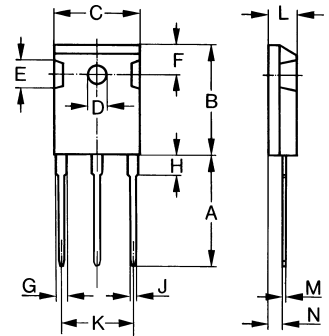
Advantages

- High power density
- Switching speed for high frequency applications
- Easy to mount with 1 screw (insulated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250\text{ }\mu\text{A}$, $V_{GE} = 0\text{ V}$	24N50 500 24N60 600		V
$V_{GE(th)}$	$I_C = 250\text{ }\mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0\text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	24N50 24N60		2.3 V 2.5 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	13	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			135	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
Q_{ge}			11	nC
Q_{gc}			30	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			15	ns
E_{on}			0.6	mJ
$t_{d(off)}$			150	ns
t_{fi}			80	ns
E_{off}		24N50B 24N60B	0.62 0.80	mJ mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			15	ns
E_{on}			0.8	mJ
$t_{d(off)}$			250	ns
t_{fi}			100	ns
E_{off}		24N50B 24N60B	0.9 1.4	mJ mJ
R_{thJC}				0.83 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

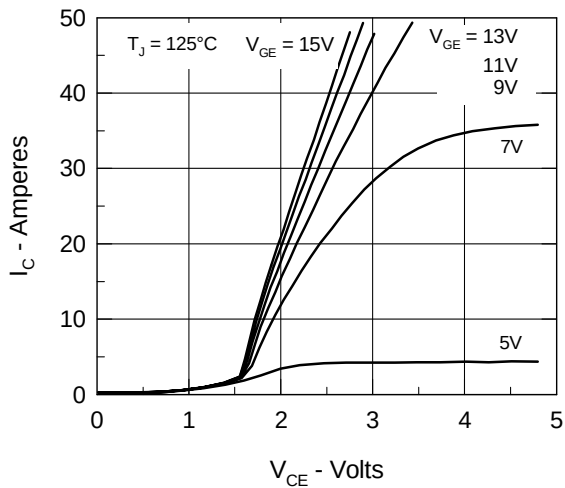


Fig. 1. Saturation Voltage Characteristics

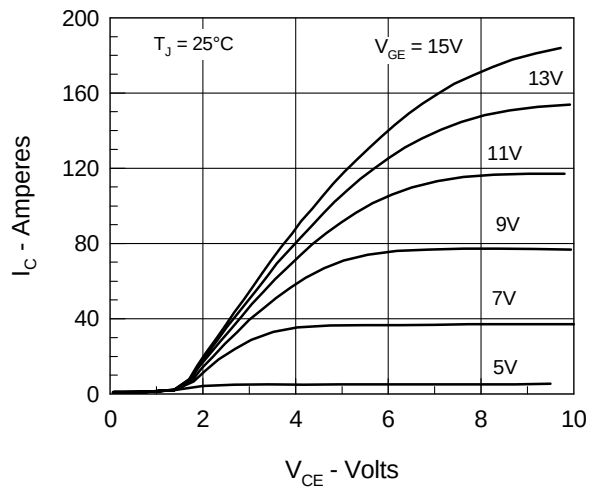


Fig. 2. Extended Output Characteristics

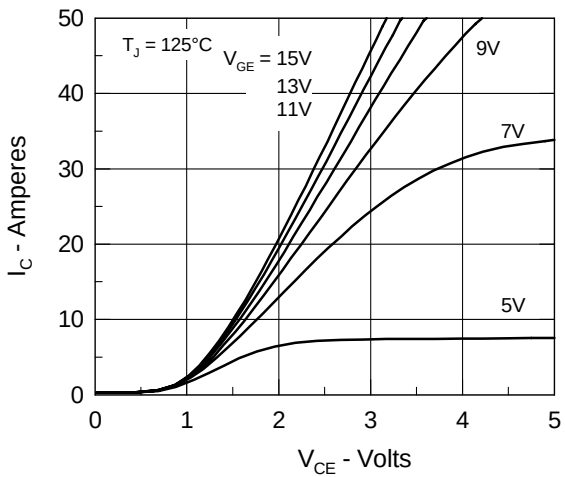


Fig. 3. Saturation Voltage Characteristics

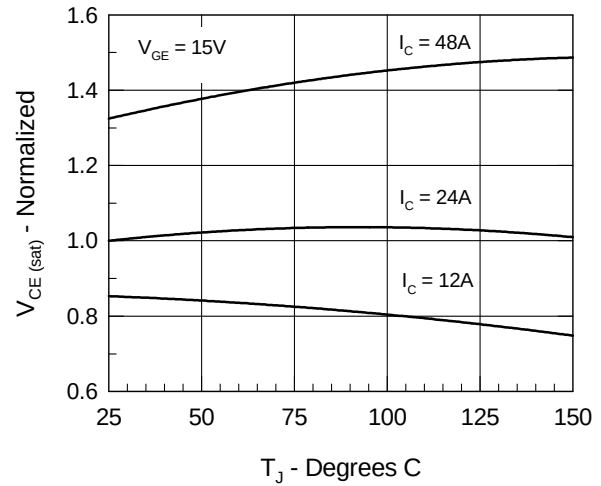


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

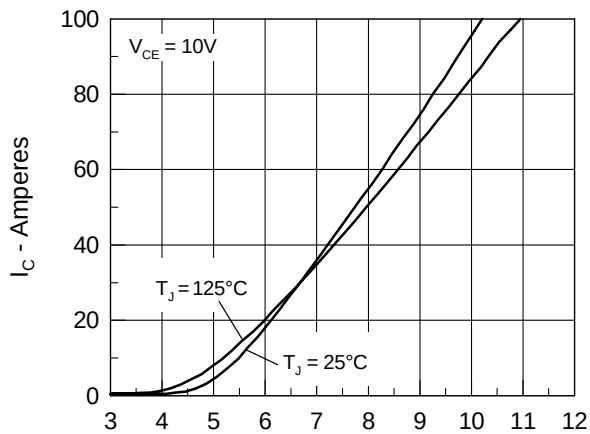


Fig. 5. Admittance Curves

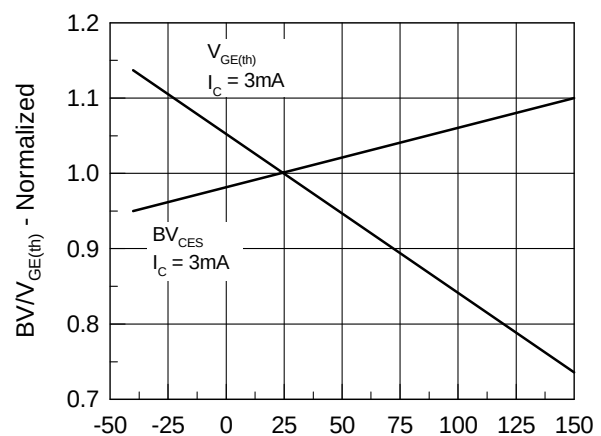


Fig. 6. Temperature Dependence of BV_{DSS} & $V_{GE(th)}$

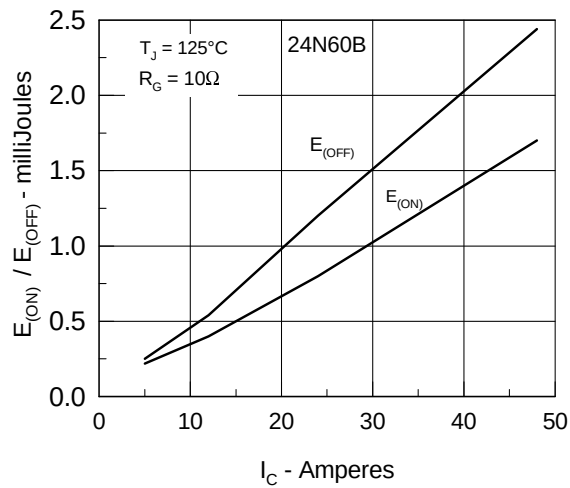


Fig. 7. Dependence of tfi and E_{OFF} on I_C .

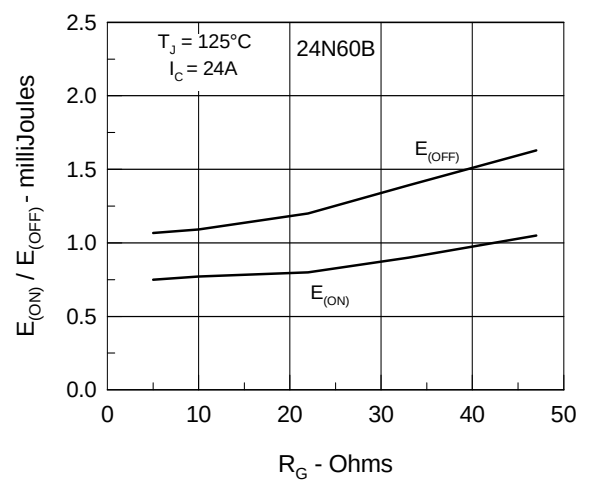


Fig. 8. Dependence of tfi and E_{OFF} on R_G .

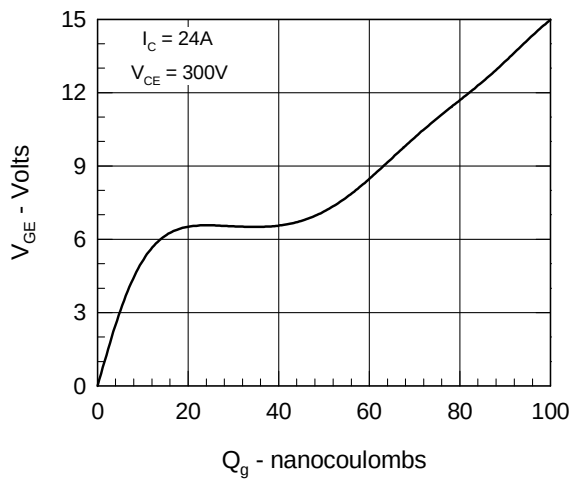


Fig. 9. Gate Charge

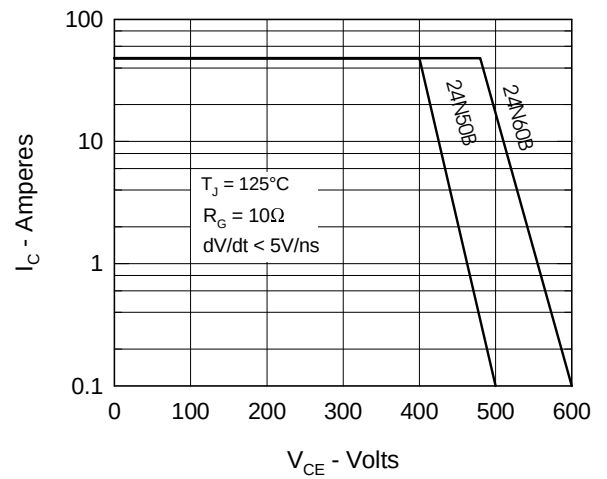


Fig. 10. Turn-off Safe Operating Area

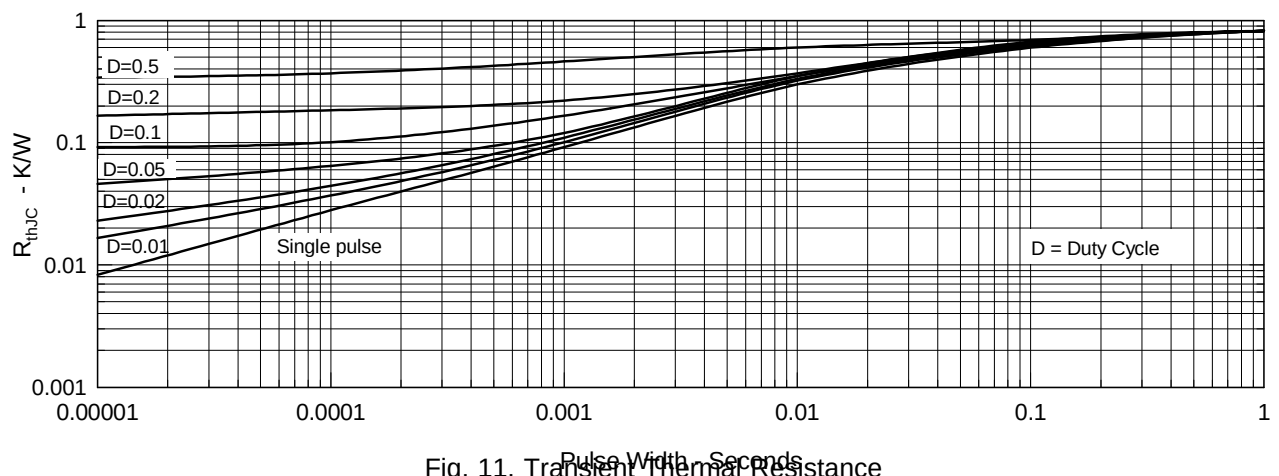


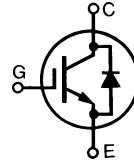
Fig. 11. Transient Thermal Resistance

HiPerFAST™ IGBT with Diode Combi Pack

IXGH24N50BU1
IXGH24N60BU1

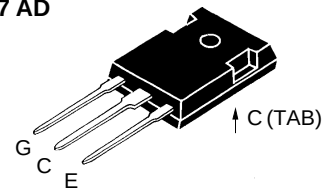
V_{CES}	$I_{C(25)}$	$V_{CE(sat)}$	t_{fi}
500 V	48 A	2.3 V	80 ns
600 V	48 A	2.5 V	80 ns

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
		24N50	24N60
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	500	600
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	500	600
V_{GES}	Continuous	± 20 V	
V_{GEM}	Transient	± 30 V	
I_{C25}	$T_C = 25^\circ\text{C}$	48 A	
I_{C90}	$T_C = 90^\circ\text{C}$	24 A	
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	96 A	
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22\text{ }\Omega$ Clamped inductive load, $L = 100\text{ }\mu\text{H}$	$I_{CM} = 48$ @ $0.8 V_{CES}$	
P_C	$T_C = 25^\circ\text{C}$	150 W	
T_J		$-55 \dots +150^\circ\text{C}$	
T_{JM}		150 $^\circ\text{C}$	
T_{stg}		$-55 \dots +150^\circ\text{C}$	
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300 $^\circ\text{C}$	
M_d	Mounting torque	1.13/10 Nm/lb.in.	
Weight		6 g	

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High frequency IGBT and antiparallel FRED in one package
- High current handling capability
- 3rd generation HDMOST™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

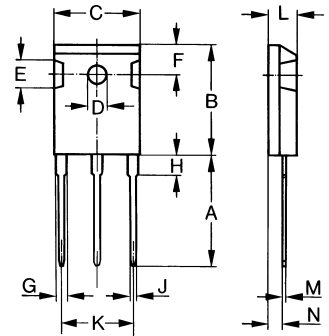
Advantages

- Space savings (two devices in one package)
- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw (insulated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750\text{ }\mu\text{A}$, $V_{GE} = 0\text{ V}$	24N50 500		V
		24N60 600		V
$V_{GE(th)}$	$I_C = 250\text{ }\mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0\text{ V}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		500 μA 8 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	24N50		2.3 V
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	24N60		2.5 V

Symbol	Test Conditions	Characteristic Values (T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
g _{fs}	I _C = I _{C90} ; V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %	9	13	S
C _{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz		1500	pF
C _{oes}			175	pF
C _{res}			40	pF
Q _g	I _C = I _{C90} ; V _{GE} = 15 V, V _{CE} = 0.5 V _{CES}		90	nC
Q _{ge}			11	nC
Q _{gc}			30	nC
t _{d(on)}	Inductive load, T_J = 25°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 10 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t _{ri}			15	ns
E _{on}			0.6	mJ
t _{d(off)}			150	ns
t _{fi}			80	ns
E _{off}		24N50BU1 24N60BU1	0.62 0.8	mJ mJ
t _{d(on)}	Inductive load, T_J = 125°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 10 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t _{ri}			15	ns
E _{on}			0.8	mJ
t _{d(off)}			250	ns
t _{fi}			100	ns
E _{off}		24N50BU1 24N60BU1	0.9 1.4	mJ mJ
R _{thJC}				0.83 K/W
R _{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Reverse Diode (FRED)		Characteristic Values (T _J = 25°C, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V _F	I _F = I _{C90} ; V _{GE} = 0 V, Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %			1.6 V
I _{RM}	I _F = I _{C90} ; V _{GE} = 0 V, -di _F /dt = 240 A/μs V _R = 360 V I _F = 1 A; -di _F /dt = 100 A/μs; V _R = 30 V		10	15 A
t _{rr}			150	ns
			35	ns
R _{thJC}				1 K/W

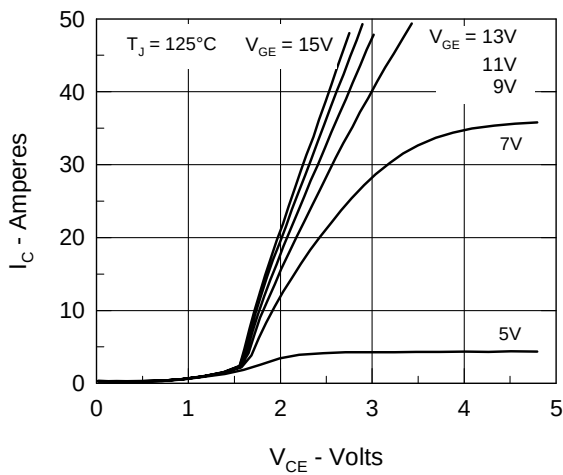


Fig. 1. Saturation Voltage Characteristics

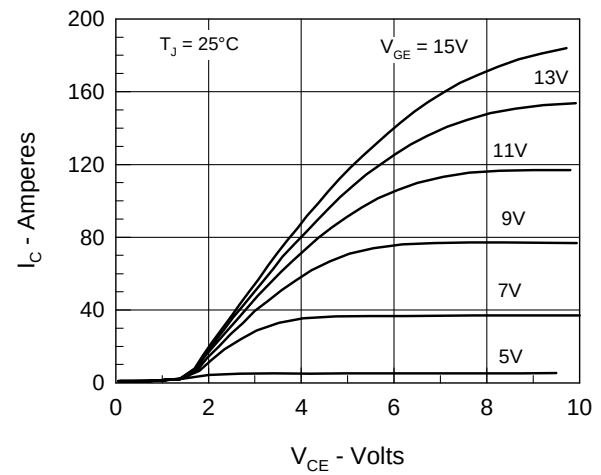


Fig. 2. Extended Output Characteristics

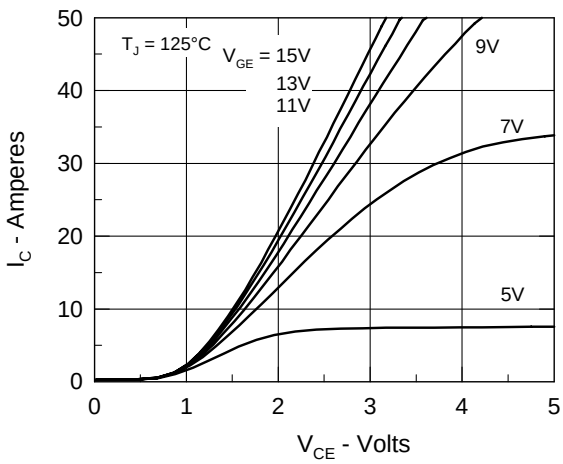


Fig. 3. Saturation Voltage Characteristics

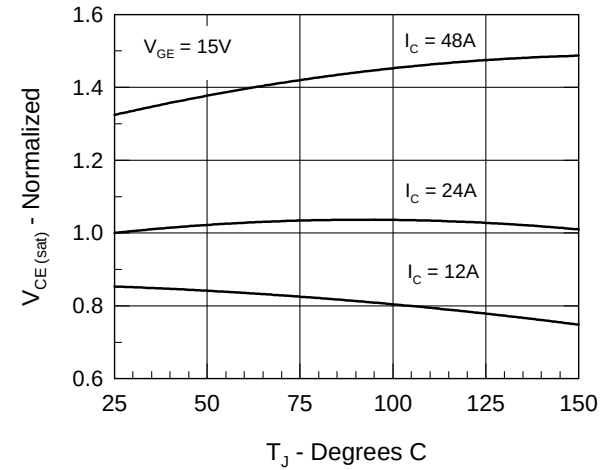
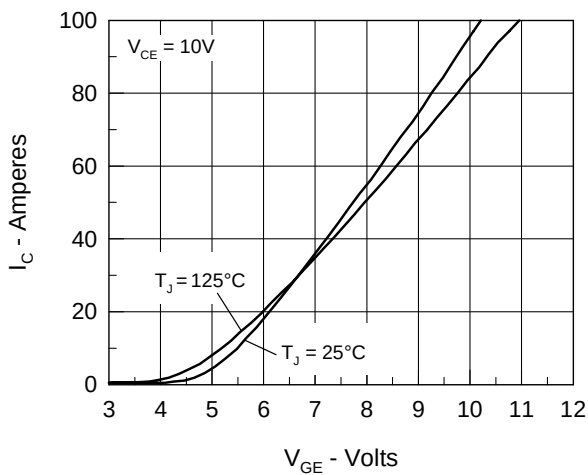
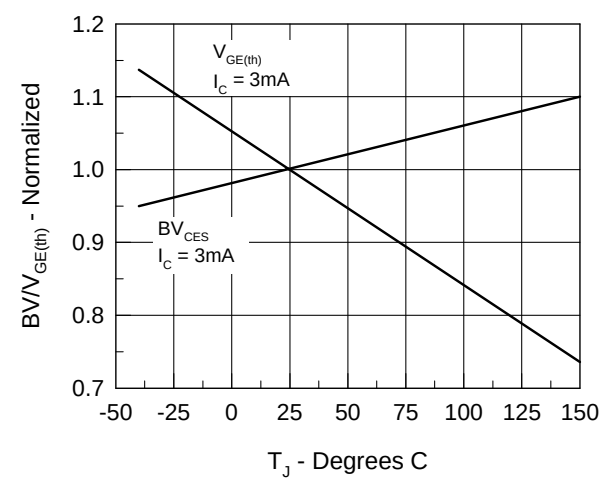

Fig. 4. Temperature Dependence of $V_{CE(sat)}$


Fig. 5. Admittance Curves


Fig. 6. Temperature Dependence of BV_{DSS} & $V_{GE(th)}$

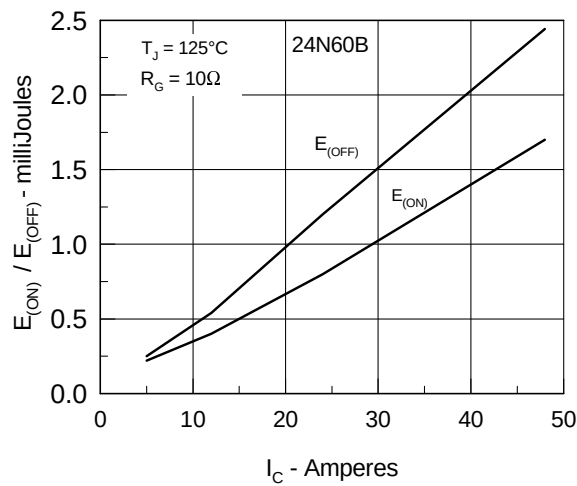


Fig. 7. Dependence of t_{fi} and E_{OFF} on I_C .

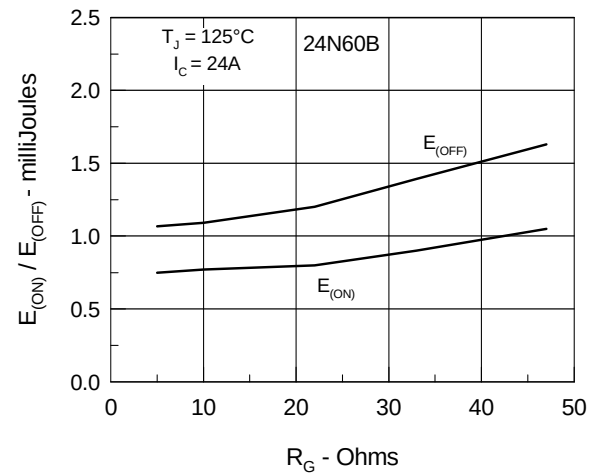


Fig. 8. Dependence of t_{fi} and E_{OFF} on R_G .

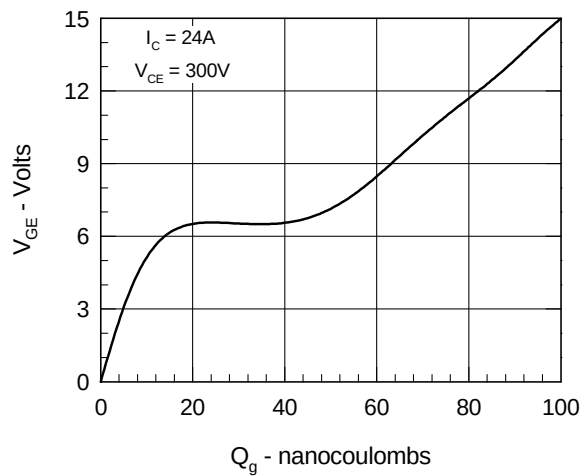


Fig. 9. Gate Charge

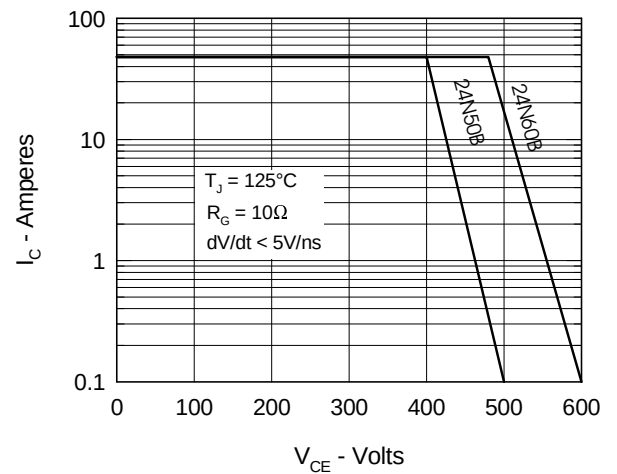


Fig. 10. Turn-off Safe Operating Area

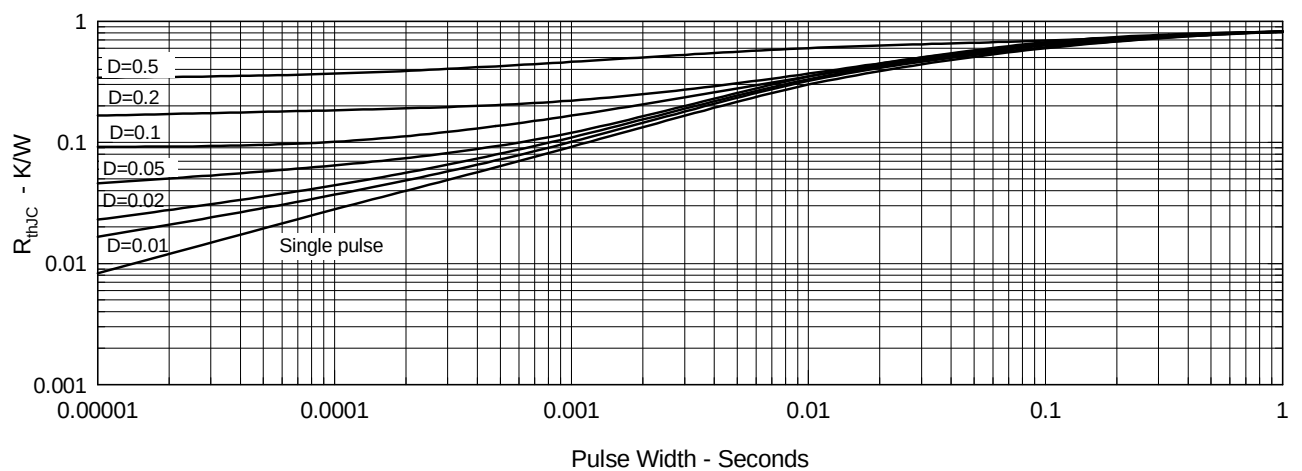


Fig. 11. Transient Thermal Resistance

Fig.12 Maximum Forward Voltage Drop

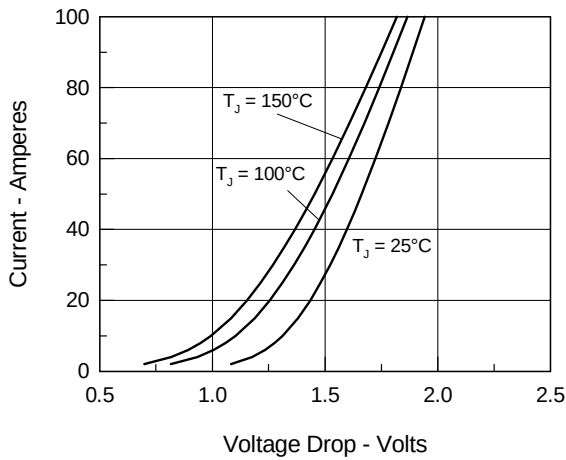


Fig.13 Peak Forward Voltage V_{FR} and Forward Recovery Time t_{fr}

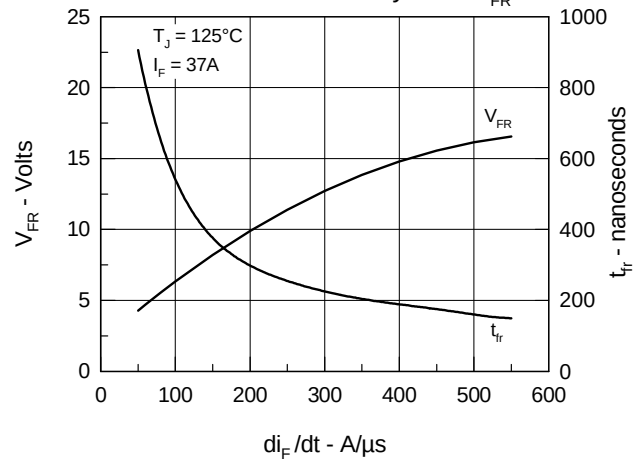


Fig.14 Junction Temperature Dependence off I_{RM} and Q_r

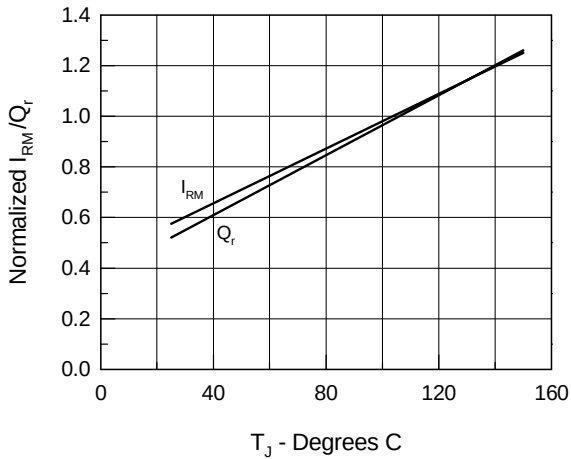


Fig.15 Reverse Recovery Charge

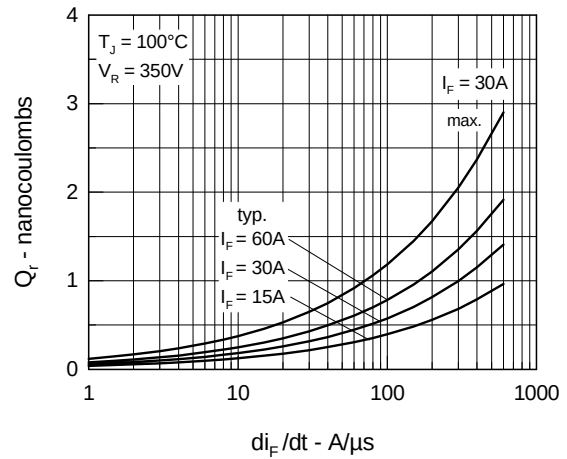


Fig.16 Peak Reverse Recovery Current

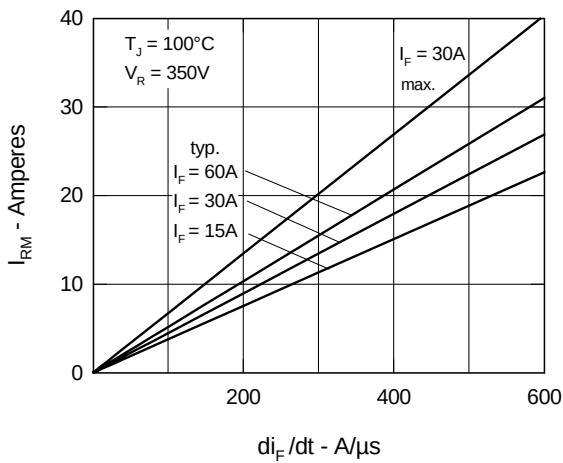


Fig.17 Reverse Recovery Time

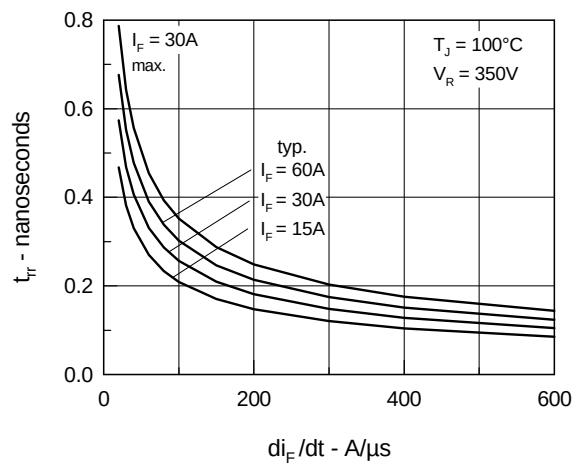
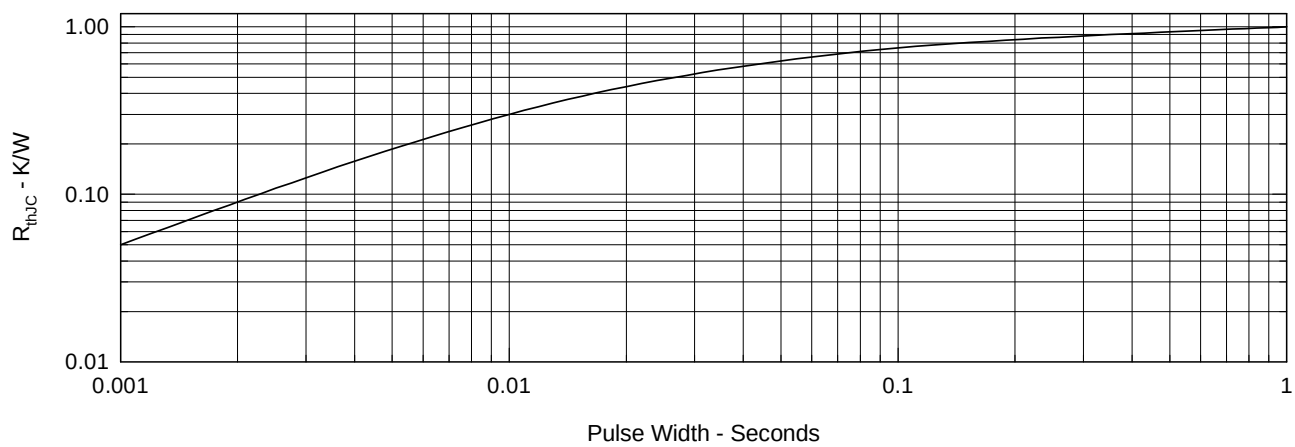


Fig.17 Diode Transient Thermal resistance junction to case



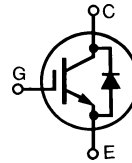
HiPerFAST™ IGBT with Diode

IXGK 50N50BU1
IXGK 50N60BU1

V_{CES}	I_{C25}	$V_{CE(sat)}$	t_{fi}
500 V	75 A	2.3 V	100ns
600 V	75 A	2.5 V	120ns

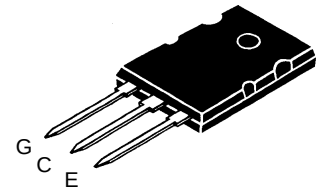
Combi Pack

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
		50N50	50N60
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	500	600
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	500	600
V_{GES}	Continuous	± 20	± 20
V_{GEM}	Transient	± 30	± 30
I_{C25}	$T_C = 25^\circ\text{C}$	75	75
I_{C90}	$T_C = 90^\circ\text{C}$	50	50
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	200	200
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10\ \Omega$ Clamped inductive load, $L = 30\ \mu\text{H}$	$I_{CM} = 100$ @ 0.8 V_{CES}	
P_C	$T_C = 25^\circ\text{C}$	300	300
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M4)	0.9/6	Nm/lb.in.
Weight		10	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-264 AA



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-264 AA
- High frequency IGBT and anti-parallel FRED in one package
- 2nd generation HDMOS™ process
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

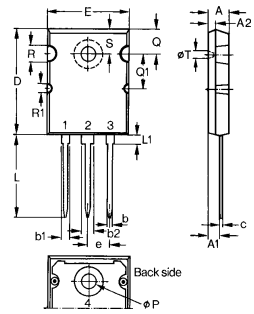
Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 500\ \mu\text{A}$, $V_{GE} = 0\text{ V}$	50N50 50N60	500 600	V
$V_{GE(th)}$	$I_C = 500\ \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0\text{ V}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		250 μA 15 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	50N50BU1 50N60BU1		2.3 V 2.5 V

Symbol	Test Conditions	Characteristic Values (T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	I _C = I _{C90} ; V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 % Remarks: Add capacitance from IXGH50N60B (DS95585B)	25	35	S
Q_g	I _C = I _{C90} ; V _{GE} = 15 V, V _{CE} = 0.5 V _{CES}		200	nC
Q_{ge}			50	nC
Q_{gc}			70	nC
t_{d(on)}	Inductive load, T_J = 25°C I _C = I _{C90} ; V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} ; R _G = R _{off} = 2.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		50	ns
t_{ri}			50	ns
t_{d(off)}			110	ns
t_{fi}		50N50	80	150 ns
E_{off}		50N60	150	ns
		50N50	1.8	mJ
		50N60		3.0 mJ
t_{d(on)}	Inductive load, T_J = 125°C I _C = I _{C90} ; V _{GE} = 15 V, L = 100 μH V _{CE} = 0.8 V _{CES} ; R _G = R _{off} = 2.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		50	ns
t_{ri}			60	ns
E_{on}			3	mJ
t_{d(off)}			200	ns
t_{fi}		50N50	100	ns
		50N60	250	
E_{off}		50N50	2.6	mJ
		50N60	4.2	mJ
R_{thJC}				0.42 K/W
R_{thCK}			0.15	K/W

TO-264 AA Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.82	5.13	.190	.202
A1	2.54	2.89	.100	.114
A2	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b1	2.39	2.69	.094	.106
b2	2.90	3.09	.114	.122
c	0.53	0.83	.021	.033
D	25.91	26.16	1.020	1.030
E	19.81	19.96	.780	.786
e	5.46 BSC		.215 BSC	
J	0.00	0.25	.000	.010
K	0.00	0.25	.000	.010
L	20.32	20.83	.800	.820
L1	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q1	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R1	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

Symbol	Test Conditions	Characteristic Values (T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
V_F	I _F = I _{C90} ; V _{GE} = 0 V, Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %			1.7 V
I_{RM}	I _F = I _{C90} ; V _{GE} = 0 V, -di _F /dt = 480 A/μs V _R = 360 V I _F = 1 A; -di _F /dt = 200 A/μs; V _R = 30 V		19	33 A
t_{rr}			175	ns
			35	50 ns
R_{thJC}				0.75 K/W

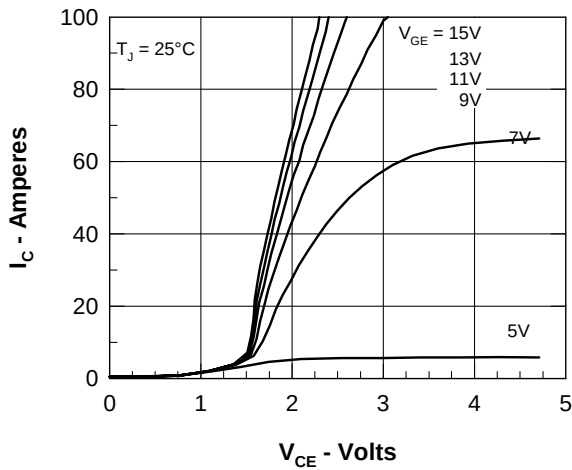


Figure 1. Saturation Voltage Characteristics

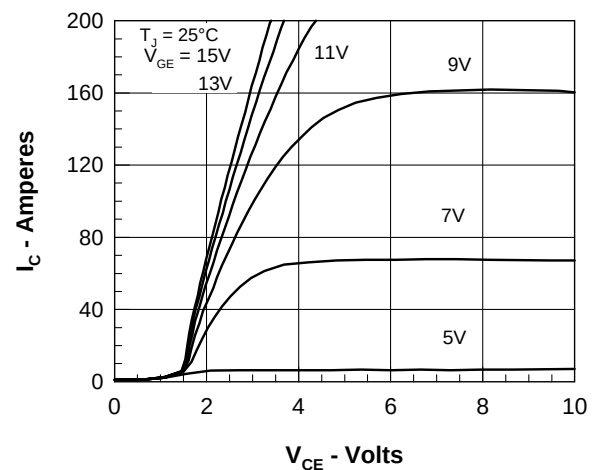


Figure 2. Extended Output Characteristics

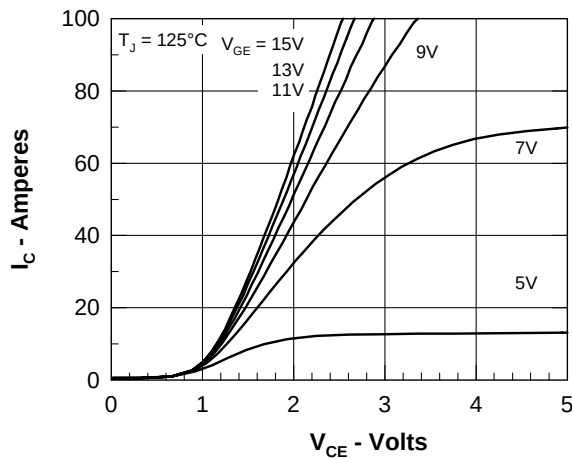


Figure 3. Saturation Voltage Characteristics

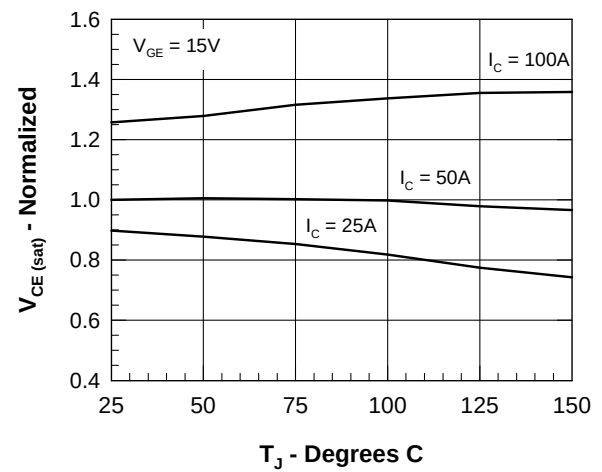


Figure 4. Temperature Dependence of $V_{CE(sat)}$

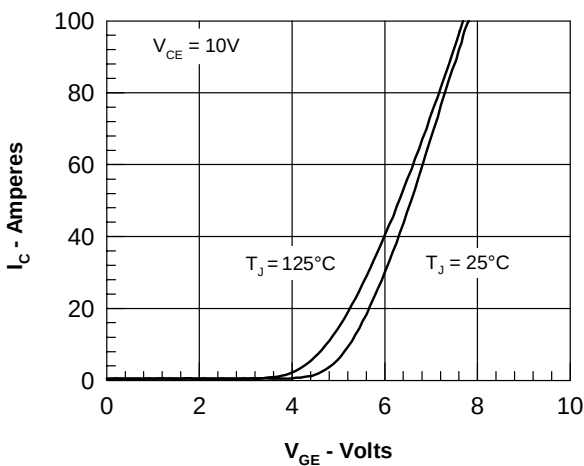


Figure 5. Admittance Curves

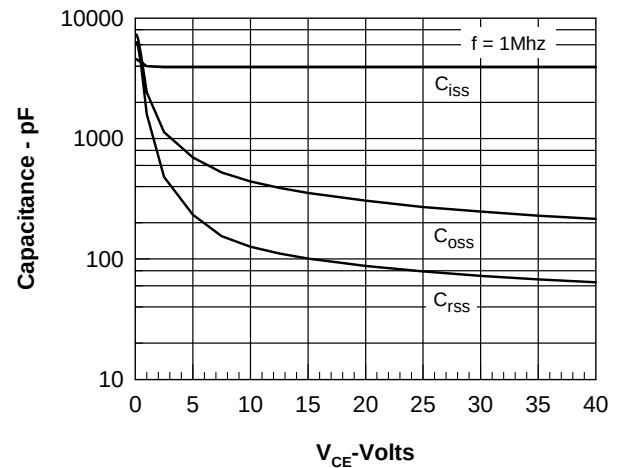


Figure 6. Capacitance Curves

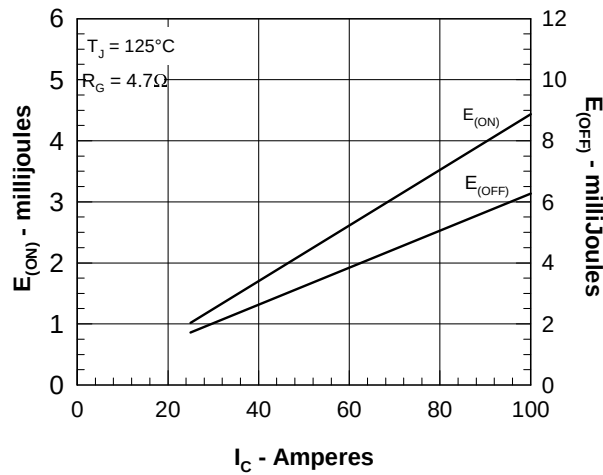
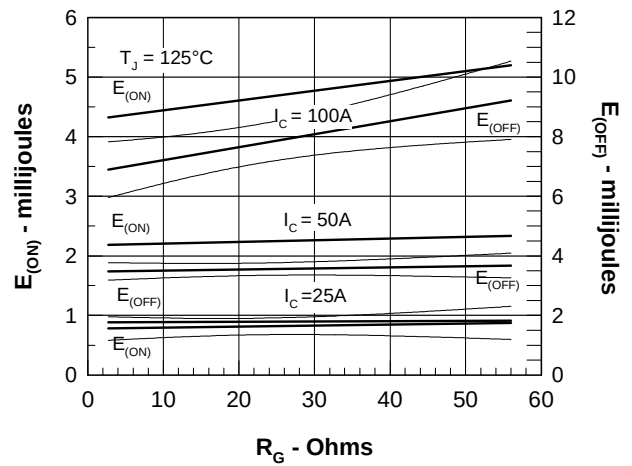
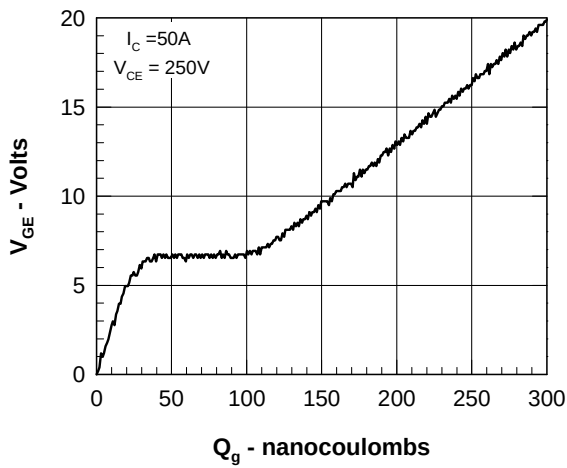

Figure 7. Dependence of E_{ON} and E_{OFF} on I_C .

Figure 8. Dependence of E_{ON} and E_{OFF} on R_G .


Figure 9. Gate Charge

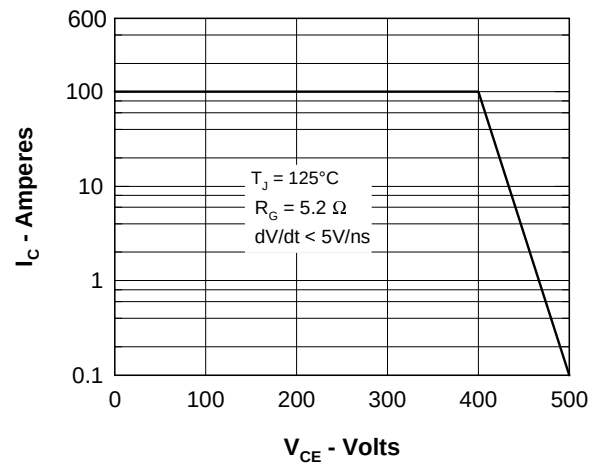


Figure 10. Turn-off Safe Operating Area

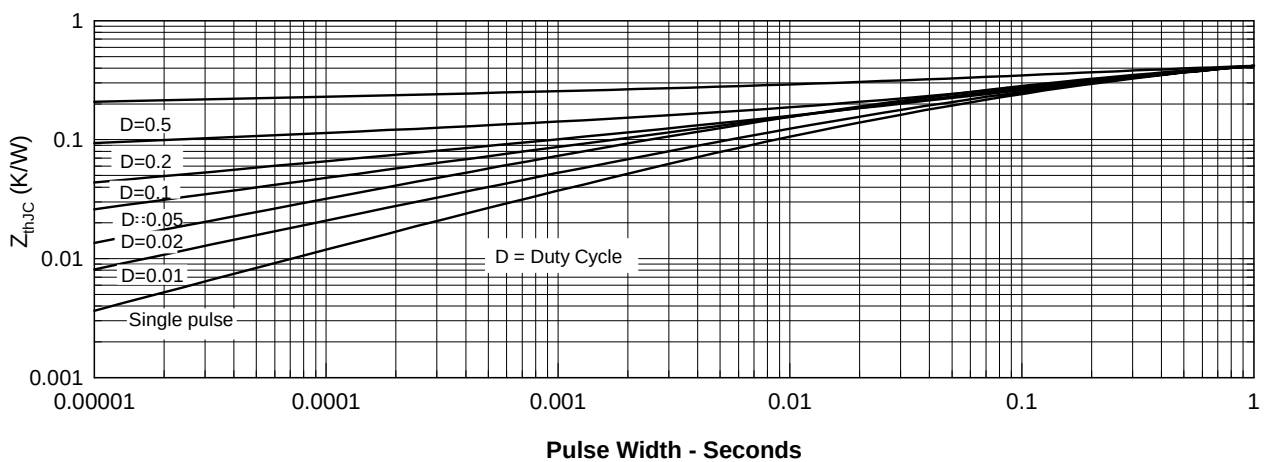


Figure 11. IGBT Transient Thermal Resistance

Fig. 12. Maximum Forward Voltage Drop

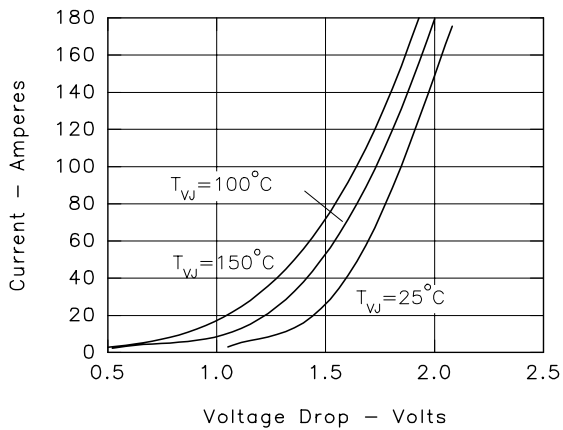
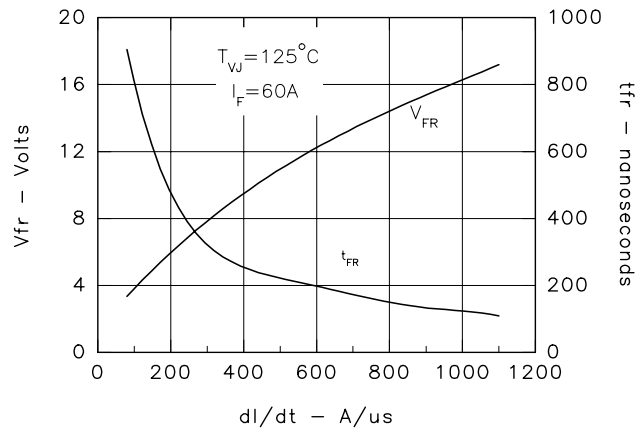
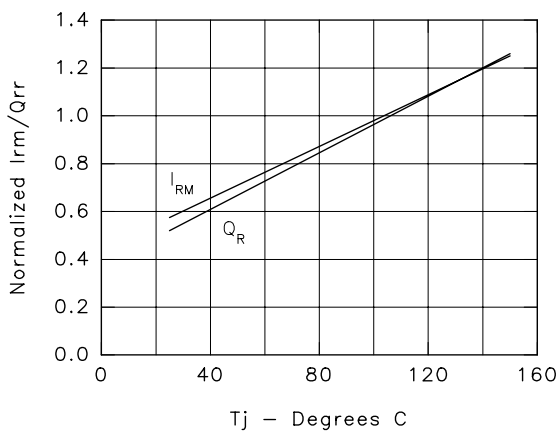
Fig. 13. Peak Forward Voltage V_{FR} and Forward Recovery Time t_{FR} .Fig. 14. Junction Temperature Dependence of I_{RM} and Q_R .

Fig. 15. Maximum Reverse Recovery Charge

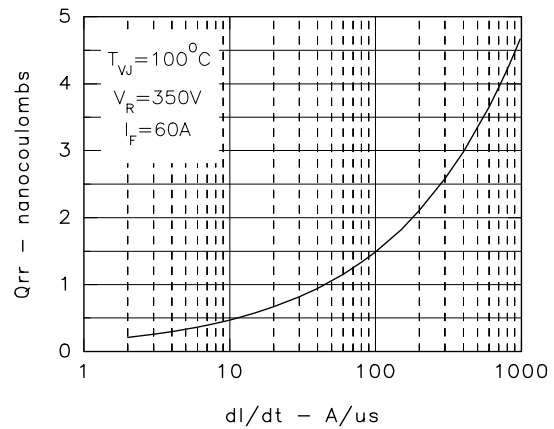


Figure 16. Peak Reverse Recovery Current.

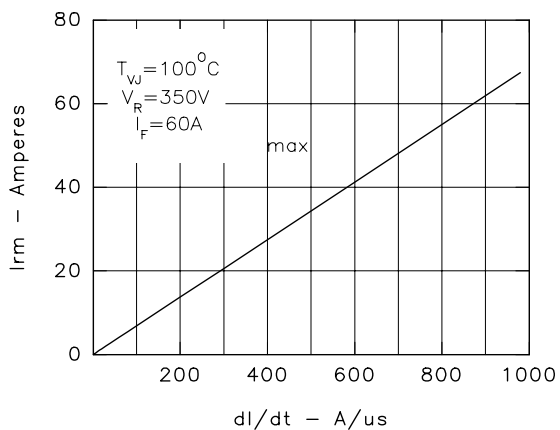
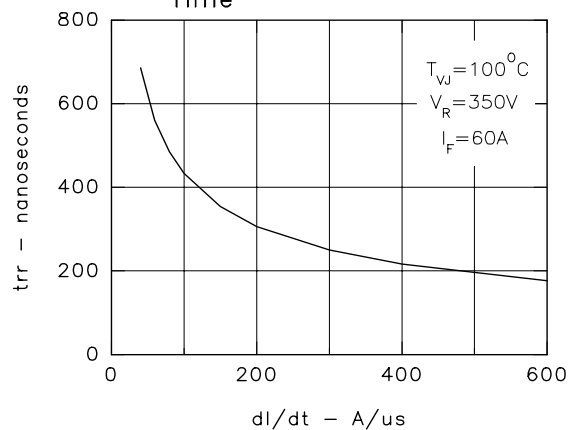


Fig. 17. Maximum Reverse Recovery Time



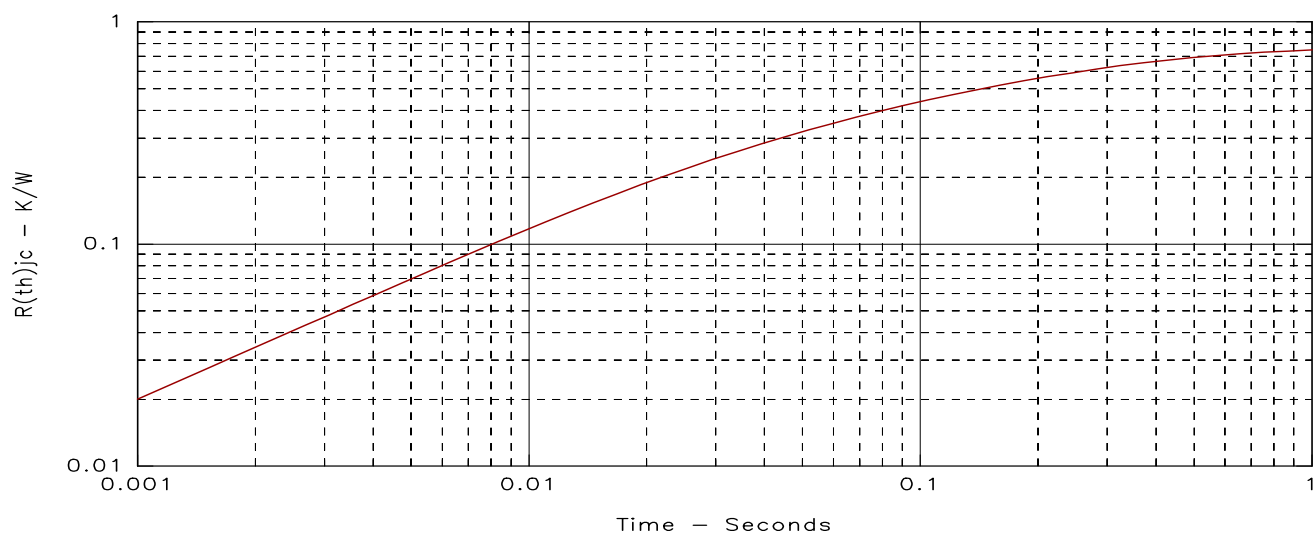
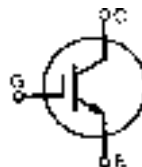


Fig. 18. Diode transient thermal resistance junction-to-case.

HiPerFAST™ IGBT

IXGA 7N60B
IXGP 7N60B

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 14 \text{ A}$
 $V_{CE(sat)typ} = 1.5 \text{ V}$
 $t_{fi} = 150 \text{ ns}$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	14	A
I_{C90}	$T_C = 90^\circ\text{C}$	7	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	30	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 14$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	54	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, (TO-220)	M3 M3.5	0.45/4 Nm/lb.in. 0.55/5 Nm/lb.in.
Weight	TO-220	4	g
	TO-263	2	g

TO-220AB (IXGP)



TO-263 (IXGA)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-263 surface mountable and JEDEC TO-220 AB
- Medium frequency IGBT
- High current handling capability
- HiPerFAST™ HDMOS™ process
- MOS Gate turn-on
- drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

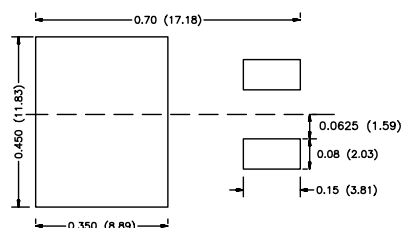
Advantages

- High power density
- Suitable for surface mounting
- Very low switching losses for high frequency applications

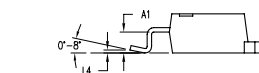
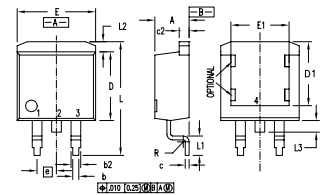
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			100 μA 500 μA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.5	1.8	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	3	7	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		500	pF
C_{oes}			50	pF
C_{res}			17	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		25	nC
Q_{ge}			5	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 22\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		9	ns
t_{ri}			10	ns
E_{on}			0.07	mJ
$t_{d(off)}$			100	ns
t_{fi}			150	ns
E_{off}			0.3	mJ
$t_{d(on)}$			10	ns
t_{ri}	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 22\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
E_{on}			0.07	mJ
$t_{d(off)}$			200	ns
t_{fi}			250	ns
E_{off}			0.6	mJ
R_{thJC}				2.3 K/W
R_{thCK}	(TO-220)	0.25		K/W

Min. Recommended Footprint

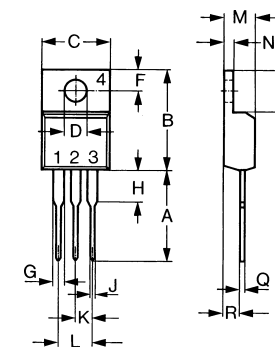


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline

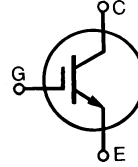


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

HiPerFAST™ IGBT Lightspeed™ Series

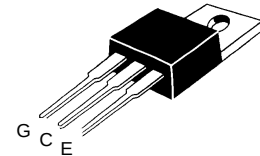
IXGA 7N60C
IXGP 7N60C

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 14 \text{ A}$
 $V_{CE(sat)typ} = 2.0 \text{ V}$
 $t_{fi} = 45 \text{ ns}$

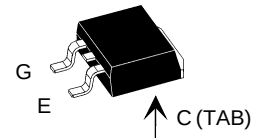


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	14	A
I_{C90}	$T_C = 90^\circ\text{C}$	7	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	30	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 14$ @ $0.8 V_{CES}$	A
P_c	$T_C = 25^\circ\text{C}$	54	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, (TO-220) M3 M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight	TO-220 TO-263	4 2	g

TO-220AB (IXGP)



TO-263 (IXGA)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-263 surface mountable and JEDEC TO-220 AB
- High frequency IGBT
- High current handling capability
- HiPerFAST™ HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

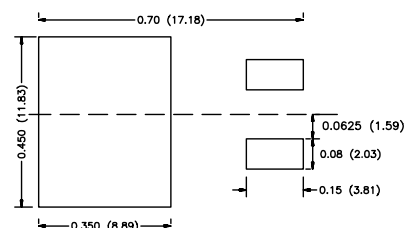
Advantages

- High power density
- Suitable for surface mounting
- Very low switching losses for high frequency applications

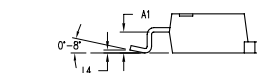
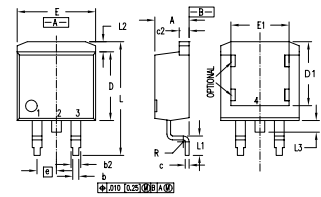
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			100 μA 500 μA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	2.0	2.5	V

Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	3	7	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		500	pF
C_{oes}			50	pF
C_{res}			17	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		25	nC
Q_{ge}			5	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 22\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		9	ns
t_{ri}			10	ns
E_{on}			0.07	mJ
$t_{d(off)}$			65	ns
t_{fi}			45	ns
E_{off}			0.12	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 22\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		10	ns
t_{ri}			15	ns
E_{on}			0.07	mJ
$t_{d(off)}$			120	ns
t_{fi}			85	ns
E_{off}			0.22	mJ
R_{thJC}	(TO-220)		2.3 K/W	
R_{thCK}			0.25 K/W	

Min. Recommended Footprint

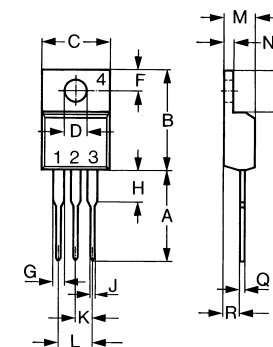


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline

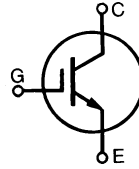


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

HiPerFAST™ IGBT with Diode Lightspeed™ Series

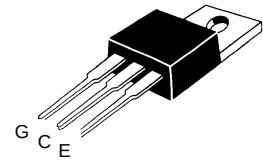
IXGA 7N60CD1
IXGP 7N60CD1

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 14 \text{ A}$
 $V_{CE(sat)typ} = 2.0 \text{ V}$
 $t_{fi} = 45 \text{ ns}$

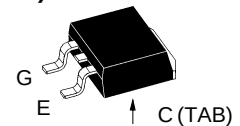


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	14	A
I_{C90}	$T_C = 90^\circ\text{C}$	7	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	30	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 14$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	54	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, (TO-220)	M3 M3.5	0.45/4Nm/lb.in. 0.55/5Nm/lb.in.
Weight	TO-220	4	g
	TO-263	2	g

TO-220AB (IXGP)



TO-263 AA (IXGA)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-263 surface mountable and JEDEC TO-220 AB
- High frequency IGBT
- High current handling capability
- HiPerFAST™ HDMOS™ process
- MOS Gate turn-on
- drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

Advantages

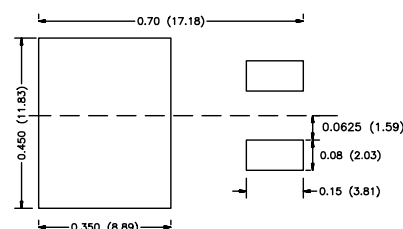
- High power density
- Suitable for surface mounting
- Very low switching losses for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			100 μA 750 μA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	2.0	2.5	V

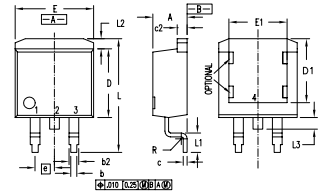
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	3	7	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		500	pF
C_{oes}			50	pF
C_{res}			17	pF
Q_g	$I_C = I_{C90}; V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		25	nC
Q_{ge}			15	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		10	ns
t_{ri}			10	ns
$t_{d(off)}$			65	130 ns
t_{fi}			45	110 ns
E_{off}			0.12	0.25 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		10	ns
t_{ri}			15	ns
E_{on}			0.15	mJ
$t_{d(off)}$			120	ns
t_{fi}			85	ns
E_{off}			0.22	mJ
R_{thJC}	IGBT			2.3 K/W
R_{thCK}			0.25	K/W

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 10\text{ A}$; $T_{VJ} = 150^\circ\text{C}$ $T_{VJ} = 25^\circ\text{C}$			1.96 V 2.95 V
I_{RM}	$V_R = 100\text{ V}$; $I_F = 25\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$ $L \leq 0.05\text{ }\mu\text{H}$; $T_{VJ} = 100^\circ\text{C}$		2	2.5 V
t_{rr}	$I_F = 1\text{ A}$; $-di/dt = 50\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		35	ns
R_{thJC}	Diode			1.6 K/W

Min. Recommended Footprint

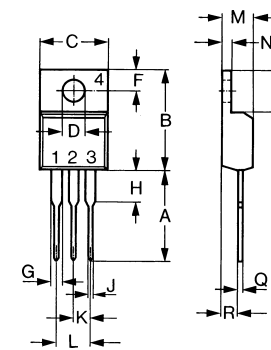


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline



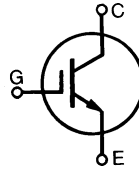
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

HiPerFAST™ IGBT

IXGH 12N60B

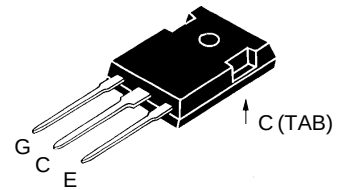
$$\begin{aligned} V_{DSS} &= 600 \text{ V} \\ I_{D25} &= 24 \text{ A} \\ V_{CE(SAT)} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 120 \text{ ns} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 Nm/lb.in. 0.55/5 Nm/lb.in.	
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- Moderate frequency IGBT
- New generation HDMOS™ process
- International standard package JEDEC TO-247
- High peak current handling capability

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode power supplies

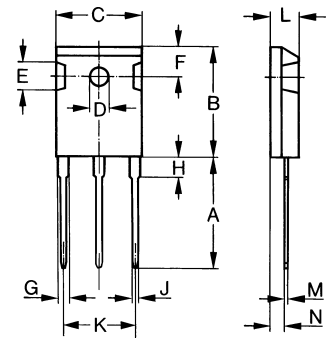
Advantages

- Fast switching speed
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}$, $V_{GE} = 15 \text{ V}$			2.1 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			64	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}; V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$		150	250	ns
t_{fi}		120	270	ns
E_{off}		0.5	0.8	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}		0.15		mJ
$t_{d(off)}$		200		ns
t_{fi}		200		ns
E_{off}		0.8		mJ
R_{thJC}				1.25 K/W
R_{thCK}		0.25		K/W

TO-247 AD (IXGH) Outline



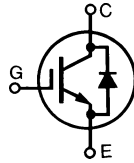
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT

IXGH 12N60BD1

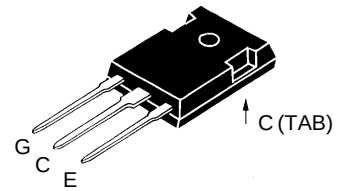
$$\begin{aligned} V_{DSS} &= 600 \text{ V} \\ I_{D25} &= 24 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 120 \text{ ns} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 Nm/lb.in. 0.55/5 Nm/lb.in.	
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247 AD



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{GE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15 \text{ V}$			2.1 V

