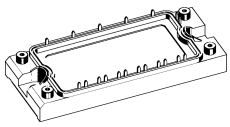
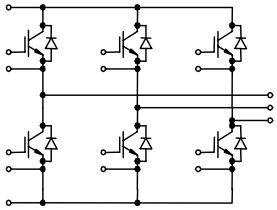
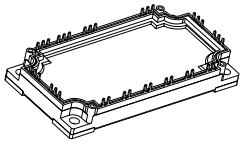
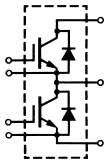
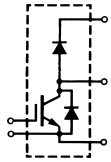
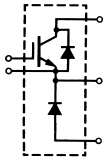
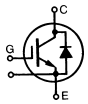
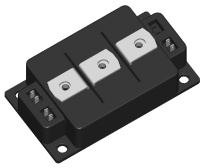
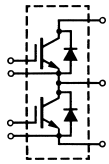
PT IGBT = punch through insulated gate bipolar transistor
NPT IGBT = non-punch through insulated gate bipolar transistor

Contents

Packages	Package style / Circuit configuration		V_{CES} V	I_{C25} T_C = 25°C A	$V_{CE(sat)}$ T_C = 25°C typ. V	Type	Page B3
	NPT IGBT Modules						
Fig. 1 		1	600	45	1.9	MWI 30-06A7/T	2
				72	1.9	MWI 50-06A7/T	6
				90	2.1	MWI 75-06A7/T	10
			1200	30	2.0	MWI 15-12A7/T	14
				50	2.2	MWI 25-12A7/T	18
				62	2.2	MWI 35-12A7/T	22
				85	2.2	MWI 50-12A7/T	26
Fig. 2 		2	600	130	2.0	MWI 100-06A8	30
				185	2.0	MWI 150-06A8	32
				240	2.0	MWI 200-06A8	34
			1200	140	2.2	MWI 75-12A8	36
				170	2.2	MWI 100-12A8	38
Fig. 3 		3	1200	90	2.2	MII 75-12A3	40
		3		135	2.2	MII 100-12A3	44
		3		160	2.2	MII 145-12A3	48
		4		180	2.2	MII 150-12A4	52
		4		270	2.2	MII 200-12A4	56
		4		330	2.2	MII 300-12A4	60
Fig. 4 		3	1200	90	2.2	MID 75-12A3	40
		3		135	2.2	MID 100-12A3	44
		3		160	2.2	MID 145-12A3	48
		4		180	2.2	MID 150-12A4	52
		4		270	2.2	MID 200-12A4	56
		4		330	2.2	MID 300-12A4	60
		4		670	2.3	MID 550-12A4	64
Fig. 5 		3	1200	90	2.2	MDI 75-12A3	40
		3		135	2.2	MDI 100-12A3	44
		3		160	2.2	MDI 145-12A3	48
		4		180	2.2	MDI 150-12A4	52
		4		270	2.2	MDI 200-12A4	56
		4		330	2.2	MDI 300-12A4	60
		4		670	2.3	MDI 550-12A4	64
	PT IGBT Modules						
		5	300	425	1.5	VII 420-03S4	68
Fig. 6 		6	300	1100	1.3	VIO 1000-03G4	70

See also *Discrete NPT IGBTs section B5 page 1*

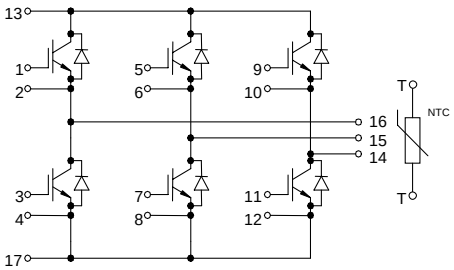
IGBT Modules
Sixpack

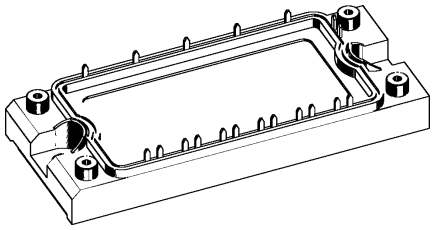
Short Circuit SOA Capability
Square RBSOA

I_{C25} = 45 A
V_{CES} = 600 V
$V_{CE(sat)\ typ.}$ = 1.9 V

Preliminary Data

Type:	NTC - Option:
MWI 30-06 A7	without NTC
MWI 30-06 A7T	with NTC





IGBTs

Symbol	Conditions		Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C		600	V
V_{GES}			± 20	V
I_{C25}	T_C = 25°C		45	A
I_{C80}	T_C = 80°C		30	A
RBSOA	V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = $V_{CEK} \le V_{CES}$	60	A
t_{SC} **(SCSOA)**	$V_{CE} = V_{CES}$; V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C non-repetitive		10	µs
P_{tot}	T_C = 25°C		140	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 30 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.9	2.4	V
	T_{VJ} = 125°C		2.2		V
$V_{GE(th)}$	I_C = 0.7 mA; $V_{GE} = V_{CE}$	4.5		6.5	V
I_{CES}	$V_{CE} = V_{CES}$; V_{GE} = 0 V; T_{VJ} = 25°C			0.6	mA
	T_{VJ} = 125°C		0.5		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		50		ns
t_r	V_{CE} = 300 V; I_C = 30 A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 33 Ω		270		ns
t_f			40		ns
E_{on}			1.4		mJ
E_{off}			1.0		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1600		pF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 30 A		150		nC
R_{thJC}	(per IGBT)			0.88	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	36	A
I_{F80}	T_C = 80°C	24	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 30 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.0	2.2	V
	T_{VJ} = 125°C		1.5	1.7	V
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		90		ns
R_{thJC}	(per diode)			2.11	K/W

Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

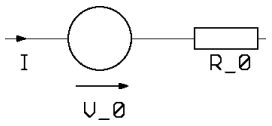
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

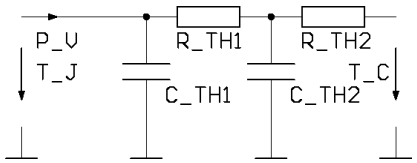
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.95 V; R_0 = 42 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.09 V; R_0 = 12 mΩ

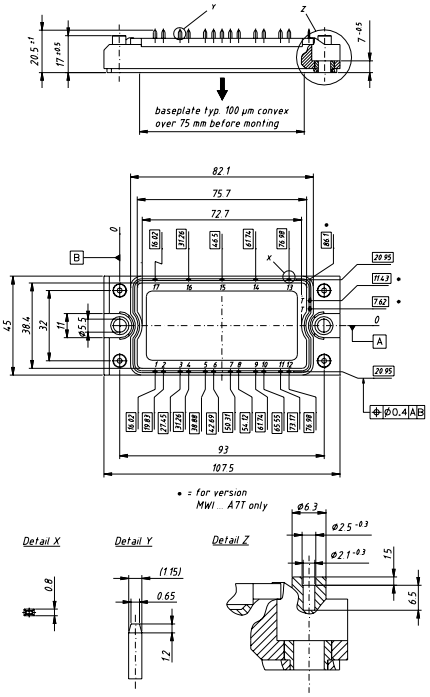
Thermal Response



IGBT (typ.)
C_{th1} = 0.156 J/K; R_{th1} = 0.545 K/W
C_{th2} = 1.164 J/K; R_{th2} = 0.155 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.065 J/K; R_{th1} = 0.636 K/W
C_{th2} = 1.766 J/K; R_{th2} = 0.344 K/W

Dimensions in mm (1 mm = 0.0394")



023

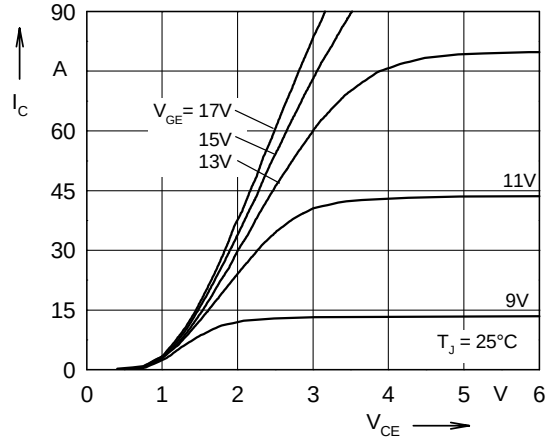


Fig. 1 Typ. output characteristics

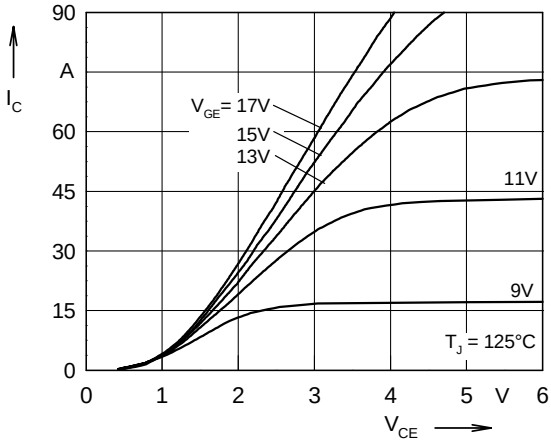


Fig. 2 Typ. output characteristics

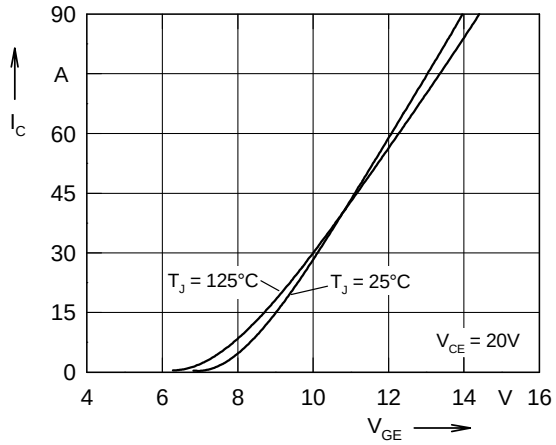


Fig. 3 Typ. transfer characteristics

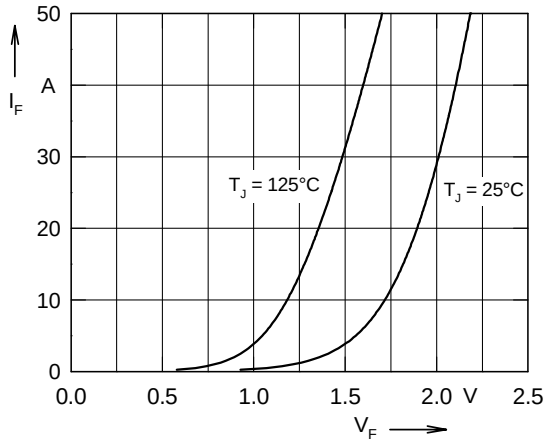


Fig. 4 Typ. forward characteristics of free wheeling diode

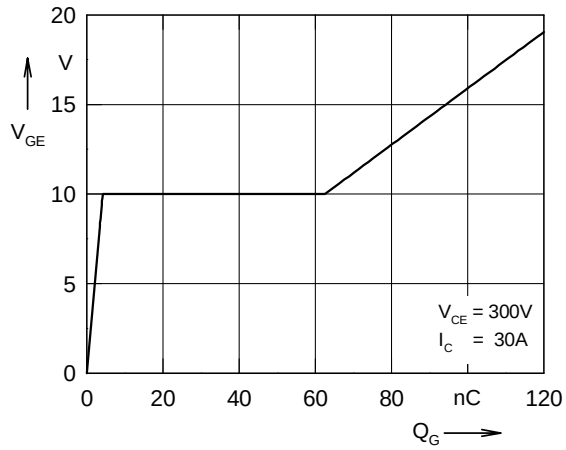


Fig. 5 Typ. turn on gate charge

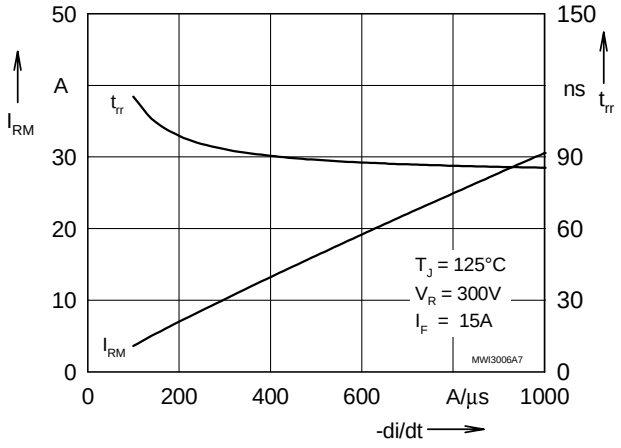


Fig. 6 Typ. turn off characteristics of free wheeling diode

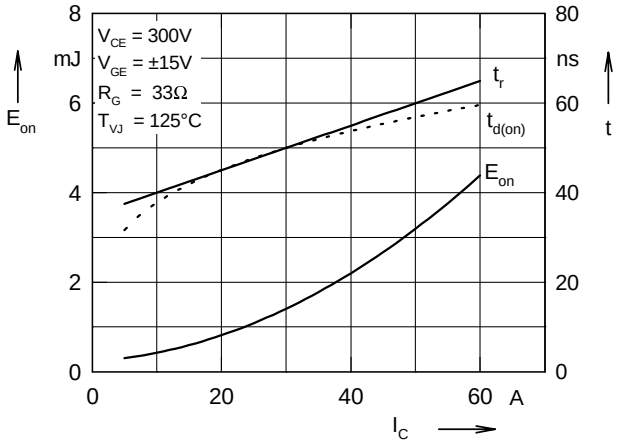


Fig. 7 Typ. turn on energy and switching times versus collector current

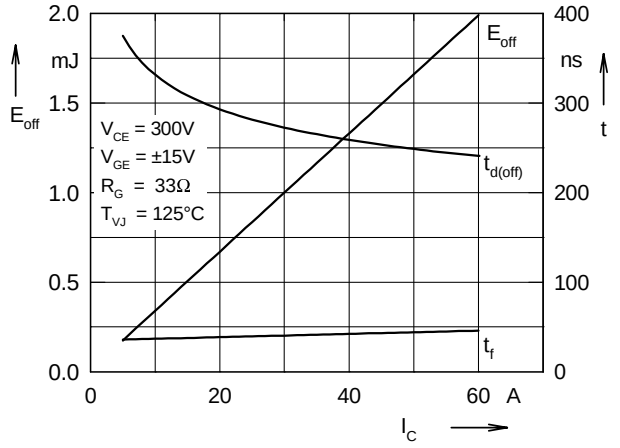


Fig. 8 Typ. turn off energy and switching times versus collector current

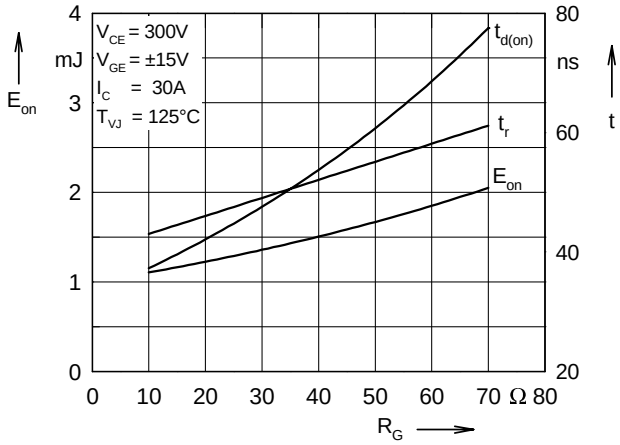


Fig. 9 Typ. turn on energy and switching times versus gate resistor

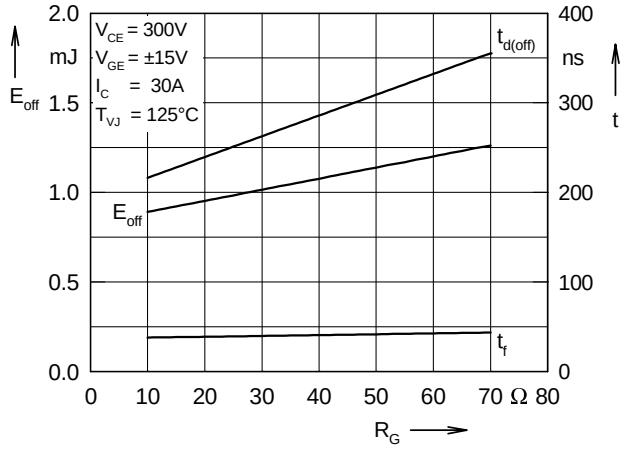


Fig.10 Typ. turn off energy and switching times versus gate resistor

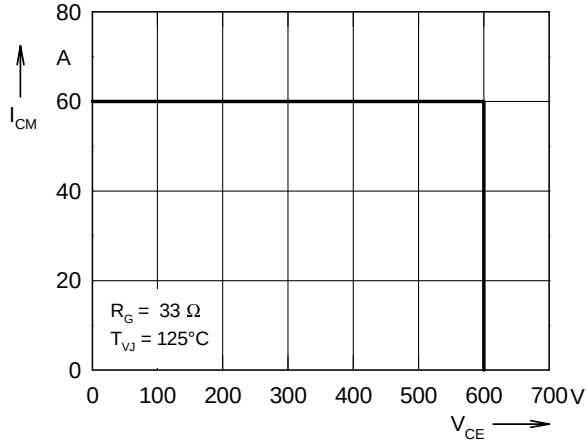


Fig. 11 Reverse biased safe operating area RBSOA

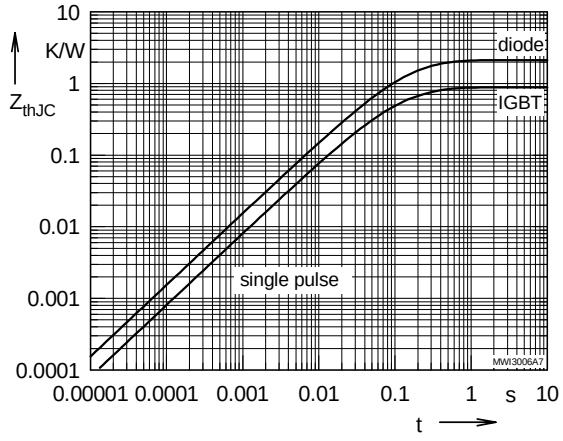


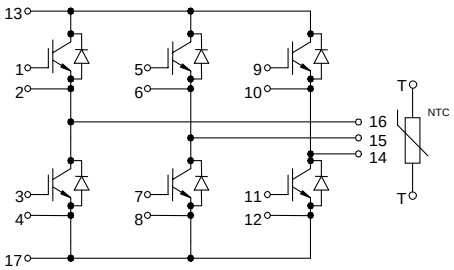
Fig. 12 Typ. transient thermal impedance

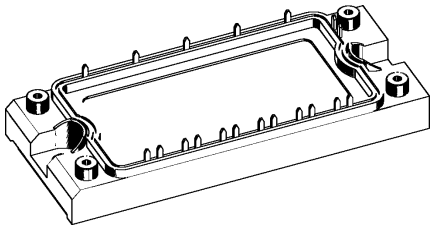
IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 72 A
V_{CES} = 600 V
$V_{CE(sat)\ typ.}$ = 1.9 V

Type:	NTC - Option:
MWI 50-06 A7	without NTC
MWI 50-06 A7T	with NTC





Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

IGBTs

Symbol	Conditions		Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C		600	V
V_{GES}			± 20	V
I_{C25}	T_C = 25°C		72	A
I_{C80}	T_C = 80°C		50	A
RBSOA	V_{GE} = ±15 V; R_G = 22 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = $V_{CEK} \le V_{CES}$	100	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 22 Ω; T_{VJ} = 125°C non-repetitive		10	µs
P_{tot}	T_C = 25°C		225	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 50 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.9	2.4	V
	T_{VJ} = 125°C		2.2		V
$V_{GE(th)}$	I_C = 1 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.6	mA
	T_{VJ} = 125°C		0.7		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 50 A V_{GE} = ±15 V; R_G = 22 Ω		50		ns
t_r			60		ns
$t_{d(off)}$			300		ns
t_f			30		ns
E_{on}			2.3		mJ
E_{off}			1.7		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		2800		pF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 50 A		120		nC
R_{thJC}	(per IGBT)			0.55	K/W

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	72	A
I_{F80}	T_C = 80°C	45	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 50 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.6	1.8	V
	T_{VJ} = 125°C		1.3	1.5	V
I_{RM}	I_F = 30 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		25		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		90		ns
R_{thJC}	(per diode)			1.19	K/W

Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

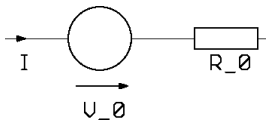
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

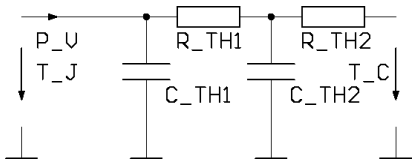
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.82 V; R_0 = 28 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 0.89 V; R_0 = 8 mΩ

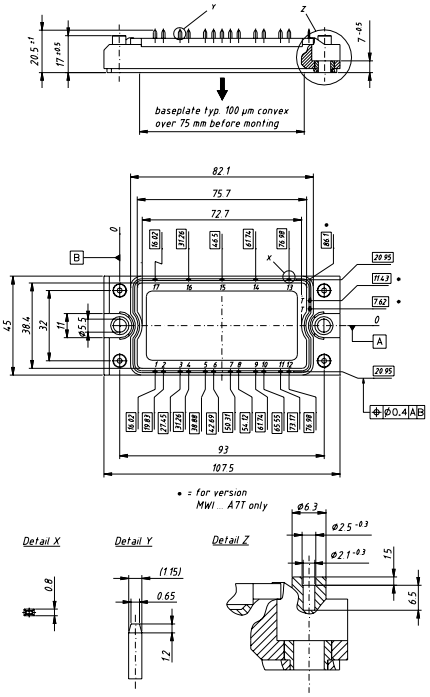
Thermal Response



IGBT (typ.)
C_{th1} = 0.201 J/K; R_{th1} = 0.42 K/W
C_{th2} = 1.252 J/K; R_{th2} = 0.131K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.116 J/K; R_{th1} = 0.973 K/W
C_{th2} = 0.88 J/K; R_{th2} = 0.217 K/W

Dimensions in mm (1 mm = 0.0394")



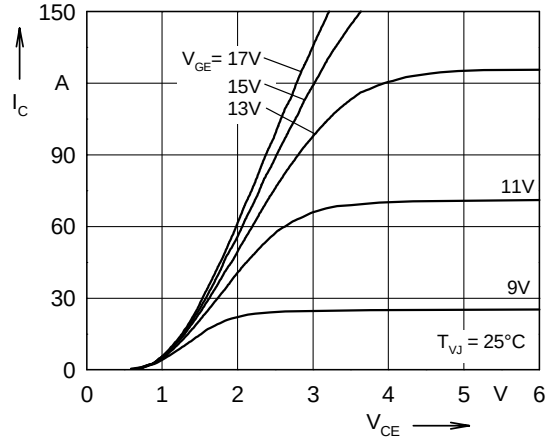


Fig. 1 Typ. output characteristics

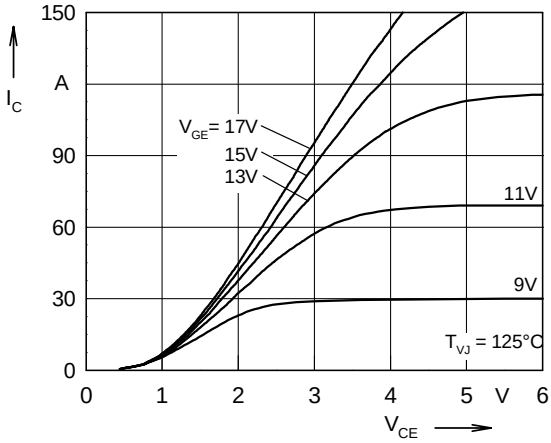


Fig. 2 Typ. output characteristics

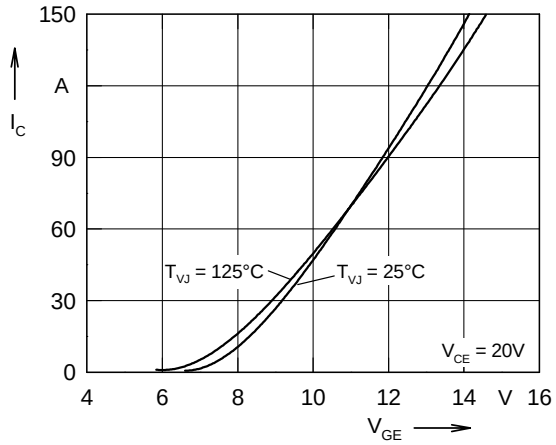


Fig. 3 Typ. transfer characteristics

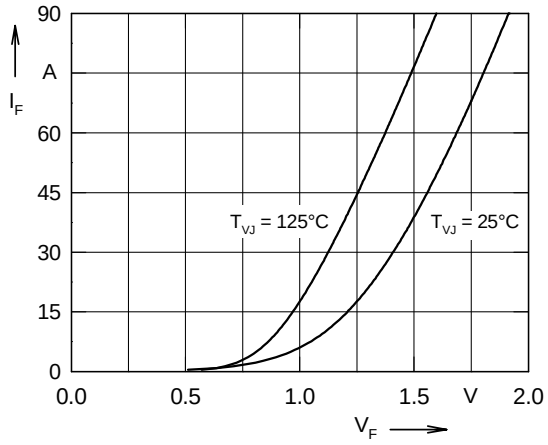


Fig. 4 Typ. forward characteristics of free wheeling diode

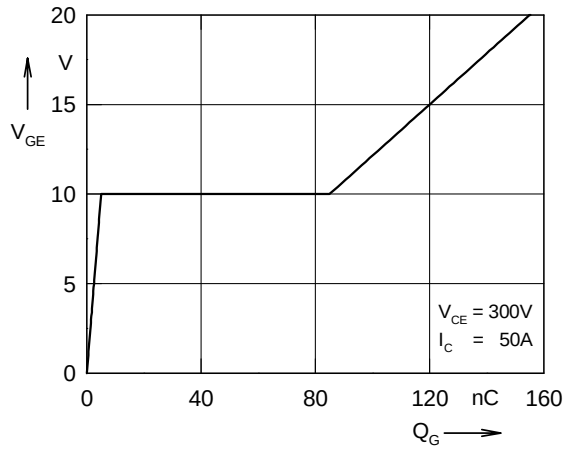


Fig. 5 Typ. turn on gate charge

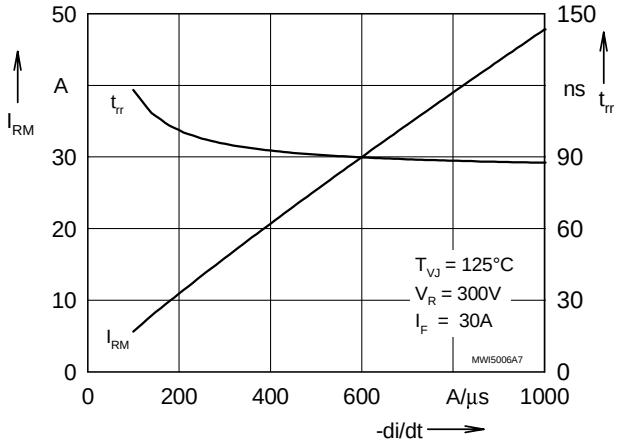


Fig. 6 Typ. turn off characteristics of free wheeling diode

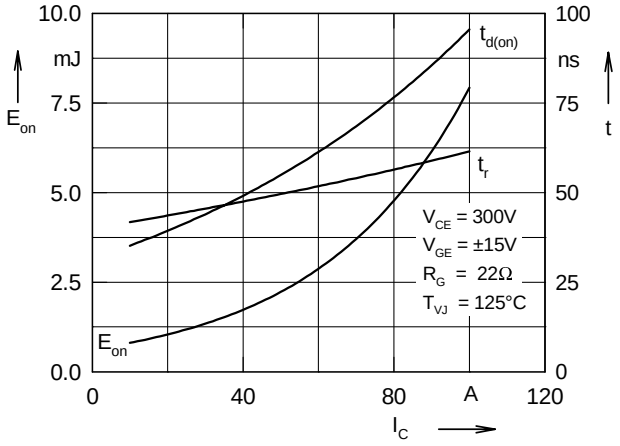


Fig. 7 Typ. turn on energy and switching times versus collector current

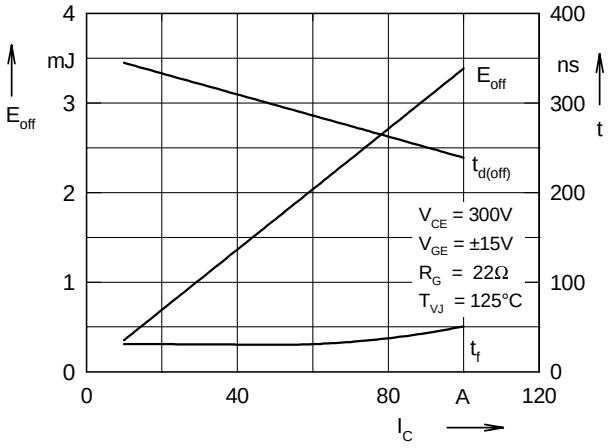


Fig. 8 Typ. turn off energy and switching times versus collector current

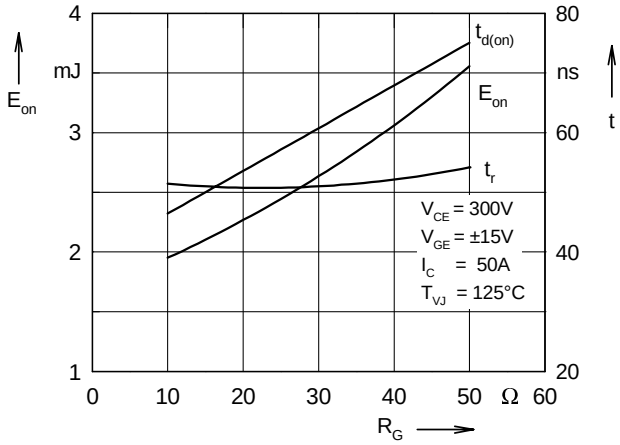


Fig. 9 Typ. turn on energy and switching times versus gate resistor

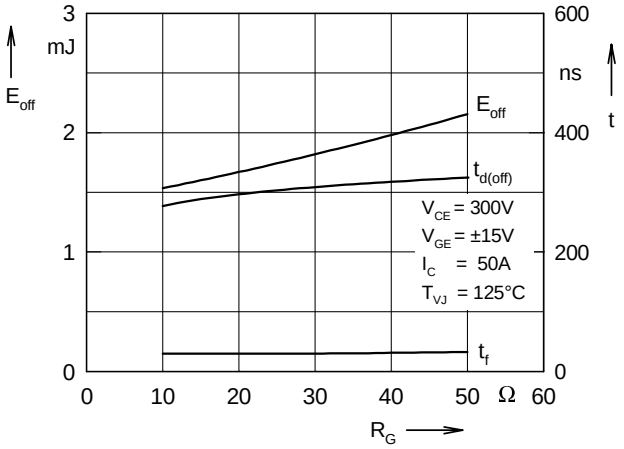


Fig.10 Typ. turn off energy and switching times versus gate resistor

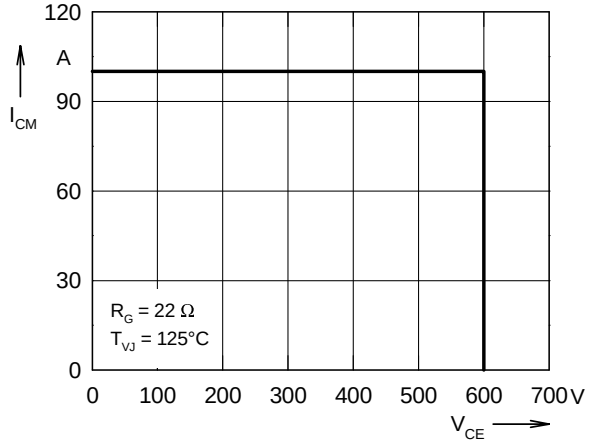


Fig. 11 Reverse biased safe operating area RBSOA

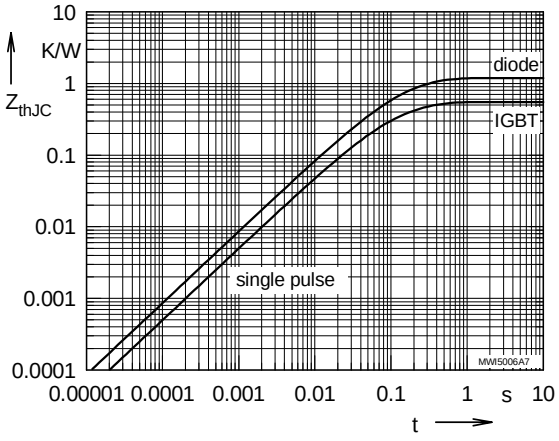


Fig. 12 Typ. transient thermal impedance

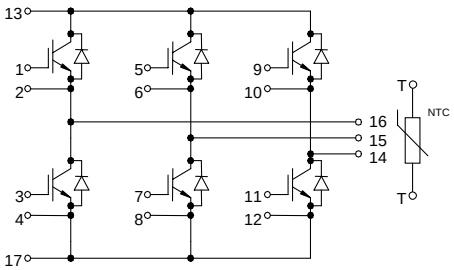
IGBT Modules
Sixpack

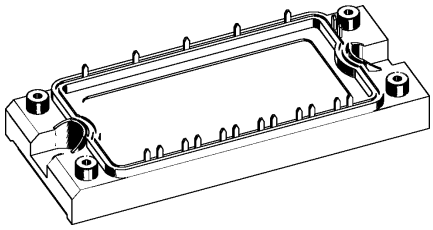
Short Circuit SOA Capability
Square RBSOA

