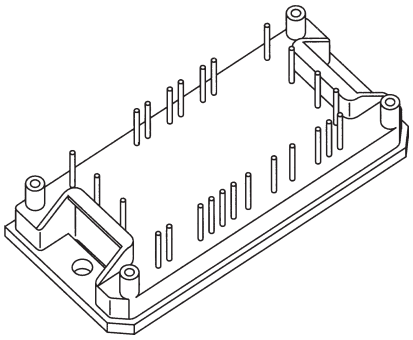
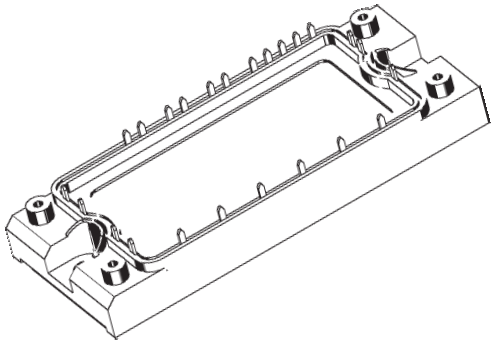
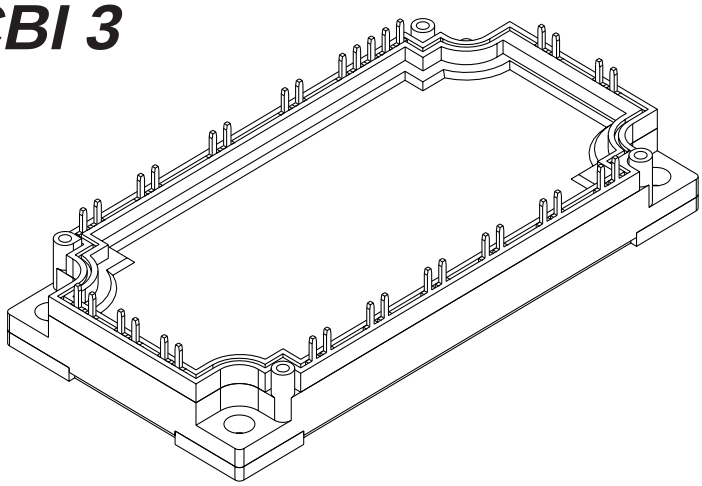
CBI 1



CBI 2

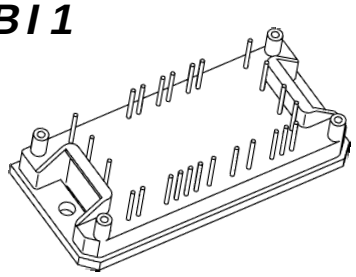


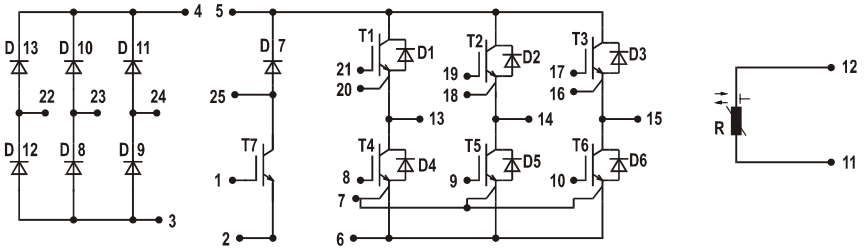
CBI 3



Contents

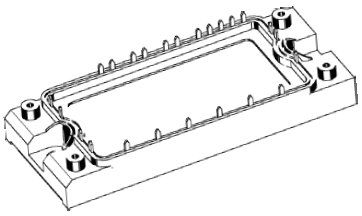
CBI 1

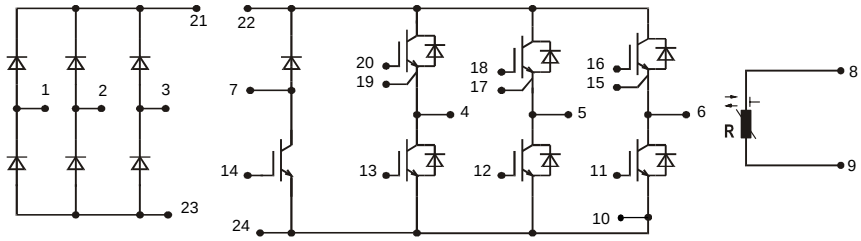




Rectifier 3~			Inverter 3~					Brakechopper			Type	Page
V_{RRM} V	I_{FAVM} T_H = 70°C A	R_{thJC} typ. K/W	V_{CES} V	I_C T_C = 25°C A	I_C T_C = 90°C A	$V_{CE(sat)}$ typ. V	R_{thJC} typ. K/W	V_{CES} V	I_C T_C = 90°C A	R_{thJC} typ. K/W		
1200	11	1.4	600	7	4.5	2.0	2.7	600	4.5	2.7	MUBW 6-06A6	B4- 4
	11	1.4		11	8	2.0	2.3		8	2.3	MUBW 10-06A6	B4-12
	11	1.4		18	10	2.1	1.7		8	2.3	MUBW 15-06A6	B4-20
	11	1.4		23	13	2.1	1.5		8	2.3	MUBW 20-06A6	B4-28
	11	1.4		27.5	16	2.1	1.35		10	1.7	MUBW 25-06A6	B4-36
	25	1.05		38	22	2.1	1.0		13	1.5	MUBW 35-06A6	B4-44
1600	11	1.4	1200	3.6	2.4	2.8	2.3	1200	2.4	2.3	MUBW 4-12A6	B4-52
	11	1.4		13	8	2.8	1.55		2.4	2.3	MUBW 10-12A6	B4-60
	25	1.05		18	11.5	2.6	1.5		8	1.55	MUBW 15-12A6	B4-68
	25	1.05		31	17	2.2	1.0		11.5	1.5	MUBW 30-12A6	B4-76

CBI 2



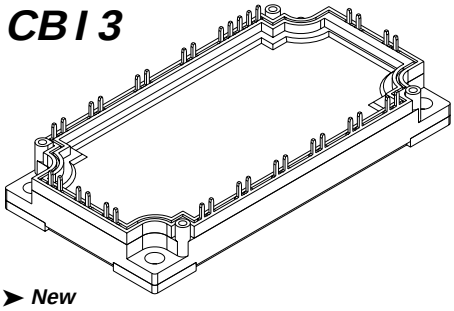


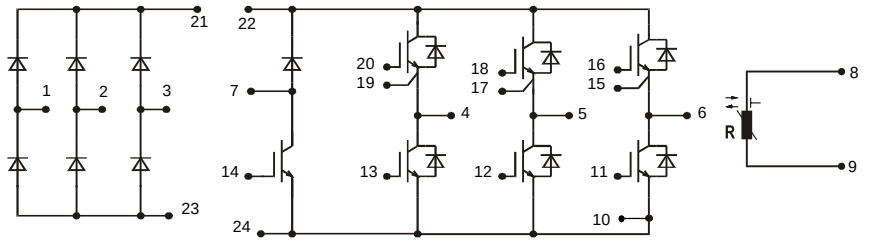
Rectifier 3~			Inverter 3~					Brakechopper			Type	Page
V_{RRM} V	I_d T_C = 80°C A	R_{thJC} max. K/W	V_{CES} V	I_C T_C = 25°C A	I_C T_C = 80°C A	$V_{CE(sat)}$ typ. V	R_{thJC} max. K/W	V_{CES} V	I_C T_C = 80°C A	R_{thJC} max. K/W		
1600	18	1.47	600	20	15	1.9	1.5	600	15	1.5	MUBW 10-06A7	B4-84
	18	1.47		25	18	1.9	1.3		15	1.5	MUBW 15-06A7	B4-92
	24	1.3		35	25	1.9	1.0		18	1.39	MUBW 20-06A7	B4-100
	24	1.3		50	35	1.9	0.7		19	1.39	MUBW 30-06A7	B4-108
	29	1.06		75	50	1.9	0.5		25	1.0	MUBW 50-06A7	B4-116
1600	18	1.47	1200	20	15	2.3	1.2	1200	15	1.2	MUBW 10-12A7	B4-124
	24	1.3		35	25	2.1	0.7		15	1.2	MUBW 15-12A7	B4-132
	24	1.3		50	25	2.2	0.55		15	1.2	MUBW 25-12A7	B4-140
	29	1.06		50	35	2.6	0.55		25	0.7	MUBW 35-12A7	B4-148