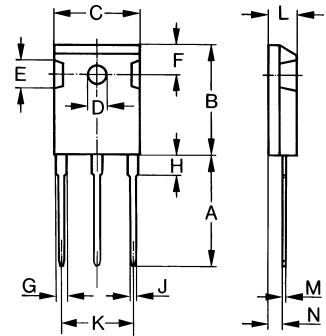
Features

- Moderate frequency IGBT
- New generation HDMOS™ process
- International standard package JEDEC TO-247
- High peak current handling capability and antiparallel diode in one package

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode power supplies

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			100	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}; V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$		150	250	ns
t_{fi}		120	270	ns
E_{off}		0.5	0.8	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}		0.5		mJ
$t_{d(off)}$		200		ns
t_{fi}		200		ns
E_{off}		0.8		mJ
R_{thJC}	IGBT			1.25 K/W
R_{thCK}		0.25		K/W

TO-247 AD (IXGH) Outline


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 15\text{ A}$; $T_{VJ} = 150^\circ\text{C}$ $T_{VJ} = 25^\circ\text{C}$		1.3	V 2.5 V
I_{RM}	$V_R = 100\text{ V}$; $I_F = 25\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$ $L \leq 0.05\text{ }\mu\text{H}$; $T_{VJ} = 100^\circ\text{C}$		2	2.5 A
t_{rr}	$I_F = 1\text{ A}$; $-di/dt = 50\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		35	ns
R_{thJC}	Diode			1.6 K/W

HiPerFAST™ IGBT

IXGA 12N60BD1

IXGP 12N60BD1

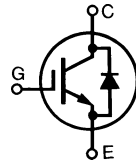
$$V_{CES} = 600 \text{ V}$$

$$I_{C25} = 24 \text{ A}$$

$$V_{CE(sat)} = 2.1 \text{ V}$$

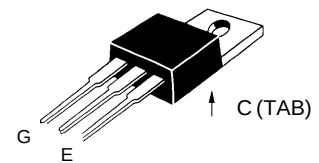
$$t_{fi(typ)} = 120 \text{ ns}$$

Preliminary data

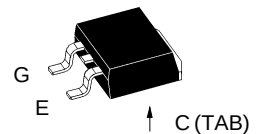


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight		4	g

TO-220 AB (IXGP)



TO-263 (IXGA)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- Moderate frequency IGBT and anti-parallel FRED in one package
- New generation HDMOS™ process
- International standard package JEDEC TO-220AB and TO-263AA
- High peak current handling capability

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode power supplies

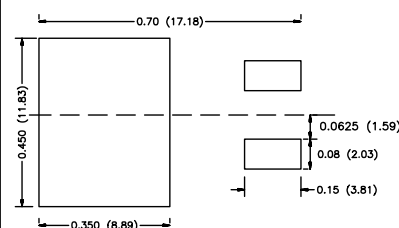
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}$, $V_{GE} = 15 \text{ V}$			2.1 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			100	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$		150	250	ns
t_{fi}		120	270	ns
E_{off}		0.5	0.8	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}		0.15		mJ
$t_{d(off)}$		200		ns
t_{fi}		200		ns
E_{off}		0.8		mJ
R_{thJC}	IGBT			1.25 K/W
R_{thCK}		0.25		K/W

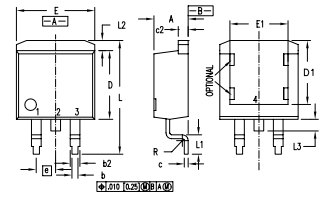
Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 15\text{ A}$; $T_{VJ} = 150^\circ\text{C}$ $T_{VJ} = 25^\circ\text{C}$		1.3	V 2.5 V
I_{RM}	$V_R = 100\text{ V}$; $I_F = 25\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$ $L \leq 0.05\text{ }\mu\text{H}$; $T_{VJ} = 100^\circ\text{C}$		2	2.5 A
t_{rr}	$I_F = 1\text{ A}$; $-di_F/dt = 50\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		35	ns
R_{thJC}	Diode			1.6 K/W

Min. Recommended Footprint

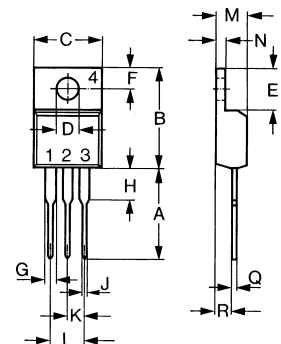


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline

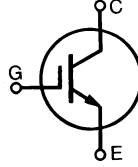


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

HiPerFAST™ IGBT Lightspeed™ Series

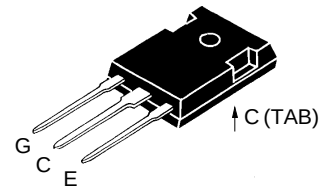
IXGH 12N60C

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 24 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- Very high frequency IGBT
- New generation HDMOS™ process
- International standard package
JEDEC TO-247
- High peak current handling capability

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode
power supplies
- High power audio amplifiers

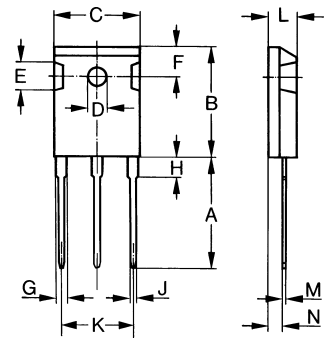
Advantages

- Fast switching speed
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15 \text{ V}$	2.1	2.7	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			64	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}; V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$			60	ns
t_{fi}			55	ns
E_{off}			0.09	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}			0.15	mJ
$t_{d(off)}$			85	180 ns
t_{fi}			85	180 ns
E_{off}			0.27	0.60 mJ
R_{thJC}				1.25 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



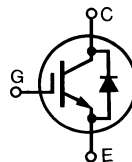
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT Lightspeed™ Series

IXGH 12N60CD1

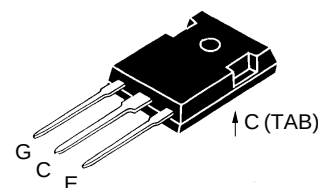
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 24 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- Very high frequency IGBT
- New generation HDMOS™ process
- International standard package JEDEC TO-247AD
- High peak current handling capability

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode power supplies
- High power audio amplifiers

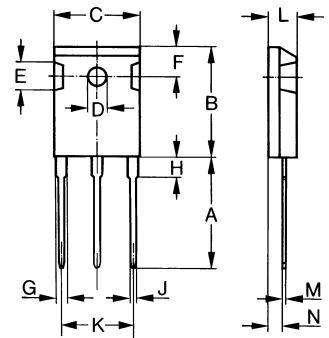
Advantages

- Fast switching speed
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$	2.1	2.7	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			100	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}; V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$			60	ns
t_{fi}			55	ns
E_{off}			0.09	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}			0.5	mJ
$t_{d(off)}$			85	180 ns
t_{fi}			85	180 ns
E_{off}			0.27	0.60 mJ
R_{thJC}	IGBT			1.25 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

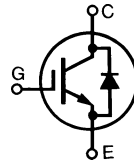
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 15\text{ A}$; $T_{VJ} = 150^\circ\text{C}$ $T_{VJ} = 25^\circ\text{C}$		1.7	V 2.5 V
I_{RM}	$V_R = 100\text{ V}$; $I_F = 25\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$ $L \leq 0.05\text{ }\mu\text{H}$; $T_{VJ} = 100^\circ\text{C}$		2	2.5 A
t_{rr}	$I_F = 1\text{ A}$; $-di_F/dt = 50\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		35	ns
R_{thJC}	Diode			1.6 K/W

HiPerFAST™ IGBT Lightspeed™ Series

IXGA 12N60CD1
IXGP 12N60CD1

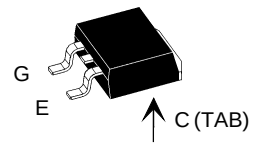
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 24 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$

Preliminary data

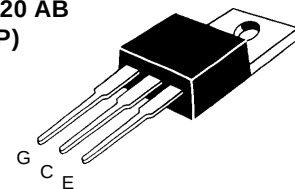


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight		4	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-263 (IXGA)



TO-220 AB (IXGP)



G = Gate C = Collector
E = Emitter TAB = Collector

Features

- Very high frequency IGBT
- New generation HDMOS™ process
- International standard package
JEDEC TO-220AB and TO-263AA
- High peak current handling capability

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode power supplies
- High power audio amplifiers

Advantages

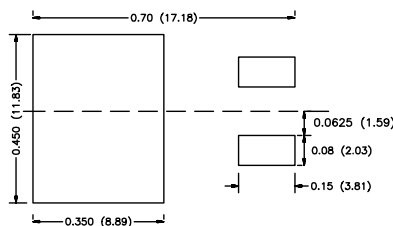
- Fast switching speed
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}$, $V_{GE} = 15 \text{ V}$	2.1	2.7	V

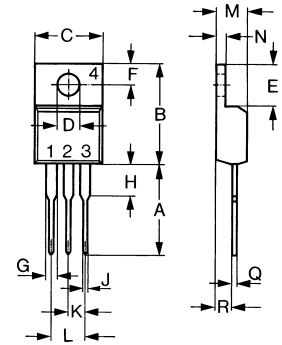
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			100	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$			60	ns
t_{fi}			55	ns
E_{off}			0.09	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}			0.5	mJ
$t_{d(off)}$			85	180 ns
t_{fi}			85	180 ns
E_{off}			0.27	0.60 mJ
R_{thJC}	IGBT			1.25 K/W
R_{thCK}			0.25	K/W

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 15\text{ A}$; $T_{VJ} = 150^\circ\text{C}$ $T_{VJ} = 25^\circ\text{C}$		1.7	V 2.5 V
I_{RM}	$V_R = 100\text{ V}$; $I_F = 25\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$ $L \leq 0.05\text{ }\mu\text{H}$; $T_{VJ} = 100^\circ\text{C}$		2	2.5 A
t_{rr}	$I_F = 1\text{ A}$; $-di_F/dt = 50\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		35	ns
R_{thJC}	Diode			1.6 K/W

Min. Recommended Footprint

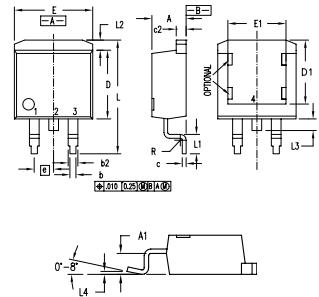


TO-220 AB (IXGP) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

TO-263 AA (IXGA) Outline



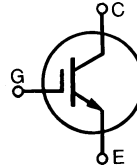
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

HiPerFAST™ IGBT

IXGA12N60C
IXGP12N60C

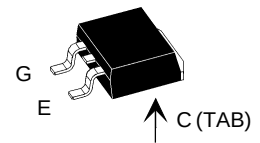
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 24 \text{ A} \\ V_{CE(sat)typ} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$

Preliminary Data Sheet

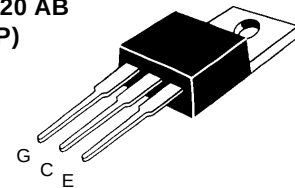


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight		4	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-263 (IXGA)



TO-220 AB (IXGP)



G = Gate C = Collector
E = Emitter TAB = Collector

Features

- Very high frequency IGBT
- New generation HDMOS™ process
- International standard package
JEDEC TO-220AB and TO-263AA
- High peak current handling capability

Applications

- PFC circuits
- AC motor speed control
- DC servo & robot drives
- Switch-mode and resonant-mode power supplies
- High power audio amplifiers

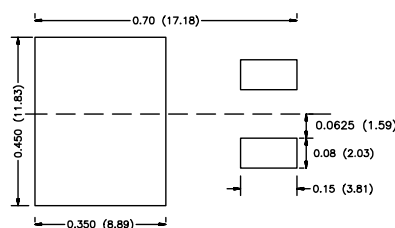
Advantages

- Fast switching speed
- High power density

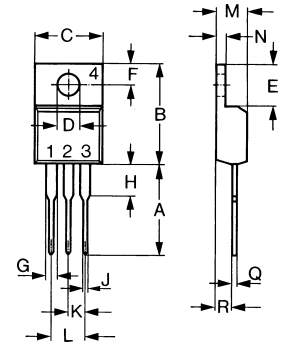
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{GE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8, V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ 200 μA $T_J = 125^\circ\text{C}$ 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15$	2.1	2.7	V

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$, $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	7	11	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		860	pF
C_{oes}			64	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$			60	ns
t_{fi}			55	ns
E_{off}			0.09	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}			0.15	mJ
$t_{d(off)}$			85	ns
t_{fi}			85	ns
E_{off}			0.27	mJ
R_{thJC}				1.25 K/W
R_{thCK}			0.25	K/W

Min. Recommended Footprint

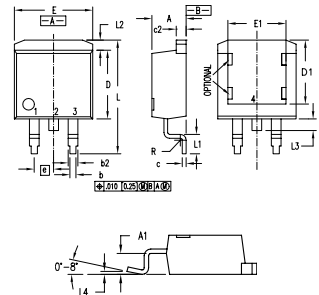


TO-220 AB (IXGP) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

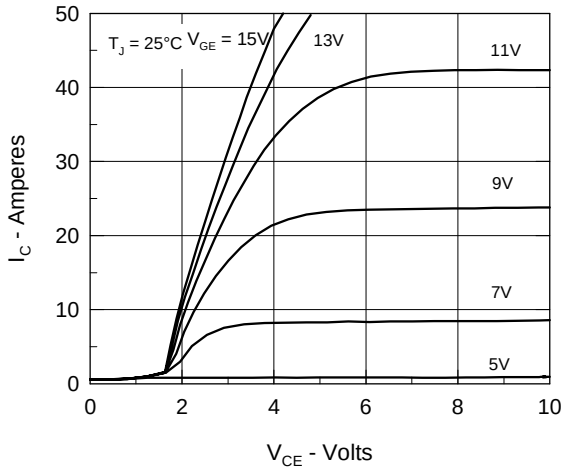


Fig. 1. Saturation Voltage Characteristics

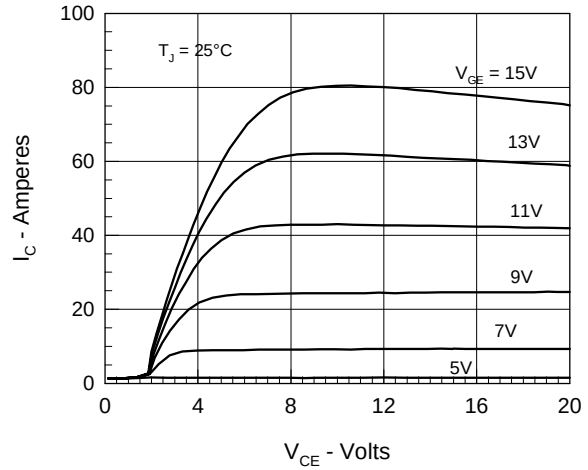


Fig. 2. Extended Output Characteristics

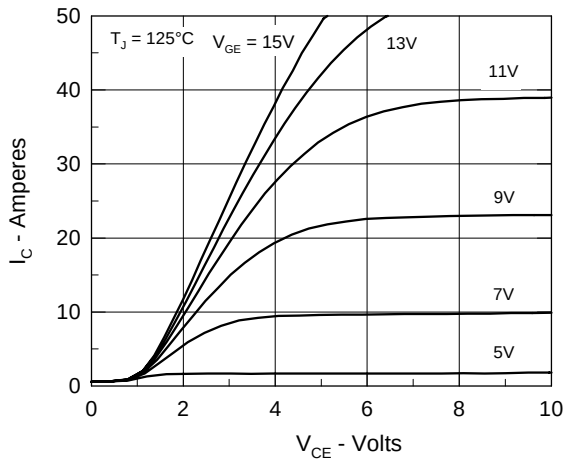


Fig. 3. Saturation Voltage Characteristics

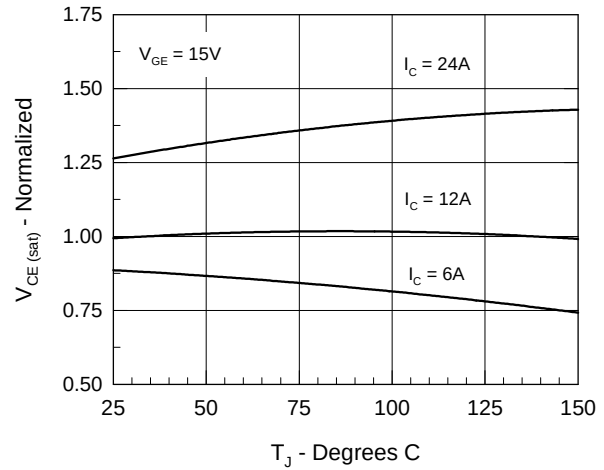
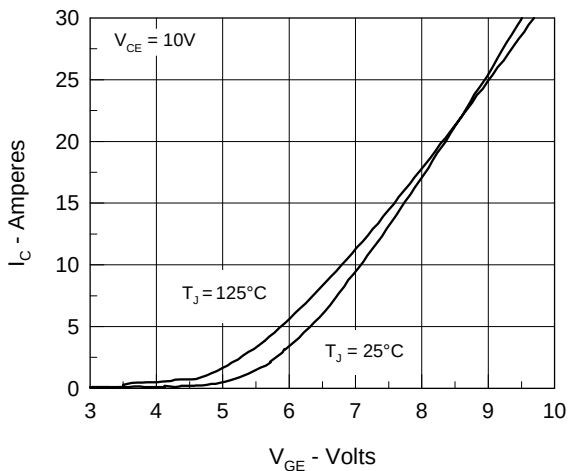

Fig. 4. Temperature Dependence of $V_{CE(sat)}$


Fig. 5. Saturation Voltage Characteristics

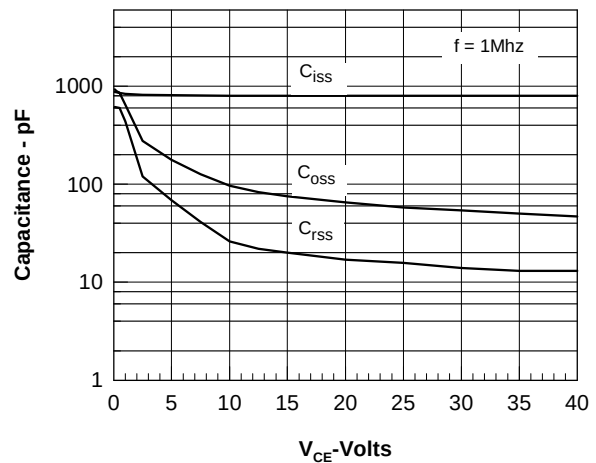


Fig. 6. Junction Capacitance Curves

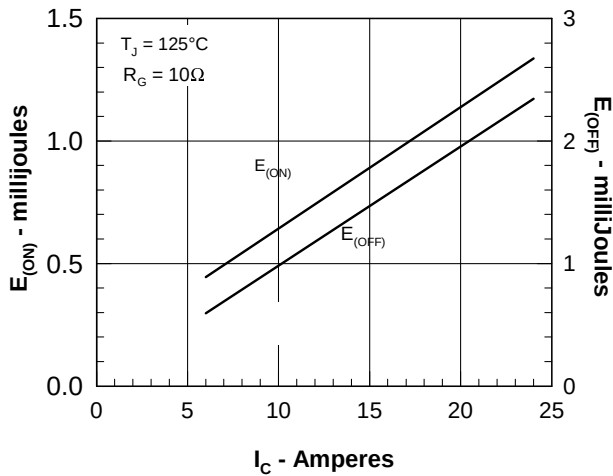


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

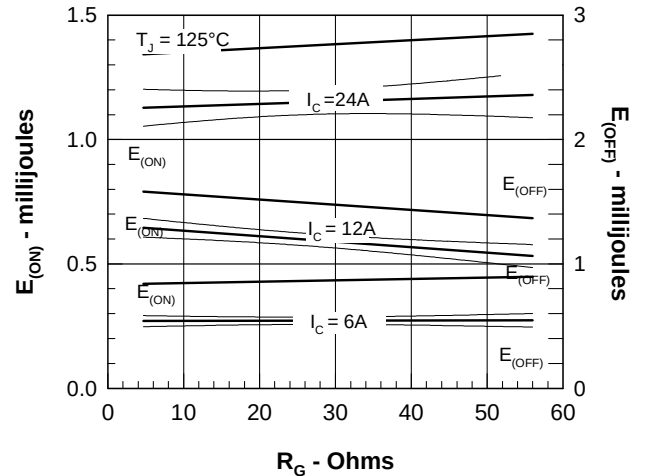


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

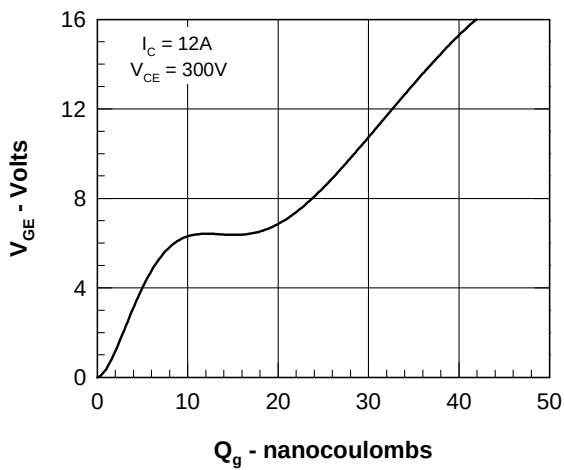


Fig. 9. Gate Charge

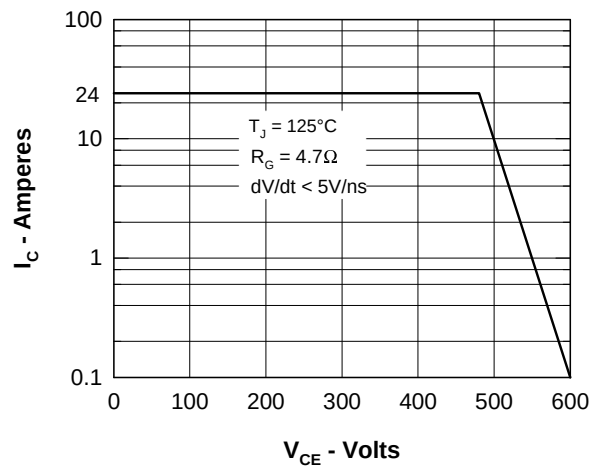


Fig. 10. Turn-off Safe Operating Area

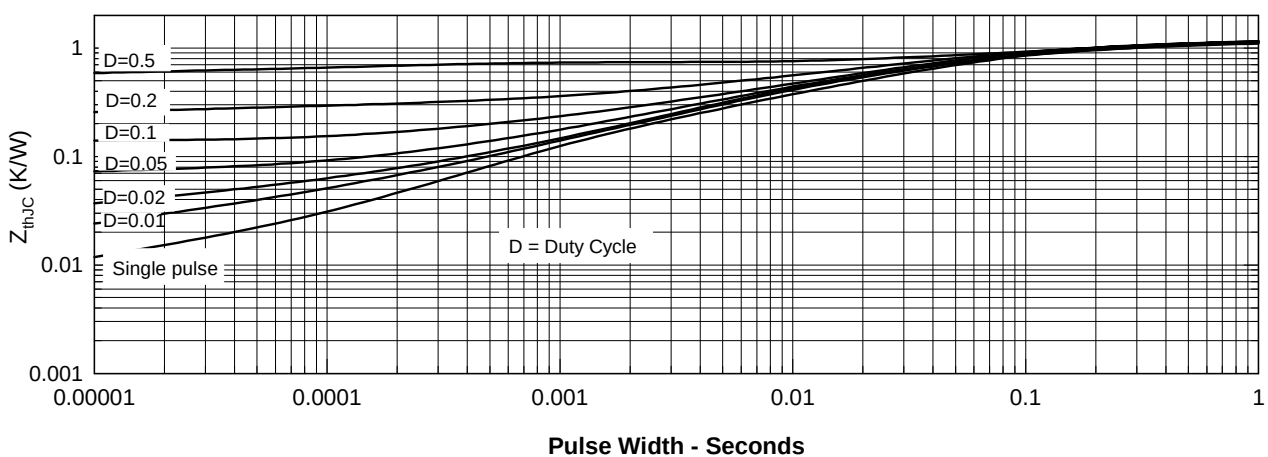


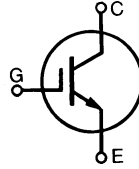
Fig. 11. Transient Thermal Resistance

HiPerFAST™ IGBT ISOPLUS247™

IXGR 12N60C

(Electrically Isolated Back Surface)

Preliminary data sheet

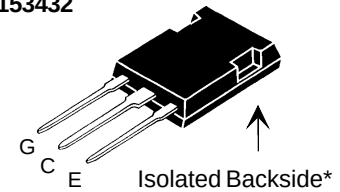


$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 15 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	15	A
I_{C90}	$T_C = 90^\circ\text{C}$	8	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	55	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
V_{ISOL}	Isolation Voltage	2500	V
Weight		5	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

ISOPLUS 247

E153432



G = Gate C = Drain
E = Source

* Patent pending

Features

- Silicon chip on Direct-Copper-Bond substrate
- High power dissipation
- Isolated mounting surface
- 2500V electrical isolation
- Low collector to tab capacitance (<35pF)
- 3rd generation HDMOS™ process
- $V_{CE(sat)}$
- Rugged polysilicon gate cell structure

Applications

- PFC circuits
- AC motor control
- Switched-mode and resonant-mode power supplies, UPS, no screws, or isolation foils
- DC choppers

Advantages

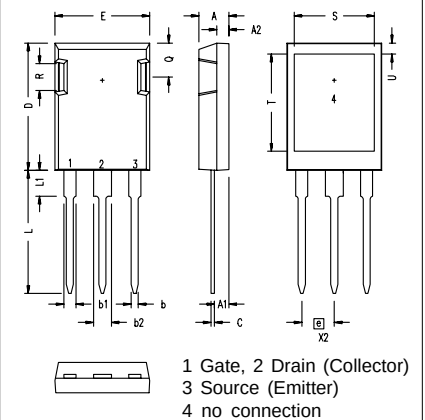
- Easy assembly
- Low capacitance to ground, low EMI

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_T, V_{GE} = 15 \text{ V}$		2.1	2.7 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_T, V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	7	11	S
C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		860	pF
C_{oes}			64	pF
C_{res}			15	pF
Q_g	$I_C = I_T, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		32	nC
Q_{ge}			10	nC
Q_{gc}			10	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_T, V_{GE} = 15\text{ V}, L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}, R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$			60	ns
t_{fi}			55	ns
E_{off}			0.09	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_T, V_{GE} = 15\text{ V}, L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}, R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}			0.15	mJ
$t_{d(off)}$			85	180 ns
t_{fi}			85	180 ns
E_{off}			0.27	0.60 mJ
R_{thJC}				2.27 K/W
R_{thCK}			0.15	K/W

Note: $I_T = 12\text{ A}$

ISOPLUS 247 (IXGR) OUTLINE



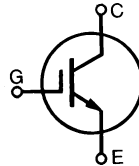
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45 BSC		.215 BSC	
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080

HiPerFAST™ IGBT

IXGH 20N60B
IXGT 20N60B

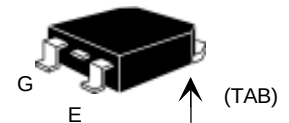
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 40 \text{ A} \\ V_{CE(sat)typ} &= 1.7 \text{ V} \\ t_{fi(typ)} &= 100 \text{ ns} \end{aligned}$$

Preliminary data sheet

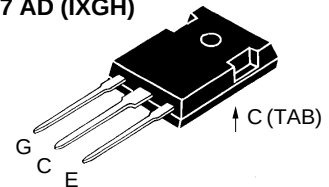


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-247	6	g
	TO-268	4	g

TO-268 (D3) (IXGT)



TO-247 AD (IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface mountable and JEDEC TO-247 AD
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

Advantages

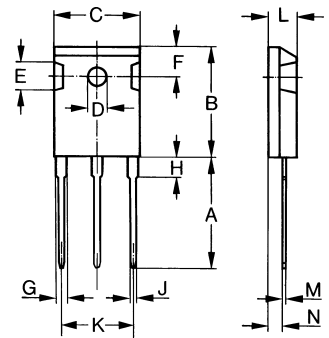
- Space savings (two devices in one package)
- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, TO-247 (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$200 \mu\text{A}$ 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.7	2.0	V

Symbol	Test Conditions	Characteristic Values (T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
g _{fs}	I _C = I _{C90} ; V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %	9	17	S
C _{ies} C _{oes} C _{res}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz		1500 175 40	pF pF pF
Q _g Q _{ge} Q _{gc}		I _C = I _{C90} , V _{GE} = 15 V, V _{CE} = 0.5 V _{CES}	90 11 30	nC nC nC
t _{d(on)} t _{ri} E _{on} t _{d(off)} t _{fi} E _{off}			Inductive load, T _J = 25°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 10 Ω Note 1	15 35 0.15 150 100 0.7
t _{d(on)} t _{ri} E _{on} t _{d(off)} t _{fi} E _{off}	Inductive load, T _J = 125°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 10 Ω Note 1			15 35 0.15 220 140 1.2
R _{thJC} R _{thCK}				0.25

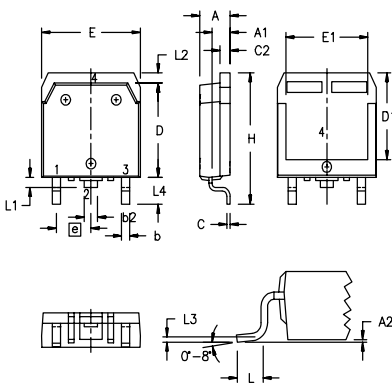
Note 1: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G

TO-247 AD (IXGH) Outline



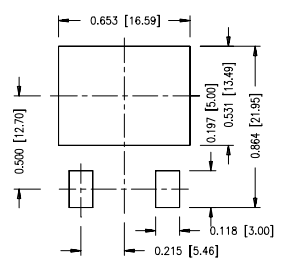
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

Min. Recommended Footprint



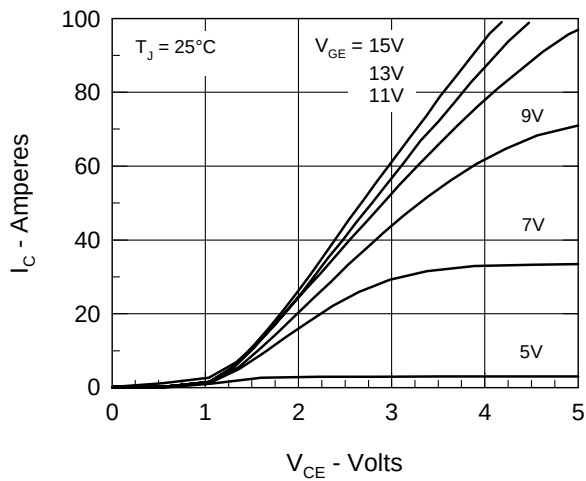


Fig. 1. Output Characteristics

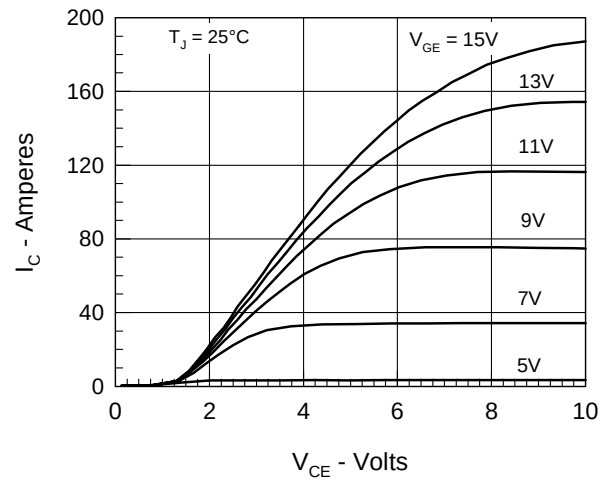


Fig. 2. Extended Output Characteristics

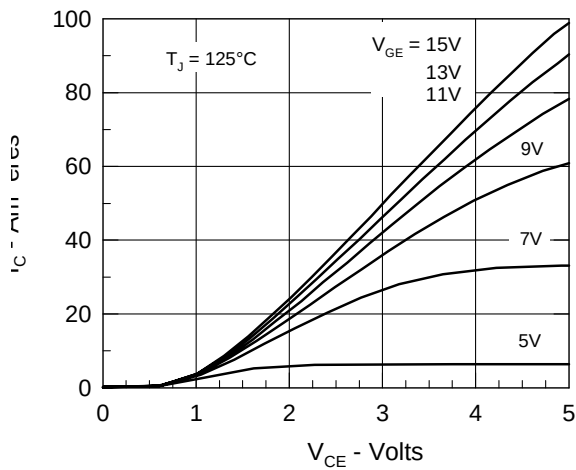


Fig. 3. High Temperature Output Characteristics

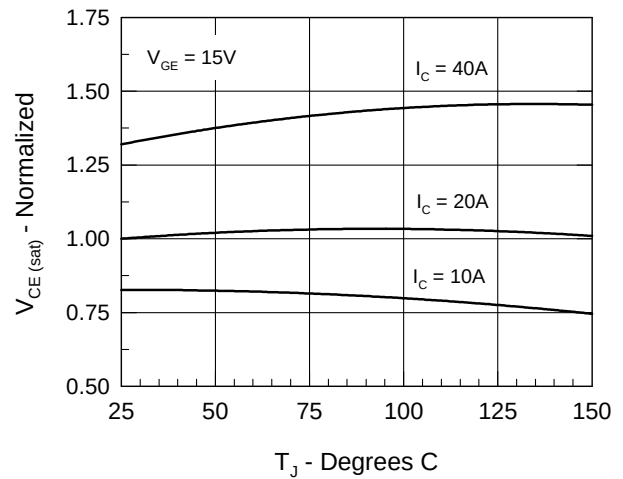


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

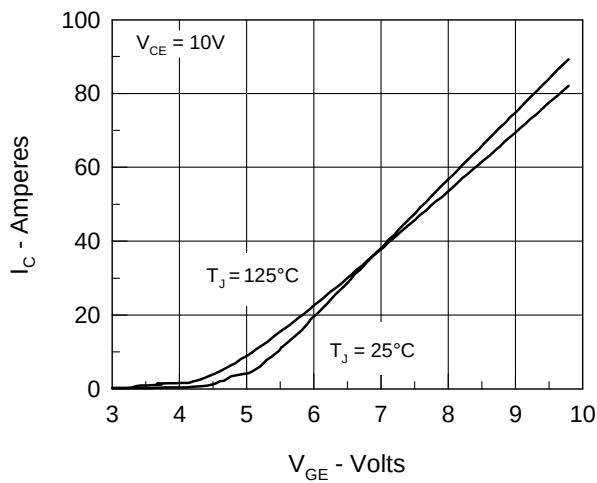


Fig. 5. Admittance Curves

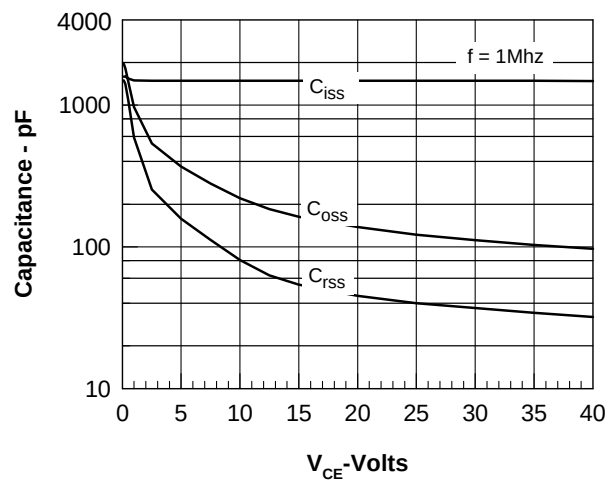


Fig. 6. Capacitance Curves

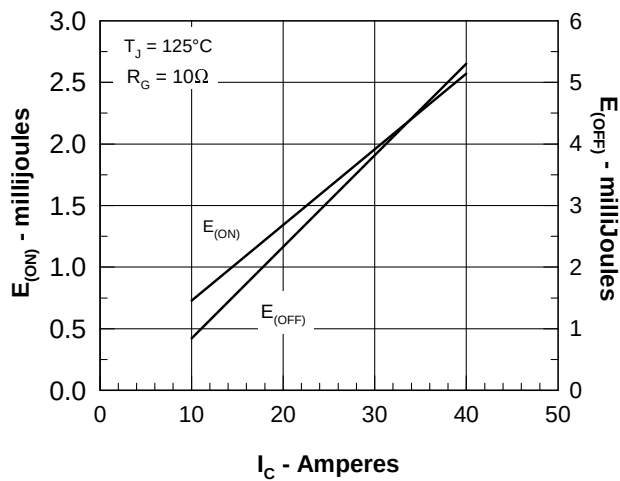


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

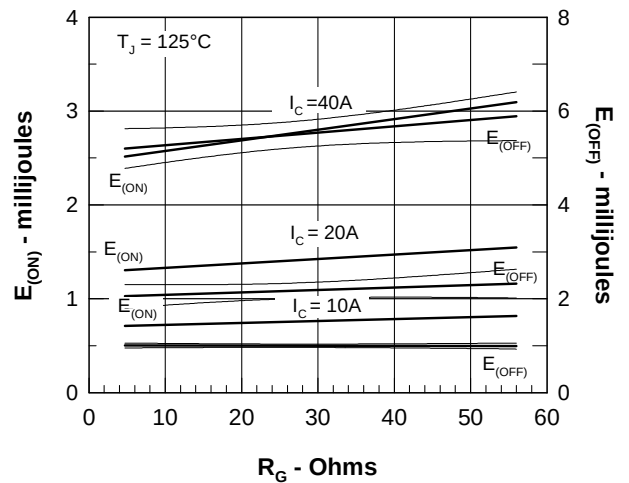


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

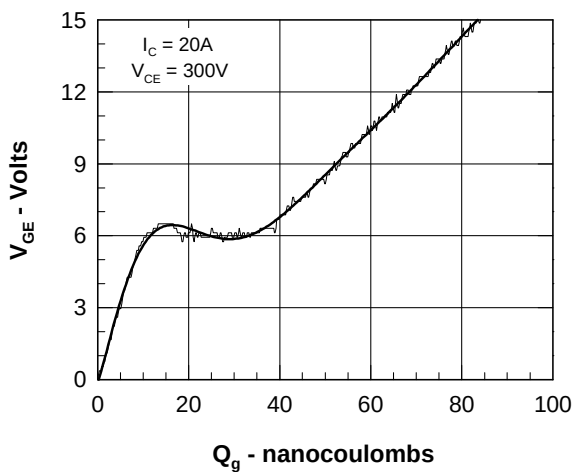


Fig. 9. Gate Charge

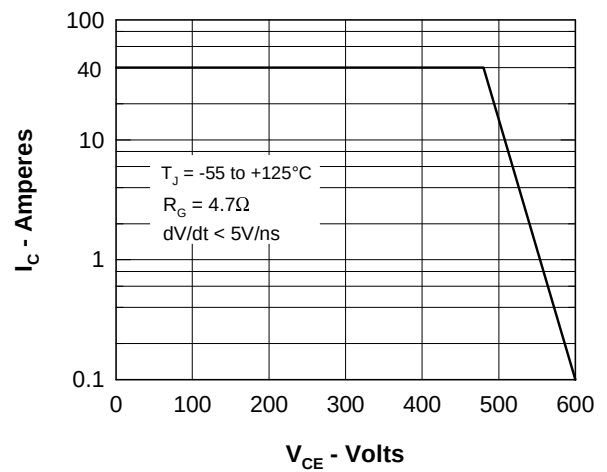


Fig. 10. Turn-off Safe Operating Area

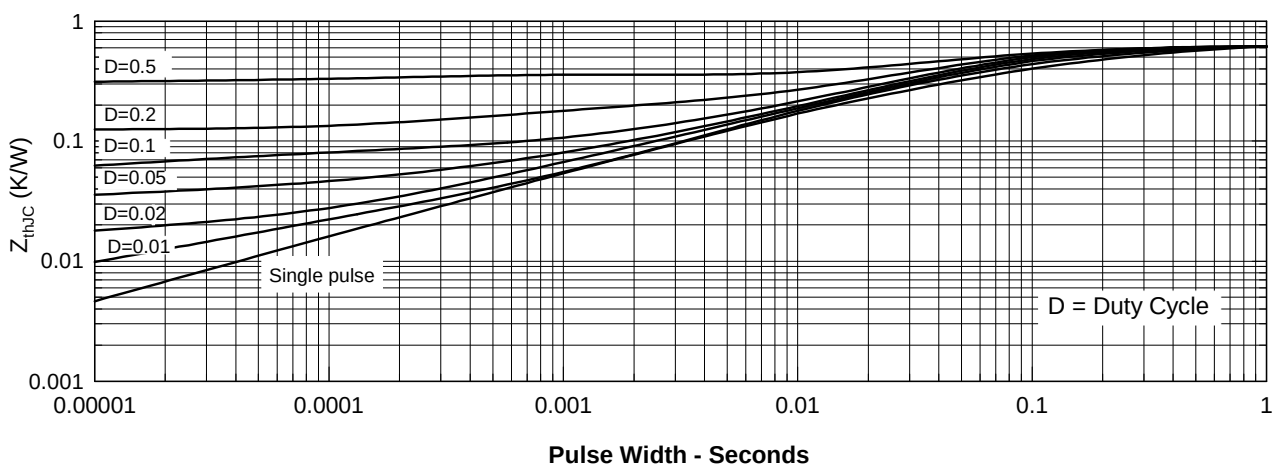


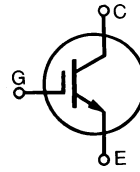
Fig. 11. IGBT Transient Thermal Resistance Junction-to-Case

HiPerFAST™ IGBT

IXGA 20N60B
IXGP 20N60B

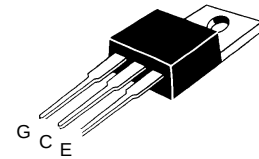
$V_{CES} = 600 \text{ V}$
 $I_{C25} = 40 \text{ A}$
 $V_{CE(sat)typ} = 1.7 \text{ V}$
 $t_{fi} = 100 \text{ ns}$

Preliminary data sheet

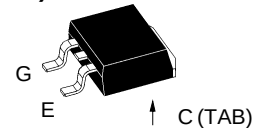


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (TO-220)	M3 0.45/4 Nm/lb.in. M3.5 0.55/5 Nm/lb.in.	
Weight	TO-220 TO-263	4 2	g

TO-220AB (IXGP)



TO-263 AA (IXGA)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-263 surface mountable and JEDEC TO-220 AB
- High frequency IGBT
- High current handling capability
- HiPerFAST™ HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

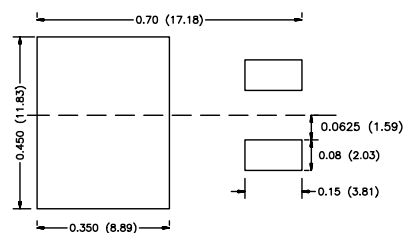
Advantages

- High power density
- Suitable for surface mounting
- Very low switching losses for high frequency applications

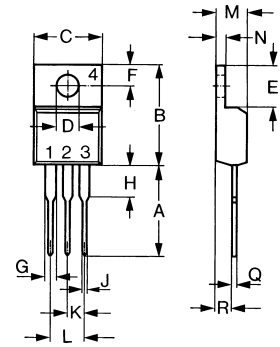
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.7	2.0	V

Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			175	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
Q_{ge}			11	nC
Q_{gc}			30	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			35	ns
E_{on}			0.15	mJ
$t_{d(off)}$			150	ns
t_{fi}			100	ns
E_{off}			0.7	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			35	ns
E_{on}			0.15	mJ
$t_{d(off)}$			220	ns
t_{fi}			140	ns
E_{off}			1.2	mJ
R_{thJC}	(TO-220)		0.83 K/W	
R_{thCK}			0.25 K/W	

Min. Recommended Footprint

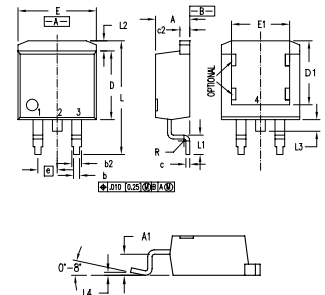


TO-220 AB (IXGP) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

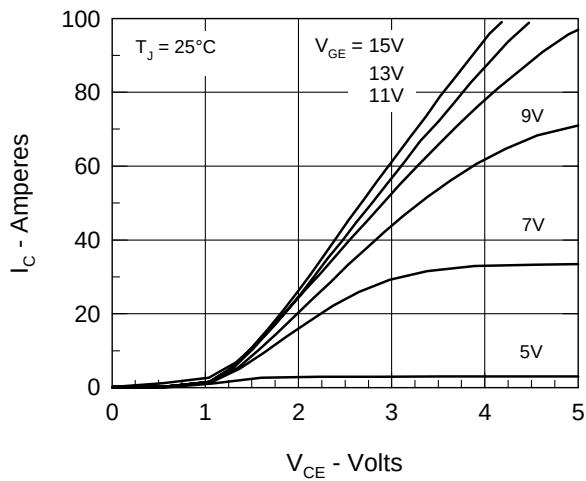


Fig. 1. Output Characteristics

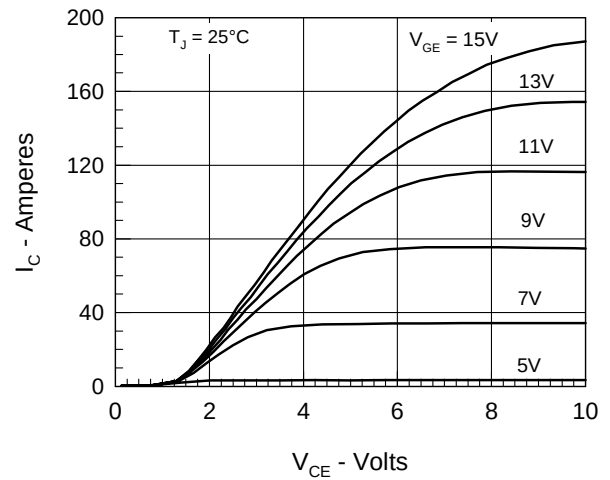


Fig. 2. Extended Output Characteristics

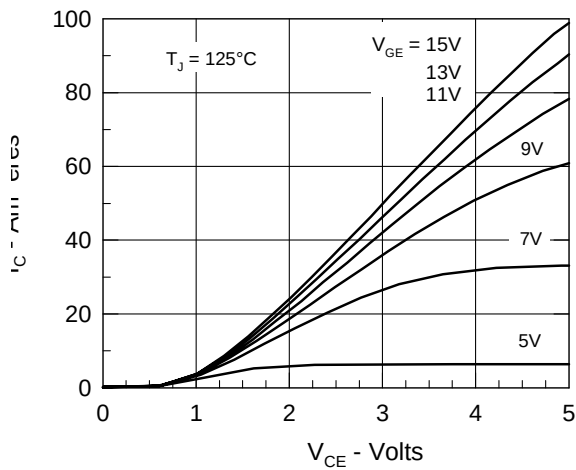


Fig. 3. High Temperature Output Characteristics

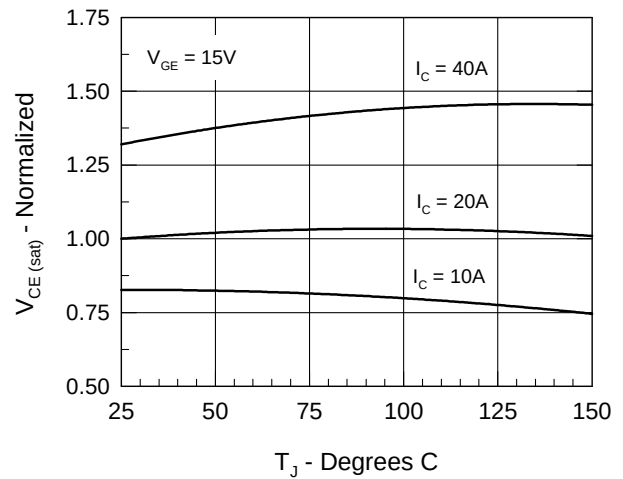


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

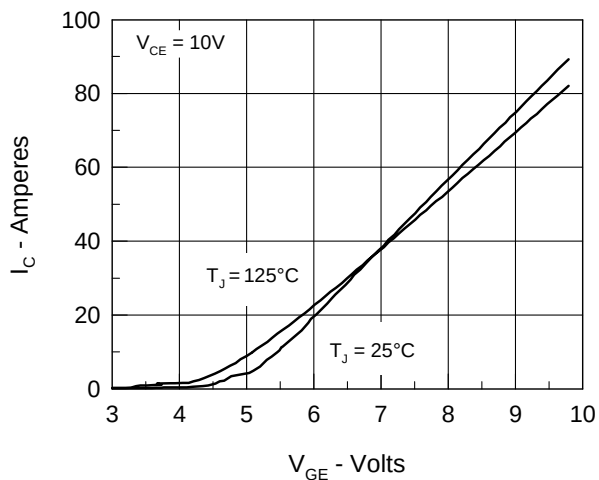


Fig. 5. Admittance Curves

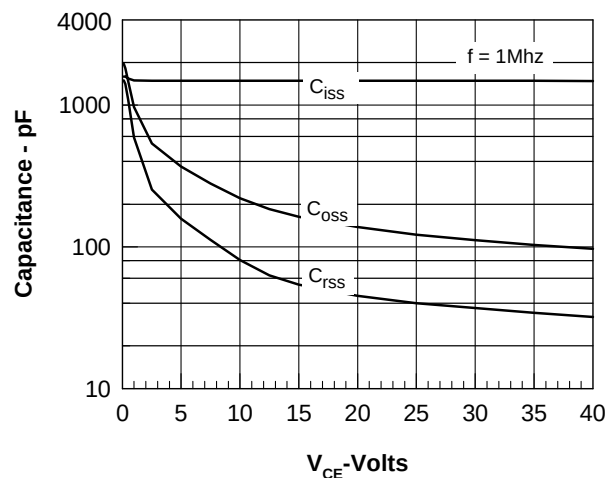


Fig. 6. Capacitance Curves

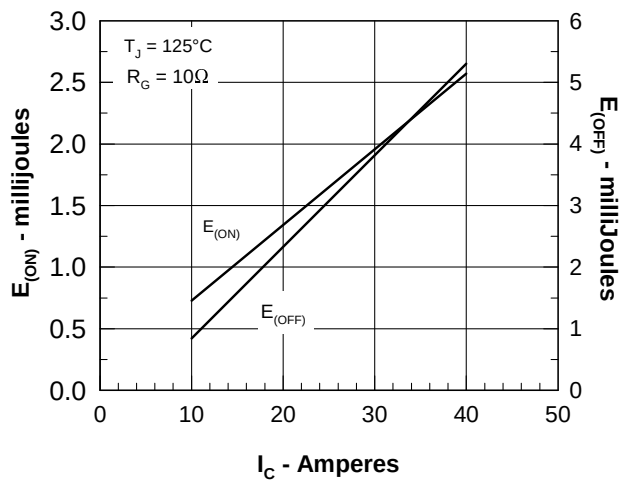


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

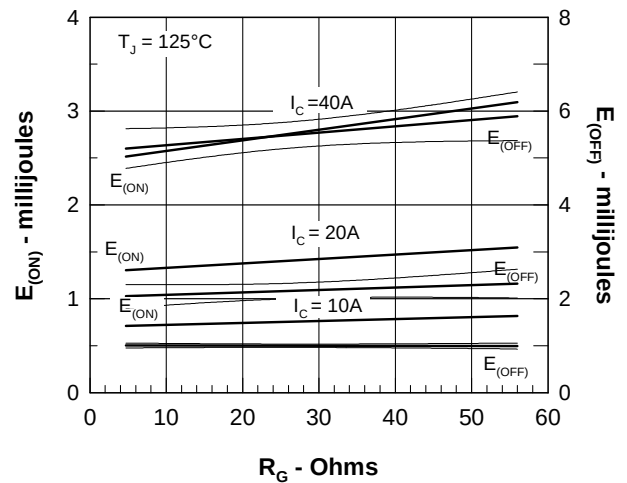


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

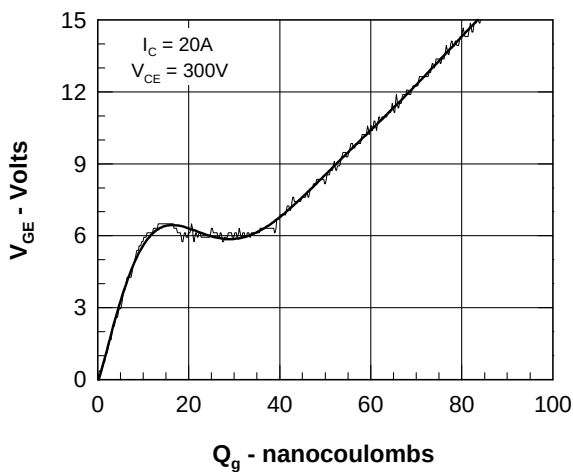


Fig. 9. Gate Charge

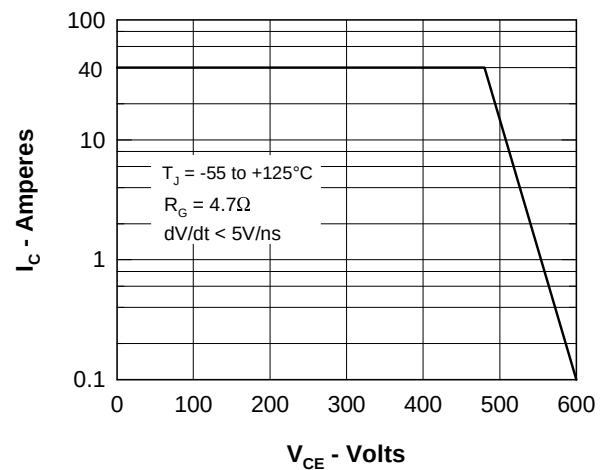


Fig. 10. Turn-off Safe Operating Area

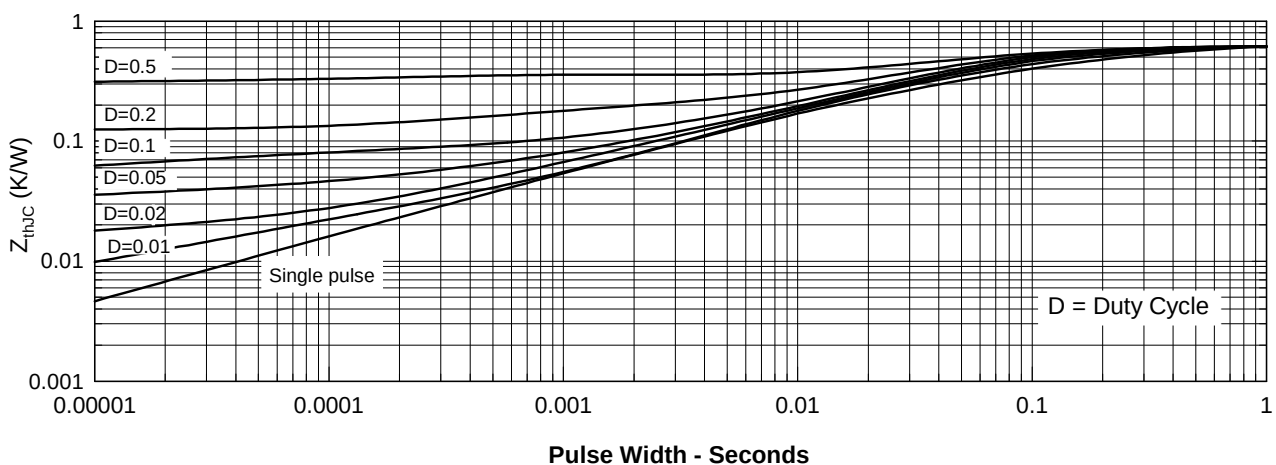


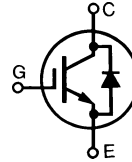
Fig. 11. IGBT Transient Thermal Resistance Junction-to-Case

HiPerFAST™ IGBT with Diode Combi Pack

IXGH20N60BU1

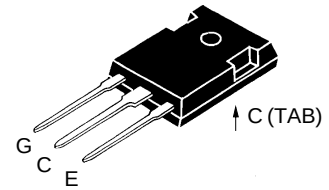
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C(25)} &= 40 \text{ A} \\ V_{CE(sat)typ} &= 1.7 \text{ V} \\ t_{fi(typ)} &= 100 \text{ ns} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-247 AD
- High frequency IGBT and antiparallel FRED in one package
- High current handling capability
- HiPerFAST™ HDMOST™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

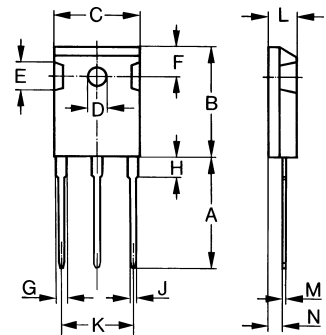
Advantages

- Space savings (two devices in one package)
- High power density
- Suitable for surface mounting
- Very low switching losses for high frequency applications
- Easy to mount with 1 screw, TO-247 (insulated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 8 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	1.7	2.0	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}, V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies} C_{oes} C_{res}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
			175	pF
			40	pF
Q_g Q_{ge} Q_{gc}	$I_C = I_{C90}, V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		90	nC
			11	nC
			30	nC
$t_{d(on)}$ t_{ri} E_{on} $t_{d(off)}$ t_{fi} E_{off}	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Note 1		15	ns
			35	ns
			0.15	mJ
			150	ns
			100	ns
			0.7	mJ
$t_{d(on)}$ t_{ri} E_{on} $t_{d(off)}$ t_{fi} E_{off}	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Note 1		15	ns
			35	ns
			0.15	mJ
			220	ns
			140	ns
			1.2	mJ
R_{thJC} R_{thCK}			0.83	K/W
			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C90}, V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$			1.6 V
I_{RM} t_{rr}	$I_F = I_{C90}, V_{GE} = 0\text{ V}$, $-di_F/dt = 240\text{ A}/\mu\text{s}$ $V_R = 360\text{ V}$ $T_J = 125^\circ\text{C}$ $I_F = 1\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		10	15 A
			150	ns
			35	50 ns
R_{thJC}				1 K/W

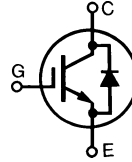
Note 1: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G

HiPerFAST™ IGBT with Diode

IXGH 20N60BD1
IXGT 20N60BD1

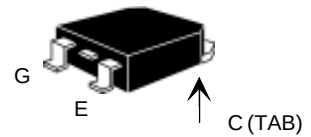
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 40 \text{ A} \\ V_{CE(sat)typ} &= 1.7 \text{ V} \\ t_{fi(typ)} &= 100 \text{ ns} \end{aligned}$$

Preliminary data

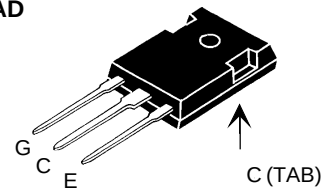


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3) TO-247AD	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight	TO-247AD	6	g
	TO-268	4	g

TO-268
(IXGT)



TO-247 AD
(IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
- High frequency IGBT and antiparallel FRED in one package
- High current handling capability
- HiPerFAST™ HDMOS™ process
- MOS Gate turn-on -drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

Advantages

- Space savings (two devices in one package)
- High power density
- Suitable for surface mounting
- Very low switching losses for high frequency applications
- Easy to mount with 1 screw, TO-247 (insulated mounting screw hole)

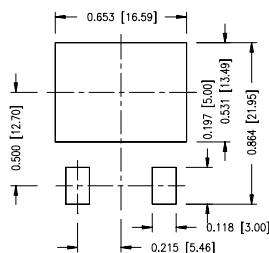
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$	1.7	2.0	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			150	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		55	nC
Q_{ge}			12	nC
Q_{gc}			20	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			110	200 ns
t_{fi}			100	150 ns
E_{off}			0.7	1.0 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			35	ns
E_{on}			0.75	mJ
$t_{d(off)}$			220	ns
t_{fi}			140	ns
E_{off}			1.2	mJ
R_{thJC}				0.83 K/W
R_{thCK}	TO-247		0.25	K/W

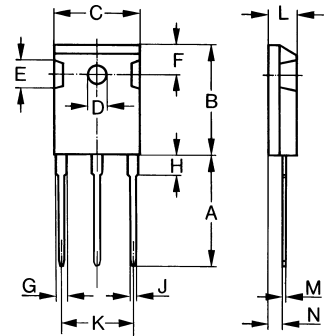
Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = 30\text{ A}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V
		$T_J = 25^\circ\text{C}$		2.5 V
I_{RM}	$I_F = 30\text{ A}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$		6	A
t_{rr}		$T_J = 100^\circ\text{C}$	100	ns
		$T_J = 25^\circ\text{C}$	25	ns
R_{thJC}				1.0 K/W

Min. Recommended Footprint

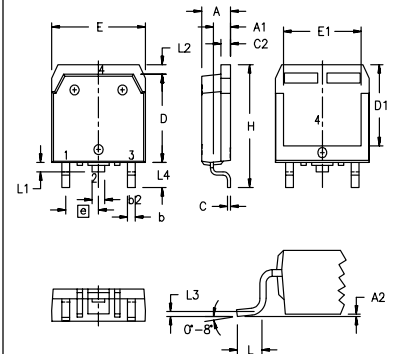


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



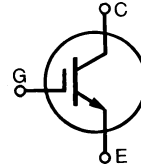
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

HiPerFAST™ IGBT Lightspeed™ Series

IXGH 24N60C
IXGT 24N60C

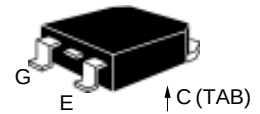
$V_{CES} = 600 \text{ V}$
 $I_{C25} = 48 \text{ A}$
 $V_{CE(sat)typ} = 2.1 \text{ V}$
 $t_{fi typ} = 60 \text{ ns}$

Preliminary data

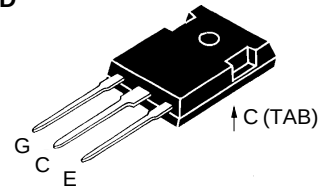


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	48	A
I_{C110}	$T_C = 110^\circ\text{C}$	24	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	96	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 48$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247	6	g
	TO-268	4	g

TO-268
(IXGT)



TO-247 AD
(IXGH)



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- International standard packages
JEDEC TO-247 and surface mountable TO-268
- High frequency IGBT
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on
- drive simplicity

Applications

- PFC circuits
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

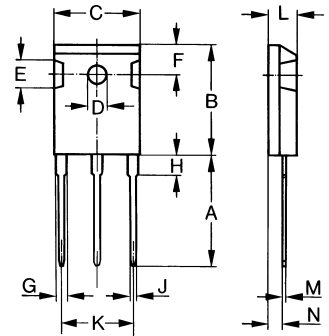
Advantages

- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C110}, V_{GE} = 15 \text{ V}$	2.1	2.5	V

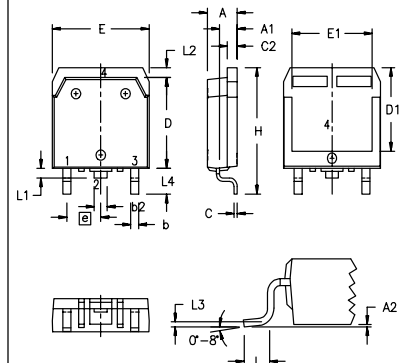
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C110}$, $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			120	pF
C_{res}			40	pF
Q_g	$I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		55	nC
Q_{ge}			13	nC
Q_{gc}			17	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			75	140 ns
t_{fi}			60	110 ns
E_{off}			0.24	0.36 mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			0.15	mJ
$t_{d(off)}$			130	ns
t_{fi}			110	ns
E_{off}			0.6	mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

TO-247 AD (IXGH) Outline



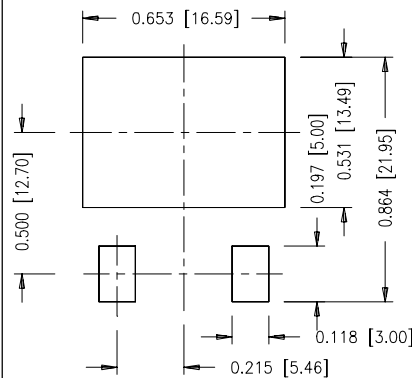
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.075 .083
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

Min. Recommended Footprint

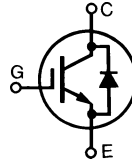


HiPerFAST™ IGBT with Diode Lightspeed Series

IXGH 24N60CD1
IXGT 24N60CD1

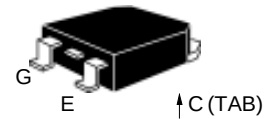
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 48 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \end{aligned}$$

Preliminary data

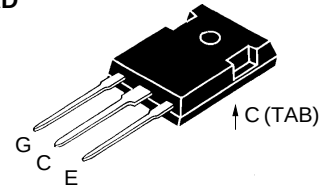


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	48	A
I_{C110}	$T_C = 110^\circ\text{C}$	24	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 48$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		$-55 \dots +150$	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		$-55 \dots +150$	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247	6 g
		TO-268	4 g

TO-268
(IXGT)



TO-247 AD
(IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-247 and surface mountable TO-268
- High frequency IGBT
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on
 - drive simplicity
- Fast recovery expitaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- PFC circuits
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

Advantages

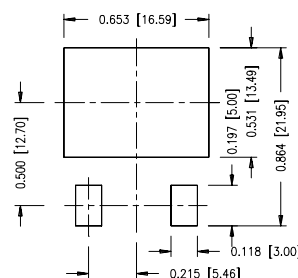
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ 200 μA $T_J = 150^\circ\text{C}$ 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C110}$, $V_{GE} = 15 \text{ V}$	2.1	2.5	V

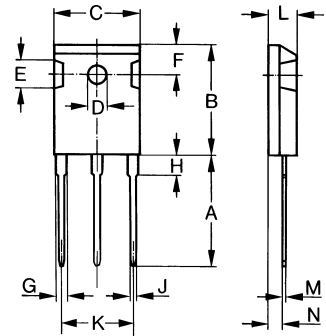
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C110}$, $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			170	pF
C_{res}			40	pF
Q_g	$I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		55	nC
Q_{ge}			13	nC
Q_{gc}			17	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			75	140 ns
t_{fi}			60	110 ns
E_{off}			0.24	0.36 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			1	mJ
$t_{d(off)}$			130	ns
t_{fi}			110	ns
E_{off}			0.6	mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_{C110}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V
		$T_J = 25^\circ\text{C}$		2.5 V
I_{RM}	$I_F = I_{C110}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$	$T_J = 100^\circ\text{C}$	6	A
t_{rr}		$T_J = 25^\circ\text{C}$	100	ns
			25	ns
R_{thJC}				0.9 K/W

Min. Recommended Footprint

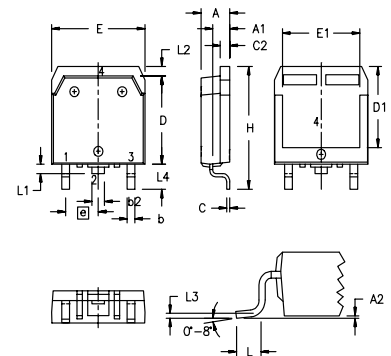


TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.075	.083
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