I_{C25} = 90 A
V_{CES} = 600 V
$V_{CE(sat)\ typ.}$ = 2.1 V

Preliminary Data

Type	NTC - Option
MWI 75-06 A7	without NTC
MWI 75-06 A7T	with NTC





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	90	A
I_{C80}	T_C = 80°C	60	A
RBSOA	V_{GE} = ±15 V; R_G = 18 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 120 $V_{CEK} \le V_{CES}$	A
t_{SC} **(SCSOA)**	$V_{CE} = V_{CES}$; V_{GE} = ±15 V; R_G = 18 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	280	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 75 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.1	2.6	V
	T_{VJ} = 125°C		2.5		V
$V_{GE(th)}$	I_C = 1.5 mA; $V_{GE} = V_{CE}$	4.5		6.5	V
I_{CES}	$V_{CE} = V_{CES}$; V_{GE} = 0 V; T_{VJ} = 25°C			1.3	mA
	T_{VJ} = 125°C		0.9		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		50		ns
t_r	V_{CE} = 300 V; I_C = 75 A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 18 Ω		270		ns
t_f			40		ns
E_{on}			3.5		mJ
E_{off}			2.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		3200		pF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 75 A		190		nC
R_{thJC}	(per IGBT)			0.44	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	140	A
I_{F80}	T_C = 80°C	85	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 50 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.8	2.1	V
	T_{VJ} = 125°C		1.3	1.5	V
I_{RM}	I_F = 60 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		28		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		100		ns
R_{thJC}	(per diode)			0.61	K/W

Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

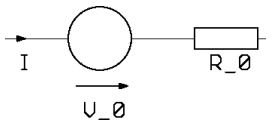
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	I_{ISOL} ≤ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

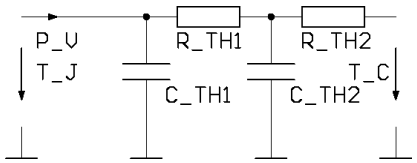
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.95 V; R_0 = 20 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.014 V; R_0 = 4 mΩ

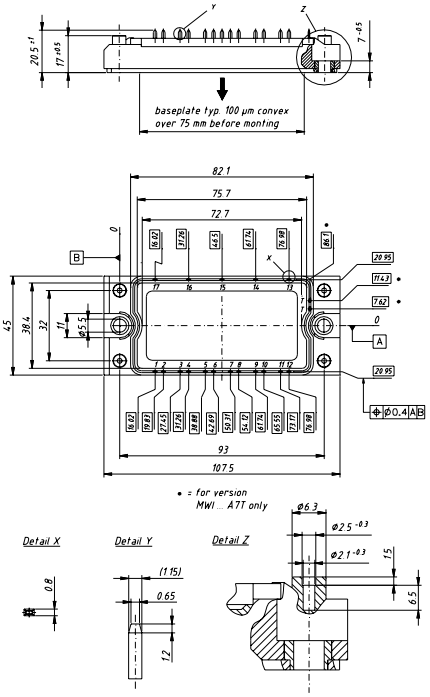
Thermal Response



IGBT (typ.)
C_{th1} = 0.248 J/K; R_{th1} = 0.343 K/W
C_{th2} = 1.849 J/K; R_{th2} = 0.097 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.23 J/K; R_{th1} = 0.483 K/W
C_{th2} = 1.3 J/K; R_{th2} = 0.127 K/W

Dimensions in mm (1 mm = 0.0394")



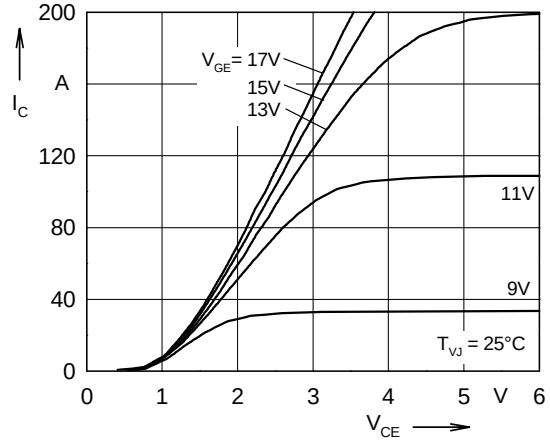


Fig. 1 Typ. output characteristics

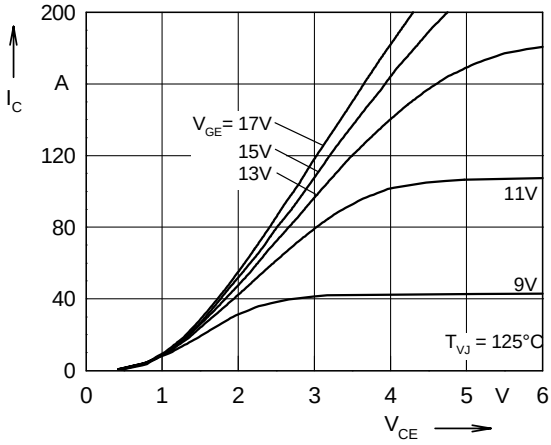


Fig. 2 Typ. output characteristics

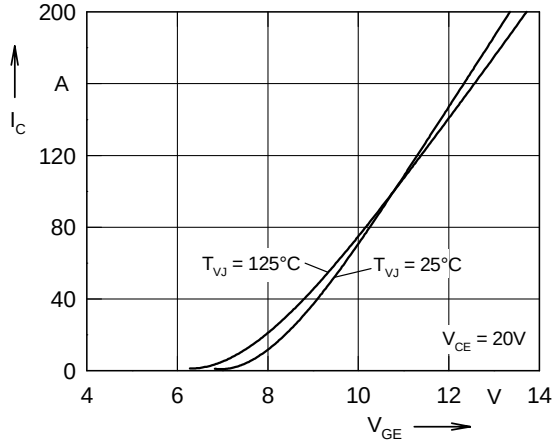


Fig. 3 Typ. transfer characteristics

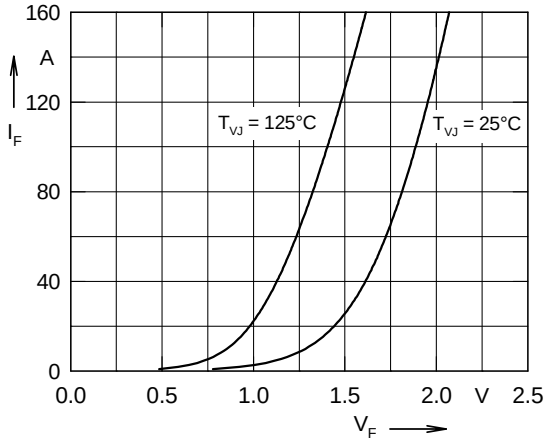


Fig. 4 Typ. forward characteristics of free wheeling diode

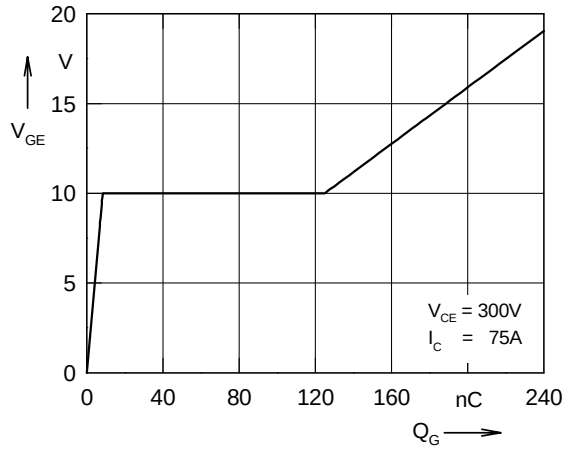


Fig. 5 Typ. turn on gate charge

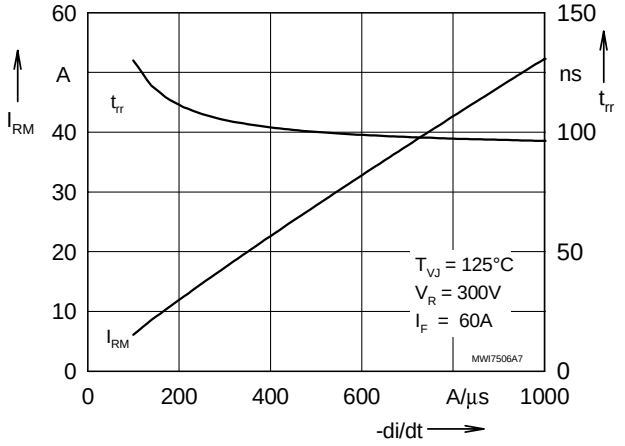


Fig. 6 Typ. turn off characteristics of free wheeling diode

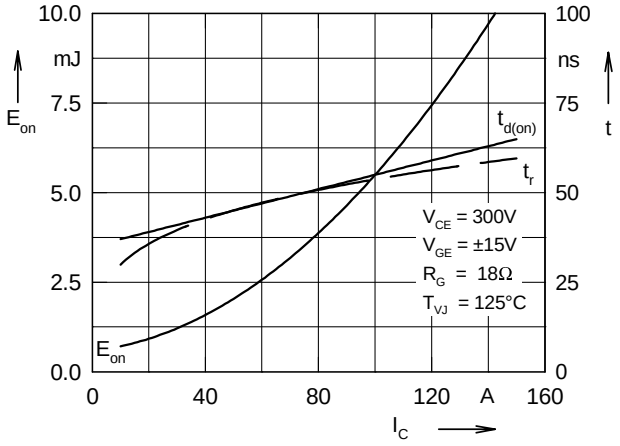


Fig. 7 Typ. turn on energy and switching times versus collector current

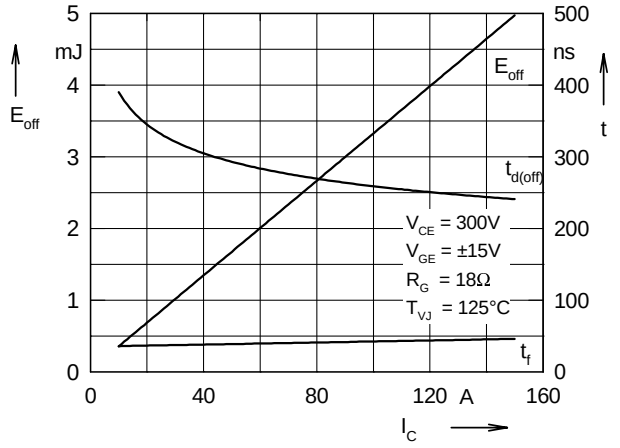


Fig. 8 Typ. turn off energy and switching times versus collector current

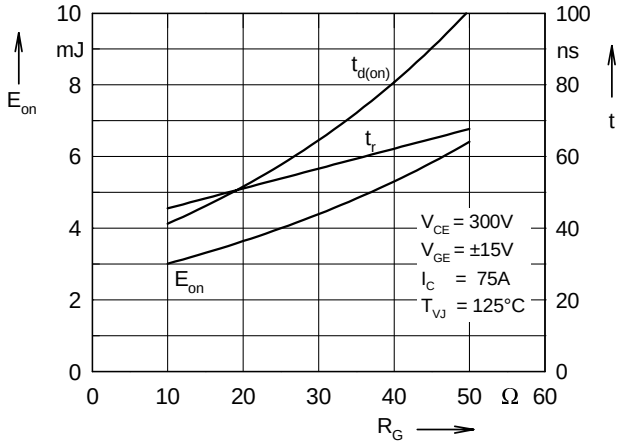


Fig. 9 Typ. turn on energy and switching times versus gate resistor

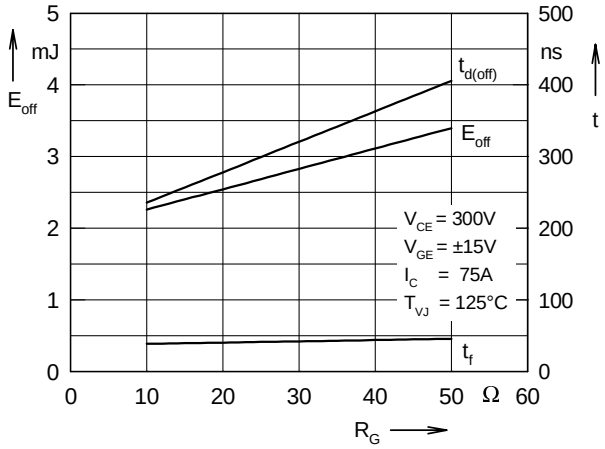


Fig.10 Typ. turn off energy and switching times versus gate resistor

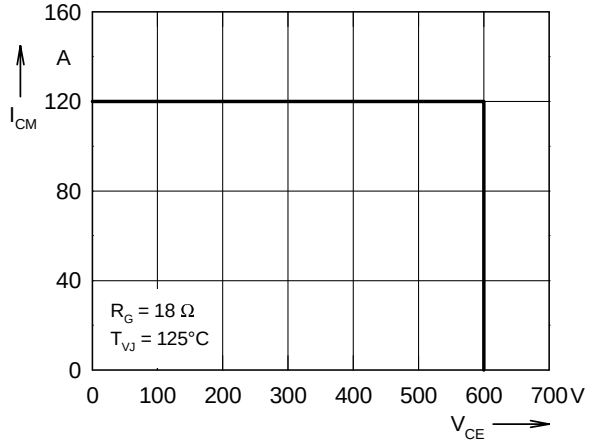


Fig. 11 Reverse biased safe operating area RBSOA

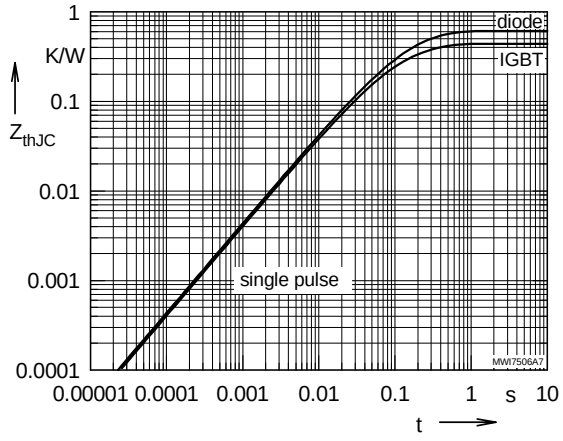
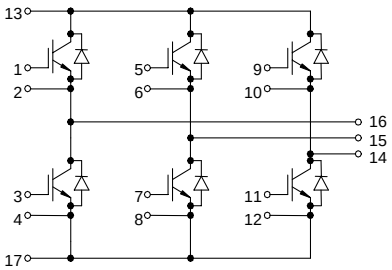


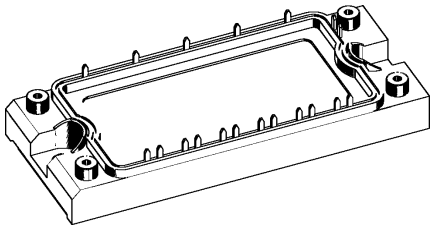
Fig. 12 Typ. transient thermal impedance

IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 30 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.0 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	30	A
I_{C80}	T_C = 80°C	20	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 35 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	$V_{CE} = V_{CES}$; V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	140	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 15 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.6	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 0.6 mA; $V_{GE} = V_{CE}$	4.5		6.5	V
I_{CES}	$V_{CE} = V_{CES}$; V_{GE} = 0 V; T_{VJ} = 25°C			0.9	mA
	T_{VJ} = 125°C		0.8		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 600 V; I_C = 15 A V_{GE} = ±15 V; R_G = 82 Ω		100		ns
t_r			75		ns
$t_{d(off)}$			500		ns
t_f			70		ns
E_{on}			2.3		mJ
E_{off}			1.8		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1000		pF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 15 A		70		nC
R_{thJC}	(per IGBT)			0.88	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	25	A
I_{F80}	T_C = 80°C	17	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.4	2.7	V
	T_{VJ} = 125°C		1.7		V
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		16		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		130		ns
R_{thJC}	(per diode)			2.1	K/W

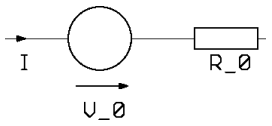
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

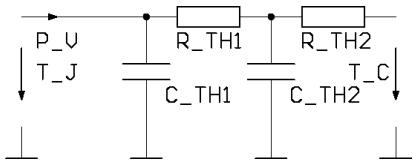
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.37 V; R_0 = 62 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.327 V; R_0 = 30 mΩ

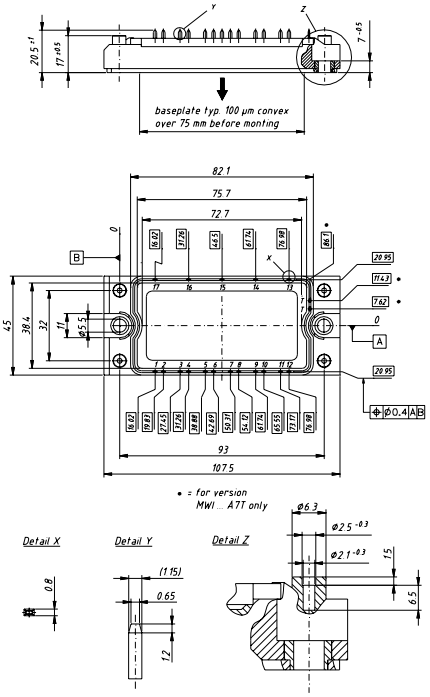
Thermal Response



IGBT (typ.)
C_{th1} = 0.156 J/K; R_{th1} = 0.685 K/W
C_{th2} = 1.162 J/K; R_{th2} = 0.195 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.065 J/K; R_{th1} = 1.758 K/W
C_{th2} = 0.639 J/K; R_{th2} = 0.342 K/W

Dimensions in mm (1 mm = 0.0394")



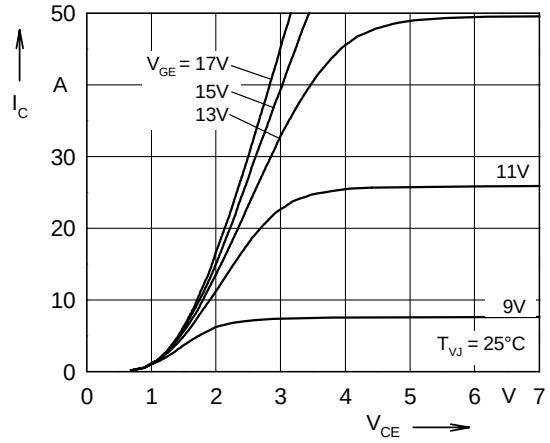


Fig. 1 Typ. output characteristics

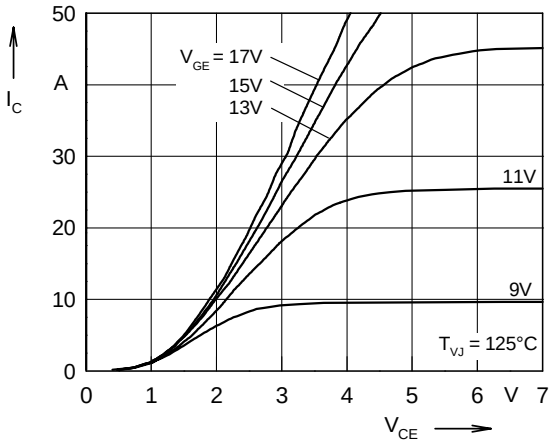


Fig. 2 Typ. output characteristics

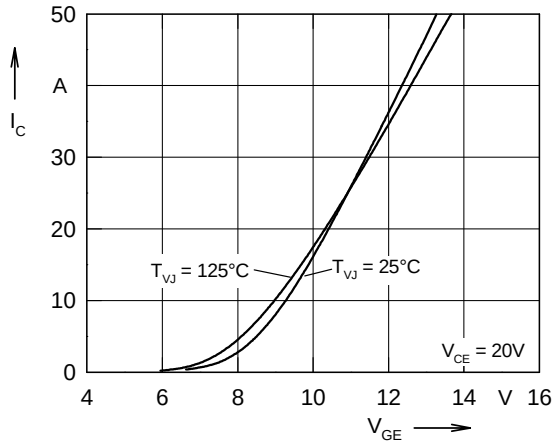


Fig. 3 Typ. transfer characteristics

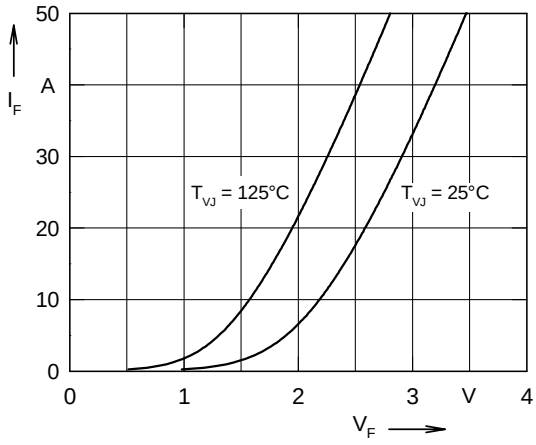


Fig. 4 Typ. forward characteristics of free wheeling diode

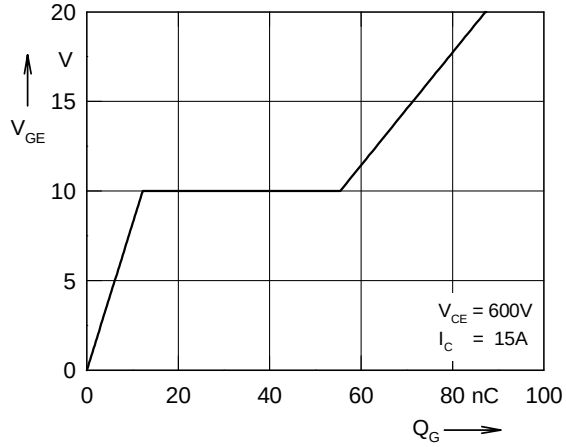


Fig. 5 Typ. turn on gate charge

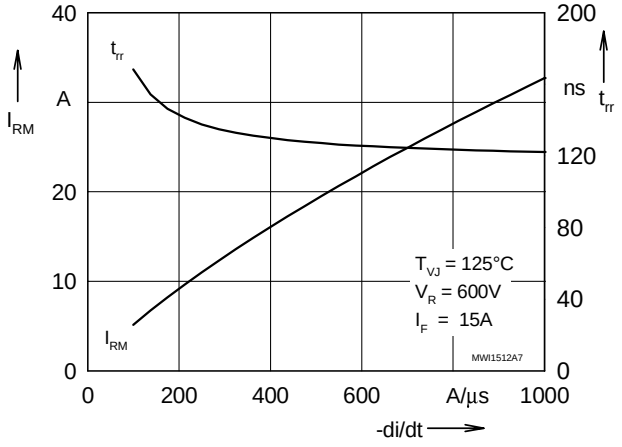


Fig. 6 Typ. turn off characteristics of free wheeling diode

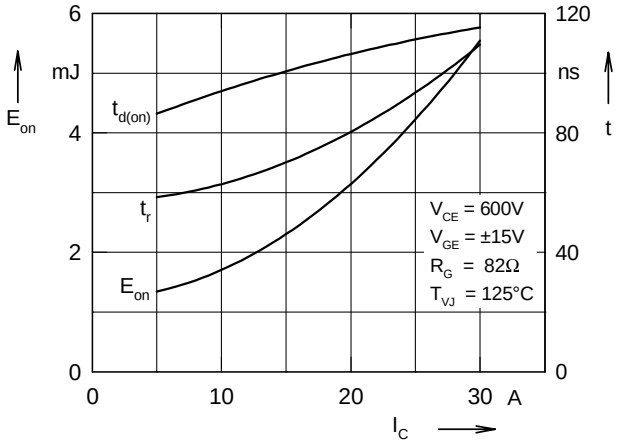


Fig. 7 Typ. turn on energy and switching times versus collector current

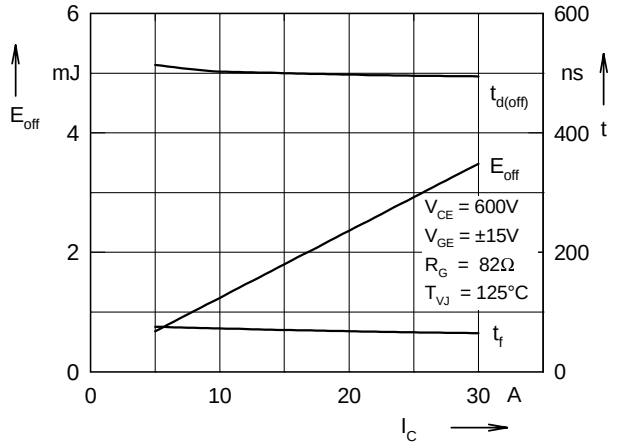


Fig. 8 Typ. turn off energy and switching times versus collector current

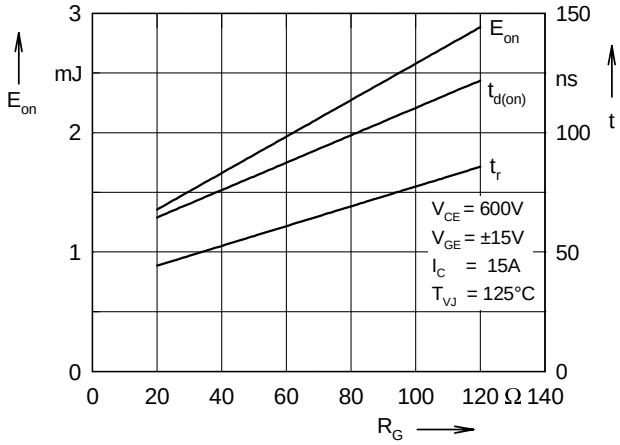


Fig. 9 Typ. turn on energy and switching times versus gate resistor

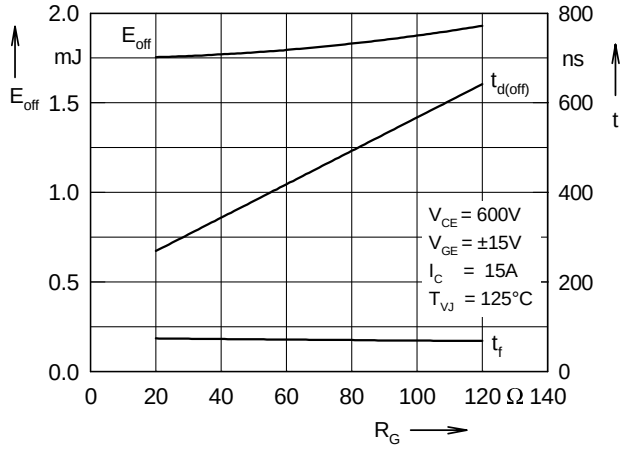


Fig.10 Typ. turn off energy and switching times versus gate resistor

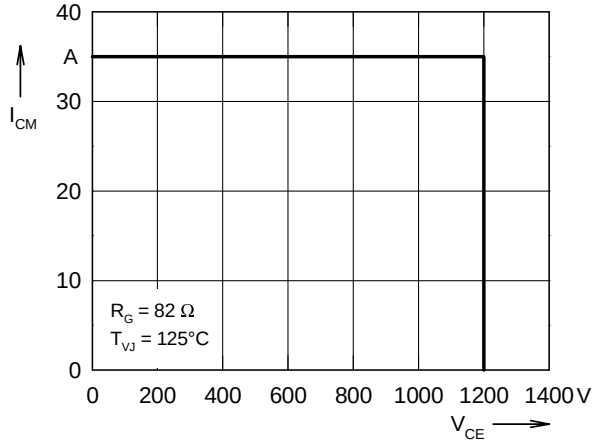


Fig. 11 Reverse biased safe operating area RBSOA

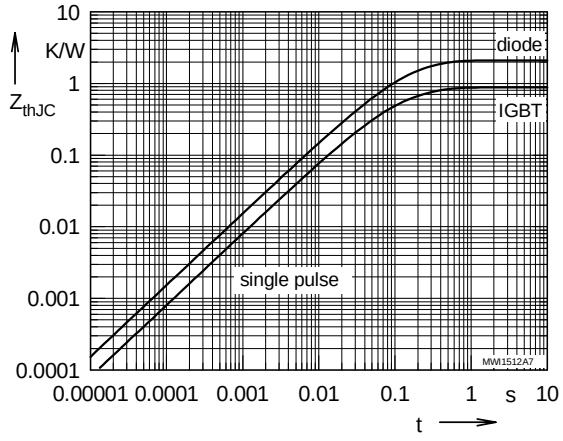


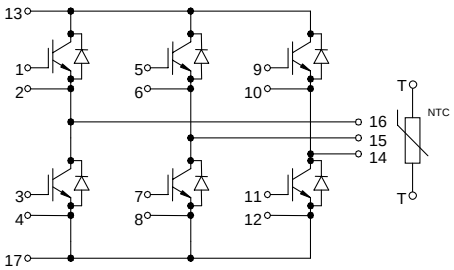
Fig. 12 Typ. transient thermal impedance