Contents of CBI 3 Modules B4 - 3

Contents

CBI 3

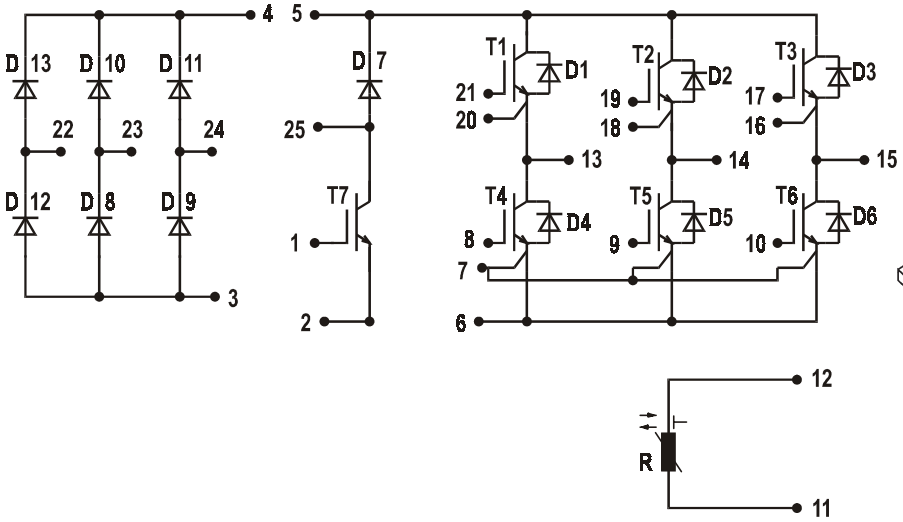


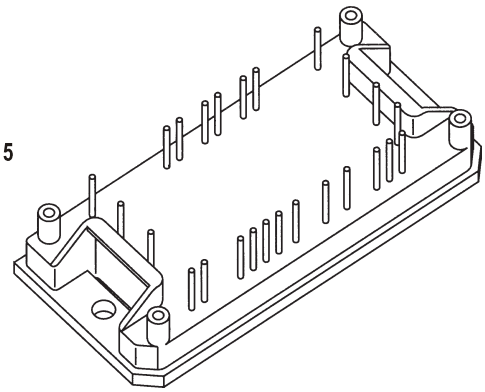


➤ *New*

Rectifier 3~			Inverter 3~					Brakechopper			Type	Page
V_{RRM} V	I_d T_C = 80°C A	R_{thJC} max. K/W	V_{CES} V	I_C T_C = 25°C A	I_C T_C = 80°C A	$V_{CE(sat)}$ typ. V	R_{thJC} max. K/W	V_{CES} V	I_C T_C = 80°C A	R_{thJC} max. K/W		
1600	29	1.06	600	75	50	1.9	0.5	600	25	1	➤ MUBW 50-06A8	B4-156
	35	0.94		100	65	2.0	0.39		35	0.75	➤ MUBW 75-06A8	B4-160
	35	0.94		125	85	1.9	0.3		50	0.55	➤ MUBW 100-06A8	B4-164
1600	29	1.06	1200	50	35	2.5	0.55	1200	25	0.7	➤ MUBW 35-12A8	B4-168
	35	0.94		95	65	2.2	0.3		35	0.55	➤ MUBW 50-12A8	B4-172

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1200V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 600 V I_{C25} = 7 A $V_{CE(sat)}$ = 2.0 V	V_{CES} = 600 V I_{C25} = 7 A $V_{CE(sat)}$ = 2.0 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1200	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	7 4.5	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	14 9	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	38	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			10	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.2 mA	3	4	5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 0.5 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 4 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.0 2.3	2.5 2.8	V V
t_f	Inductive load, T_{VJ} = 150°C V_{CC} = 400 V; I_C = 4 A R_G = 50 Ω; V_{GE} = ±15 V		100	150	ns
t_r			20	30	ns
$t_{d(on)}$			20	30	ns
$t_{d(off)}$			260	390	ns
E_{off}			0.1	0.13	mJ
E_{on}			0.2	0.26	mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		270	340	pF
C_{oss}			30	40	pF
C_{rss}			18	23	pF
g_{fs}	V_{CE} = 20 V; I_C = 4 A	0.8	3.2		S
Q_g	V_{CC} = 400 V; I_C = 6 A pulse; V_{GE} = 15 V		24		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 150°C		2 1.8		V V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -350 A/µs; T_{VJ} = 100°C		0.2		µs
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -350 A/µs; V_{GE}= 0 V; T_{VJ} = 125°C		0.3 0.9		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.7 2.3		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	7 4.5	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	14 9	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	38	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			20	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.2 mA	3	4	5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 0.5 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 4 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.0 2.3	2.5 2.8	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 150°C V_{CC} = 400 V; I_C = 4 A R_G = 50 Ω; V_{GE} = ±15 V		100 20 20 260 0.1 0.2	150 30 30 390 0.13 0.26	ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		270 30 18	340 40 23	pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 4 A	0.8	3.2		S
Q_g	V_{CC} = 400 V; I_C = 6 A pulse; V_{GE} = 15 V		24		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 150°C		2 1.8		V V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -350 A/µs; T_{VJ} = 100°C		0.2		µs
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -350 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		0.3 0.9		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.7 2.3		°C/W °C/W

Module

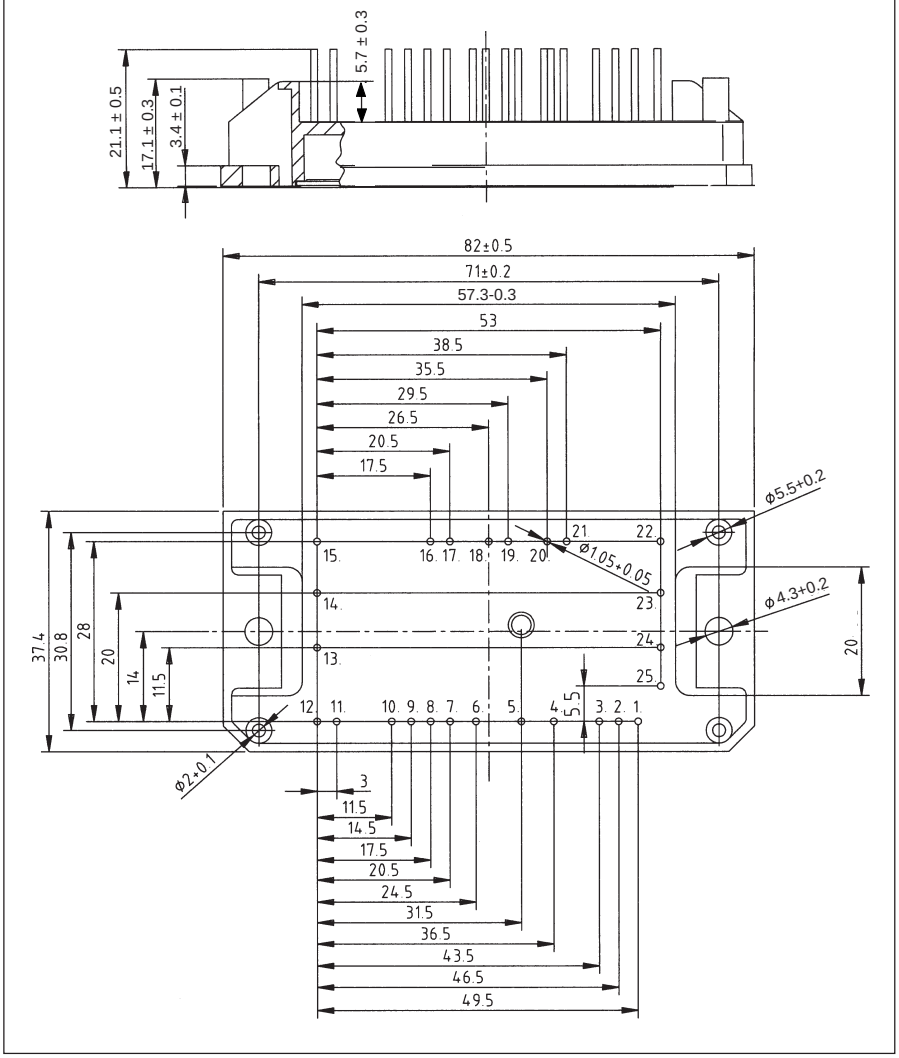
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

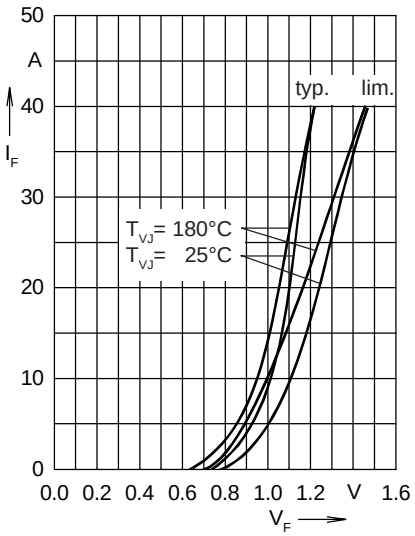
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

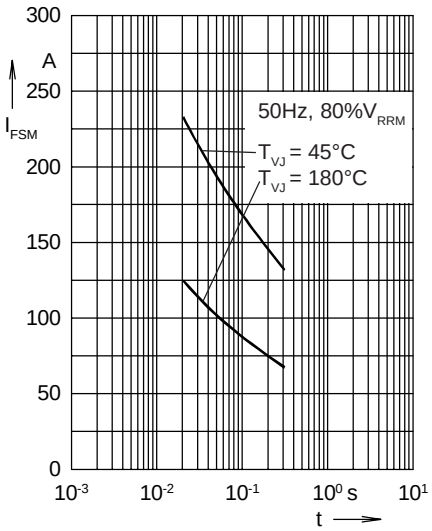
Dimensions in mm (1 mm = 0.0394")