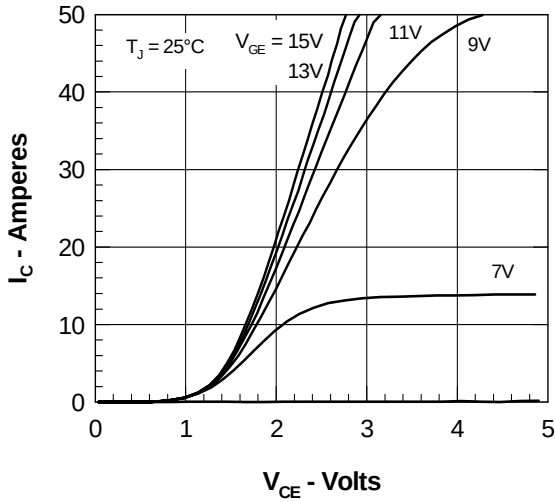


Fig. 1 Saturation Voltage Characteristics

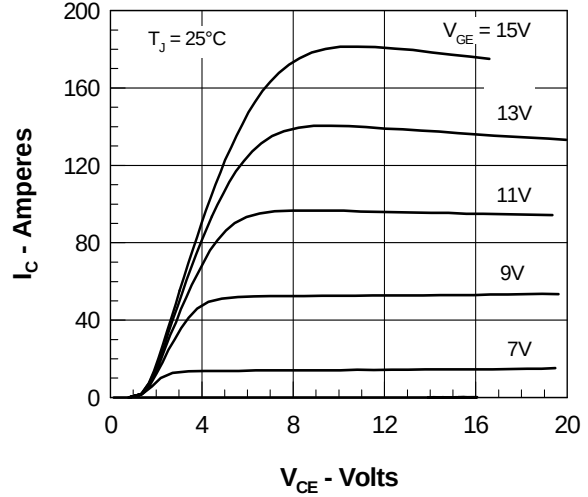


Fig. 2 Extended Output Characteristics

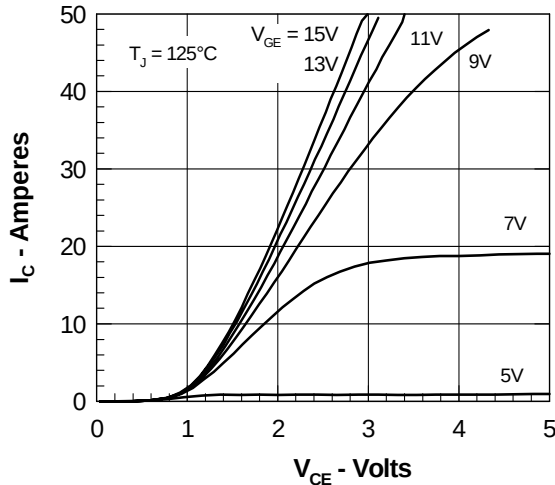


Fig. 3 Saturation Voltage Characteristics

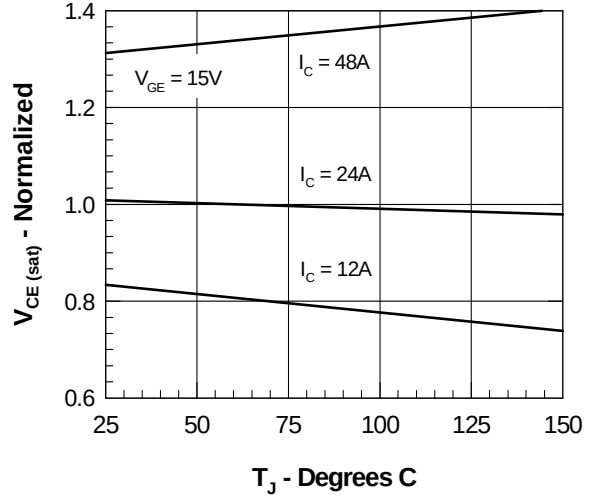


Fig. 4 Temperature Dependence of $V_{CE(sat)}$

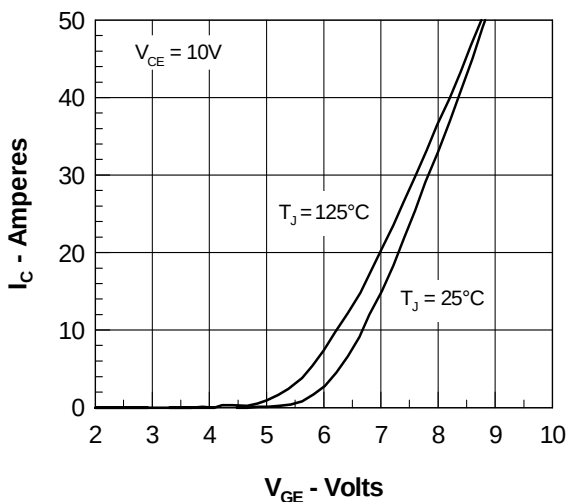


Fig. 5 Admittance Curves

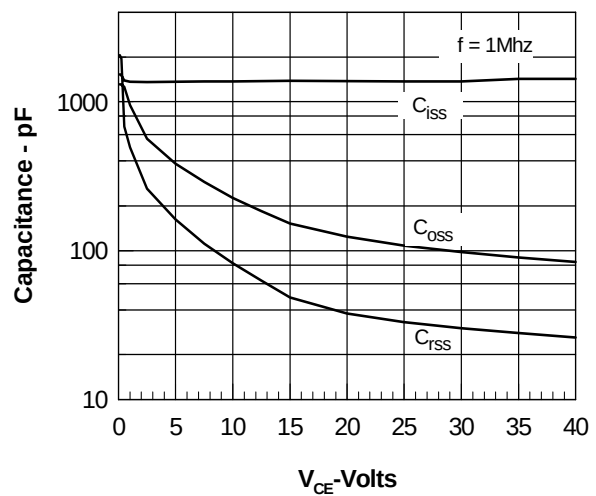


Fig. 6 Temperature Dependence of V_F & V_F

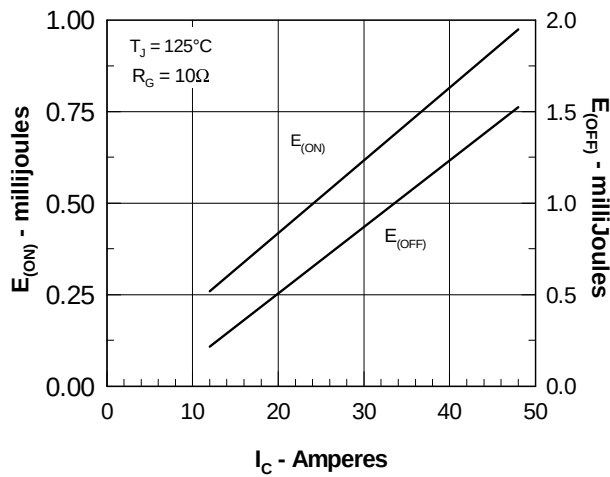


Fig.7. Dependence of E_{ON} and E_{OFF} on I_C

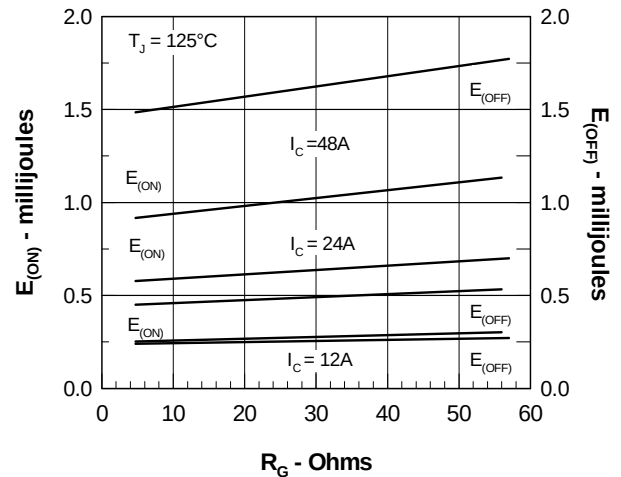


Fig.8. Dependence of E_{ON} and E_{OFF} on R_G

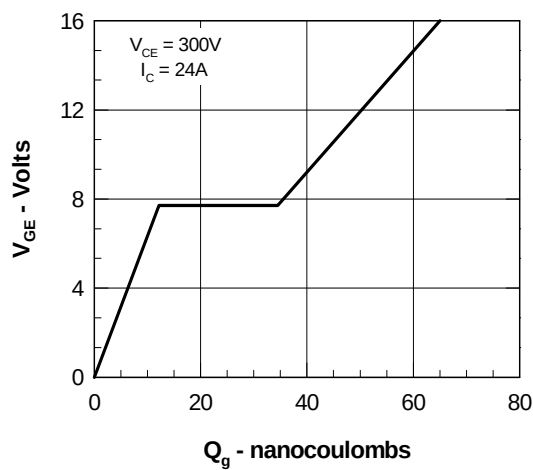


Fig.9. Gate Charge

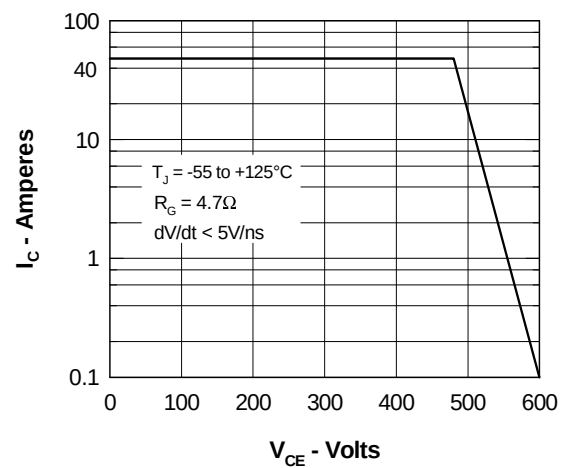


Fig.10. Turn-off Safe Operating Area

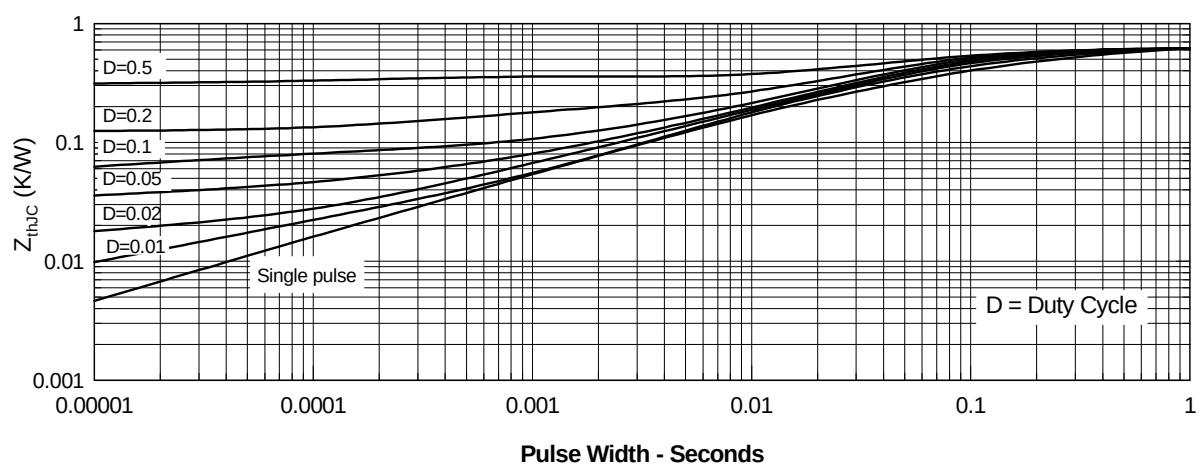


Fig.11 IGBT Transient Thermal Resistance

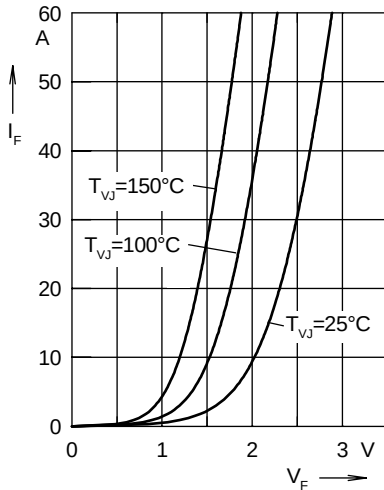


Fig. 12 Forward current I_F versus V_F

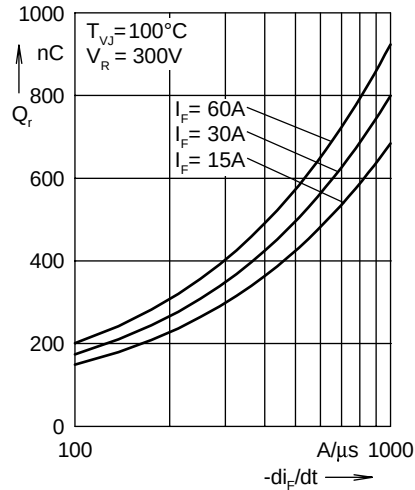


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

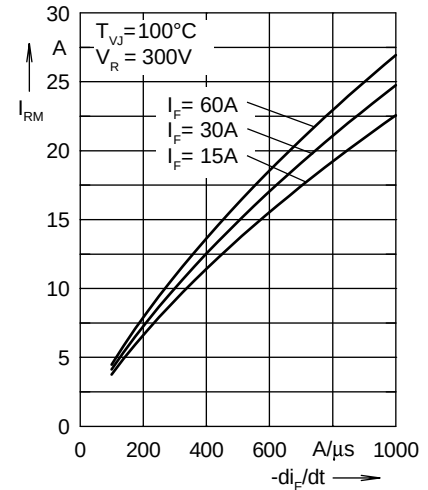


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

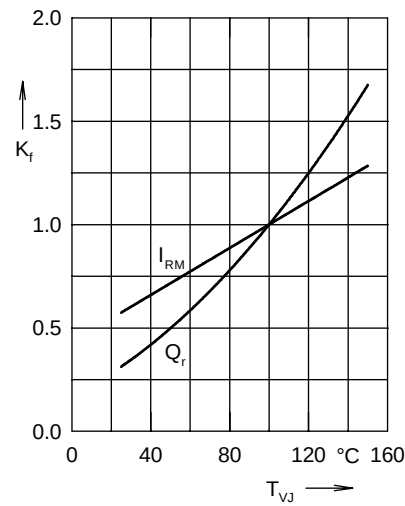


Fig. 15 Dynamic parameters Q_r and I_{RM} versus T_{VJ} temperature

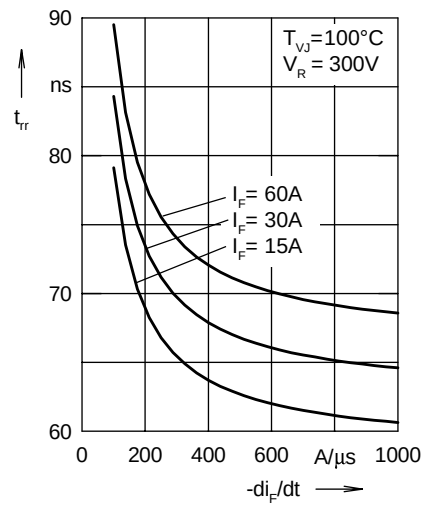


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

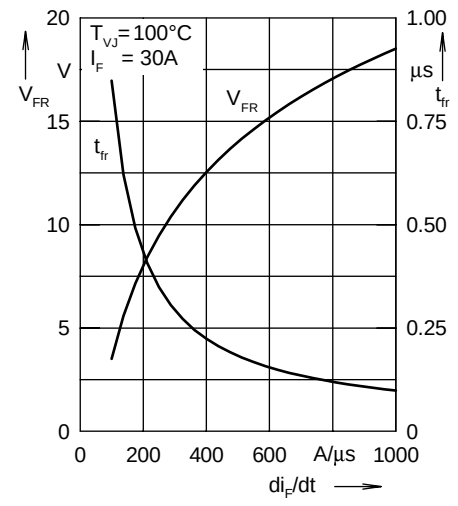


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

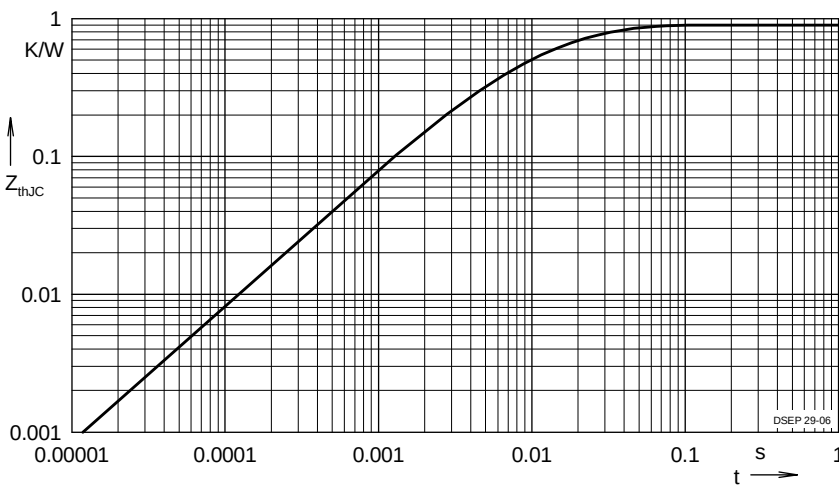


Fig. 18 Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162

HiPerFAST™ IGBT

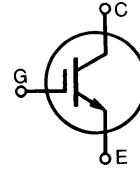
ISOPLUS247™

(Electrically Isolated Back Surface)

IXGR 24N60C

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 42 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \\ t_{fi(typ)} &= 60 \text{ ns} \end{aligned}$$

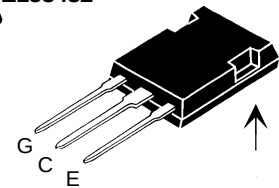
Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	42	A
I_{C110}	$T_C = 110^\circ\text{C}$	22	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 48$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	80	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
V_{ISOL}	50/60 Hz, RMS, $t = 1$ minute leads-to-tab	2500	V
Weight		6	g

ISOPLUS 247

 E153432



G = Gate, C = Collector
E = Emitter

* Patent pending

Features

- DCB Isolated mounting tab
- Meets TO-247AD package Outline
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

Advantages

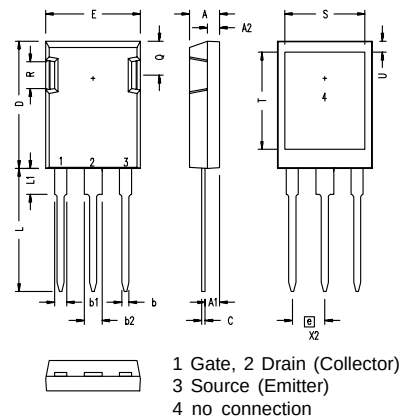
- Easy assembly
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_T$, $V_{GE} = 15 \text{ V}$ (see note 1)	2.1	2.5	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_T$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			170	pF
C_{res}			40	pF
Q_g	$I_C = I_T$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		55	nC
Q_{ge}			13	nC
Q_{gc}			17	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			75	140 ns
t_{fi}			60	110 ns
E_{off}			0.24	0.36 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			12	ns
E_{on}			0.3	mJ
$t_{d(off)}$			130	ns
t_{fi}			110	ns
E_{off}			0.6	mJ
R_{thJC}			1.57	K/W
R_{thCK}		0.15		K/W

Note: 1. $I_T = 24\text{ A}$

ISOPLUS 247 (IXGR) OUTLINE



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45	BSC	.215	BSC
L	19.81	20.32	.780	.800
L ₁	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080

HiPerFAST™ IGBT with Diode

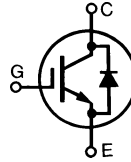
ISOPLUS247™

(Electrically Isolated Back Surface)

IXGR 24N60CD1

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 42 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \end{aligned}$$

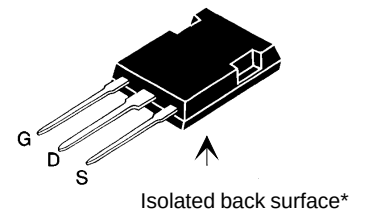
Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	42	A
I_{C90}	$T_C = 90^\circ\text{C}$	22	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 48$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	80	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
V_{ISOL}		2500	V
Weight	TO-247	6	g

ISOPLUS 247

 E153432



G = Gate, C = Collector
E = Emitter

* Patent pending

Features

- Silicon chip on Direct-Copper-Bond substrate
- High power dissipation
- Isolated mounting surface
- 2500V electrical isolation
- Low drain to tab capacitance (<35pF)
- Low $R_{DS(on)}$ HDMOS™ process
- Rugged polysilicon gate cell structure
- Unclamped Inductive Switching (UIS) rated
- Fast intrinsic rectifier
- Low gate charge process

Applications

- DC-DC converters
- Battery chargers
- Switched-mode and resonant-mode power supplies
- DC choppers
- AC motor control

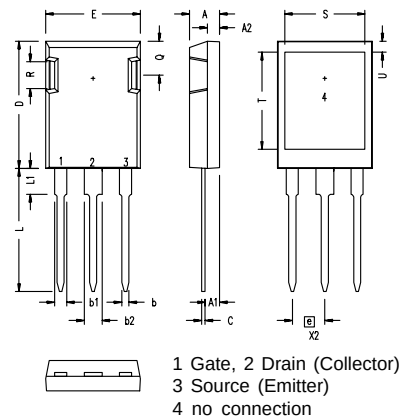
Advantages

- Easy assembly
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_T$, $V_{GE} = 15 \text{ V}$	2.1	2.5	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_T$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	17	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			170	pF
C_{res}			40	pF
Q_g	$I_C = I_T$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		55	nC
Q_{ge}			13	nC
Q_{gc}			17	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			75	140 ns
t_{fi}			60	110 ns
E_{off}			0.24	0.36 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 18\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			1	mJ
$t_{d(off)}$			130	ns
t_{fi}			110	ns
E_{off}			0.6	mJ
R_{thJC}			0.157	K/W
R_{thCK}			0.15	K/W

ISOPLUS 247 (IXGR) OUTLINE



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45	BSC	.215	BSC
L	19.81	20.32	.780	.800
L ₁	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080

Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_T$, $V_{GE} = 0\text{ V}$ Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$ $T_J = 25^\circ\text{C}$		1.6 V 2.5 V
I_{RM}	$I_F = I_T$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$	$T_J = 100^\circ\text{C}$ $T_J = 25^\circ\text{C}$	6	A
t_{rr}			100	ns
			25	ns
R_{thJC}			1.65	K/W

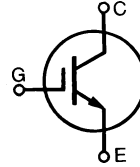
- Notes: 1. $I_T = 24\text{ A}$
2. See IXGH24N60CD1 data sheet for characteristic curves.

Ultra-Low $V_{CE(sat)}$ IGBT with Diode

IXGH 28N60B
IXGT 28N60B

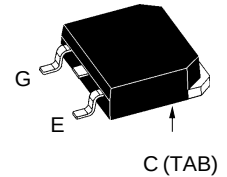
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 40 \text{ A} \\ V_{CE(sat)} &= 2.0 \text{ V} \end{aligned}$$

Preliminary data

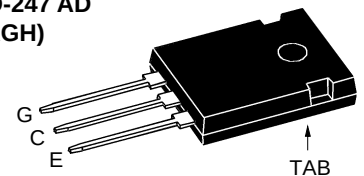


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 56$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3) TO-247	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight	TO-247	6	g
	TO-268	4	g

TO-268
(IXGT)



TO-247 AD
(IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- High current handling capability
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

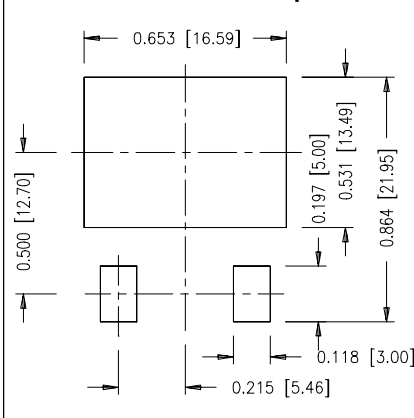
Advantages

- Easy to mount with 1 screw (isolated mounting screw hole)
- Low losses, high efficiency
- High power density

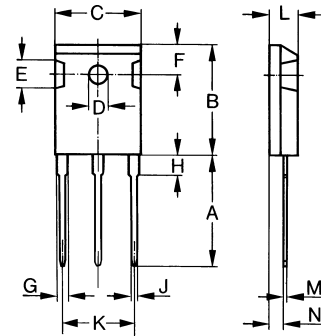
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		100 μA
				500 μA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.0 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	14	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		80	nC
Q_{ge}			15	nC
Q_{gc}			30	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			200	ns
t_{fi}			200	ns
E_{off}			3	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			0.2	mJ
$t_{d(off)}$			400	ns
t_{fi}			400	ns
E_{off}			6	mJ
R_{thJC}	TO-247			0.83 K/W
R_{thCK}			0.25	K/W

Min. Recommended Footprint

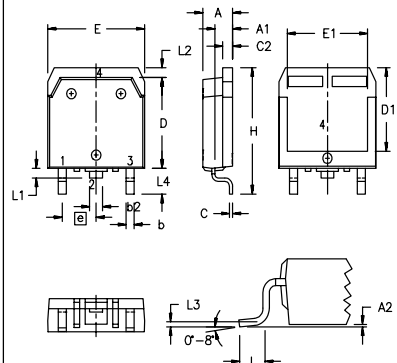


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



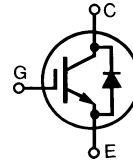
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

Low $V_{CE(sat)}$ IGBT with Diode

IXGH 28N60BD1
IXGT 28N60BD1

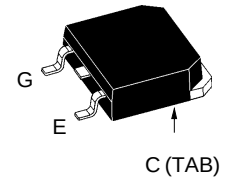
$V_{CES} = 600\text{ V}$
 $I_{C25} = 40\text{ A}$
 $V_{CE(sat)} = 2.0\text{ V}$

Preliminary data

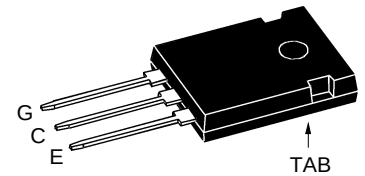


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10\text{ }\Omega$ Clamped inductive load, $L = 100\text{ }\mu\text{H}$	$I_{CM} = 56$ @ $0.8\text{ }V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3) TO-247	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight	TO-247	6	g
	TO-268	4	g

**TO-268
(IXGT)**



**TO-247 AD
(IXGH)**



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
- IGBT and anti-parallel FRED in one package
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

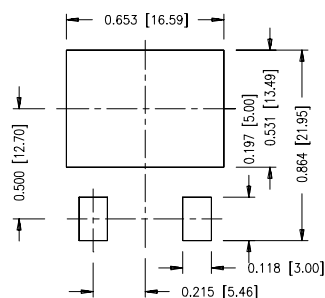
- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750\text{ }\mu\text{A}$, $V_{GE} = 0\text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250\text{ }\mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0\text{ V}$			$200\text{ }\mu\text{A}$ 3 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$			2.0 V

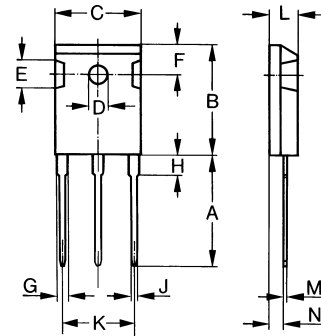
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	9	14	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			170	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		80	nC
Q_{ge}			15	nC
Q_{gc}			30	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			200	400 ns
t_{fi}			200	400 ns
E_{off}			3	6 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			1	mJ
$t_{d(off)}$			400	ns
t_{fi}			400	ns
E_{off}			6	mJ
R_{thJC}	TO-247			0.83 K/W
R_{thCK}			0.25	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V
		$T_J = 25^\circ\text{C}$		2.5 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$	$T_J = 100^\circ\text{C}$	6	A
t_{rr}		$T_J = 25^\circ\text{C}$	100	ns
			25	ns
R_{thJC}				1 K/W

Min. Recommended Footprint

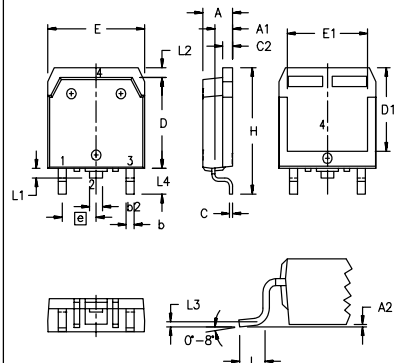


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)

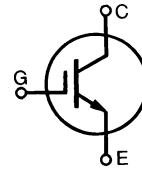


Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A1	2.7 2.9	.106 .114
A2	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b2	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E1	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L1	1.20 1.40	.047 .055
L2	1.00 1.15	.039 .045
L3	0.25 BSC	.010 BSC
L4	3.80 4.10	.150 .161

HiPerFAST™ IGBT

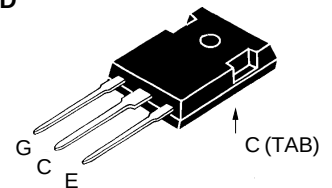
IXGH30N60B
IXGT30N60B

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 1.8 \text{ V}$
 $t_{fi} = 100 \text{ ns}$

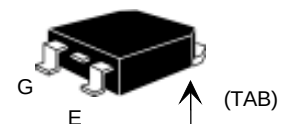


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C110}	$T_C = 110^\circ\text{C}$	30	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 33 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 60$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		6	g

**TO-247 AD
(IXGH)**



**TO-268 (D3)
(IXGT)**



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-268 surface mountable and JEDEC TO-247 AD
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

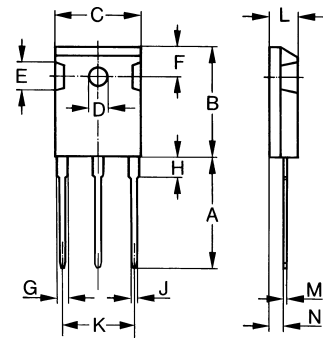
Advantages

- Space savings (two devices in one package)
- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, TO-247 (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$ BV_{CES} temperature coefficient	600	0.072	V %/K
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$ $V_{GE(th)}$ temperature coefficient	2.5	-0.286	V %/K
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			± 100 nA
$V_{CE(sat)}$	$I_C = I_{C110}$, $V_{GE} = 15 \text{ V}$			1.8 V
$V_{CE(sat)}$	$I_C = I_{C110}$, $V_{GE} = 15 \text{ V}$ $T_J = 150^\circ\text{C}$			2.0 V

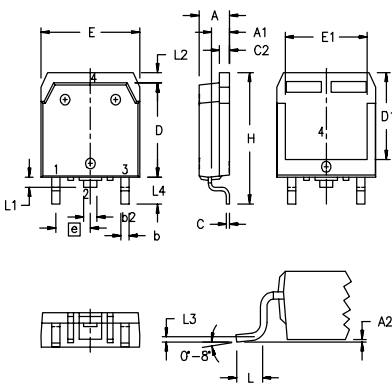
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C110}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2700	pF
C_{oes}			190	pF
C_{res}			50	pF
Q_g	$I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		125	150 nC
Q_{ge}			23	35 nC
Q_{gc}			50	75 nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			30	ns
$t_{d(off)}$			130	220 ns
t_{fi}			100	190 ns
E_{off}			1.3	2 mJ
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			35	ns
E_{on}			0.3	mJ
$t_{d(off)}$			200	ns
t_{fi}			290	ns
E_{off}			3	mJ
R_{thJC}				0.62 K/W
R_{thCK}	(IXGH30N60B)		0.25	K/W

TO-247 AD (IXGH) Outline



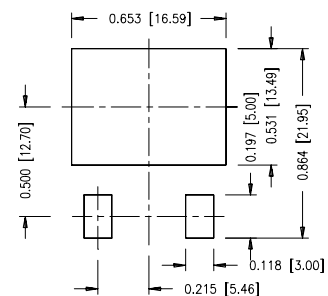
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

IXBH30N60B characteristic curves are located in the IXBH30N60BU1 data sheet.

TO-268AA (D³ PAK)

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

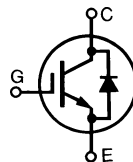
Min. Recommended Footprint



HiPerFAST™ IGBT with Diode

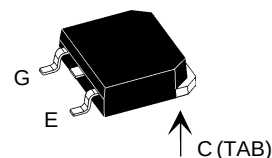
IXGH 30N60BD1
IXGT 30N60BD1

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 1.8 \text{ V}$
 $t_{fi(typ)} = 100 \text{ ns}$

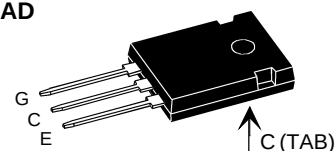


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	30	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 60$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-268
(IXGT)



TO-247 AD
(IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package
- Moderate frequency IGBT and antiparallel FRED in one package
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

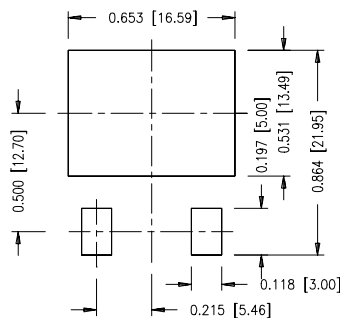
- Space savings (two devices in one package)
- High power density
- Optimized $V_{ce(sat)}$ and switching speeds for medium frequency application

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ 200 μA $T_J = 150^\circ\text{C}$ 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			1.8 V

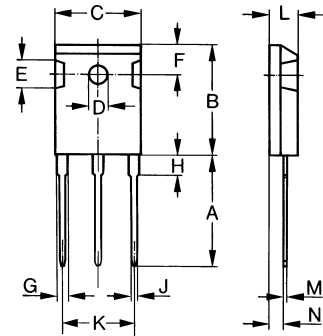
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2700	pF
C_{oes}			240	pF
C_{res}			50	pF
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			30	ns
$t_{d(off)}$			130	220
t_{fi}			100	190
E_{off}			1.0	2.0
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			35	ns
E_{on}			1.0	mJ
$t_{d(off)}$			200	ns
t_{fi}			230	ns
E_{off}			2.5	mJ
R_{thJC}				0.62 K/W
R_{thCK}	(TO-247 AD)		0.25	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, Pulse test $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V 2.5 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$	$T_J = 100^\circ\text{C}$	6	A
t_{rr}			100	ns
			25	ns
R_{thJC}				0.9 K/W

Min. Recommended Footprint

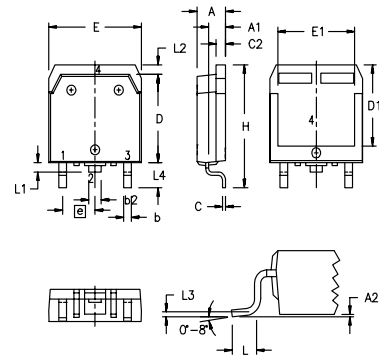


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A1	2.7 2.9	.106 .114
A2	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b2	1.9 2.1	.075 .083
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E1	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L1	1.20 1.40	.047 .055
L2	1.00 1.15	.039 .045
L3	0.25 BSC	.010 BSC
L4	3.80 4.10	.150 .161

Fig. 1. Saturation Voltage Characteristics

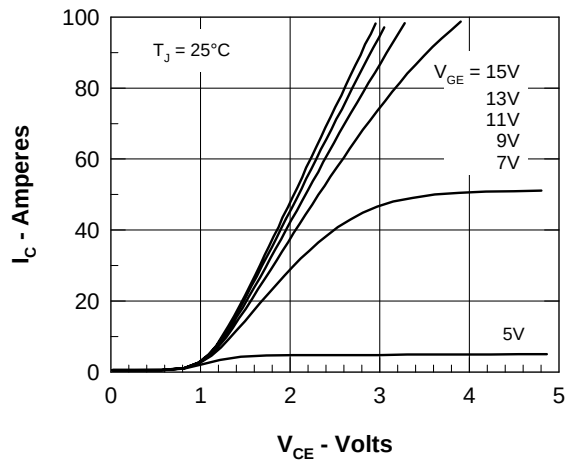


Fig. 2. Extended Output Characteristics

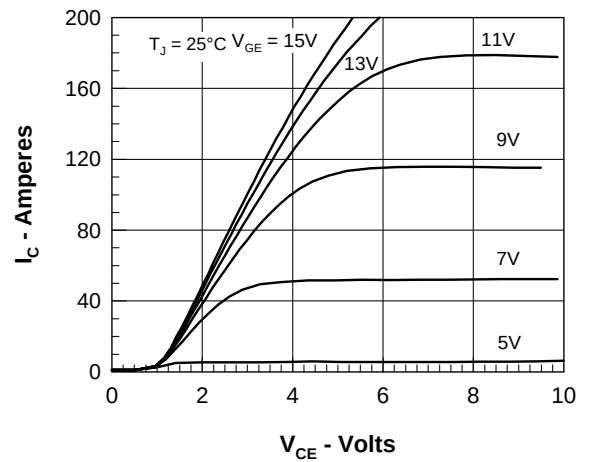


Fig. 3. Saturation Voltage Characteristics

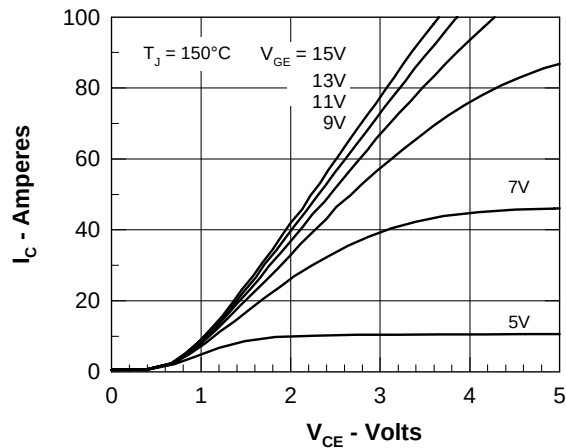
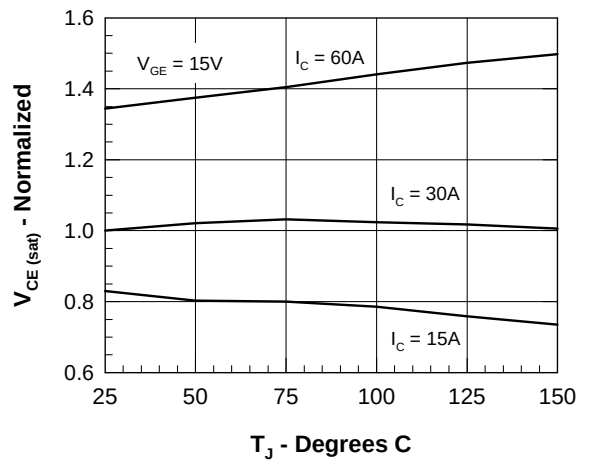

 Fig. 4. Temperature Dependence of $V_{CE(sat)}$


Fig. 5. Admittance Curves

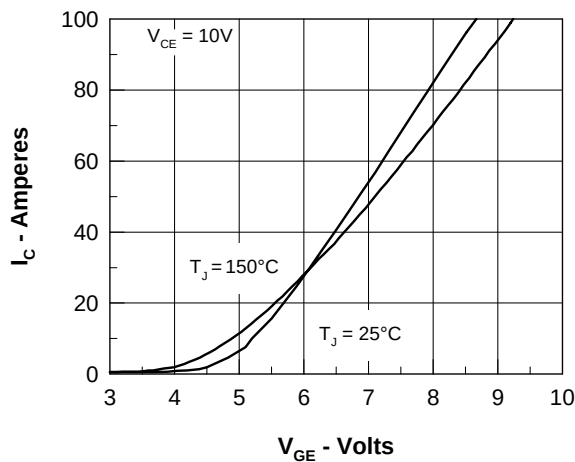
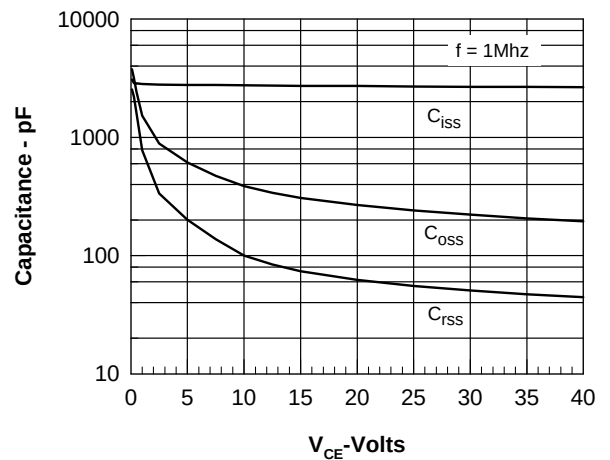

 Fig. 6. Temperature Dependence of BV_{DSS} & $V_{GE(th)}$


Fig. 7. Dependence of E_{OFF} and E_{ON} on I_C .

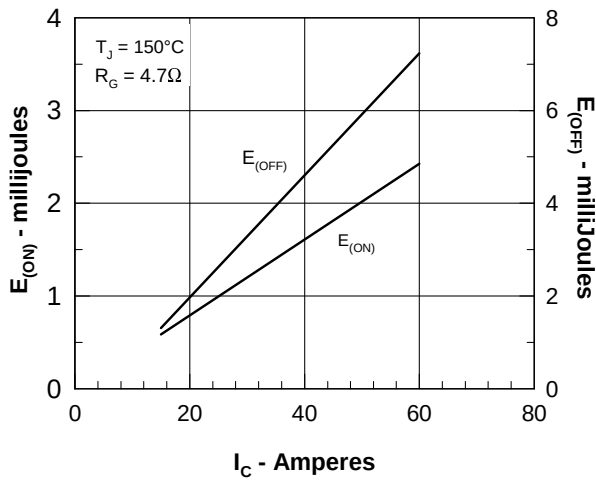


Fig. 8. Dependence of E_{OFF} on R_G .

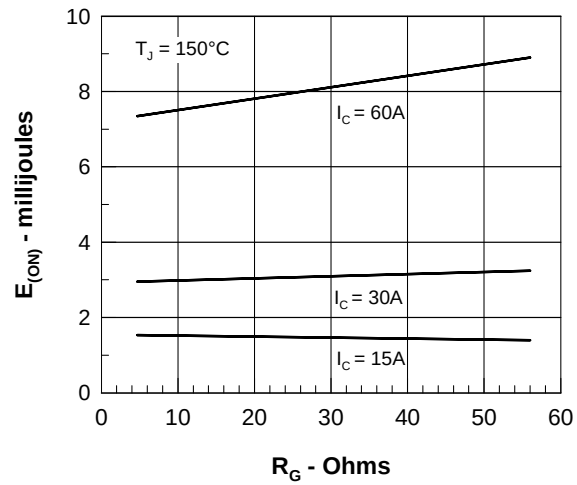


Fig. 9. Gate Charge

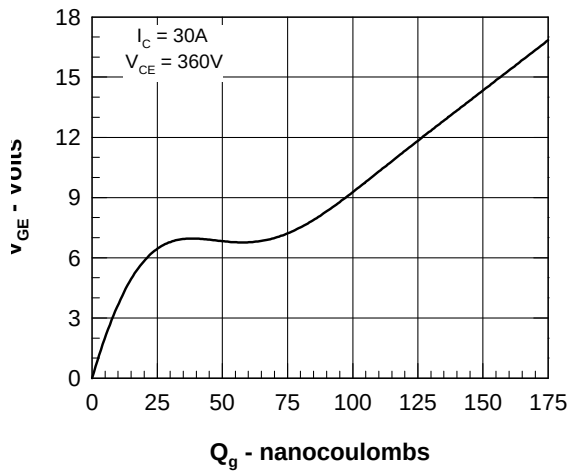


Fig. 10. Turn-off Safe Operating Area

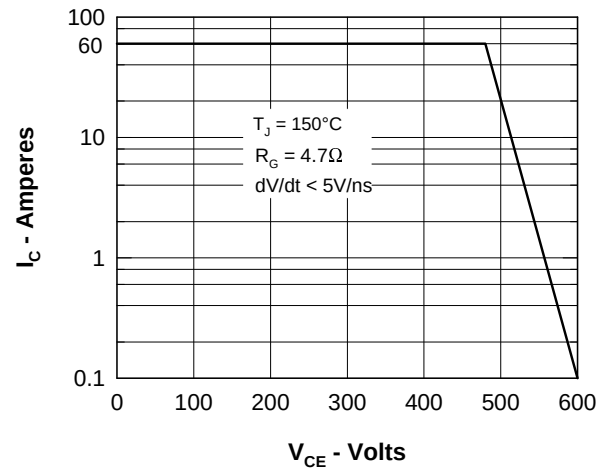
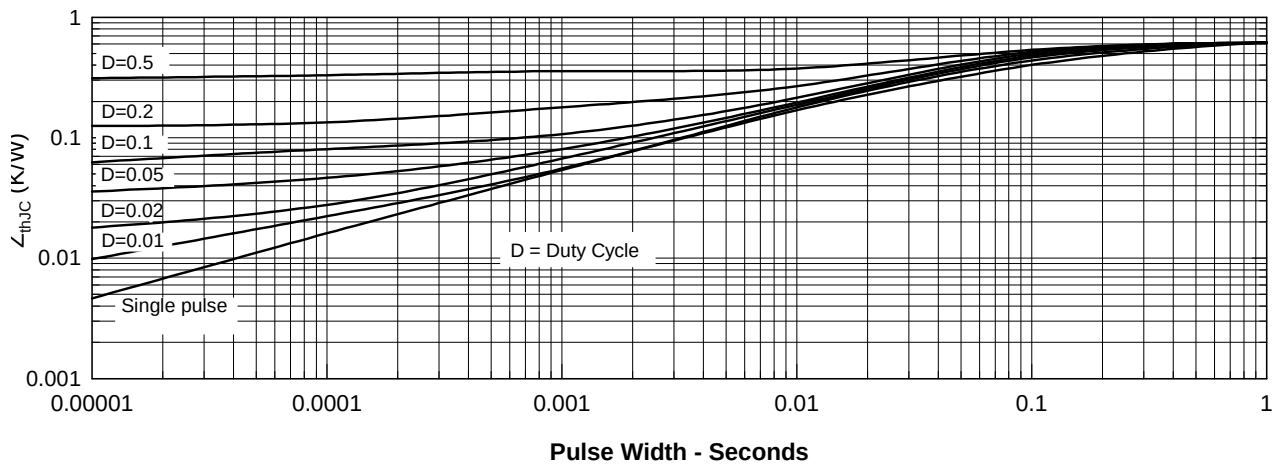


Fig. 11. IGBT Transient Thermal Resistance



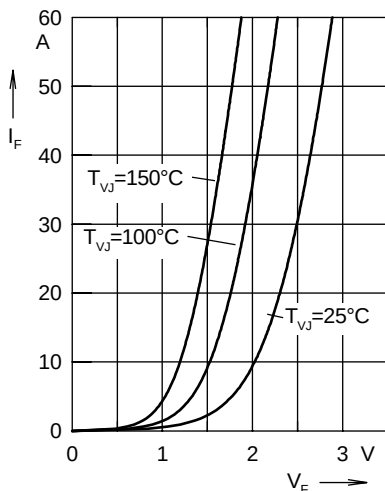


Fig. 12 Forward current I_F versus V_F

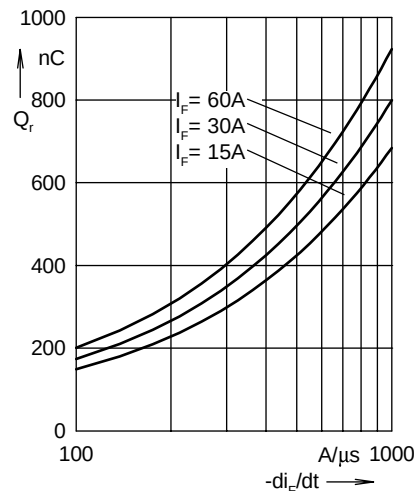


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

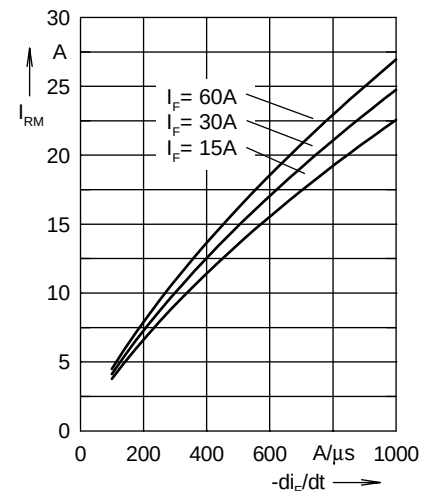


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

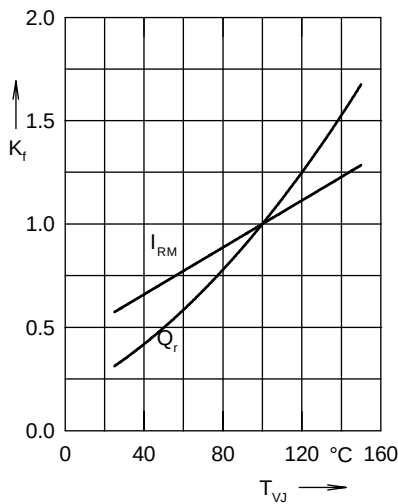


Fig. 15 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

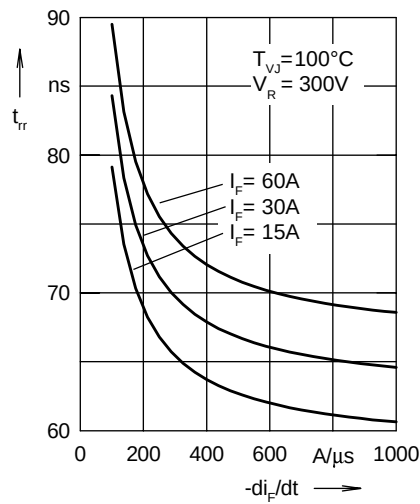


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

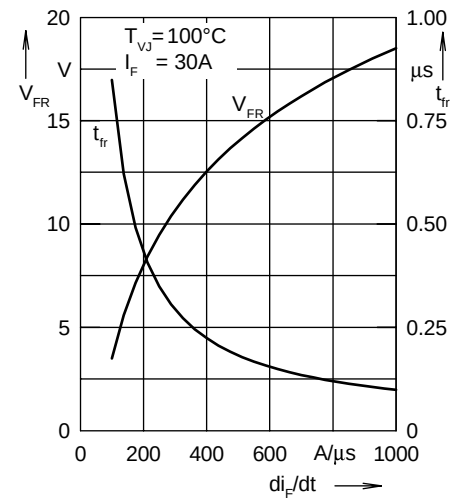


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

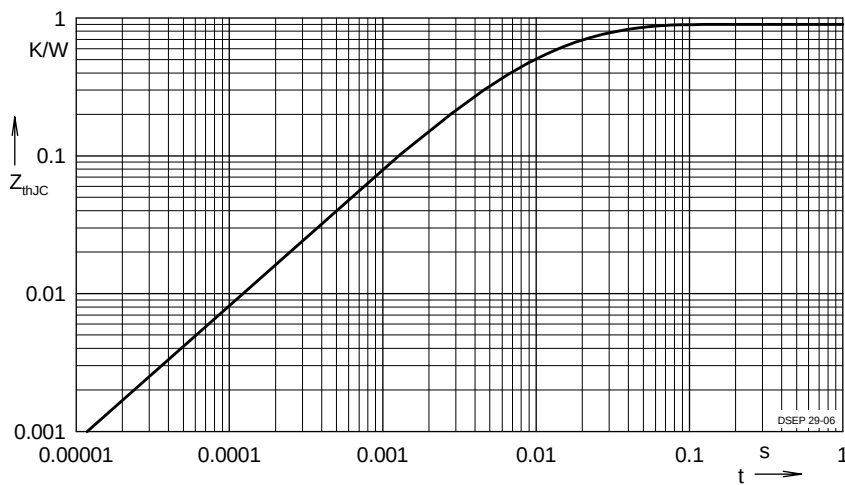


Fig. 18 Transient thermal resistance junction to case

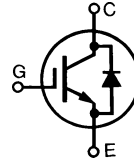
Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162

HiPerFAST™ IGBT with Diode

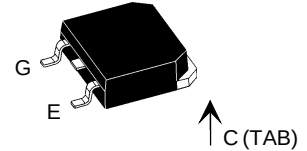
IXGH 30N60BU1
IXGT 30N60BU1

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 60 \text{ A} \\ V_{CE(sat)} &= 1.8 \text{ V} \\ t_{fi} &= 100 \text{ ns} \end{aligned}$$

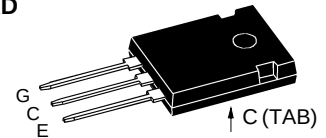


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C110}	$T_C = 110^\circ\text{C}$	30	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 60$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		$-55 \dots +150$	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		$-55 \dots +150$	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-268	4	g
	TO-247 AD	6	g

TO-268
(IXGT)



TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-247 AD and surface
mountable TO-268
- High frequency IGBT and antiparallel
FRED in one package
- High current handling capability
- Newest generation HDMOS™
process
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode
power supplies

Advantages

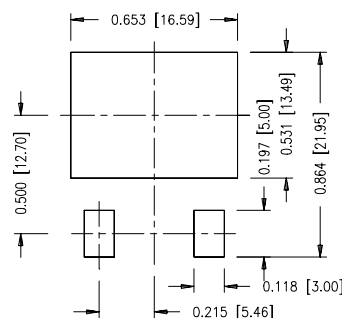
- Space savings (two devices in one
package)
- High power density
- Optimized $V_{CE(sat)}$ and switching
speeds for medium frequency
applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}, V_{GE} = 0 \text{ V}$ BV_{CES} temperature coefficient	600	0.072	V %/K
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$ $V_{GE(th)}$ temperature coefficient	2.5	-0.286	V %/K
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$			500 μA 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			± 100 nA
$V_{CE(sat)}$	$I_C = I_{C110}, V_{GE} = 15 \text{ V}$			1.8 V
$V_{CE(sat)}$	$I_C = I_{C110}, V_{GE} = 15 \text{ V}$ $T_J = 150^\circ\text{C}$			2.0 V

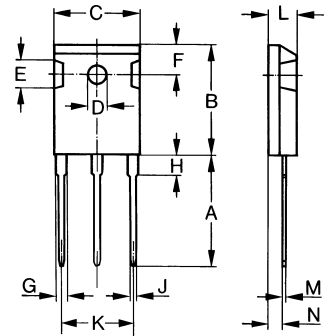
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C110}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2710	pF
C_{oes}			240	pF
C_{res}			50	pF
Q_g	$I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			30	ns
$t_{d(off)}$			130	ns
t_{fi}			100	ns
E_{off}			1.0	mJ
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			35	ns
E_{on}			1	mJ
$t_{d(off)}$			200	ns
t_{fi}			230	ns
E_{off}			2.5	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C110}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$			1.6 V
I_{RM}	$I_F = I_{C110}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 240\text{ A}/\mu\text{s}$, $V_R = 360\text{ V}$		10	15 A
t_{rr}	$I_F = 1\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$		35	50 ns
R_{thJC}				1 K/W

Min. Recommended Footprint

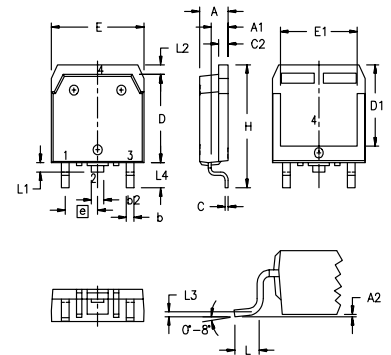


TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

Fig. 1. Saturation Voltage Characteristics

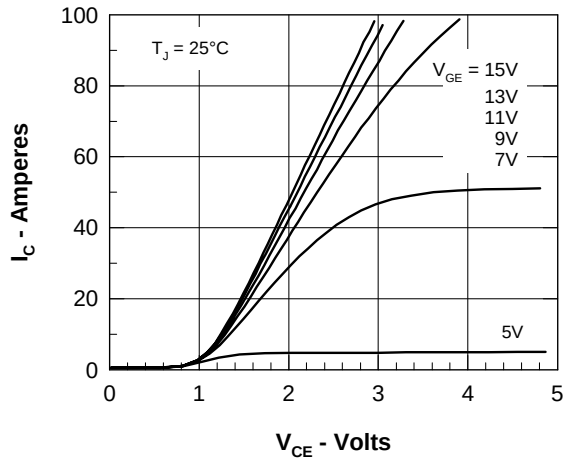


Fig. 2. Extended Output Characteristics

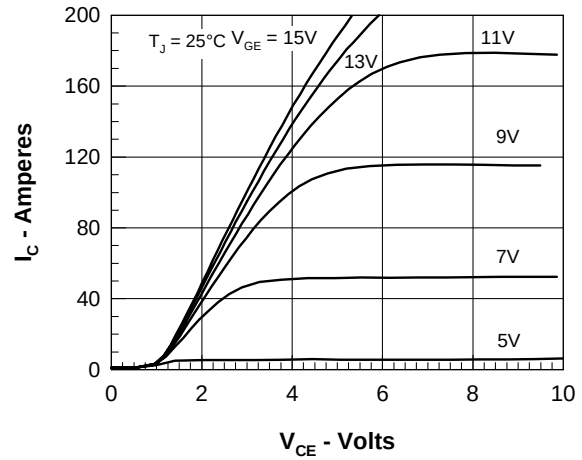


Fig. 3. Saturation Voltage Characteristics

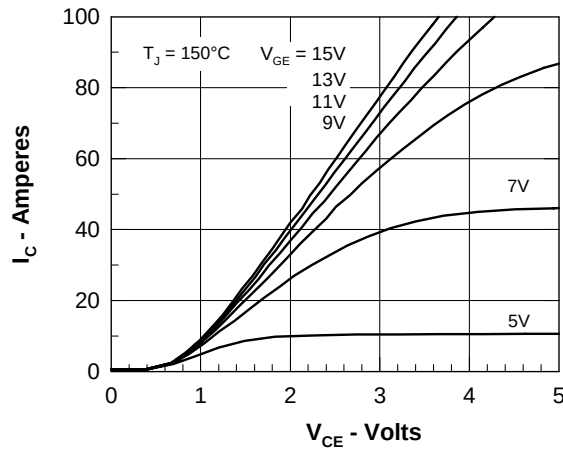
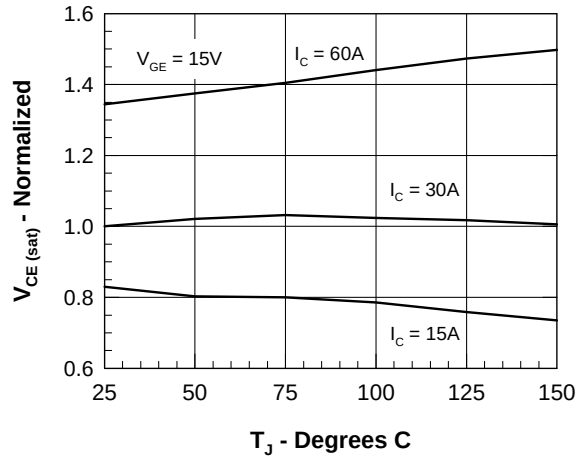

 Fig. 4. Temperature Dependence of $V_{CE(sat)}$


Fig. 5. Admittance Curves

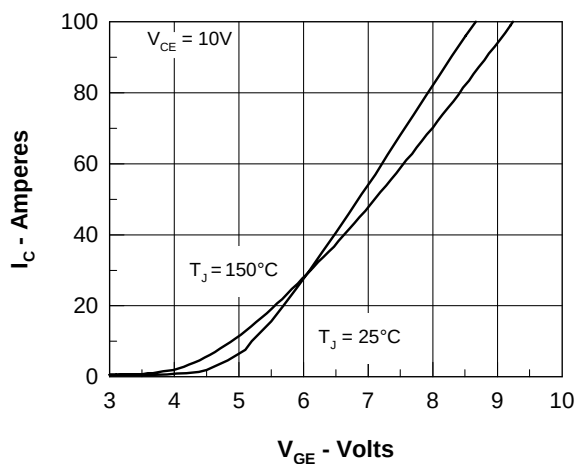
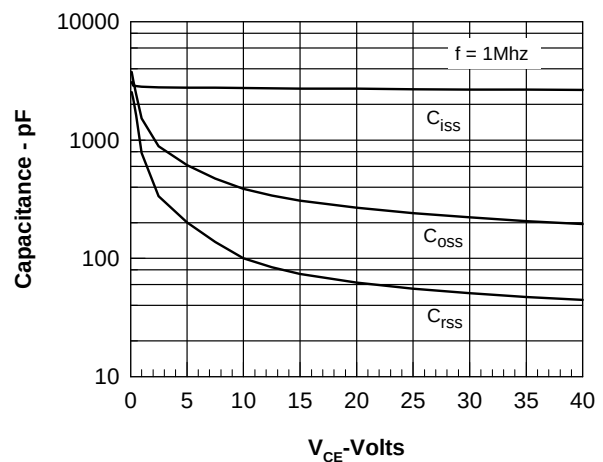

 Fig. 6. Temperature Dependence of BV_{DSS} & $V_{GE(th)}$


Fig. 7. Dependence of E_{OFF} and E_{ON} on I_C .

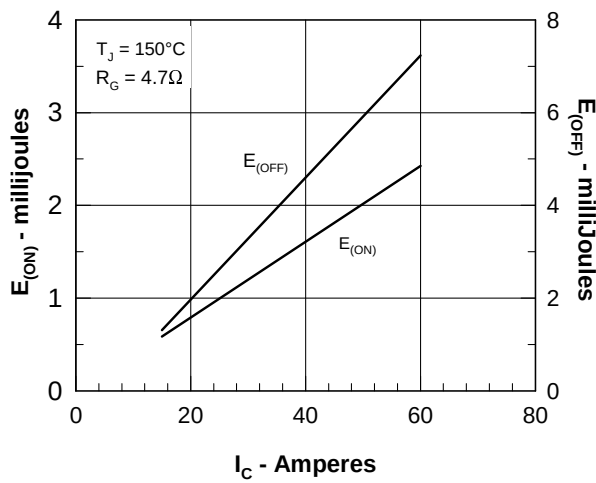


Fig. 8. Dependence of E_{OFF} on R_G .

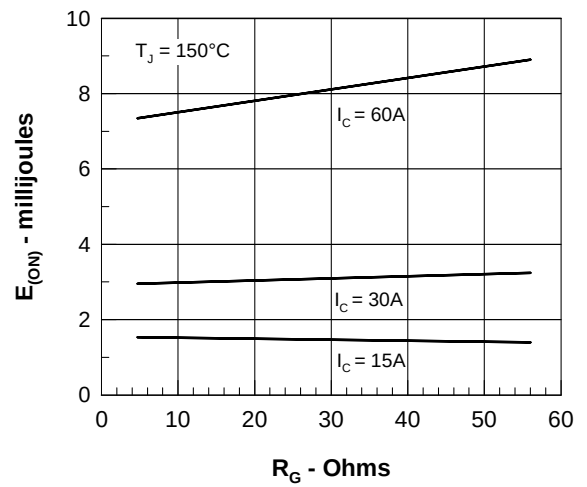


Fig. 9. Gate Charge

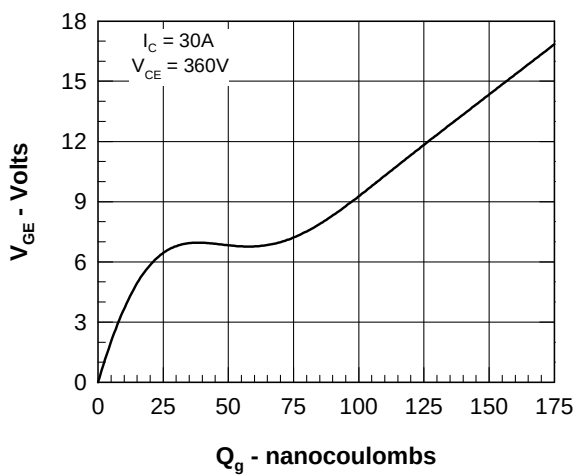


Fig. 10. Turn-off Safe Operating Area

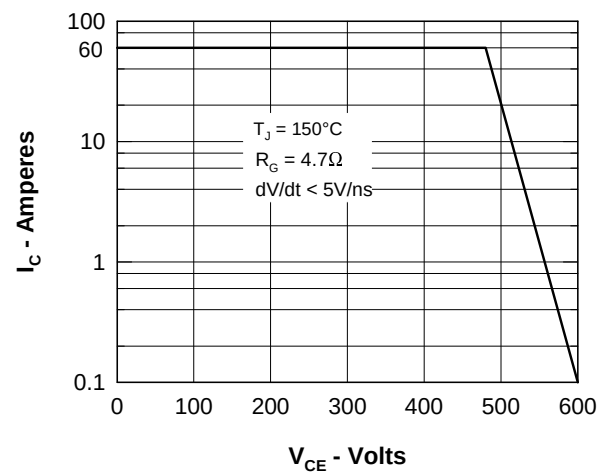


Fig. 11. IGBT Transient Thermal Resistance

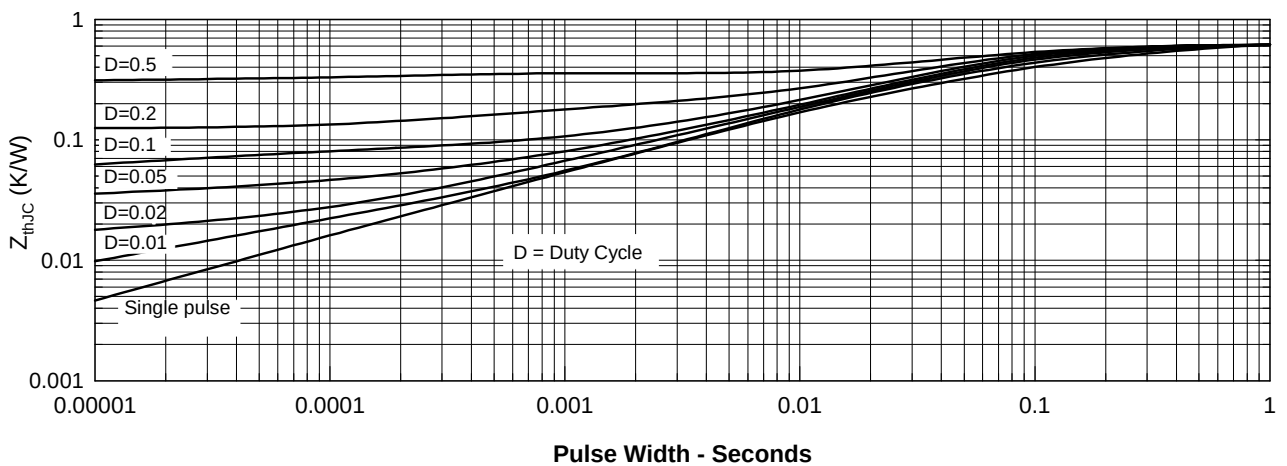


Fig. 12. Forward current versus voltage drop.

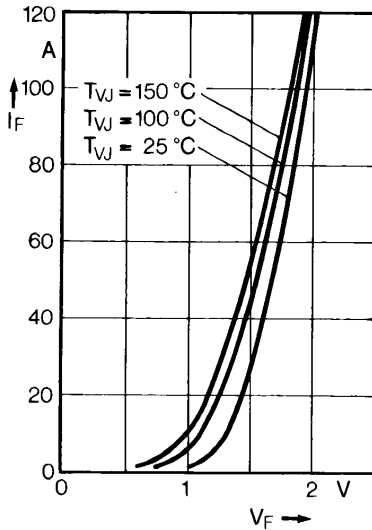


Fig. 13. Recovery charge versus $-di_F/dt$.

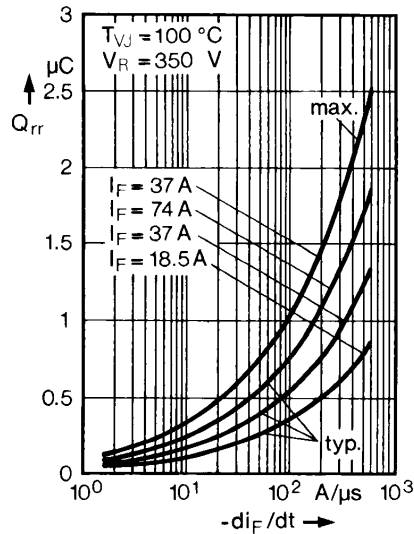


Fig. 14. Peak reverse current versus $-di_F/dt$.

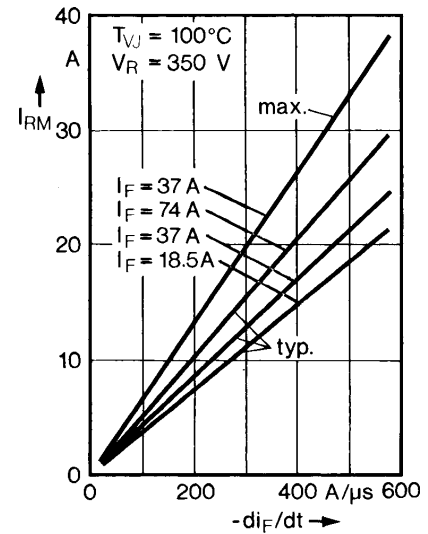


Fig. 15. Dynamic parameters versus junction temperature.

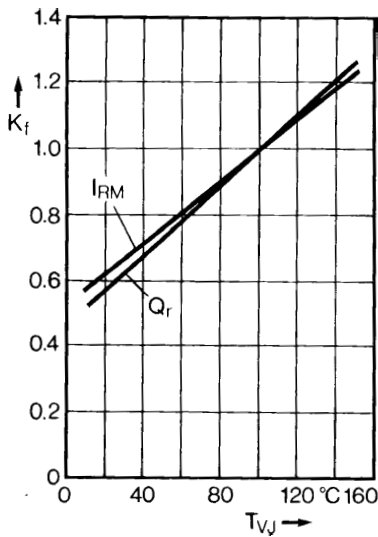


Fig. 16. Reverse recovery time vs $-di_F/dt$.

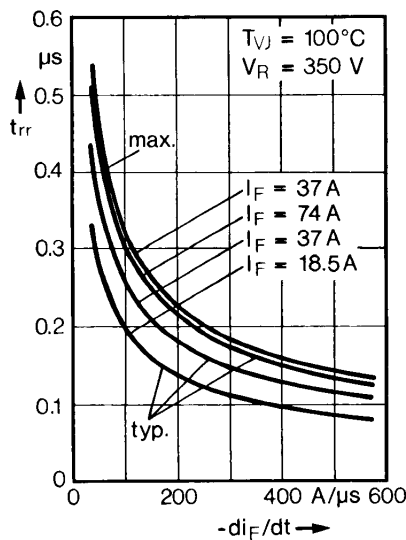


Fig. 17. Forward voltage recovery and time versus $-di_F/dt$.