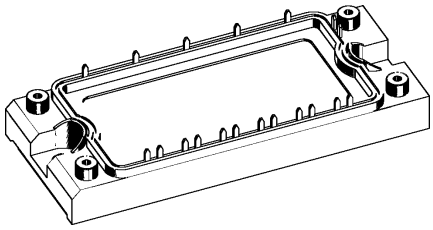
IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 50 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

Type:	NTC - Option:
MWI 25-12 A7	without NTC
MWI 25-12 A7T	with NTC





Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	50	A
I_{C80}	T_C = 80°C	35	A
RBSOA	V_{GE} = ±15 V; R_G = 47 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 50 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 47 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	225	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 25 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.2	2.7	V
	T_{VJ} = 125°C		2.6		V
$V_{GE(th)}$	I_C = 1 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			2	mA
	T_{VJ} = 125°C		2		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 600 V; I_C = 25 A V_{GE} = ±15 V; R_G = 47 Ω		100		ns
t_r			70		ns
$t_{d(off)}$			500		ns
t_f			70		ns
E_{on}			3.8		mJ
E_{off}			2.8		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1650		pF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 35 A		120		nC
R_{thJC}	(per IGBT)			0.55	K/W

023

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	50	A
I_{F80}	T_C = 80°C	33	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 35 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.4	2.6	V
	T_{VJ} = 125°C		1.7	1.9	V
I_{RM}	I_F = 25 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		20		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		200		ns
R_{thJC}	(per diode)			1.19	K/W

Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

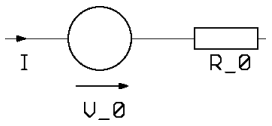
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

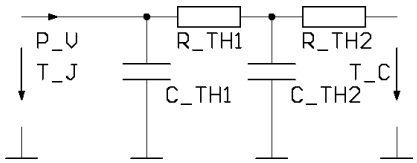
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.5 V; R_0 = 40.7 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 24.9 mΩ

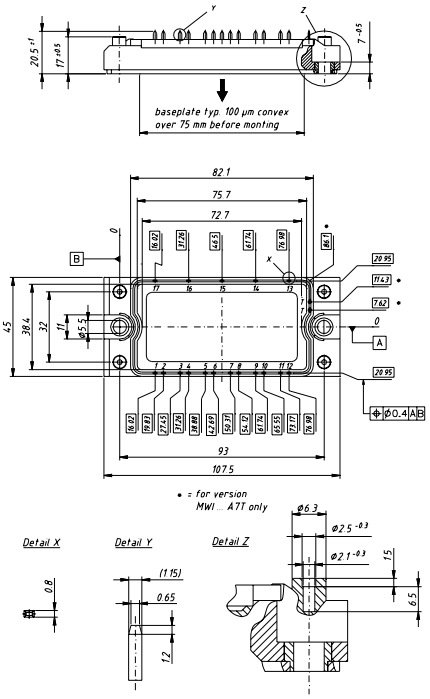
Thermal Response



IGBT (typ.)
C_{th1} = 0.136 J/K; R_{th1} = 0.418 K/W
C_{th2} = 1.309 J/K; R_{th2} = 0.132 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.081 J/K; R_{th1} = 0.973 K/W
C_{th2} = 0.915 J/K; R_{th2} = 0.217 K/W

Dimensions in mm (1 mm = 0.0394")



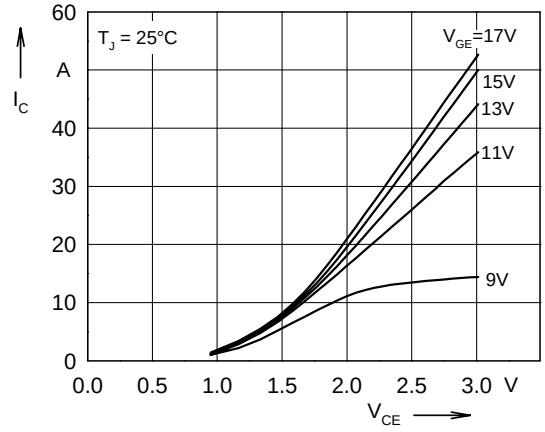


Fig. 1 Typ. output characteristics

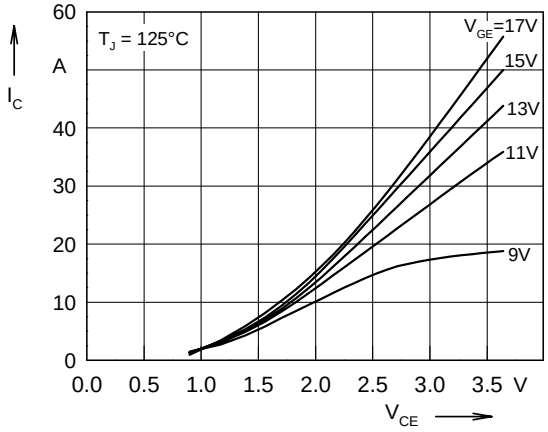


Fig. 2 Typ. output characteristics

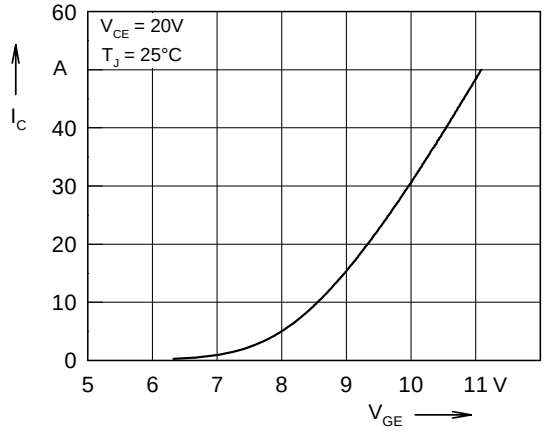


Fig. 3 Typ. transfer characteristics

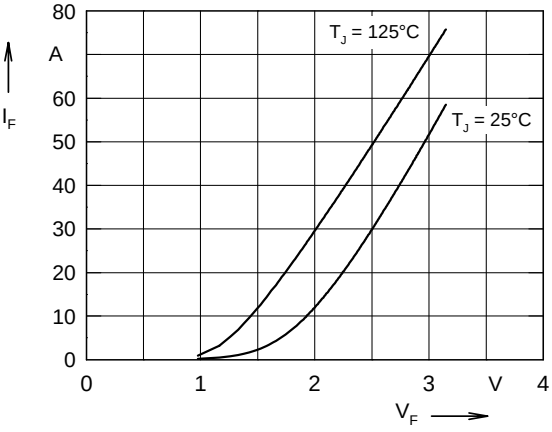


Fig. 4 Typ. forward characteristics of free wheeling diode

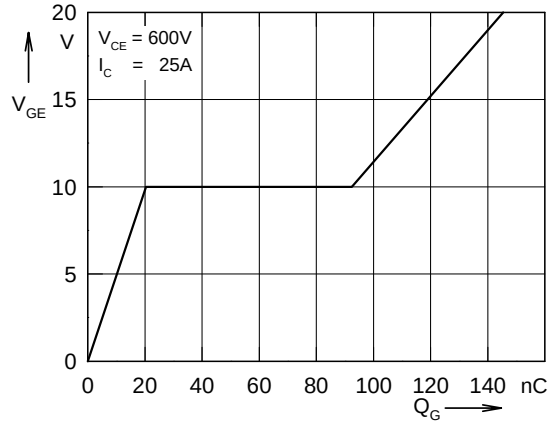


Fig. 5 Typ. turn on gate charge

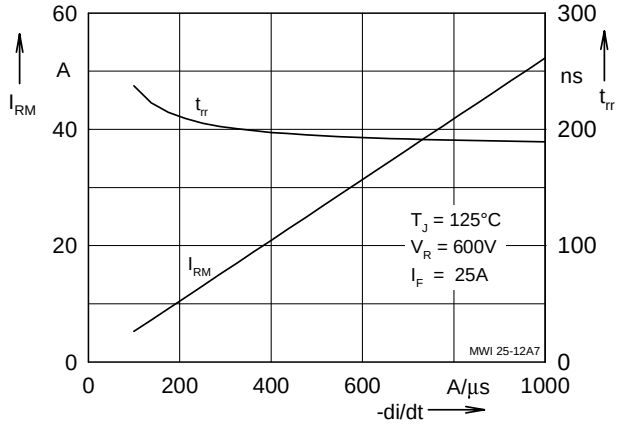


Fig. 6 Typ. turn off characteristics of free wheeling diode

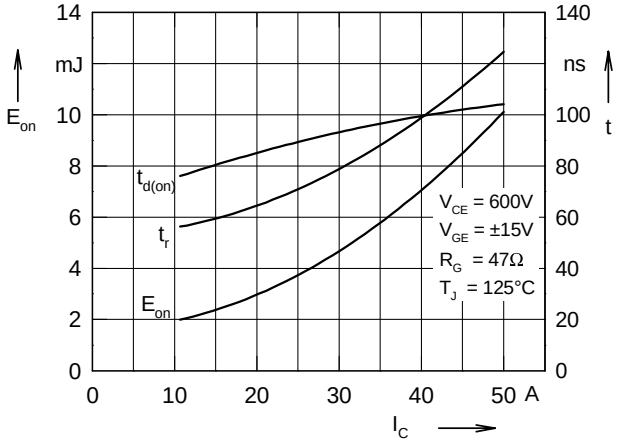


Fig. 7 Typ. turn on energy and switching times versus collector current

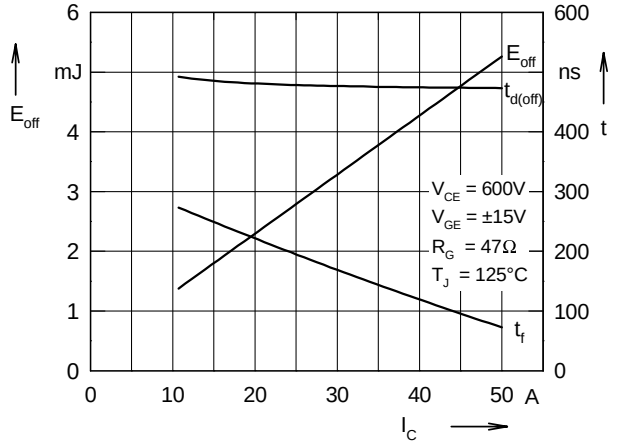


Fig. 8 Typ. turn off energy and switching times versus collector current

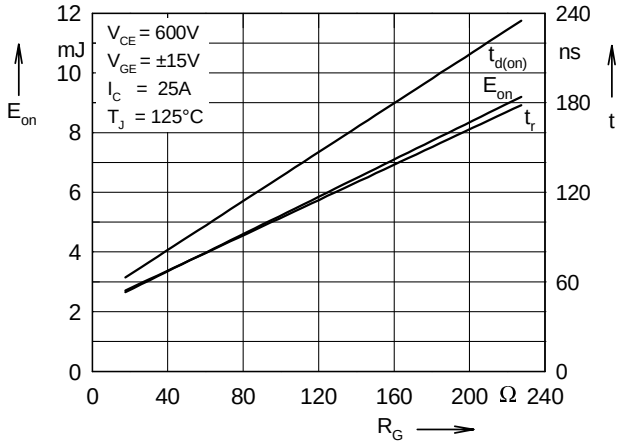


Fig. 9 Typ. turn on energy and switching times versus gate resistor

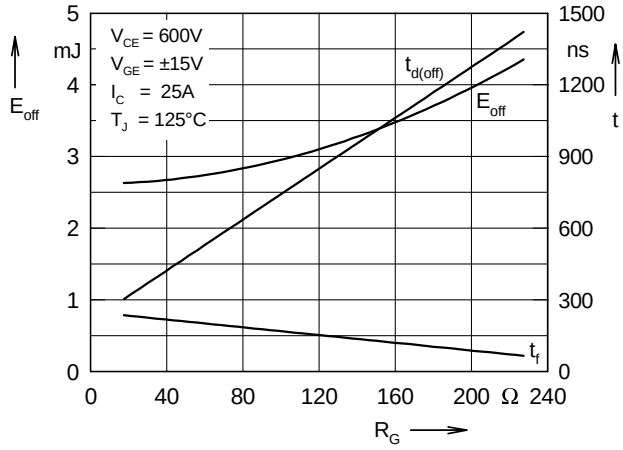


Fig.10 Typ. turn off energy and switching times versus gate resistor

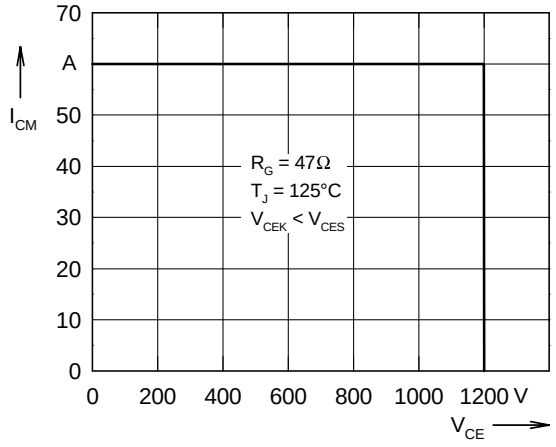


Fig. 11 Reverse biased safe operating area RBSOA

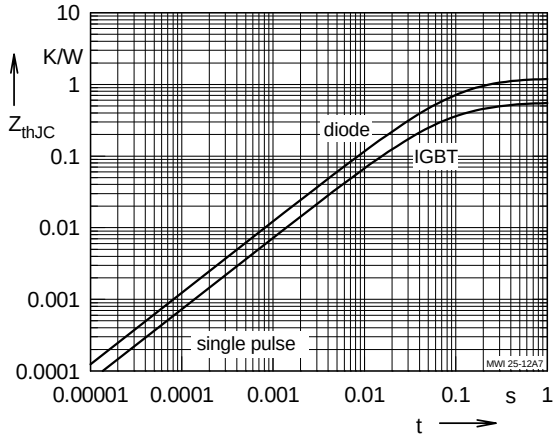


Fig. 12 Typ. transient thermal impedance

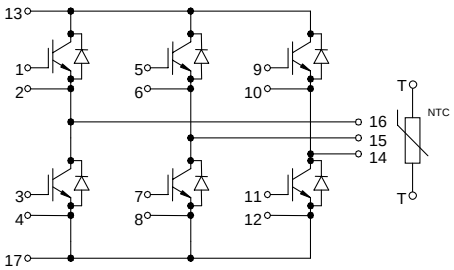
IGBT Modules
Sixpack

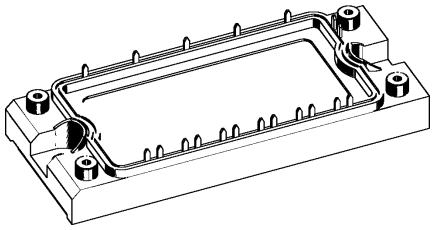
Short Circuit SOA Capability
Square RBSOA

I_{C25} = 62 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

Preliminary Data

Type:	NTC - Option:
MWI 35-12 A7	without NTC
MWI 35-12 A7T	with NTC





Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	62	A
I_{C80}	T_C = 80°C	44	A
RBSOA	V_{GE} = ±15 V; R_G = 39 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 70 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 39 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	280	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 35 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.2	2.8	V
	T_{VJ} = 125°C		2.6		V
$V_{GE(th)}$	I_C = 1.2 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			2	mA
	T_{VJ} = 125°C		2		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		100		ns
t_r	V_{CE} = 600 V; I_C = 35 A		80		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 39 Ω		500		ns
t_f			70		ns
E_{on}			5.4		mJ
E_{off}			4.2		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		2000		pF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 35 A		140		nC
R_{thJC}	(per IGBT)			0.44	K/W

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	50	A
I_{F80}	T_C = 80°C	33	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 35 A; V_{GE} = 0 V; T_{VJ} = 25°C			2.8	V
	T_{VJ} = 125°C		1.9		V
I_{RM}	I_F = 35 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		20		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		200		ns
R_{thJC}	(per diode)			1.19	K/W

Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

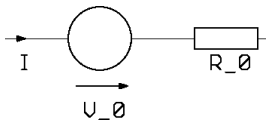
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

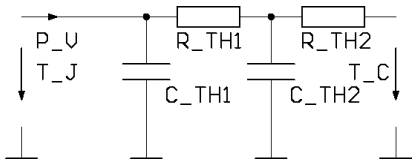
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.6 V; R_0 = 28 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 24.9 mΩ

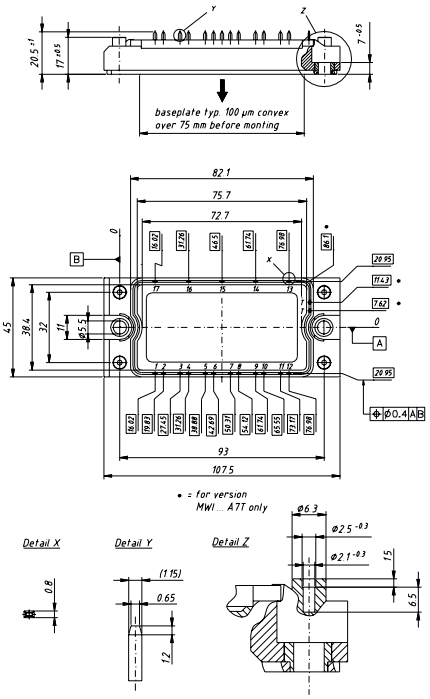
Thermal Response



IGBT (typ.)
C_{th1} = 0.166 J/K; R_{th1} = 0.342 K/W
C_{th2} = 1.921 J/K; R_{th2} = 0.098 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.081 J/K; R_{th1} = 0.973 K/W
C_{th2} = 0.915 J/K; R_{th2} = 0.217 K/W

Dimensions in mm (1 mm = 0.0394")



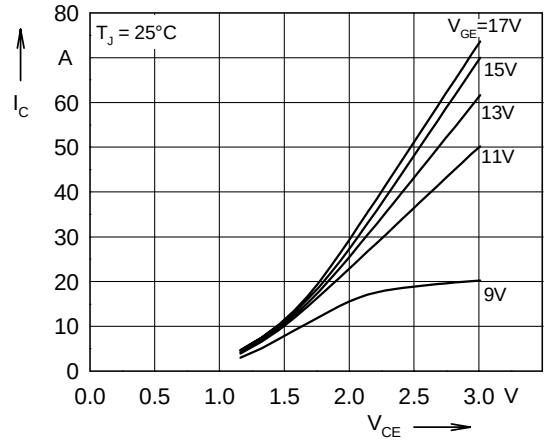


Fig. 1 Typ. output characteristics

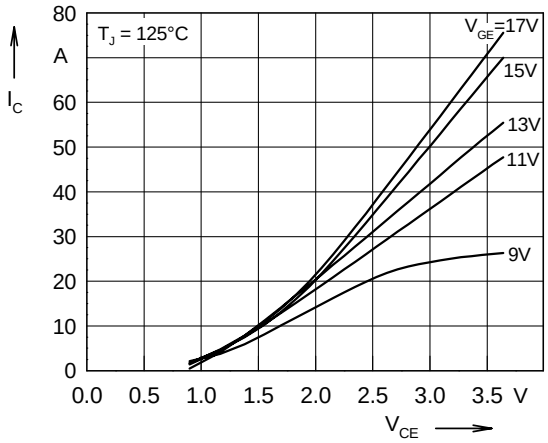


Fig. 2 Typ. output characteristics

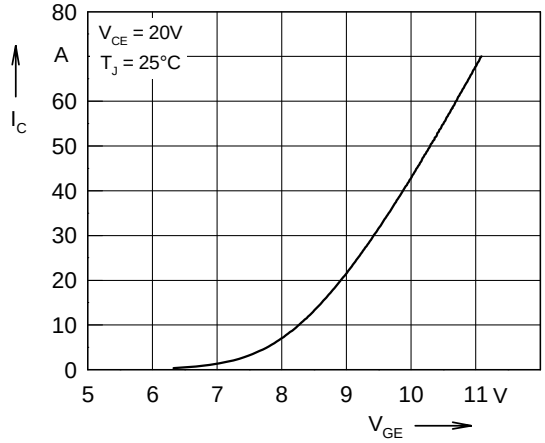


Fig. 3 Typ. transfer characteristics

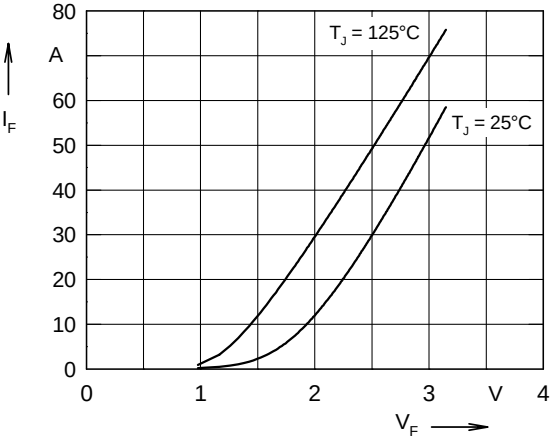


Fig. 4 Typ. forward characteristics of free wheeling diode

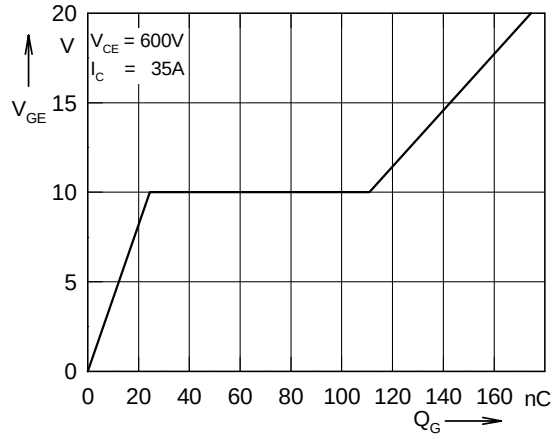


Fig. 5 Typ. turn on gate charge

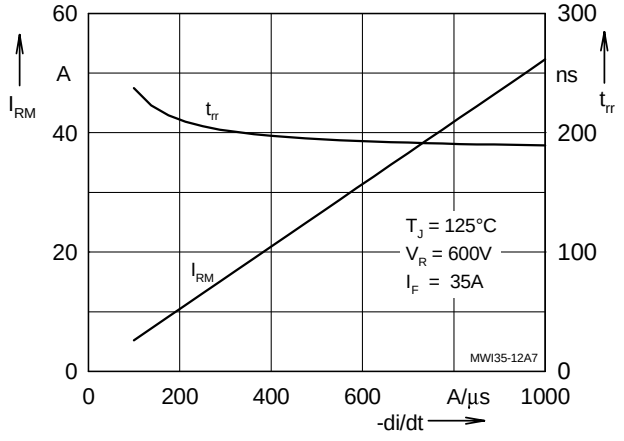


Fig. 6 Typ. turn off characteristics of free wheeling diode

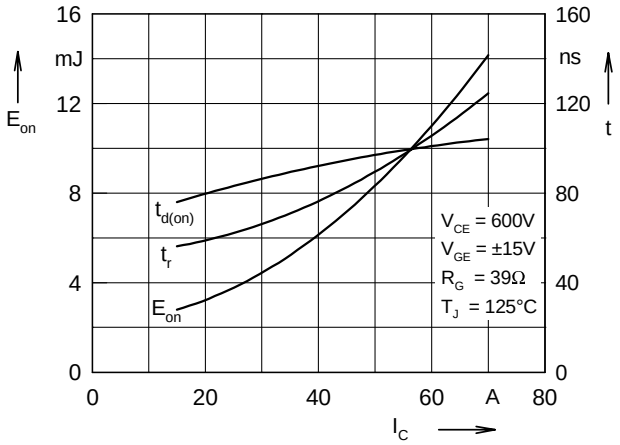


Fig. 7 Typ. turn on energy and switching times versus collector current

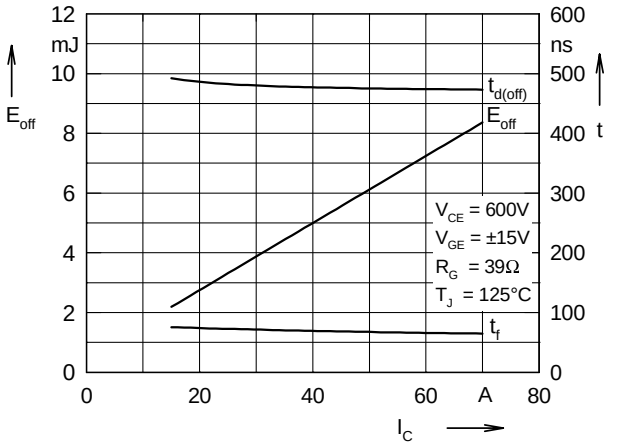


Fig. 8 Typ. turn off energy and switching times versus collector current

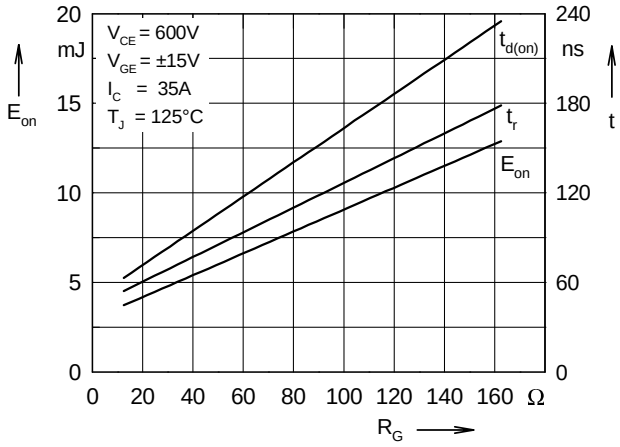


Fig. 9 Typ. turn on energy and switching times versus gate resistor

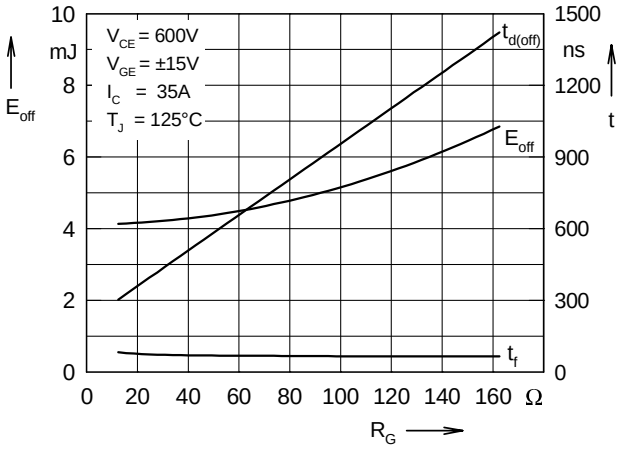


Fig.10 Typ. turn off energy and switching times versus gate resistor

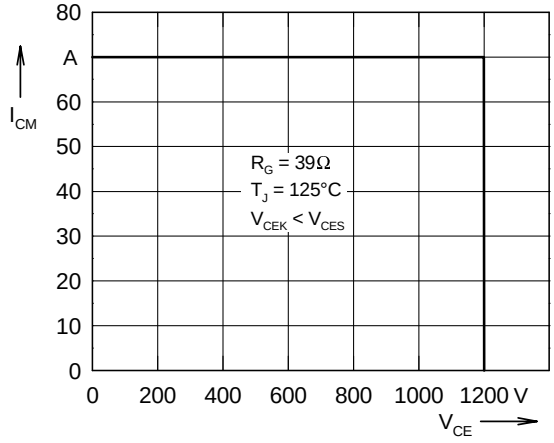


Fig. 11 Reverse biased safe operating area RBSOA

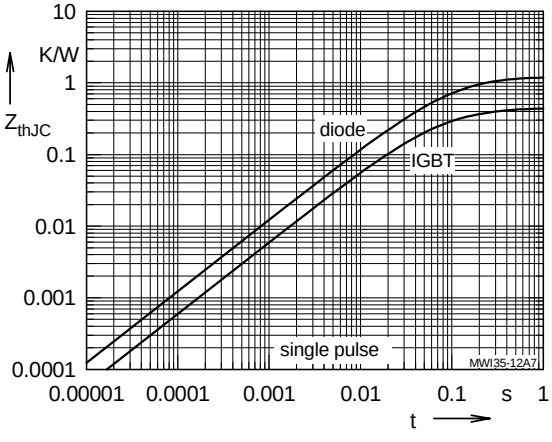


Fig. 12 Typ. transient thermal impedance

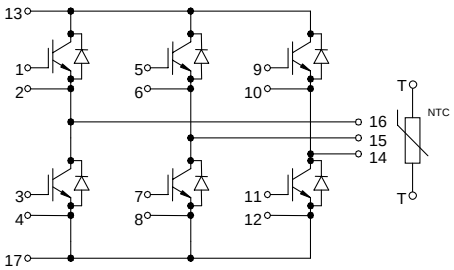
IGBT Modules
Sixpack

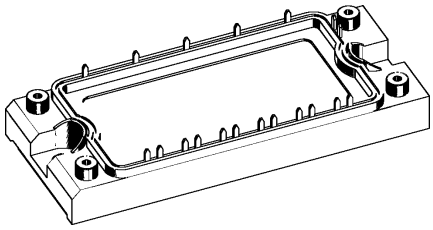
I_{C25} = 85 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