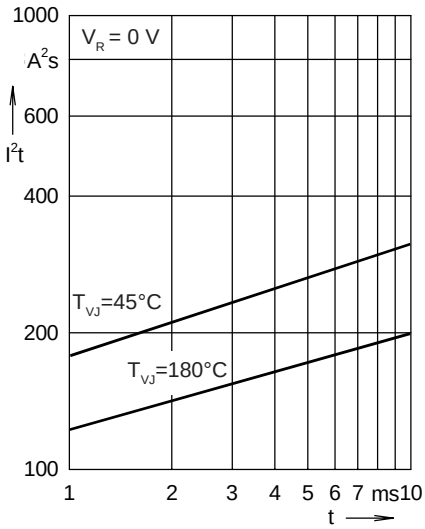
Input Rectifier Bridge D8 - D13



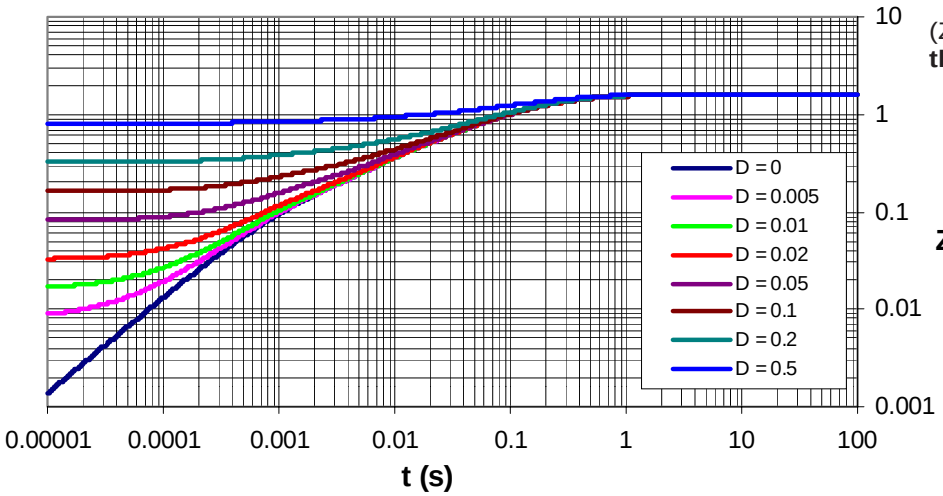
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

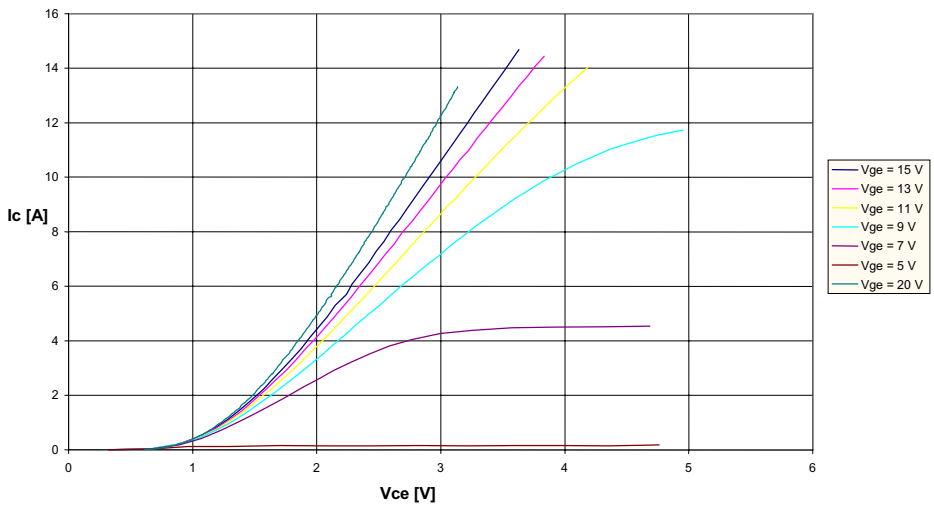


(Z_{thJH} is measured using 50 µm thermal grease)

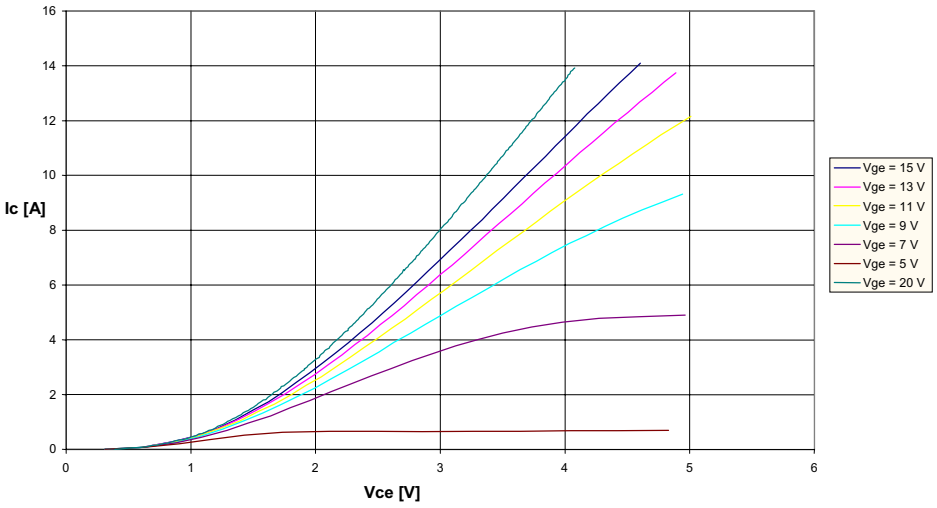
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6, D1 - D6

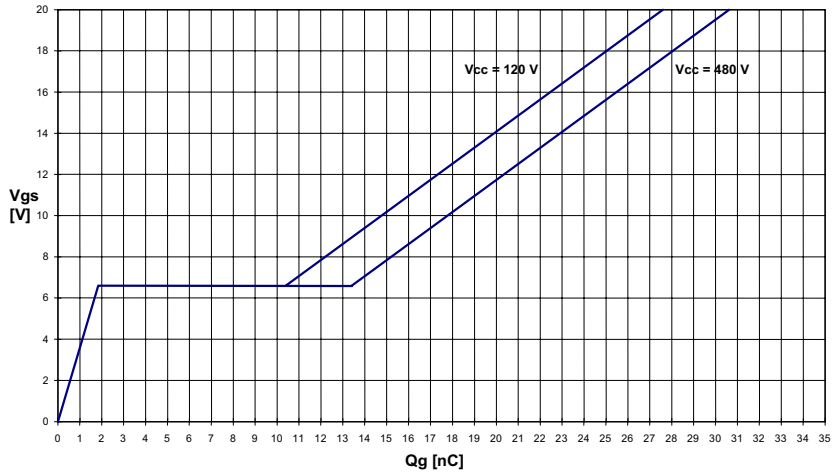
Typ. Output characteristics, 25°C



Typ. Output characteristics, 125°C

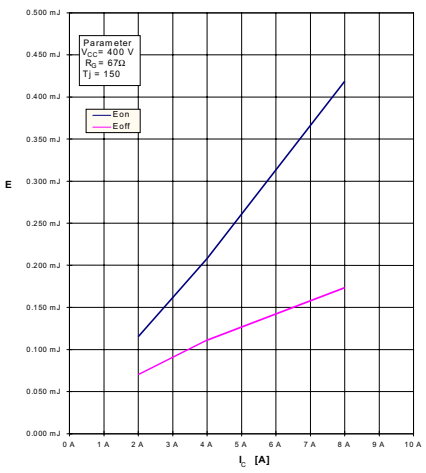


Typ. Gate-Charge

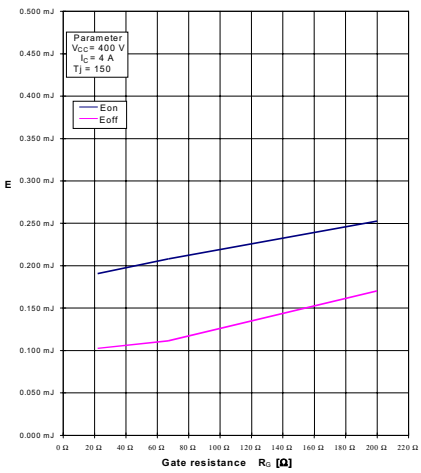


Output Inverter T1 - T6, D1 - D6

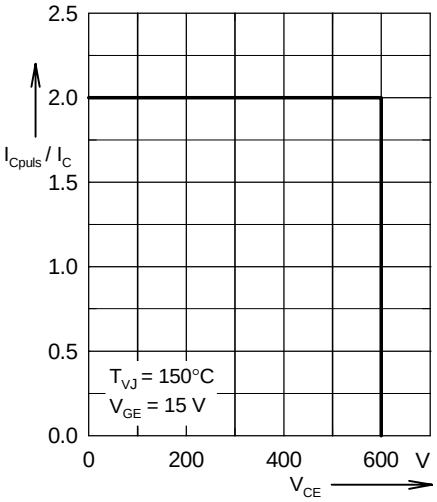
Typ. Switching losses E=f(Ic)



Typ. Switching losses E=f(R)



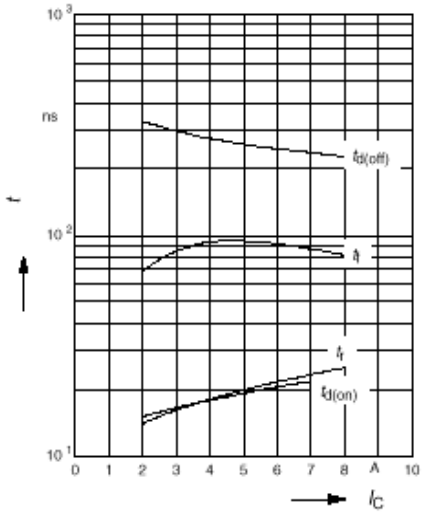
Reverse biased safe operating area



Typ. switching time

$t = f(I_C)$, inductive load, $T_j = 150°C$

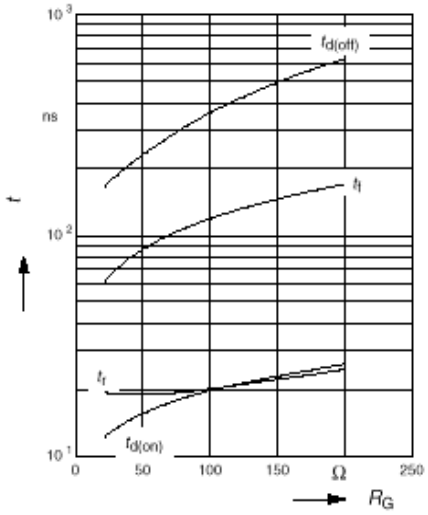
par.: $V_{CE} = 400$ V, $V_{GE} = 0/+15$ V, $R_G = 67\ \Omega$