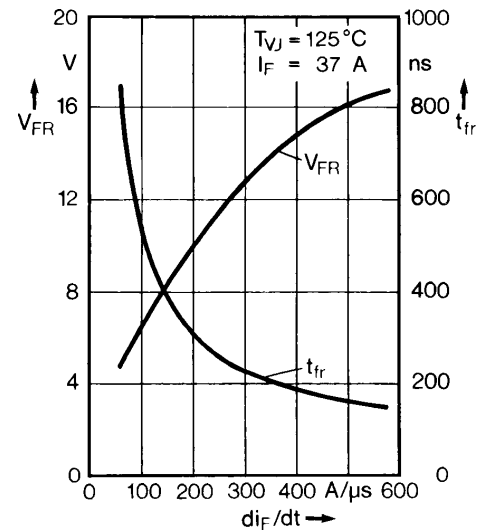
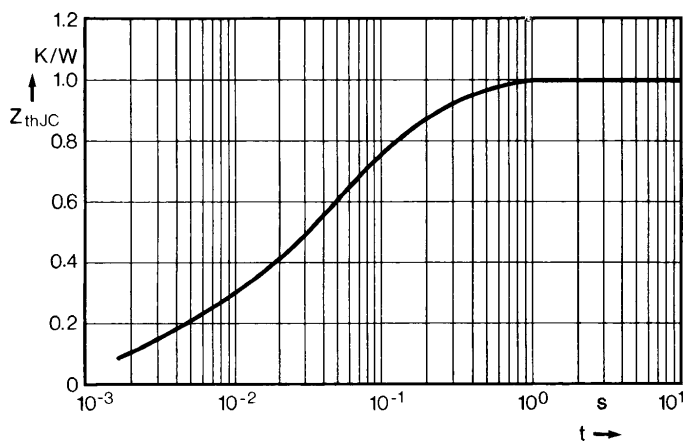


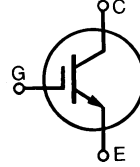
Fig. 18. Transient thermal resistance junction to case.



Ultra-Low $V_{CE(sat)}$ IGBT

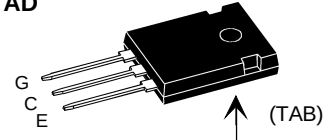
IXGH 31N60
IXGT 31N60

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 1.7 \text{ V}$

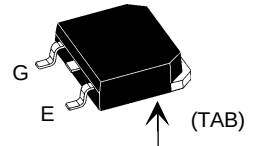


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	31	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 62$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3) TO-247	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight	TO-247	6	g
	TO-268	4	g

TO-247 AD



TO-268



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- High current handling capability
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

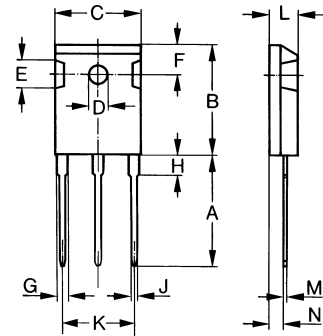
Advantages

- Easy to mount with 1 screw (isolated mounting screw hole)
- Low losses, high efficiency
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			100 μA 500 μA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			1.7 V

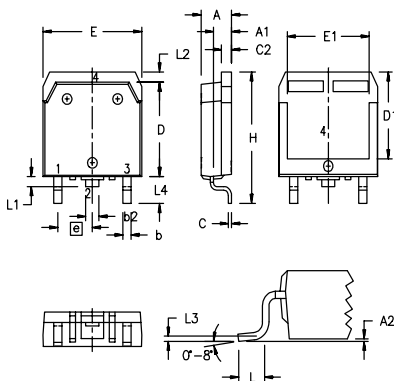
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	10	16	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		80	nC
Q_{ge}			15	nC
Q_{gc}			30	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			400	ns
t_{fi}			400	ns
E_{off}			6	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			0.2	mJ
$t_{d(off)}$			800	ns
t_{fi}			800	ns
E_{off}			12	mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

TO-247 AD (IXFH) Outline



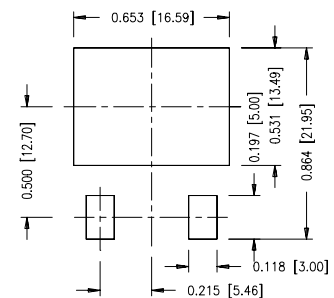
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

Min. Recommended Footprint

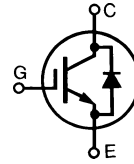


Ultra-Low $V_{CE(sat)}$ IGBT with Diode

IXGH 31N60D1
IXGT 31N60D1

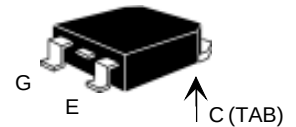
$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 1.7 \text{ V}$

Preliminary data

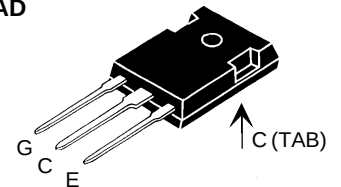


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	31	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 62$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3) TO-247	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight	TO-247	6	g
	TO-268	4	g

**TO-268
(IXGT)**



**TO-247 AD
(IXGH)**



G = Gate,
E = Emitter,

C = Collector,
TAB = Collector

Features

- IGBT and anti-parallel FRED in one package
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

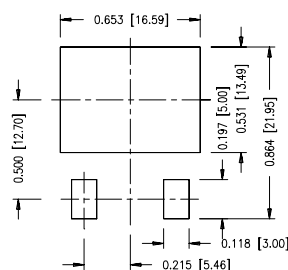
- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			1.7 V

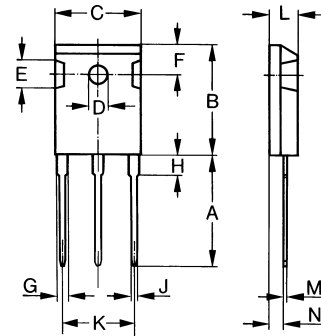
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	10	16	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1500	pF
C_{oes}			130	pF
C_{res}			40	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		80	nC
Q_{ge}			15	nC
Q_{gc}			30	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
$t_{d(off)}$			400	ns
t_{fi}			400	ns
E_{off}			6	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			25	ns
E_{on}			1	mJ
$t_{d(off)}$			800	ns
t_{fi}			800	ns
E_{off}			12	mJ
R_{thJC}				0.83 K/W
R_{thCK}			0.25	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V
		$T_J = 25^\circ\text{C}$		2.5 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$	$T_J = 100^\circ\text{C}$	6	A
t_{rr}		$T_J = 25^\circ\text{C}$	100	ns
			25	ns
R_{thJC}				1 K/W

Min. Recommended Footprint

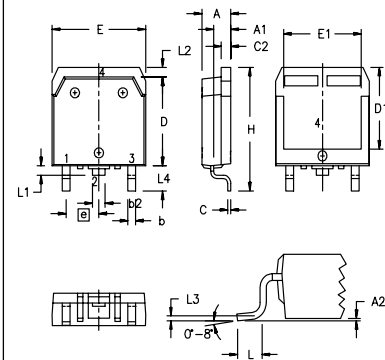


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)

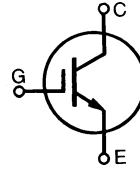


Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

HiPerFAST™ IGBT

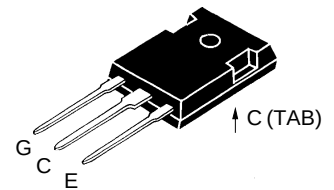
IXGH32N60B

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 60 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \\ t_{fi} &= 80 \text{ ns} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	32	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- PFC circuits
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

Advantages

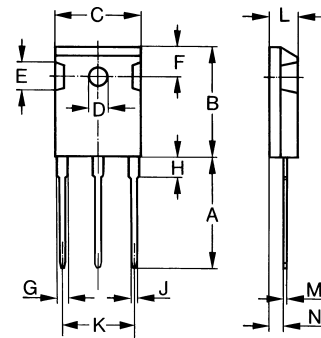
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$200 \mu\text{A}$ 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.5 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	15	20	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2500	pF
C_{oes}			230	pF
C_{res}			70	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		125	nC
Q_{ge}			23	nC
Q_{gc}			50	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			30	ns
$t_{d(off)}$			100	ns
t_{fi}			80	ns
E_{off}			0.8	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			35	ns
E_{on}			0.3	mJ
$t_{d(off)}$			120	ns
t_{fi}			120	ns
E_{off}			1.4	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

IXGH 32N60B characteristic curves are located in the IXGH 32N60BU1 data sheet.

TO-247 AD (IXGH) Outline

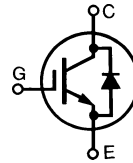


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT with Diode

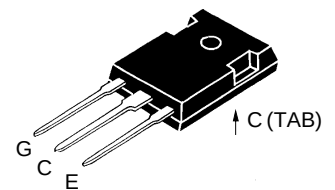
IXGH32N60BU1

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 2.5 \text{ V}$
 $t_{fi} = 80 \text{ ns}$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	32	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g

TO-247 AD



G = Gate, C = Collector,
 E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- High frequency IGBT and antiparallel FRED in one package
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

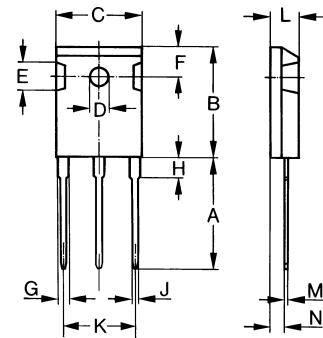
Advantages

- Space savings (two devices in one package)
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			500 μA 8 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.5 V

Symbol	Test Conditions	Characteristic Values		
		(T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	I _C = I _{C90} , V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %	15	20	S
C_{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz		2500	pF
C_{oes}			270	pF
C_{res}			70	pF
Q_g	I _C = I _{C90} , V _{GE} = 15 V, V _{CE} = 0.5 V _{CES}		125	150 nC
Q_{ge}			23	35 nC
Q_{gc}			50	75 nC
t_{d(on)}	Inductive load, T _J = 25°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 4.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t_{ri}			30	ns
t_{d(off)}			100	200 ns
t_{fi}			80	150 ns
E_{off}			0.8	1.6 mJ
t_{d(on)}	Inductive load, T _J = 125°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 4.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t_{ri}			35	ns
E_{on}			1	mJ
t_{d(off)}			120	ns
t_{fi}			120	ns
E_{off}			1.4	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Symbol	Test Conditions	Characteristic Values		
		(T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
V_F	I _F = I _{C90} , V _{GE} = 0 V, Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %			1.6 V
I_{RM}	I _F = I _{C90} , V _{GE} = 0 V, -di _F /dt = 240 A/μs V _R = 360 V I _F = 1 A; -di/dt = 100 A/μs; V _R = 30 V		10	15 A
t_{rr}			150	ns
			35	50 ns
R_{thJC}				1 K/W

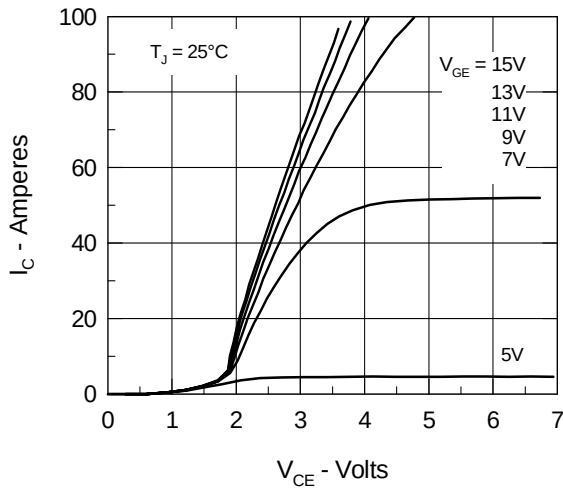


Fig. 1. Saturation Voltage Characteristics

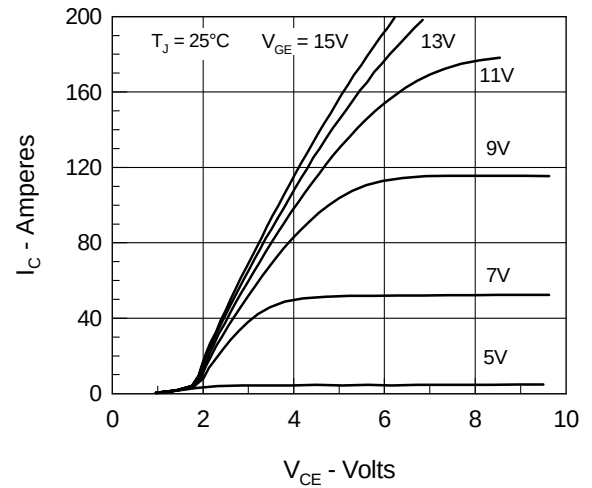


Fig. 2. Extended Output Characteristics

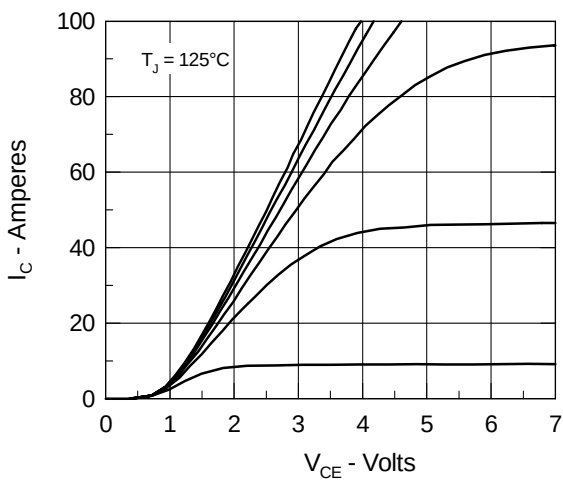


Fig. 3. Saturation Voltage Characteristics

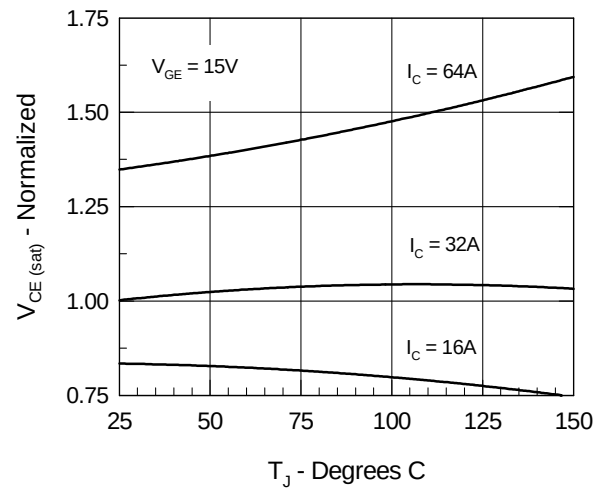


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

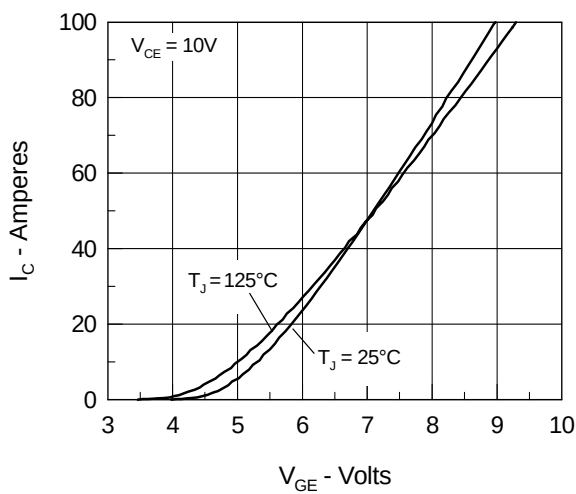


Fig. 5. Admittance Curves

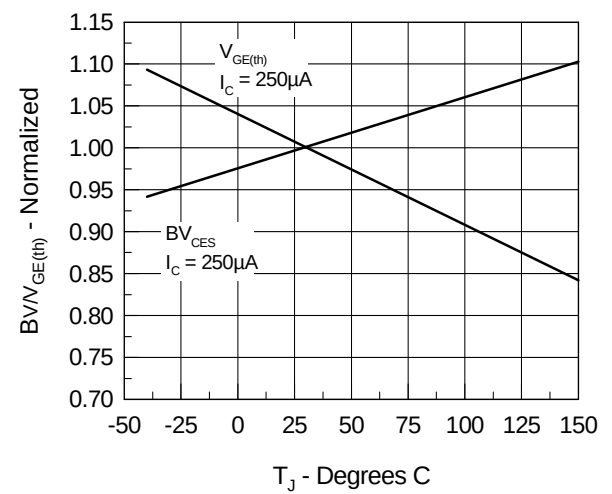


Fig. 6. Temperature Dependence of BV_{DSS} & $V_{GE(th)}$

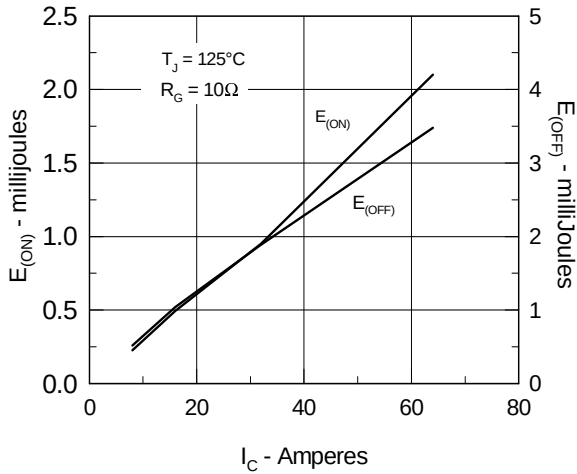


Fig. 7. Dependence of t_{fi} and E_{OFF} on I_C .

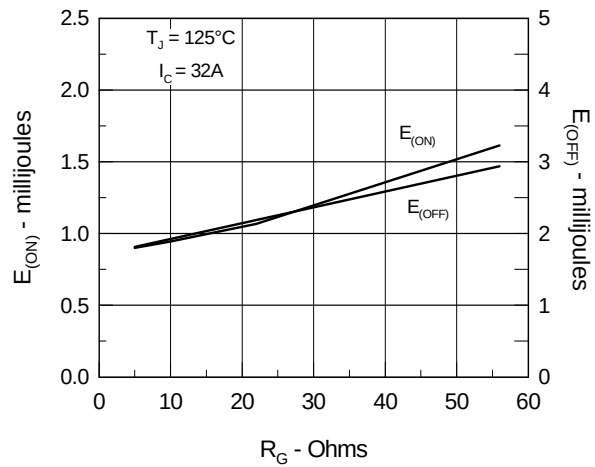


Fig. 8. Dependence of t_{fi} and E_{OFF} on R_G .

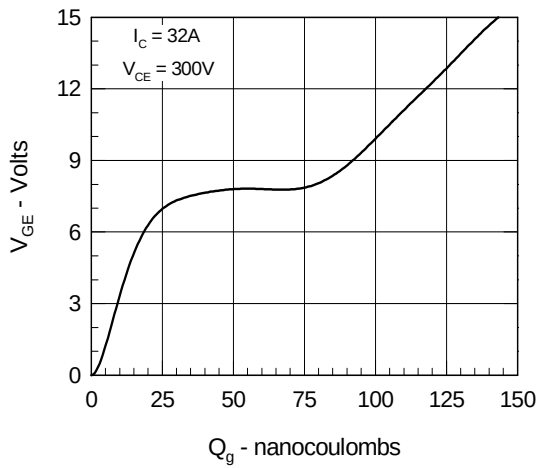


Fig. 9. Gate Charge

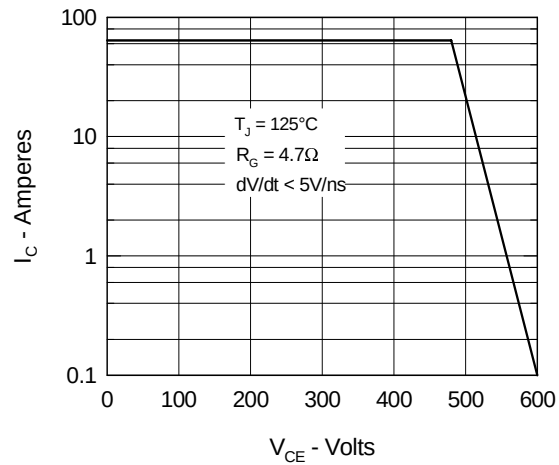


Fig. 10. Turn-off Safe Operating Area

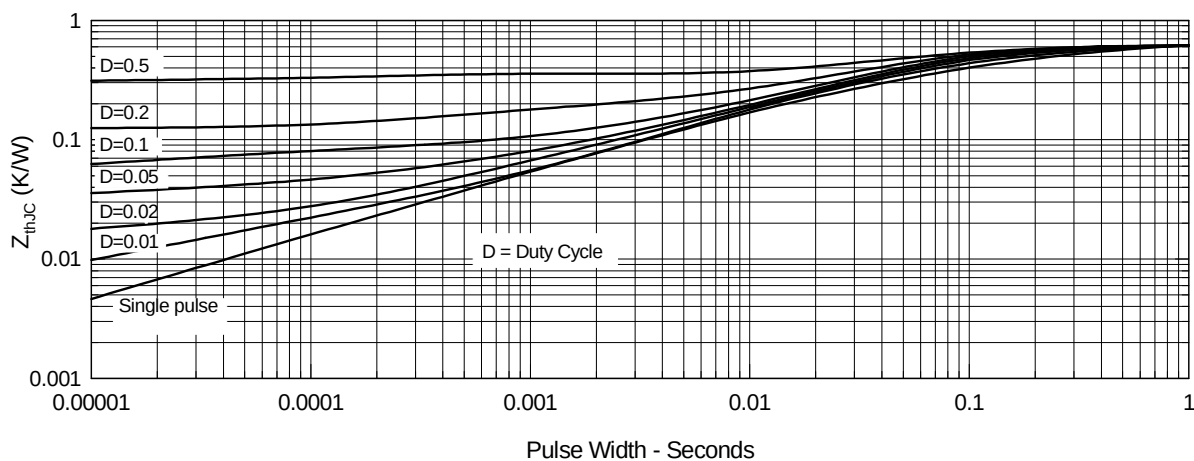


Fig. 11. Transient Thermal Resistance

Fig.12 Maximum Forward Voltage Drop

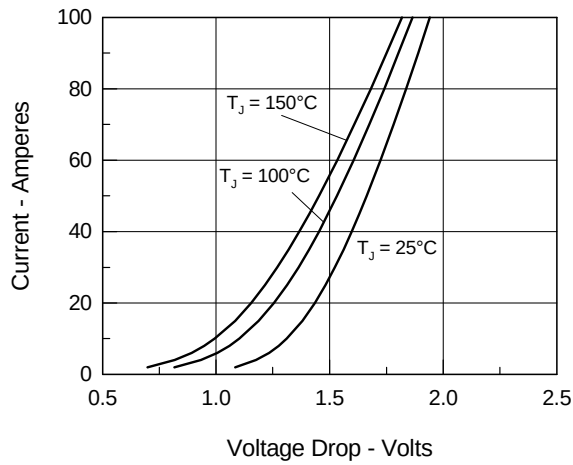


Fig.13 Peak Forward Voltage V_{FR} and Forward Recovery Time t_{FR}

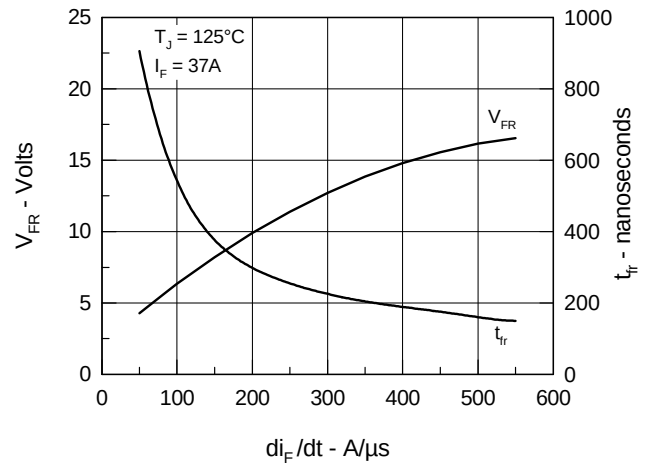


Fig.14 Junction Temperature Dependence of I_{RM} and Q_r

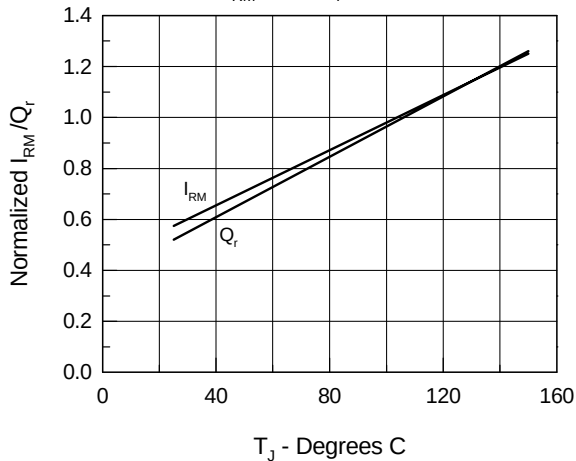


Fig.15 Reverse Recovery Charge

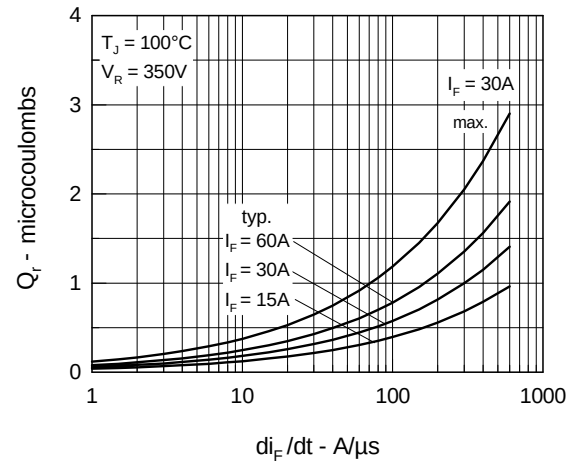


Fig.16 Peak Reverse Recovery Current

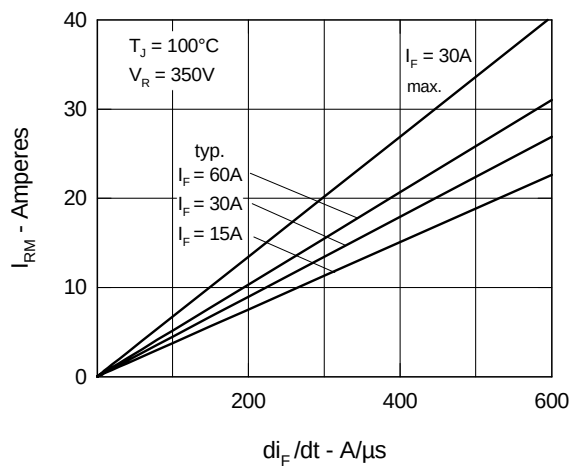


Fig.17 Reverse Recovery Time

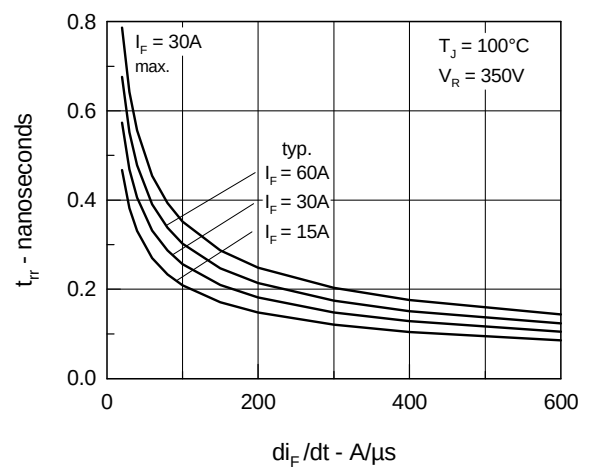
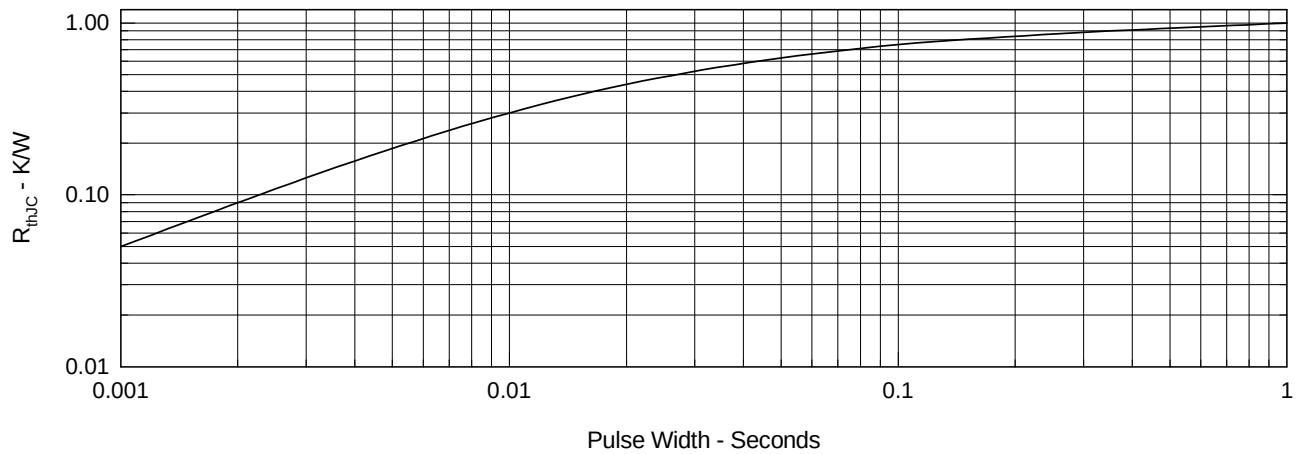


Fig.18 Diode Transient Thermal resistance junction to case



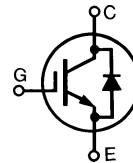
HiPerFAST™ IGBT with Diode

IXGH 32N60BD1

Light Speed Series

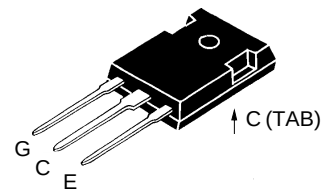
$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)} = 2.2 \text{ V}$
 $t_{f1(typ)} = 85 \text{ ns}$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	32	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight		6	g

TO-247 AD



G = Gate, C = Collector,
 E = Emitter, TAB = Collector

Features

- International standard TO-247AD package
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

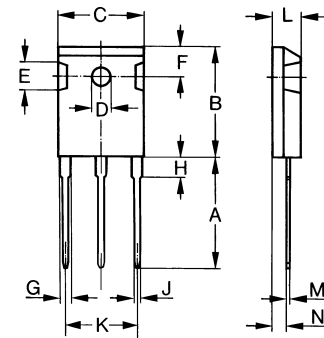
Advantages

- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.2 V

Symbol	Test Conditions	Characteristic Values		
		(T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	I _C = I _{C90} ; V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %		25	S
C_{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz		2700	pF
C_{oes}			240	pF
C_{res}			50	pF
Q_g	I _C = I _{C90} , V _{GE} = 15 V, V _{CE} = 0.5 V _{CES}		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
t_{d(on)}	Inductive load, T _J = 150°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 4.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t_{ri}			20	ns
t_{d(off)}			100	200
t_{fi}			80	150
E_{off}			0.6	1.2
t_{d(on)}	Inductive load, T _J = 125°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 4.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t_{ri}			25	ns
E_{on}			1	mJ
t_{d(off)}			120	ns
t_{fi}			120	ns
E_{off}			1.2	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



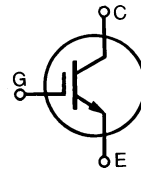
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Reverse Diode (FRED)		Characteristic Values		
		(T _J = 25°C, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	I _F = I _{C90} , V _{GE} = 0 V, Pulse test t ≤ 300 μs, duty cycle d ≤ 2 %	T _J = 25°C T _J = 150°C		2.5 V 1.6 V
I_{RM}	I _F = I _{C90} , V _{GE} = 0 V, -di _F /dt = 240 A/μs V _R = 360 V I _F = 1 A; -di _F /dt = 100 A/μs; V _R = 30 V		6	A
t_{rr}		T _J = 125°C	100	ns
		T _J = 25°C	25	ns
R_{thJC}				1 K/W

HiPerFAST™ IGBT Lightspeed™ Series

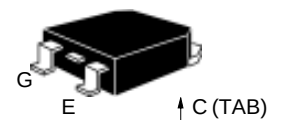
IXGH 32N60C
IXGT 32N60C

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(sat)typ} = 2.1 \text{ V}$
 $t_{fi typ} = 55 \text{ ns}$

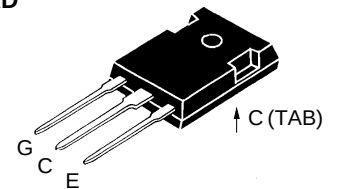


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C110}	$T_C = 110^\circ\text{C}$	32	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

**TO-268
(IXGT)**



**TO-247 AD
(IXGH)**



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-247 and surface mountable TO-268
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- PFC circuits
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

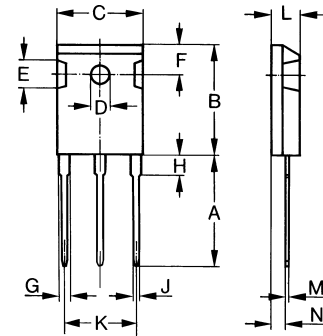
Advantages

- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$200 \mu\text{A}$ 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C110}, V_{GE} = 15 \text{ V}$	2.1	2.5	V

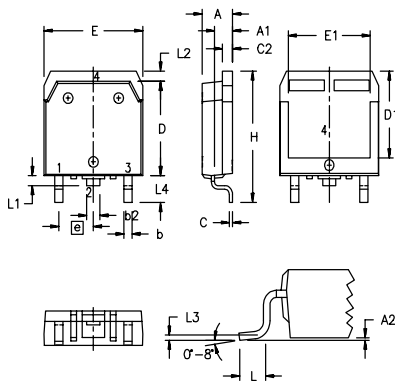
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C110}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2700	pF
C_{oes}			190	pF
C_{res}			50	pF
Q_g	$I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		25	ns
t_{ri}			20	ns
$t_{d(off)}$			85	ns
t_{fi}			55	ns
E_{off}			0.32	mJ
$t_{d(on)}$	Inductive load, $T_j = 150^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		25	ns
t_{ri}			25	ns
E_{on}			0.30	mJ
$t_{d(off)}$			110	170 ns
t_{fi}			105	160 ns
E_{off}			0.85	1.25 mJ
R_{thJC}				0.62 K/W
R_{thCK}	(IXGH32N60C)		0.25	K/W

TO-247 AD (IXGH) Outline



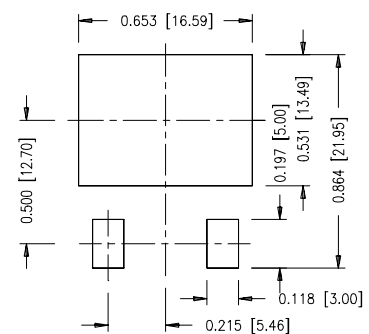
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

Min. Recommended Footprint



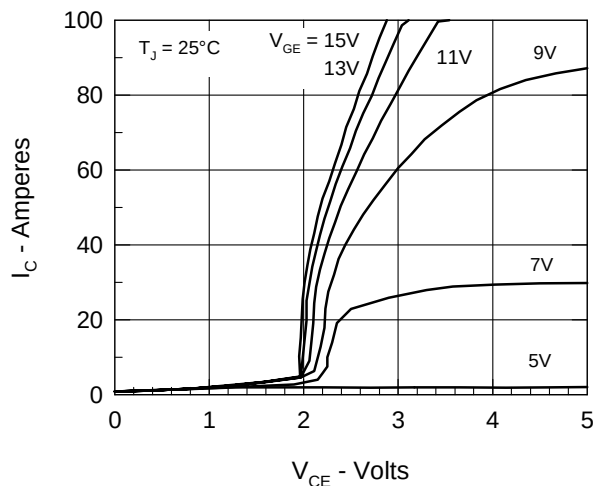


Fig. 1. Output Characteristics

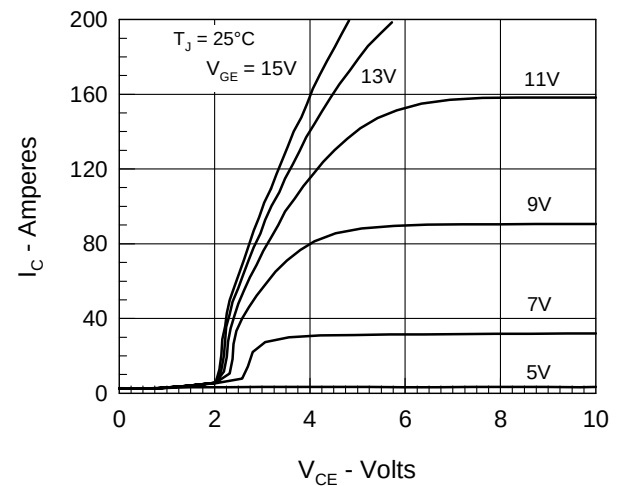


Fig. 2. Extended Output Characteristics

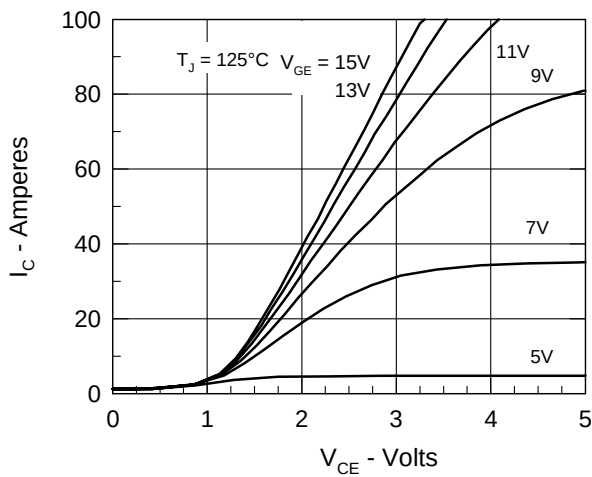


Fig. 3. High Temperature Output Characteristics

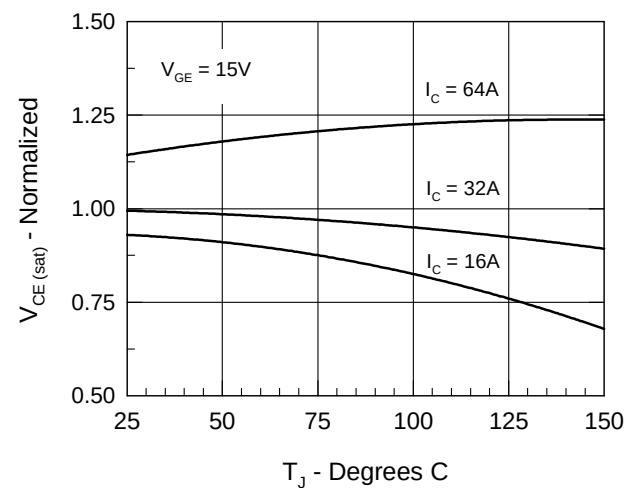
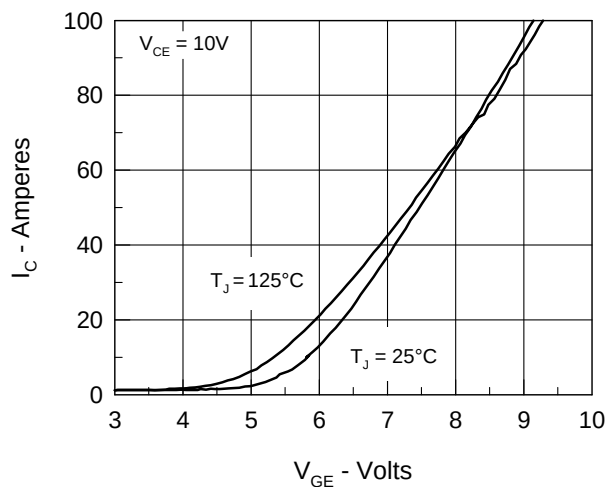

 Fig. 4. Temperature Dependence of $V_{CE(sat)}$


Fig. 5. Admittance Curves

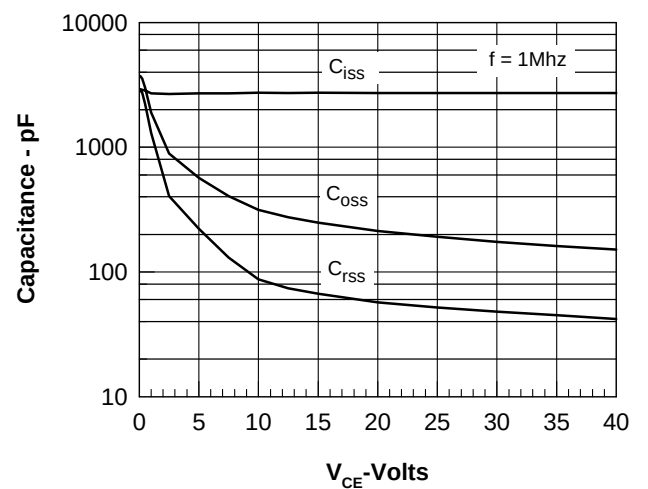


Fig. 6. Capacitance Curves

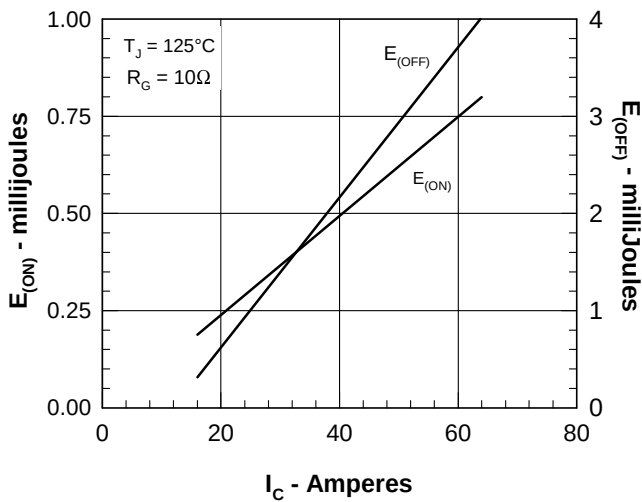


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

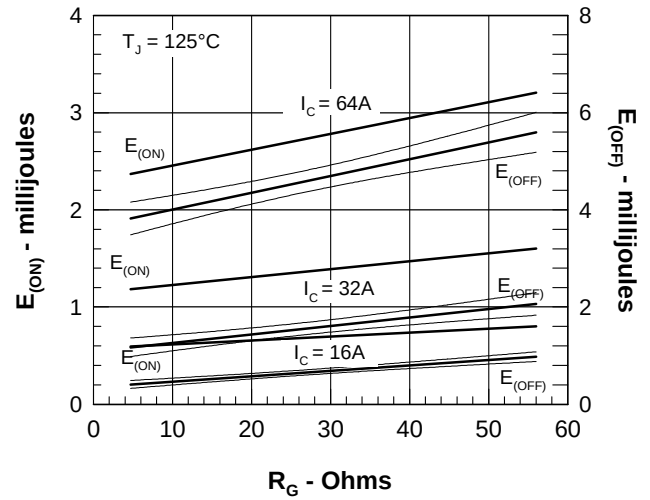


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

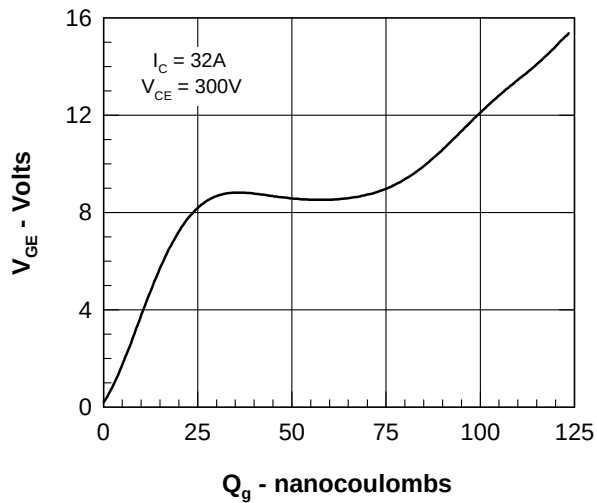


Fig. 9. Gate Charge

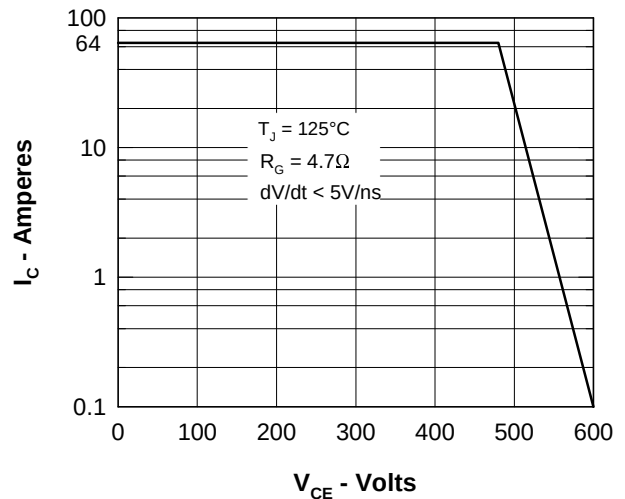


Fig. 10. Turn-off Safe Operating Area

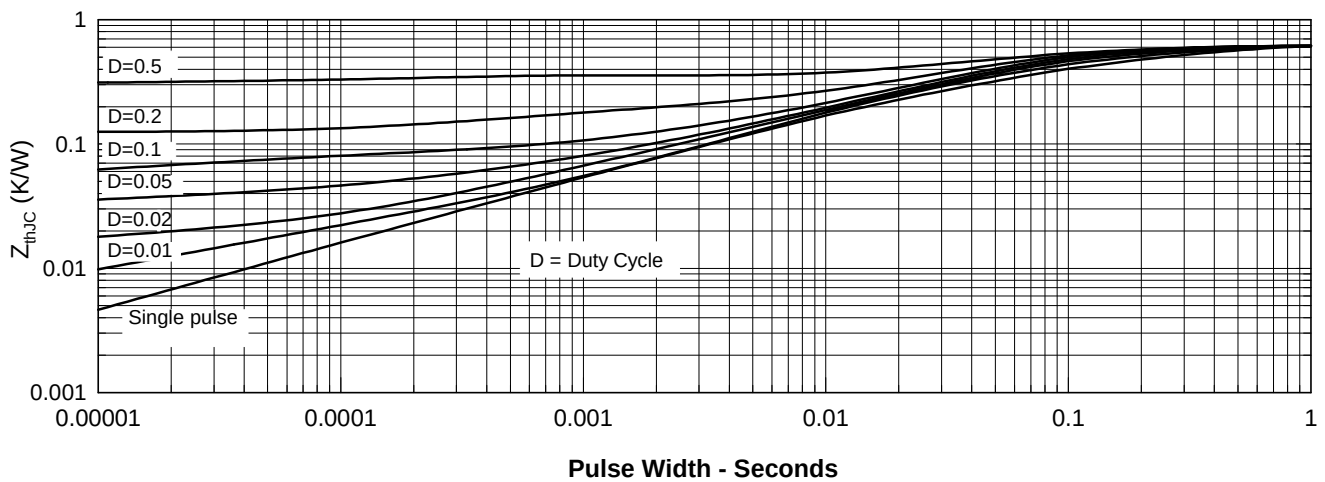


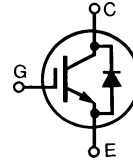
Fig. 11. Transient Thermal Resistance

HiPerFAST™ IGBT with Diode

Light Speed Series

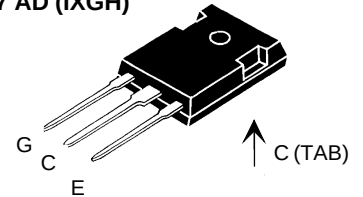
IXGH 32N60CD1
IXGT 32N60CD1

$V_{CES} = 600 \text{ V}$
 $I_{C25} = 60 \text{ A}$
 $V_{CE(SAT)typ} = 2.1 \text{ V}$
 $t_{fi(typ)} = 55 \text{ ns}$

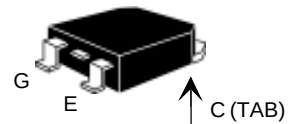


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	60	A
I_{C90}	$T_C = 90^\circ\text{C}$	32	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g
	TO-268	5	g

TO-247 AD (IXGH)



TO-268 (D3) (IXGT)



G = Gate C = Collector
E = Emitter

Features

- International standard TO-247AD package
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

Advantages

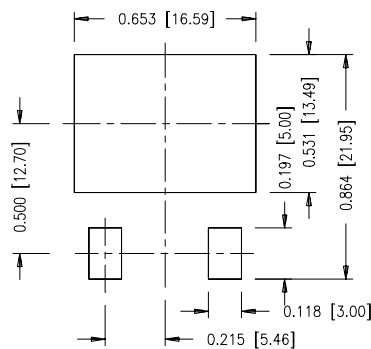
- High power density
- Very fast switching speeds for high frequency applications
- High power surface mountable package

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ 200 μA $T_J = 125^\circ\text{C}$ 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$	2.1	2.5	V

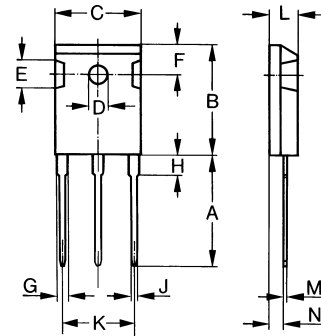
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2700	pF
C_{oes}			240	pF
C_{res}			50	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			20	ns
$t_{d(off)}$			85	ns
t_{fi}			55	ns
E_{off}			0.32	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			25	ns
E_{on}			1	mJ
$t_{d(off)}$			110	170 ns
t_{fi}			100	160 ns
E_{off}			0.85	1.25 mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, Pulse test $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V
		$T_J = 25^\circ\text{C}$		2.5 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$	$T_J = 100^\circ\text{C}$	6	A
t_{rr}		$T_J = 25^\circ\text{C}$	100	ns
			25	ns
R_{thJC}				0.9 K/W

Min. Recommended Footprint

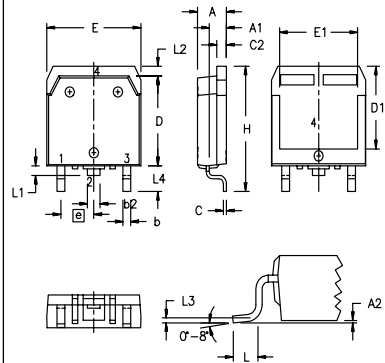


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L1	1.20 1.40	.047 .055
L2	1.00 1.15	.039 .045
L3	0.25 BSC	.010 BSC
L4	3.80 4.10	.150 .161

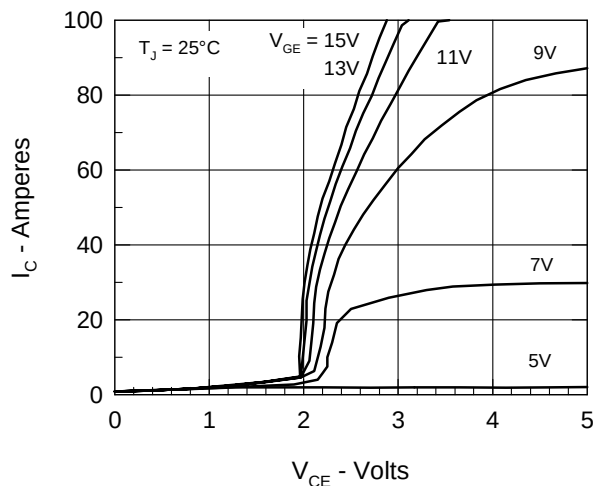


Fig. 1. Output Characteristics

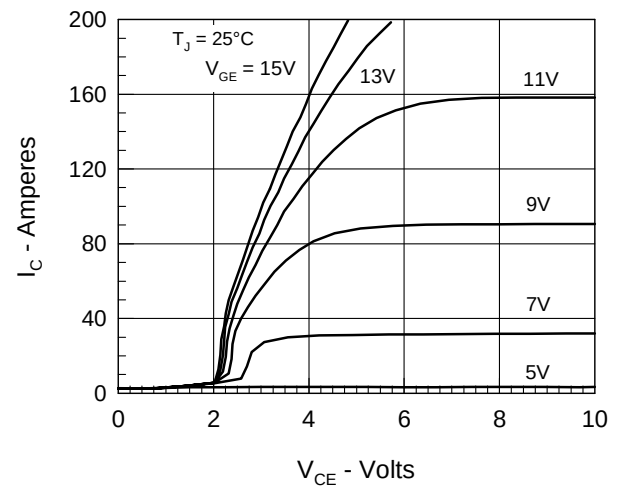


Fig. 2. Extended Output Characteristics

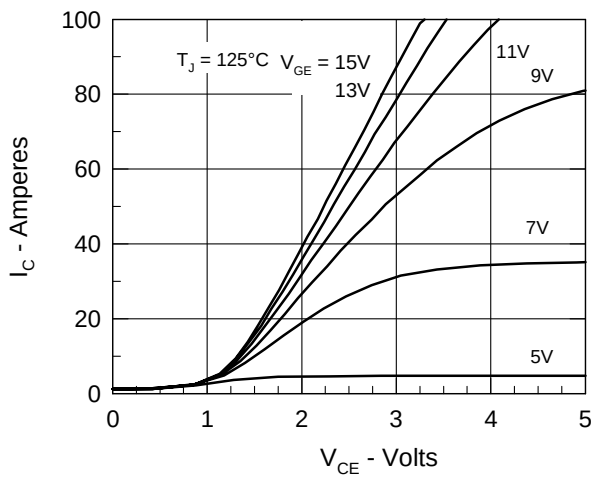


Fig. 3. High Temperature Output Characteristics

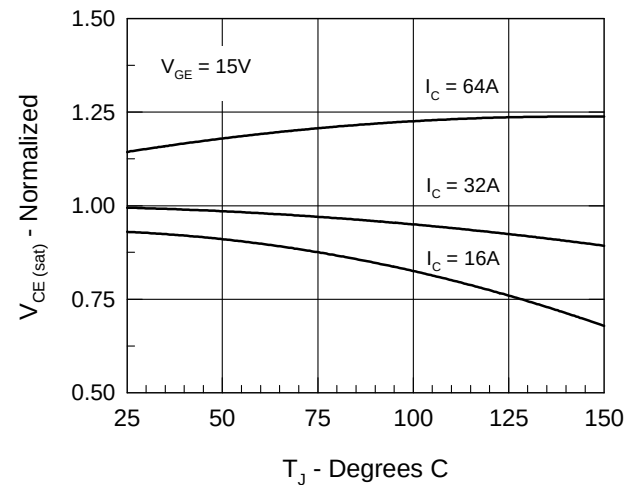


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

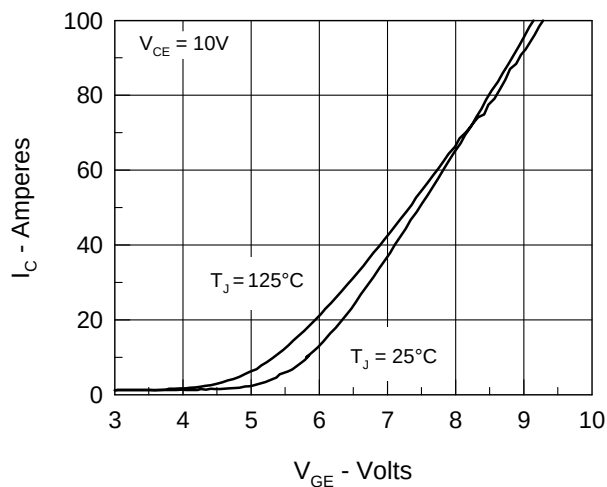


Fig. 5. Admittance Curves

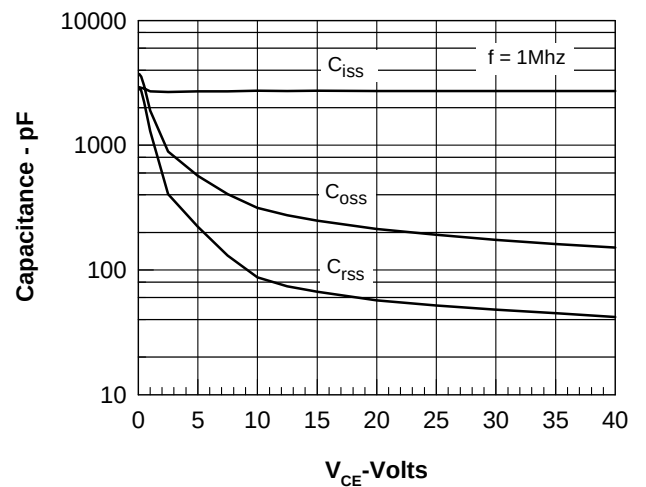


Fig. 6. Capacitance Curves

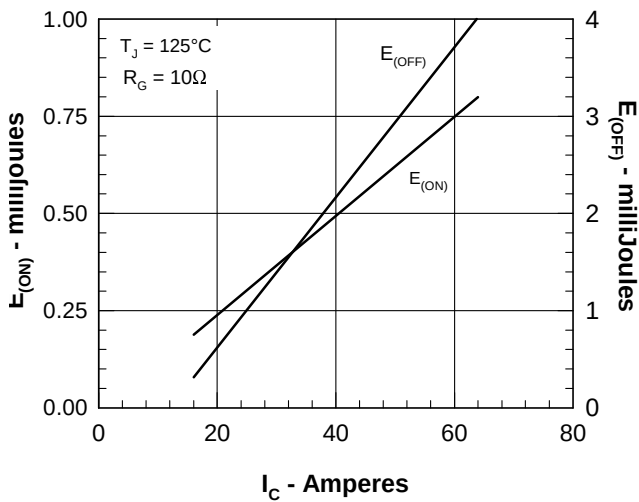


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

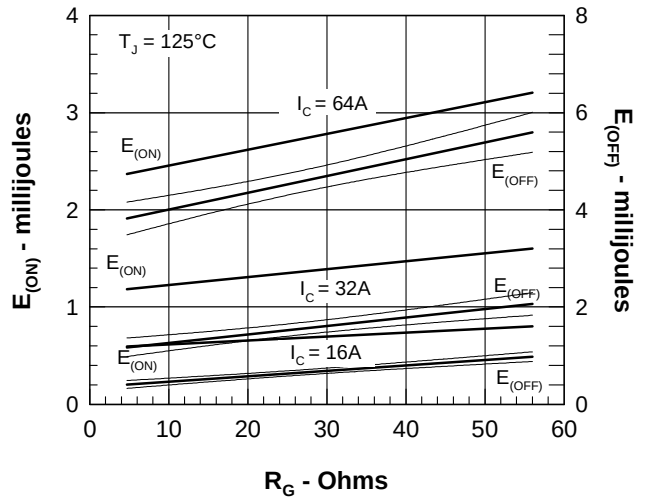


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

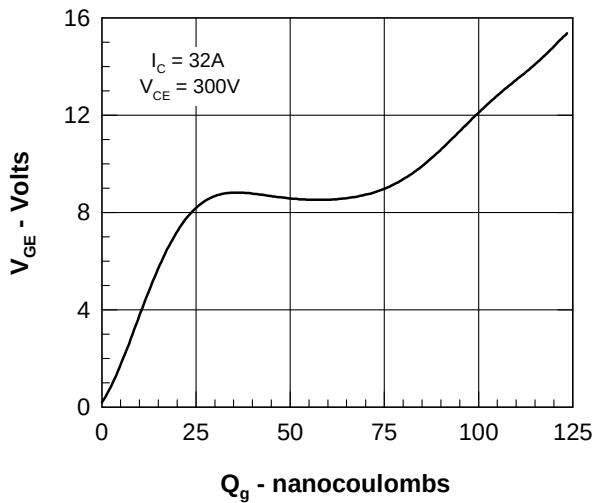


Fig. 9. Gate Charge

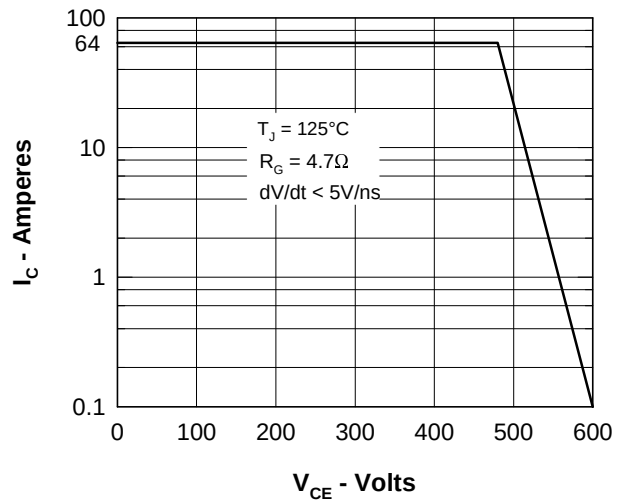


Fig. 10. Turn-off Safe Operating Area

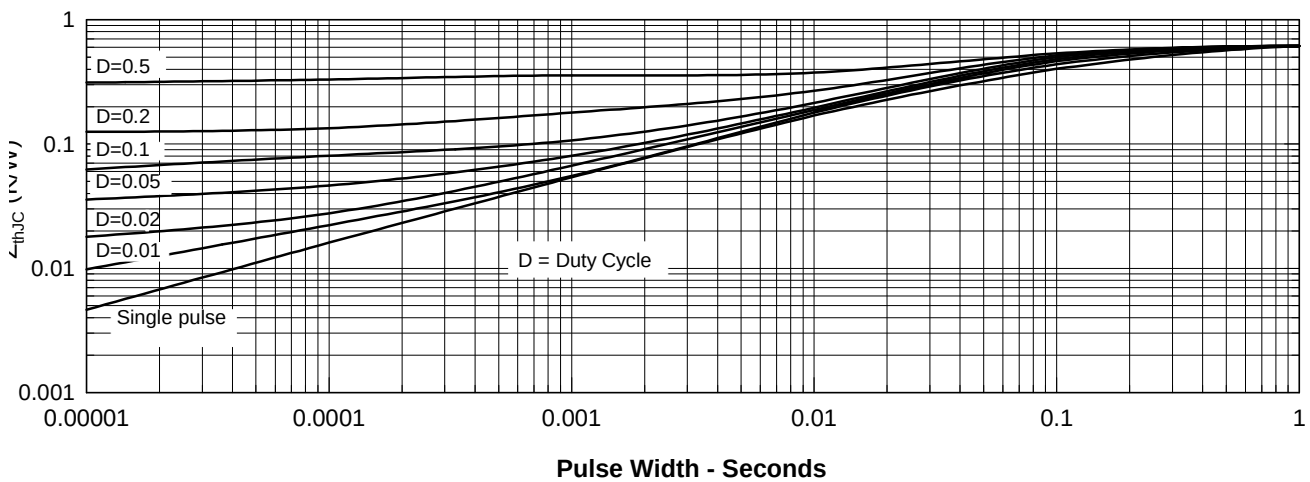


Fig. 11. Transient Thermal Resistance

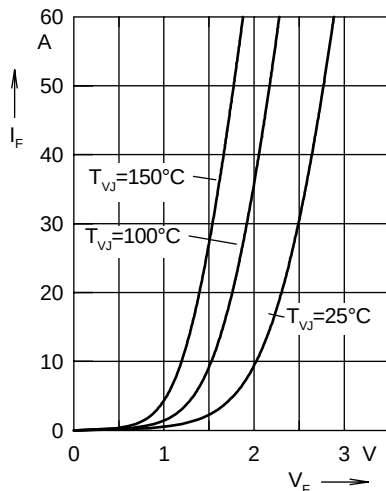


Fig. 12 Forward current I_F versus V_F

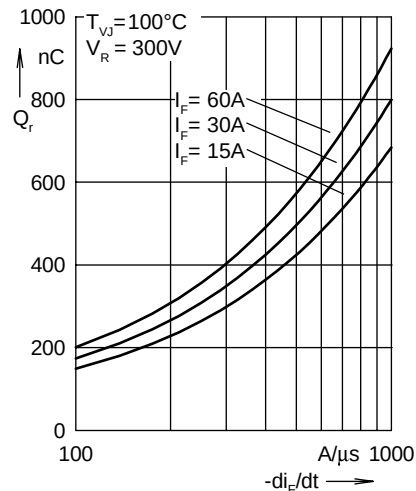


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

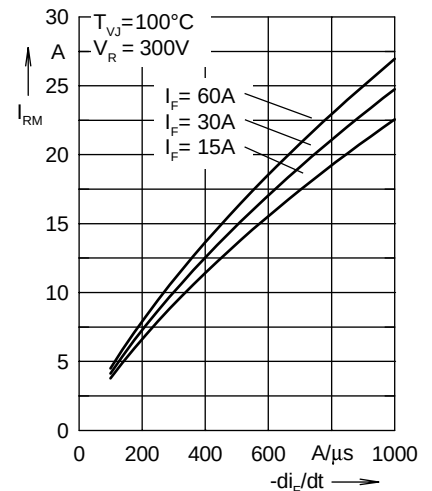


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

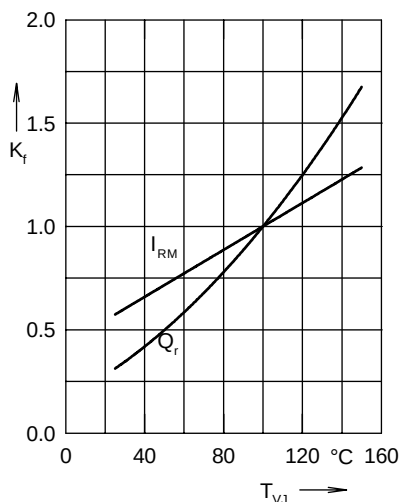


Fig. 15 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

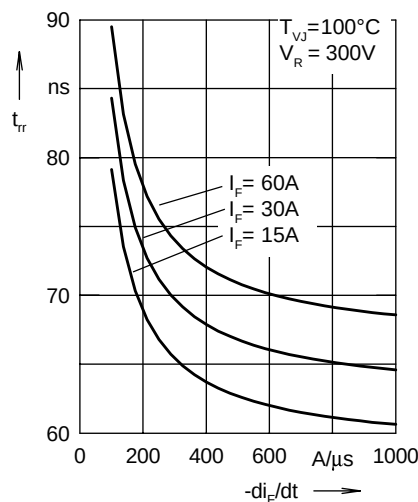


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

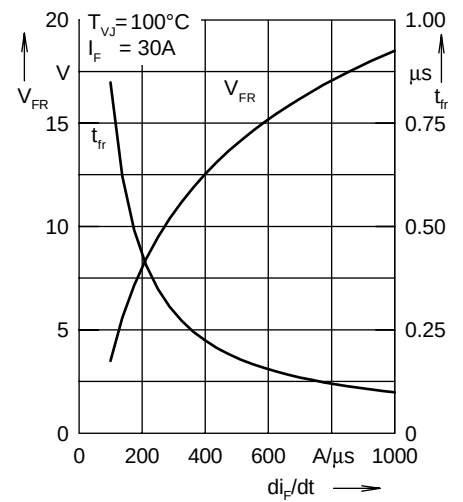


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

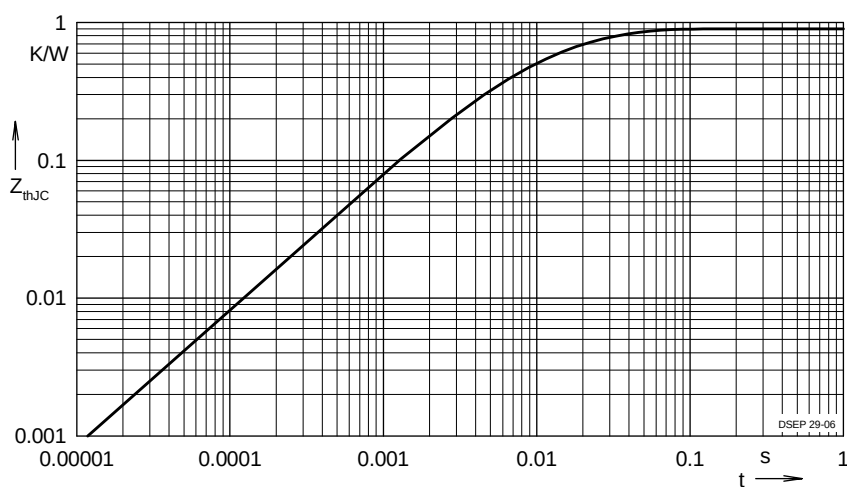


Fig. 18 Transient thermal resistance junction to case

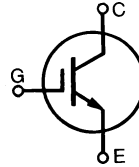
Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162

HiPerFAST™ IGBT Lightspeed Series ISOPLUS247™ package (Electrically Isolated Back Side)

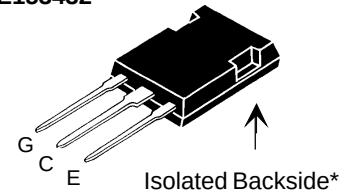
IXGR 32N60C

$$\begin{aligned} V_{CE} &= 600 \text{ V} \\ I_{C25} &= 45 \text{ A} \\ V_{CE(sat)typ} &= 2.1 \text{ V} \\ t_{fi typ} &= 55 \text{ ns} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	45	A
I_{C110}	$T_C = 110^\circ\text{C}$	26	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	140	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
V_{ISOL}	50/60 Hz, RMS, $t = 1 \text{ minute leads-to-tab}$	2500	V
Weight		6	g

ISOPLUS 247™
E153432



G = Gate, C = Collector,
E = Emitter

*Patent pending

Features

- DCB Isolated mounting tab
- Meets TO-247AD package Outline
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

Advantages

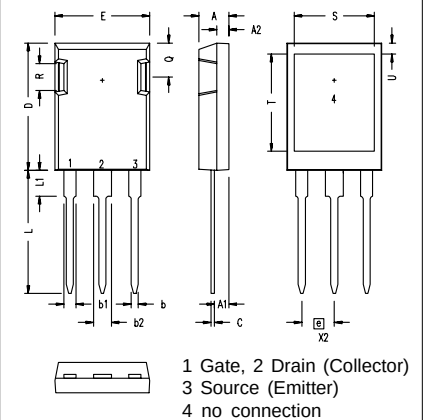
- Easy assembly
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_T, V_{GE} = 15 \text{ V}$ (see note 1)	2.1	2.5	V

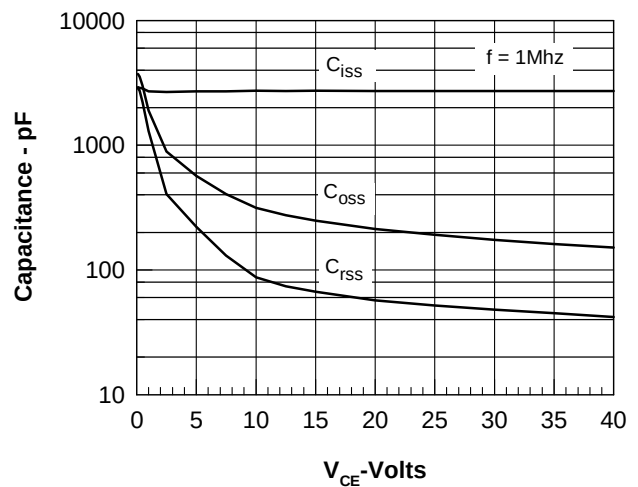
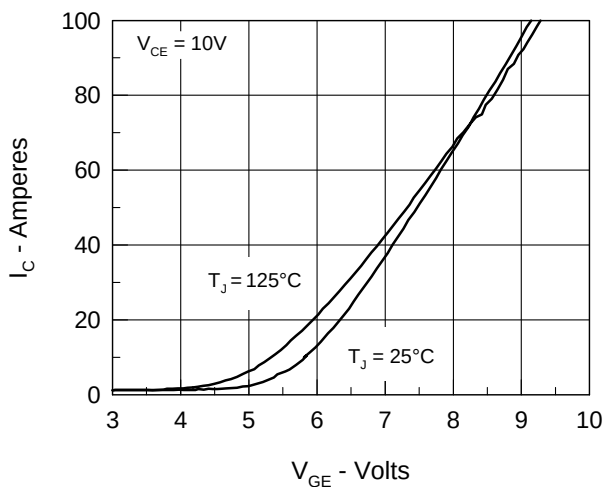
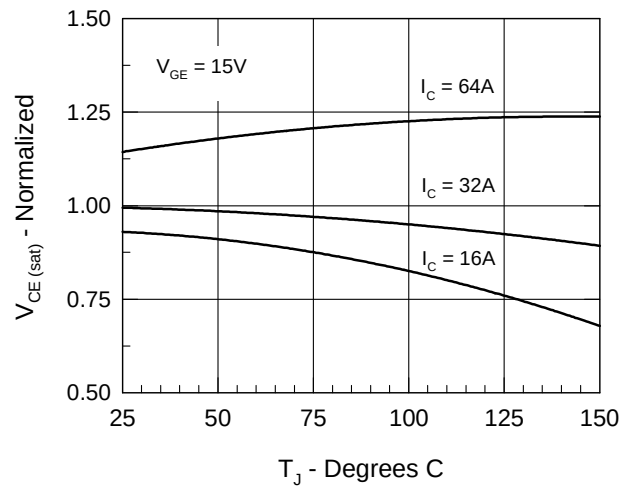
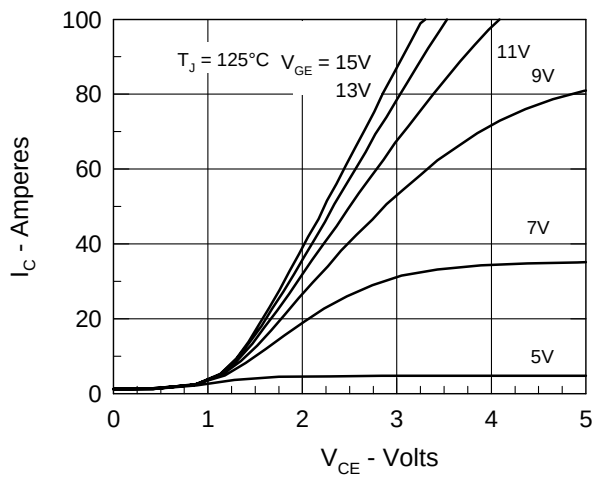
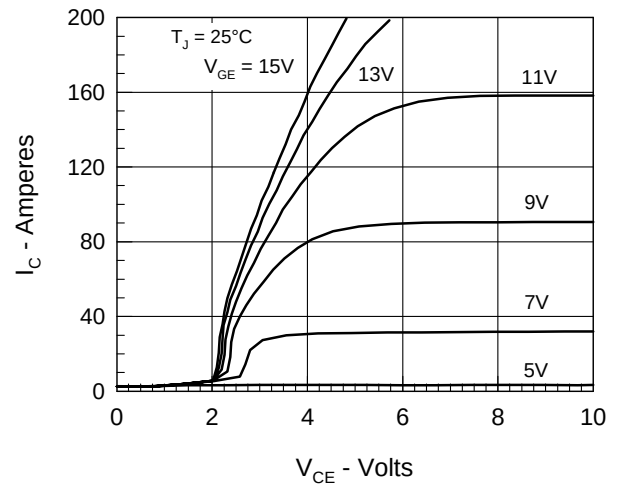
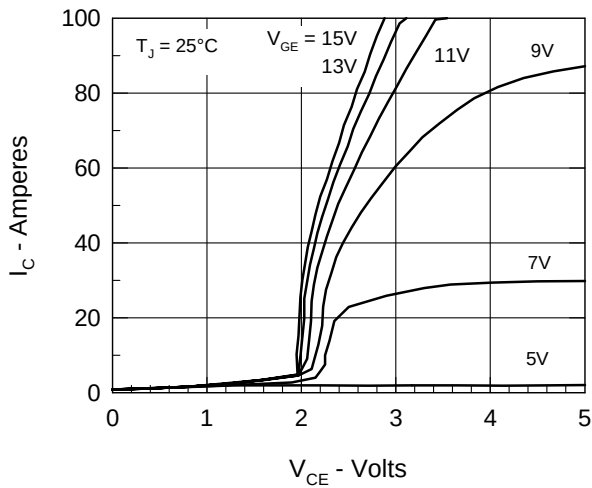
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_T; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2700	pF
C_{oes}			190	pF
C_{res}			50	pF
Q_g	$I_C = I_T$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			20	ns
$t_{d(off)}$			85	ns
t_{fi}			55	ns
E_{off}			0.32	mJ
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			25	ns
E_{on}			0.30	mJ
$t_{d(off)}$			110	170 ns
t_{fi}			105	160 ns
E_{off}			0.85	1.25 mJ
R_{thJC}				0.90 K/W
R_{thCK}			0.15	K/W

Note 1: $I_T = 32\text{ A}$

ISOPLUS 247 (IXGR) OUTLINE



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45 BSC		.215 BSC	
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080



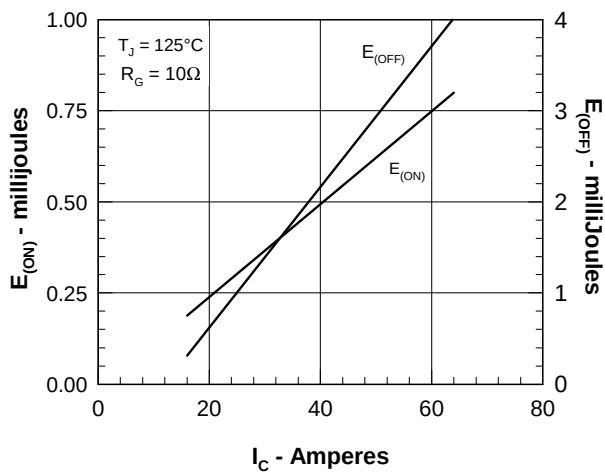


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

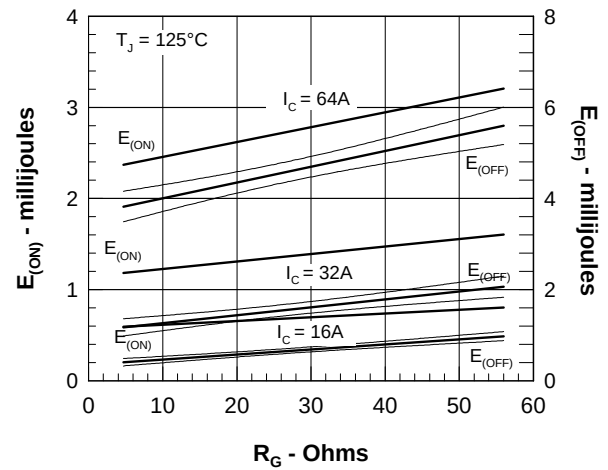


Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .

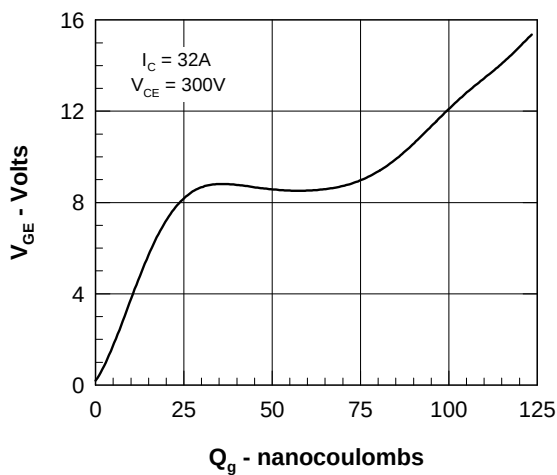


Fig. 9. Gate Charge

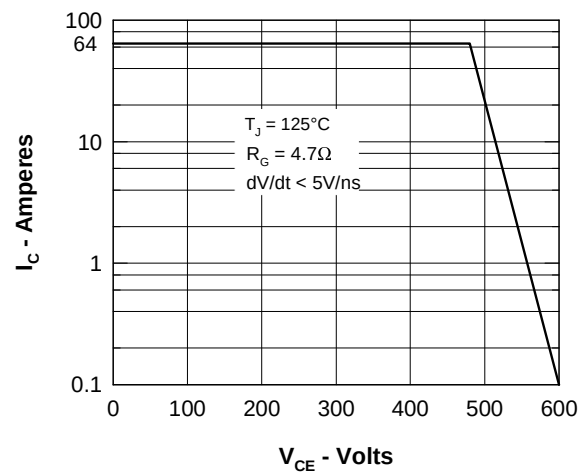


Fig. 10. Turn-off Safe Operating Area

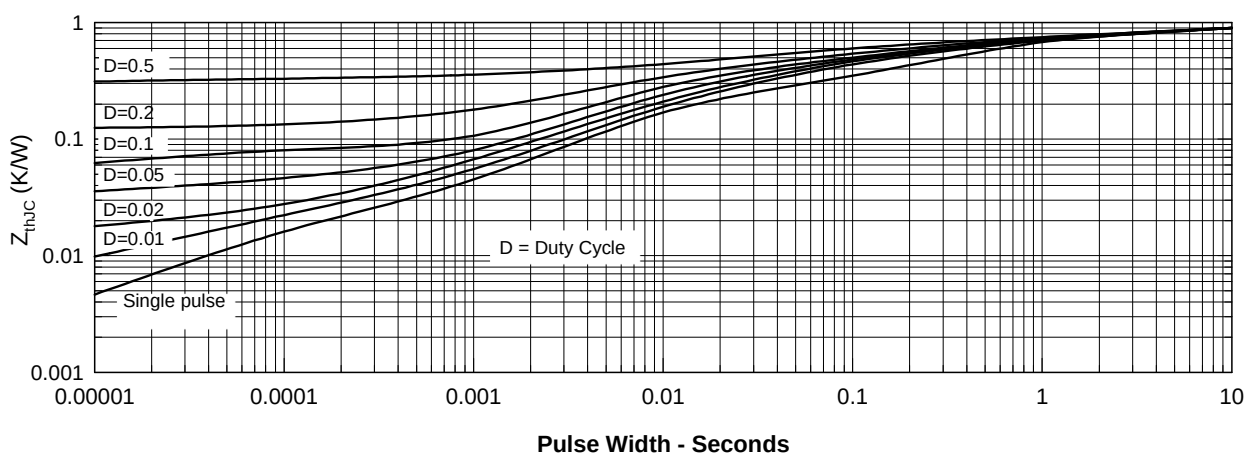


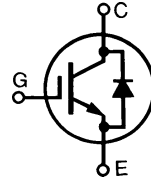
Fig. 11. Transient Thermal Resistance

HiPerFAST™ IGBT with Diode ISOPLUS247™

(Electrically Isolated Backside)

IXGR 32N60CD1

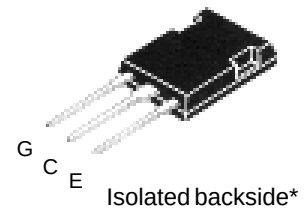
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 45 \text{ A} \\ V_{CE(SAT)typ} &= 2.1 \text{ V} \\ t_{fi(typ)} &= 55 \text{ ns} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	45	A
I_{C90}	$T_C = 90^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 64$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	140	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead and Tab temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
V_{ISOL}	50/60 Hz, RMS $t = 1 \text{ min}$ leads-to housing	2500	V~
Weight		5	g

ISOPLUS 247™ (IXGR)

 E 153432



G = Gate, C = Collector,
E = Emitter, TAB = Collector

*Patent pending

Features

- DCB Isolated mounting tab
- Meets TO-247AD package Outline
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on
 - drive simplicity

Applications

- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

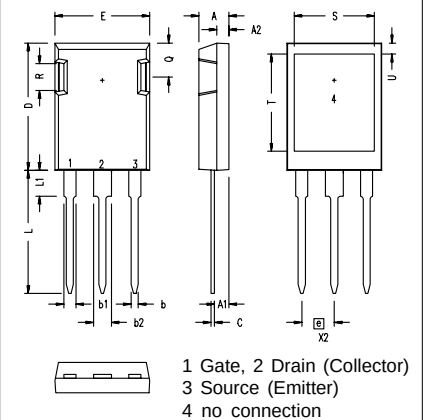
Advantages

- Easy assembly
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 3 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_T$, $V_{GE} = 15 \text{ V}$ Note 1	2.1	2.5	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_T$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$		25	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2700	pF
C_{oes}			240	pF
C_{res}			50	pF
Q_g	$I_C = I_T$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		110	nC
Q_{ge}			22	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			20	ns
$t_{d(off)}$			85	ns
t_{fi}			55	ns
E_{off}			0.32	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_T$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			25	ns
E_{on}			1	mJ
$t_{d(off)}$			110	170 ns
t_{fi}			100	160 ns
E_{off}			0.85	1.25 mJ
R_{thJC}				0.90 K/W
R_{thCK}			0.15	K/W

ISOPLUS 247 (IXGR) OUTLINE



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45 BSC		.215 BSC	
L	19.81	20.32	.780	.800
L ₁	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080

Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_T$, $V_{GE} = 0\text{ V}$, Pulse test $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	$T_J = 150^\circ\text{C}$		1.6 V
		$T_J = 25^\circ\text{C}$		2.5 V
I_{RM}	$I_F = I_T$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$ $I_F = 1\text{ A}$; $-di/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$		6	A
t_{rr}		$T_J = 100^\circ\text{C}$	100	ns
		$T_J = 25^\circ\text{C}$	25	ns
R_{thJC}				1.15 K/W

Note: 1. $I_T = 32\text{ A}$

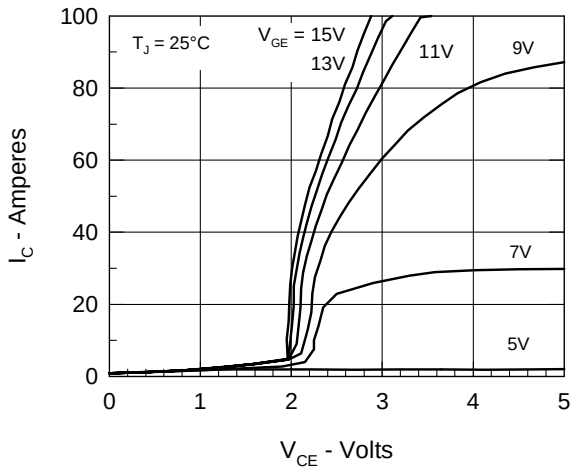


Fig. 1. Output Characteristics

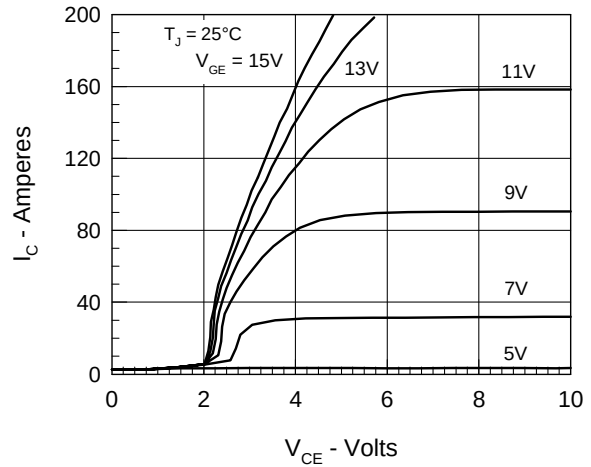


Fig. 2. Extended Output Characteristics

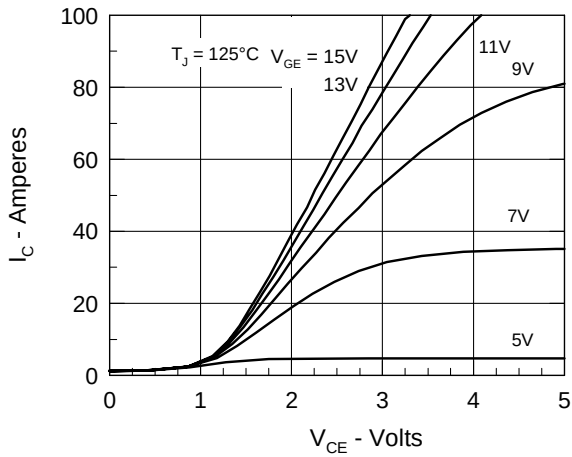


Fig. 3. High Temperature Output Characteristics

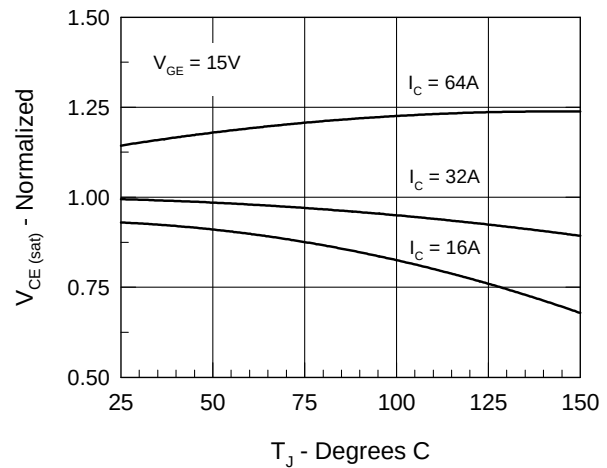


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

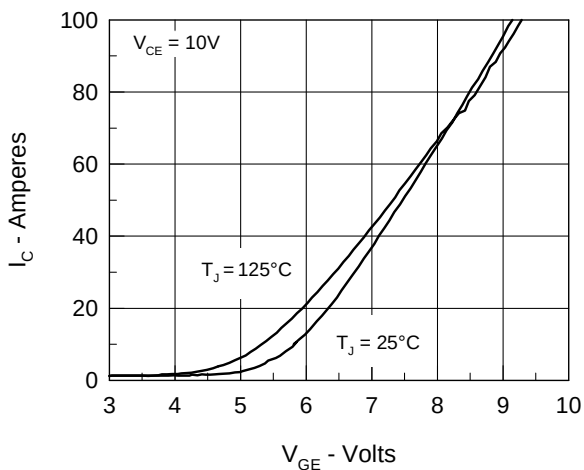


Fig. 5. Admittance Curves

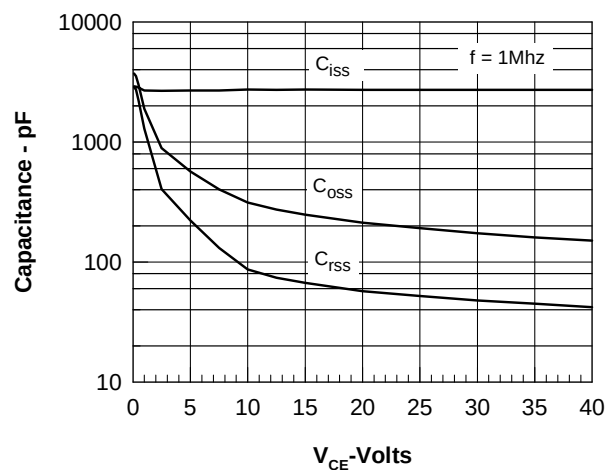


Fig. 6. Capacitance Curves

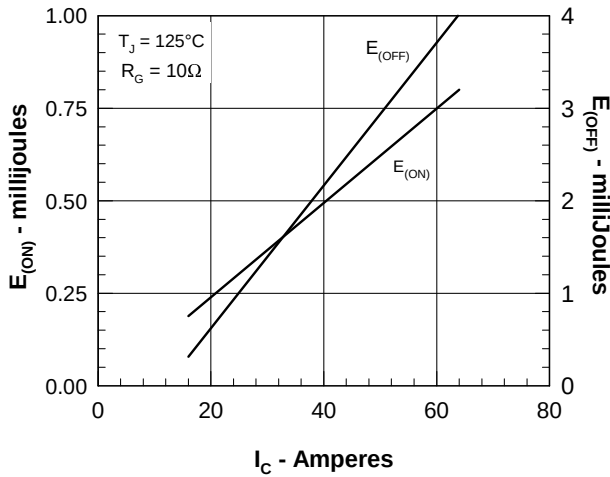
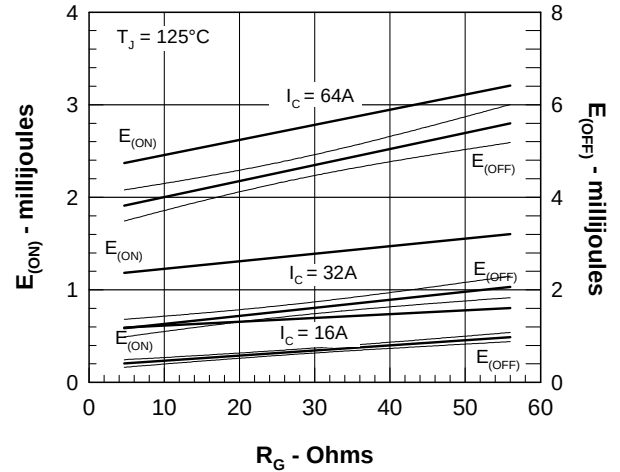
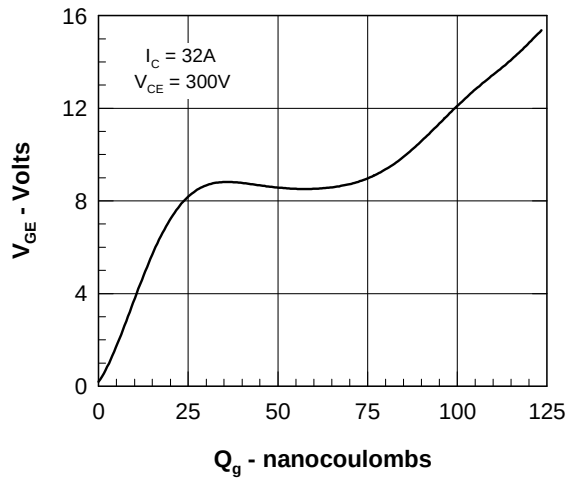

 Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

 Fig. 8. Dependence of E_{ON} and E_{OFF} on R_G .


Fig. 9. Gate Charge

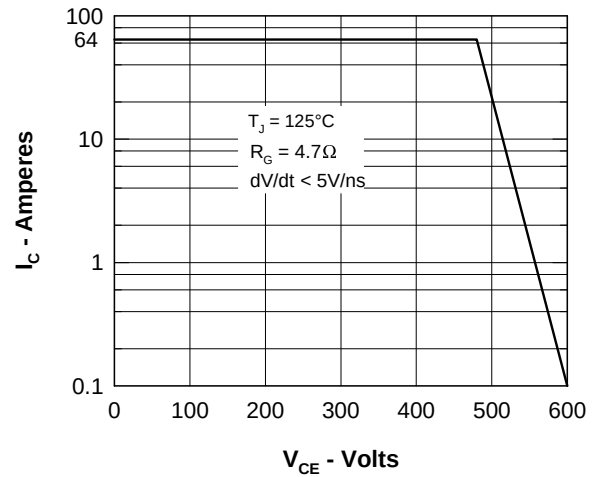


Fig. 10. Turn-off Safe Operating Area

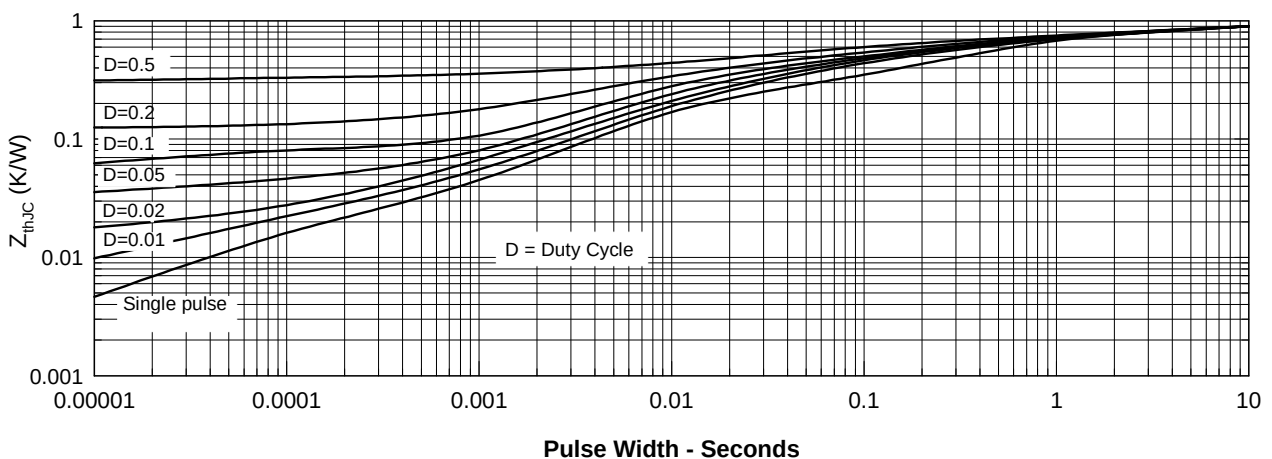


Fig. 11. Transient Thermal Resistance

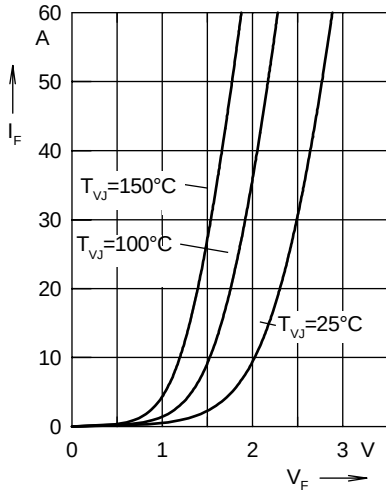


Fig. 12. Forward current I_F versus V_F

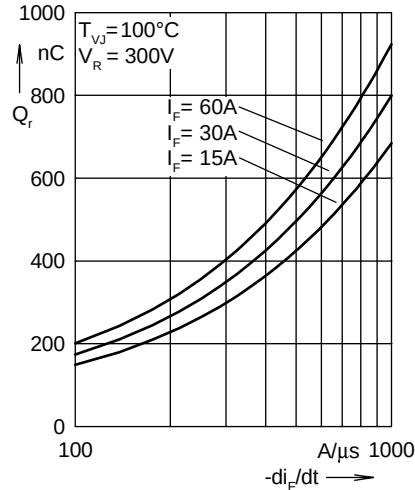


Fig. 13. Reverse recovery charge Q_r versus $-di_F/dt$

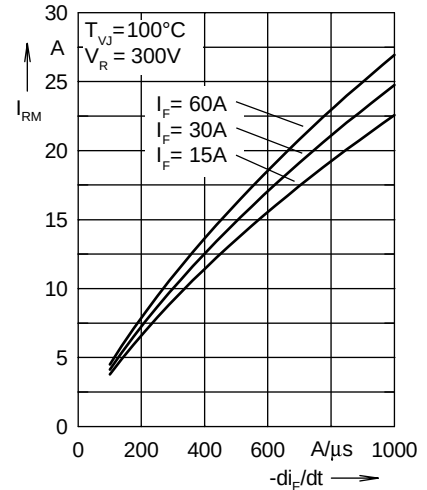


Fig. 14. Peak reverse current I_{RM} versus $-di_F/dt$

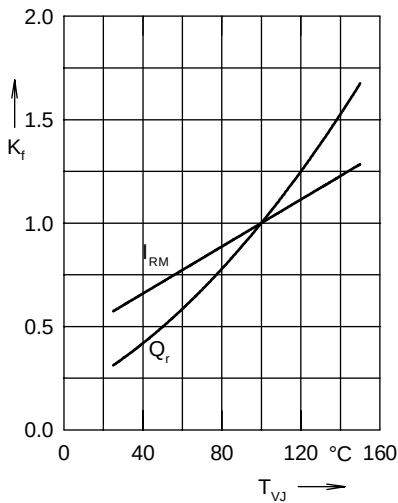


Fig. 15. Dynamic parameters Q_r , I_{RM} versus T_{VJ}

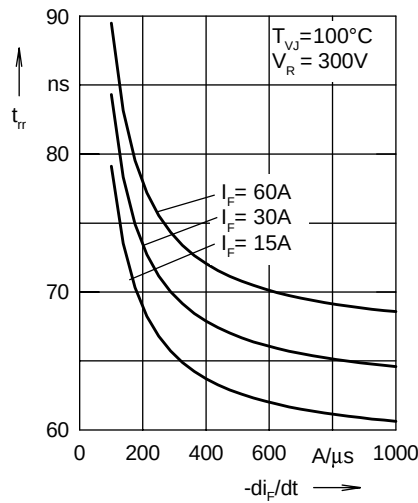


Fig. 16. Recovery time t_{tr} versus $-di_F/dt$

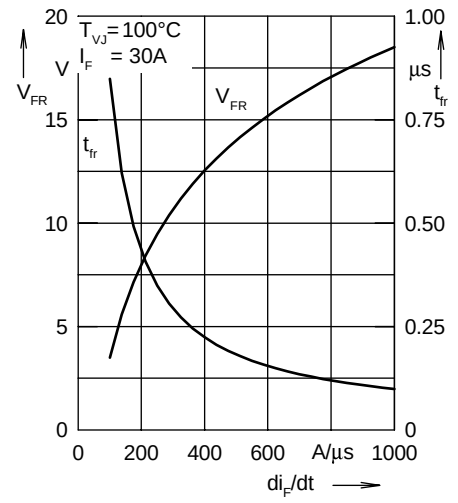


Fig. 17. Peak forward voltage V_{FR} and t_{tr} versus di_F/dt

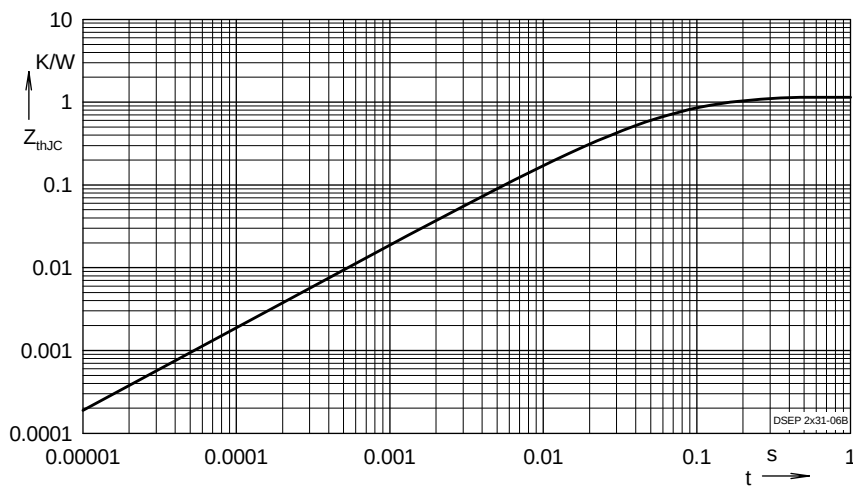


Fig. 18. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

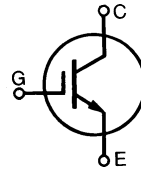
i	R_{thi} (K/W)	t_i (s)
1	0.436	0.0055
2	0.482	0.0092
3	0.117	0.0007
4	0.115	0.0418

HiPerFAST™ IGBT

IXGH39N60B

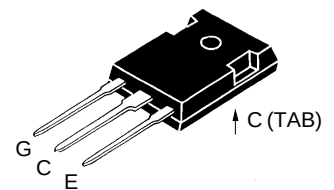
$V_{CES} = 600 \text{ V}$
 $I_{C25} = 76 \text{ A}$
 $V_{CE(sat)} = 1.7 \text{ V}$
 $t_{fi} = 200 \text{ ns}$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	76	A
I_{C90}	$T_C = 90^\circ\text{C}$	39	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	152	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 22 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 76$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		6	g

TO-247 AD



G = Gate, C = Collector,
 E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-247 AD
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- PFC circuits
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

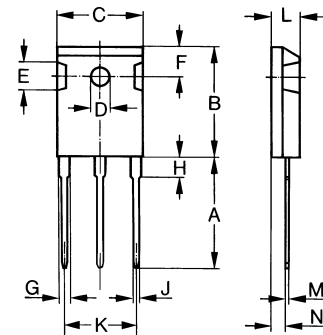
Advantages

- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			1.7 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	19	28	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2750	pF
C_{oes}			200	pF
C_{res}			50	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		120	nC
Q_{ge}			25	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			30	ns
$t_{d(off)}$			250	500 ns
t_{fi}			200	360 ns
E_{off}			4.0	6.0 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			30	ns
E_{on}			0.3	mJ
$t_{d(off)}$			360	ns
t_{fi}			350	ns
E_{off}			6.0	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



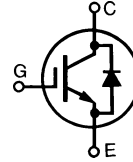
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT with Diode

IXGH 39N60BD1

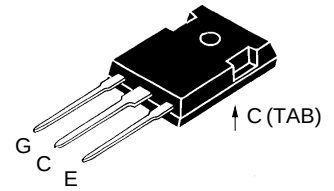
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 76 \text{ A} \\ V_{CE(sat)} &= 1.8 \text{ V} \\ t_{fi(typ)} &= 200 \text{ ns} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	76	A
I_{C90}	$T_C = 90^\circ\text{C}$	39	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	152	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 76$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-247 AD	6	g

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- Moderate frequency IGBT and antiparallel FRED in one package
- Low leakage current FRED
- High current handling capability
- Newest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

Applications

- PFC circuits
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

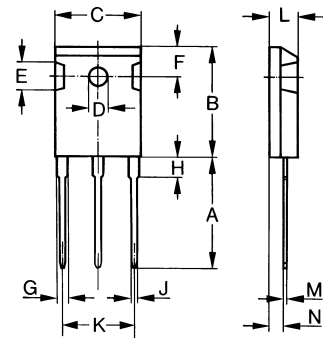
Advantages

- Space savings (two devices in one package)
- High power density
- Insulated mounting screw hole

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 3 μA mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			± 100 nA
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			1.8 V

Symbol	Test Conditions	Characteristic Values		
		(T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	I _C = I _{C90} ; V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %	19	28	S
C_{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz		2750	pF
C_{oes}			250	pF
C_{res}			50	pF
Q_g	I _C = I _{C90} , V _{GE} = 15 V, V _{CE} = 0.5 V _{CES}		120	nC
Q_{ge}			25	nC
Q_{gc}			40	nC
t_{d(on)}	Inductive load, T _J = 25°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH, V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 4.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t_{ri}			30	ns
t_{d(off)}			250	500 ns
t_{fi}			200	360 ns
E_{off}			4.0	6.0 mJ
t_{d(on)}	Inductive load, T _J = 150°C I _C = I _{C90} , V _{GE} = 15 V, L = 100 μH V _{CE} = 0.8 V _{CES} , R _G = R _{off} = 4.7 Ω Remarks: Switching times may increase for V _{CE} (Clamp) > 0.8 • V _{CES} , higher T _J or increased R _G		25	ns
t_{ri}			30	ns
E_{on}			0.3	mJ
t_{d(off)}			360	ns
t_{fi}			350	ns
E_{off}			6.0	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

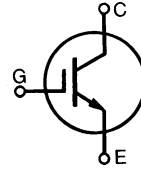
Reverse Diode (FRED)		Characteristic Values		
		(T _J = 25°C, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	I _F = 30A, V _{GE} = 0 V, Note 1	T _J = 150°C T _J = 25°C		1.6 V 2.5 V
I_{RM}	I _F = 50A, V _{GE} = 0 V, V _R = 100 V -di _F /dt = 100 A/μs	T _J = 100°C	3.5	A
t_{rr}	I _F = 1 A; -di/dt = 100 A/μs; V _R = 30 V	T _J = 25°C	25	ns
R_{thJC}				1.0 K/W

Note 1: Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %

Ultra-Low $V_{CE(sat)}$ IGBT

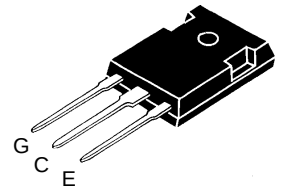
IXGH 41N60

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 76 \text{ A} \\ V_{CE(sat)} &= 1.6 \text{ V} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	76	A
I_{C90}	$T_C = 90^\circ\text{C}$	41	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	152	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 76$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		$-55 \dots +150$	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		$-55 \dots +150$	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10	Nm/lb.in.
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247 AD



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD
- Newest generation HDMOS™ process
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- High current handling capability
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Solid state relays
- Lighting controls
- Temperature regulators

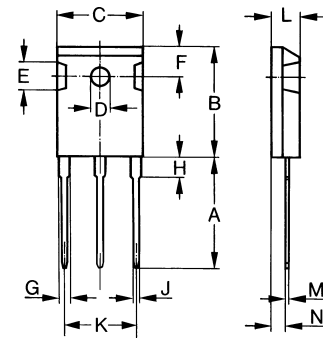
Advantages

- Easy to mount with 1 screw (isolated mounting screw hole)
- Low losses, high efficiency
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			1.6 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	19	28	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		2750	pF
C_{oes}			206	pF
C_{res}			55	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		120	nC
Q_{ge}			25	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		30	ns
t_{ri}			30	ns
$t_{d(off)}$			600	ns
t_{fi}			450	ns
E_{off}			8	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		40	ns
t_{ri}			40	ns
E_{on}			0.3	mJ
$t_{d(off)}$			800	ns
t_{fi}			600	ns
E_{off}			15	mJ
R_{thJC}				0.62 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline

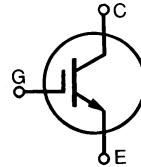


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT

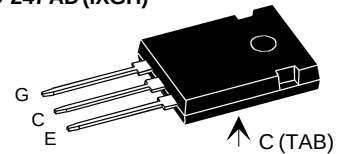
IXGH 50N60B
IXGK 50N60B
IXGT 50N60B

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \\ t_{fi(typ)} &= 150 \text{ ns} \end{aligned}$$

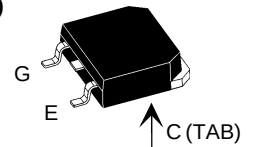


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	75	A
I_{C90}	$T_C = 90^\circ\text{C}$	50	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	200	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque	TO-247AD TO-264	1.13/10 Nm/lb.in. 0.9/6 Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight		TO-247 TO-264 TO-268	6 10 4 g

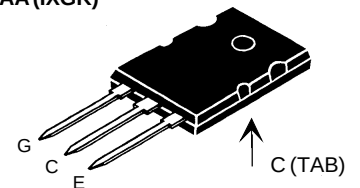
TO-247 AD (IXGH)



TO-268 (D3) (IXGT)



TO-264 AA (IXGK)



G = Gate
E = Emitter

D = Drain
TAB = Collector

Features

- International standard packages
- High frequency IGBT
- Latest generation HDMOS™ process
- High current handling capability
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

- Easy to mount with 1 screw (insulated mounting screw hole)
- Switching speed for high frequency applications
- High power density

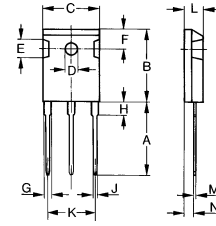
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ 200 μA $T_J = 125^\circ\text{C}$ 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.5 V

IXYS reserves the right to change limits, test conditions, and dimensions.

95585E (7/00)

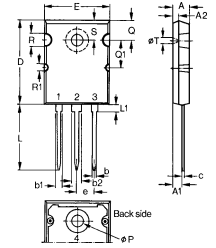
Symbol	Test Conditions	Characteristic Values		
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}, V_{CE} = 10\text{ V},$ Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	25	35	S
C_{iss}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		4000	pF
C_{oss}			340	pF
C_{rss}			100	pF
Q_g	$I_C = I_{C90}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		110	180 nC
Q_{ge}			30	50 nC
Q_{gc}			40	100 nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 \cdot V_{CES}, R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			50	ns
$t_{d(off)}$			200	300 ns
t_{fi}			150	270 ns
E_{off}			3.0	6.0 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 \cdot V_{CES}, R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			50	ns
E_{on}			2	mJ
$t_{d(off)}$			280	ns
t_{fi}			250	ns
E_{off}			4.2	mJ
R_{thJC}				0.62 K/W
R_{thCK}	TO-247 package		0.25	K/W
	TO-264 package		0.15	K/W

TO-247 AD (IXGH) Outline



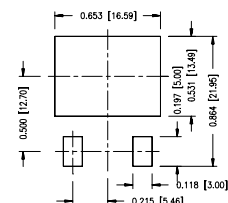
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-264 AA (IXGK) Outline

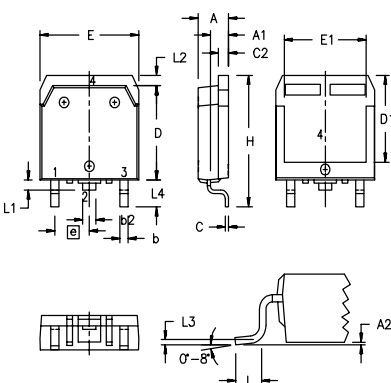


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.82	5.13	.190	.202
A1	2.54	2.89	.100	.114
A2	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b1	2.39	2.69	.094	.106
b2	2.90	3.09	.114	.122
c	0.53	0.83	.021	.033
D	25.91	26.16	1.020	1.030
E	19.81	19.96	.780	.786
e	5.46 BSC		.215 BSC	
J	0.00	0.25	.000	.010
K	0.00	0.25	.000	.010
L	20.32	20.83	.800	.820
L1	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q1	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R1	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

Min. Recommended Footprint



TO-268AA (IXGT) (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A1	2.7	2.9	.106	.114
A2	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b2	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E1	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

Figure 1. Saturation Voltage Characteristics

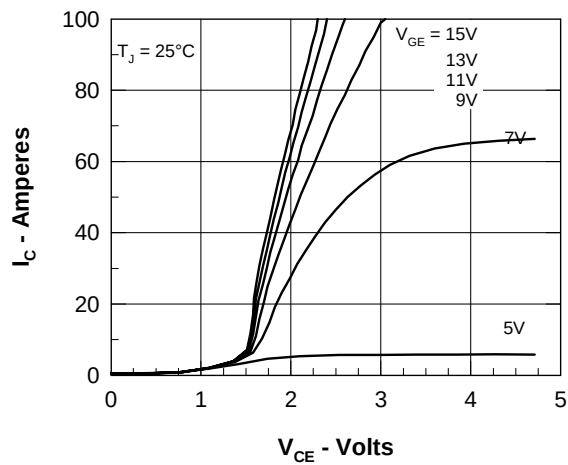


Figure 2. Extended Output Characteristics

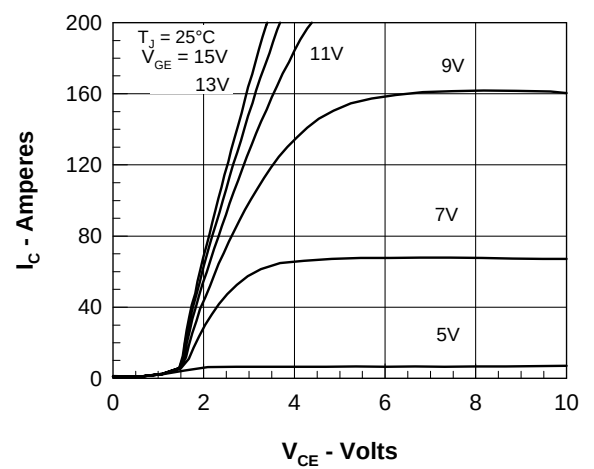


Figure 3. Saturation Voltage Characteristics

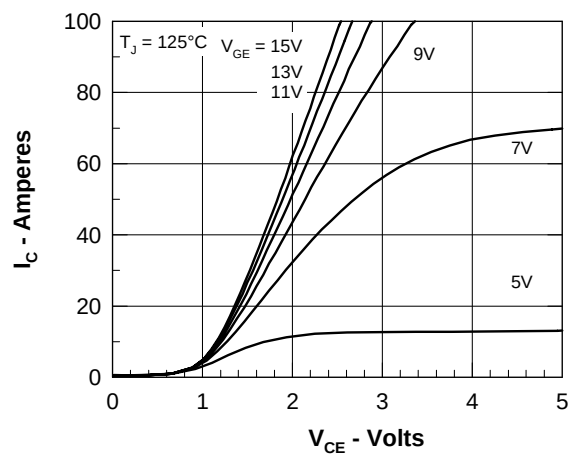
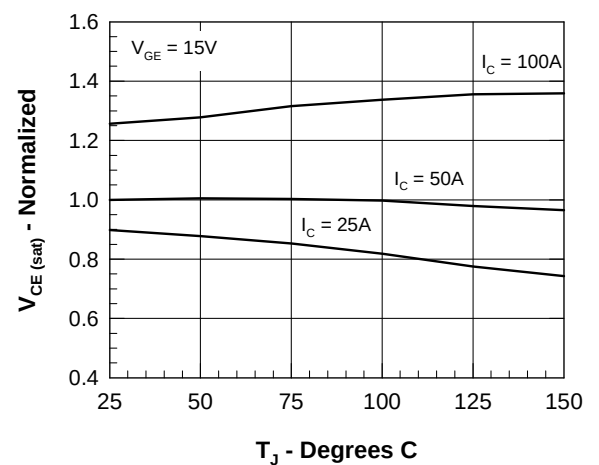

 Figure 4. Temperature Dependence of $V_{CE(sat)}$


Figure 5. Admittance Curves

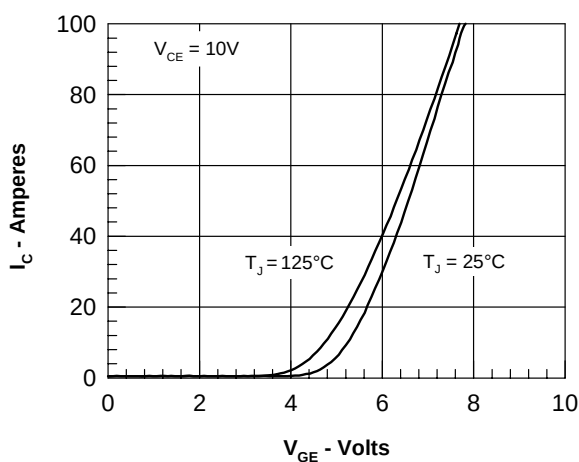


Figure 6. Capacitance Curves

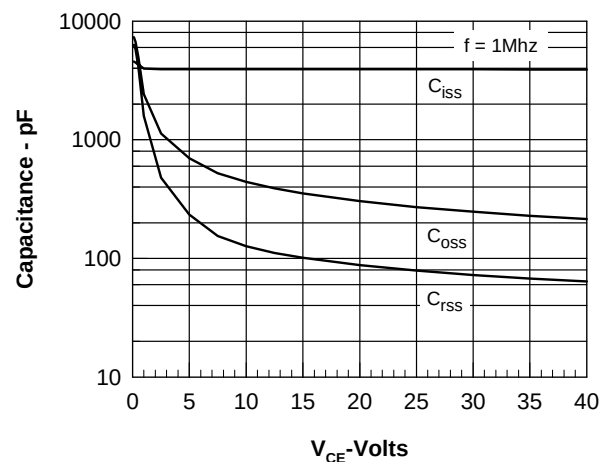


Figure 7. Dependence of E_{ON} and E_{OFF} on I_C .

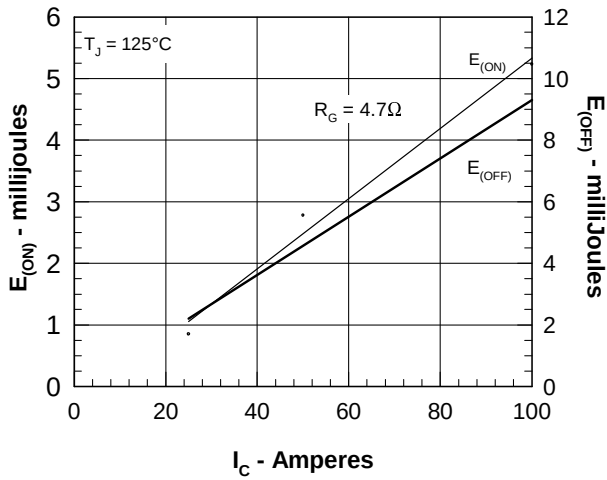


Figure 8. Dependence of E_{ON} and E_{OFF} on R_G .

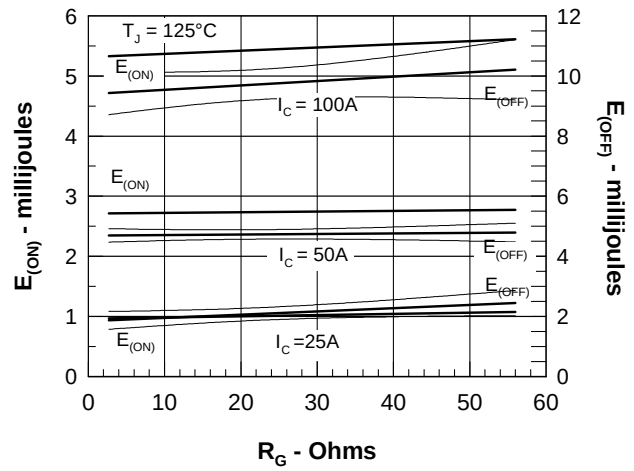


Figure 9. Gate Charge

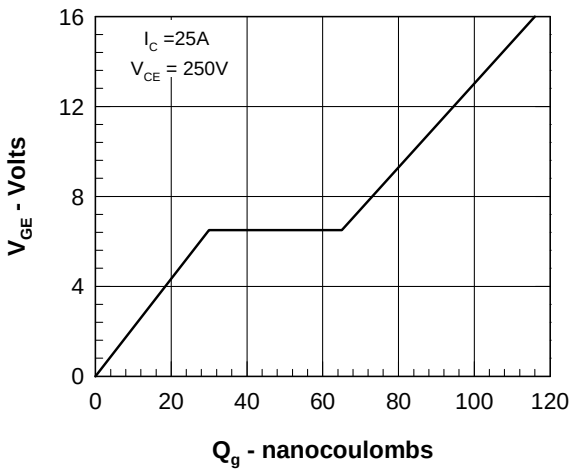


Figure 10. Turn-off Safe Operating Area

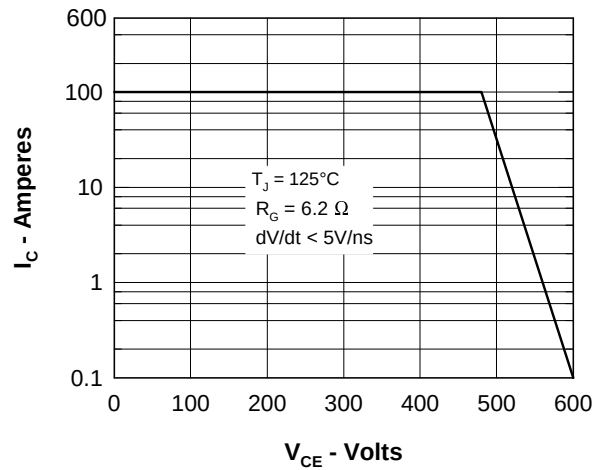
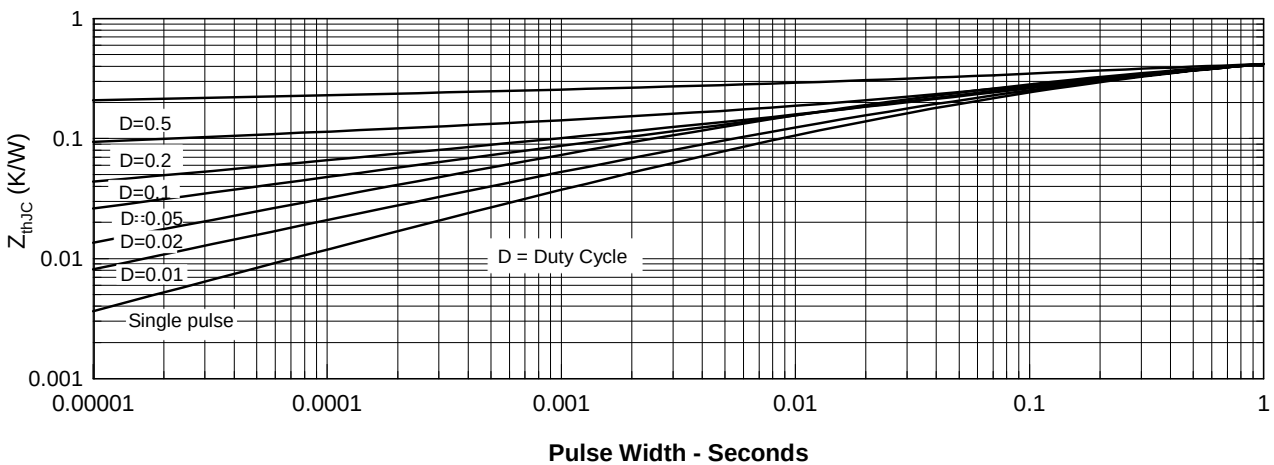


Figure 11. IGBT Transient Thermal Resistance

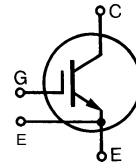


HiPerFAST™ IGBT

IXGN 50N60B

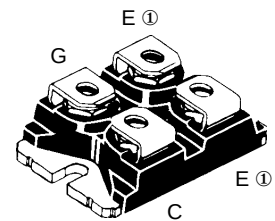
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \end{aligned}$$

Preliminary data sheet



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	75	A
I_{C90}	$T_C = 90^\circ\text{C}$	50	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	200	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	250	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque	1.5/13	Nm/lb.in.
	Terminal connection torque (M4)	1.5/13	Nm/lb.in.
Weight		30	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

SOT-227B miniBLOC



G = Gate, C = Collector, E = Emitter
① Either emitter terminal can be used as Main or Kelvin Emitter

Features

- International standard package SOT-227B
- Aluminium nitride isolation
 - high power dissipation
- Isolation voltage 3000 V~
- Very high current, fast switching IGBT
- Low $V_{CE(sat)}$ for minimum on-state conduction losses
- MOS Gate turn-on drive simplicity
- Low collector-to-case capacitance (< 50 pF)
- Low package inductance (< 5 nH)
 - easy to drive and to protect

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

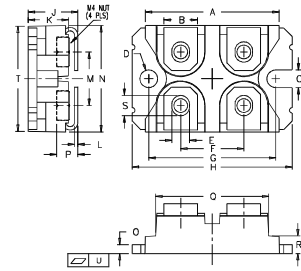
Advantages

- Easy to mount with 2 screws
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			2.5 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	25	35	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4000	pF
C_{oes}			340	pF
C_{res}			100	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		110	nC
Q_{ge}			30	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			30	ns
$t_{d(off)}$			200	ns
t_{fi}			150	ns
E_{off}			3	mJ
$t_{d(on)}$			50	ns
t_{ri}	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
E_{on}			3	mJ
$t_{d(off)}$			280	ns
t_{fi}			250	ns
E_{off}			4.2	mJ
R_{thJC}				0.50 K/W
R_{thCK}			0.05	K/W

miniBLOC, SOT-227 B



M4 screws (4x) supplied

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

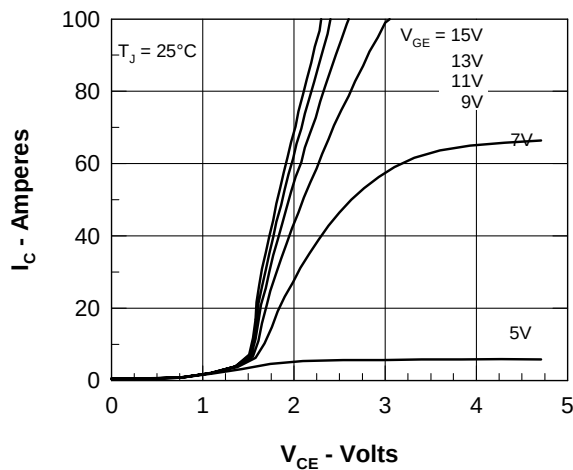


Figure 1. Saturation Voltage Characteristics

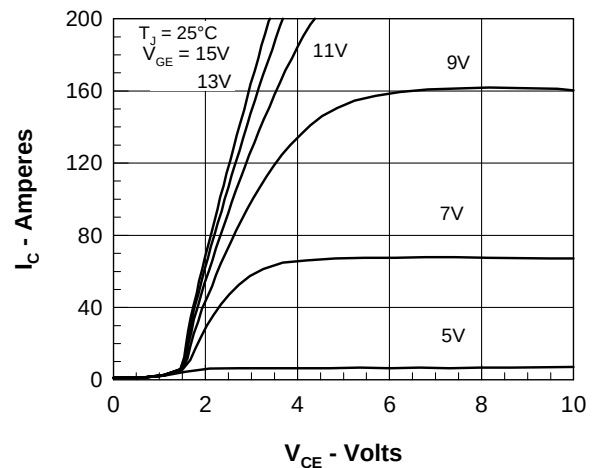


Figure 2. Extended Output Characteristics

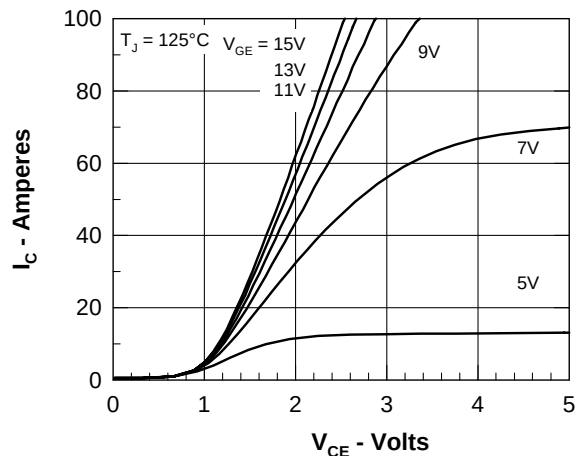


Figure 3. Saturation Voltage Characteristics

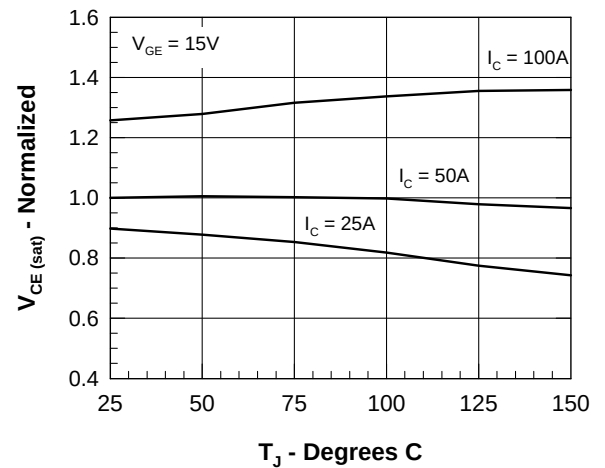


Figure 4. Temperature Dependence of $V_{CE(sat)}$

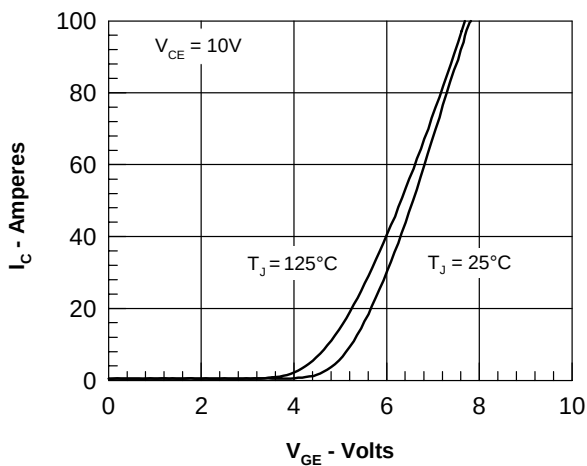


Figure 5. Admittance Curves

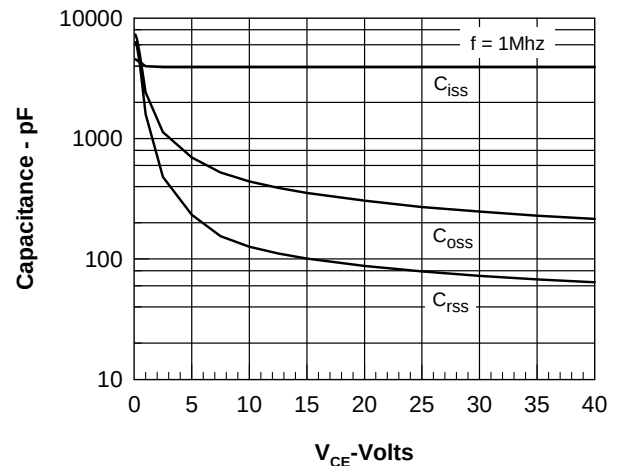


Figure 6. Capacitance Curves

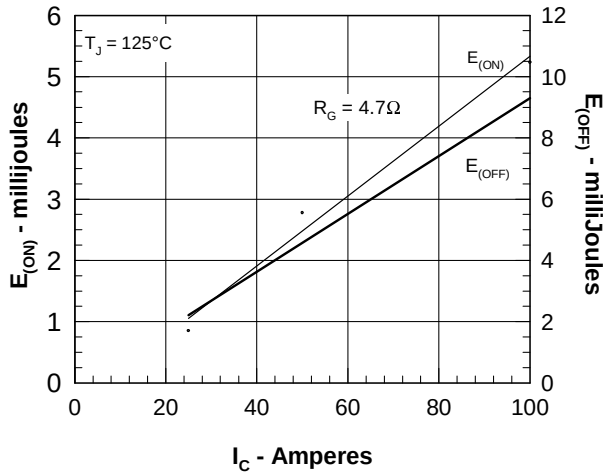


Figure 7. Dependence of E_{ON} and E_{OFF} on I_C .

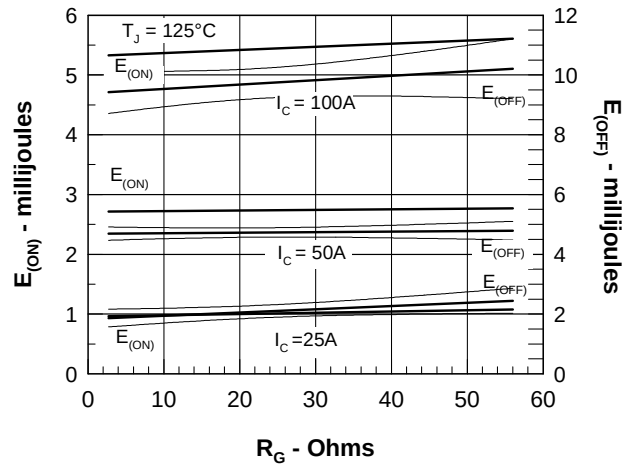


Figure 8. Dependence of E_{ON} and E_{OFF} on R_G .