Short Circuit SOA Capability
Square RBSOA

Preliminary Data

Type:	NTC - Option:
MWI 50-12 A7	without NTC
MWI 50-12 A7T	with NTC





IGBTs

Symbol	Conditions		Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C		1200	V
V_{GES}			± 20	V
I_{C25}	T_C = 25°C		85	A
I_{C80}	T_C = 80°C		60	A
RBSOA	V_{GE} = ±15 V; R_G = 22 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = $V_{CEK} \le V_{CES}$	100	A
t_{SC} (SCSOA)	$V_{CE} = V_{CES}$; V_{GE} = ±15 V; R_G = 22 Ω; T_{VJ} = 125°C non-repetitive		10	µs
P_{tot}	T_C = 25°C		350	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 50 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.2	2.7	V
	T_{VJ} = 125°C		2.5		V
$V_{GE(th)}$	I_C = 2 mA; $V_{GE} = V_{CE}$	4.5		6.5	V
I_{CES}	$V_{CE} = V_{CES}$; V_{GE} = 0 V; T_{VJ} = 25°C			4	mA
	T_{VJ} = 125°C		3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 600 V; I_C = 50 A V_{GE} = ±15 V; R_G = 22 Ω		100		ns
t_r			70		ns
$t_{d(off)}$			500		ns
t_f			70		ns
E_{on}			7.6		mJ
E_{off}			5.6		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		3300		pF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 50 A		230		nC
R_{thJC}	(per IGBT)			0.35	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	110	A
I_{F80}	T_C = 80°C	70	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 50 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.2	2.6	V
	T_{VJ} = 125°C		1.6	1.8	V
I_{RM}	I_F = 50 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		40		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		200		ns
R_{thJC}	(per diode)			0.61	K/W

Temperature Sensor NTC (MWI ... A7T version only)

Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

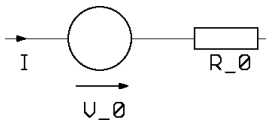
Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	2.7 - 3.3	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.02		K/W
Weight			180		g

Equivalent Circuits for Simulation

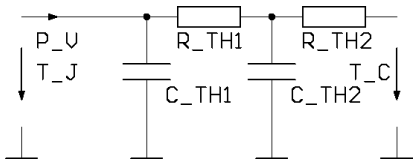
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.5 V; R_0 = 20.7 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 11.3 mΩ

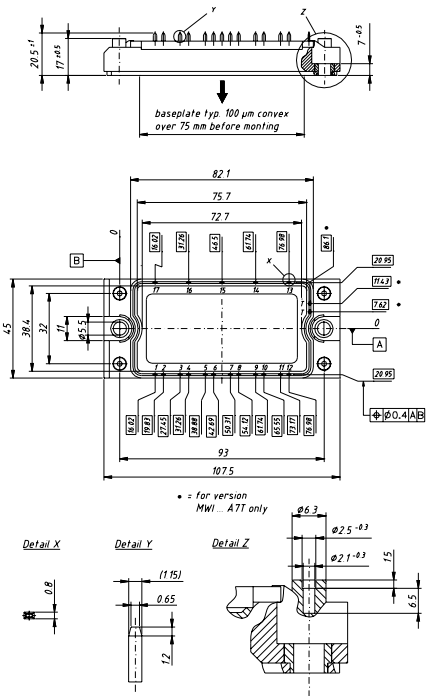
Thermal Response



IGBT (typ.)
C_{th1} = 0.22 J/K; R_{th1} = 0.26 K/W
C_{th2} = 1.74 J/K; R_{th2} = 0.09 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.16 J/K; R_{th1} = 0.483 K/W
C_{th2} = 1.37 J/K; R_{th2} = 0.127 K/W

Dimensions in mm (1 mm = 0.0394")



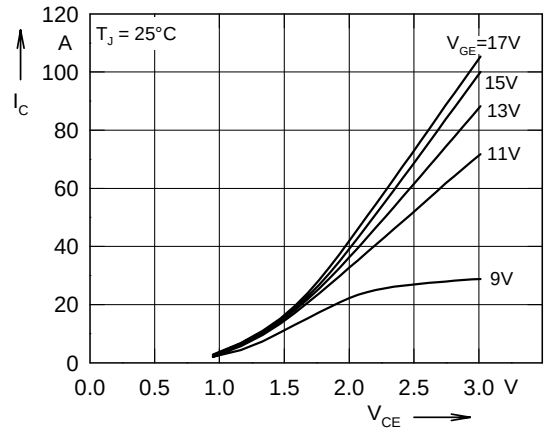


Fig. 1 Typ. output characteristics

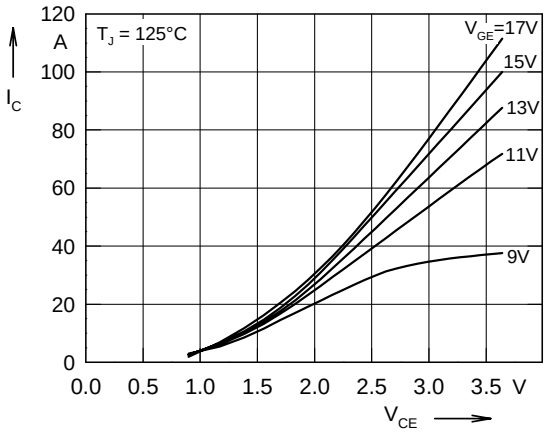


Fig. 2 Typ. output characteristics

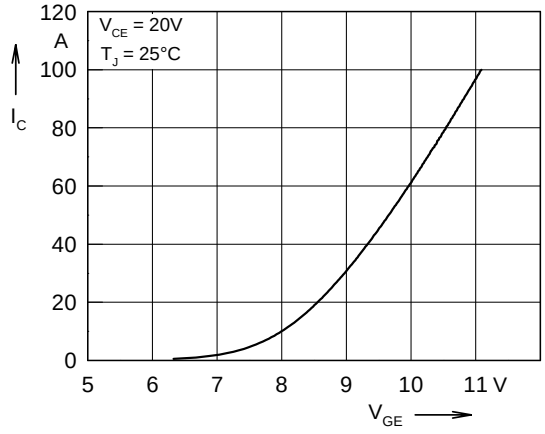


Fig. 3 Typ. transfer characteristics

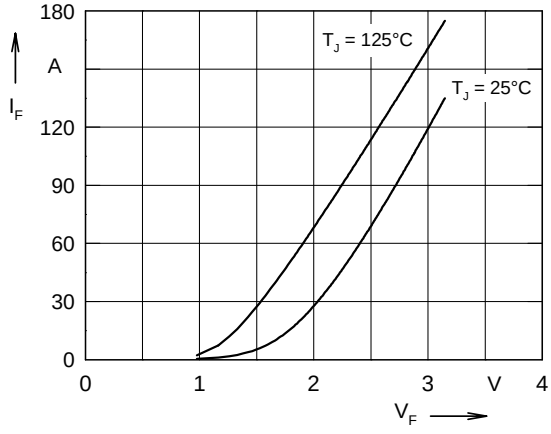


Fig. 4 Typ. forward characteristics of free wheeling diode

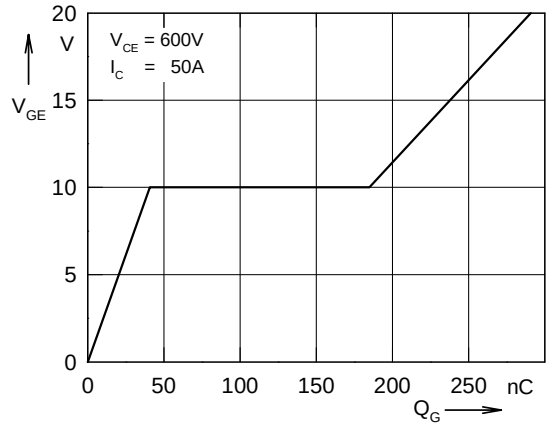


Fig. 5 Typ. turn on gate charge

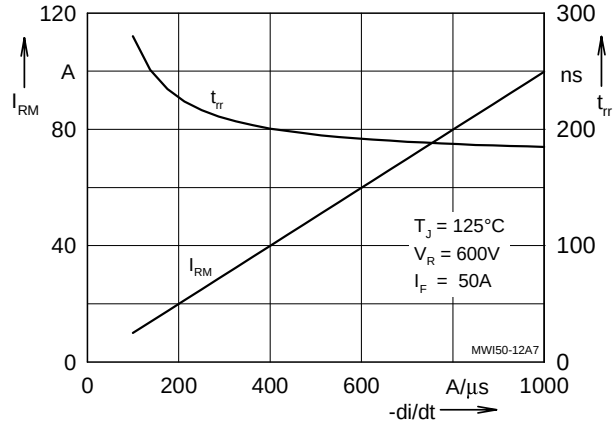


Fig. 6 Typ. turn off characteristics of free wheeling diode

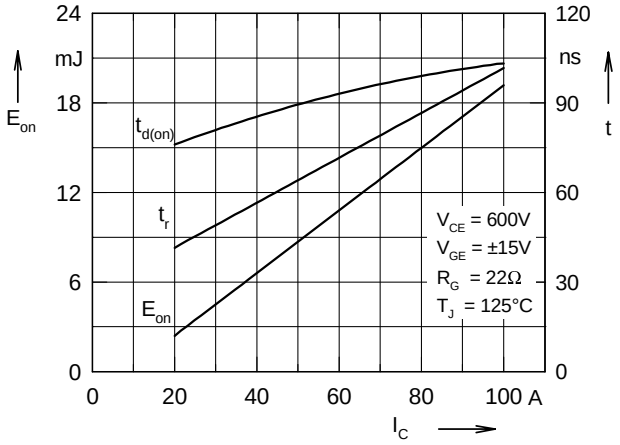


Fig. 7 Typ. turn on energy and switching times versus collector current

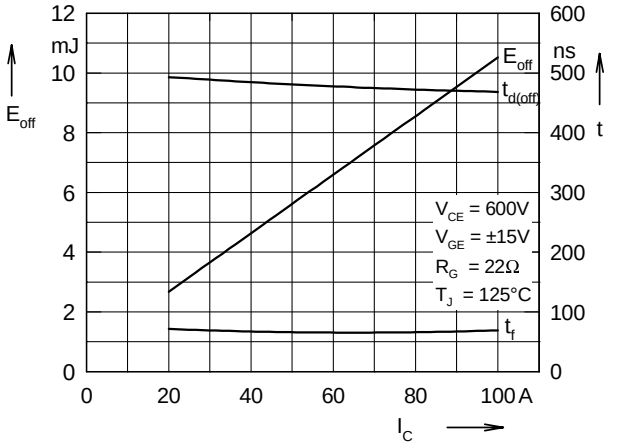


Fig. 8 Typ. turn off energy and switching times versus collector current

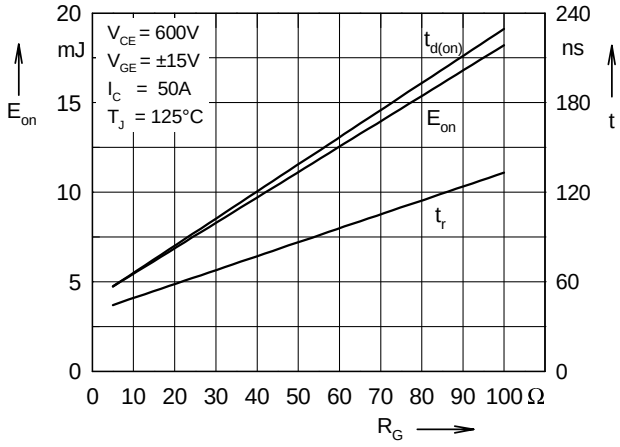


Fig. 9 Typ. turn on energy and switching times versus gate resistor

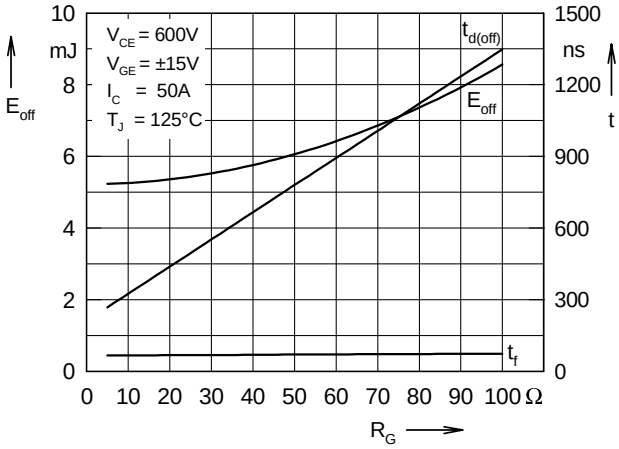


Fig.10 Typ. turn off energy and switching times versus gate resistor

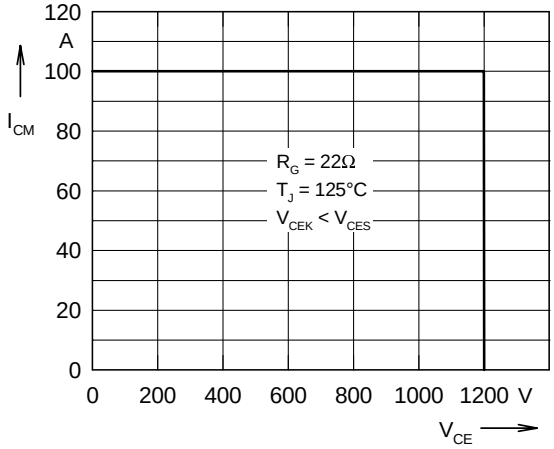


Fig. 11 Reverse biased safe operating area RBSOA

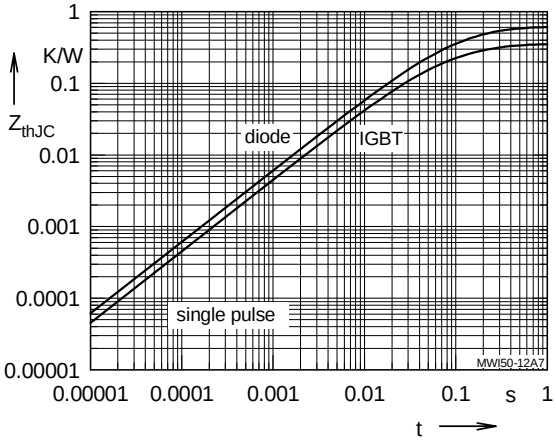
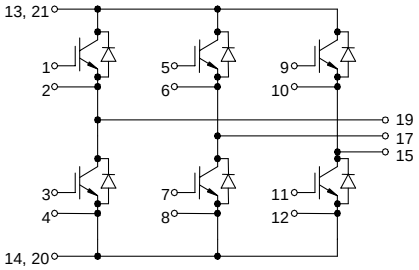


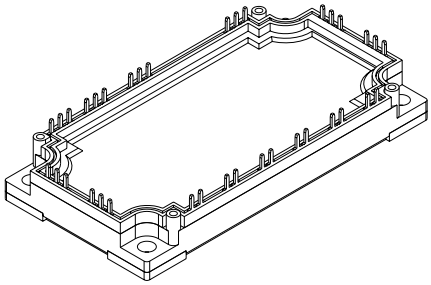
Fig. 12 Typ. transient thermal impedance

IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 130 A
V_{CES} = 600 V
$V_{CE(sat)\ typ.}$ = 2.0 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	130	A
I_{C80}	T_C = 80°C	88	A
RBSOA	V_{GE} = ±15 V; R_G = 2.2 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 200 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 2.2 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	410	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 100 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.5	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 1.5 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			1.2	mA
	T_{VJ} = 125°C		0.9		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			400	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		25		ns
t_r	V_{CE} = 300 V; I_C = 100 A		11		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 2.2 Ω		150		ns
t_f			30		ns
E_{on}			1.0		mJ
E_{off}			2.9		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		4.3		nF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 100 A		tbd		nC
R_{thJC}	(per IGBT)			0.3	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	140	A
I_{F80}	T_C = 80°C	88	A

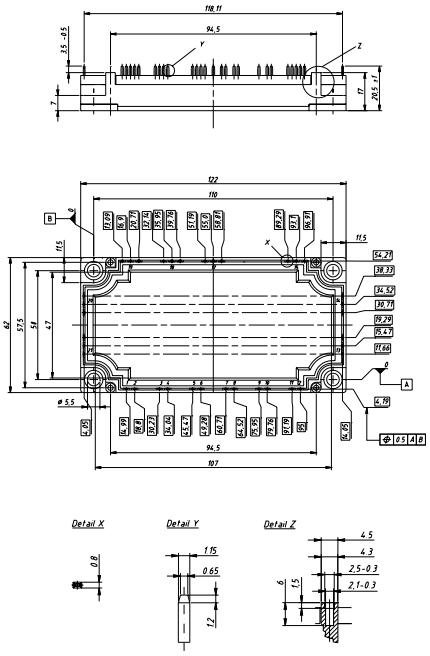
Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 100 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.9	2.1	V
	T_{VJ} = 125°C		1.4		V
I_{RM}	I_F = 60 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		28		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		100		ns
R_{thJC}	(per diode)			0.61	K/W

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			1.8		mΩ
d_S	Creepage distance on surface	10			mm
d_A	Strike distance in air	10			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

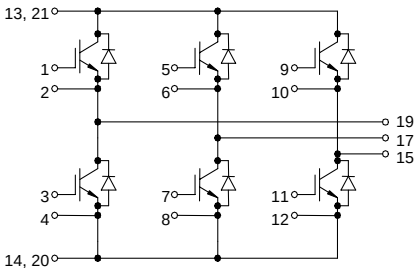
Dimensions in mm (1 mm = 0.0394")

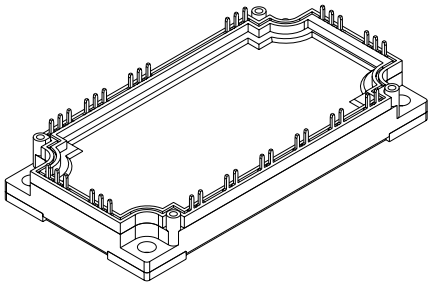


IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 185 A
V_{CES} = 600 V
$V_{CE(sat)\ typ.}$ = 2.0 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	185	A
I_{C80}	T_C = 80°C	130	A
RBSOA	V_{GE} = ±15 V; R_G = 1.5 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 300 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	$V_{CE} = V_{CES}$; V_{GE} = ±15 V; R_G = 1.5 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	620	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 150 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.5	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 3 mA; $V_{GE} = V_{CE}$	4.5		6.5	V
I_{CES}	$V_{CE} = V_{CES}$; V_{GE} = 0 V; T_{VJ} = 25°C			1.5	mA
	T_{VJ} = 125°C		1.1		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			400	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 150 A V_{GE} = ±15 V; R_G = 1.5 Ω		125		ns
t_r			30		ns
$t_{d(off)}$			225		ns
t_f			35		ns
E_{on}			2.3		mJ
E_{off}			4.6		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		6.5		nF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 150 A		tbd		nC
R_{thJC}	(per IGBT)			0.2	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

021

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	210	A
I_{F80}	T_C = 80°C	130	A

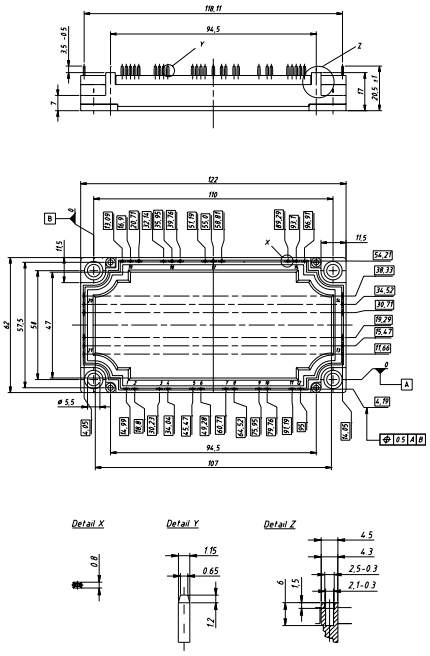
Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 150 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.9	2.0	V
	T_{VJ} = 125°C		1.4		V
I_{RM}	I_F = 150 A; di_F/dt = -750 A/µs; T_{VJ} = 125°C		37		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		100		ns
R_{thJC}	(per diode)			0.41	K/W

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			1.8		mΩ
d_S	Creepage distance on surface	10			mm
d_A	Strike distance in air	10			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

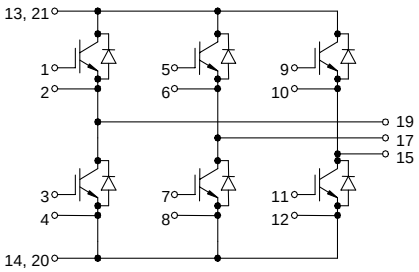
Dimensions in mm (1 mm = 0.0394")

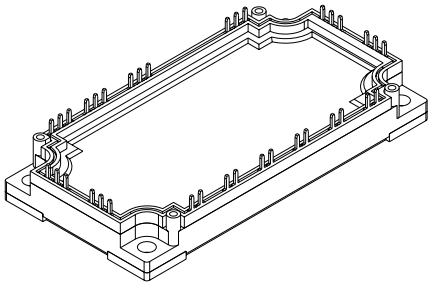


IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 240 A
V_{CES} = 600 V
$V_{CE(sat)\ typ.}$ = 2.0 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	240	A
I_{C80}	T_C = 80°C	165	A
RBSOA	V_{GE} = ±15 V; R_G = 1.5 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 400 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 1.5 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	750	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 200 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.0	2.5	V
	T_{VJ} = 125°C		2.3		V
$V_{GE(th)}$	I_C = 4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			1.8	mA
	T_{VJ} = 125°C		1.5		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			400	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		180		ns
t_r	V_{CE} = 300 V; I_C = 200A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 1.5 Ω		300		ns
t_f			40		ns
E_{on}			4.6		mJ
E_{off}			6.3		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		9.0		nF
Q_{Gon}	V_{CE} = 300V; V_{GE} = 15 V; I_C = 200 A		tbd		nC
R_{thJC}	(per IGBT)			0.17	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

021

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	260	A
I_{F80}	T_C = 80°C	165	A

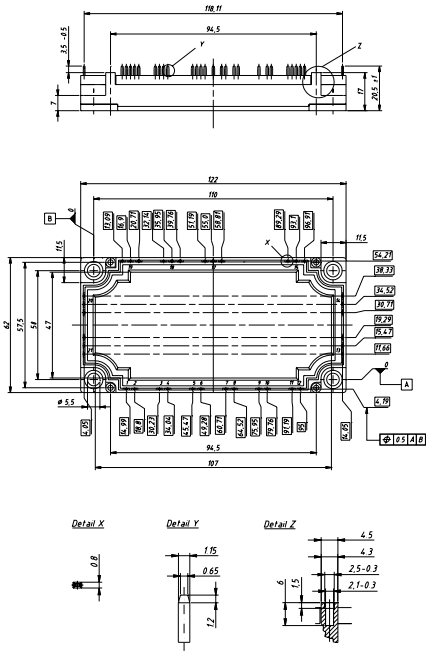
Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 200 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.9	2.1	V
	T_{VJ} = 125°C		1.5		V
I_{RM}	I_F = 120 A; di_F/dt = -1000 A/µs; T_{VJ} = 125°C		56		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		100		ns
R_{thJC}	(per diode)			0.3	K/W

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			1.8		mΩ
d_S	Creepage distance on surface	10			mm
d_A	Strike distance in air	10			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

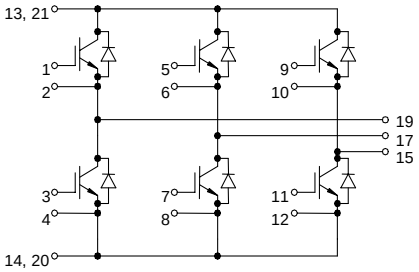
Dimensions in mm (1 mm = 0.0394")

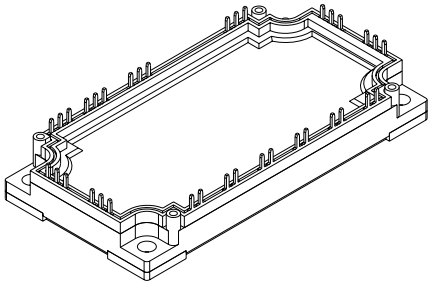


IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 140 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	140	A
I_{C80}	T_C = 80°C	100	A
RBSOA	V_{GE} = ±15 V; R_G = 15 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 150 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	$V_{CE} = V_{CES}$; V_{GE} = ±15 V; R_G = 15 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	620	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 75 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.2	2.6	V
	T_{VJ} = 125°C		2.5		V
$V_{GE(th)}$	I_C = 3 mA; $V_{GE} = V_{CE}$	4.5		6.5	V
I_{CES}	$V_{CE} = V_{CES}$; V_{GE} = 0 V; T_{VJ} = 25°C			5	mA
	T_{VJ} = 125°C		3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			400	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		100		ns
t_r	V_{CE} = 600 V; I_C = 75 A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 15 Ω		650		ns
t_f			50		ns
E_{on}			12.1		mJ
E_{off}			10.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		5.5		nF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 75 A		350		nC
R_{thJC}	(per IGBT)			0.2	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

021

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	150	A
I_{F80}	T_C = 80°C	100	A

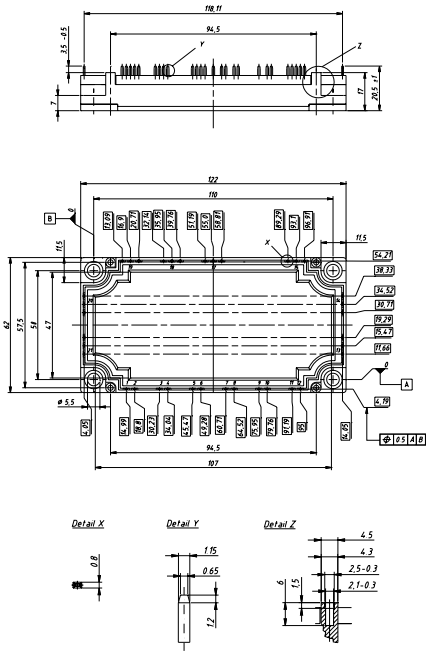
Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 75 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.2	2.5	V
	T_{VJ} = 125°C		1.6		V
I_{RM}	I_F = 75 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		79		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		220		ns
R_{thJC}	(per diode)			0.41	K/W

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			1.8		mΩ
d_S	Creepage distance on surface	10			mm
d_A	Strike distance in air	10			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

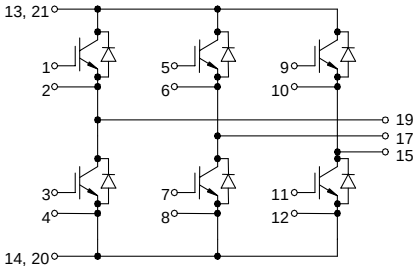
Dimensions in mm (1 mm = 0.0394")

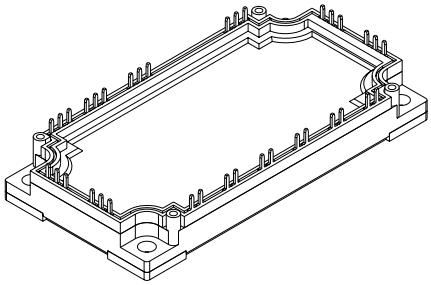


IGBT Modules
Sixpack

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 170 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	170	A
I_{C80}	T_C = 80°C	120	A
RBSOA	V_{GE} = ±15 V; R_G = 6.8 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 200 $V_{CEK} \le V_{CES}$	A
t_{SC} **(SCSOA)**	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 6.8 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	750	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 100 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.2	2.6	V
	T_{VJ} = 125°C		2.5		V
$V_{GE(th)}$	I_C = 4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			6.3	mA
	T_{VJ} = 125°C		4		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			400	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		100		ns
t_r	V_{CE} = 600 V; I_C = 100 A		60		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 6.8 Ω		600		ns
t_f			90		ns
E_{on}			16.1		mJ
E_{off}			14.6		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		6.5		nF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 100 A		475		nC
R_{thJC}	(per IGBT)			0.17	K/W