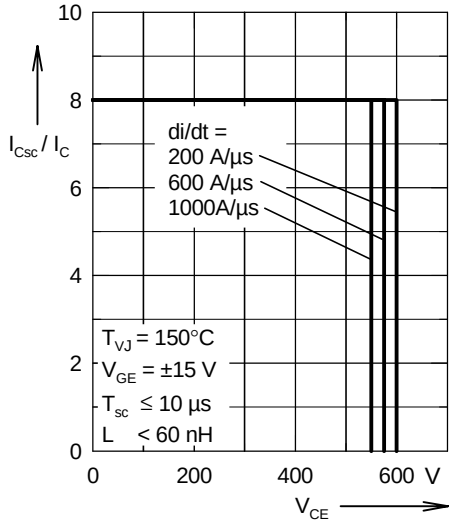
Typ. switching time

$t = f(R_G)$, inductive load, $T_j = 150°C$

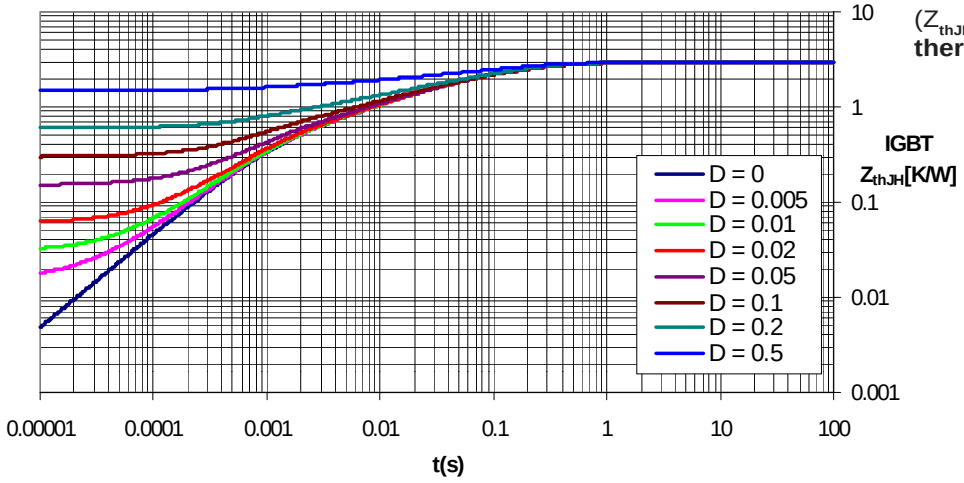
par.: $V_{CE} = 400$ V, $V_{GE} = 0/+15$ V, $I_C = 4$ A



Short circuit safe operating area

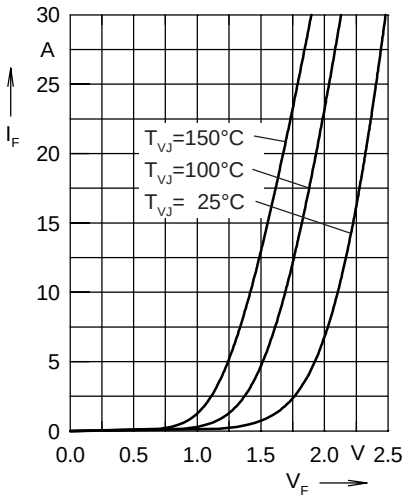


Transient thermal resistance junction to heatsink

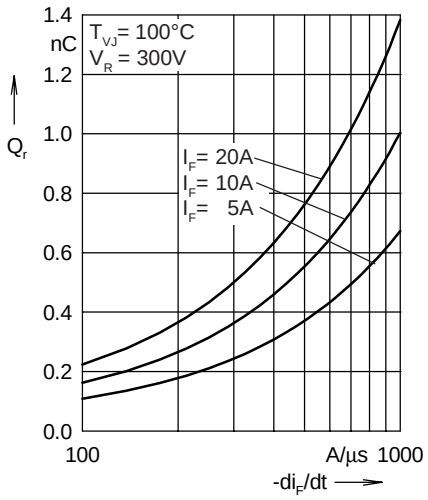


(Z_{thJH} is measured using 50 µm thermal grease)

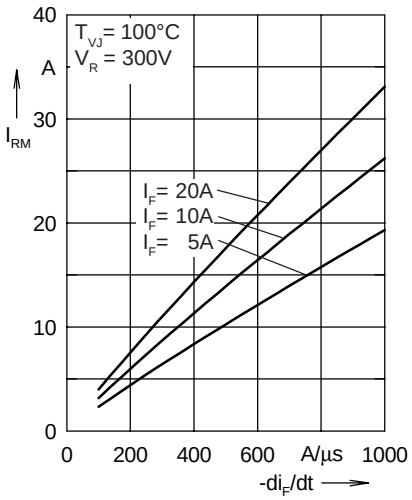
Output Inverter D1 - D6



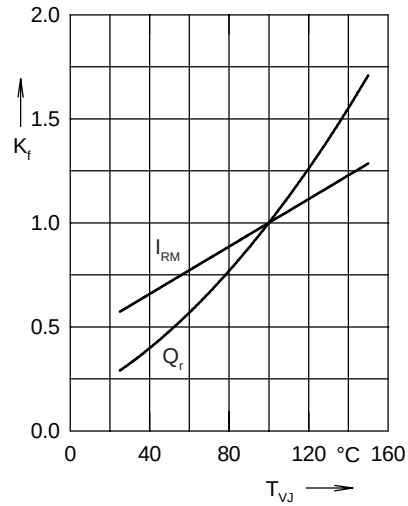
Forward current I_F versus V_F



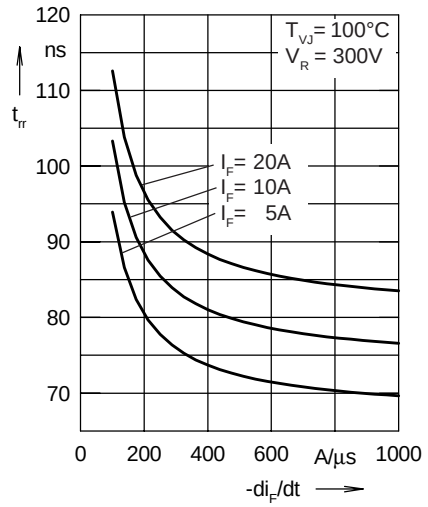
Reverse recovery charge Q_r versus $-di_F/dt$



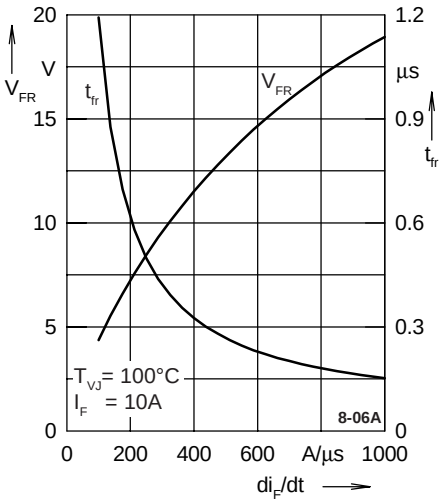
Peak reverse current I_{RM} versus $-di_F/dt$



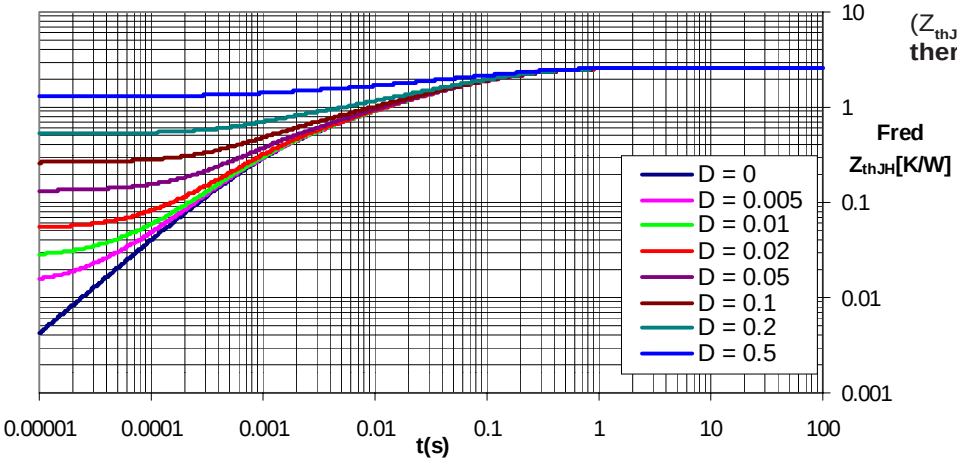
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



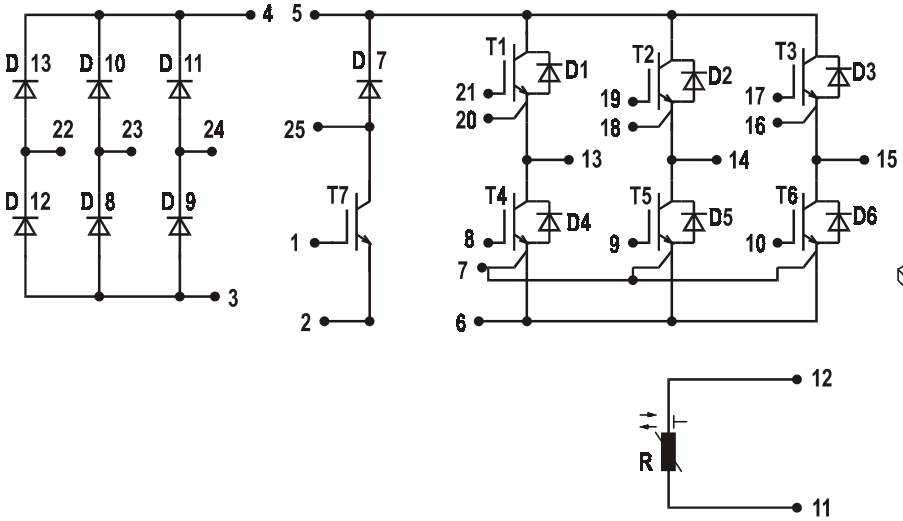
Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