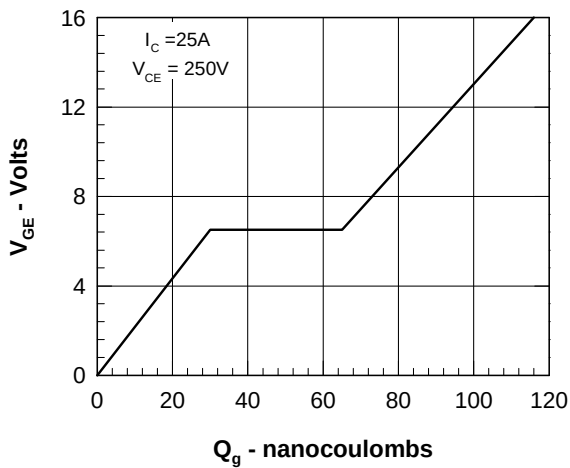


Figure 9. Gate Charge

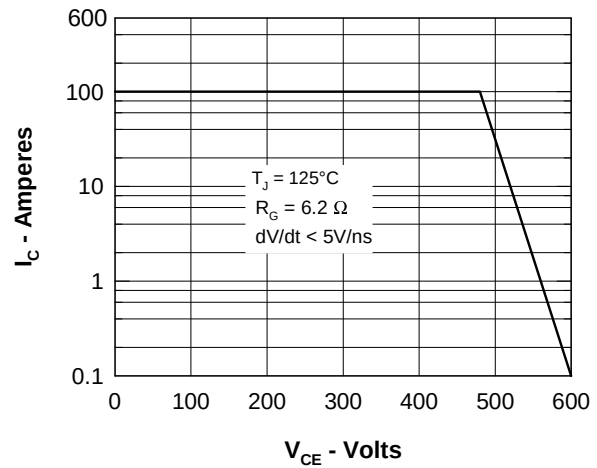


Figure 10. Turn-off Safe Operating Area

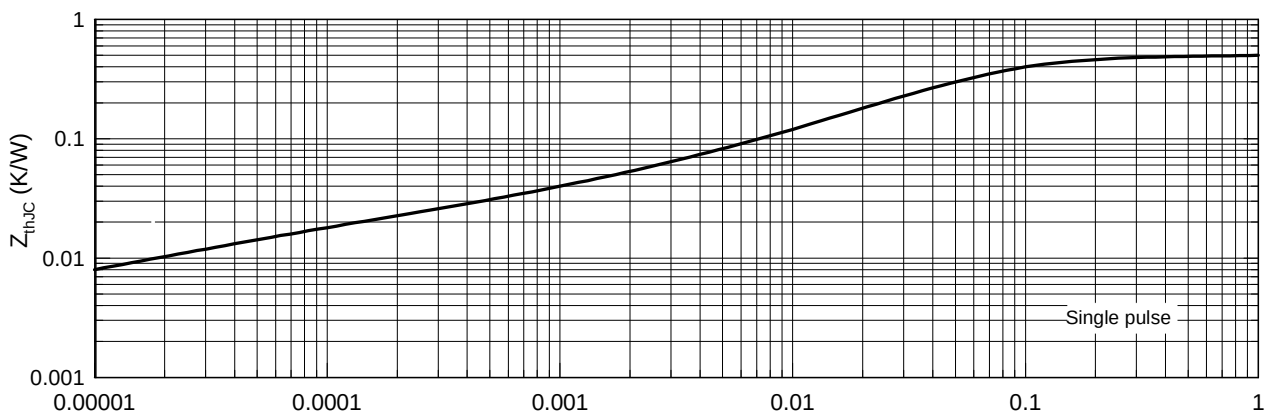
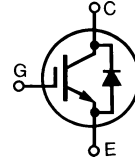


Figure 11. IGBT Transient Thermal Resistance

HiPerFAST™ IGBT with Diode

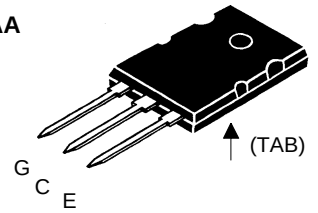
IXGK 50N60BD1
IXGX 50N60BD1

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 2.3 \text{ V} \\ t_{fi} &= 85 \text{ ns} \end{aligned}$$

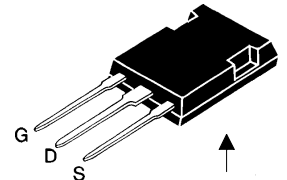


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	75	A
I_{C90}	$T_C = 90^\circ\text{C}$	50	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	200	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque, TO-247 AD	1.13/10	Nm/lb.in.
Weight	TO-264	10	g
	TO-268	5	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-264 AA
(IXGK)



PLUS247
(IXGX)



G = Gate C = Collector
E = Emitter Tab = Collector

Features

- International standard packages JEDEC TO-268 and PLUS247 (hole-less TO-247)
- High frequency IGBT and antiparallel FRED in one package
- New generation HDMOS™ process
- High current handling capability
- MOS Gate turn-on for drive simplicity
- Fast Recovery Epitaxial Diode (FRED) with soft recovery and low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

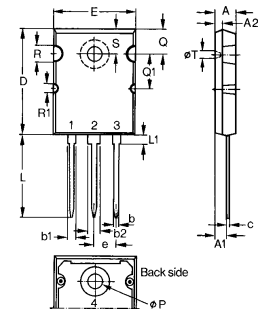
- Space savings (two devices on one package)
- Easy to mount with 1 screw

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 1 \text{ mA}, V_{GE} = 0 \text{ V}$	500		V
$V_{GE(th)}$	$I_C = 500 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			650 μA 5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.3 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	25	35	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4000	pF
C_{oes}			340	pF
C_{res}			100	pF
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		110	nC
Q_{ge}			30	nC
Q_{gc}			35	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			50	ns
$t_{d(off)}$			200	ns
t_{fi}			85	ns
E_{off}			150	ns
			1.5	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			60	ns
E_{on}			3	mJ
$t_{d(off)}$			200	ns
t_{fi}			175	ns
E_{off}			2.5	mJ
R_{thJC}	TO-264 package			0.42 K/W
R_{thCK}			0.15	K/W

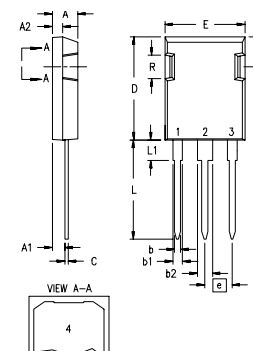
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ ms}$, duty cycle $\leq 22\%$			2.5 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A/ms}$, $V_R = 100\text{ V}$		2	2.5 A
t_{rr}	$I_F = 1\text{ A}$; $-di_F/dt = 200\text{ A/ms}$; $V_R = 30\text{ V}$		35	175 ns
R_{thJC}				50 ns
				0.65 K/W

TO-264 AA Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.82	5.13	.190	.202
A1	2.54	2.89	.100	.114
A2	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b1	2.39	2.69	.094	.106
b2	2.90	3.09	.114	.122
c	0.53	0.83	.021	.033
D	25.91	26.16	1.020	1.030
E	19.81	19.96	.780	.786
e	5.46	BSC	.215	BSC
J	0.00	0.25	.000	.010
K	0.00	0.25	.000	.010
L	20.32	20.83	.800	.820
L1	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q1	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R1	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

PLUS247™ (IXGX)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A1	2.29	2.54	.090	.100
A2	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b1	1.91	2.13	.075	.084
b2	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45	BSC	.215	BSC
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190

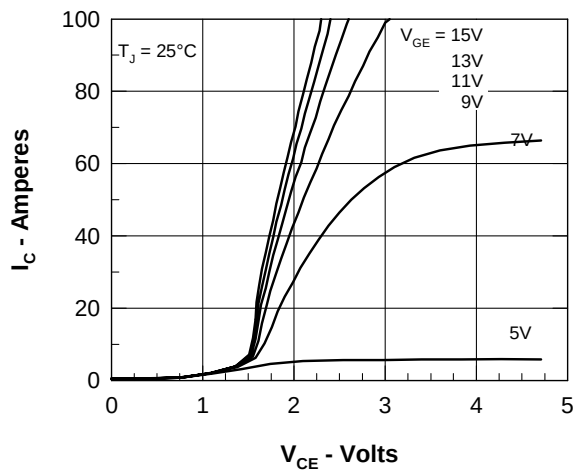


Figure 1. Saturation Voltage Characteristics

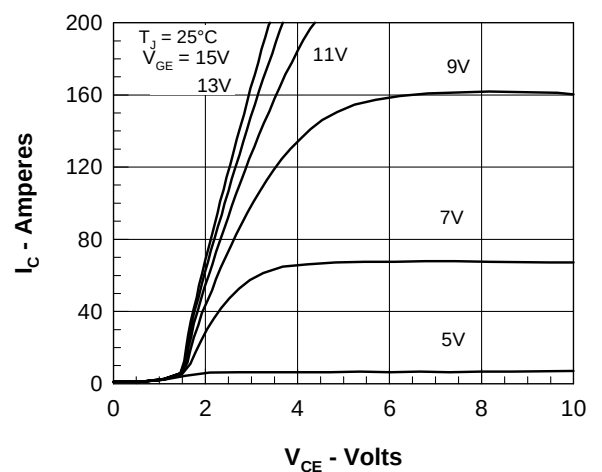


Figure 2. Extended Output Characteristics

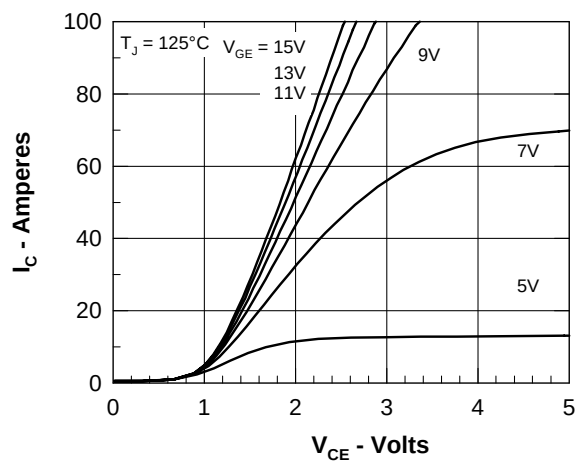


Figure 3. Saturation Voltage Characteristics

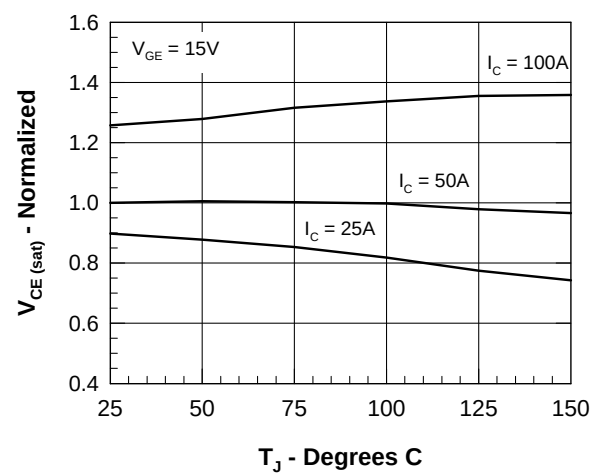


Figure 4. Temperature Dependence of $V_{CE(sat)}$

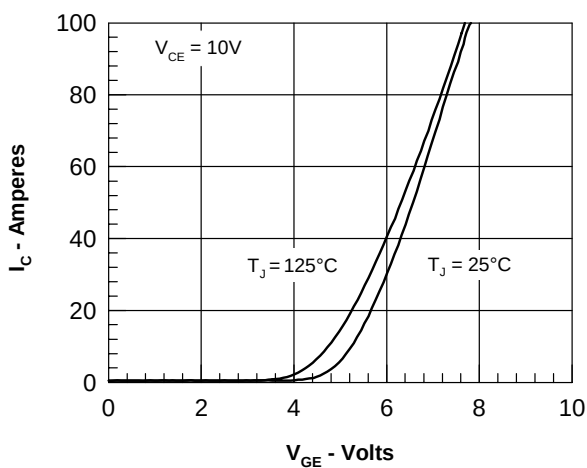


Figure 5. Admittance Curves

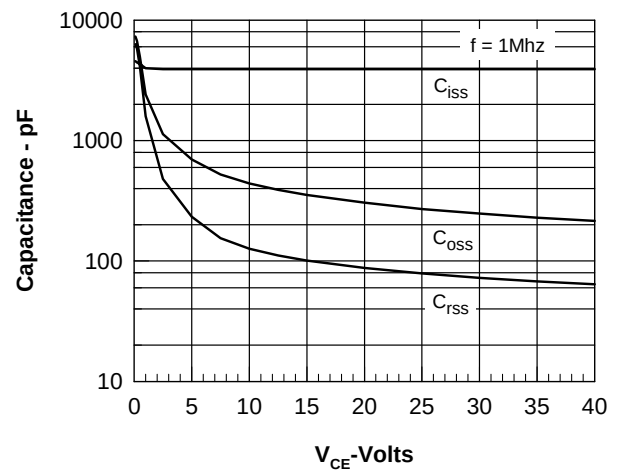


Figure 6. Capacitance Curves

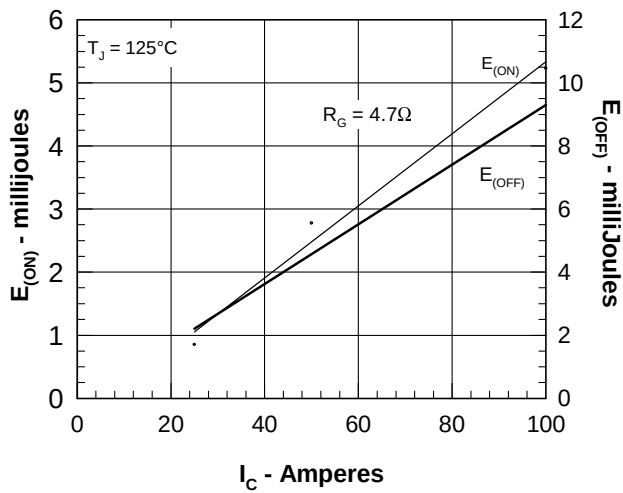


Figure 7. Dependence of E_{ON} and E_{OFF} on I_C .

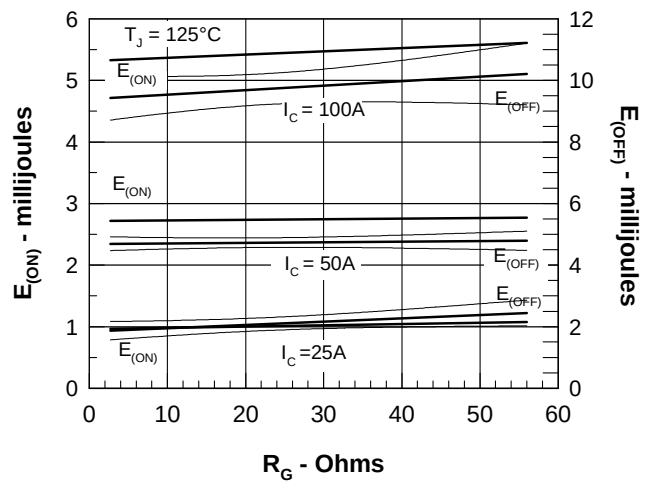


Figure 8. Dependence of E_{ON} and E_{OFF} on R_G .

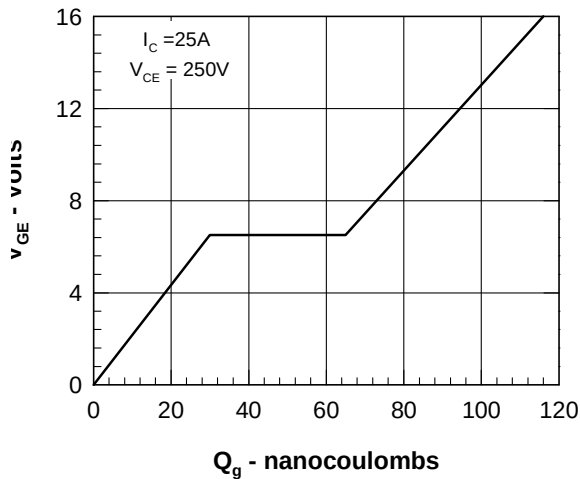


Figure 9. Gate Charge

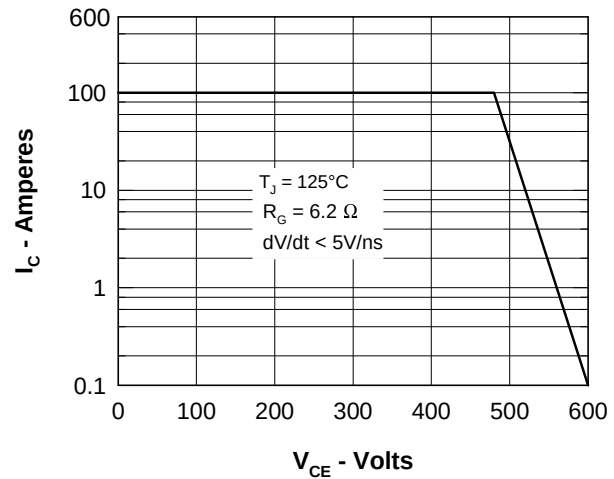


Figure 10. Turn-off Safe Operating Area

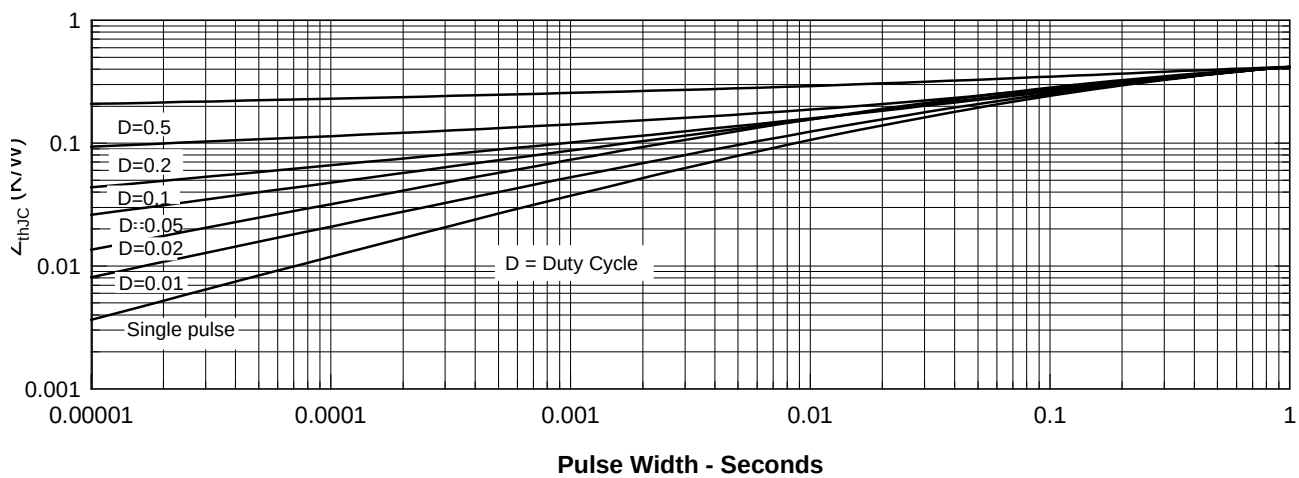


Figure 11. IGBT Transient Thermal Resistance

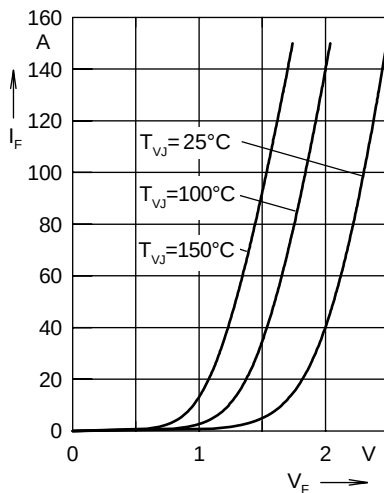


Fig. 12. Forward current I_F versus V_F

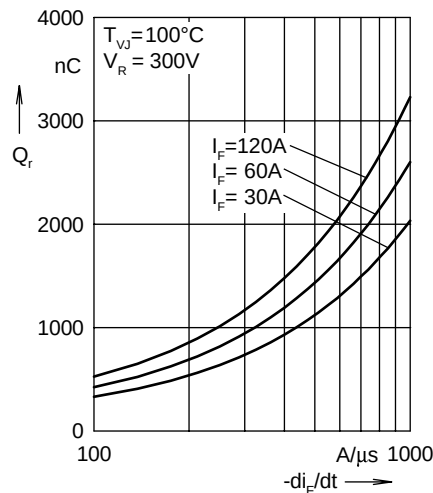


Fig. 13. Reverse recovery charge Q_r versus $-di_F/dt$

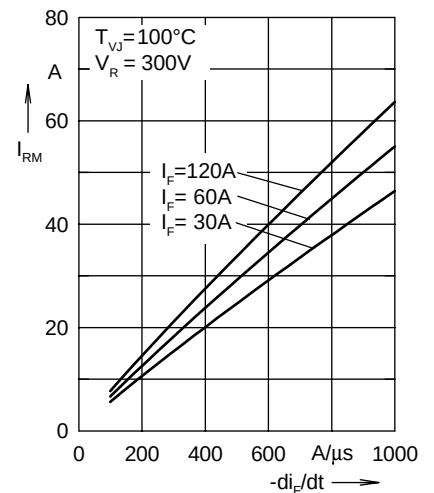


Fig. 14. Peak reverse current I_{RM} versus $-di_F/dt$

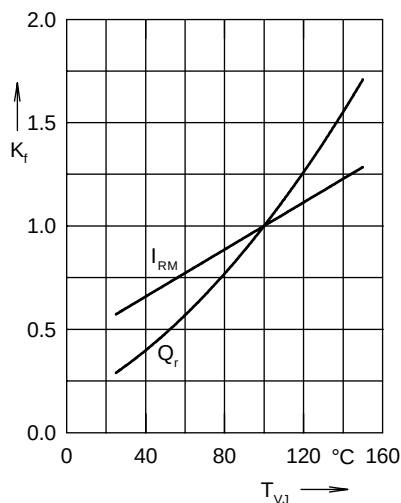


Fig. 15. Dynamic parameters Q_r , I_{RM} versus T_{VJ}

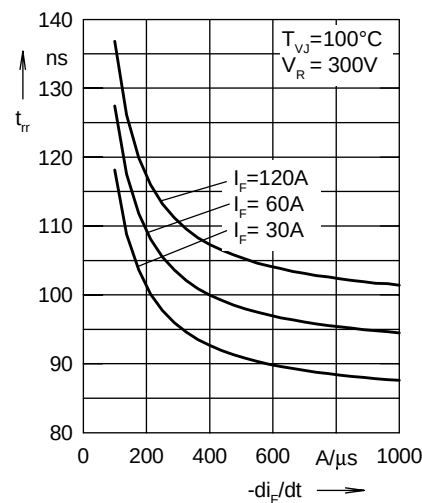


Fig. 16. Recovery time t_{rr} versus $-di_F/dt$

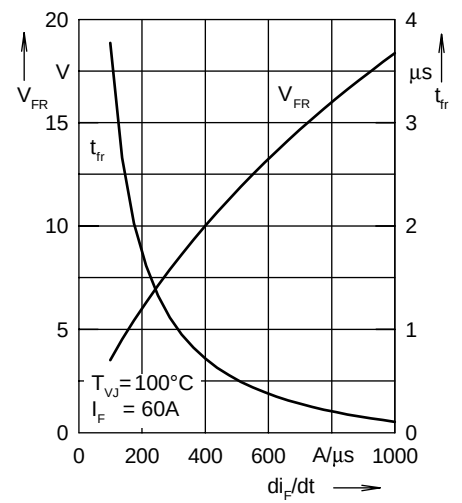


Fig. 17. Peak forward voltage V_{FR} and t_{rr} versus di_F/dt

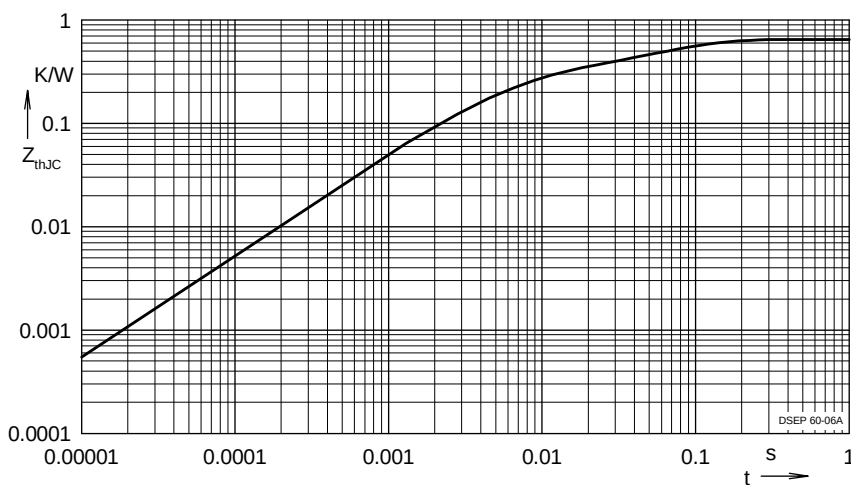


Fig. 18. Transient thermal resistance junction to case

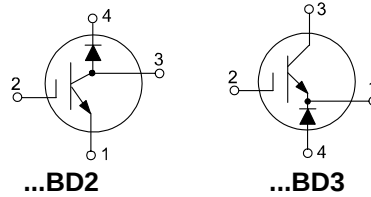
Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.324	0.0052
2	0.125	0.0003
3	0.201	0.0385

HiPerFAST™ IGBT with HiPerFRED

Buck & boost configurations

IXGN 50N60BD2
IXGN 50N60BD3

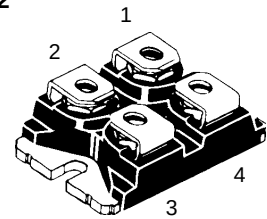


$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \\ t_{fi} &= 150 \text{ ns} \end{aligned}$$

	Symbol	Test Conditions	Maximum Ratings	
IGBT	V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
	V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
	V_{GES}	Continuous	± 20	V
	V_{GEM}	Transient	± 30	V
	I_{C25}	$T_C = 25^\circ\text{C}$	75	A
	I_{C90}	$T_C = 90^\circ\text{C}$	50	A
	I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	200	A
	SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
Diode	P_C	$T_C = 25^\circ\text{C}$	250	W
	V_{RRM}		600	V
	I_{FAVM}	$T_C = 70^\circ\text{C}; \text{rectangular, } d = 50\%$	60	A
	I_{FRM}	$t_p \leq 10 \text{ ms}; \text{pulse width limited by } T_J$	600	A
	P_D	$T_C = 25^\circ\text{C}$	150	W
Case	T_J		-40 ... +150	$^\circ\text{C}$
	T_{JM}		150	$^\circ\text{C}$
	T_{stg}		-40 ... +150	$^\circ\text{C}$
	M_d	Mounting torque	1.5/13	Nm/lb.in.
		Terminal connection torque (M4)	1.5/13	Nm/lb.in.
	Weight		30	g
		Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s	300	$^\circ\text{C}$

SOT-227B, miniBLOC

E 153432



IXGN50N60BD2

1 = Emitter; 2 = Gate
3 = Collector; 4 = Diode cathode

IXGN50N60BD3

1 = Emitter/Diode Cathode; 2 = Gate
3 = Collector; 4 = Diode anode

Features

- International standard package miniBLOC
- Aluminium nitride isolation
 - high power dissipation
- Isolation voltage 3000 V~
- Very high current, fast switching IGBT & FRED diode
- MOS Gate turn-on
 - drive simplicity
- Low collector-to-case capacitance
- Low package inductance ($< 10 \text{ nH}$)
 - easy to drive and to protect
- Molding epoxies meet UL 94 V-0 flammability classification

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Buck converters

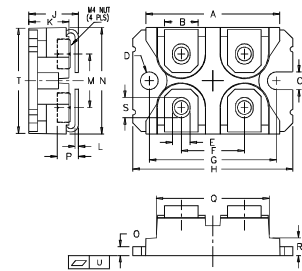
Advantages

- Easy to mount with 2 screws
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.5 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	35	50	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4100	pF
C_{oes}			290	pF
C_{res}			50	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		110	nC
Q_{ge}			30	nC
Q_{gc}			35	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			50	ns
$t_{d(off)}$			110	250 ns
t_{fi}			150	220 ns
E_{off}			3.0	4.0 mJ
$t_{d(on)}$			50	ns
t_{ri}	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		60	ns
E_{on}			3.0	mJ
$t_{d(off)}$			200	ns
t_{fi}			250	ns
E_{off}			4.2	mJ
R_{thJC}				0.50 K/W
R_{thCK}		0.05		K/W

miniBLOC, SOT-227 B



M4 screws (4x) supplied

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

Reverse Diode (FRED) Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)

Symbol	Test Conditions	typ.	max.
I_R	$T_{VJ} = 25^\circ\text{C}$ $V_R = V_{RRM}$		650 μA
	$T_{VJ} = 150^\circ\text{C}$		2.5 mA
V_F	$I_F = 60\text{ A}$, $T_{VJ} = 150^\circ\text{C}$		1.75 V
	Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$ $T_{VJ} = 25^\circ\text{C}$		2.40 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 540\text{ V}$		8.0 A
t_{rr}	$I_F = 1\text{ A}$, $-di_F/dt = 50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$	35	ns
R_{thJC}			0.85 K/W

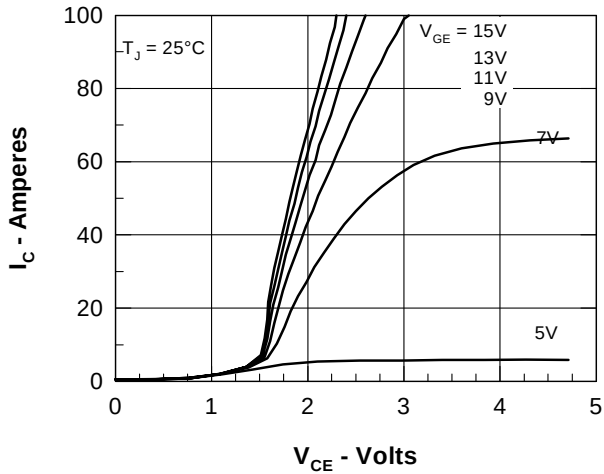


Fig. 1. Saturation Voltage Characteristics

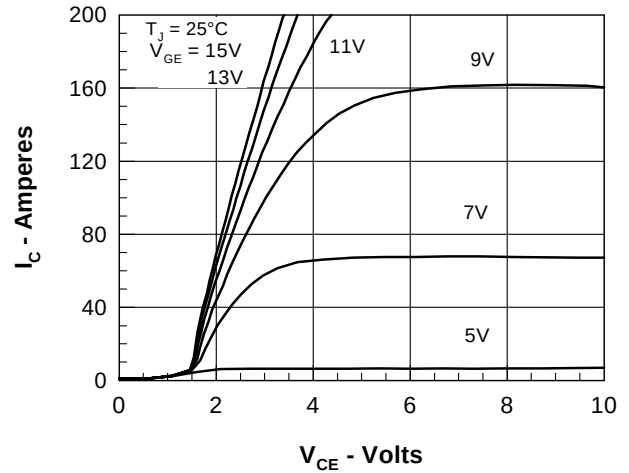


Fig. 2. Extended Output Characteristics

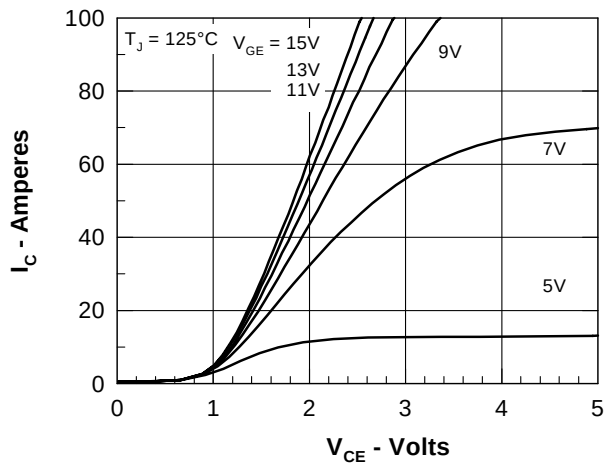


Fig. 3. Saturation Voltage Characteristics

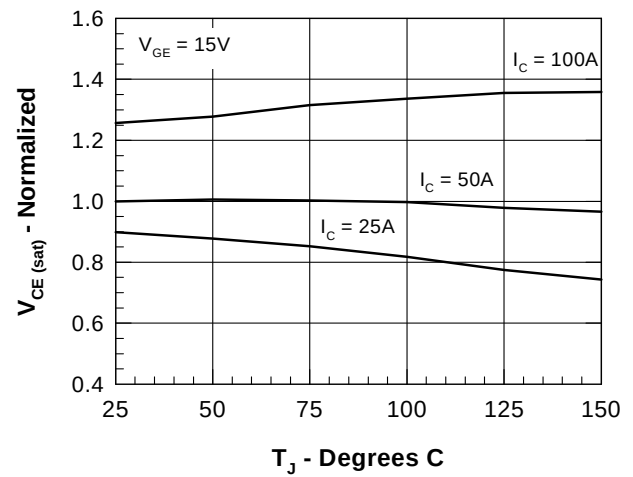


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

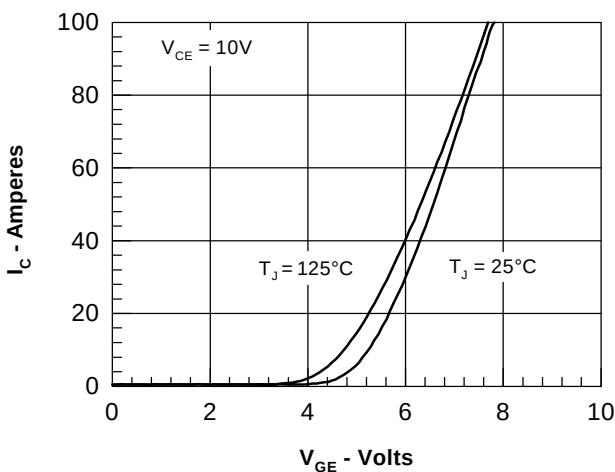


Fig. 5. Saturation Voltage Characteristics

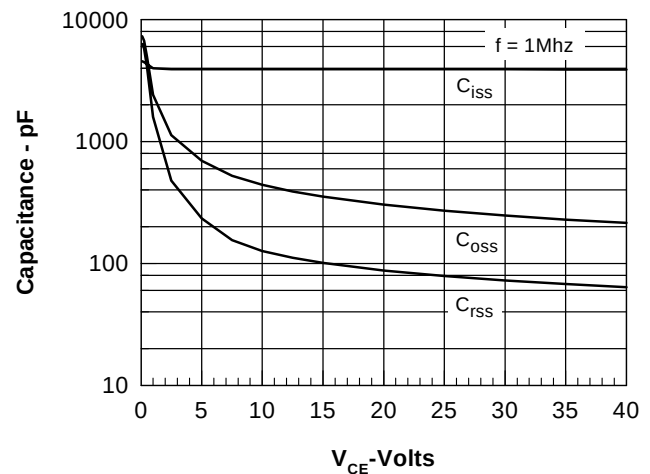


Fig. 6. Junction Capacitance Curves

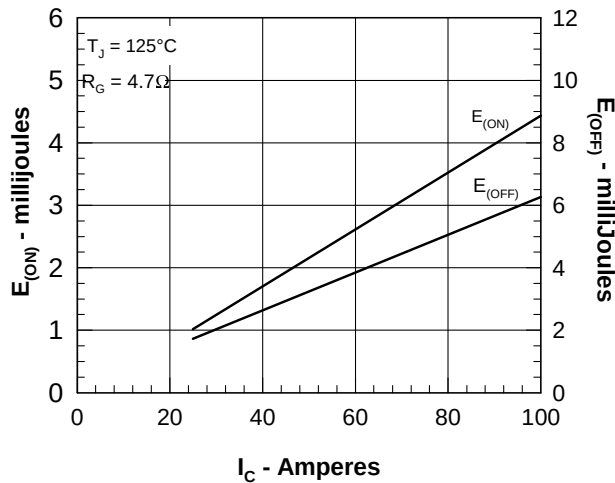


Fig. 7. Dependence of E_{ON} and E_{OFF} on I_C .

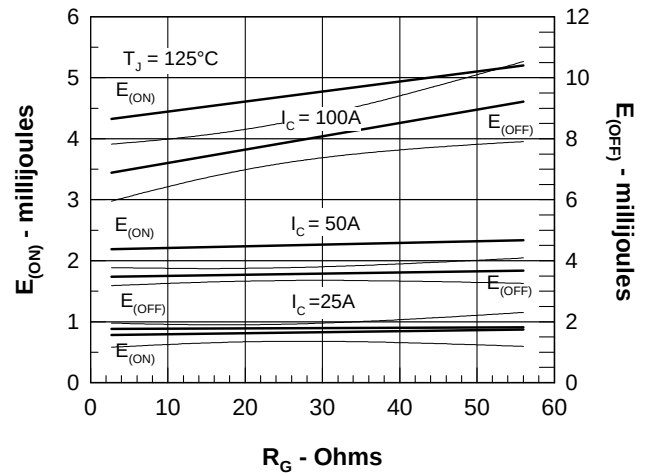


Fig. 8. Dependence of t_{fi} and E_{OFF} on R_G .

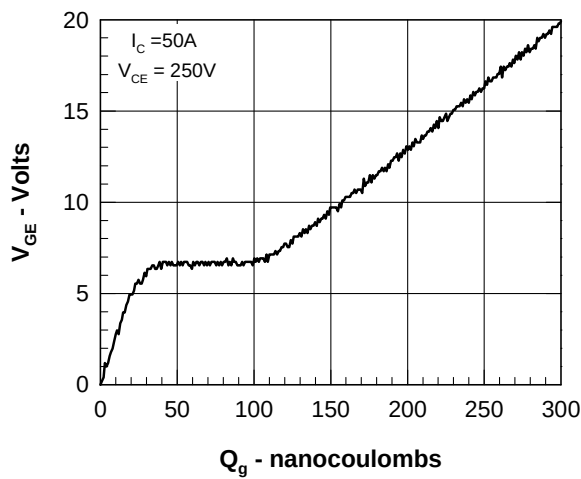


Fig. 9. Gate Charge

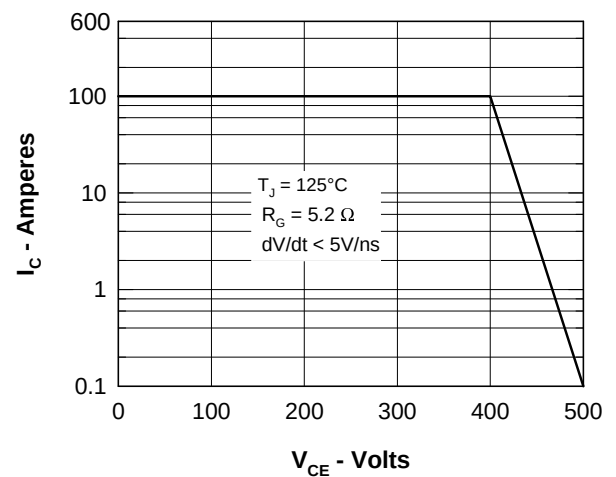


Fig. 10. Turn-off Safe Operating Area

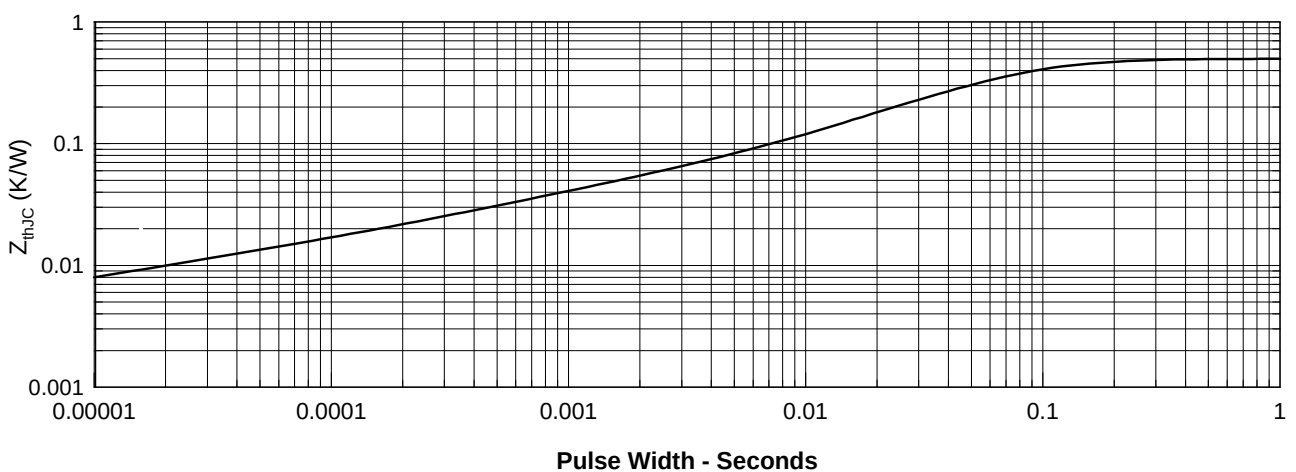


Fig. 11. Transient Thermal Resistance

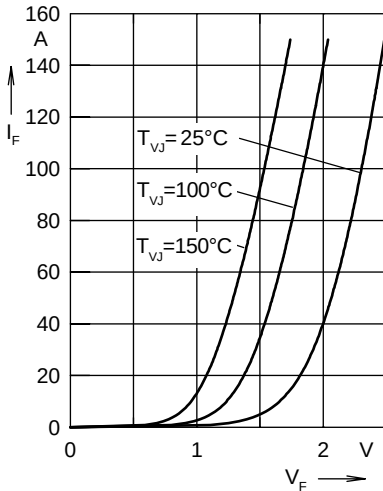


Fig. 12 Forward current I_F versus V_F

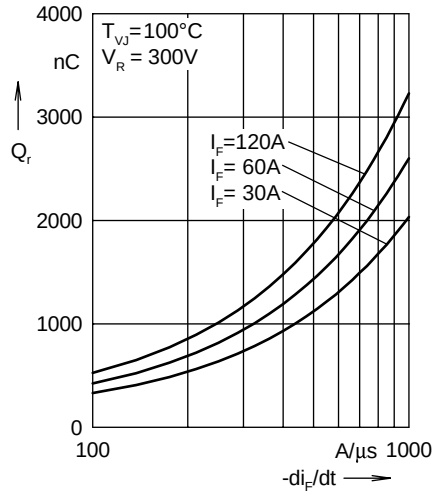


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

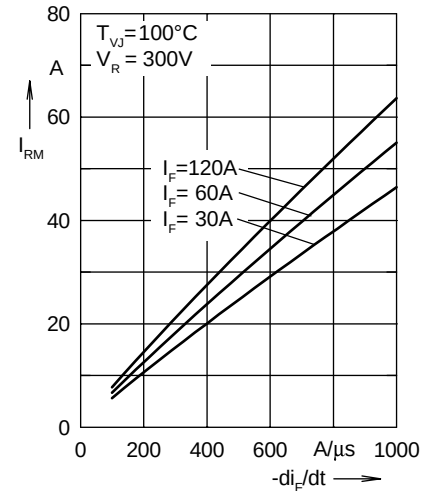


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

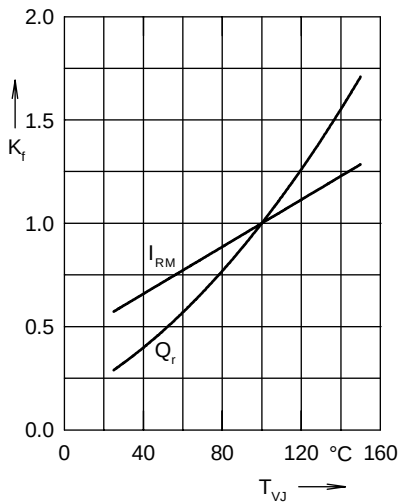


Fig. 15 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

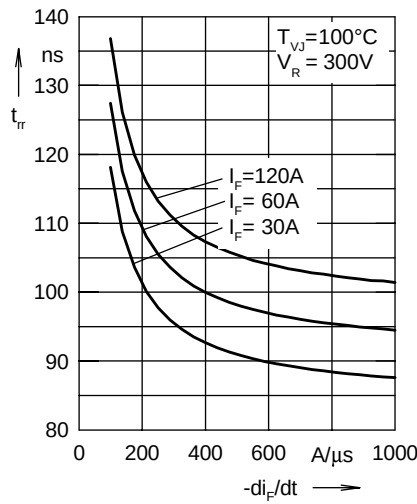


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

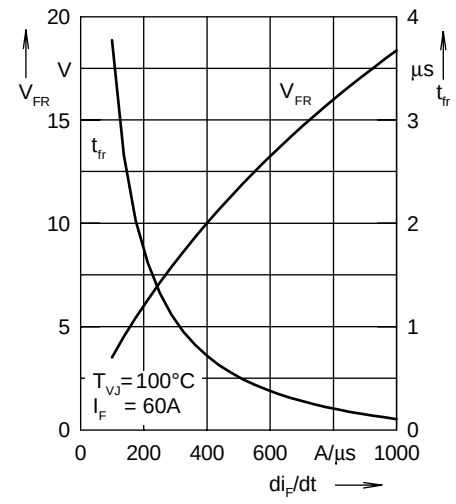


Fig. 17 Peak forward voltage V_{FR} and t_{rr} versus di_F/dt

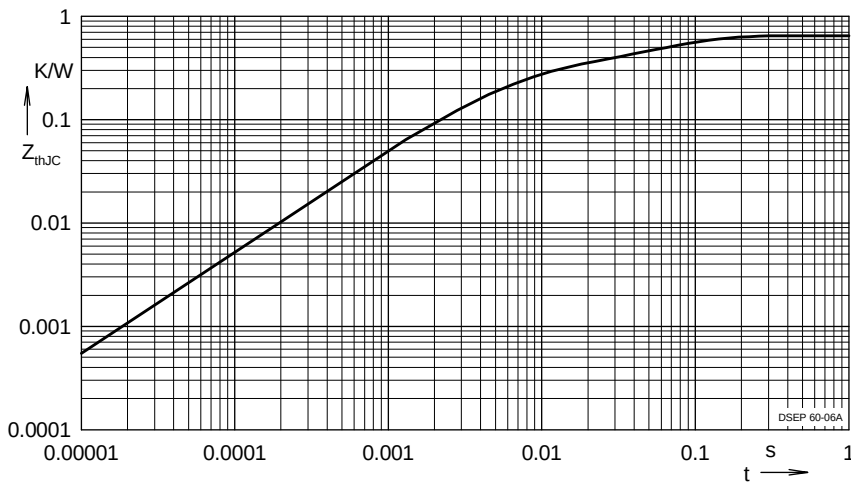


Fig. 18 Transient thermal resistance junction to case

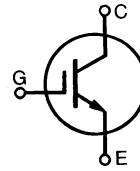
Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.324	0.0052
2	0.125	0.0003
3	0.201	0.0385

Ultra-Low $V_{CE(sat)}$ IGBT

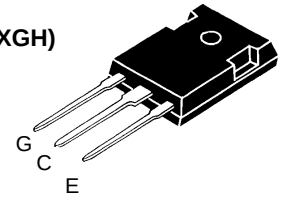
IXGH 60N60
IXGK 60N60
IXGT 60N60

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 1.7 \text{ V} \end{aligned}$$

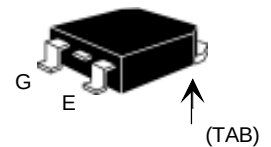


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$, limited by leads	75	A
I_{C90}	$T_C = 90^\circ\text{C}$	60	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	200	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight	TO-247	6	g
	TO-264	10	g
	TO-268	4	g

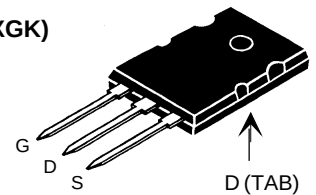
TO-247 AD (IXGH)



TO-268
(IXGT)



TO-264 (IXGK)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard package JEDEC TO-247 AD, TO-264, TO-268
- New generation HDMOS™ process
- Low $V_{CE(sat)}$ for minimum on-state conduction losses
- High current handling capability
- MOS Gate turn-on drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

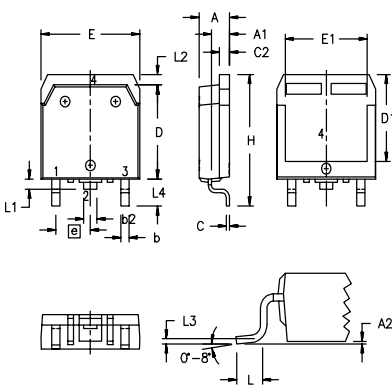
Advantages

- Easy to mount with 1 screw (isolated mounting screw hole)
- Low losses, high efficiency
- High power density
- High power, surface mount package

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			1.7 V

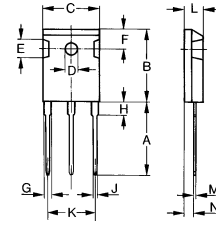
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	30	55	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		3700	pF
C_{oes}			290	pF
C_{res}			86	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		130	nC
Q_{ge}			30	nC
Q_{gc}			45	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		50	ns
t_{ri}			25	ns
$t_{d(off)}$			300	600 ns
t_{fi}			360	570 ns
E_{off}			8	15 mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		50	ns
t_{ri}			25	ns
E_{on}			3	mJ
$t_{d(off)}$			650	ns
t_{fi}			550	ns
E_{off}			17	mJ
R_{thJC}				0.42 K/W
R_{thCK}	(IXGH)		0.25	K/W
	(IXGK)		0.15	K/W

TO-268AA (IXFT) (D³ PAK)



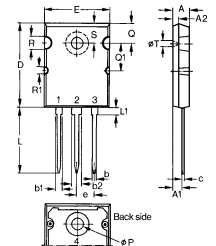
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₁	1.9	2.1	.75	.83
b ₂	.4	.65	.016	.026
C	13.80	14.00	.543	.551
D	15.85	16.05	.624	.632
E	13.3	13.6	.524	.535
E ₁	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

TO-247 AD (IXFH) Outline



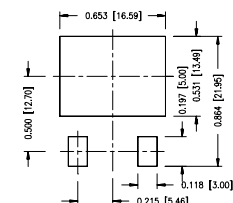
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-264 AA (IXFK) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.82	5.13	.190	.202
A ₁	2.54	2.89	.100	.114
A ₂	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b ₁	2.39	2.69	.094	.106
b ₂	2.90	3.09	.114	.122
c	0.53	0.83	.021	.033
D	25.91	26.16	1.020	1.030
E	19.81	19.96	.780	.786
e	5.46 BSC		.215 BSC	
J	0.00	0.25	.000	.010
K	0.00	0.25	.000	.010
L	20.32	20.83	.800	.820
L ₁	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q ₁	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R ₁	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

Min. Recommended Footprint



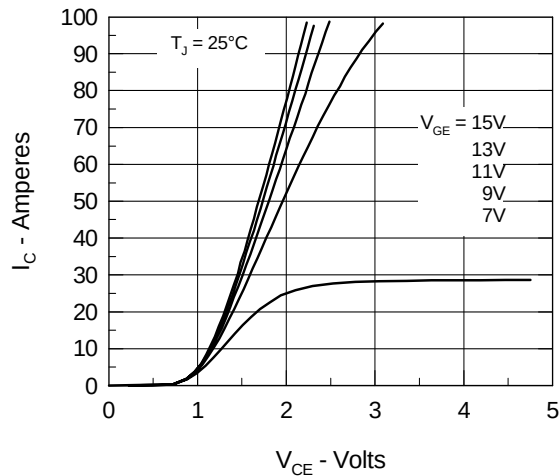


Fig. 1. Saturation Voltage Characteristics

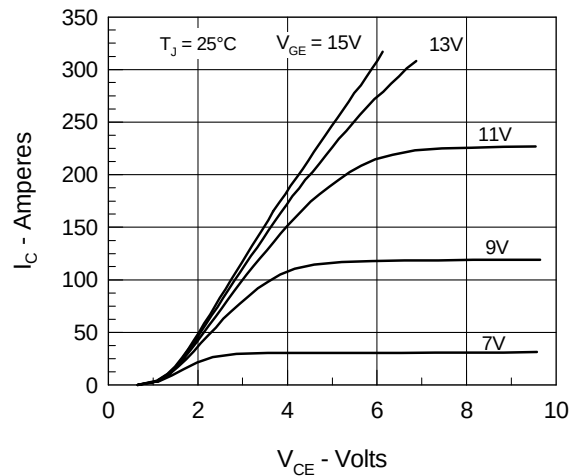


Fig. 2. Extended Output Characteristics

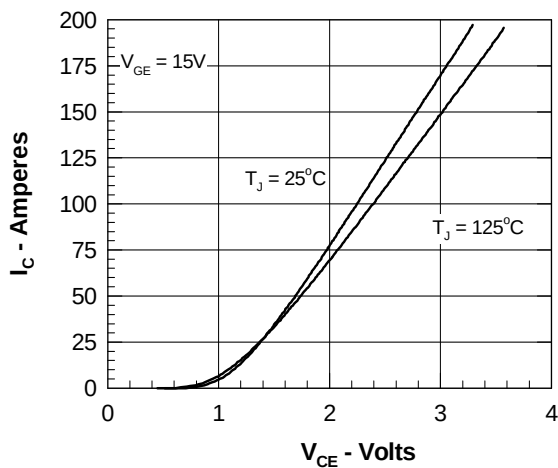


Fig. 3. Saturation Voltage Characteristics

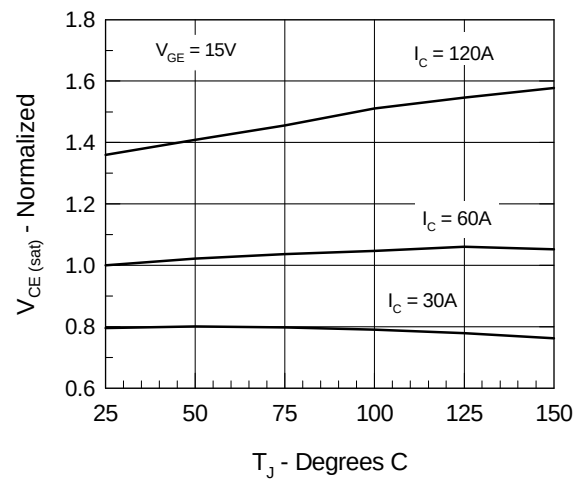


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

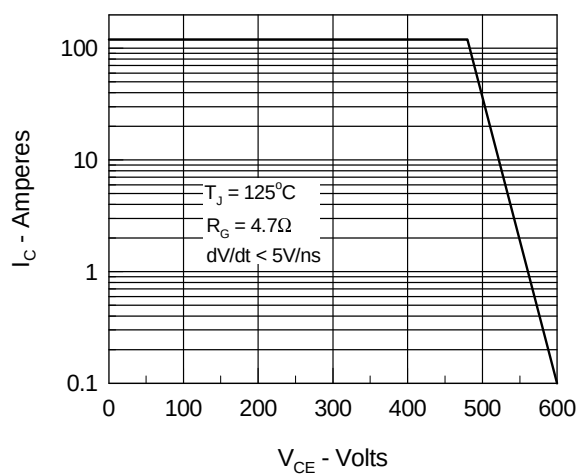


Fig. 5. Turn-off Safe Operating Area

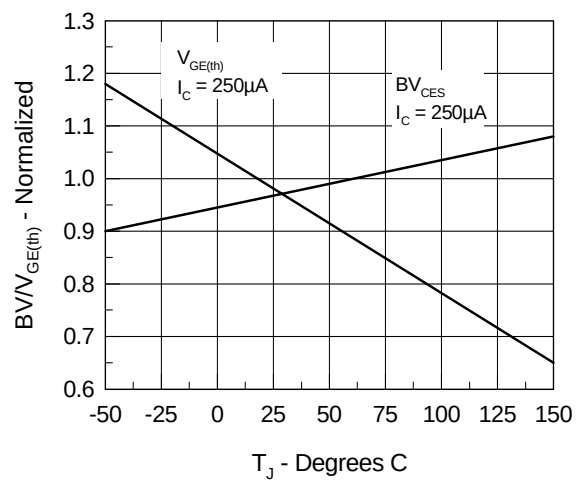


Fig. 6. Temperature Dependence of BV_{CES} & $V_{GE(th)}$

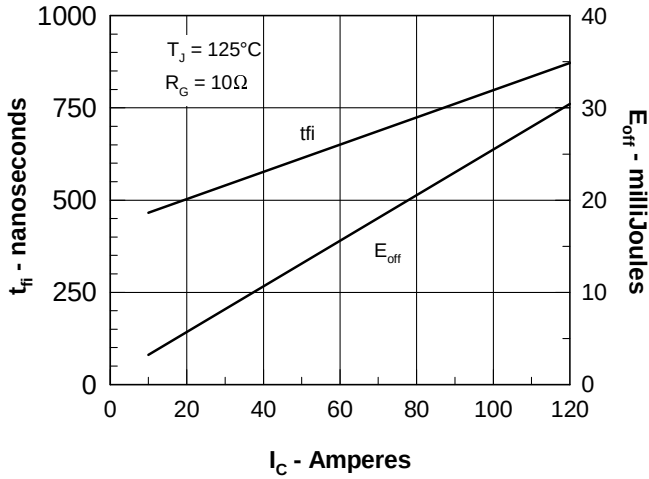


Fig. 7. Dependence of t_{fi} and E_{OFF} on I_C .

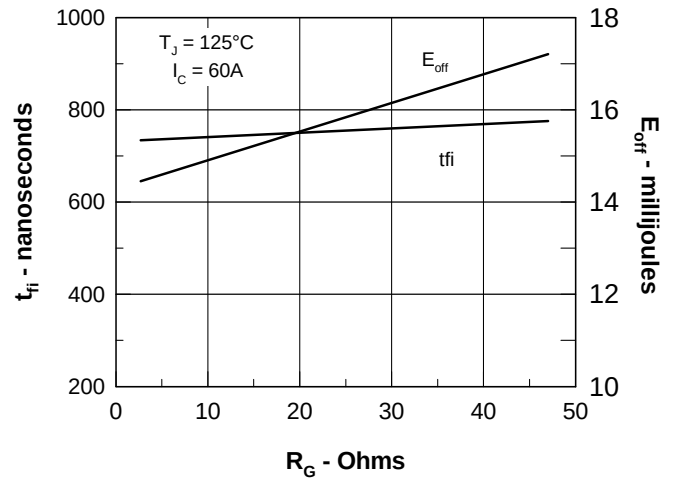


Fig. 8. Dependence of t_{fi} and E_{OFF} on R_G .

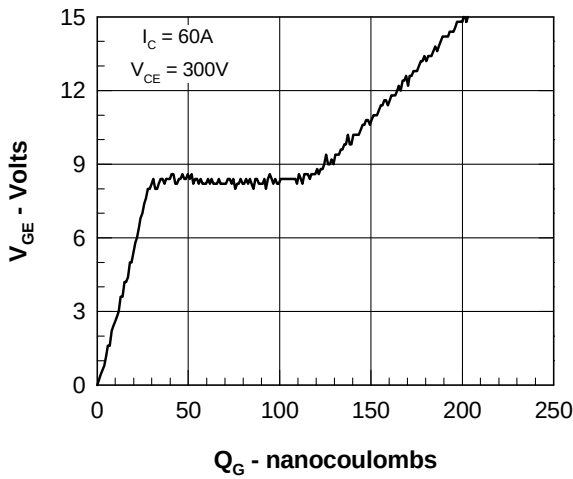


Fig. 9. Gate Charge

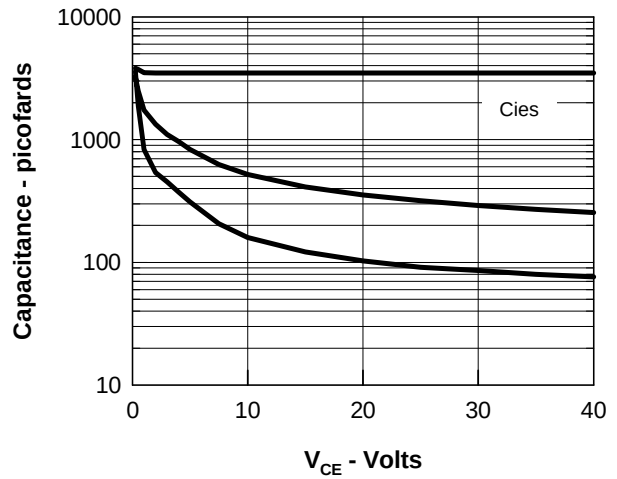


Fig. 10. Junction Capacitance Curves

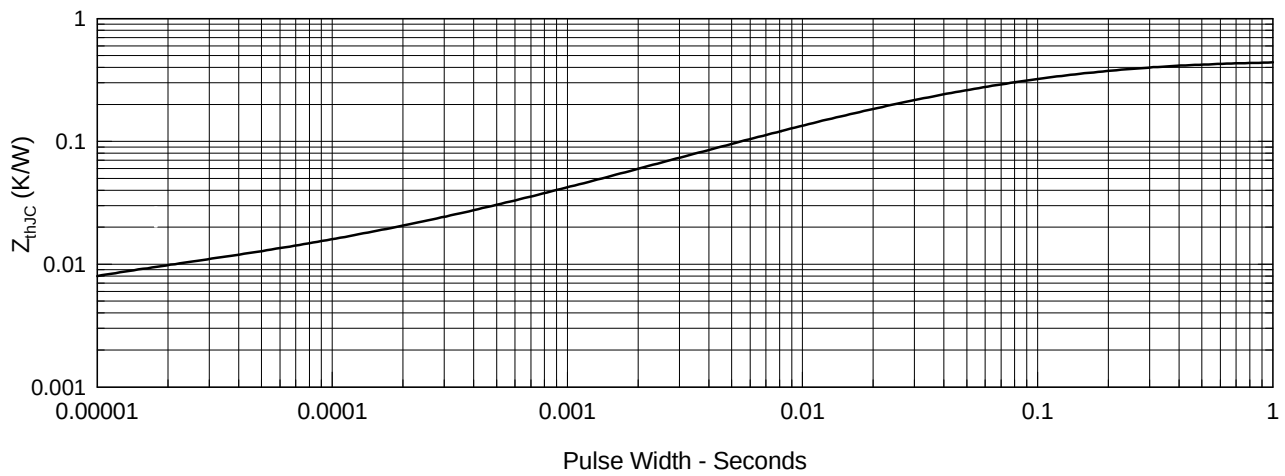


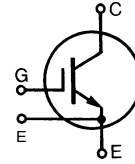
Fig. 11. Transient Thermal Resistance

Ultra-Low $V_{CE(sat)}$ IGBT

IXGN 60N60

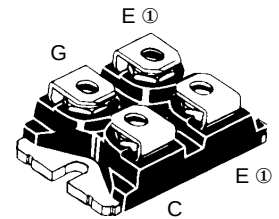
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 100 \text{ A} \\ V_{CE(sat)} &= 1.7 \text{ V} \end{aligned}$$

Preliminary data sheet



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	100	A
I_{C90}	$T_C = 90^\circ\text{C}$	60	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	200	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	250	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque Terminal connection torque (M4)	1.5/13 1.5/13	Nm/lb.in.
Weight		30	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

SOT-227B miniBLOC



G = Gate, C = Collector, E = Emitter
① Either emitter terminal can be used as Main or Kelvin Emitter

Features

- International standard package SOT-227B
- Aluminium nitride isolation
 - high power dissipation
- Isolation voltage 3000 V~
- Very high current, fast switching IGBT
- Low $V_{CE(sat)}$ for minimum on-state conduction losses
- MOS Gate turn-on drive simplicity
- Low collector-to-case capacitance (< 50 pF)
- Low package inductance (< 5 nH)
 - easy to drive and to protect

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

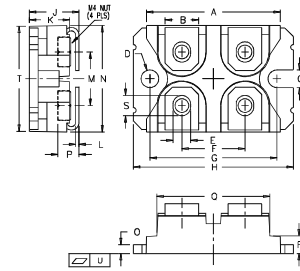
Advantages

- Easy to mount with 2 screws
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			1.7 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	30	55	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4000	pF
C_{oes}			290	pF
C_{res}			100	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		200	nC
Q_{ge}			35	nC
Q_{gc}			80	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			30	ns
$t_{d(off)}$			300	600 ns
t_{fi}			360	570 ns
E_{off}			8	15 mJ
$t_{d(on)}$			50	ns
t_{ri}	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		30	ns
E_{on}			3	mJ
$t_{d(off)}$			650	ns
t_{fi}			550	ns
E_{off}			17	mJ
R_{thJC}				0.50 K/W
R_{thCK}			0.05	K/W

miniBLOC, SOT-227 B



M4 screws (4x) supplied

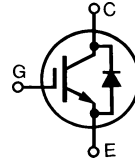
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

Low $V_{CE(sat)}$ IGBT with Diode ISOPLUS247™ (Electrically Isolated Back Surface)

IXGR 60N60U1

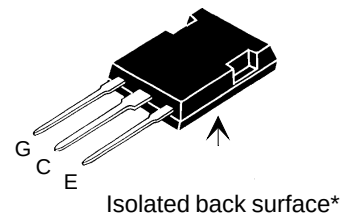
$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 1.7 \text{ V} \end{aligned}$$

Preliminary data



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	75	A
I_{C100}	$T_C = 90^\circ\text{C}$	60	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	200	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load; $V_{CL} = 0.8 V_{CES}$	$I_{CM} = 100$	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		-55 .. + 150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55...+ 150	$^\circ\text{C}$
T_L	1.6 mm (0.062 in.) from case for 10 s	300	$^\circ\text{C}$
V_{ISOL}	50/60Hz, RMS, t = 1minute, leads-to tab	2500	V
Weight		5	g

ISOPLUS247™



G = Gate, C = Collector,
E = Emitter, TAB = Collector

* Patent pending

Features

- Silicon chip on Direct-Copper-Bond substrate
- High power dissipation
- Isolated mounting surface
- 2500V electrical isolation
- Low collector to tab capacitance (<25pF)
- Rugged polysilicon gate cell structure
- Fast intrinsic Rectifier
- Low $V_{CE(sat)}$ IGBT and standard diode for minimum on-state conduction losses
- MOS Gate turn-on for drive simplicity

Applications

- Solid state relays
- Capacitor discharge circuits
- High power ignition circuits

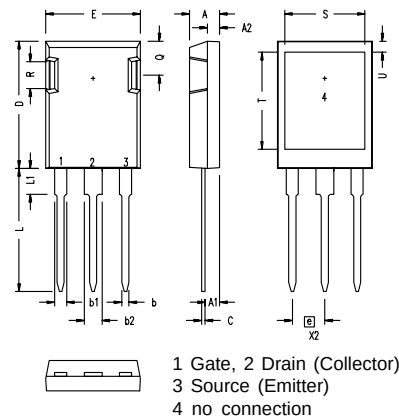
Advantages

- Space savings (two devices in one package)
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1 \text{ mA}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$ 250 2 μA mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			± 100 nA
$V_{CE(sat)}$	$I_C = I_{C100}$, $V_{GE} = 15 \text{ V}$			1.7 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C100}$, $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	30	40	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4000	pF
C_{oes}			340	pF
C_{res}			100	pF
Q_g	$I_C = I_{C100}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		200	nC
Q_{ge}			35	nC
Q_{gc}			80	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$		50	ns
t_{ri}	$I_C = I_{C100}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$		200	ns
$t_{d(off)}$			600	800 ns
t_{fi}	Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		500	700 ns
E_{off}			16	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$		50	ns
t_{ri}	$I_C = I_{C100}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 2.7\text{ }\Omega$		240	ns
$t_{d(off)}$			1000	ns
t_{fi}	Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		1000	ns
E_{off}			26	mJ
R_{thJC}				0.5 K/W
R_{thCK}			0.15	K/W

ISOPLUS 247 (IXGR) OUTLINE



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45	BSC	.215	BSC
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190
S	13.21	13.72	.520	.540
T	15.75	16.26	.620	.640
U	1.65	3.03	.065	.080

Reverse Diode

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_{C100}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$			2.2 V
R_{thJC}				1.0 K/W

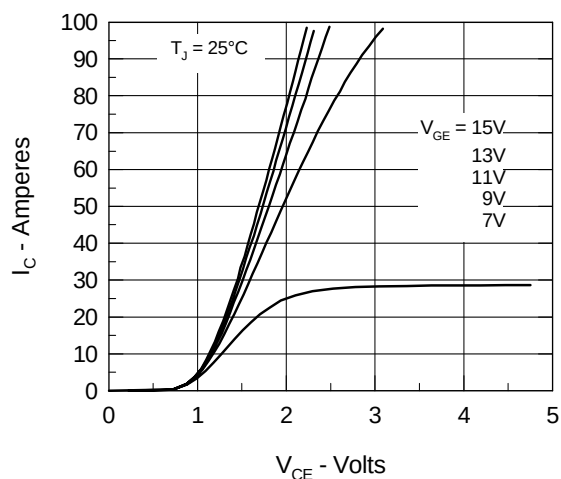


Figure 1. Saturation Voltage Characteristics

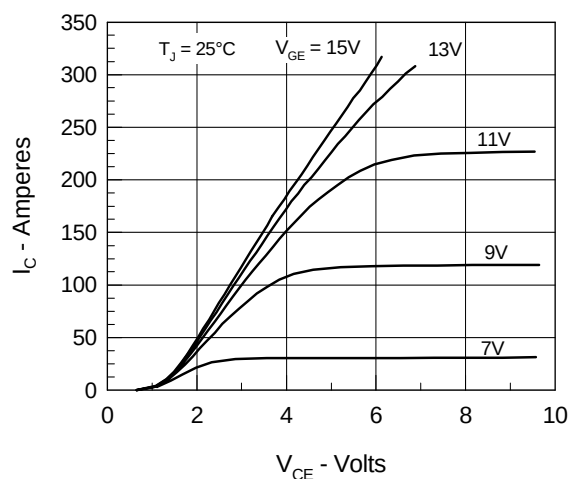


Figure 2. Extended Output Characteristics

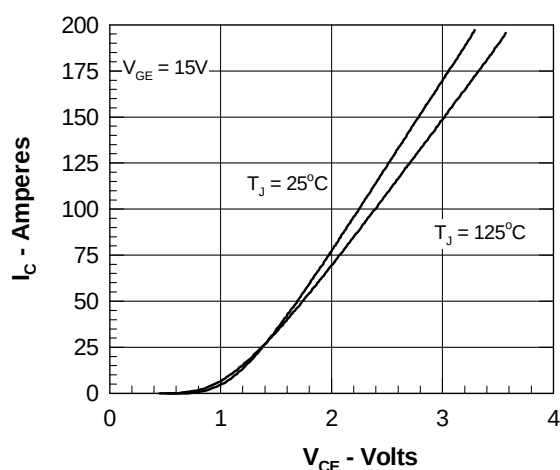


Figure 3. Saturation Voltage Characteristics

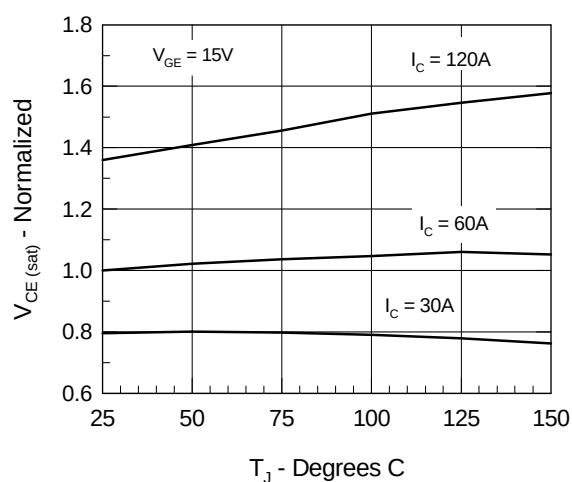


Figure 4. Temperature Dependence of $V_{CE(sat)}$

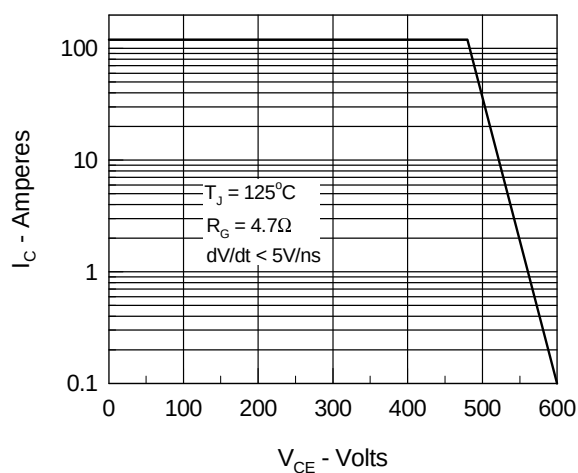


Figure 5. Admittance Curves

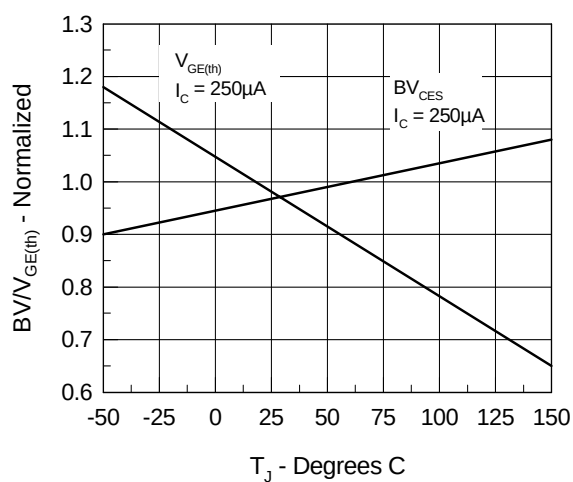


Figure 6. Capacitance Curves

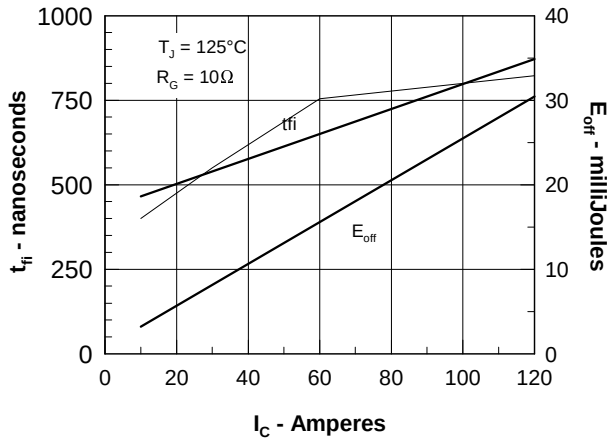


Figure 7. Dependence of E_{ON} and E_{OFF} on I_C .