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- solderable pins for PCB mounting
- package with copper base plate

Advantages
- space savings
- reduced protection circuits
- package designed for wave soldering

Typical Applications
- AC motor control
- AC servo and robot drives
- power supplies

021

Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	200	A
I_{F80}	T_C = 80°C	130	A

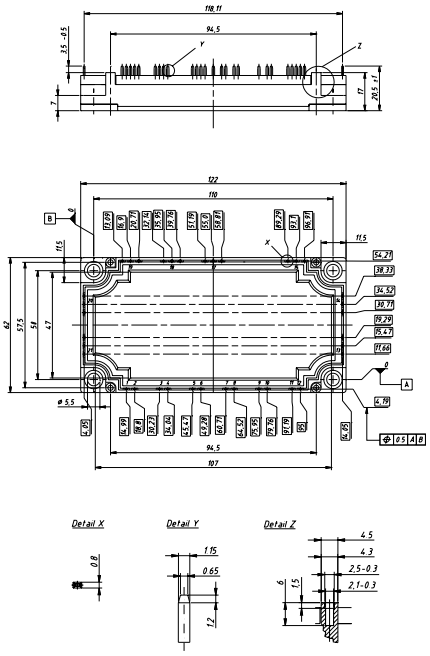
Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 100 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.2	2.5	V
	T_{VJ} = 125°C		1.6		V
I_{RM}	I_F = 120 A; di_F/dt = -750 A/µs; T_{VJ} = 125°C		82		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		200		ns
R_{thJC}	(per diode)			0.3	K/W

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			1.8		mΩ
d_S	Creepage distance on surface	10			mm
d_A	Strike distance in air	10			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

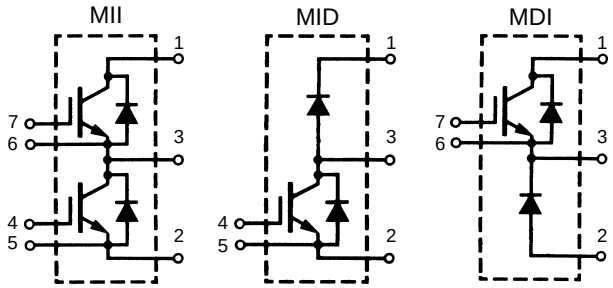
Dimensions in mm (1 mm = 0.0394")

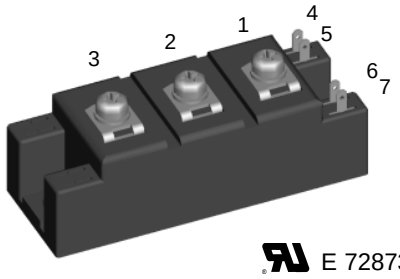


IGBT Modules

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 90 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V





E 72873

Preliminary data

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	90	A
I_{C80}	T_C = 80°C	60	A
I_{CM}	T_C = 80°C, t_p = 1 ms	120	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C R_G = 22 Ω, non repetitive	10	µs
RBSOA	V_{GE} = ±15 V, T_J = 125°C, R_G = 22 Ω Clamped inductive load, L = 100 µH	I_{CM} = 100 $V_{CEK} \leq V_{CES}$	A
P_{tot}	T_C = 25°C	370	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min $I_{ISOL} \leq$ 1 mA t = 1 s Insulating material: Al_2O_3	4000 4800	V~ V~
M_d	Mounting torque (module) (teminals)	2.25-2.75 20-25 2.5-3.7 22-33	Nm lb.in. Nm lb.in.
d_S	Creepage distance on surface	12.7	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	130 4.6	g oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

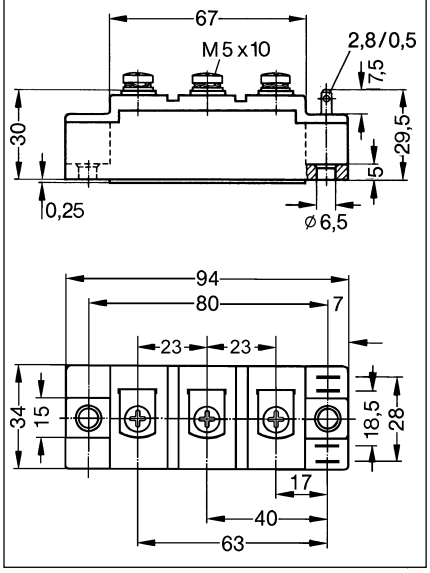
Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

922

Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 2 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			4	mA
		T_J = 125°C		6		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±200	nA
$V_{CE(sat)}$	I_C = 50 A, V_{GE} = 15 V			2.2	2.7	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			3.3		nF
C_{oes}				0.5		nF
C_{res}				0.22		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C**			100		ns
t_r	I_C = 50 A, V_{GE} = ±15 V			70		ns
$t_{d(off)}$	V_{CE} = 600 V, R_G = 22 Ω			500		ns
t_f				70		ns
E_{on}				7.6		mJ
E_{off}				5.6		mJ
R_{thJC}					0.33	K/W
R_{thJS}	with heatsink compound			0.66		K/W

Dimensions in mm (1 mm = 0.0394")

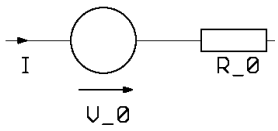


Reverse Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 50 A, V_{GE} = 0 V,		2.2	2.5	V
	I_F = 50 A, V_{GE} = 0 V, T_J = 125°C		1.8	1.9	V
I_F	T_C = 25°C			100	A
	T_C = 80°C			60	A
I_{RM}	I_F = 50 A, V_{GE} = 0 V, -di_F/dt = 400 A/µs		40		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.66	K/W
R_{thJS}	with heatsink compound		1.32		K/W

Equivalent Circuits for Simulation

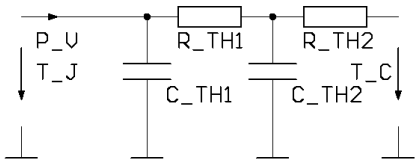
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.5 V; R_0 = 20.1 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 10.8 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.13 J/K; R_{th1} = 0.323 K/W
C_{th2} = 0.32 J/K; R_{th2} = 0.008 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.10 J/K; R_{th1} = 0.645 K/W
C_{th2} = 0.18 J/K; R_{th2} = 0.013 K/W

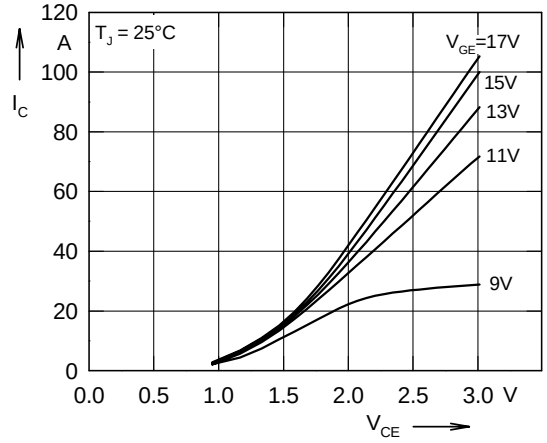


Fig. 1 Typ. output characteristics

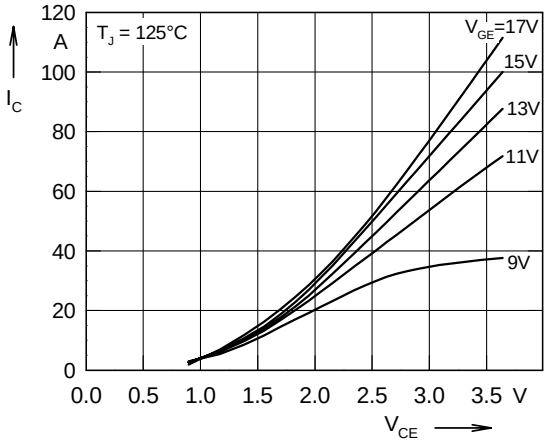


Fig. 2 Typ. output characteristics

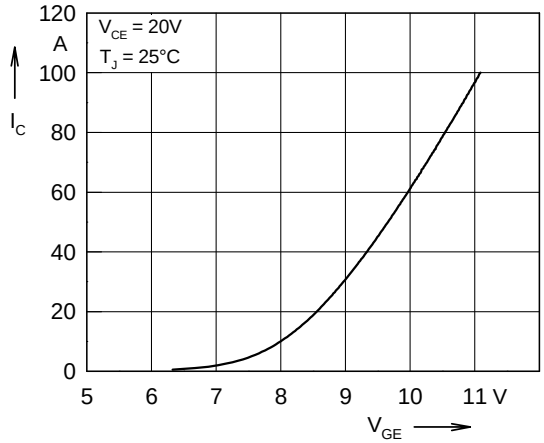


Fig. 3 Typ. transfer characteristics

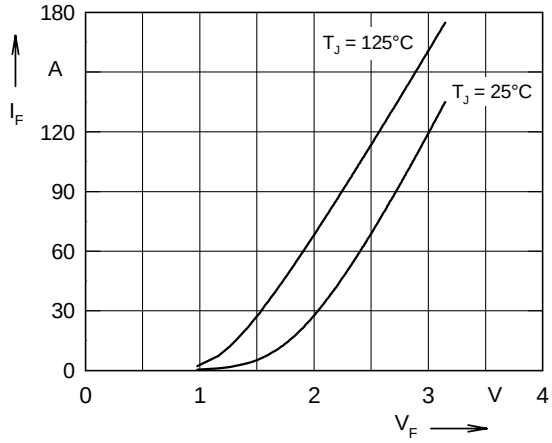


Fig. 4 Typ. forward characteristics of free wheeling diode

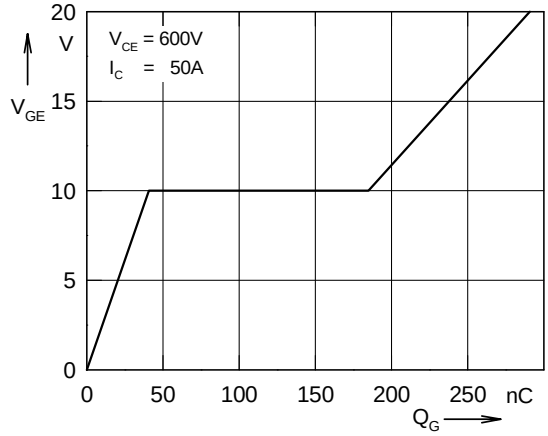


Fig. 5 Typ. turn on gate charge

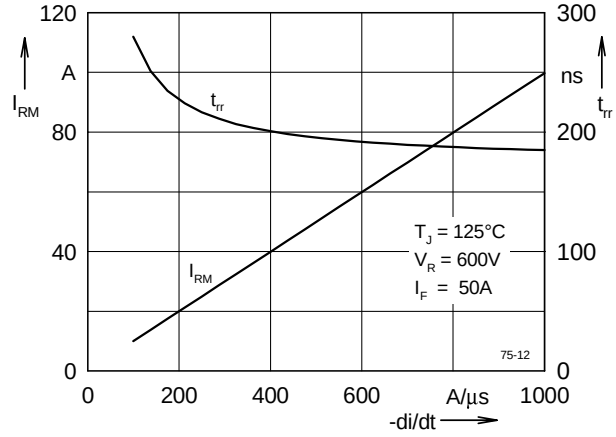


Fig. 6 Typ. turn off characteristics of free wheeling diode

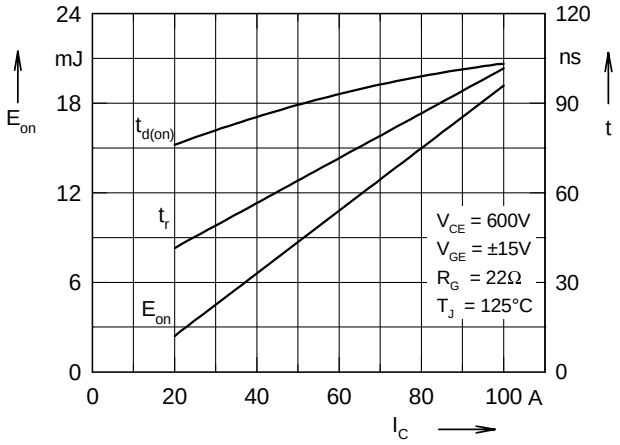


Fig. 7 Typ. turn on energy and switching times versus collector current

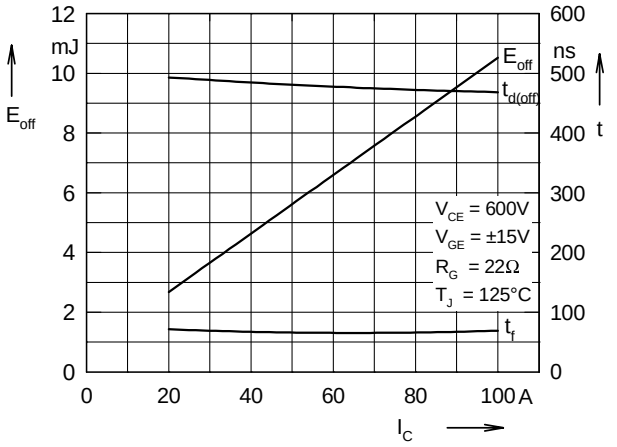


Fig. 8 Typ. turn off energy and switching times versus collector current

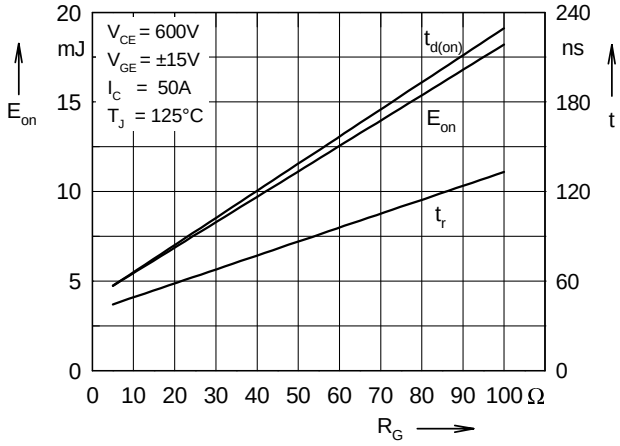


Fig. 9 Typ. turn on energy and switching times versus gate resistor

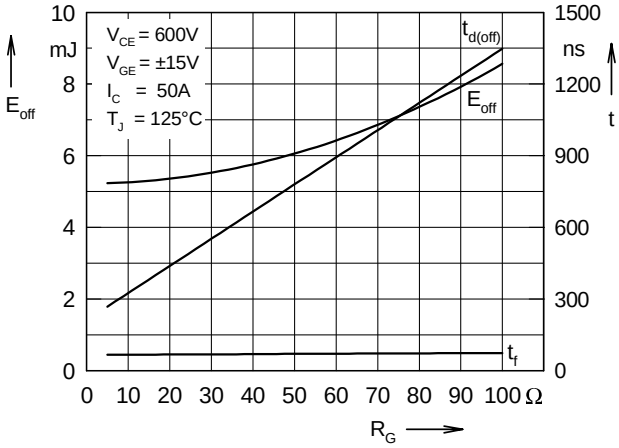


Fig.10 Typ. turn off energy and switching times versus gate resistor

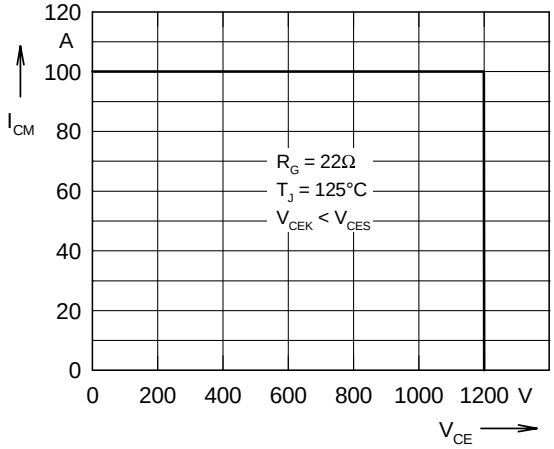


Fig. 11 Reverse biased safe operating area RBSOA

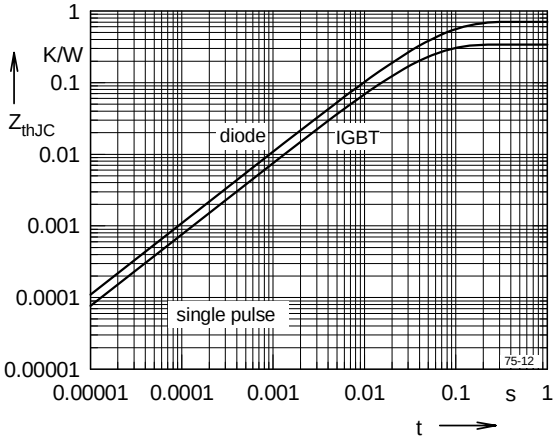
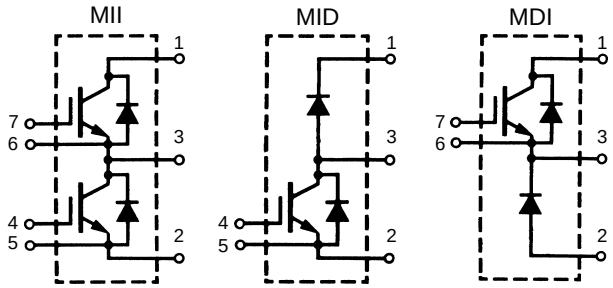


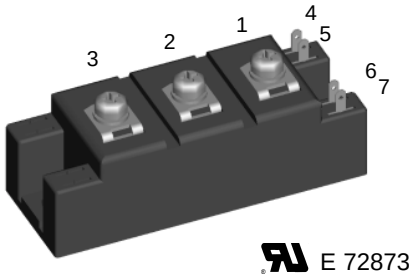
Fig. 12 Typ. transient thermal impedance

IGBT Modules

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 135 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V





E 72873

Preliminary data

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	135	A
I_{C80}	T_C = 80°C	90	A
I_{CM}	T_C = 80°C, t_p = 1 ms	180	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C R_G = 15 Ω, non repetitive	10	µs
RBSOA	V_{GE} = ±15 V, T_J = 125°C, R_G = 15 Ω Clamped inductive load, L = 100 µH	I_{CM} = 150 $V_{CEK} \leq V_{CES}$	A
P_{tot}	T_C = 25°C	560	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min $I_{ISOL} \leq$ 1 mA t = 1 s Insulating material: Al_2O_3	4000 4800	V~ V~
M_d	Mounting torque (module) (teminals)	2.25-2.75 20-25 2.5-3.7 22-33	Nm lb.in. Nm lb.in.
d_S	Creepage distance on surface	12.7	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	130 4.6	g oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

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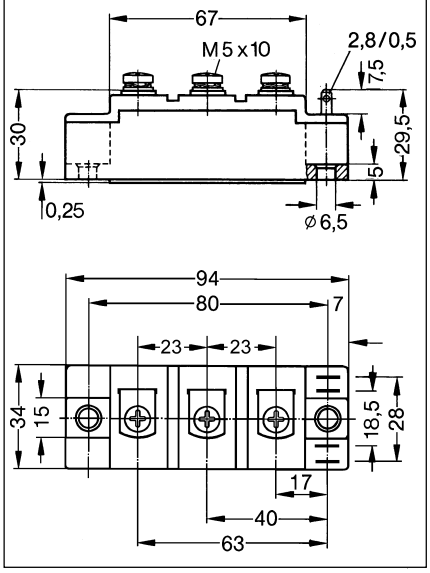
Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 3 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			5	mA
		T_J = 125°C		7.5		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±300	nA
$V_{CE(sat)}$	I_C = 75 A, V_{GE} = 15 V			2.2	2.7	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			5.5		nF
C_{oes}				0.75		nF
C_{res}				0.33		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C**			100		ns
t_r	I_C = 75 A, V_{GE} = ±15 V			50		ns
$t_{d(off)}$	V_{CE} = 600 V, R_G = 15 Ω			650		ns
t_f				50		ns
E_{on}				12.1		mJ
E_{off}				10.5		mJ
R_{thJC}					0.22	K/W
R_{thJS}	with heatsink compound			0.44		K/W

Dimensions in mm (1 mm = 0.0394")

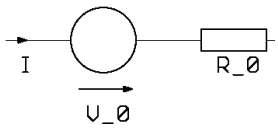


Reverse Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 75 A, V_{GE} = 0 V,		2.2	2.5	V
	I_F = 75 A, V_{GE} = 0 V, T_J = 125°C		1.7	1.8	V
I_F	T_C = 25°C			150	A
	T_C = 80°C			95	A
I_{RM}	I_F = 75 A, V_{GE} = 0 V, -di_F/dt = 600 A/µs		62		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.45	K/W
R_{thJS}	with heatsink compound		0.9		K/W

Equivalent Circuits for Simulation

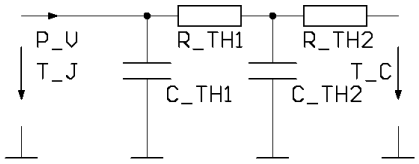
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.5 V; R_0 = 13.6 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 6.5 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.20 J/K; R_{th1} = 0.218 K/W
C_{th2} = 0.47 J/K; R_{th2} = 0.005 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.14 J/K; R_{th1} = 0.443 K/W
C_{th2} = 0.26 J/K; R_{th2} = 0.009 K/W

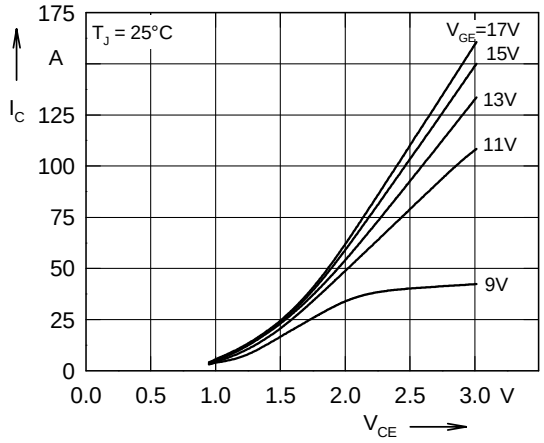


Fig. 1 Typ. output characteristics

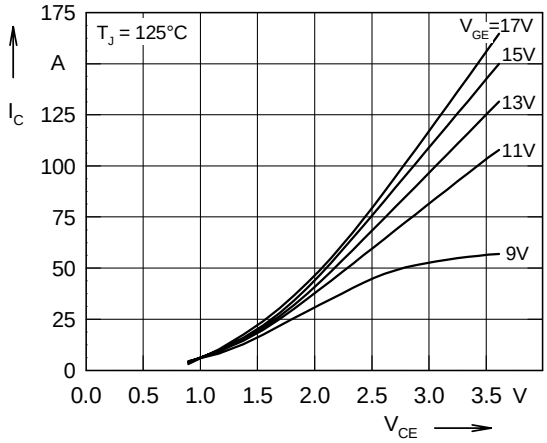


Fig. 2 Typ. output characteristics

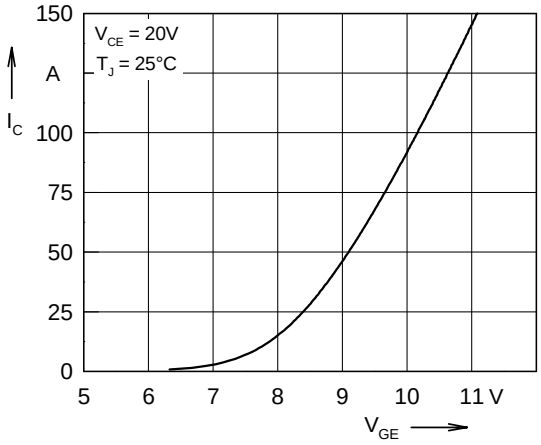


Fig. 3 Typ. transfer characteristics

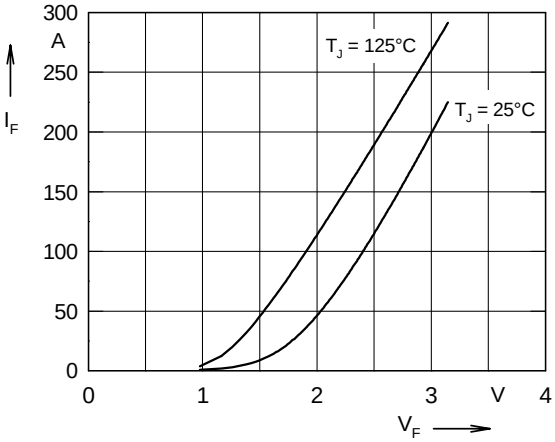


Fig. 4 Typ. forward characteristics of free wheeling diode

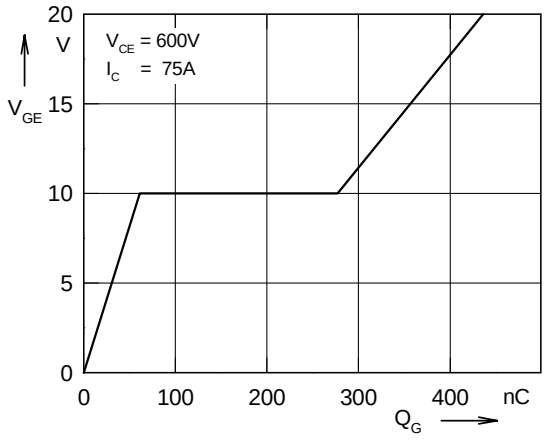


Fig. 5 Typ. turn on gate charge

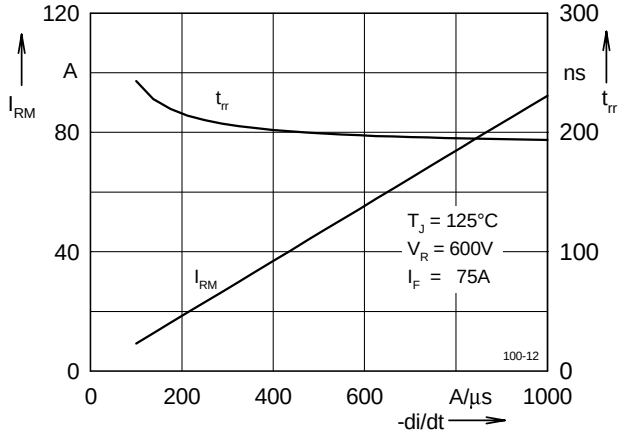


Fig. 6 Typ. turn off characteristics of free wheeling diode

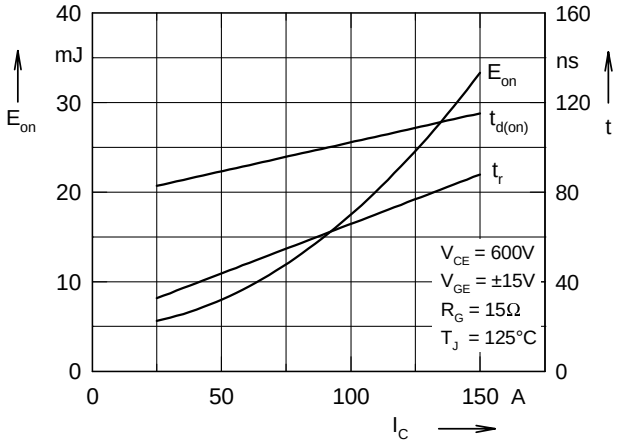


Fig. 7 Typ. turn on energy and switching times versus collector current

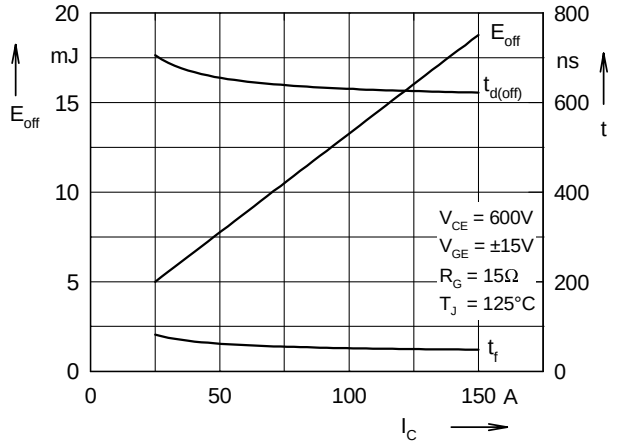


Fig. 8 Typ. turn off energy and switching times versus collector current

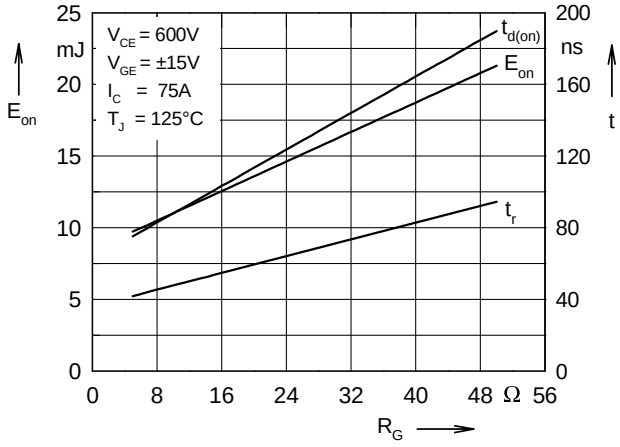


Fig. 9 Typ. turn on energy and switching times versus gate resistor

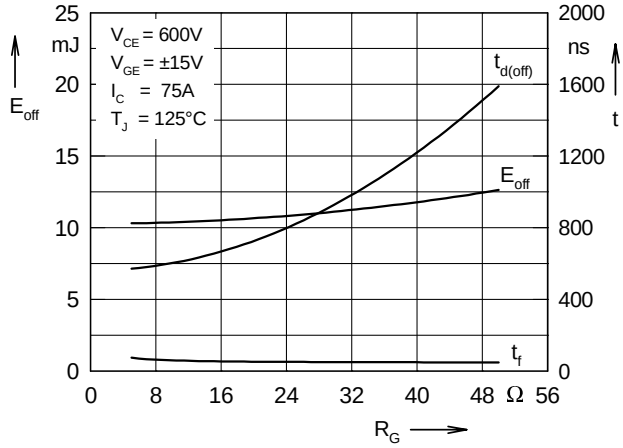


Fig.10 Typ. turn off energy and switching times versus gate resistor

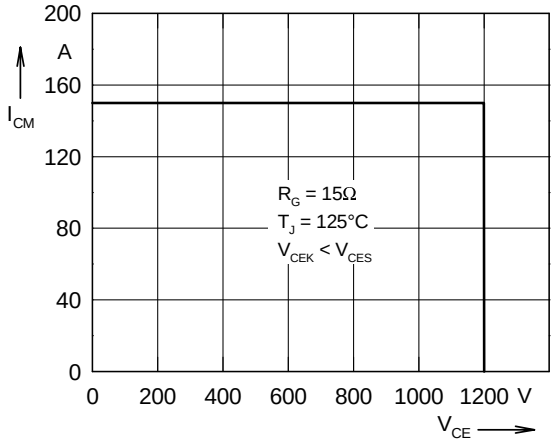


Fig. 11 Reverse biased safe operating area RBSOA

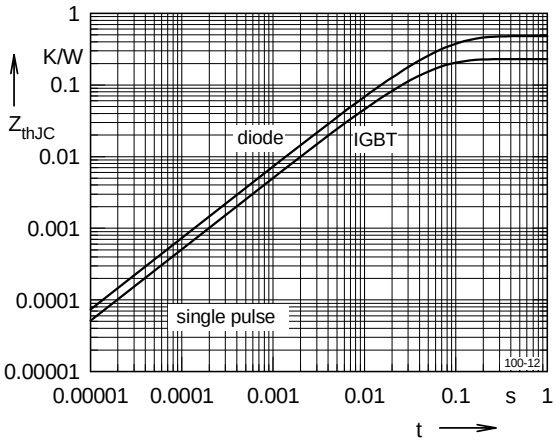
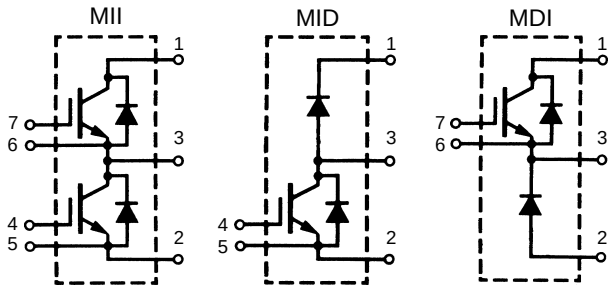