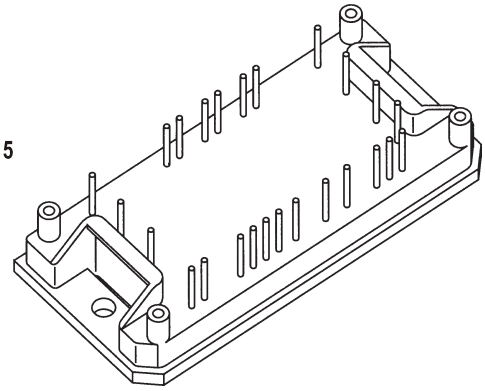


(Z_{thJH} is measured using 50 µm thermal grease)

Transient thermal resistance junction to heatsink

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1200V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 600 V I_{C25} = 11 A $V_{CE(sat)}$ = 2 V	V_{CES} = 600 V I_{C25} = 11 A $V_{CE(sat)}$ = 2 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1200	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	11 8	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	22 16	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			20	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.5 mA	3	4	5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 0.5 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 6 A; T_{VJ} = 25°C T_{VJ} = 150°C		2 2.3	2.5 2.8	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 150°C V_{CC} = 400 V; I_C = 6 A R_G = 50 Ω; V_{GE} = ±15 V		75 30 50 250 0.21 0.25	110 45 80 375	ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		350 40 25	435 50 30	pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 6 A	4.2			S
Q_g	V_{CC} = 400 V; I_C = 6 A pulse; V_{GE} = 15 V		32.5		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 150°C		2 1.8		V V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -350 A/µs; T_{VJ} = 150°C		0.2		µs
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -350 A/µs; V_{GE}= 0 V; T_{VJ} = 125°C		0.3 0.9		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.3 2.3		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C	11	A
	T_C = 90°C	8	A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C	22	A
	T_C = 90°C	16	A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ}	Free-Wheeling Diode	+150	°C
T_{VJ}	IGBT	+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			20	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.5 mA	3	4	5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 0.5 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 6 A; T_{VJ} = 25°C		2	2.5	V
	T_{VJ} = 150°C		2.3	2.8	V
t_f	Inductive load, T_{VJ} = 150°C		75	110	ns
t_r	V_{CC} = 400 V; I_C = 6 A		30	45	ns
$t_{d(on)}$	R_G = 50 Ω; V_{GE} = ±15 V		50	80	ns
$t_{d(off)}$			250	375	ns
E_{off}			0.21		mJ
E_{on}			0.25		mJ
C_{iss}	V_{GE} = 0 V		350	435	pF
C_{oss}	V_{CE} = 25 V		40	50	pF
C_{rss}	f = 1 MHz		25	30	pF
g_{fs}	V_{CE} = 20 V; I_C = 6 A	4.2			S
Q_g	V_{CC} = 400 V; I_C = 6 A pulse; V_{GE} = 15 V		32.5		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C		2		V
	T_{VJ} = 150°C		1.8		V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V		0.2		µs
	di_F/dt = -350 A/µs; T_{VJ} = 150°C				
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C		0.3		µC
	di_F/dt = -350 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		0.9		µC
I_r				250	µA
R_{thJC}	IGBT (per die)		2.3		°C/W
	Diode (per die)		2.3		°C/W

Module

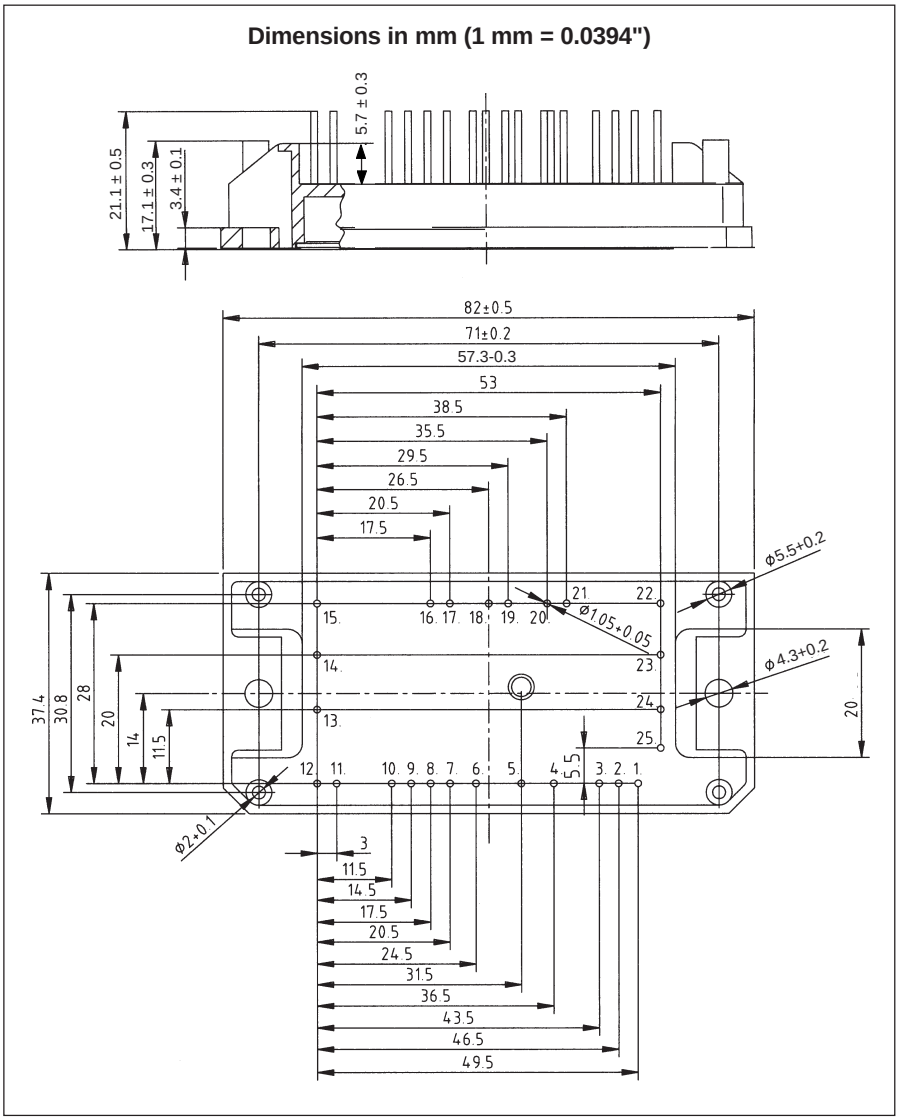
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

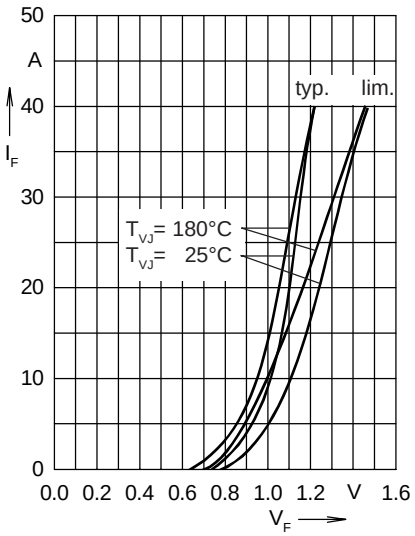
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

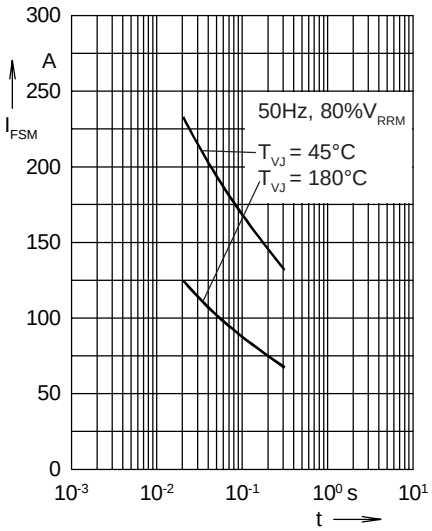
Dimensions in mm (1 mm = 0.0394")