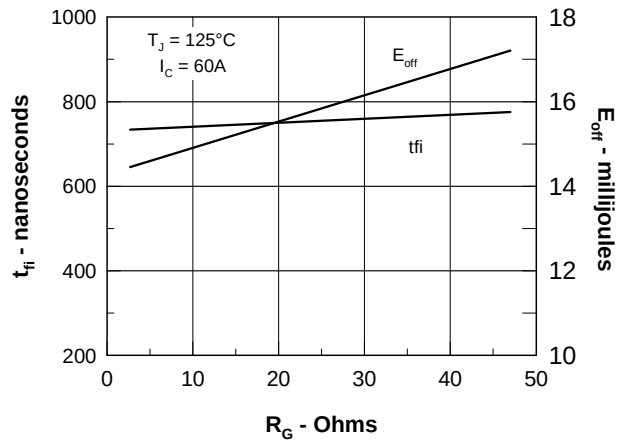


Figure 8. Dependence of E_{ON} and E_{OFF} on R_G .

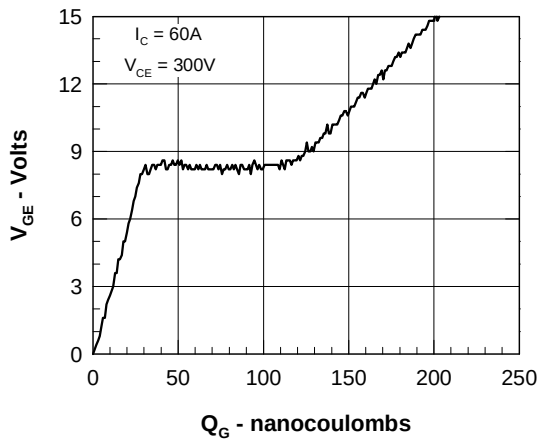


Figure 9. Gate Charge

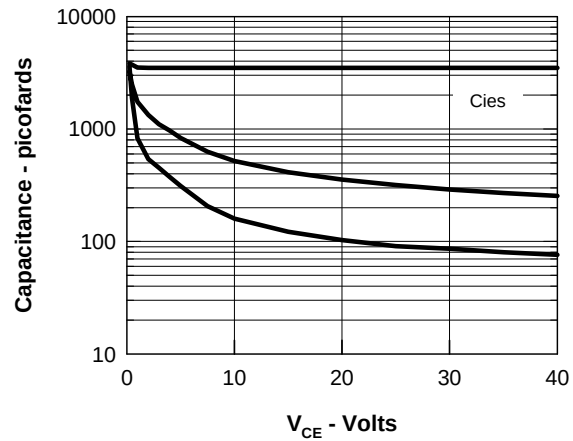


Figure 10. Turn-off Safe Operating Area

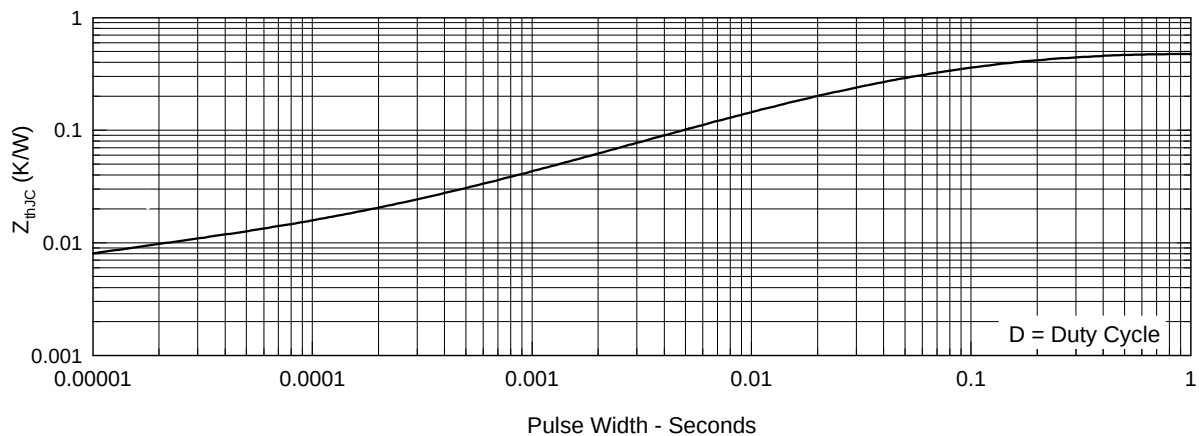


Figure 11. IGBT Transient Thermal Resistance

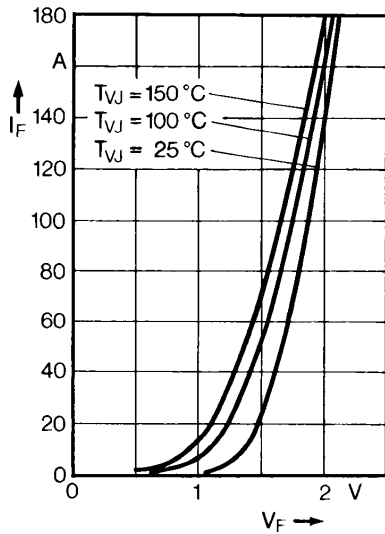


Fig. 12 Forward current versus voltage drop.

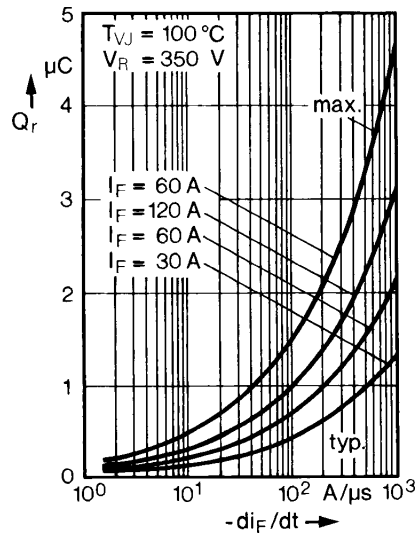


Fig. 13 Recovery charge versus $-di_F/dt$.

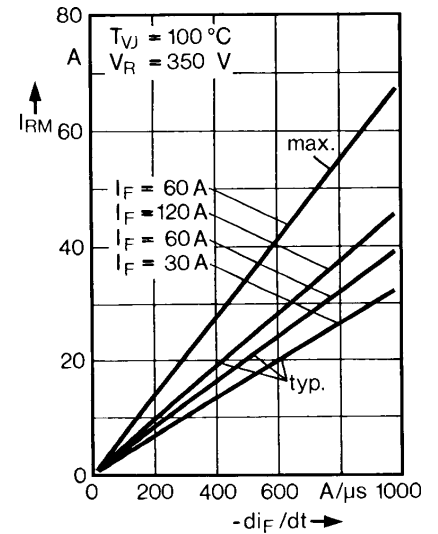


Fig. 14 Peak reverse current versus $-di_F/dt$.

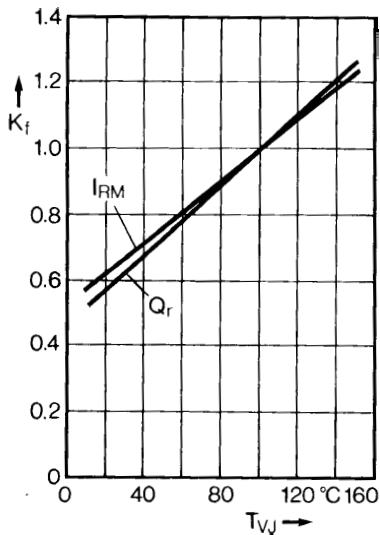


Fig. 15 Dynamic parameters versus junction temperature.

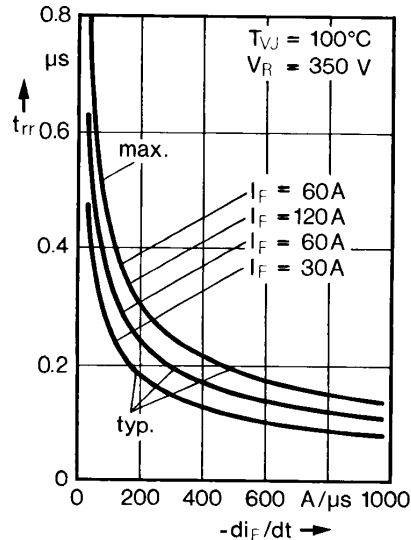


Fig. 16 Recovery time versus $-di_F/dt$.

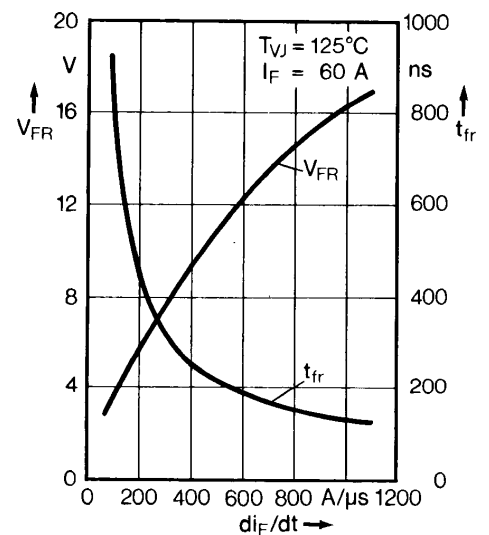


Fig. 17 Peak forward voltage vs. di_F/dt .

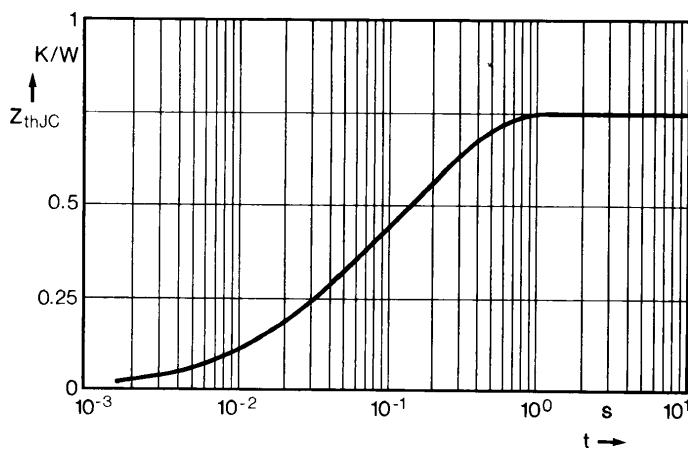
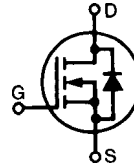


Fig. 18 Transient thermal impedance junction to case.

HiPerFAST™ IGBT

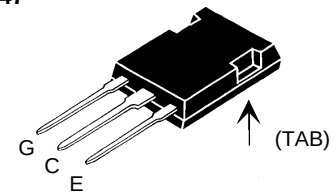
IXGK 120N60B IXGX 120N60B

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 200 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \end{aligned}$$

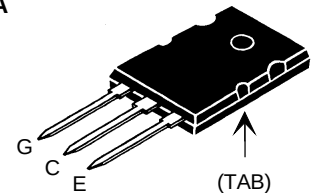


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GS} = 1 \text{ M}\Omega$	600	V
V_{CES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	200	A
I_{C90}	$T_C = 90^\circ\text{C}$	120	A
$I_{L(RMS)}$	External lead limit	76	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	300	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 2.4 \Omega$ Clamped inductive load	$I_{CM} = 200$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	560	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
T_L	1.6 mm (0.063 in.) from case for 10 s	300	$^\circ\text{C}$
M_d	Mounting torque	TO-264	0.4/6 Nm/lb.in.
Weight	PLUS 247	6	g
	TO-264	10	g

PLUS 247™ (IXGX)



TO-264 AA (IXGK)



G = Gate
C = Collector

E = Emitter
TAB = Collector

Features

- International standard packages
- Very high current, fast switching IGBT
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

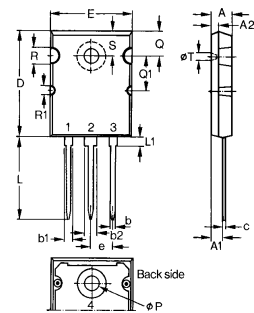
Advantages

- PLUS 247™ package for clip or spring mounting
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1 \text{ mA}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 1 \text{ mA}$, $V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ 200 μA 2 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 400 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			2.1 V

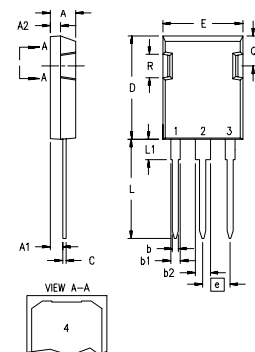
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = 60\text{ A}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	50	75	S
C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		11000	pF
C_{oes}			680	pF
C_{res}			190	pF
Q_g	$I_C = I_{C90}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		350	nC
Q_{ge}			72	nC
Q_{gc}			131	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}, R_G = R_{off} = 2.4\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		60	ns
t_{ri}			45	ns
E_{on}			2.4	mJ
$t_{d(off)}$			200	360 ns
t_{fi}			160	280 ns
E_{off}			5.5	9.6 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}, R_G = R_{off} = 2.4\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		60	ns
t_{ri}			60	ns
E_{on}			4.8	mJ
$t_{d(off)}$			290	ns
t_{fi}			250	ns
E_{off}			8.7	mJ
R_{thJC}			0.21	K/W
R_{thCK}			0.15	K/W

TO-264 AA Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.82	5.13	.190	.202
A1	2.54	2.89	.100	.114
A2	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b1	2.39	2.69	.094	.106
b2	2.90	3.09	.114	.122
c	0.53	0.83	.021	.033
D	25.91	26.16	1.020	1.030
E	19.81	19.96	.780	.786
e	5.46 BSC		.215 BSC	
J	0.00	0.25	.000	.010
K	0.00	0.25	.000	.010
L	20.32	20.83	.800	.820
L1	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q1	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R1	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

PLUS247™ (IXGX)

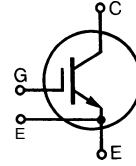


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A1	2.29	2.54	.090	.100
A2	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b1	1.91	2.13	.075	.084
b2	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45 BSC		.215 BSC	
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190

HiPerFAST™ IGBT

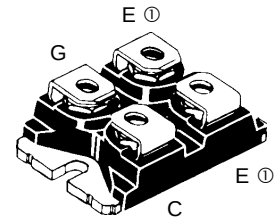
IXGN 200N60
IXGN 200N60A

V_{CES}	I_{C25}	$V_{CE(sat)}$
600 V	200 A	2.5 V
600 V	200 A	2.7 V



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	200	A
I_{C90}	$T_C = 90^\circ\text{C}$	100	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	300	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 22\ \Omega$ Clamped inductive load, $L = 30\ \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	600	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
V_{ISOL}	50/60 Hz $I_{ISOL} \leq 1\text{ mA}$	t = 1 min t = 1 s	2500 V~ 3000 V~
M_d	Mounting torque Terminal connection torque (M4)	1.5/13 1.5/13	Nm/lb.in. Nm/lb.in.
Weight		30	g

SOT-227B, miniBLOC



G = Gate, C = Collector, E = Emitter
① either emitter terminal can be used as Main or Kelvin Emitter

Features

- International standard package miniBLOC (ISOTOP compatible)
- Aluminium nitride isolation
 - high power dissipation
- Isolation voltage 3000 V~
- Very high current, fast switching IGBT
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Low collector-to-case capacitance (< 50 pF)
- Low package inductance (< 5 nH)
 - easy to drive and to protect

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

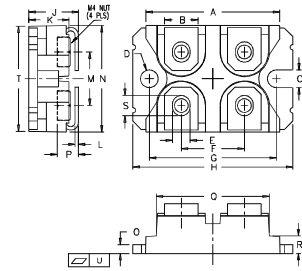
Advantages

- Easy to mount with 2 screws
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250\ \mu\text{A}$, $V_{GE} = 0\text{ V}$	600		
$V_{GE(th)}$	$I_C = 10\text{ mA}$, $V_{CE} = V_{GE}$	2.5		6
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0\text{ V}$			200 μA 2 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 400\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$			2.5 V 2.7 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = 60\text{ A}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	40	57	S
C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		9000	pF
C_{oes}			600	pF
C_{res}			305	pF
Q_g	$I_C = I_{C90}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		465	nC
Q_{ge}			52	nC
Q_{gc}			228	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}, V_{GE} = 15\text{ V}, L = 30\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}, R_G = R_{off} = 2.4\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G	200N60	100	ns
t_{ri}		200N60	100	ns
E_{on}		200N60	2.4	mJ
$t_{d(off)}$		200N60	800	ns
t_{fi}		200N60	700	ns
t_{fi}		200N60A	350	ns
t_{fi}		200N60A	200	ns
E_{off}		200N60	14.4	mJ
E_{off}		200N60A	9.6	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ (IXGN 200N60A) $I_C = I_{C90}, V_{GE} = 15\text{ V}, L = 30\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}, R_G = R_{off} = 2.4\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G	200N60A	100	ns
t_{ri}		200N60A	200	ns
E_{on}		200N60A	4.8	mJ
$t_{d(off)}$		200N60A	780	ns
t_{fi}		200N60A	250	ns
t_{fi}		200N60A	14.4	mJ
E_{off}		200N60A	14.4	mJ
R_{thJC}			0.05	0.21 K/W
R_{thCK}			0.05	K/W

miniBLOC, SOT-227 B



M4 screws (4x) supplied

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

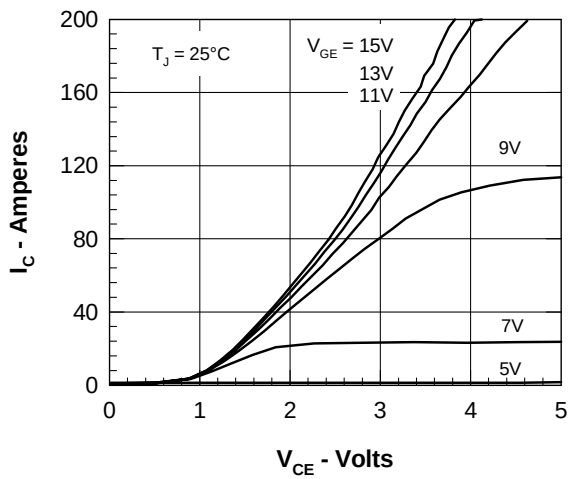


Fig. 1. Saturation Voltage Characteristics

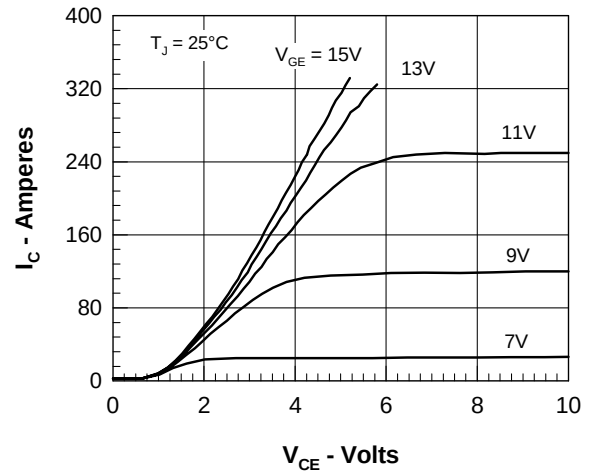


Fig. 2. Extended Output Characteristics

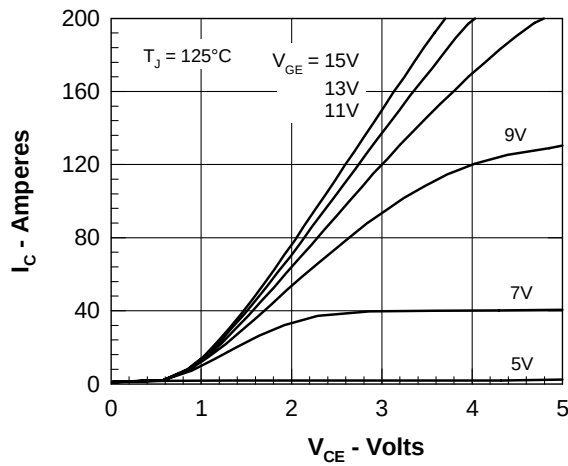


Fig. 3. Saturation Voltage Characteristics

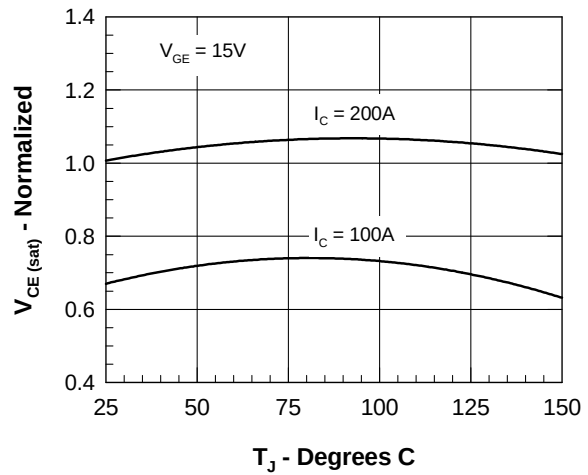


Fig. 4. Temperature Dependence of $V_{CE(sat)}$

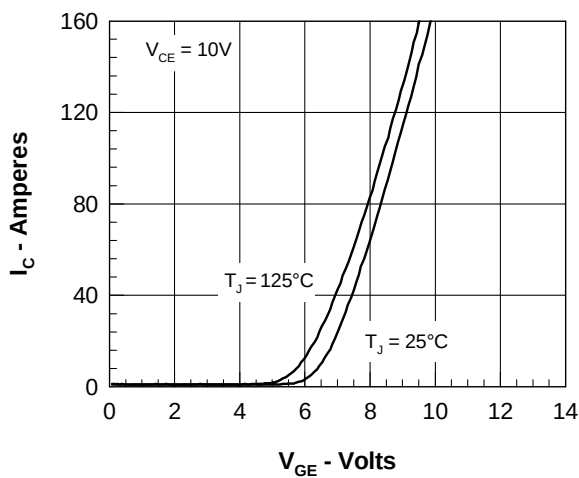


Fig. 5. Turn-off Safe Operating Area

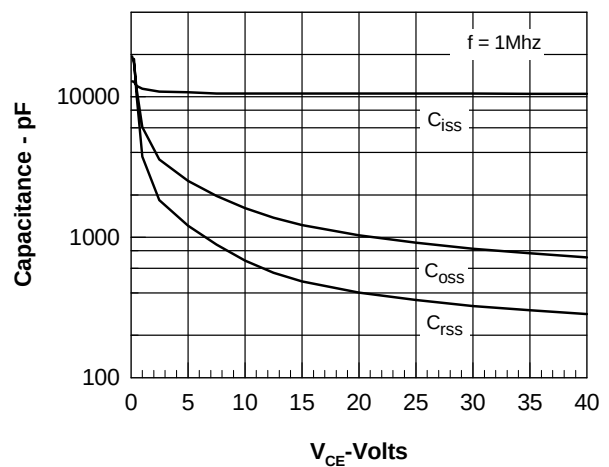
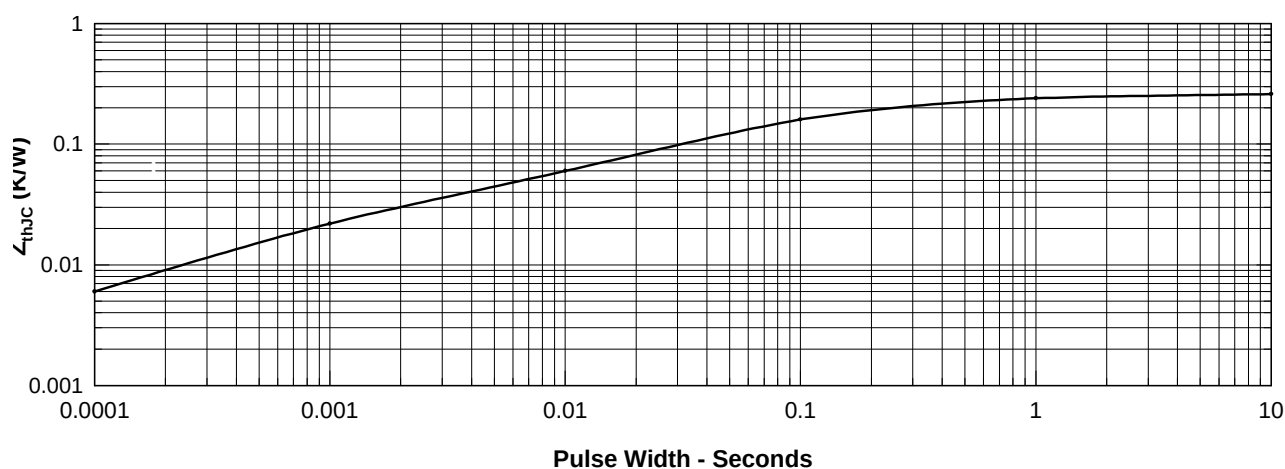
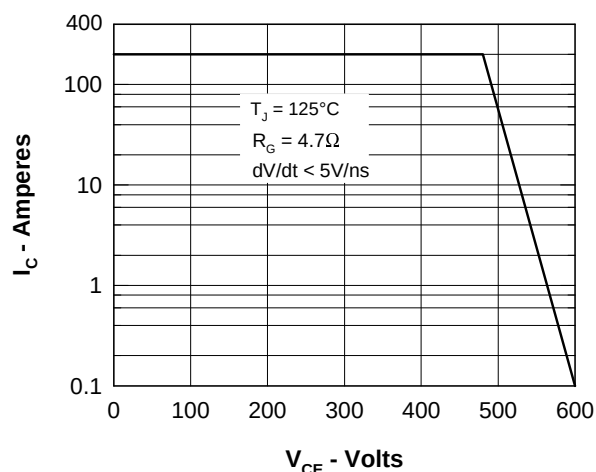
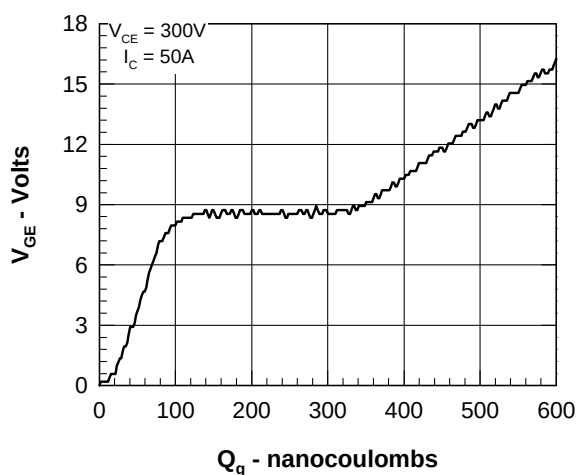
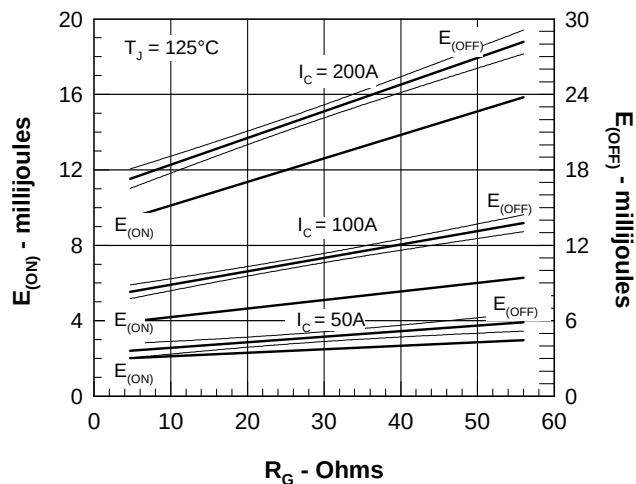
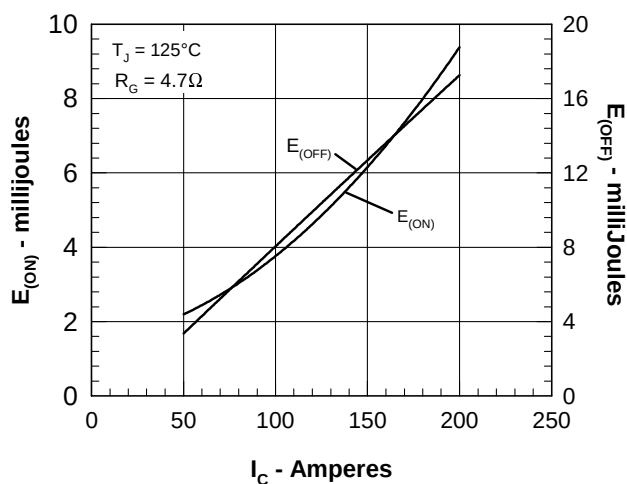


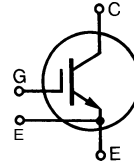
Fig. 6. Temperature Dependence of BV_{CES} & $V_{GE(th)}$



HiPerFAST™ IGBT

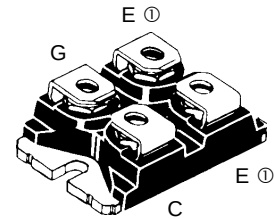
IXGN 200N60B

$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 200 \text{ A} \\ V_{CE(sat)} &= 2.1 \text{ V} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	600	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	200	A
I_{C90}	$T_C = 90^\circ\text{C}$	120	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	400	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 2.4 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 200$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	600	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
V_{ISOL}	50/60 Hz $I_{ISOL} \leq 1 \text{ mA}$	$t = 1 \text{ min}$ $t = 1 \text{ s}$	2500 V~ 3000 V~
M_d	Mounting torque Terminal connection torque (M4)	1.5/13 Nm/lb.in. 1.5/13 Nm/lb.in.	
Weight		30	g

SOT-227B, miniBLOC



G = Gate, C = Collector, E = Emitter
① either emitter terminal can be used as Main or Kelvin Emitter

Features

- International standard package miniBLOC
- Aluminium nitride isolation
 - high power dissipation
- Isolation voltage 3000 V~
- Very high current, fast switching IGBT
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Low collector-to-case capacitance (< 50 pF)
- Low package inductance (< 5 nH)
 - easy to drive and to protect

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

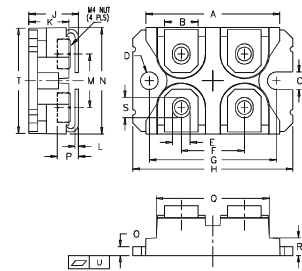
Advantages

- Easy to mount with 2 screws
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1 \text{ mA}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 1 \text{ mA}, V_{CE} = V_{GE}$	2.5		5.5 V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			200 μA 2 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 400 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$			2.1 V

Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = 60\text{ A}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	50	75	S
C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		11000	pF
C_{oes}			680	pF
C_{res}			190	pF
Q_g	$I_C = I_{C90}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		350	nC
Q_{ge}			72	nC
Q_{gc}			131	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}, R_G = R_{off} = 2.4\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		60	ns
t_{ri}			45	ns
E_{on}			2.4	mJ
$t_{d(off)}$			200	360 ns
t_{ri}			160	280 ns
E_{off}			5.5	9.6 mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = 100\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}, R_G = R_{off} = 2.4\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		60	ns
t_{ri}			60	ns
E_{on}			4.8	mJ
$t_{d(off)}$			290	ns
t_{ri}			250	ns
E_{off}			8.7	mJ
R_{thJC}		0.05	0.21 K/W	
R_{thCK}			K/W	

miniBLOC, SOT-227 B



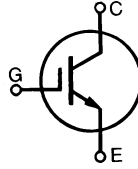
M4 screws (4x) supplied

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

HiPerFAST™ IGBT Lightspeed™ Series

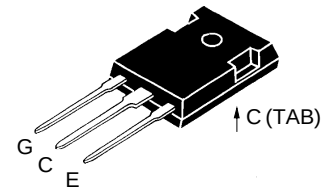
IXGH 12N90C

$$\begin{aligned} V_{CES} &= 900 \text{ V} \\ I_{C25} &= 24 \text{ A} \\ V_{CES(sat)} &= 3.0 \text{ V} \\ t_{fi(typ)} &= 70 \text{ ns} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	900	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	900	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	48	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 33 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 Nm/lb.in. 0.55/5 Nm/lb.in.	
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Weight		6	g

TO-247



G = Gate,
E = Emitter,
C = Collector,
TAB = Collector

Features

- Very high frequency IGBT
- New generation HDMOS™ process
- International standard package JEDEC TO-247
- High peak current handling capability

Applications

- PFC circuit
- AC motor speed control
- DC servo and robot drives
- Switch-mode and resonant-mode power supplies
- High power audio amplifiers

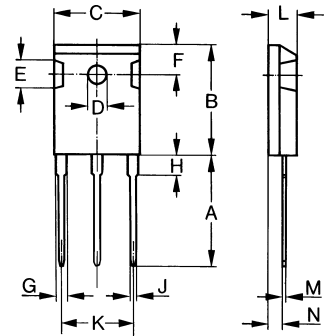
Advantages

- Fast switching speed
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			100 μA 1.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15 \text{ V}$			3.0 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	5	10	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		780	pF
C_{oes}			60	pF
C_{res}			15	pF
Q_g	$I_C = I_{C90}; V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		33	nC
Q_{ge}			10	nC
Q_{gc}			12	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 22\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
$t_{d(off)}$		135	200	ns
t_{fi}		70	180	ns
E_{off}		0.32	0.70	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}$, $R_G = R_{off} = 22\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		20	ns
t_{ri}			20	ns
E_{on}		0.15		mJ
$t_{d(off)}$		200		ns
t_{fi}		150		ns
E_{off}		0.70		mJ
R_{thJC}				1.25 K/W
R_{thCK}		0.25		K/W

TO-247 AD (IXGH) Outline



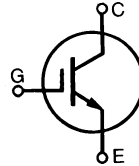
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

HiPerFAST™ IGBT

IXGH 28N90B
IXGT 28N90B

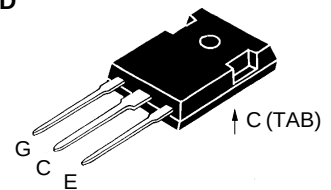
$V_{CES} = 900 \text{ V}$
 $I_{C25} = 51 \text{ A}$
 $V_{CE(SAT)} = 1.8 \text{ V}$
 $t_{fi(typ)} = 130 \text{ ns}$

Preliminary data sheet

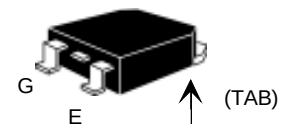


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	900	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	900	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	51	A
I_{C110}	$T_C = 110^\circ\text{C}$	28	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	120	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 56$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque (M3) 1.13/10	Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-247 AD
(IXGH)



TO-268 (D3)
(IXGT)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface mountable and JEDEC TO-247 AD
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

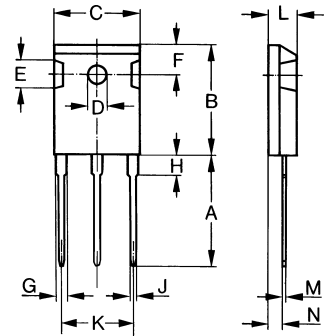
Advantages

- Space savings (two devices in one package)
- High power density
- Suitable for surface mounting
- Switching speed for high frequency applications
- Easy to mount with 1 screw, TO-247 (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	900		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$			500 μA 5 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C110}$, $V_{GE} = 15 \text{ V}$	1.8	2.5	V

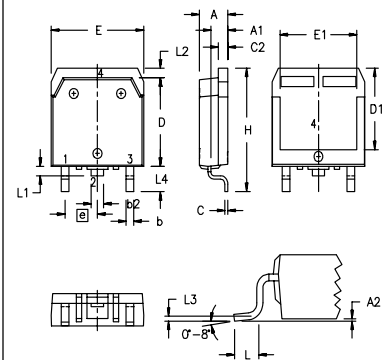
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C110}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	20	32	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		3200	pF
C_{oes}			160	pF
C_{res}			32	pF
Q_g	$I_C = I_{C110}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		100	nC
Q_{ge}			18	nC
Q_{gc}			40	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		30	ns
t_{ri}			30	ns
$t_{d(off)}$			100	170 ns
t_{fi}			130	220 ns
E_{off}			1.2	2 mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C110}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 4.7\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_j or increased R_G		30	ns
t_{ri}			35	ns
E_{on}			0.3	mJ
$t_{d(off)}$			280	ns
t_{fi}			190	ns
E_{off}			2.5	mJ
R_{thJC}				0.62 K/W
R_{thCK}	TO-247		0.25	K/W

TO-247 AD (IXGH) Outline



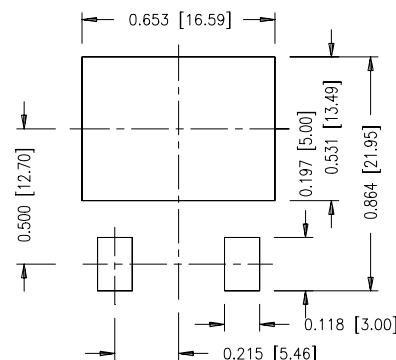
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

Min. Recommended Footprint

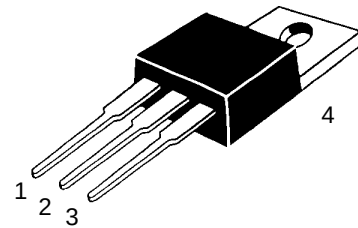


High Voltage IGBT

	V_{CES}	I_{C90}	$V_{CE(SAT)}$
IXGP 2N100	1000 V	1.5 A	3.5 V
IXGP 2N100A	1000 V	1.5 A	4.0 V

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1000	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	3	A
I_{C90}	$T_C = 90^\circ\text{C}$	1.5	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	5	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_J = 125^\circ\text{C}$, $R_G = 150\Omega$ Clamped inductive load, $L = 300\text{ }\mu\text{H}$	$I_{CM} = 3$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	25	W
P_C	$T_A = 25^\circ\text{C}$	1.1	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{STG}		-55 ... +150	$^\circ\text{C}$
Weight		4	g
Max. Lead Temperature for Soldering (1.6mm from case for 10s)		300	$^\circ\text{C}$

TO-220



1 = Gate 2 = Collector
3 = Emitter 4 = Collector

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$ unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 25\mu\text{A}$, $V_{GE} = 0\text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 25\mu\text{A}$, $V_{CE} = V_{GE}$	4		8 V
I_{CES}	$V_{CE} = 0.8 V_{CES}$			10 μA
	$V_{GE} = 0\text{ V}$			200 μA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	IXGP2N100		3.5 V
		IXGP2N100A		4.0 V

Features

- International standard package
- Low $V_{CE(sat)}$
 - for low on-state conduction losses
- High current handling capability
- MOS Gate turn-on
 - drive simplicity
- Voltage rating guaranteed at high temperature (150°C)

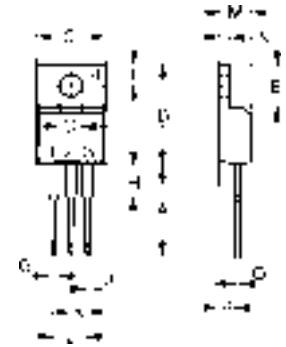
Applications

- Capacitor discharge
- Anode triggering of thyristors
- DC choppers
- Switched-mode and resonant-mode power supplies.

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$ unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}, V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	0.25	0.5	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		80	pF
C_{oes}			7.5	pF
C_{res}			1.8	pF
Q_g	$I_C = I_{C90}, V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		50	nC
Q_{ge}			15	nC
Q_{gc}			25	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$		100	ns
t_{ri}	$I_C = I_{C90}, V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$		200	ns
$t_{d(off)}$	$R_G = 150\text{ }\Omega$		600	ns
t_{fi}	$V_{CLAMP} = 0.8 V_{CES}$ IXGP2N100 IXGP2N100A		800 400	ns ns
E_{off}	Note 1		0.25	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$		100	ns
t_{ri}	$I_C = I_{C90}, V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$		200	ns
$E_{(on)}$	$R_G = R_{(off)} = 150\text{ }\Omega$		0.14	mJ
$t_{d(off)}$	$V_{CLAMP} = 0.8 V_{CES}$		100	ns
t_{fi}	Note 1		1200	ns
t_c			1500	ns
E_{off}			0.5	mJ
R_{thJC}				5 K/W
R_{thJA}				110 K/W

Notes: 1. Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G .

TO-220 AB (IXGP) Outline



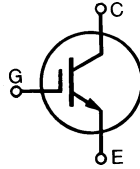
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

IGBT

IXGA 8N100
IXGP 8N100

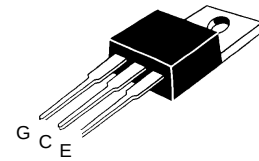
$$\begin{aligned} V_{CES} &= 1000 \text{ V} \\ I_{C25} &= 16 \text{ A} \\ V_{CE(sat)} &= 2.7 \text{ V} \end{aligned}$$

Preliminary data sheet

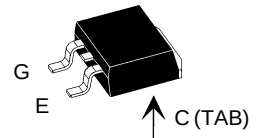


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1000	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	16	A
I_{C90}	$T_C = 90^\circ\text{C}$	8	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	32	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 120 \Omega$ Clamped inductive load	$I_{CM} = 16$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	54	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight	TO-220 TO-263	4 2	g

TO-220AB (IXGP)



TO-263 (IXGA)



Features

- International standard packages JEDEC TO-220AB and TO-263AA
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies
- Capacitor discharge

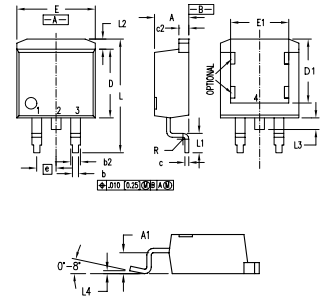
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 1 \text{ mA}, V_{GE} = 0 \text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8 V_{CES}$ $V_{GE} = 0 \text{ V}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		25 250
				μA μA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			± 100 nA
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15 \text{ V}$	2.2	2.7	V

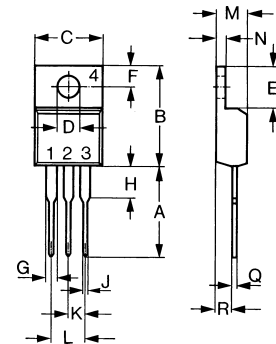
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$ $V_{CE} = 10\text{ V}$ Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	4	7.6	S
$I_{C(on)}$	$V_{GE} = 10\text{ V}$, $V_{CE} = 10\text{ V}$		40	A
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		595	pF
C_{oes}			34	pF
C_{res}			10	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		22.5	nC
Q_{ge}			4.8	nC
Q_{gc}			8.5	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			30	ns
$t_{d(off)}$			600	1000 ns
t_{fi}			390	900 ns
E_{off}			2.3	5.0 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G		15	ns
t_{ri}			30	ns
E_{on}			0.5	mJ
$t_{d(off)}$			800	ns
t_{fi}			630	ns
E_{off}			3.7	mJ
R_{thJC}				2.3 K/W
R_{thCK}	TO-220			0.5 K/W

TO-263 AA (IXGA) Outline



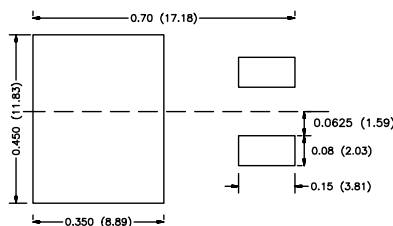
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

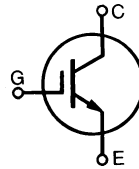
Min. Recommended Footprint



Low $V_{CE(sat)}$ IGBT High Speed IGBT

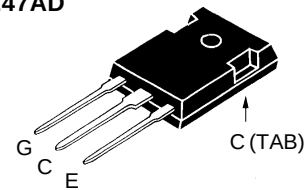
IXGH 12N100
IXGH 12N100A

V_{CES}	I_{C25}	$V_{CE(sat)}$
1000 V	24 A	3.5 V
1000 V	24 A	4.0 V



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1000	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 150\ \Omega$ Clamped inductive load, $L = 300\ \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10	Nm/lb.in.
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247AD



G = Gate C = Collector
E = Emitter TAB = Collector

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 3\text{ mA}$, $V_{GE} = 0\text{ V}$ BV_{CES} temperature coefficient	1000	0.072	V %/K
$V_{GE(th)}$	$I_C = 500\ \mu\text{A}$, $V_{GE} = V_{GE}$ $V_{GE(th)}$ temperature coefficient	2.5	-0.192	V %/K
I_{CES}	$V_{CE} = 0.8 V_{CES}$, $T_J = 25^\circ\text{C}$ $V_{GE} = 0\text{ V}$, $T_J = 125^\circ\text{C}$			250 μA 1 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	12N100 12N100A		3.5 V 4.0 V

Features

- International standard package JEDEC TO-247 AD
- 2nd generation HDMOS™ process
- Low $V_{CE(sat)}$
 - for low on-state conduction losses
- High current handling capability
- MOS Gate turn-on
 - drive simplicity
- Voltage rating guaranteed at high temperature (125°C)

Applications

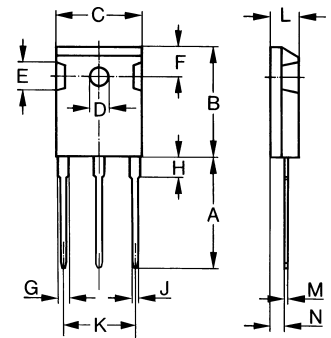
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

- Easy to mount with 1 screw (isolated mounting screw hole)
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	6	10	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		750	pF
C_{oes}			80	pF
C_{res}			30	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		65	nC
Q_{ge}			8	nC
Q_{gc}			24	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 V_{CES}$, higher T_J or increased R_G		100	ns
t_{ri}			200	ns
$t_{d(off)}$			850	1000 ns
t_{fi}		12N100	800	1000 ns
E_{off}		12N100A	500	700 ns
		12N100	2.5	mJ
		12N100A	1.5	3.0 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 V_{CES}$, higher T_J or increased R_G		100	ns
t_{ri}			200	ns
E_{on}			1.1	mJ
$t_{d(off)}$			900	ns
t_{fi}		12N100	1250	ns
		12N100A	950	ns
E_{off}		12N100	3.5	mJ
		12N100A	2.2	mJ
R_{thJC}				1.25 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



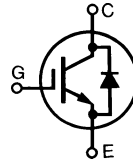
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

IXGH12N100/A characteristic curves may be found in the IXGH12N100U/AU1 data sheet.

Low $V_{CE(sat)}$ IGBT with Diode High Speed IGBT with Diode Combi Pack

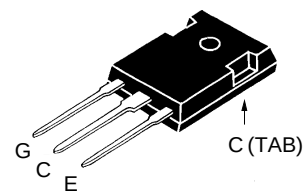
IXGH 12N100U1
IXGH 12N100AU1

V_{CES}	I_{C25}	$V_{CE(sat)}$
1000 V	24 A	3.5 V
1000 V	24 A	4.0 V



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1000	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1\text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}, 1\text{ ms}$	48	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 150\ \Omega$ Clamped inductive load, $L = 300\ \mu\text{H}$	$I_{CM} = 24$ @ $0.8\ V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3	1.13/10	Nm/lb.in.
Weight		6	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-247AD



G = Gate C = Collector
E = Emitter TAB = Collector

Features

- International standard packages JEDEC TO-247
- IGBT with antiparallel FRED in one package
- HDMOSTM process
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- DC choppers
- AC motor speed control
- DC servo and robot drives
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

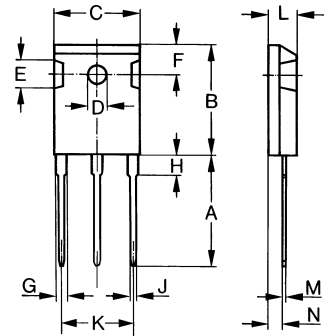
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- Space savings (two devices in one package)

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 3\text{ mA}, V_{GE} = 0\text{ V}$ BV_{CES} temperature coefficient	1000	0.072	V %/K
$V_{GE(th)}$	$I_C = 500\ \mu\text{A}, V_{GE} = V_{GE}$ $V_{GE(th)}$ temperature coefficient	2.5	-0.192	V %/K
I_{CES}	$V_{CE} = 0.8, V_{CES}$ $V_{GE} = 0\text{ V}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		300 μA 5 mA
I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15$	12N100U1 12N100AU1		3.5 V 4.0 V

Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	6	10	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		750	pF
C_{oes}			120	pF
C_{res}			30	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		65	nC
Q_{ge}			8	nC
Q_{gc}			24	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G		100	ns
t_{ri}			200	ns
$t_{d(off)}$			850	1000
t_{fi}		12N100U1	800	1000
		12N100AU1	500	700
E_{off}		12N100U1	2.5	mJ
		12N100AU1	1.5	3.0
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G		100	ns
t_{ri}			200	ns
$E_{(on)}$			1.1	mJ
$t_{d(off)}$			900	ns
t_{fi}		12N100U1	1250	ns
		12N100AU1	950	ns
E_{off}		12N100U1	3.5	mJ
		12N100AU1	2.2	mJ
R_{thJC}				1.25 K/W
R_{thCK}			0.25	K/W

TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

Reverse Diode (FRED)		Characteristic Values		
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$		
Symbol	Test Conditions	Min.	Typ.	Max.
V_F	$I_F = 8\text{ A}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$			2.75 V
I_{RM}	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$		6.5	A
t_{rr}	$V_R = 540\text{ V}$	$T_J = 125^\circ\text{C}$	120	ns
	$I_F = 1\text{ A}$, $-di_F/dt = 50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	$T_J = 25^\circ\text{C}$	50	60 ns
R_{thJC}				2.5 K/W

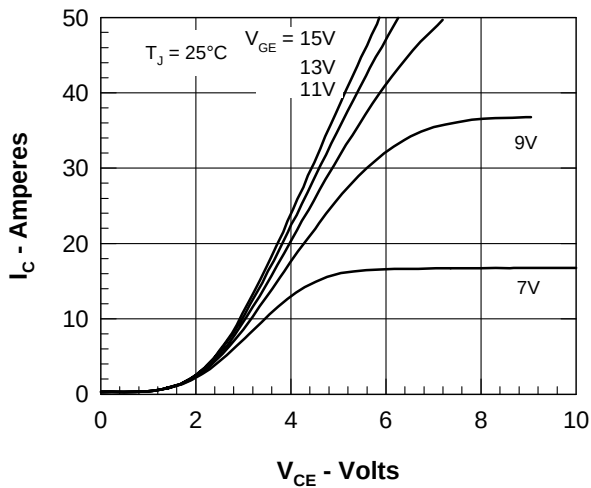


Figure 1. Saturation Voltage Characteristics

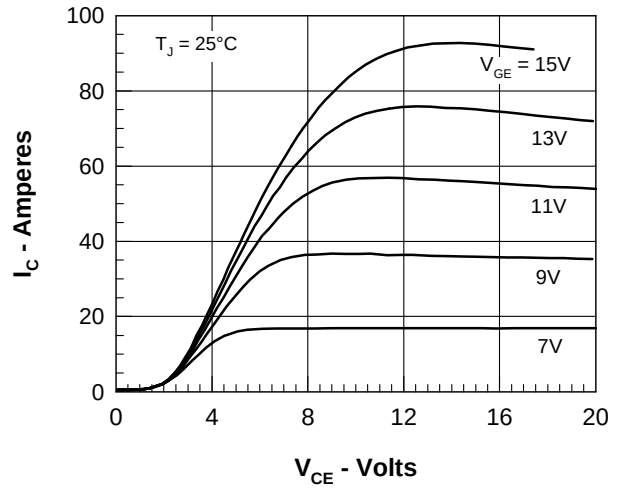


Figure 2. Extended Output Characteristics

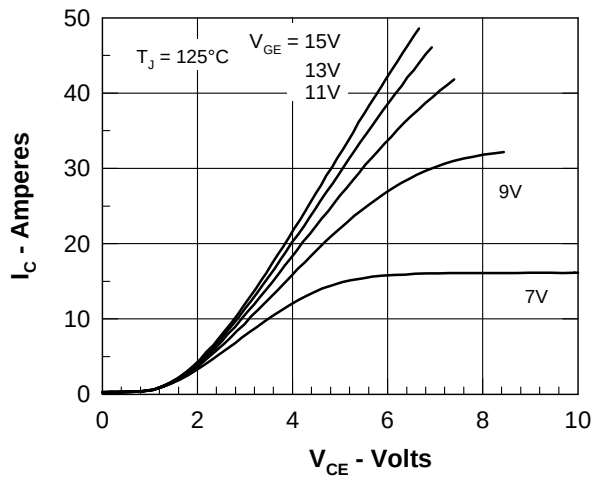


Figure 3. Saturation Voltage Characteristics

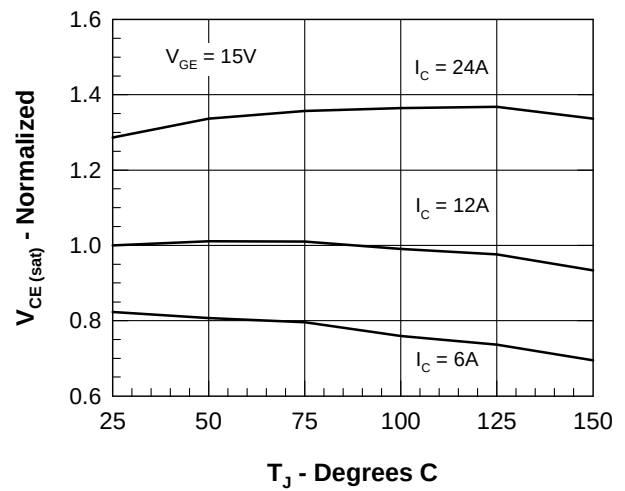


Figure 4. Temperature Dependence of $V_{CE(sat)}$

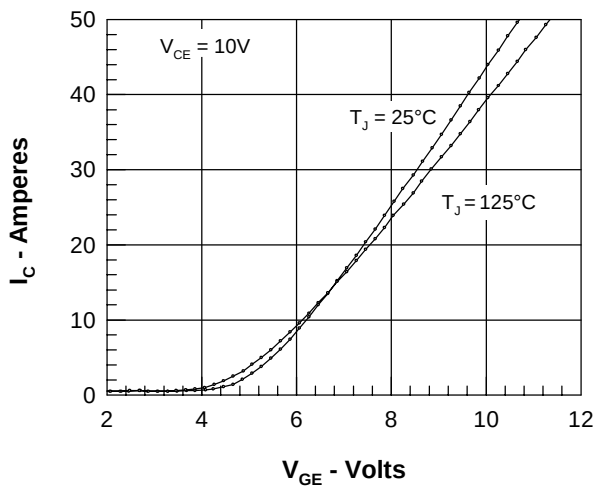


Figure 5. Admittance Curves

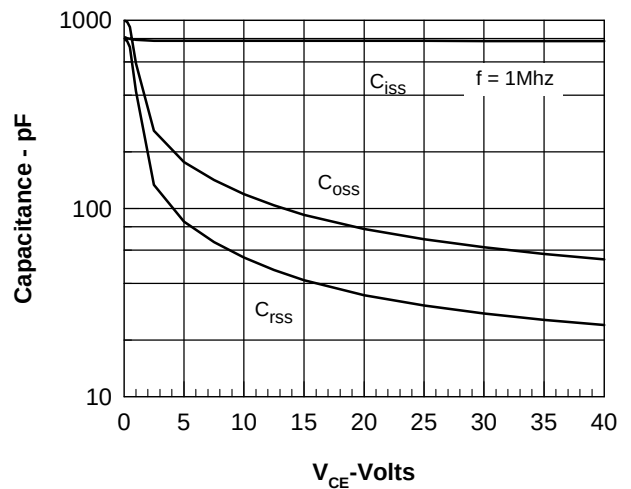


Figure 6. Capacitance Curves

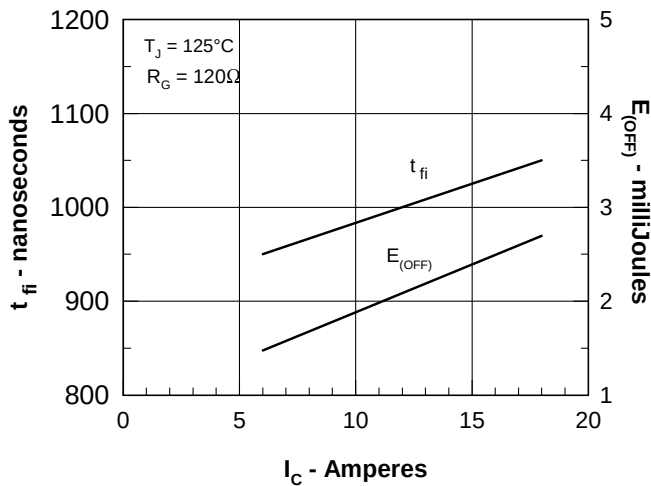


Figure 7. Dependence of t_{fi} and E_{OFF} on I_C .

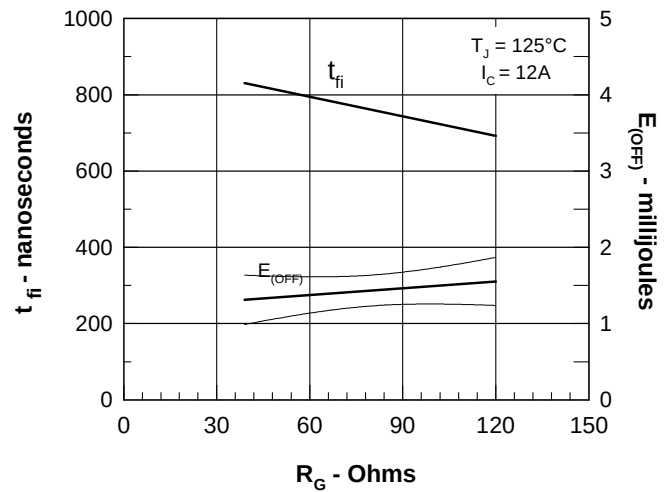


Figure 8. Dependence of t_{fi} and E_{OFF} on R_G .

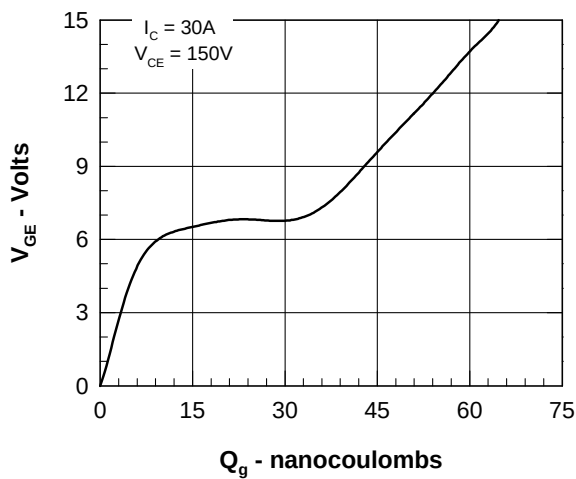


Figure 9. Gate Charge

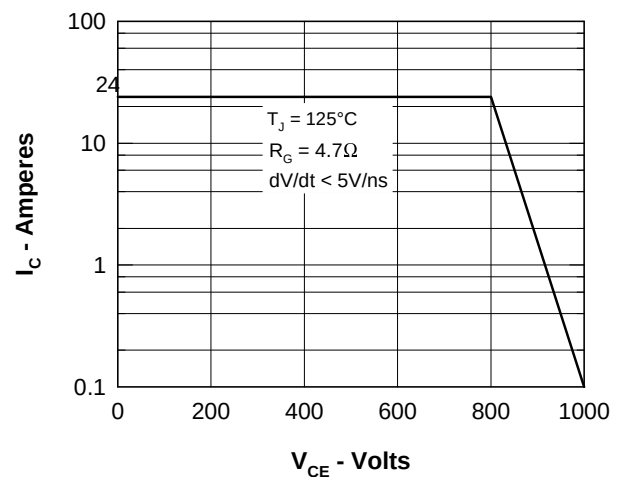


Figure 10. Turn-off Safe Operating Area

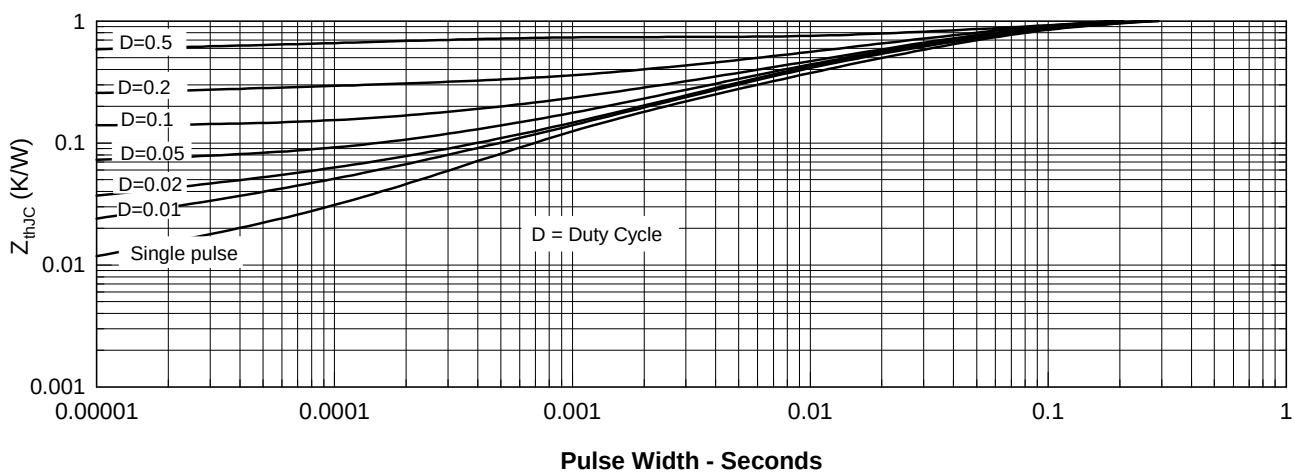


Figure 11. Transient Thermal Resistance

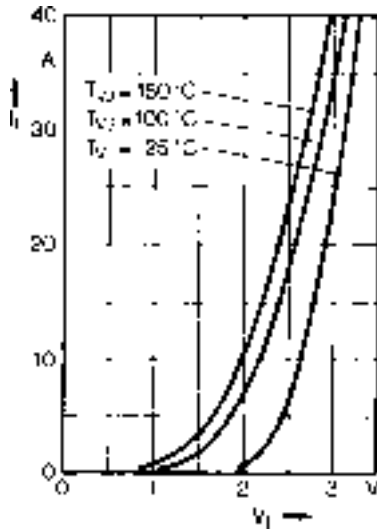


Fig. 12. Forward current versus voltage drop.

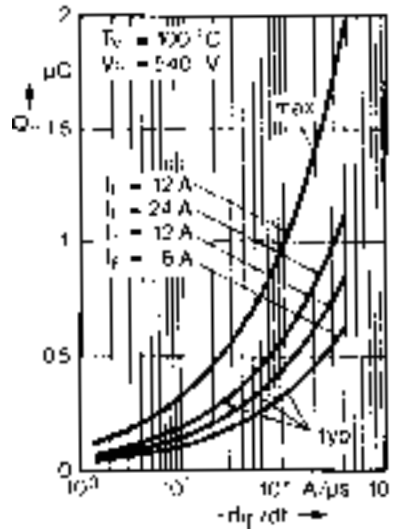


Fig. 13. Recovery charge versus $-di_F/dt$.

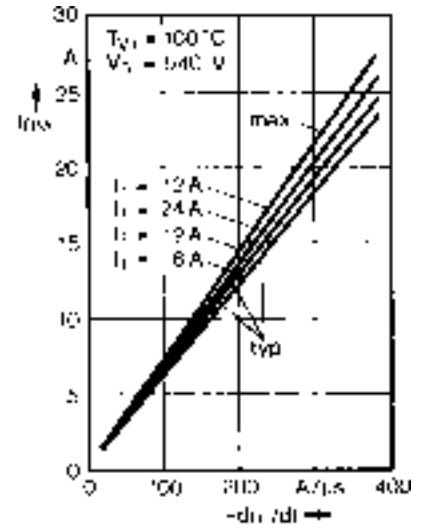


Fig. 14. Peak reverse current versus $-di_F/dt$.

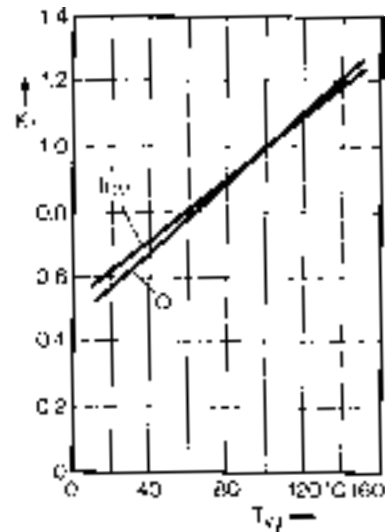


Fig. 15. Dynamic parameters versus junction temperature.

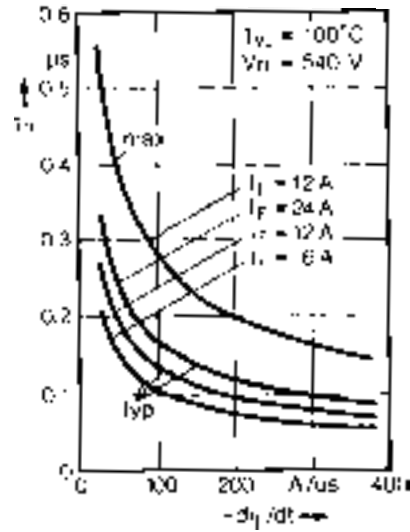


Fig. 16. Reverse recovery time versus $-di_F/dt$.

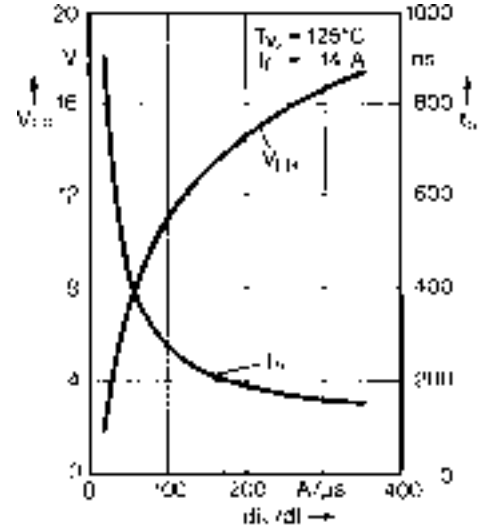


Fig. 17. Forward voltage recovery and time versus $-di_F/dt$.

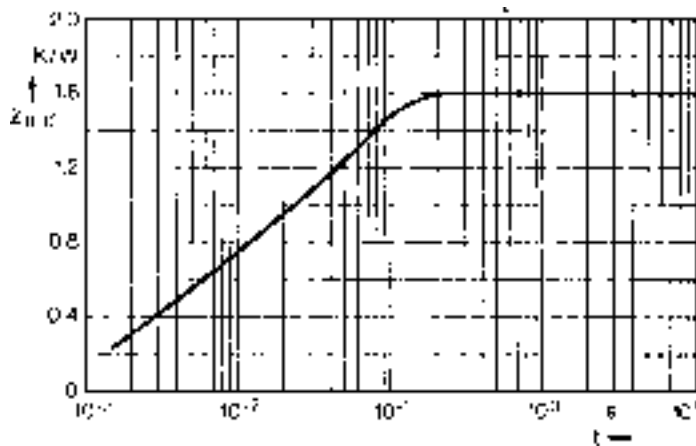


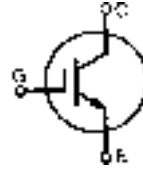
Fig. 18. Transient thermal impedance junction to case.