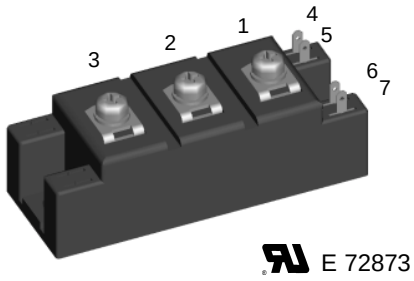
Fig. 12 Typ. transient thermal impedance

IGBT Modules

Short Circuit SOA Capability
Square RBSOA

I_{C25} = 160 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V





E 72873

Preliminary data

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	160	A
I_{C80}	T_C = 80°C	110	A
I_{CM}	T_C = 80°C, t_p = 1 ms	220	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C R_G = 6.8 Ω, non repetitive	10	µs
RBSOA	V_{GE} = ±15 V, T_J = 125°C, R_G = 6.8 Ω Clamped inductive load, L = 100 µH	I_{CM} = 200 $V_{CEK} \leq V_{CES}$	A
P_{tot}	T_C = 25°C	700	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min $I_{ISOL} \leq$ 1 mA t = 1 s Insulating material: Al_2O_3	4000 4800	V~ V~
M_d	Mounting torque (module) (teminals)	2.25-2.75 20-25 2.5-3.7 22-33	Nm lb.in. Nm lb.in.
d_S	Creepage distance on surface	12.7	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	130 4.6	g oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

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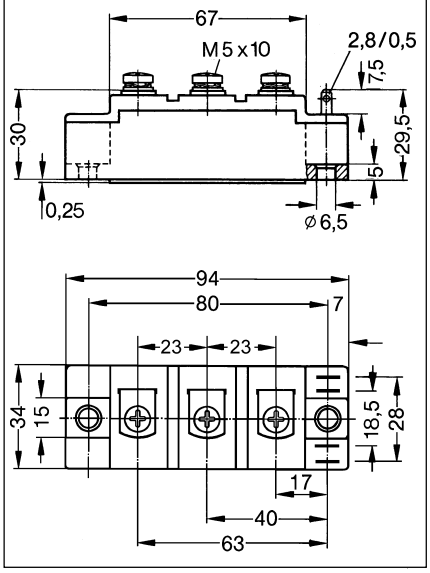
Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 4 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			6	mA
		T_J = 125°C		9		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±400	nA
$V_{CE(sat)}$	I_C = 100 A, V_{GE} = 15 V			2.2	2.7	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			6.5		nF
C_{oes}				1		nF
C_{res}				0.5		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C**			100		ns
t_r	I_C = 100 A, V_{GE} = ±15 V			60		ns
$t_{d(off)}$	V_{CE} = 600 V, R_G = 6.8 Ω			600		ns
t_f				90		ns
E_{on}				16		mJ
E_{off}				15		mJ
R_{thJC}					0.18	K/W
R_{thJS}	with heatsink compound			0.36		K/W

Dimensions in mm (1 mm = 0.0394")

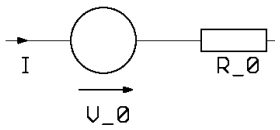


Reverse Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 100 A, V_{GE} = 0 V,		2.4	2.6	V
	I_F = 100 A, V_{GE} = 0 V, T_J = 125°C		1.9	2.0	V
I_F	T_C = 25°C			150	A
	T_C = 80°C			95	A
I_{RM}	I_F = 100 A, V_{GE} = 0 V, -di_F/dt = 600 A/µs		62		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.45	K/W
R_{thJS}	with heatsink compound		0.9		K/W

Equivalent Circuits for Simulation

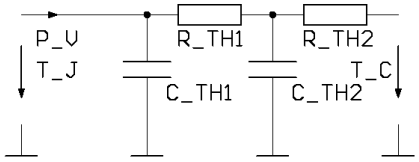
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.3 V; R_0 = 12.0 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 6.5 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.25 J/K; R_{th1} = 0.175 K/W
C_{th2} = 0.58 J/K; R_{th2} = 0.004 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.14 J/K; R_{th1} = 0.443 K/W
C_{th2} = 0.26 J/K; R_{th2} = 0.009 K/W

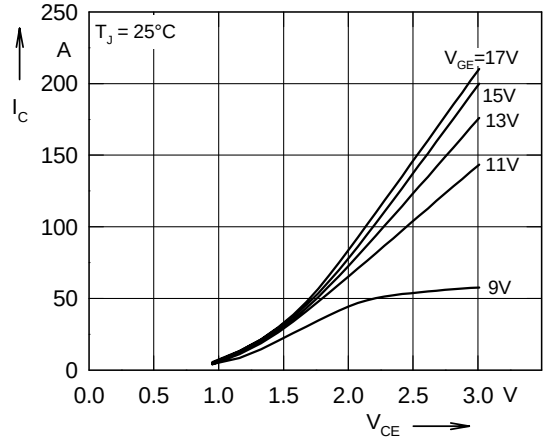


Fig. 1 Typ. output characteristics

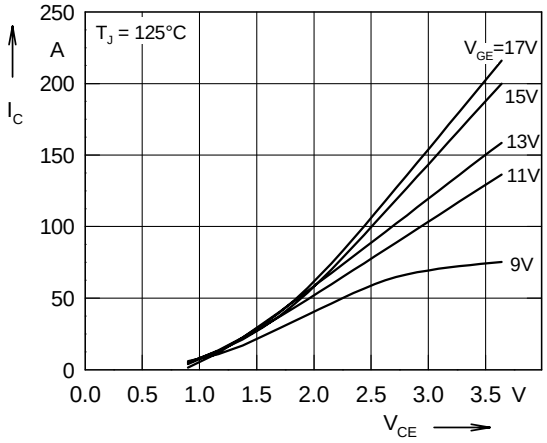


Fig. 2 Typ. output characteristics

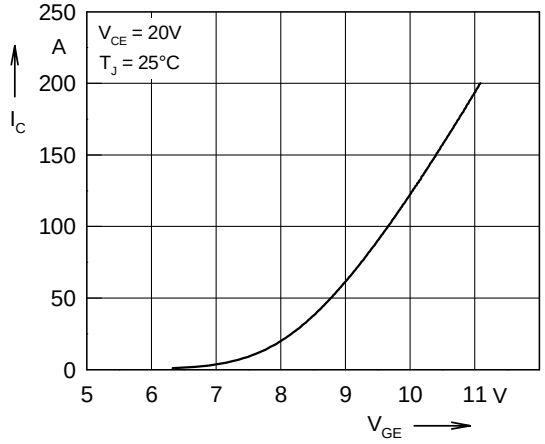


Fig. 3 Typ. transfer characteristics

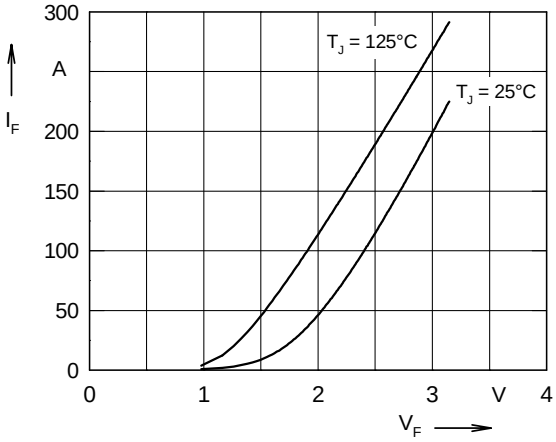


Fig. 4 Typ. forward characteristics of free wheeling diode

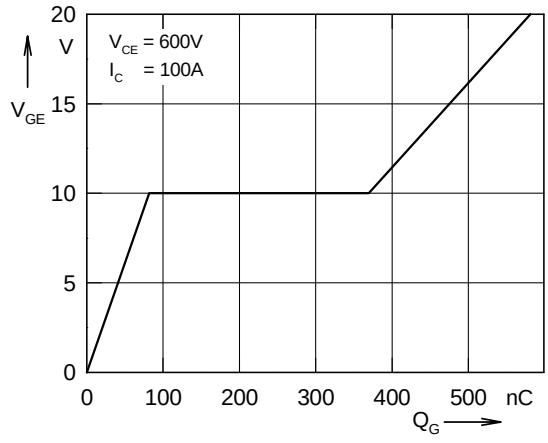


Fig. 5 Typ. turn on gate charge

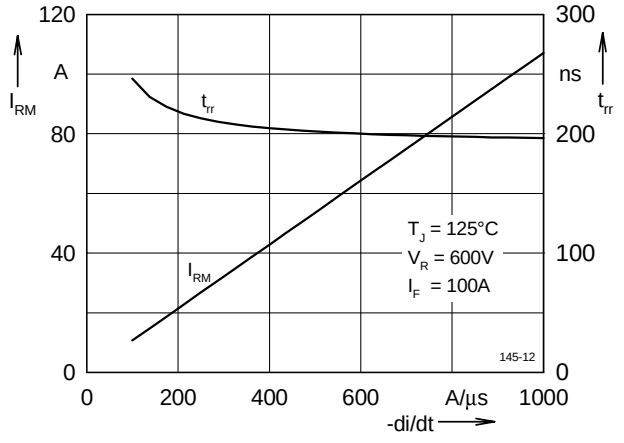


Fig. 6 Typ. turn off characteristics of free wheeling diode

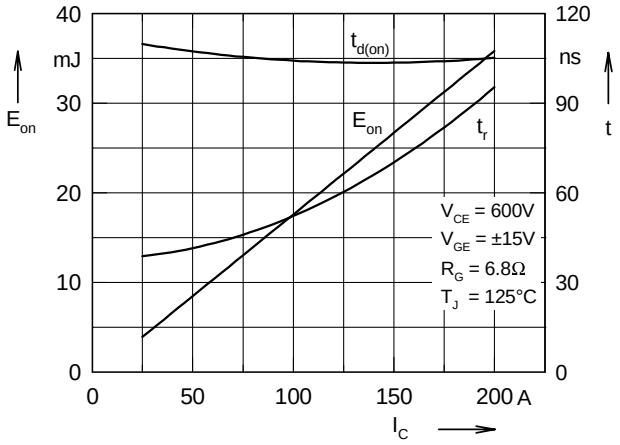


Fig. 7 Typ. turn on energy and switching times versus collector current

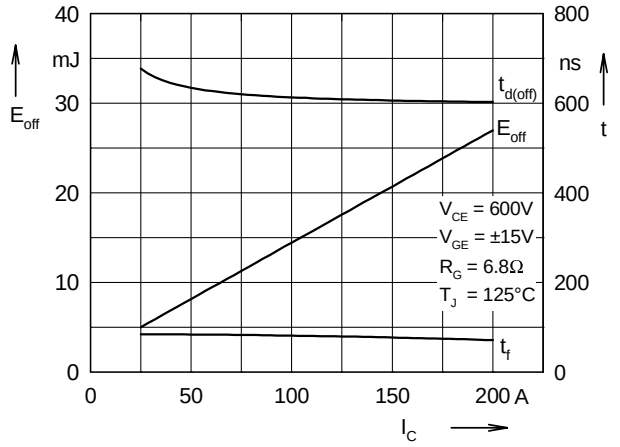


Fig. 8 Typ. turn off energy and switching times versus collector current

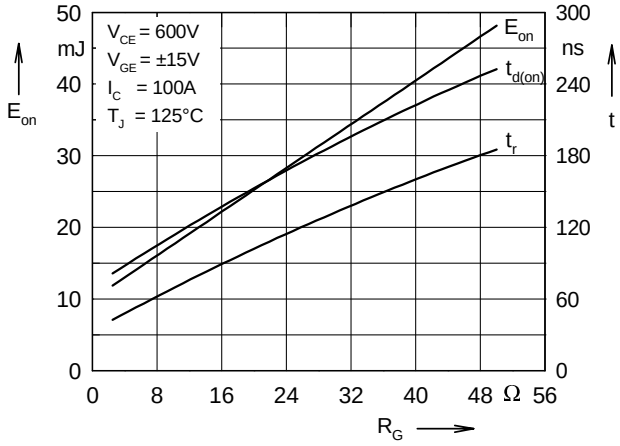


Fig. 9 Typ. turn on energy and switching times versus gate resistor

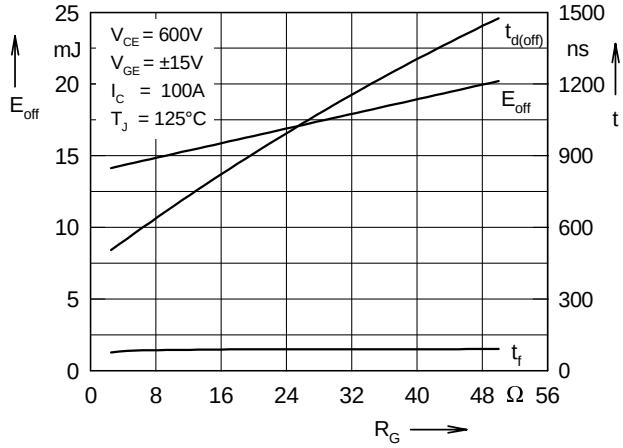


Fig.10 Typ. turn off energy and switching times versus gate resistor

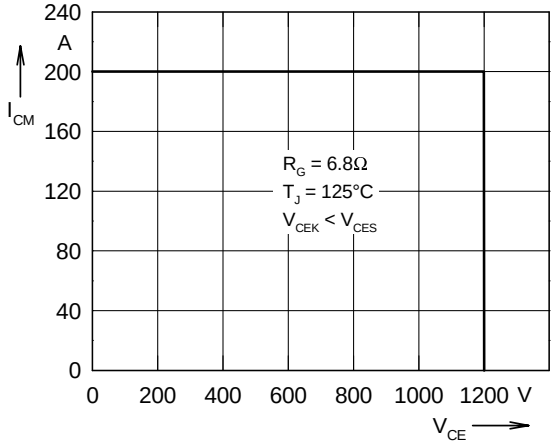


Fig. 11 Reverse biased safe operating area RBSOA

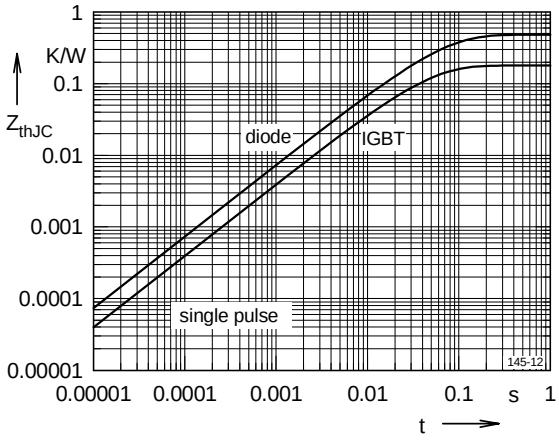
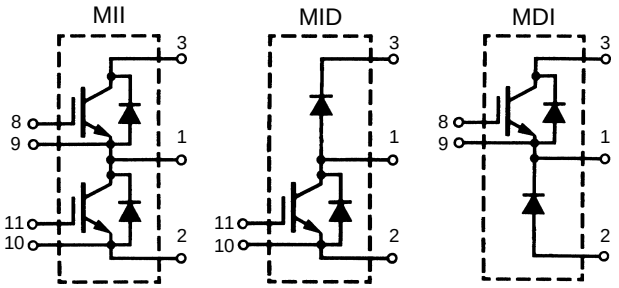


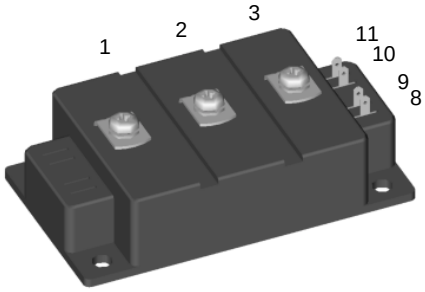
Fig. 12 Typ. transient thermal impedance

IGBT Modules

I_{C25} = 180 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

Short Circuit SOA Capability
Square RBSOA





Preliminary data

E 72873

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	180	A
I_{C80}	T_C = 80°C	120	A
I_{CM}	T_C = 80°C, t_p = 1 ms	240	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C; R_G = 10 Ω, non repetitive	10	µs
RBSOA	V_{GE} = ±15 V, T_J = 125°C, R_G = 10 Ω; Clamped inductive load, L = 100 µH	I_{CM} = 200; $V_{CEK} \le V_{CES}$	A
P_{tot}	T_C = 25°C	760	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min	4000	V~
	$I_{ISOL} \le$ 1 mA t = 1 s	4800	V~
	Insulating material: Al_2O_3		
M_d	Mounting torque (module)	2.25-2.75	Nm
		20-25	lb.in.
	(teminals)	2.5-3.7	Nm
		22-33	lb.in.
d_S	Creepage distance on surface	10	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	250	g
		8.8	oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

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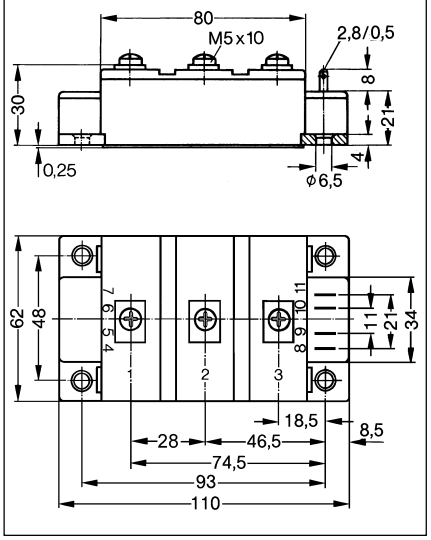
Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 4 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			7.5	mA
		T_J = 125°C		11		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±400	nA
$V_{CE(sat)}$	I_C = 100 A, V_{GE} = 15 V			2.2	2.7	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			6.6		nF
C_{oes}				1		nF
C_{res}				0.44		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C** I_C = 100 A, V_{GE} = ±15 V V_{CE} = 600 V, R_G = 10 Ω			100		ns
t_r				70		ns
$t_{d(off)}$				500		ns
t_f				70		ns
E_{on}				15		mJ
E_{off}				11.5		mJ
R_{thJC}					0.17	K/W
R_{thJS}	with heatsink compound			0.33		K/W

Dimensions in mm (1 mm = 0.0394")

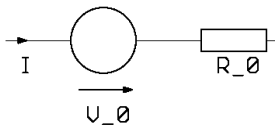


Reverse Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 100 A, V_{GE} = 0 V,		2.3	2.5	V
	I_F = 100 A, V_{GE} = 0 V, T_J = 125°C		1.8	1.9	V
I_F	T_C = 25°C			200	A
	T_C = 80°C			130	A
I_{RM}	I_F = 100 A, V_{GE} = 0 V, -di$_F$/dt = 800 A/µs		80		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.33	K/W
R_{thJS}	with heatsink compound		0.66		K/W

Equivalent Circuits for Simulation

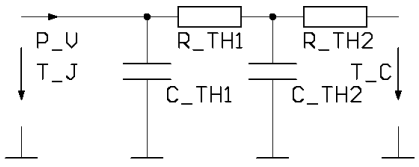
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.5 V; R_0 = 10.2 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 5.5 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.27 J/K; R_{th1} = 0.163 K/W
C_{th2} = 0.63 J/K; R_{th2} = 0.004 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.19 J/K; R_{th1} = 0.326 K/W
C_{th2} = 0.36 J/K; R_{th2} = 0.007 K/W

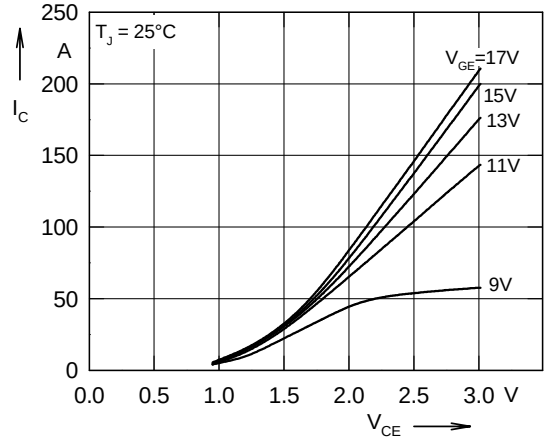


Fig. 1 Typ. output characteristics

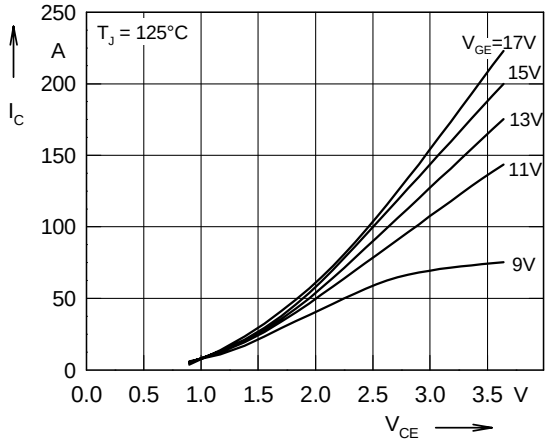


Fig. 2 Typ. output characteristics

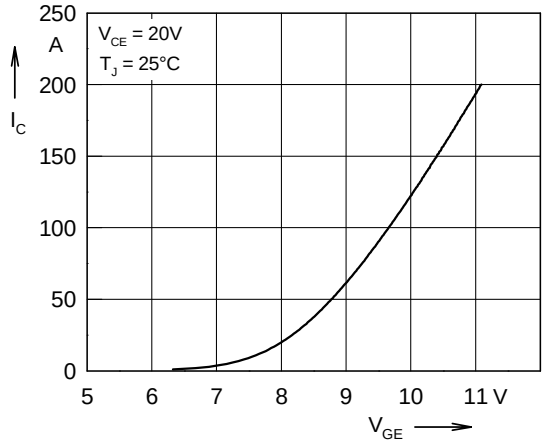


Fig. 3 Typ. transfer characteristics

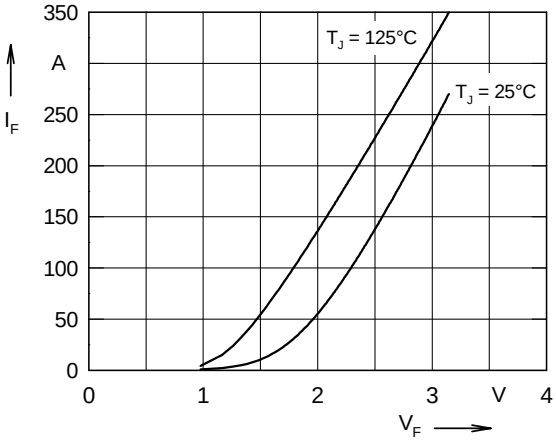


Fig. 4 Typ. forward characteristics of free wheeling diode

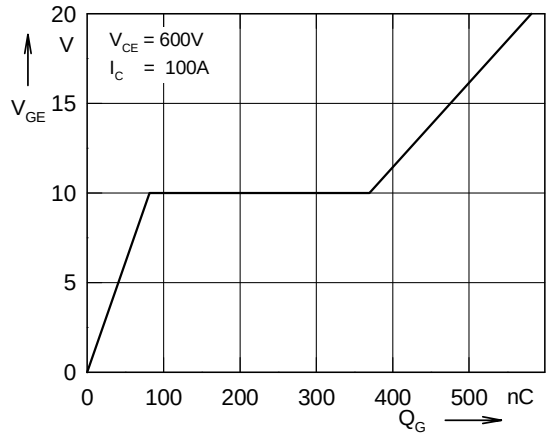


Fig. 5 Typ. turn on gate charge

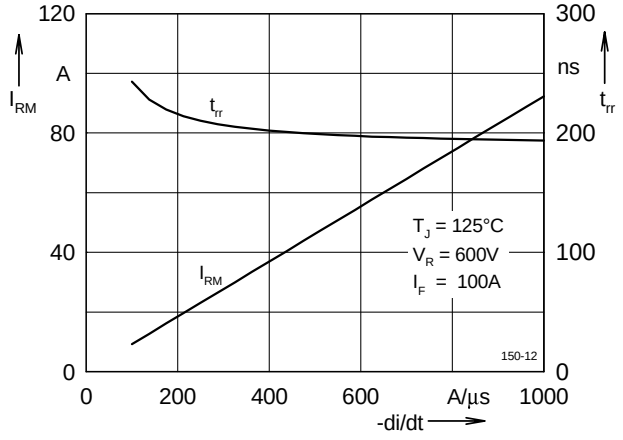


Fig. 6 Typ. turn off characteristics of free wheeling diode

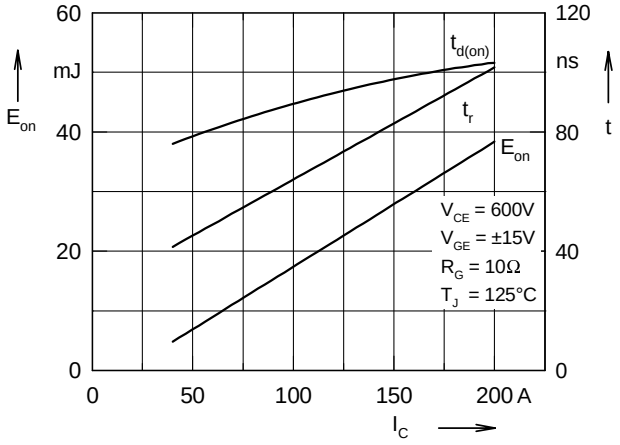


Fig. 7 Typ. turn on energy and switching times versus collector current

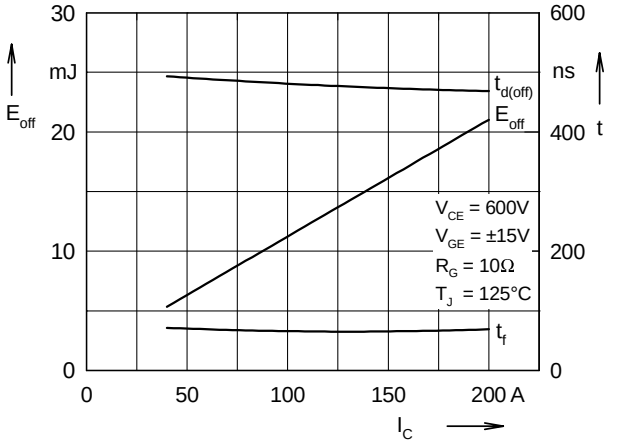


Fig. 8 Typ. turn off energy and switching times versus collector current

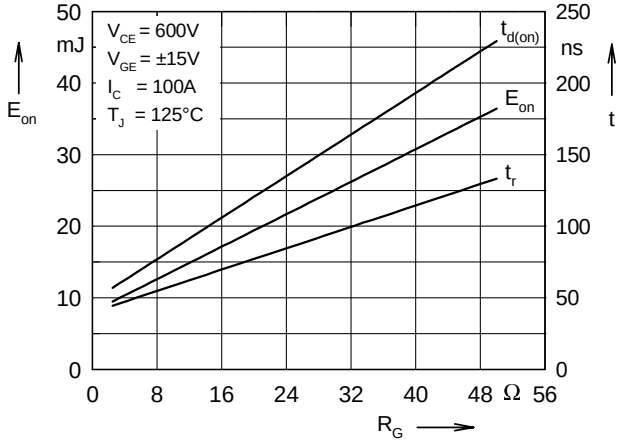


Fig. 9 Typ. turn on energy and switching times versus gate resistor

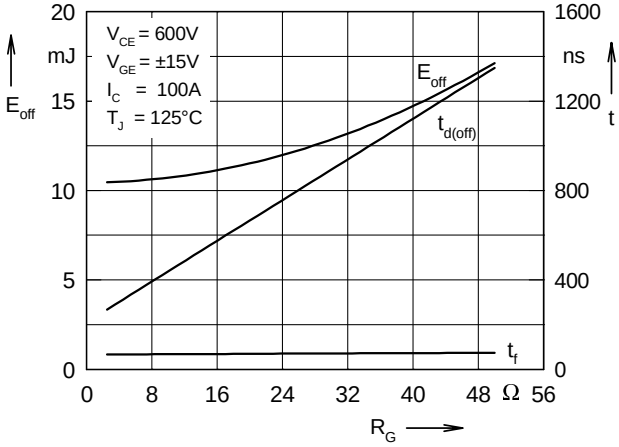


Fig.10 Typ. turn off energy and switching times versus gate resistor

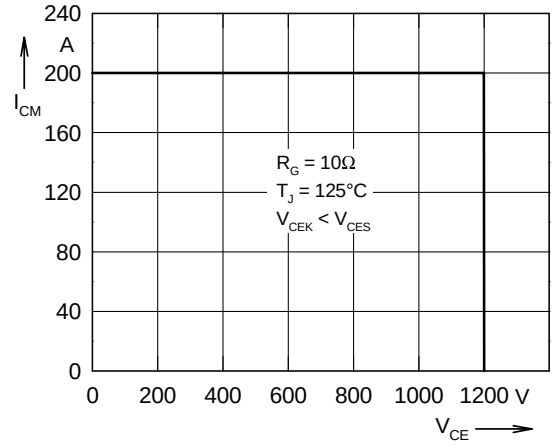


Fig. 11 Reverse biased safe operating area RBSOA

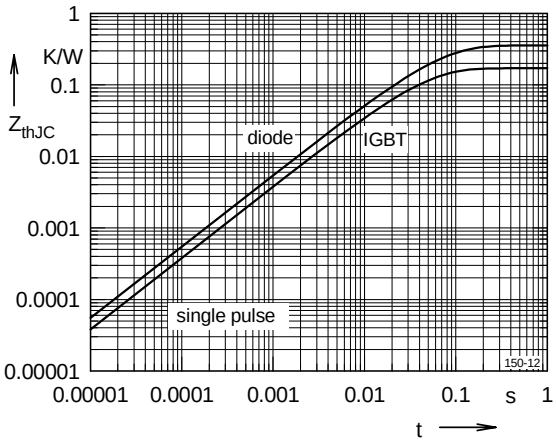
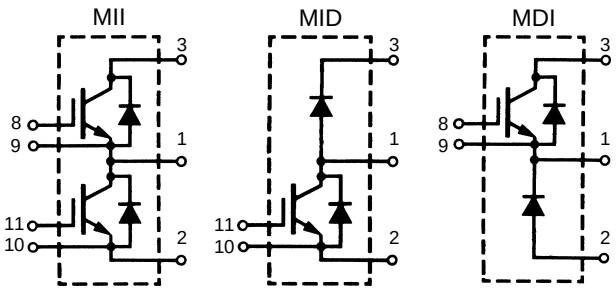