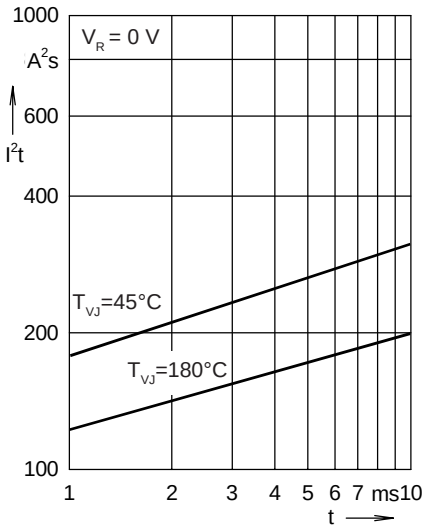
Input Rectifier Bridge D8 - D13



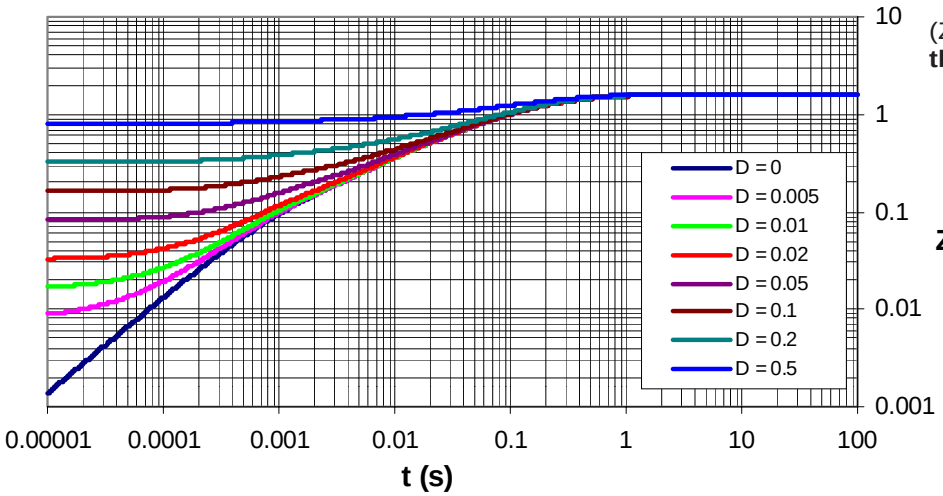
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)



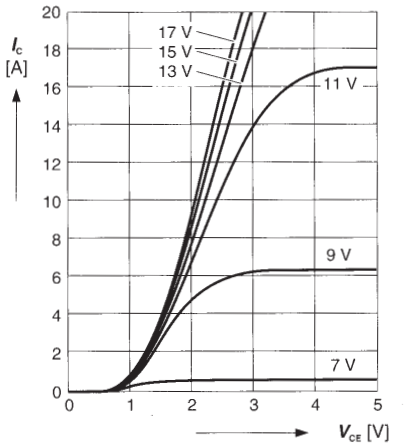
(Z_{thJH} is measured using 50 µm thermal grease)

Z_{thJH}[K/W]

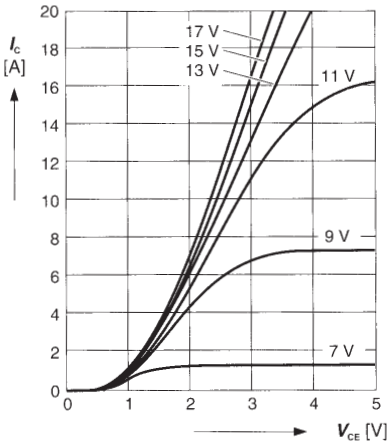
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6, D1 - D6

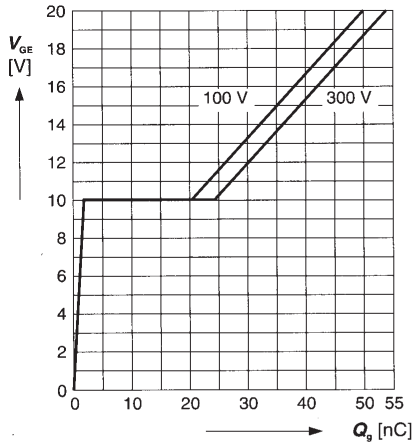
Typ. output characteristics
$I_C = f(V_{CE})$
parameter: t_p = 250 µs; T_j = 25 °C



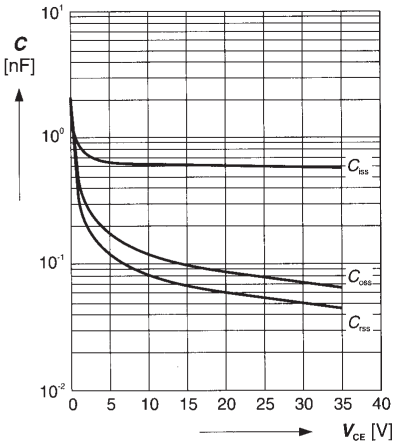
Typ. output characteristics
$I_C = f(V_{CE})$
parameter: t_p = 250 µs; T_j = 125 °C



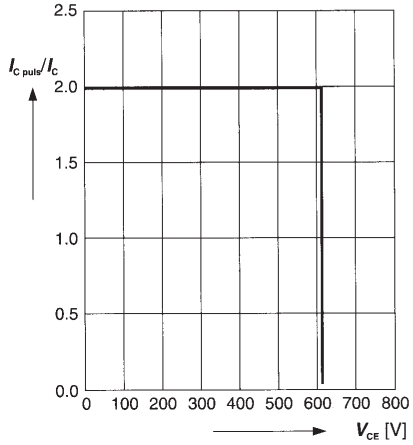
Typ. gate charge
$V_{GE} = f(Q_g)$
parameter: $I_{C\,puls}$ = 10 A



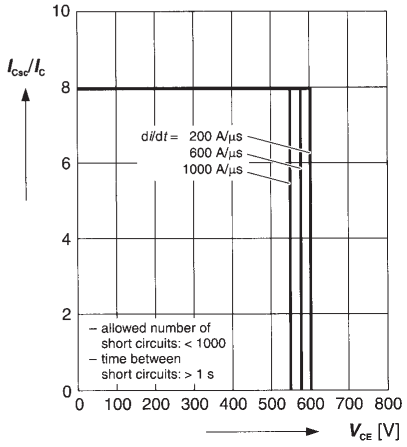
Typ. capacitances
$C = f(V_{CE})$
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area
$I_{C\,puls} = f(V_{CE})$, T_j = 150 °C
parameter: V_{GE} = 15 V

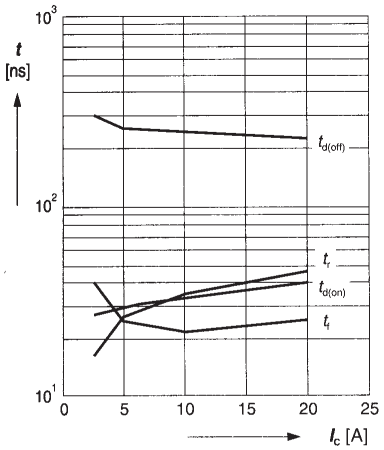


Short circuit safe operating area
$I_{Csc} = f(V_{CE})$, T_j = 150 °C
parameter: V_{GE} = ± 15 V ; t_{sc} ≤ 10 µs; L < 60 nH

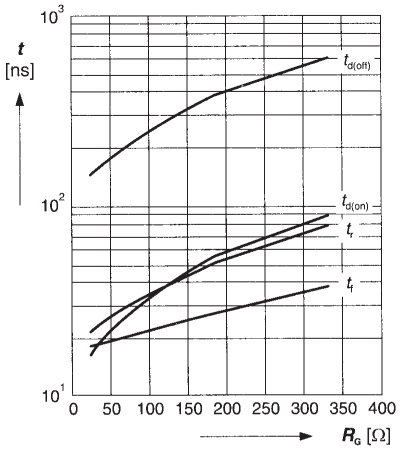


Output Inverter T1 - T6, D1 - D6

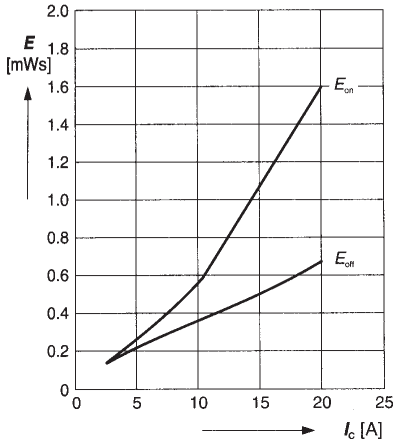
Typ. switching time
$t = f(I_C)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; R_G = 100 Ω



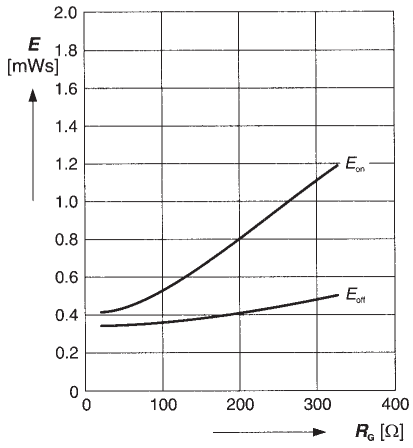
Typ. switching time
$t = f(R_G)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; I_C = 10 A



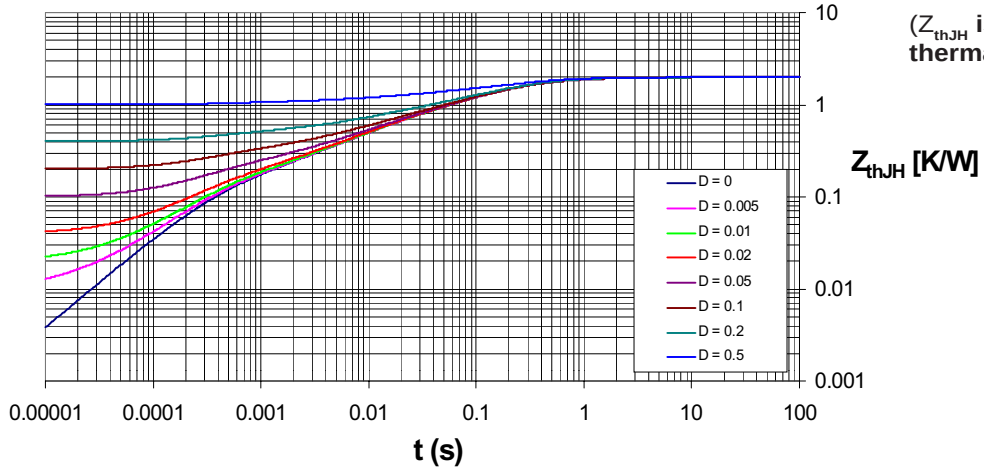
Typ. switching losses
$E = f(I_C)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; R_G = 100 Ω