IGBT

IXGA/IXGP12N100
IXGA/IXGP12N100A

V_{CES}	I_{C25}	$V_{CE(sat)}$
1000 V	24 A	3.5 V
1000 V	24 A	4.0 V

Preliminary Data Sheet

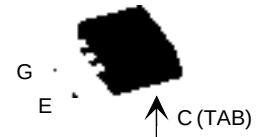


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1000	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 150\ \Omega$ Clamped inductive load, $L = 300\ \mu\text{H}$	$I_{CM} = 24$ @ 0.8 V_{CES}	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight		4	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-220AB (IXGP)



TO-263 (IXGA)



Features

- International standard packages JEDEC TO-220AB and TO-263AA
- Second generation HDMOS™ process
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

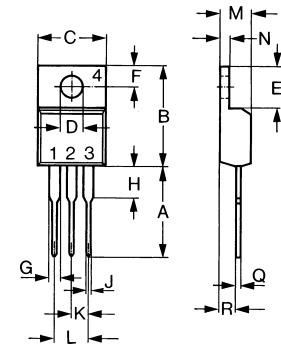
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 3\text{ mA}$, $V_{GE} = 0\text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250\ \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8$, V_{CES} $V_{GE} = 0\text{ V}$			250 μA 1 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}$, $V_{GE} = 15$			3.5 V 4.0 V

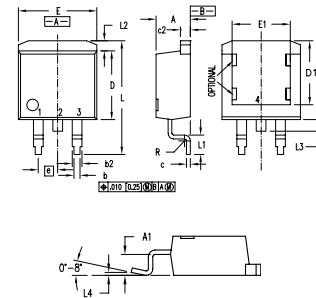
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	6	10	S
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$	65	90	nC
Q_{ge}		8	20	nC
Q_{gc}		24	45	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8\text{ V}_{CES}$, higher T_J or increased R_G	100		ns
t_{ri}		200		ns
$t_{d(off)}$		850	1000	ns
t_{fi}		12N100A 500	700	ns
E_{off}		12N100 800	1000	ns
		12N100A 2.5	4	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 300\text{ }\mu\text{H}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 120\text{ }\Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8\text{ V}_{CES}$, higher T_J or increased R_G	100		ns
t_{ri}		200		ns
E_{on}		1.1		mJ
$t_{d(off)}$		900		ns
t_{fi}		12N100A 950		ns
		12N100 1250		ns
E_{off}		12N100A 4		mJ
		12N100 6		mJ
R_{thJC}			1.25	K/W
R_{thCK}		0.25		K/W

TO-220 AB (IXGP) Outline



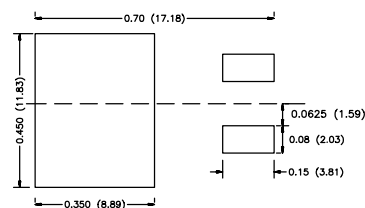
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

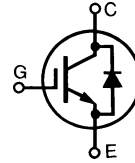
Min. Recommended Footprint



IGBT

Combi Pack

IXGA/IXGP12N100U1
IXGA/IXGP12N100AU1

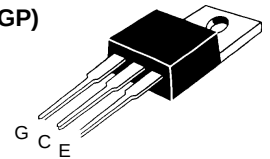


Preliminary Data Sheet

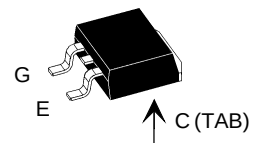
V_{CES}	I_{C25}	$V_{CE(sat)}$
1000 V	24 A	3.5 V
1000 V	24 A	4.0 V

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1000	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	24	A
I_{C90}	$T_C = 90^\circ\text{C}$	12	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	48	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 150\ \Omega$ Clamped inductive load, $L = 300\ \mu\text{H}$	$I_{CM} = 24$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	100	W
T_J		$-55 \dots +150$	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		$-55 \dots +150$	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight		4	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

TO-220AB(IXGP)



TO-263 AA (IXGA)



Features

- International standard packages JEDEC TO-220AB and TO-263AA
- IGBT with antiparallel FRED in one package
- Second generation HDMOS™ process
- Low $V_{CE(sat)}$
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Exptaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

- Easy to mount with one screw
- Space savings (two devices in one package)
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 3\text{ mA}$, $V_{GE} = 0\text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250\ \mu\text{A}$, $V_{GE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = 0.8$, V_{CES} $V_{GE} = 0\text{ V}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		300 μA 3 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}$, $V_{GE} = 15$	12N100 12N100A		3.5 V 4.0 V

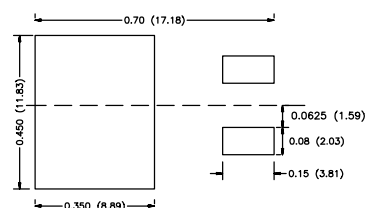
Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10 \text{ V}$, Pulse test, $t \leq 300 \mu\text{s}$, duty cycle $\leq 2 \%$	6	10	S
Q_g	$I_C = I_{C90}; V_{GE} = 15 \text{ V}, V_{CE} = 0.5 V_{CES}$	65	90	nC
Q_{ge}		8	20	nC
Q_{gc}		24	45	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15 \text{ V}, L = 300 \mu\text{H}$ $V_{CE} = 800 \text{ V}, R_G = R_{off} = 120 \Omega$ Remarks: Switching times may increase for $V_{CE} (\text{Clamp}) > 0.8 V_{CES}$, higher T_J or increased R_G	100		ns
t_{ri}		200		ns
$t_{d(off)}$		850	1000	ns
t_{fi}		500	700	ns
E_{off}		800	1000	ns
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}; V_{GE} = 15 \text{ V}, L = 300 \mu\text{H}$ $V_{CE} = 800 \text{ V}, R_G = R_{off} = 120 \Omega$ Remarks: Switching times may increase for $V_{CE} (\text{Clamp}) > 0.8 V_{CES}$, higher T_J or increased R_G	100		ns
t_{ri}		200		ns
E_{on}		1.1		mJ
$t_{d(off)}$		900		ns
t_{fi}		950		ns
E_{off}		1250		ns
		8		mJ
		10		mJ
R_{thJC}			0.25	1.25 K/W
R_{thCK}				K/W

Reverse Diode (FRED)

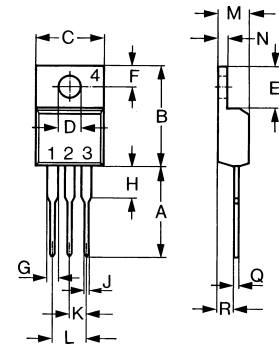
($T_J = 25^\circ\text{C}$, unless otherwise specified)

Symbol	Test Conditions	Min.	Typ.	Max.
V_F	$I_F = 8\text{A}, V_{GE} = 0 \text{ V}$, Pulse test, $t \leq 300 \mu\text{s}$, duty cycle $d \leq 2 \%$			2.75 V
I_{RM}	$I_F = I_{C90}; V_{GE} = 0 \text{ V}, -di_F/dt = 100 \text{ A}/\mu\text{s}$		6.5	A
t_{rr}	$V_R = 100 \text{ V}, T_J = 125^\circ\text{C}$		140	ns
	$I_F = 1 \text{ A}, -di_F/dt = 50 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}, T_J = 25^\circ\text{C}$		50	60 ns
R_{thJC}				2.5 K/W

Min. Recommended Footprint

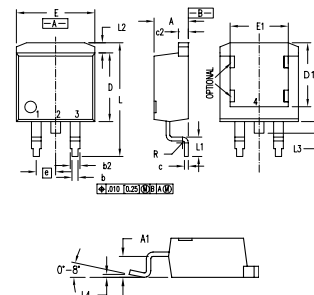


TO-220 AB (IXGP) Outline



Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	12.70 13.97	0.500 0.550
B	14.73 16.00	0.580 0.630
C	9.91 10.66	0.390 0.420
D	3.54 4.08	0.139 0.161
E	5.85 6.85	0.230 0.270
F	2.54 3.18	0.100 0.125
G	1.15 1.65	0.045 0.065
H	2.79 5.84	0.110 0.230
J	0.64 1.01	0.025 0.040
K	2.54 BSC	0.100 BSC
M	4.32 4.82	0.170 0.190
N	1.14 1.39	0.045 0.055
Q	0.35 0.56	0.014 0.022
R	2.29 2.79	0.090 0.110

TO-263 AA (IXGA) Outline



Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	4.06 4.83	.160 .190
A1	2.03 2.79	.080 .110
b	0.51 0.99	.020 .039
b2	1.14 1.40	.045 .055
c	0.46 0.74	.018 .029
c2	1.14 1.40	.045 .055
D	8.64 9.65	.340 .380
D1	7.11 8.13	.280 .320
E	9.65 10.29	.380 .405
E1	6.86 8.13	.270 .320
e	2.54 BSC	.100 BSC
L	14.61 15.88	.575 .625
L1	2.29 2.79	.090 .110
L2	1.02 1.40	.040 .055
L3	1.27 1.78	.050 .070
L4	0 0.38	0 .015
R	0.46 0.74	.018 .029

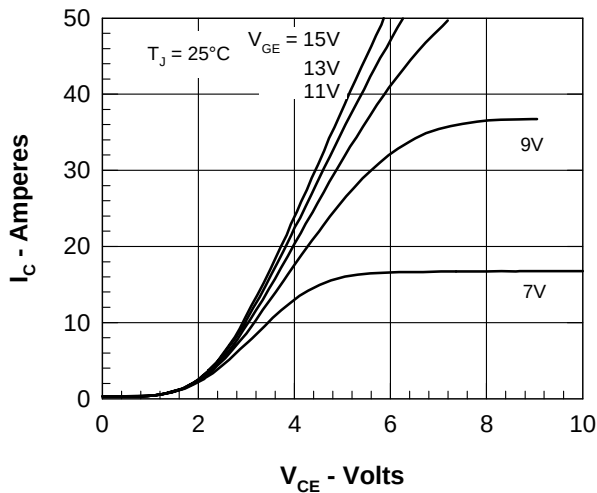


Figure 1. Saturation Voltage Characteristics

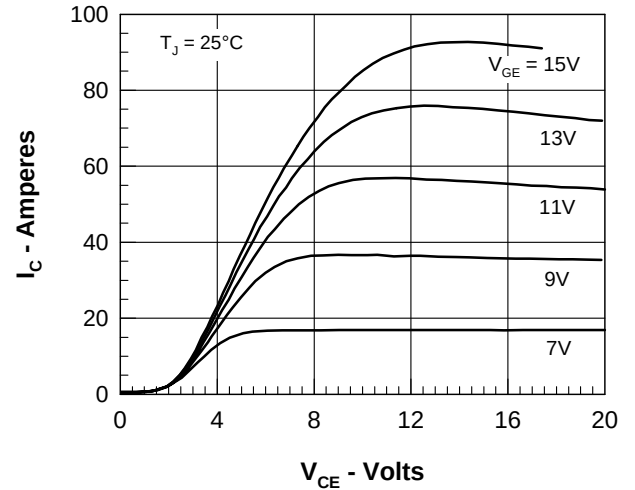


Figure 2. Extended Output Characteristics

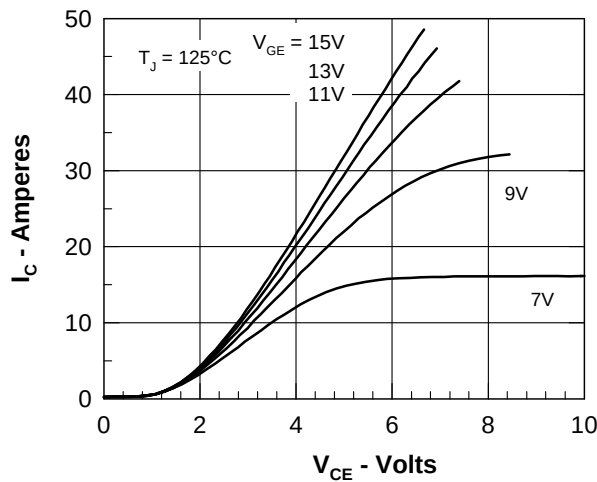


Figure 3. Saturation Voltage Characteristics

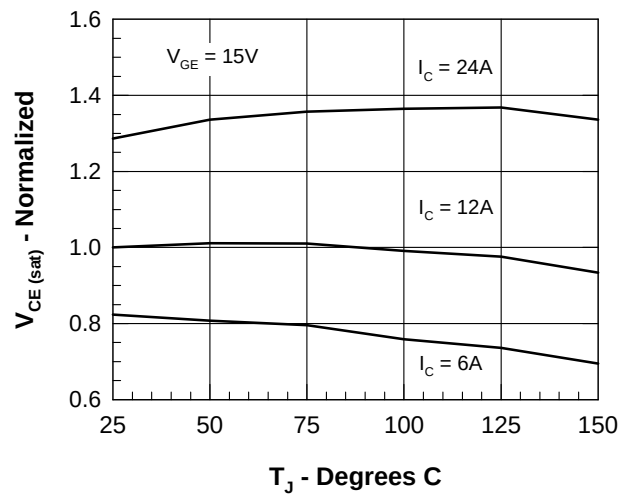
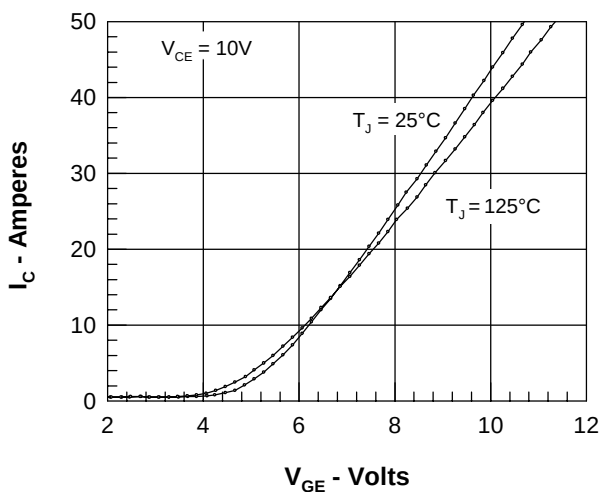

Figure 4. Temperature Dependence of $V_{CE(sat)}$


Figure 5. Admittance Curves

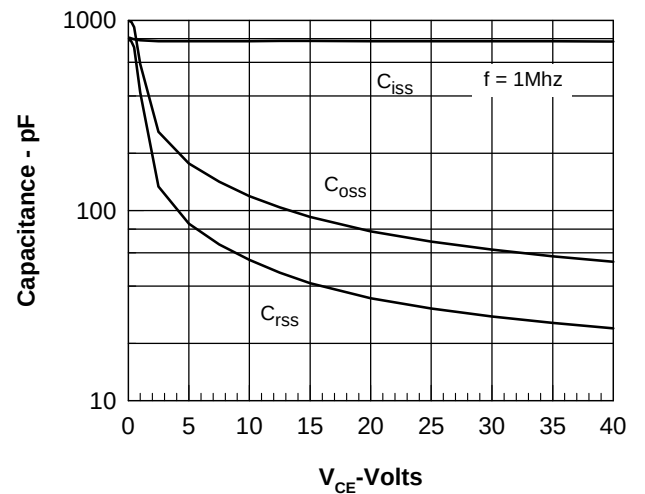


Figure 6. Capacitance Curves

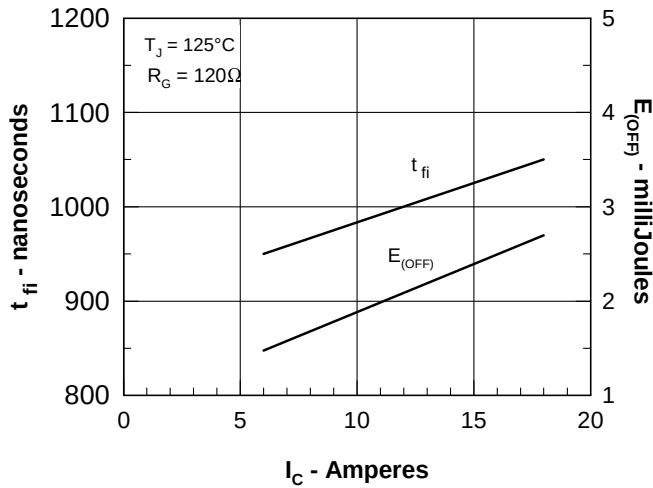


Figure 7. Dependence of t_{fi} and E_{OFF} on I_C .

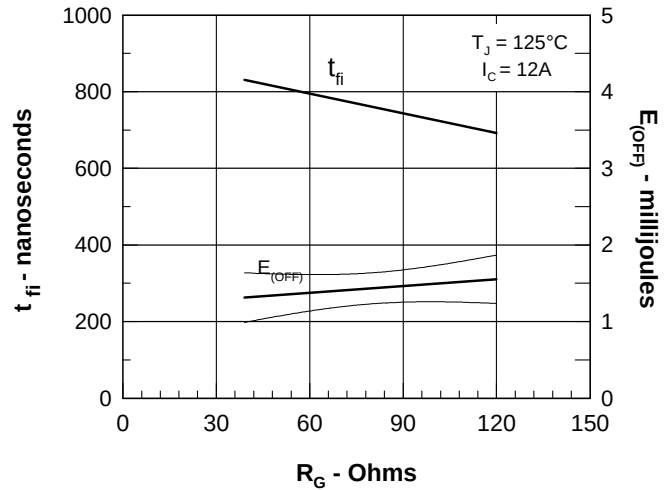


Figure 8. Dependence of t_{fi} and E_{OFF} on R_G .

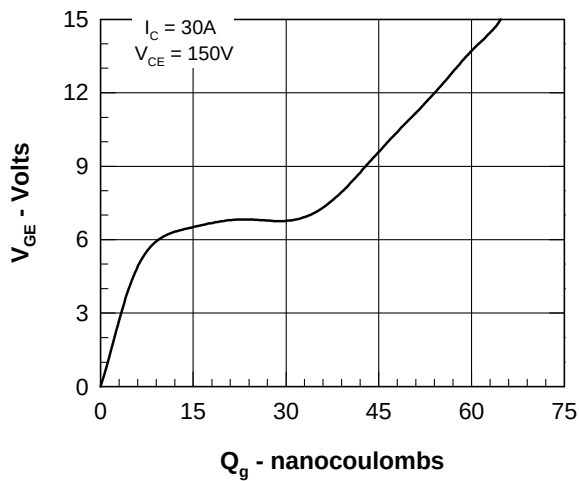


Figure 9. Gate Charge

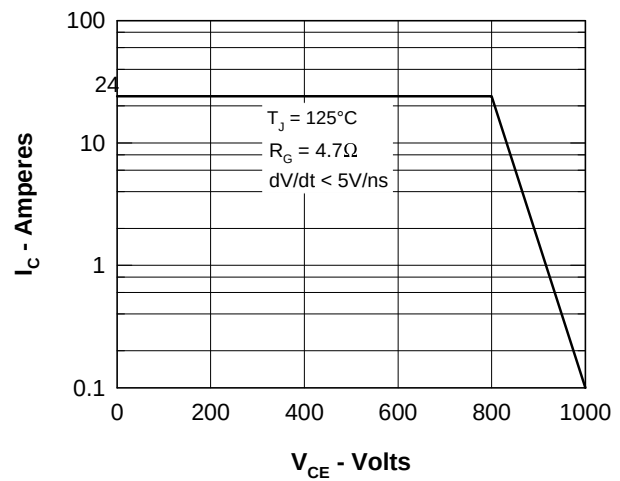


Figure 10. Turn-off Safe Operating Area

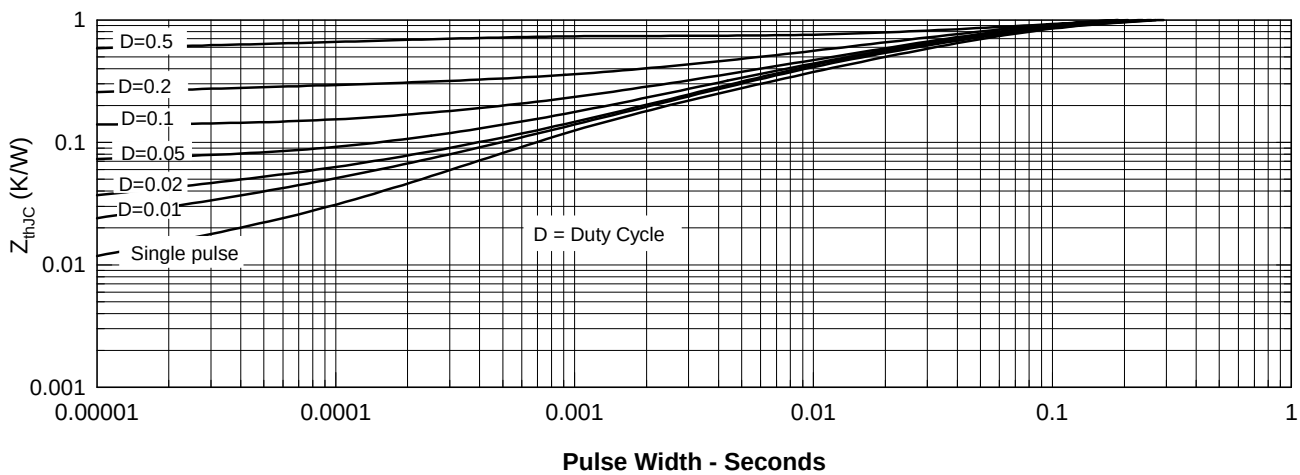


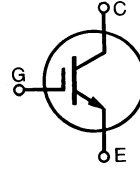
Figure 11. Transient Thermal Resistance

IGBT

Lightspeed Series

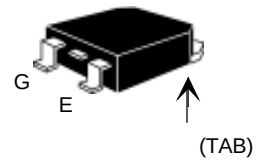
IXGH 15N100C
IXGT 15N100C

$V_{CES} = 1000 \text{ V}$
 $I_{C25} = 30 \text{ A}$
 $V_{CE(sat)} = 3.5 \text{ V}$

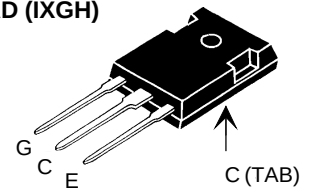


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1000	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	30	A
I_{C90}	$T_C = 90^\circ\text{C}$	15	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	60	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3) (TO-247)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-268
(IXGT)



TO-247 AD (IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface and
JEDEC TO-247 AD
- Low switching losses
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode
power supplies

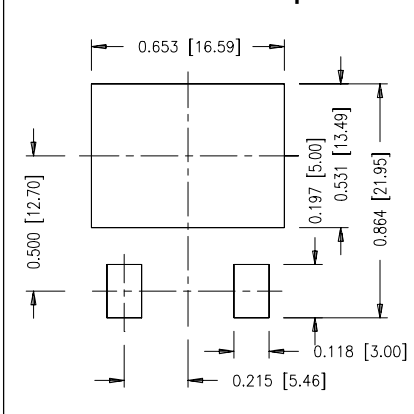
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw,
(isolated mounting screw hole)

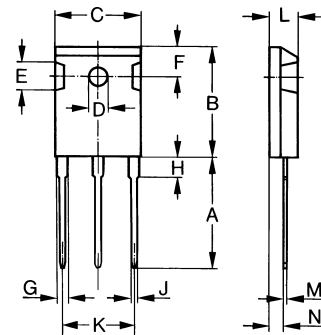
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			100 μA 3.0 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$ $T_J = 125^\circ\text{C}$	2.6		3.5 V V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	16	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1720	pF
C_{oes}			95	pF
C_{res}			35	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		73	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			15	ns
$t_{d(off)}$		150	200	ns
t_{fi}		101	160	ns
E_{off}		0.85	1.40	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			18	ns
E_{on}		0.60		mJ
$t_{d(off)}$		220		ns
t_{fi}		210		ns
E_{off}		1.85		mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

Min. Recommended Footprint

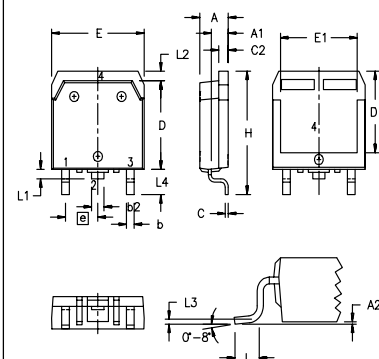


TO-247 AD (IXGH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

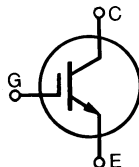
IGBT

IXGA 15N100C

IXGP 15N100C

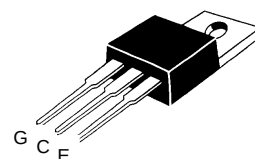
 $V_{CES} = 1000 \text{ V}$ $I_{C25} = 30 \text{ A}$ $V_{CE(sat)} = 3.5 \text{ V}$ $t_{fi(typ)} = 115 \text{ ns}$

Lightspeed Series

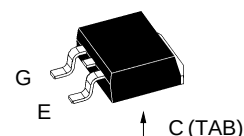


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1000	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	30	A
I_{C90}	$T_C = 90^\circ\text{C}$	15	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	60	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight	TO-220 TO-263	4 2	g

TO-220AB (IXGP)



TO-263 AA (IXGA)



Features

- International standard packages JEDEC TO-220AB and TO-263AA
- Low switching losses
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

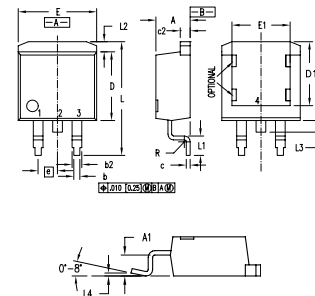
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$	$T_J = 25^\circ\text{C}$		100 μA
		$T_J = 125^\circ\text{C}$		3.0 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15$	$T_J = 125^\circ\text{C}$		3.5 V
		2.6		V

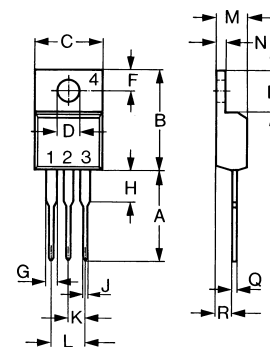
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	16	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1720	pF
C_{oes}			95	pF
C_{res}			35	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		73	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 960\text{ V}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8\text{ V}_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			15	ns
$t_{d(off)}$			150	200
t_{fi}			101	160
E_{off}			0.85	1.40
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 960\text{ V}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8\text{ V}_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			18	ns
E_{on}			0.60	mJ
$t_{d(off)}$			220	ns
t_{fi}			210	ns
E_{off}			1.85	mJ
R_{thJC}				0.83 K/W
R_{thCK}	TO-220		0.5	K/W

TO-263 AA (IXGA) Outline



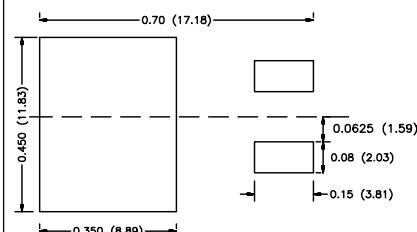
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

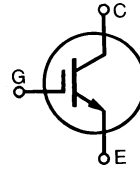
Min. Recommended Footprint



IGBT

IXGH 20N100
IXGT 20N100

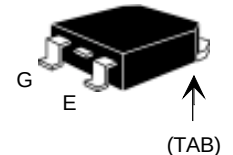
$$\begin{aligned} V_{CES} &= 1000 \text{ V} \\ I_{C25} &= 40 \text{ A} \\ V_{CE(sat)} &= 3.0 \text{ V} \\ t_{fi(typ)} &= 280 \text{ ns} \end{aligned}$$



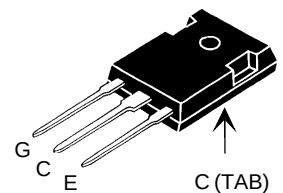
Preliminary data

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1000	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 47 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g
		TO-268	4 g

TO-268
(IXGT)



TO-247 AD (IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-268 surface and JEDEC TO-247 AD
- High current handling capability
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- Capacitor discharge

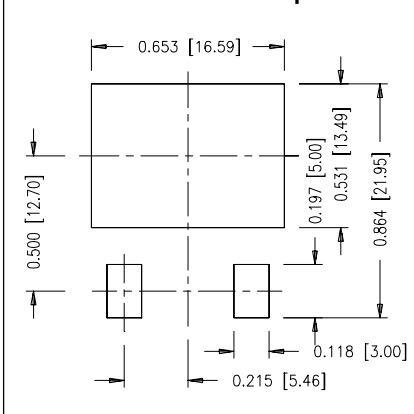
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw, (isolated mounting screw hole)

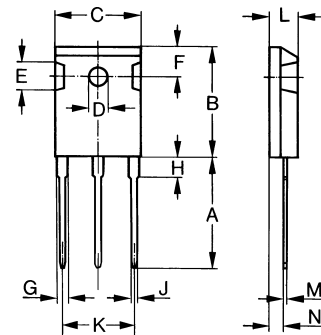
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1 \text{ mA}$, $V_{GE} = 0 \text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			250 μA 1 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$	2.2	3.0	V

Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	16	S
$I_{C(ON)}$	$V_{GE} = 10\text{ V}$, $V_{CE} = 10\text{ V}$		90	A
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1750	pF
C_{oes}			100	pF
C_{res}			38	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		73	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 47\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		30	ns
t_{ri}			30	ns
$t_{d(off)}$			350	700 ns
t_{fi}			280	700 ns
E_{off}			3.5	8.0 mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 47\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		30	ns
t_{ri}			30	ns
E_{on}			0.65	mJ
$t_{d(off)}$			700	ns
t_{fi}			520	ns
E_{off}			6.5	mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

Min. Recommended Footprint

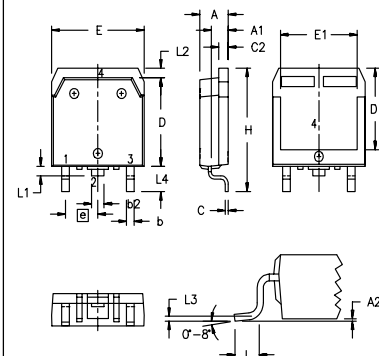


TO-247 AD (IXGH) Outline



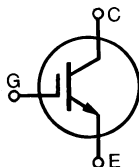
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



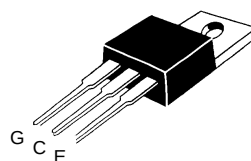
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.075 .083
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

IGBT

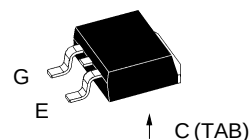
IXGA 20N100
IXGP 20N100
 $V_{CES} = 1000 \text{ V}$
 $I_{C25} = 40 \text{ A}$
 $V_{CE(sat)} = 3.0 \text{ V}$


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1000	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1000	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	80	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 47 \Omega$ Clamped inductive load, $L = 300 \mu\text{H}$	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight	TO-220	4	g
	TO-263	2	g

TO-220AB (IXGP)



TO-263 AA (IXGA)



Features

- International standard packages
JEDEC TO-220AB and TO-263AA
- High current handling capability
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode
power supplies
- Capacitor discharge

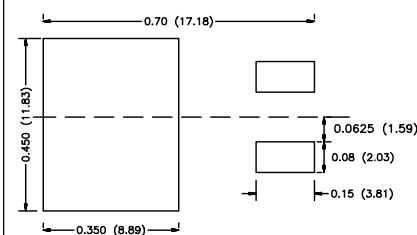
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- High power density

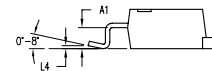
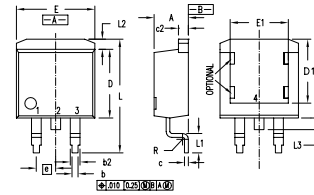
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 1 \text{ mA}, V_{GE} = 0 \text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.0 V
I_{CES}	$V_{CE} = V_{CES}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		250 μA
	$V_{GE} = 0 \text{ V}$			1 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15$	2.2		3.0 V

Symbol	Test Conditions ($T_j = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	16	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1750	pF
C_{oes}			100	pF
C_{res}			38	pF
$I_{C(ON)}$	$V_{GE} = 10\text{ V}$, $V_{CE} = 10\text{ V}$		90	A
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		73	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 47\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 V_{CES}$, higher T_j or increased R_G		30	ns
t_{ri}			30	ns
$t_{d(off)}$			350	700 ns
t_{fi}			280	700 ns
E_{off}			3.5	8.0 mJ
$t_{d(on)}$			30	ns
t_{ri}	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$, $R_G = R_{off} = 47\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 V_{CES}$, higher T_j or increased R_G		30	ns
E_{on}			0.65	mJ
$t_{d(off)}$			700	ns
t_{fi}			520	ns
E_{off}			6.5	mJ
R_{thJC}				0.83 K/W
R_{thCK}	TO-220		0.5	K/W

Min. Recommended Footprint

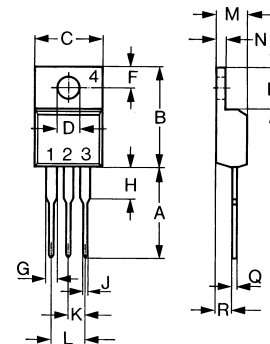


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

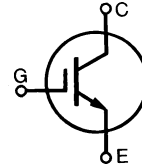
IGBT

Lightspeed Series

IXGH 15N120C
IXGT 15N120C

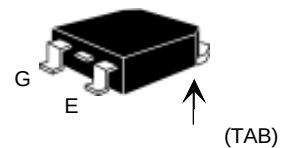
$V_{CES} = 1200 \text{ V}$
 $I_{C25} = 30 \text{ A}$
 $V_{CE(sat)} = 3.8 \text{ V}$
 $t_{fi(typ)} = 115 \text{ ns}$

Preliminary data

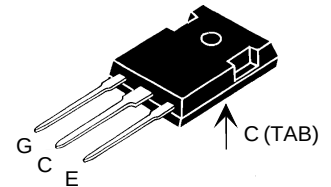


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	30	A
I_{C90}	$T_C = 90^\circ\text{C}$	15	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	60	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_c	$T_C = 25^\circ\text{C}$	150	W
T_J		$-55 \dots +150$	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		$-55 \dots +150$	$^\circ\text{C}$
Maximum Lead temperature for soldering		300	$^\circ\text{C}$
1.6 mm (0.062 in.) from case for 10 s			
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

TO-268 (IXGT)



TO-247 AD (IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface and
JEDEC TO-247 AD
- Low switching losses
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode
power supplies

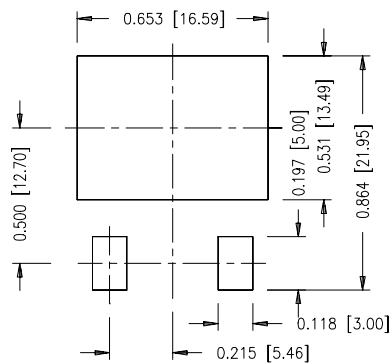
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw,
(mounting screw hole)

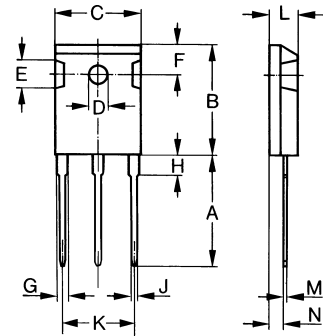
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$ $V_{GE} = 0 \text{ V}, T_J = 125^\circ\text{C}$			100 μA 3.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$ $T_J = 125^\circ\text{C}$	3.0		3.8 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	15	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1720	pF
C_{oes}			95	pF
C_{res}			35	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		69	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			15	ns
$t_{d(off)}$			150	ns
t_{fi}			115	ns
E_{off}			1.05	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			18	ns
E_{on}			0.60	mJ
$t_{d(off)}$			220	ns
t_{fi}			250	ns
E_{off}			2.1	mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

Min. Recommended Footprint

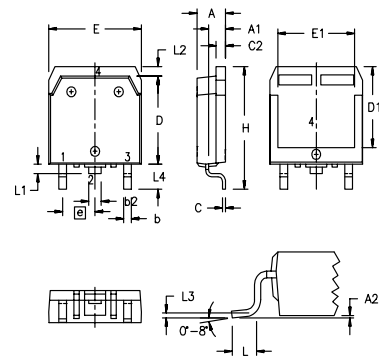


TO-247 AD (IXGH) Outline



Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



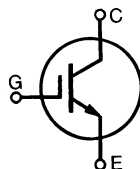
Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

IGBT

Lightspeed Series

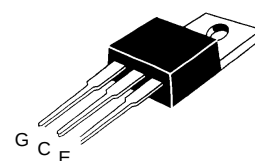
IXGA 15N120C

IXGP 15N120C

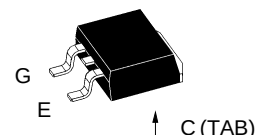
 $V_{CES} = 1200 \text{ V}$ $I_{C25} = 30 \text{ A}$ $V_{CE(sat)} = 3.8 \text{ V}$ $t_{fi(typ)} = 115 \text{ ns}$ 

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	30	A
I_{C90}	$T_C = 90^\circ\text{C}$	15	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	60	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight	TO-220 TO-263	4 2	g

TO-220AB (IXGP)



TO-263 AA (IXGA)



Features

- International standard packages
JEDEC TO-220AB and TO-263AA
- Low switching losses
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

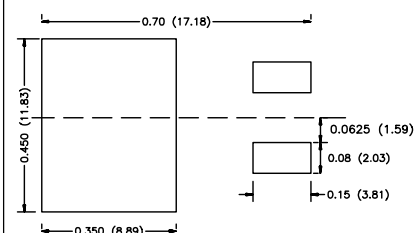
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- High power density

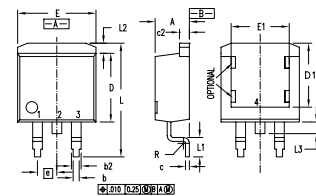
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		100 μA
	$V_{GE} = 0 \text{ V}$			3.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15$ $T_J = 125^\circ\text{C}$	3.0		V

Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10 \text{ V}$, Pulse test, $t \leq 300 \mu\text{s}$, duty cycle $\leq 2 \%$	12	15	S
C_{ies}	$V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$		1720	pF
C_{oes}			95	pF
C_{res}			35	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$, $V_{CE} = 0.5 V_{CES}$		69	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$ $V_{CE} = 960 \text{ V}$, $R_G = R_{off} = 10 \Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G	25		ns
t_{ri}		15		ns
$t_{d(off)}$		150	200	ns
t_{fi}		115	190	ns
E_{off}		1.05	1.6	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$ $V_{CE} = 960 \text{ V}$, $R_G = R_{off} = 10 \Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 V_{CES}$, higher T_J or increased R_G	25		ns
t_{ri}		18		ns
E_{on}		0.60		mJ
$t_{d(off)}$		220		ns
t_{fi}		250		ns
E_{off}		2.1		mJ
R_{thJC}	TO-220		0.83	K/W
R_{thCK}		0.5		K/W

Min. Recommended Footprint

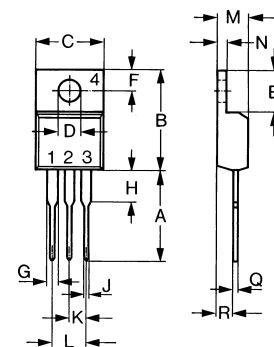


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline

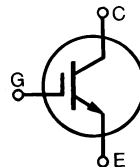


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

HiPerFAST™ IGBT

IXGH 15N120B
IXGT 15N120B

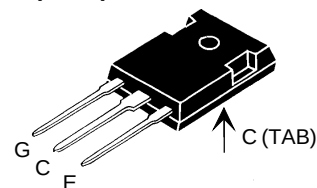
$V_{CES} = 1200 \text{ V}$
 $I_{C25} = 30 \text{ A}$
 $V_{CE(sat)} = 3.2 \text{ V}$
 $t_{fi(typ)} = 160 \text{ ns}$



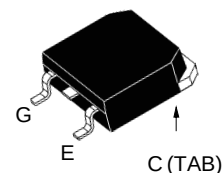
Preliminary data

Symbol	Test Conditions	Maximum Ratings		
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V	
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1200	V	
V_{GES}	Continuous	± 20	V	
V_{GEM}	Transient	± 30	V	
I_{C25}	$T_C = 25^\circ\text{C}$	30	A	
I_{C90}	$T_C = 90^\circ\text{C}$	15	A	
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	60	A	
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A	
P_C	$T_C = 25^\circ\text{C}$	150	W	
T_J		-55 ... +150	$^\circ\text{C}$	
T_{JM}		150	$^\circ\text{C}$	
T_{stg}		-55 ... +150	$^\circ\text{C}$	
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$	
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$	
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.		
Weight		TO-247 AD	6	g
		TO-268	4	g

TO-247 AD (IXGH)



TO-268 (IXGT)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-268 surface and JEDEC TO-247 AD
- Low switching losses, low $V_{(sat)}$
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

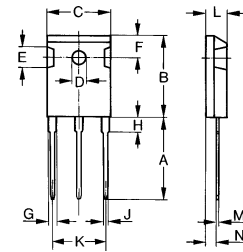
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw, (isolated mounting screw hole)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 250 \mu\text{A}, V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}, V_{GE} = 0 \text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			100 μA 3.5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$ $T_J = 125^\circ\text{C}$	2.5		3.2 V

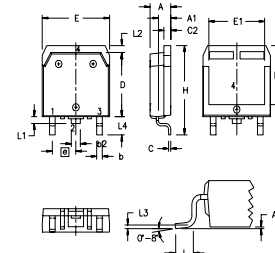
Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	15	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1720	pF
C_{oes}			95	pF
C_{res}			35	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		69	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		25	ns
t_{ri}			15	ns
$t_{d(off)}$		180	280	ns
t_{fi}		160	320	ns
E_{off}		1.75	3.0	mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		25	ns
t_{ri}			18	ns
E_{on}			0.60	mJ
$t_{d(off)}$		300		ns
t_{fi}		360		ns
E_{off}		3.5		mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)	0.25		K/W

TO-247 AD (IXGH) Outline



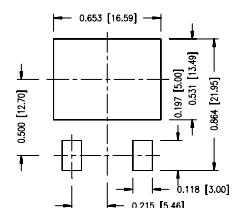
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

Min.
Recommended
Footprint

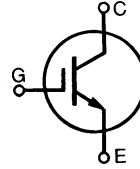


HiPerFAST™ IGBT

IXGA 15N120B
IXGP 15N120B

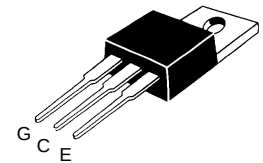
$V_{CES} = 1200\text{ V}$
 $I_{C25} = 30\text{ A}$
 $V_{CE(sat)} = 3.2\text{ V}$
 $t_{fi(typ)} = 160\text{ ns}$

Preliminary data

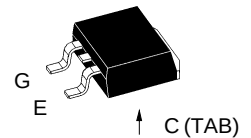


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1\text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	30	A
I_{C90}	$T_C = 90^\circ\text{C}$	15	A
I_{CM}	$T_C = 25^\circ\text{C}, 1\text{ ms}$	60	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10\ \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
M_d	Mounting torque with screw M3 Mounting torque with screw M3.5	0.45/4 0.55/5	Nm/lb.in.
Weight	TO-220 TO-263	4 2	g

TO-220AB (IXGP)



TO-263 AA (IXGA)



Features

- International standard packages JEDEC TO-220AB and TO-263AA
- Low switching losses, low $V_{(sat)}$
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

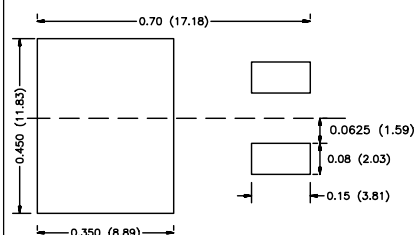
Advantages

- Easy to mount with one screw
- Reduces assembly time and cost
- High power density

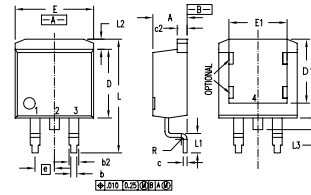
Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 250\ \mu\text{A}, V_{GE} = 0\text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 250\ \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$			100 μA
	$V_{GE} = 0\text{ V}, T_J = 125^\circ\text{C}$			3.5 mA
I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{CE90}, V_{GE} = 15$ $T_J = 125^\circ\text{C}$		2.5	3.2 V V

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$, unless otherwise specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	15	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1720	pF
C_{oes}			95	pF
C_{res}			35	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		69	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 960\text{ V}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			15	ns
$t_{d(off)}$			180	ns
t_{fi}			160	ns
E_{off}			1.75	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 960\text{ V}$, $R_G = R_{off} = 10\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 V_{CES}$, higher T_J or increased R_G		25	ns
t_{ri}			18	ns
E_{on}			0.60	mJ
$t_{d(off)}$			300	ns
t_{fi}			360	ns
E_{off}			3.5	mJ
R_{thJC}	TO-220			0.83 K/W
R_{thCK}			0.5	K/W

Min. Recommended Footprint

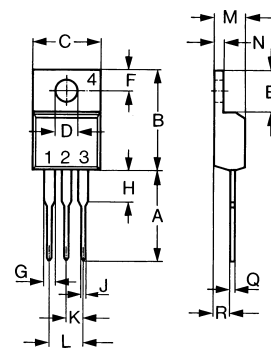


TO-263 AA (IXGA) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

TO-220 AB (IXGP) Outline



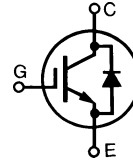
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

Low $V_{CE(sat)}$ IGBT with Diode High Speed IGBT with Diode

IXGH/IXGT 15N120BD1
IXGH/IXGT 15N120CD1

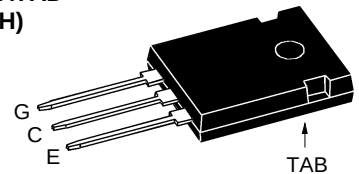
V_{DSS}	I_{C25}	$V_{CE(sat)}$
1200 V	30 A	3.2 V
1200 V	30 A	3.8 V

Preliminary data

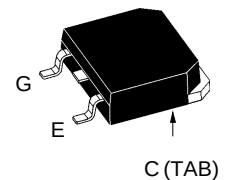


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1200	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	30	A
I_{C90}	$T_C = 90^\circ\text{C}$	15	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	60	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_J = 125^\circ\text{C}$, $R_G = 10\ \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum tab temperature soldering SMD devices for 10s		260	$^\circ\text{C}$
Weight	TO-247AD/TO-268	6/4	g

TO-247AD
(IXGH)



TO-268
(IXGT)



G = Gate
E = Emitter

C = Collector
TAB = Collector

Features

- International standard packages: JEDEC TO-247AD & TO-268
- IGBT and anti-parallel FRED in one package
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Exptaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

- Saves space (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost

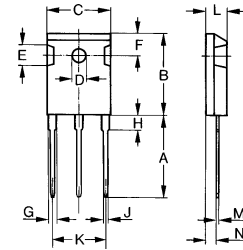
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1\text{ A}$, $V_{GE} = 0\text{ V}$	1000		V
$V_{GE(th)}$	$I_C = 250\ \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0\text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		2	500 μA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ Note 2			3.2 V 3.8 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Note 2.	12	15	S
C_{ies}			1700	pF
C_{oes}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		155	pF
C_{res}			38	pF
Q_g			69	nC
Q_{ge}	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$; $R_G = R_{off} = 10\ \Omega$ Note 1.		25	ns
t_{ri}			15	ns
$t_{d(off)}$			150	ns
t_{fi}		15N120BD1	160	ns
		15N120CD1	115	ns
E_{off}		15N120BD1	1.75	mJ
		15N120CD1	1.05	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$; $R_G = R_{off} = 10\ \Omega$ Note 1		25	ns
t_{ri}			18	ns
E_{on}			1.5	mJ
$t_{d(off)}$		15N120BD1	270	ns
t_{fi}		15N120CD1	360	ns
		15N120BD1	250	mJ
		15N120BD1	3.5	mJ
		15N120CD1	2.1	mJ
R_{thJC}				0.83 K/W
R_{thCK}	TO-247		0.25	K/W

Reverse Diode (FRED)		Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = 20\text{ A}$, $V_{GE} = 0\text{ V}$ $I_F = 20\text{ A}$, $V_{GE} = 0\text{ V}$, $T_J = 125^\circ\text{C}$	2.6	2.8	V
I_F	$T_C = 25^\circ\text{C}$ $T_C = 90^\circ\text{C}$		33	V
I_{RM}	$I_F = 20\text{ A}$; $-di_F/dt = 400\text{ A}/\mu\text{s}$, $V_R = 600\text{ V}$	15		A
t_{rr}	$V_{GE} = 0\text{ V}$; $T_J = 125^\circ\text{C}$	200		ns
t_{rr}	$I_F = 1\text{ A}$; $-di_F/dt = 100\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$, $V_{GE} = 0\text{ V}$	40		ns
R_{thJC}				1.6 K/W

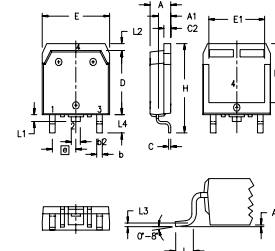
- Notes:
- Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G .
 - Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $d \leq 2\%$

TO-247 AD (IXGH) Outline

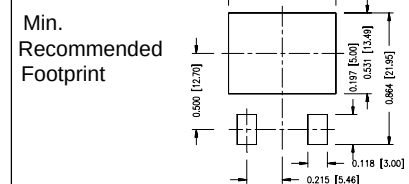


Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-268AA (D³ PAK)



Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L ₁	1.20	1.40	.047	.055
L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC	
L ₄	3.80	4.10	.150	.161

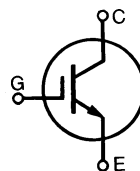


IGBT

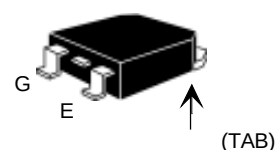
High Voltage, Low $V_{CE(sat)}$

IXGH 20N120

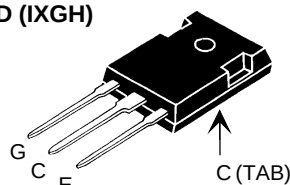
IXGT 20N120

 $V_{CES} = 1200\text{ V}$ $I_{C25} = 40\text{ A}$ $V_{CE(sat)} = 2.5\text{ V}$ $t_{fi(typ)} = 380\text{ ns}$ 

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1200	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	40	A
I_{C90}	$T_C = 90^\circ\text{C}$	20	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	80	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 47\text{ }\Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	150	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g
		TO-268	4 g

TO-268
(IXGT)

TO-247 AD (IXGH)

G = Gate,
E = Emitter,C = Collector,
TAB = Collector

Features

- International standard packages JEDEC TO-268 surface and JEDEC TO-247 AD
- High current handling capability
- MOS Gate turn-on - drive simplicity
- Molding epoxies meet UL 94 V-0 flammability classification

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- Capacitor discharge

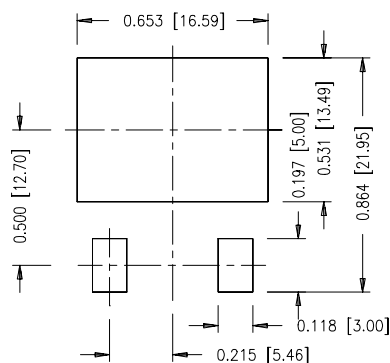
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw, (isolated mounting screw hole)

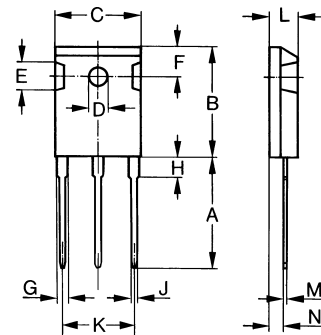
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1\text{ mA}$, $V_{GE} = 0\text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 250\text{ }\mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0\text{ V}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$			250 μA 1 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$	2.0	2.5	V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	12	16	S
$I_{C(ON)}$	$V_{GE} = 10\text{ V}$, $V_{CE} = 10\text{ V}$		90	A
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		1750	pF
C_{oes}			90	pF
C_{res}			31	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		63	nC
Q_{ge}			13	nC
Q_{gc}			26	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 47\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		28	ns
t_{ri}			20	ns
$t_{d(off)}$			400	800 ns
t_{fi}			380	700 ns
E_{off}			6.5	10.5 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\text{ }\mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 47\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		30	ns
t_{ri}			27	ns
E_{on}			0.90	mJ
$t_{d(off)}$			700	ns
t_{fi}			550	ns
E_{off}			9.5	mJ
R_{thJC}				0.83 K/W
R_{thCK}	(TO-247)		0.25	K/W

Min. Recommended Footprint

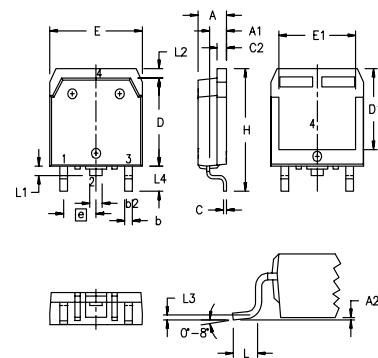


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

HiPerFAST™ IGBT

IXGH 35N120B

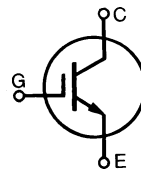
IXGT 35N120B

$V_{CES} = 1200\text{ V}$

$I_{C2} = 70\text{ A}$

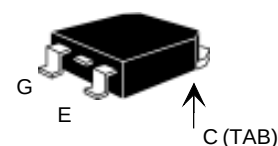
$V_{CE(sat)} = 3.3\text{ V}$

$t_{fi(typ)} = 160\text{ ns}$

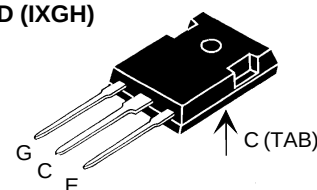


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1200	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	70	A
I_{C90}	$T_C = 90^\circ\text{C}$	35	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	140	A
SSOA (RBSOA)	$V_{GE} = 15\text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 5\ \Omega$ Clamped inductive load	$I_{CM} = 90$ @ 0.8 V_{CES}	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		$-55 \dots +150$	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		$-55 \dots +150$	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g
		TO-268	4 g

TO-268 (IXGT)



TO-247 AD (IXGH)



G = Gate, C = Collector,
E = Emitter, TAB = Collector

Features

- International standard packages JEDEC TO-268 and JEDEC TO-247 AD
- Low switching losses, low $V_{(sat)}$
- MOS Gate turn-on - drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies

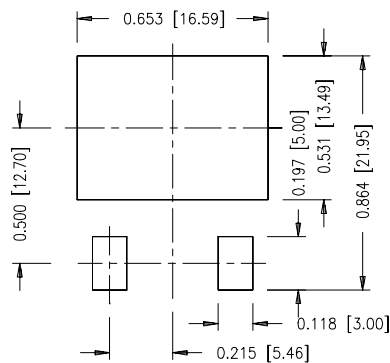
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw, (isolated mounting screw hole)

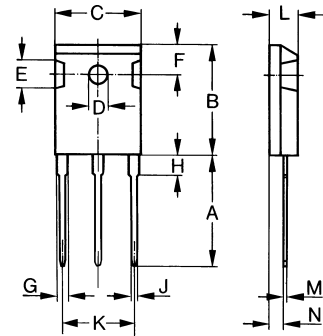
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1\text{ mA}$, $V_{GE} = 0\text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 750\ \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0\text{ V}$			250 μA 5 mA
I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			$\pm 100\text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$		2.7	3.3 V V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	30	40	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4620	pF
C_{oes}			260	pF
C_{res}			90	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5\text{ V}_{CES}$		170	nC
Q_{ge}			28	nC
Q_{gc}			57	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 5\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50	ns
t_{ri}			27	ns
$t_{d(off)}$			180	ns
t_{fi}			160	ns
E_{off}			3.8	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8\text{ V}_{CES}$, $R_G = R_{off} = 5\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		55	ns
t_{ri}			31	ns
E_{on}			2.6	mJ
$t_{d(off)}$			300	ns
t_{fi}			360	ns
E_{off}			8.0	mJ
R_{thJC}				0.42 K/W
R_{thCK}	(TO-247) (TO-268)		0.25 0.3	K/W K/W

Min. Recommended Footprint

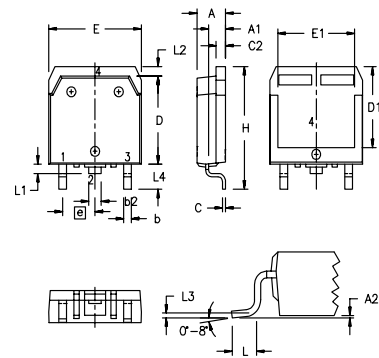


TO-247 AD (IXGH) Outline



Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

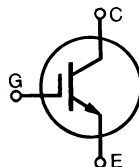
TO-268AA (D³ PAK)



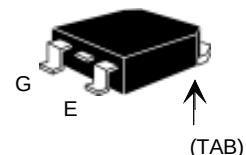
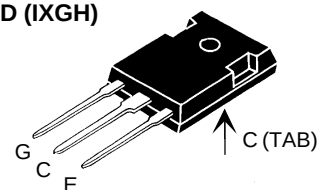
Dim.	Millimeter	Inches
	Min. Max.	Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

IGBT

Lightspeed Series

IXGH 35N120C
IXGT 35N120C
 $V_{CES} = 1200 \text{ V}$
 $I_{C25} = 70 \text{ A}$
 $V_{CE(sat)} = 4.0 \text{ V}$
 $t_{fi(typ)} = 115 \text{ ns}$


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
V_{CGR}	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	70	A
I_{C90}	$T_C = 90^\circ\text{C}$	35	A
I_{CM}	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	140	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 5 \Omega$ Clamped inductive load	$I_{CM} = 90$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight	TO-247 AD	6	g
	TO-268	4	g

**TO-268
(IXGT)**

TO-247 AD (IXGH)

G = Gate,
E = Emitter,

C = Collector,
TAB = Collector

Features

- International standard packages
JEDEC TO-268 surface and
JEDEC TO-247 AD
- Low switching losses
- MOS Gate turn-on
- drive simplicity

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode
power supplies

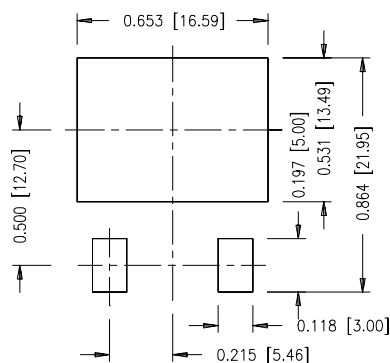
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw,
(isolated mounting screw hole)

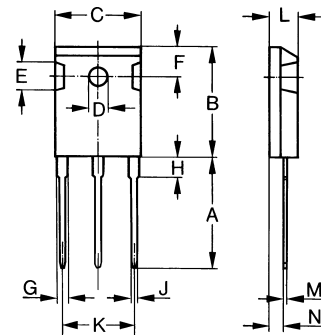
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1 \text{ mA}, V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 750 \mu\text{A}, V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$ $V_{GE} = 0 \text{ V}, T_J = 125^\circ\text{C}$			250 μA 5 mA
I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}, V_{GE} = 15 \text{ V}$ $T_J = 125^\circ\text{C}$	3.2		4.0 V V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)			
		min.	typ.	max.	
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	30	40		S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4620		pF
C_{oes}			260		pF
C_{res}			90		pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		170		nC
Q_{ge}			28		nC
Q_{gc}			57		nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 5\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		50		ns
t_{ri}			27		ns
$t_{d(off)}$			150	220	ns
t_{fi}			115	190	ns
E_{off}			3.0	4.2	mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 5\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		55		ns
t_{ri}			31		ns
E_{on}			2.6		mJ
$t_{d(off)}$			220		ns
t_{fi}			260		ns
E_{off}			6.2		mJ
R_{thJC}				0.42	K/W
R_{thCK}	(TO-247)		0.25		K/W

Min. Recommended Footprint

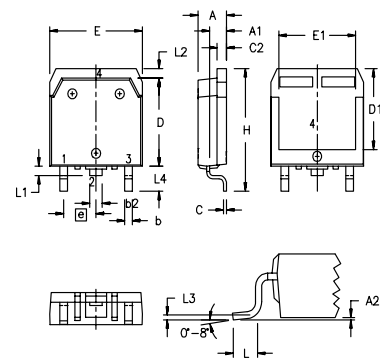


TO-247 AD (IXGH) Outline



Dim.	Millimeter Min. Max.	Inches Min. Max.
A	19.81 20.32	0.780 0.800
B	20.80 21.46	0.819 0.845
C	15.75 16.26	0.610 0.640
D	3.55 3.65	0.140 0.144
E	4.32 5.49	0.170 0.216
F	5.4 6.2	0.212 0.244
G	1.65 2.13	0.065 0.084
H	- 4.5	- 0.177
J	1.0 1.4	0.040 0.055
K	10.8 11.0	0.426 0.433
L	4.7 5.3	0.185 0.209
M	0.4 0.8	0.016 0.031
N	1.5 2.49	0.087 0.102

TO-268AA (D³ PAK)



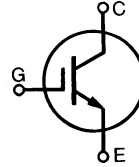
Dim.	Millimeter Min. Max.	Inches Min. Max.
A	4.9 5.1	.193 .201
A ₁	2.7 2.9	.106 .114
A ₂	.02 .25	.001 .010
b	1.15 1.45	.045 .057
b ₂	1.9 2.1	.75 .83
C	.4 .65	.016 .026
D	13.80 14.00	.543 .551
E	15.85 16.05	.624 .632
E ₁	13.3 13.6	.524 .535
e	5.45 BSC	.215 BSC
H	18.70 19.10	.736 .752
L	2.40 2.70	.094 .106
L ₁	1.20 1.40	.047 .055
L ₂	1.00 1.15	.039 .045
L ₃	0.25 BSC	.010 BSC
L ₄	3.80 4.10	.150 .161

IGBT

High Voltage, Low $V_{CE(sat)}$

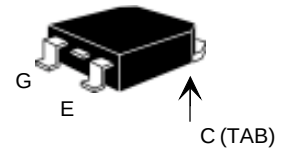
IXGH 45N120
IXGT 45N120

$V_{CES} = 1200 \text{ V}$
 $I_{C25} = 75 \text{ A}$
 $V_{CE(sat)} = 2.5 \text{ V}$
 $t_{fi(typ)} = 390 \text{ ns}$

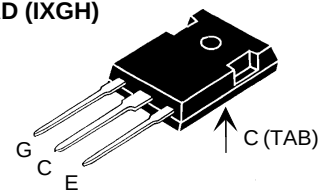


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	1200	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$, limited by leads	75	A
I_{C90}	$T_C = 90^\circ\text{C}$	45	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	180	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 5 \Omega$ Clamped inductive load	$I_{CM} = 90$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	300	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
Maximum Lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
Maximum Tab temperature for soldering SMD devices for 10 s		260	$^\circ\text{C}$
M_d	Mounting torque (M3)	1.13/10 Nm/lb.in.	
Weight		TO-247 AD	6 g
		TO-268	4 g

TO-268
(IXGT)



TO-247 AD (IXGH)



G = Gate,
E = Emitter,

C = Collector,
TAB = Collector

Features

- International standard packages JEDEC TO-268 and JEDEC TO-247 AD
- High current handling capability
- MOS Gate turn-on - drive simplicity
- Molding epoxies meet UL 94 V-0 flammability classification

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- Capacitor discharge

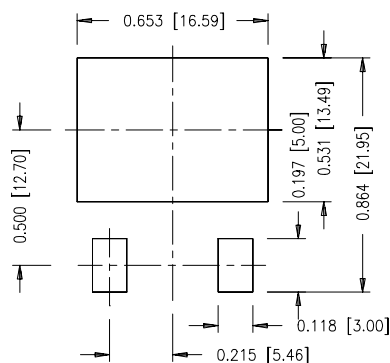
Advantages

- High power density
- Suitable for surface mounting
- Easy to mount with 1 screw, (isolated mounting screw hole)

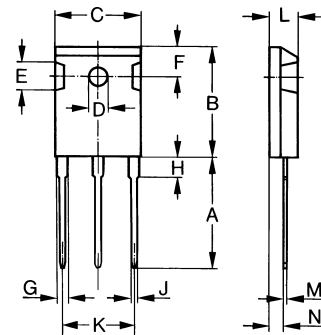
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 1 \text{ mA}$, $V_{GE} = 0 \text{ V}$	1200		V
$V_{GE(th)}$	$I_C = 750 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		V
I_{CES}	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			250 μA 2 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			2.5 V

Symbol	Test Conditions	Characteristic Values ($T_j = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}; V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$	33	44	S
$I_{C(ON)}$	$V_{GE} = 10\text{ V}$, $V_{CE} = 10\text{ V}$		220	A
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4700	pF
C_{oes}			255	pF
C_{res}			89	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		170	nC
Q_{ge}			28	nC
Q_{gc}			57	nC
$t_{d(on)}$	Inductive load, $T_j = 25^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 5\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		55	ns
t_{ri}			28	ns
$t_{d(off)}$			370	800 ns
t_{fi}			390	700 ns
E_{off}			14	25 mJ
$t_{d(on)}$	Inductive load, $T_j = 125^\circ\text{C}$ $I_C = I_{C90}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = R_{off} = 5\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_j or increased R_G		64	ns
t_{ri}			32	ns
E_{on}			3.0	mJ
$t_{d(off)}$			660	ns
t_{fi}			740	ns
E_{off}			25	mJ
R_{thJC}				0.42 K/W
R_{thCK}	(TO-247)		0.25	K/W
	(TO-268)		0.3	K/W

Min. Recommended Footprint

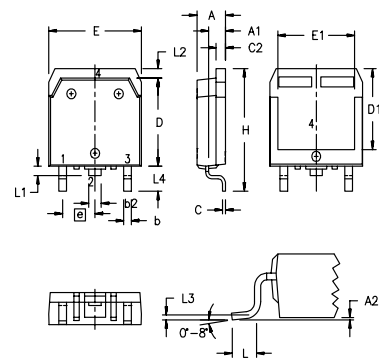


TO-247 AD (IXGH) Outline



Dim.	Millimeter	Min.	Max.	Inches	Min.	Max.
A	19.81	20.32	0.780	0.800		
B	20.80	21.46	0.819	0.845		
C	15.75	16.26	0.610	0.640		
D	3.55	3.65	0.140	0.144		
E	4.32	5.49	0.170	0.216		
F	5.4	6.2	0.212	0.244		
G	1.65	2.13	0.065	0.084		
H	-	4.5	-	0.177		
J	1.0	1.4	0.040	0.055		
K	10.8	11.0	0.426	0.433		
L	4.7	5.3	0.185	0.209		
M	0.4	0.8	0.016	0.031		
N	1.5	2.49	0.087	0.102		

TO-268AA (D³ PAK)

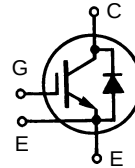


Dim.	Millimeter	Min.	Max.	Inches	Min.	Max.
A	4.9	5.1	.193	.201		
A ₁	2.7	2.9	.106	.114		
A ₂	.02	.25	.001	.010		
b	1.15	1.45	.045	.057		
b ₂	1.9	2.1	.75	.83		
C	.4	.65	.016	.026		
D	13.80	14.00	.543	.551		
E	15.85	16.05	.624	.632		
E ₁	13.3	13.6	.524	.535		
e	5.45	BSC	.215	BSC		
H	18.70	19.10	.736	.752		
L	2.40	2.70	.094	.106		
L ₁	1.20	1.40	.047	.055		
L ₂	1.00	1.15	.039	.045		
L ₃	0.25	BSC	.010	BSC		
L ₄	3.80	4.10	.150	.161		

IGBT with Diode

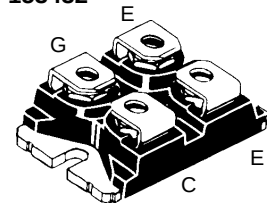
IXGN 80N30BD1

$$\begin{aligned} V_{CES} &= 300 \text{ V} \\ I_{C25} &= 120 \text{ A} \\ V_{CE(sat)} &= 2.4 \text{ V} \end{aligned}$$



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	300	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	300	A
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	120	A
I_{C90}	$T_C = 90^\circ\text{C}$	80	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	300	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_{VJ} = 125^\circ\text{C}$, $R_G = 4.7 \Omega$ Clamped inductive load	$I_{CM} = 120$ @ $0.8 V_{CES}$	A
P_C	$T_C = 25^\circ\text{C}$	310	W
V_{ISOL}	50/60 Hz	t = 1 min	2500 V~
	$I_{ISOL} \leq 1 \text{ mA}$	t = 1 s	3000 V~
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
M_d	Mounting torque	1.5/13	Nm/lb.in.
	Terminal connection torque (M4)	1.5/13	Nm/lb.in.
Weight		30	g

SOT-227B, miniBLOC
E 153432



E = Emitter ① C = Collector
G = Gate E = Emitter ①

① Either Emitter terminal can be used as Main or Kelvin Emitter

Features

- International standard package
- Aluminium-nitride isolation
 - high power dissipation
- Isolation voltage 3000 V~
- Fast Recovery Epitaxial Diode
 - short t_{rr} and low I_{RM}
- Low collector-to-case capacitance (< 50 pF)
 - reduces RFI
- Low package inductance (< 10 nH)
 - easy to drive and to protect

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

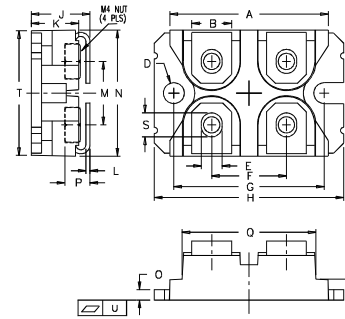
Advantages

- Space savings
- Easy to mount with 2 screws
- High power density

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 500 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	300		V
$V_{GE(th)}$	$I_C = 250 \mu\text{A}$, $V_{CE} = V_{GE}$	2.5		5 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$		400 μA
	$V_{GE} = 0 \text{ V}$			2 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$, $V_{GE} = 15 \text{ V}$			2.4 V

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$	40	56	S
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		4800	pF
C_{oes}			643	pF
C_{res}			66	pF
Q_g	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		150	nC
Q_{ge}			55	nC
Q_{gc}			65	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 60\text{ A}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		70	ns
t_{ri}			39	ns
$t_{d(off)}$			170	300 ns
t_{fi}			90	180 ns
E_{off}			1.3	2.5 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = 60\text{ A}$, $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$, $R_G = 4.7\text{ }\Omega$ Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G		70	ns
t_{ri}			42	ns
E_{on}			1.0	mJ
$t_{d(off)}$			250	ns
t_{fi}			150	ns
E_{off}			2.2	mJ
R_{thJC}				0.40 K/W
R_{thCK}			0.05	K/W

miniBLOC, SOT-227 B



M4 screws (4x) supplied

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

Reverse Diode (FRED) Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)

Symbol	Test Conditions	min.	typ.	max.
V_F	$I_F = I_{C90}$, $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\text{ }\mu\text{s}$, duty cycle $d \leq 2\%$			1.75 V
I_{RM}	$I_F = 50\text{ A}$, $V_{GE} = 0\text{ V}$, $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$, $T_J = 100^\circ\text{C}$		7	A
t_{rr}	$I_F = 1\text{ A}$; $-di/dt = 200\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$		30	ns
R_{thJC}				0.5 K/W

IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

4,835,592	4,881,106	5,017,508	5,049,961	5,187,117	5,486,715
4,850,072	4,931,844	5,034,796	5,063,307	5,237,481	5,381,025