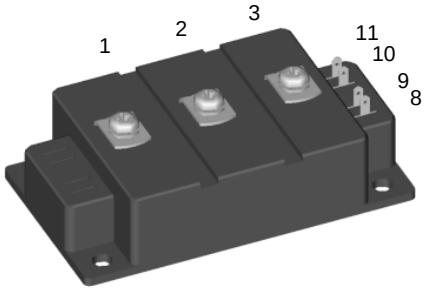
Fig. 12 Typ. transient thermal impedance

IGBT Modules

I_{C25} = 270 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

Short Circuit SOA Capability
Square RBSOA





Preliminary data

E 72873

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	270	A
I_{C80}	T_C = 80°C	180	A
I_{CM}	T_C = 80°C, t_p = 1 ms	360	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C; R_G = 6.8 Ω, non repetitive	10	µs
RBSOA	V_{GE} = ±15 V, T_J = 125°C, R_G = 6.8 Ω; Clamped inductive load, L = 100 µH	I_{CM} = 360; $V_{CEK} \le V_{CES}$	A
P_{tot}	T_C = 25°C	1130	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min	4000	V~
	$I_{ISOL} \le$ 1 mA t = 1 s	4800	V~
	Insulating material: Al_2O_3		
M_d	Mounting torque (module)	2.25-2.75	Nm
		20-25	lb.in.
	(teminals)	2.5-3.7	Nm
		22-33	lb.in.
d_S	Creepage distance on surface	10	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	250	g
		8.8	oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

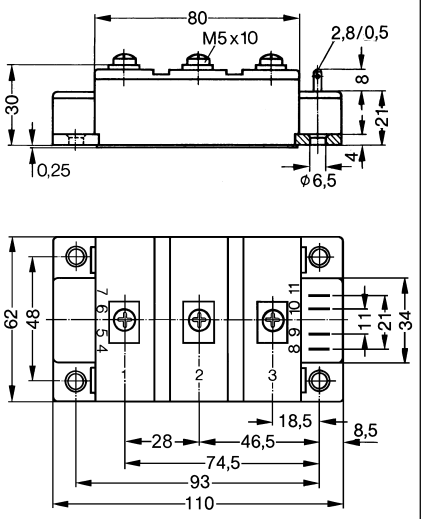
Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

922

Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 6 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			10	mA
		T_J = 125°C		15		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±700	nA
$V_{CE(sat)}$	I_C = 150 A, V_{GE} = 15 V			2.2	2.7	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			11		nF
C_{oes}				1.5		nF
C_{res}				0.65		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C** I_C = 150 A, V_{GE} = ±15 V V_{CE} = 600 V, R_G = 6.8 Ω			100		ns
t_r				50		ns
$t_{d(off)}$				650		ns
t_f				50		ns
E_{on}				24.2		mJ
E_{off}				21		mJ
R_{thJC}					0.11	K/W
R_{thJS}	with heatsink compound			0.22		K/W

Dimensions in mm (1 mm = 0.0394")

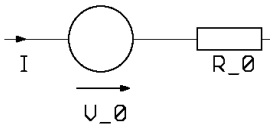


Reverse Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 150 A, V_{GE} = 0 V,		2.2	2.5	V
	I_F = 150 A, V_{GE} = 0 V, T_J = 125°C		1.8	1.9	V
I_F	T_C = 25°C			300	A
	T_C = 80°C			200	A
I_{RM}	I_F = 150 A, V_{GE} = 0 V, -di_F/dt = 1200 A/µs		125		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.23	K/W
R_{thJS}	with heatsink compound		0.45		K/W

Equivalent Circuits for Simulation

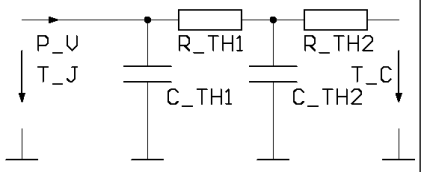
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.5 V; R_0 = 7.0 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 3.4 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.40 J/K; R_{th1} = 0.110 K/W
C_{th2} = 0.93 J/K; R_{th2} = 0.003 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.28 J/K; R_{th1} = 0.226 K/W
C_{th2} = 0.51 J/K; R_{th2} = 0.005 K/W

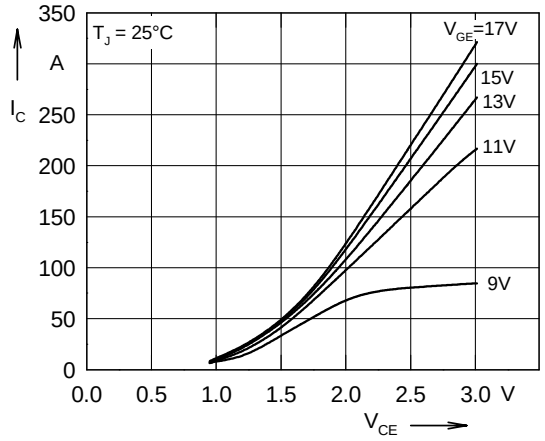


Fig. 1 Typ. output characteristics

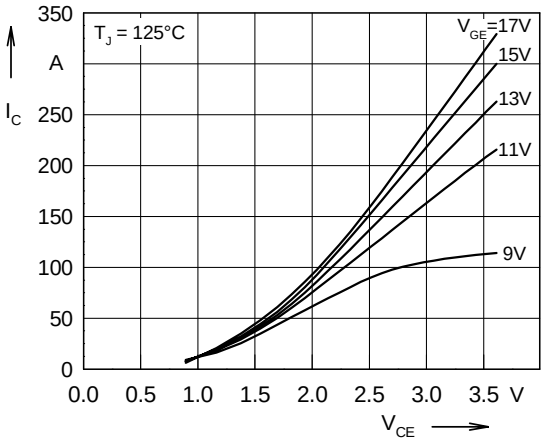


Fig. 2 Typ. output characteristics

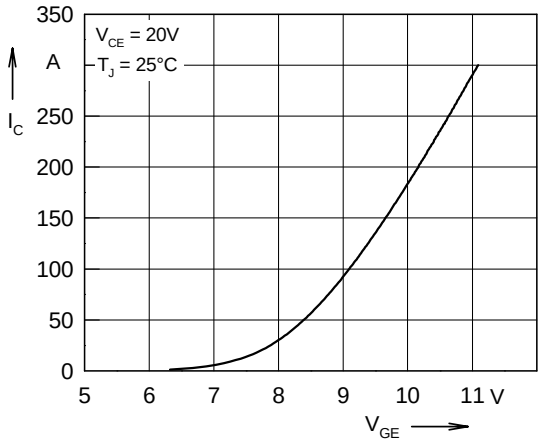


Fig. 3 Typ. transfer characteristics

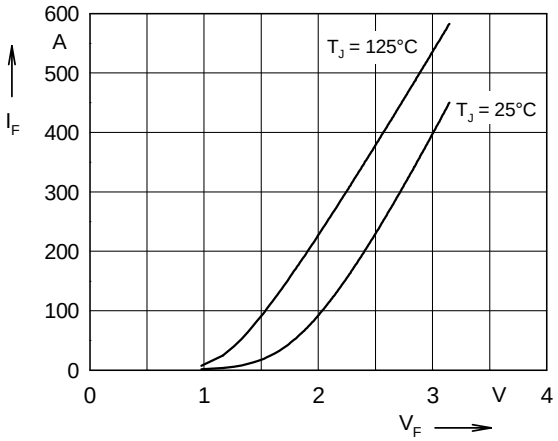


Fig. 4 Typ. forward characteristics of free wheeling diode

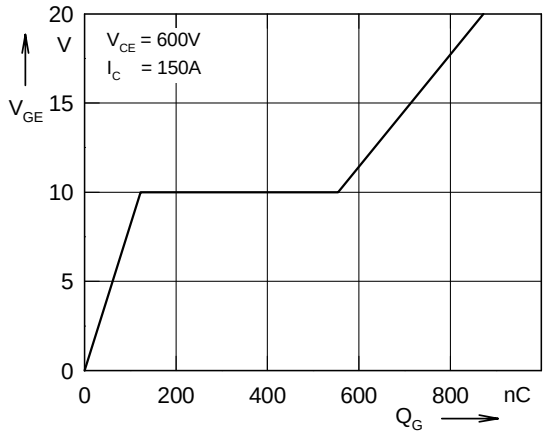


Fig. 5 Typ. turn on gate charge

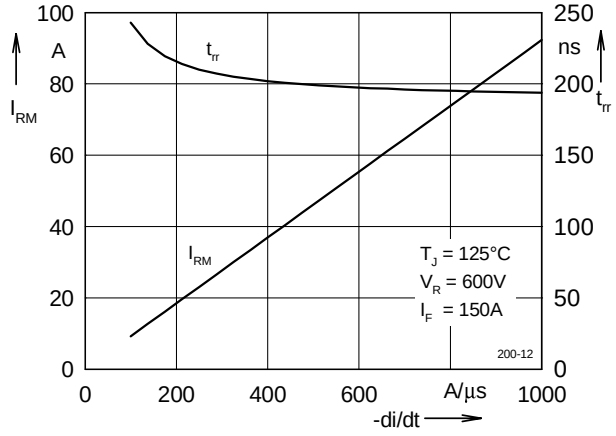


Fig. 6 Typ. turn off characteristics of free wheeling diode

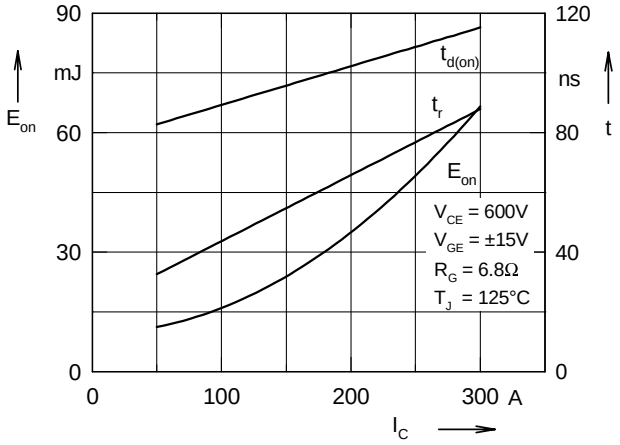


Fig. 7 Typ. turn on energy and switching times versus collector current

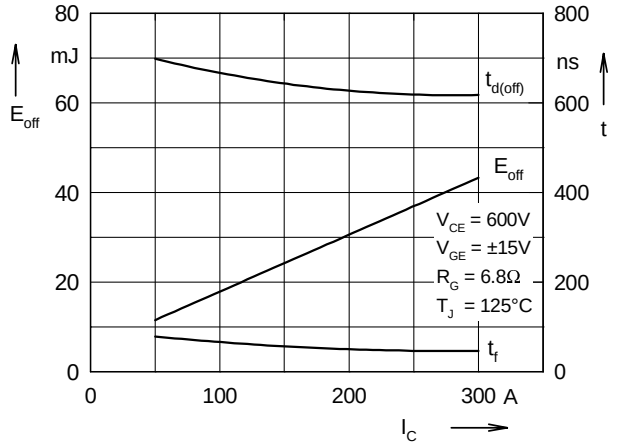


Fig. 8 Typ. turn off energy and switching times versus collector current

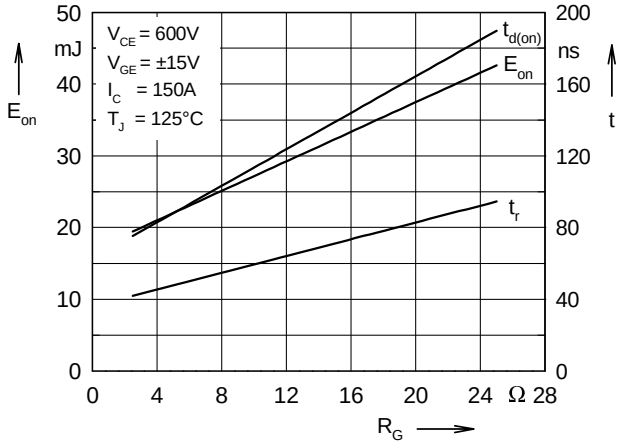


Fig. 9 Typ. turn on energy and switching times versus gate resistor

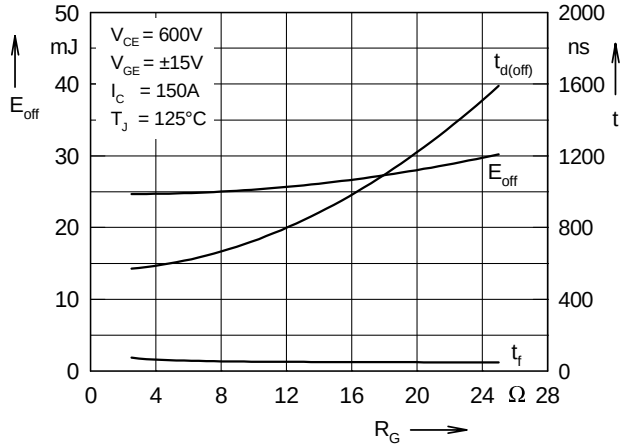


Fig.10 Typ. turn off energy and switching times versus gate resistor

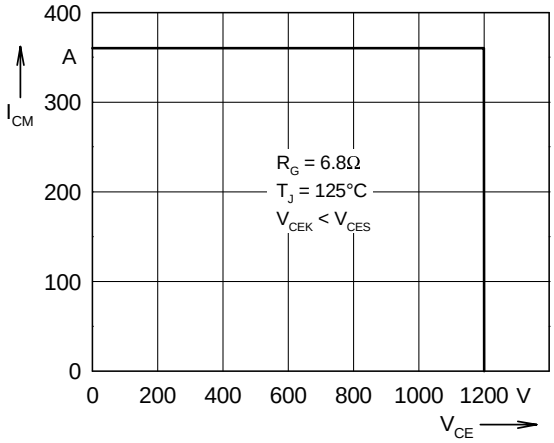


Fig. 11 Reverse biased safe operating area RBSOA

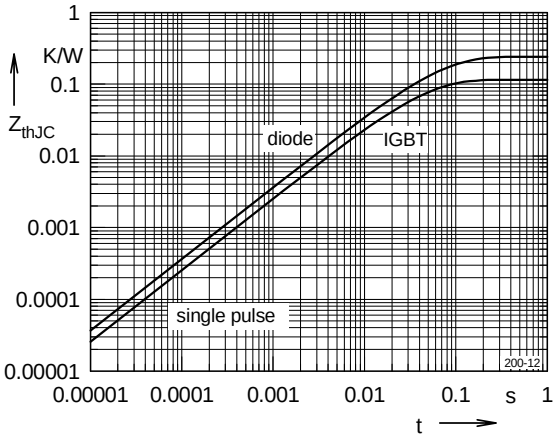
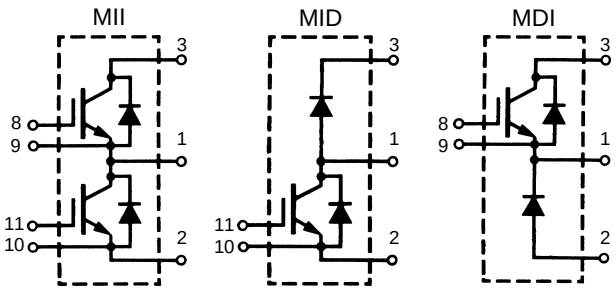


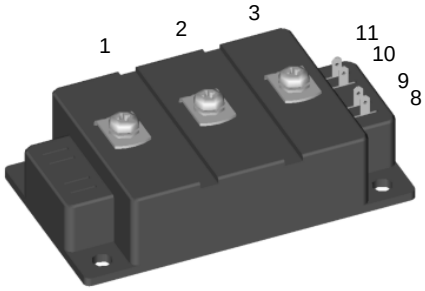
Fig. 12 Typ. transient thermal impedance

IGBT Modules

I_{C25} = 330 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.2 V

Short Circuit SOA Capability
Square RBSOA





Preliminary data

E 72873

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	330	A
I_{C80}	T_C = 80°C	220	A
I_{CM}	T_C = 80°C, t_p = 1 ms	440	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C; R_G = 3.3 Ω, non repetitive	10	µs
RBSOA	V_{GE} = ±15 V, T_J = 125°C, R_G = 3.3 Ω; Clamped inductive load, L = 100 µH	I_{CM} = 400; $V_{CEK} \le V_{CES}$	A
P_{tot}	T_C = 25°C	1380	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min	4000	V~
	$I_{ISOL} \le$ 1 mA t = 1 s	4800	V~
	Insulating material: Al_2O_3		
M_d	Mounting torque (module)	2.25-2.75	Nm
		20-25	lb.in.
	(teminals)	2.5-3.7	Nm
		22-33	lb.in.
d_S	Creepage distance on surface	10	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	250	g
		8.8	oz.

Data according to a single IGBT/FRED unless otherwise stated.

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- AC servo and robot drives
- power supplies
- welding inverters

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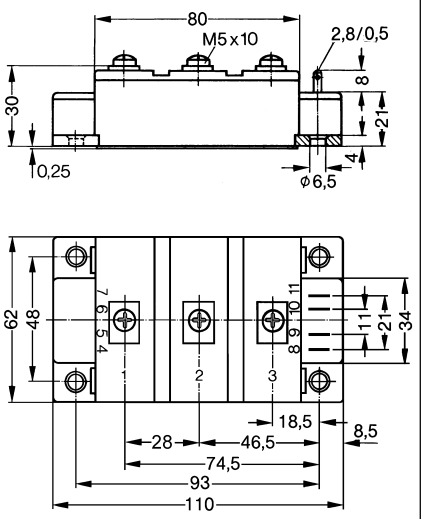
Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 8 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			13	mA
		T_J = 125°C		20		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±800	nA
$V_{CE(sat)}$	I_C = 200 A, V_{GE} = 15 V			2.2	2.7	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			13		nF
C_{oes}				2		nF
C_{res}				1		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C**			100		ns
t_r	I_C = 200 A, V_{GE} = ±15 V			60		ns
$t_{d(off)}$	V_{CE} = 600 V, R_G = 3.3 Ω			600		ns
t_f				90		ns
E_{on}				32		mJ
E_{off}				29		mJ
R_{thJC}					0.09	K/W
R_{thJS}	with heatsink compound			0.18		K/W

Dimensions in mm (1 mm = 0.0394")

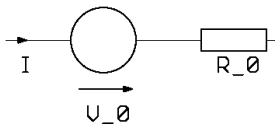


Reverse Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 200 A, V_{GE} = 0 V,		2.2	2.5	V
	I_F = 200 A, V_{GE} = 0 V, T_J = 125°C		1.7	2.3	V
I_F	T_C = 25°C			450	A
	T_C = 80°C			280	A
I_{RM}	I_F = 200 A, V_{GE} = 0 V, -di_F/dt = 1800 A/µs		180		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.15	K/W
R_{thJS}	with heatsink compound		0.3		K/W

Equivalent Circuits for Simulation

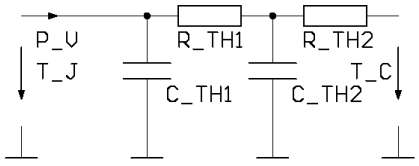
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.3 V; R_0 = 6.2 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 2.4 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.50 J/K; R_{th1} = 0.088 K/W
C_{th2} = 1.16 J/K; R_{th2} = 0.002 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.44 J/K; R_{th1} = 0.146 K/W
C_{th2} = 0.80 J/K; R_{th2} = 0.003 K/W

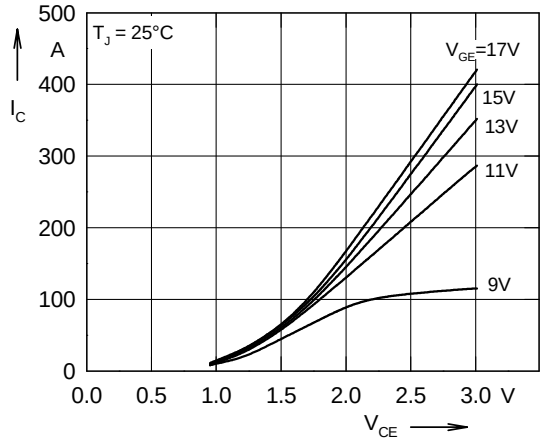


Fig. 1 Typ. output characteristics

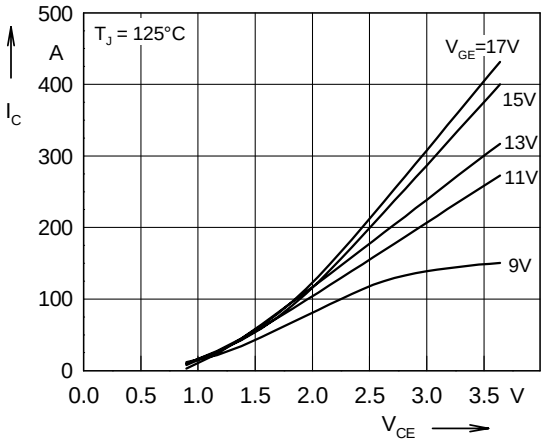


Fig. 2 Typ. output characteristics

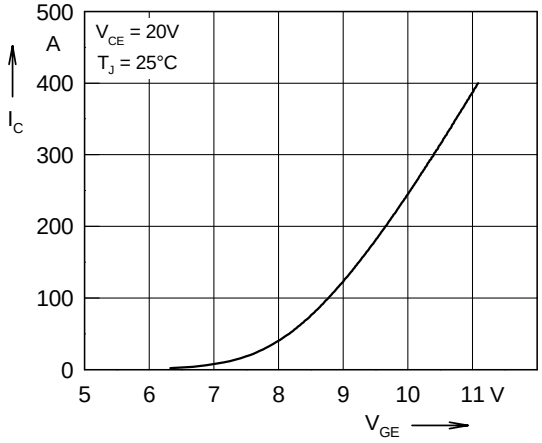


Fig. 3 Typ. transfer characteristics

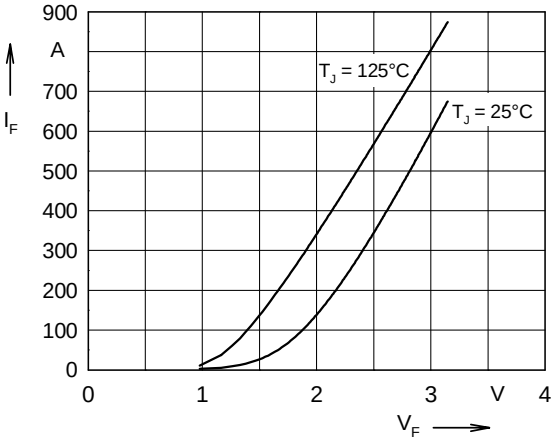


Fig. 4 Typ. forward characteristics of free wheeling diode

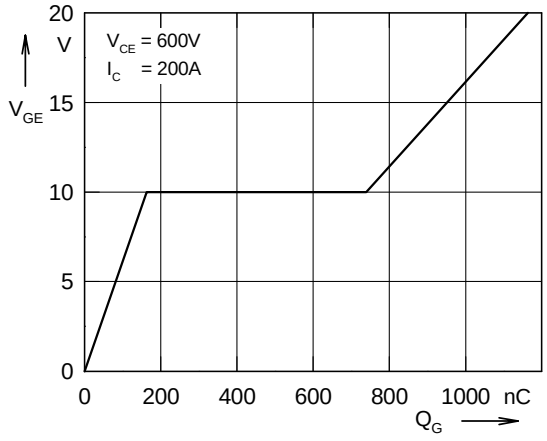


Fig. 5 Typ. turn on gate charge

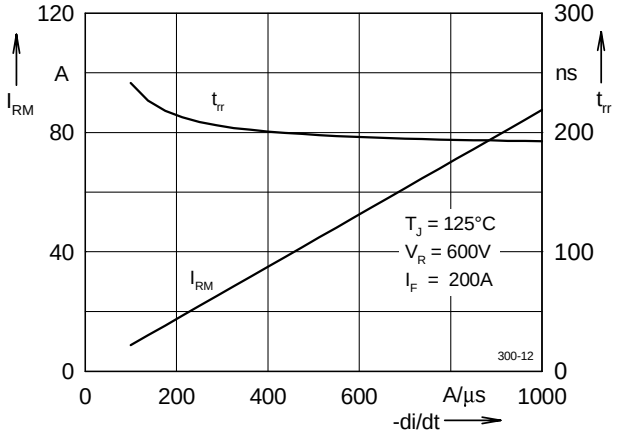


Fig. 6 Typ. turn off characteristics of free wheeling diode

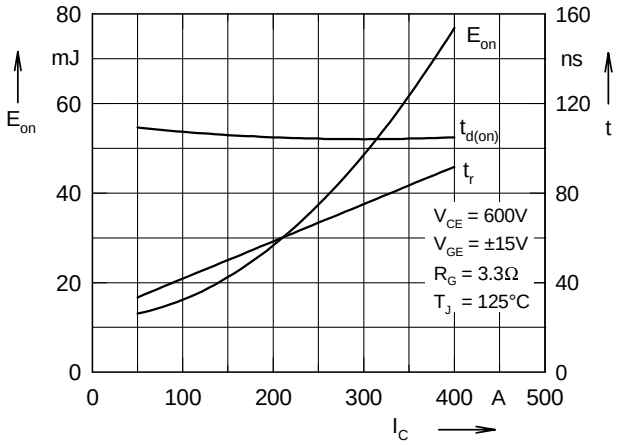


Fig. 7 Typ. turn on energy and switching times versus collector current

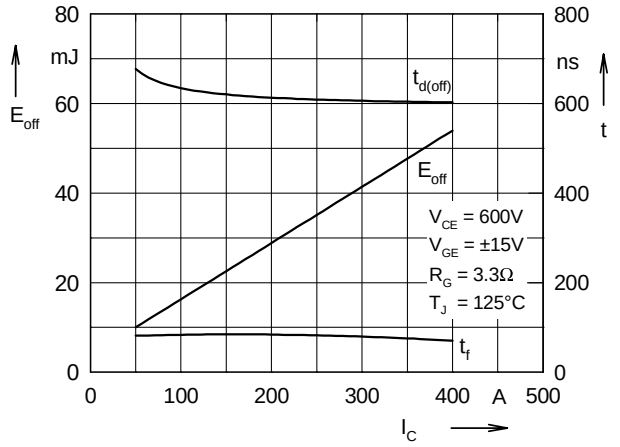


Fig. 8 Typ. turn off energy and switching times versus collector current

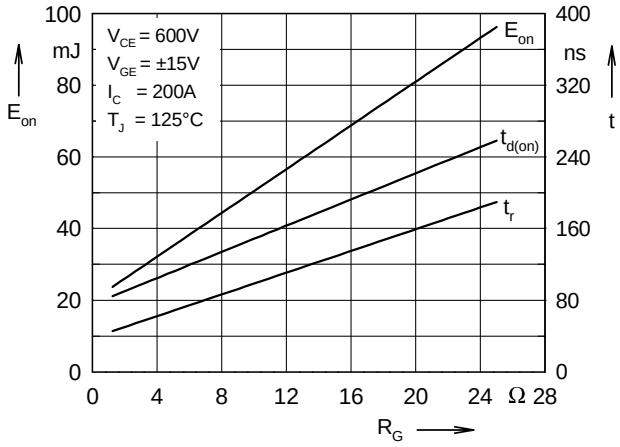


Fig. 9 Typ. turn on energy and switching times versus gate resistor

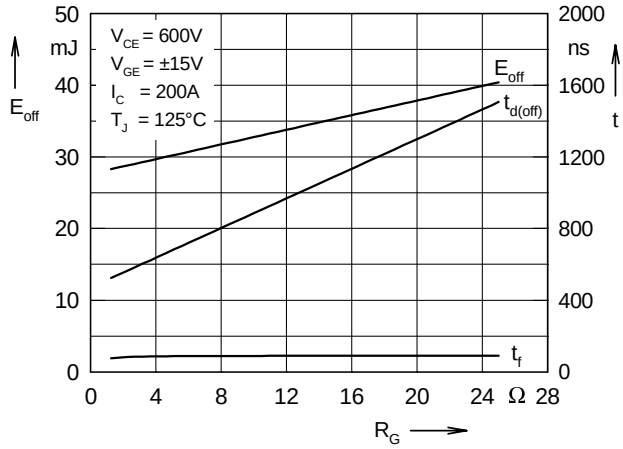


Fig.10 Typ. turn off energy and switching times versus gate resistor

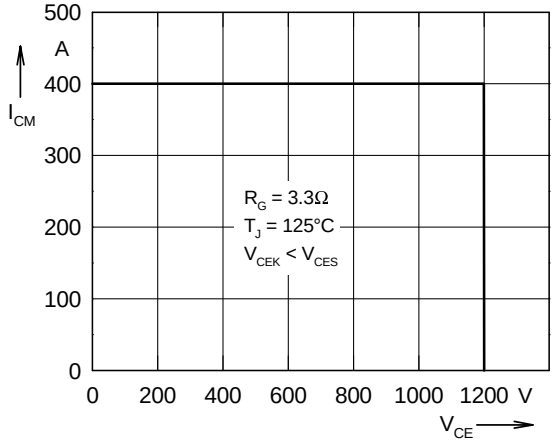


Fig. 11 Reverse biased safe operating area RBSOA

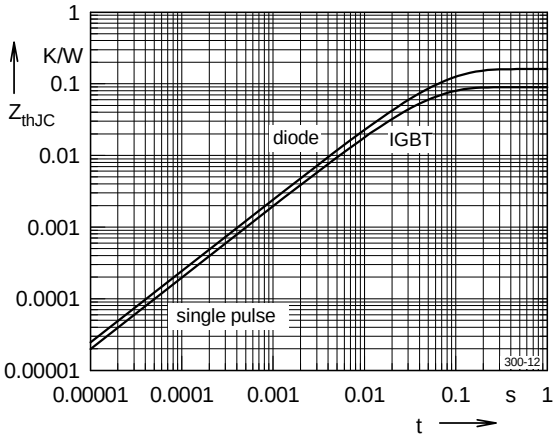


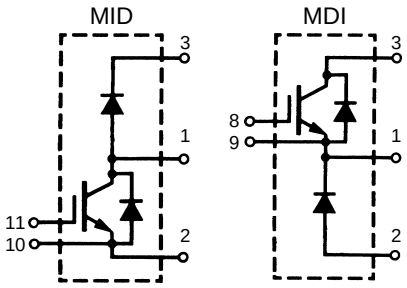
Fig. 12 Typ. transient thermal impedance