Typ. switching losses
$E = f(R_G)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; I_C = 10 A

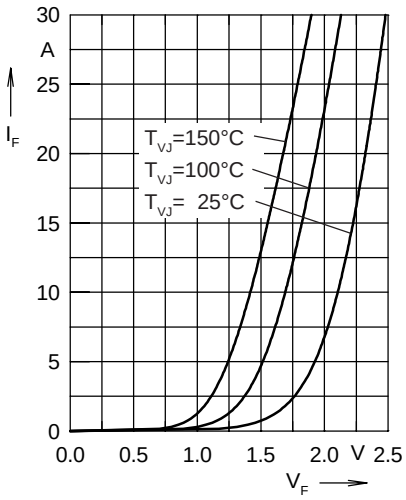


Transient thermal resistance junction to heatsink

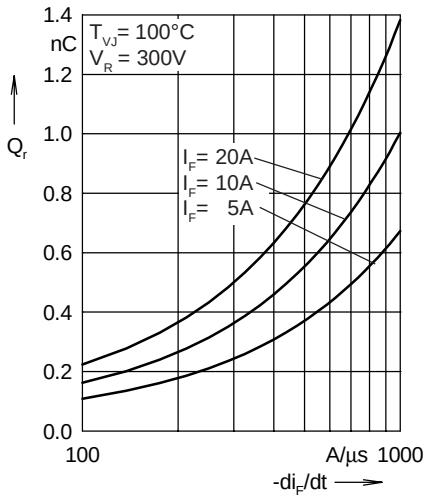


(Z_{thJH} is measured using 50 µm thermal grease)

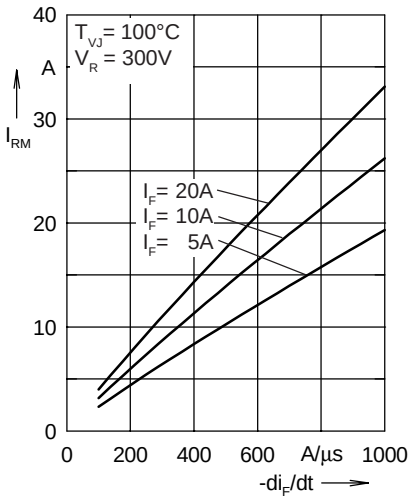
Output Inverter D1 - D6



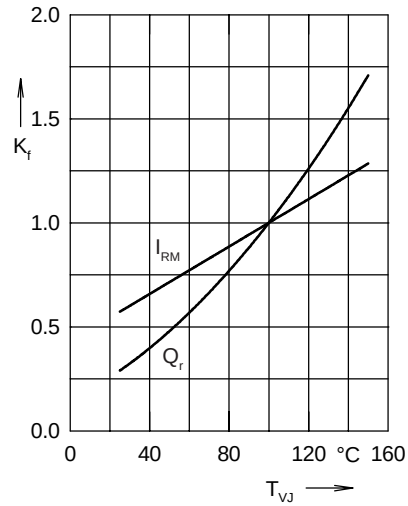
Forward current I_F versus V_F



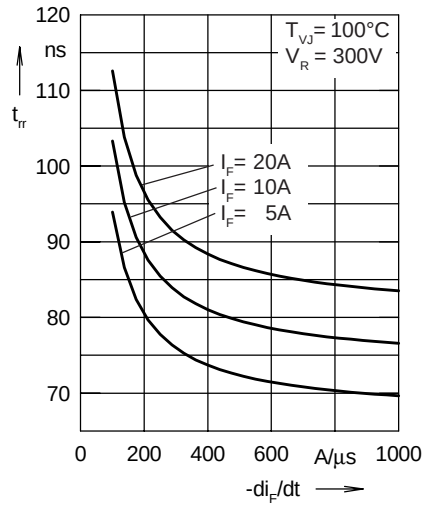
Reverse recovery charge Q_r versus $-di_F/dt$



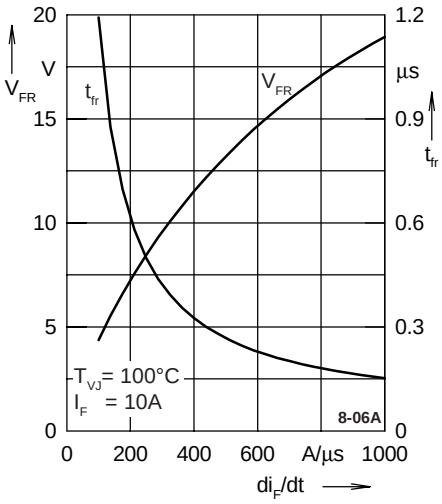
Peak reverse current I_{RM} versus $-di_F/dt$



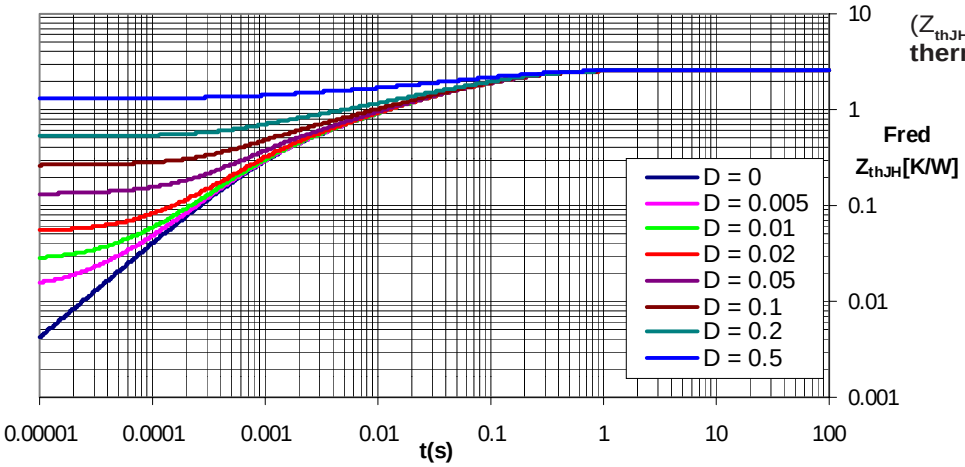
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



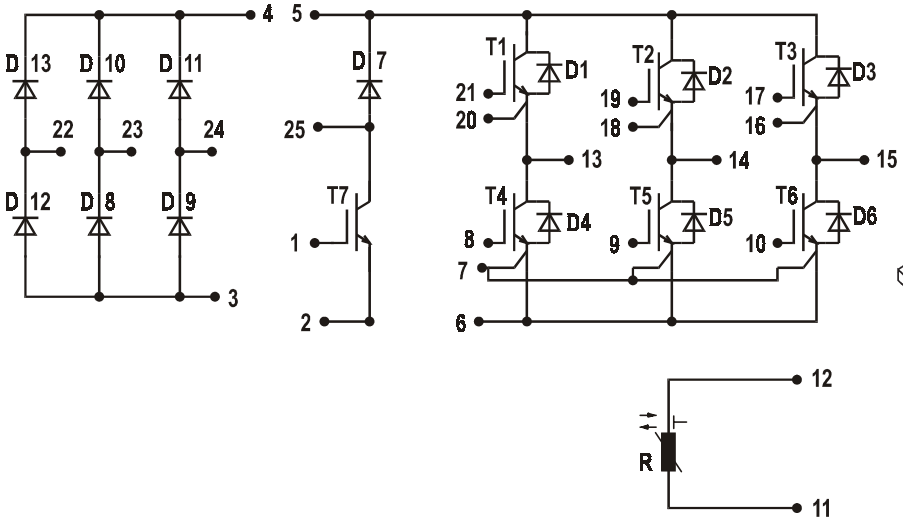
Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

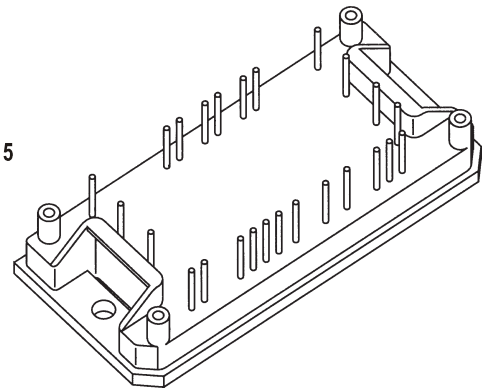


(Z_{thJH} is measured using 50 µm thermal grease)

Transient thermal resistance junction to heatsink

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1200V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 600 V I_{C25} = 11 A $V_{CE(sat)}$ = 2 V	V_{CES} = 600 V I_{C25} = 18 A $V_{CE(sat)}$ = 2.1 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1200	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C	18	A
	T_C = 90°C	10	A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C	36	A
	T_C = 90°C	20	A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	61	W
T_{VJ}	Free-Wheeling Diode	+150	°C
T_{VJ}	IGBT	+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			1	mA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.35 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 10 A; T_{VJ} = 25°C		2.1	2.5	V
	T_{VJ} = 125°C		2.4	2.8	V
t_f	Inductive load, T_{VJ} = 125°C		25		ns
t_r	V_{CC} = 300 V; I_C = 10 A		25		ns
$t_{d(on)}$	R_G = 100 Ω; V_{GE} = ±15 V		35		ns
$t_{d(off)}$			250		ns
E_{off}			0.38		mJ
E_{on}			0.58		mJ
C_{iss}	V_{GE} = 0 V		570		pF
C_{oss}	V_{CE} = 25 V		80		pF
C_{rss}	f = 1 MHz		55		pF
g_{fs}	V_{CE} = 20 V; I_C = 10 A	3			S
Q_g	V_{CC} = 300 V; I_C = 10 A pulse; V_{GE} = 15 V		39		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C		2		V
	T_{VJ} = 125°C		1.8		V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V		0.2		µs
	di_F/dt = -350 A/µs; T_{VJ} = 100°C				
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C		0.3		µC
	di_F/dt = -350 A/µs; V_{GE}= 0 V; T_{VJ} = 125°C		0.9		µC
I_r				250	µA
R_{thJC}	IGBT (per die)		1.7		°C/W
	Diode (per die)		2.3		°C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	11 8	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	22 16	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