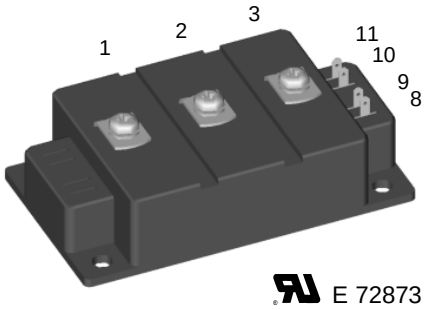
IGBT Modules

I_{C25} = 670 A
V_{CES} = 1200 V
$V_{CE(sat)\ typ.}$ = 2.3 V

Short Circuit SOA Capability

Square RBSOA





E 72873

Preliminary data

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	1200	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 20 kΩ	1200	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	670	A
I_{C80}	T_C = 80°C	460	A
I_{CM}	T_C = 80°C, t_p = 1 ms ①	920	A
t_{SC} (SCSOA)	V_{GE} = ±15 V, V_{CE} = V_{CES}, T_J = 125°C R_G = 1.8 Ω, non repetitive	10	µs
RBSOA	V_{GE}= ±15 V, T_J = 125°C, R_G = 1.8 Ω Clamped inductive load, L = 100 µH	I_{CM} = 800 $V_{CEK} \le V_{CES}$	A
$P_{tot\ IGBT}$	T_C = 25°C	2750	W
T_J		150	°C
T_{stg}		-40 ... +150	°C
V_{ISOL}	50/60 Hz, RMS t = 1 min $I_{ISOL} \le$ 1 mA t = 1 s Insulating material: Al_2O_3	4000 4800	V~ V~
M_d	Mounting torque (module) (teminals)	2.25-2.75 20-25 2.5-3.7 22-33	Nm lb.in. Nm lb.in.
d_S	Creepage distance on surface	14	mm
d_A	Strike distance through air	9.6	mm
a	Max. allowable acceleration	50	m/s^2
Weight	Typical	250 8.8	g oz.

Data according to a single IGBT/FRED unless otherwise stated.

① Additional current limitation by external leads

Features
- NPT IGBT technology
- low saturation voltage
- low switching losses
- switching frequency up to 30 kHz
- square RBSOA, no latch up
- high short circuit capability
- positive temperature coefficient for easy parallelling
- MOS input, voltage controlled
- ultra fast free wheeling diodes
- package with DCB ceramic base plate
- isolation voltage 4800 V
- UL registered E72873

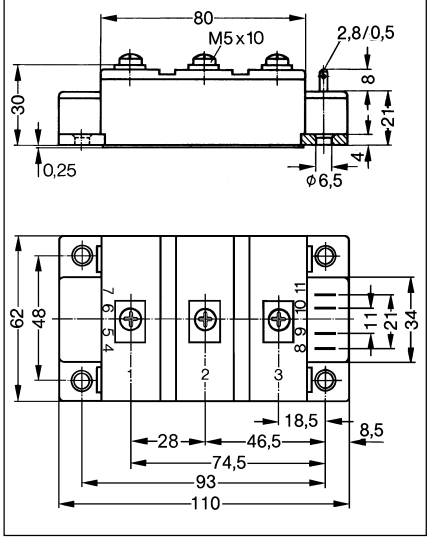
Advantages
- space and weight savings
- reduced protection circuits

Typical Applications
- AC and DC motor control
- power supplies
- welding inverters

922

Symbol	Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{(BR)CES}$	V_{GE} = 0 V		1200			V
$V_{GE(th)}$	I_C = 16 mA, V_{CE} = V_{GE}		4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			21	mA
		T_J = 125°C		30		mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				1.6	µA
$V_{CE(sat)}$	I_C = 400 A, V_{GE} = 15 V			2.3	2.8	V
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			26		nF
C_{oes}				4		nF
C_{res}				2		nF
$t_{d(on)}$	**Inductive load, T_J = 125°C**			100		ns
t_r	I_C = 400 A, V_{GE} = ±15 V			60		ns
$t_{d(off)}$	V_{CE} = 600 V, R_G = 1.8 Ω			600		ns
t_f				90		ns
E_{on}				64		mJ
E_{off}				59		mJ
R_{thJC}					0.05	K/W
R_{thJS}	with heatsink compound			0.09		K/W

Dimensions in mm (1 mm = 0.0394")



Free Wheeling Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 400 A, V_{GE} = 0 V		2.4	2.6	V
	I_F = 400 A, V_{GE} = 0 V, T_J = 125°C		1.9	2.0	V
I_F	T_C = 25°C ①			750	A
	T_C = 80°C			460	A
I_{RM}	I_F = 400 A, V_{GE} = 0 V, -di_F/dt = 3000 A/µs		300		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.09	K/W
R_{thJS}			0.18		K/W

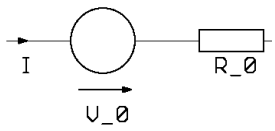
Anti Parallel Diode (FRED)

Symbol	Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 100 A, V_{GE} = 0 V		2.4	2.6	V
	I_F = 100 A, V_{GE} = 0 V, T_J = 125°C		1.9	2.0	V
I_F	T_C = 25°C			150	A
	T_C = 80°C			95	A
I_{RM}	I_F = 100 A, V_{GE} = 0 V, -di_F/dt = 600 A/µs		62		A
t_{rr}	T_J = 125°C, V_R = 600 V		200		ns
R_{thJC}				0.45	K/W
R_{thJS}			0.9		K/W

① Additional current limitation by external leads

Equivalent Circuits for Simulation

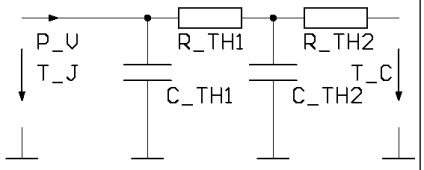
Conduction



IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.3 V; R_0 = 3.2 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.3 V; R_0 = 1.5 mΩ

Thermal Response



IGBT (typ.)
C_{th1} = 0.90 J/K; R_{th1} = 0.049 K/W
C_{th2} = 2.07 J/K; R_{th2} = 0.001 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.71 J/K; R_{th1} = 0.090 K/W
C_{th2} = 1.30 J/K; R_{th2} = 0.002 K/W

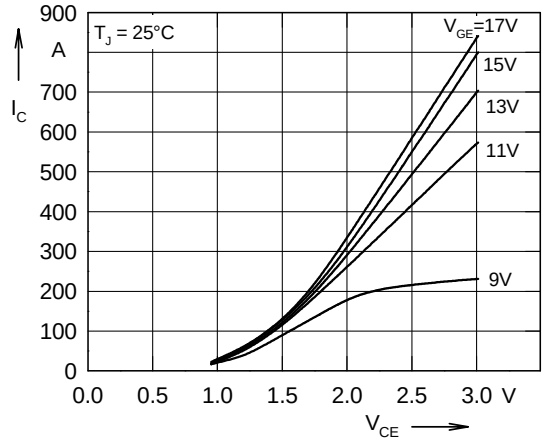


Fig. 1 Typ. output characteristics

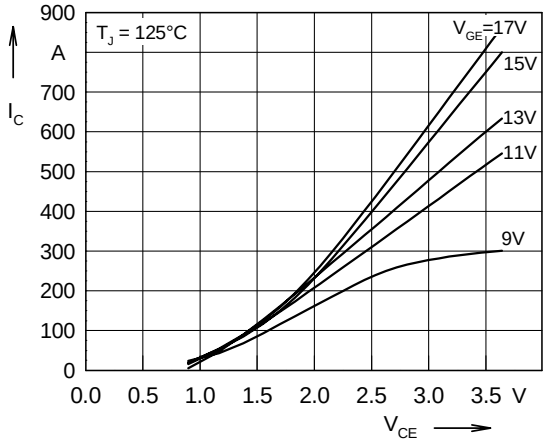


Fig. 2 Typ. output characteristics

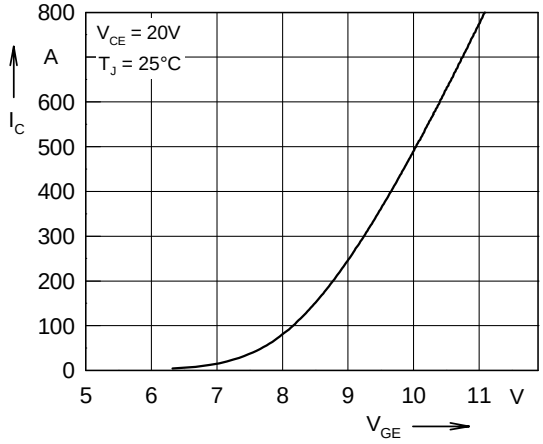


Fig. 3 Typ. transfer characteristics

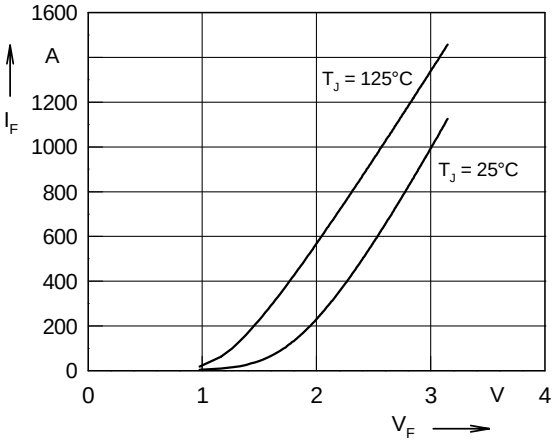


Fig. 4 Typ. forward characteristics of free wheeling diode

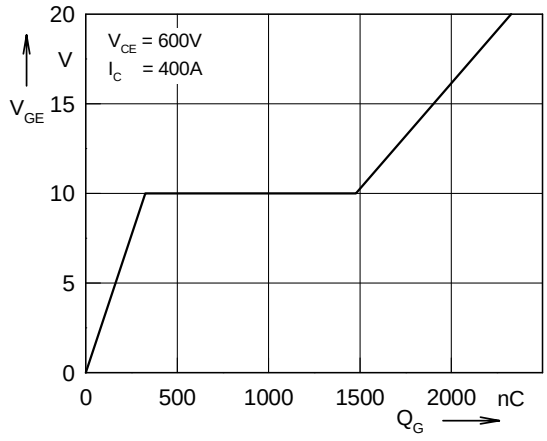


Fig. 5 Typ. turn on gate charge

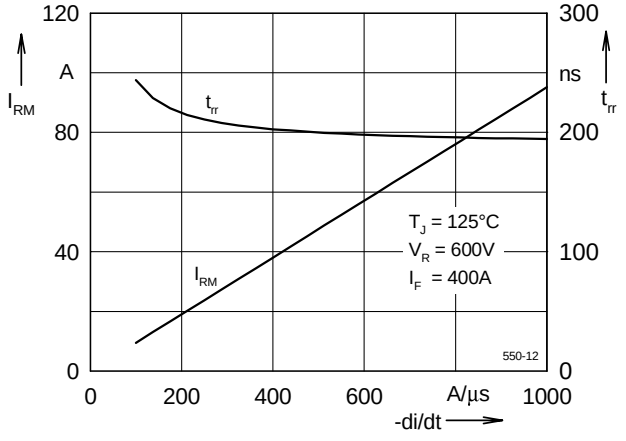


Fig. 6 Typ. turn off characteristics of free wheeling diode

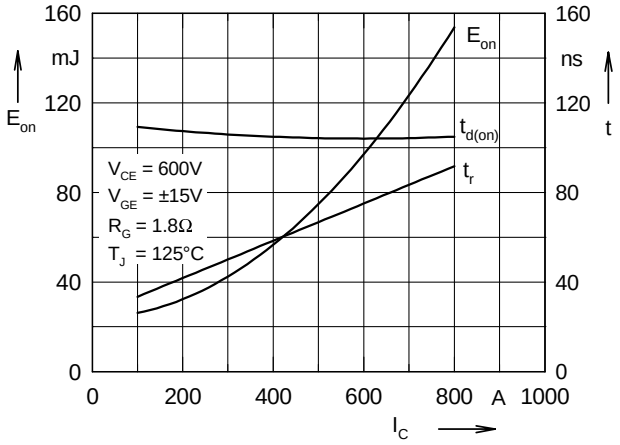


Fig. 7 Typ. turn on energy and switching times versus collector current

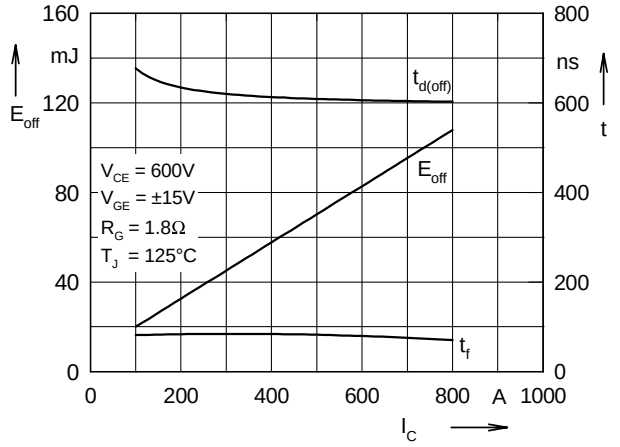


Fig. 8 Typ. turn off energy and switching times versus collector current

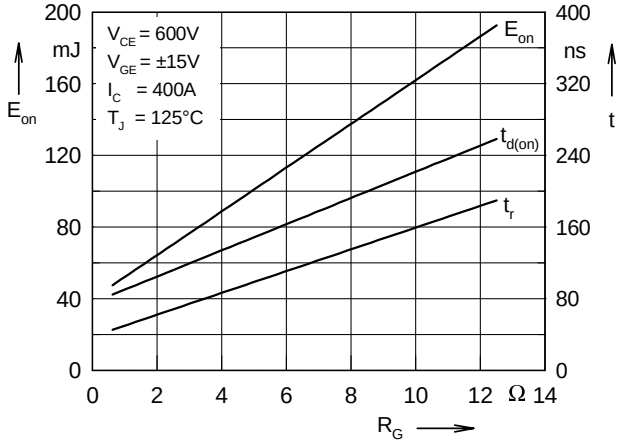


Fig. 9 Typ. turn on energy and switching times versus gate resistor

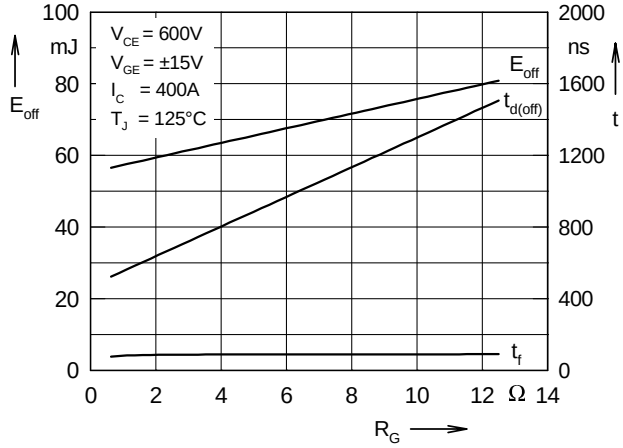


Fig.10 Typ. turn off energy and switching times versus gate resistor

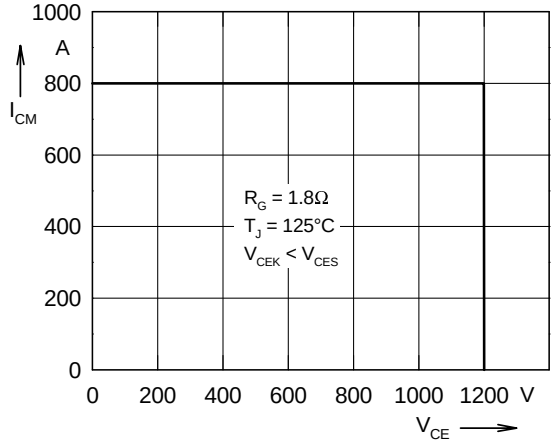


Fig. 11 Reverse biased safe operating area RBSOA

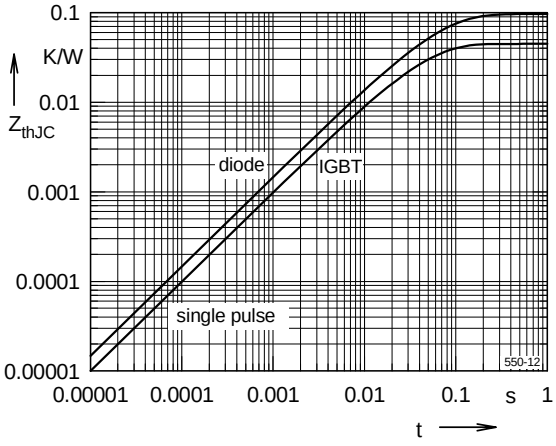


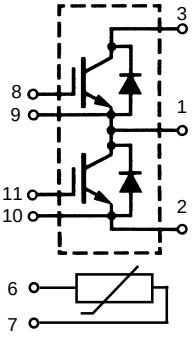
Fig. 12 Typ. transient thermal impedance

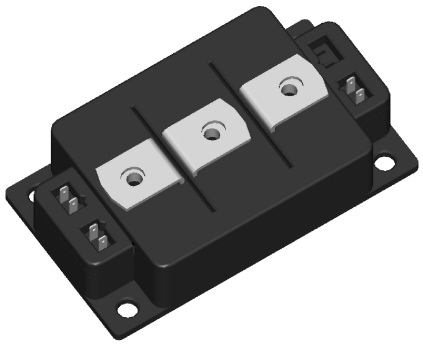
IGBT Module

High Speed
Low V_{CEsat}

VII 420-03S4

I_{C25} = 425 A
V_{CES} = 300 V
$V_{CE(sat)\ typ.}$ = 1.5 V





IGBTs

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	300	V
V_{GES}		± 20	V
I_{C25}	T_C = 25°C	425	A
I_{C80}	T_C = 80°C	300	A
I_{CM}	V_{GE} = ±15 V; R_G = 4.7 Ω; T_{VJ} = 125°C	500	A
V_{CEK}	**RBSOA**, Clamped inductive load; L = 100 µH	V_{CES}	
P_{tot}	T_C = 25°C	1000	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 300 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.5	2	V
	T_{VJ} = 125°C		1.5		V
$V_{GE(th)}$	I_C = 5 mA; V_{GE} = V_{CE}	2.5		5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			3.3	mA
	T_{VJ} = 125°C		3.5		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			600	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		100		ns
t_r	V_{CE} = 150 V; I_C = 300 A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 4.7 Ω		400		ns
t_f			200		ns
E_{on}			9		mJ
E_{off}			9.6		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		tbd		pF
Q_{Gon}	V_{CE} = 150 V; V_{GE} = 15 V; I_C = 300 A		tbd		nC
R_{thJC}	(per IGBT)			0.13	K/W
R_{thJH}	with heatsink compound		0.19		K/W

Features

- MOS-input (voltage controlled)
- Low saturation voltage
- Ultra fast free wheeling diode
- Low conduction and commutation losses
- Low parasitic inductance
- Package with DCB ceramic base plate
- Isolation voltage 3000 V~

Applications

- Motor control
- Electric vehicles
- Power Supplies

Advantages

- Space and weight savings
- Reduced protection circuits

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Diodes

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	620	A
I_{F80}	T_C = 80°C	400	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 300 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.2	1.7	V
	T_{VJ} = 125°C		1.0		V
I_{RM}	I_F = 300 A; di_F/dt = -2000 A/µs; T_{VJ} = 125°C		54		A
t_{rr}	V_R = 150 V; V_{GE} = 0 V		60		ns
R_{thJC}	(per diode)			0.15	K/W
R_{thJH}	with heatsink compound		0.27		K/W

Temperature Sensor NTC

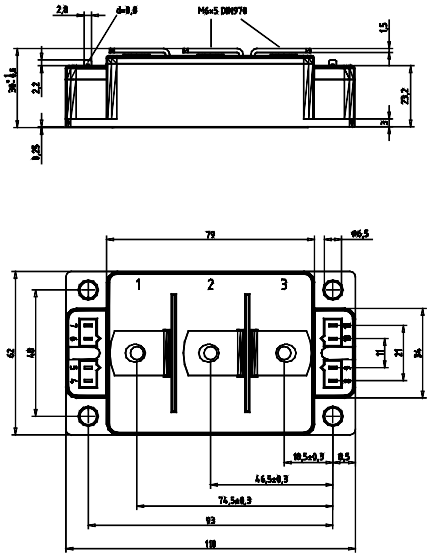
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C		2057		Ω
$B_{25/100}$			3560		K

Module

Symbol	Conditions		Maximum Ratings	
T_{VJ}			-40...+150	°C
T_{stg}			-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq$ 1 mA; 50/60 Hz		3000	V~
M_d	Mounting torque	(module, M6)	2.25 - 2.75	Nm
		(terminals, M6)	4.5 - 5.5	Nm

Symbol	Conditions	Characteristic Values min.	typ.	max.	
d_S	Creepage distance on surface	2			mm
d_A	Strike distance in air	2			mm
Weight			250		g

Dimensions in mm (1 mm = 0.0394")



Optional accessories for modules

keyed twin plugs
(UL758, style 1385, CSA class 5851, guide 460-1-1)

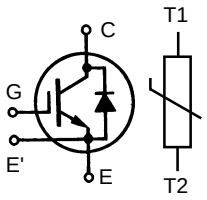
- Type ZY180L with wire length 350mm
  – for pins 4 (yellow wire) and 5 (red wire)
  – for pins 11 (yellow wire) and 10 (red wire)
- Type ZY180R with wire length 350mm
  – for pins 7 (yellow wire) and 6 (red wire)
  – for pins 8 (yellow wire) and 9 (red wire)

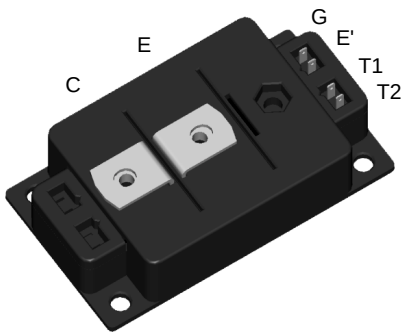
IGBT Single Switch

VIO 1000-03 G4

ULTRA Low V_{CEsat}

I_{C25} = 1100A
V_{CES} = 300 V
$V_{CE(sat)\ typ.}$ = 1.3 V





E = Emitter E' = aux. Emitter
C = Collector G = Gate

IGBT

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	300	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C ①	1100	A
I_{C80}	T_C = 80°C ①	780	A
RBSOA	V_{GE} = 15V / 0V; T_J = 125°C; R_G = 4.7 Ω	I_{CM} = 1000	A
	Clamped inductive load, L = 100 µH	$V_{CEK} \leq$ 240	V
P_{tot}	T_C = 25°C	2000	W

Diode

Symbol	Conditions	Maximum Ratings	
I_F	T_C = 25°C	600	A
	T_C = 80°C	400	A
P_{tot}	T_C = 25°C	800	W

Module

V_{ISOL}	50/60 Hz; $I_{ISOL} \leq$ 1 mA Insulating material: Al_2O_3		3000	V~
T_J			150	°C
T_{stg}			-40 ... +150	°C
M_d	Mounting torque	(module)	2.25-2.75/20-25	Nm/lb.in.
		(terminals)	4.5-5.5/40-48	Nm/lb.in.
a	acceleration		50	m/s^2

① Additional current limitation by external leads

Features

- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate
- Isolation voltage 3000 V~
- MOS-input (voltage controlled)
- Ultra Low V_{CEsat}, low conductions losses
- Low package inductance

Applications

- Self commutated MOS gated replacement of thyristor
- Solid state relays
- Fork lift trucks

Advantages

- Space and weight savings
- Simple mounting
- High power density

030

IGBT

Characteristic Values
(T_J = 25°C, unless otherwise specified)

Symbol	Conditions		min.	typ.	max.	
I_{CES}	V_{CE} = V_{CES}	T_J = 25°C			3.6	mA
		T_J = 125°C		6.0		mA
$V_{CE(sat)}$	I_C = 750 A, V_{GE} = 15 V			1.3	1.65	V
$V_{GE(th)}$	I_C = 10 mA, V_{CE} = V_{GE}		2.5		5.0	V
C_{ie}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz			tbd		nF
C_{oes}				tbd		nF
C_{res}				tbd		nF
Q_G	V_{CE} = 150 V, I_C = 750 A, V_{GE} = 15 V			tbd		nC
$t_{d(on)}$	Inductive load T_J = 125°C V_{CE} = 150 V, I_C = 300 A V_{GE} = 15V / 0V, R_G = 4.7 Ω			3.2		µs
t_r				1.1		µs
$t_{d(off)}$				2.9		µs
t_f				1.5		µs
E_{on}				0.10		J
E_{off}				0.14		J
R_{thJC}					0.063	K/W
R_{thJK}	with heatsink compound			0.093		K/W

Diode

Characteristic Values
(T_J = 25°C, unless otherwise specified)

Symbol	Conditions		min.	typ.	max.	
V_F	I_F = 750 A, V_{GE} = 0 V, T_J = 25°C				2.1	V
		T_J = 125°C		1.6		V
t_{rr}	V_R = 150 V, I_F = 750 A -di/dt = 2000 A/µs, T_J = 125°C			60		ns
R_{thJC}					0.15	K/W
R_{thJK}	with heatsink compound			0.27		K/W

Module

Characteristic Values
(T_J = 25°C, unless otherwise specified)

Symbol		min.	typ.	max.	
R_{25}	NTC, T_C = 25°C		2060		Ω
$B_{25/100}$	NTC		3560		K
d_S	Creepage distance on surface	2			mm
d_A	Strike distance through air	2			mm
Weight			250		g

Dimensions in mm (1 mm = 0.0394")