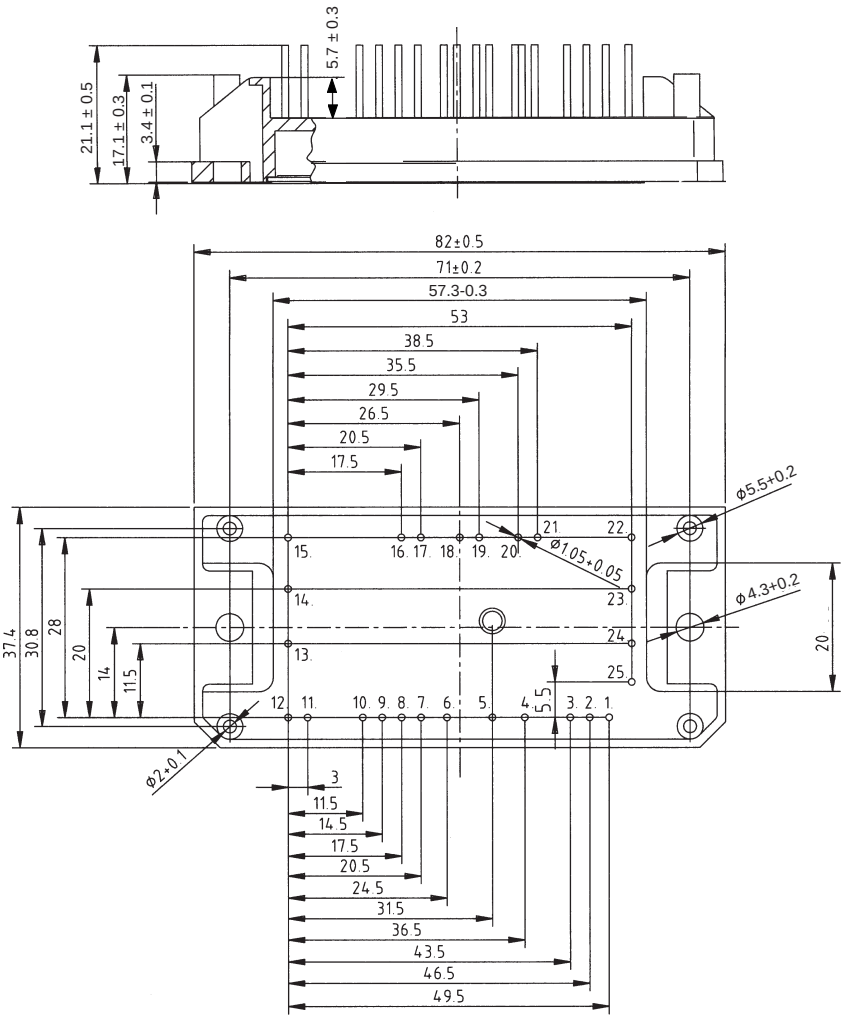
Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			20	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.5 mA	3	4	5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 0.5 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 6 A; T_{VJ} = 25°C T_{VJ} = 150°C		2 2.3	2.5 2.8	V V
t_f	Inductive load, T_{VJ} = 150°C V_{CC} = 400 V; I_C = 6 A R_G = 50 Ω; V_{GE} = ±15 V		75	110	ns
t_r			30	45	ns
$t_{d(on)}$			50	80	ns
$t_{d(off)}$			250	375	ns
E_{off}			0.21		mJ
E_{on}			0.25		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		350	435	pF
C_{oss}			40	50	pF
C_{rss}			25	30	pF
g_{fs}	V_{CE} = 20 V; I_C = 6 A	4.2			S
Q_g	V_{CC} = 400 V; I_C = 6 A pulse; V_{GE} = 15 V		32.5		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 150°C		2 1.8		V V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -350 A/µs; T_{VJ} = 150°C		0.2		µs
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -350 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		0.3 0.9		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.3 2.3		°C/W °C/W

Module			
Symbol	**Conditions**	**Maximum Ratings**	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

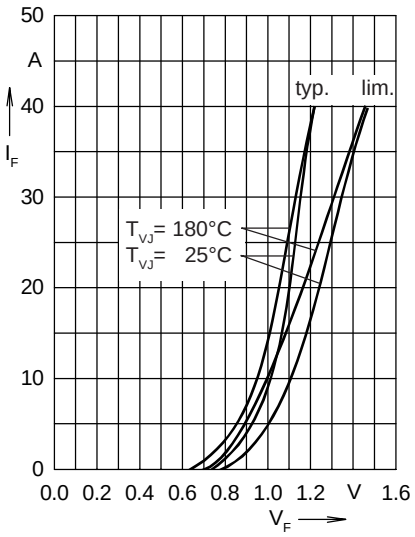
Temperature Sensor R			
Symbol	**Conditions**	**Maximum Ratings**	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

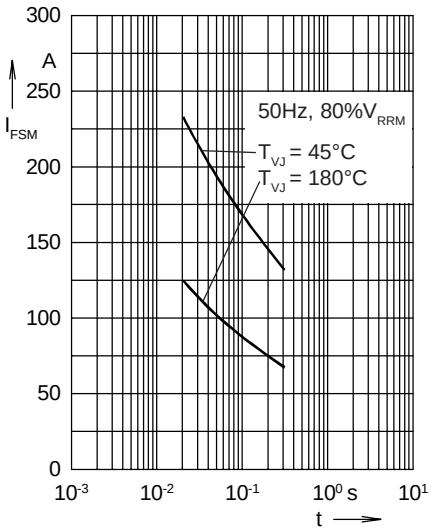
Dimensions in mm (1 mm = 0.0394")



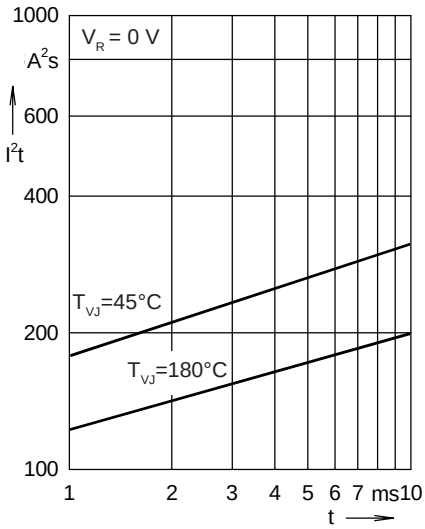
Input Rectifier Bridge D8 - D13



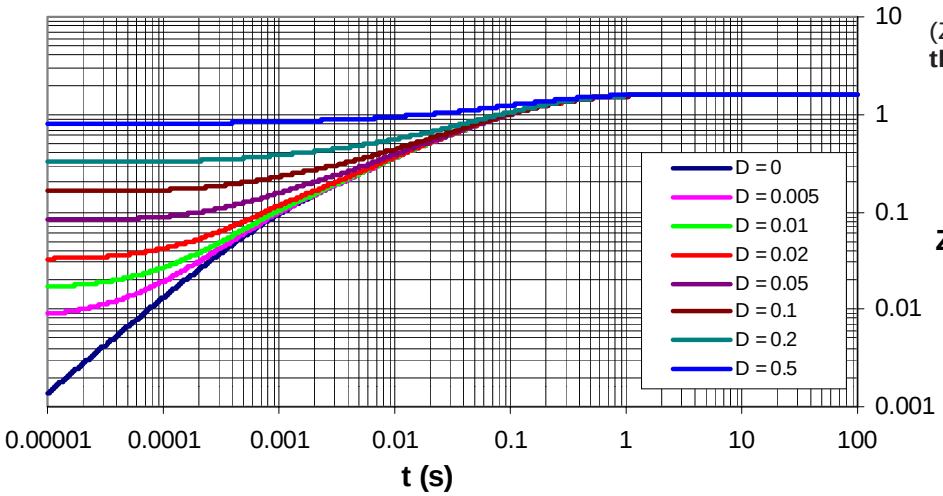
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

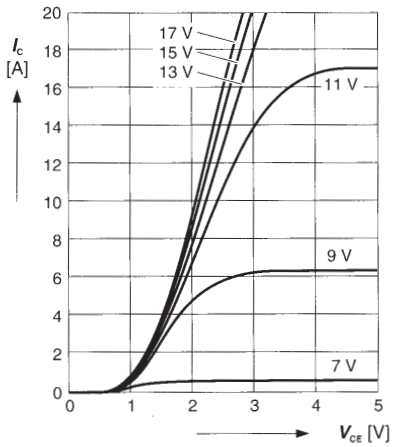


(Z_{thJH} is measured using 50 µm thermal grease)

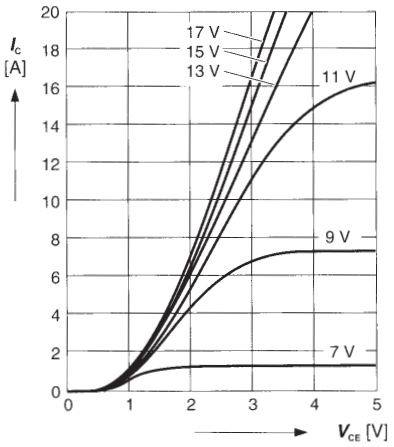
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

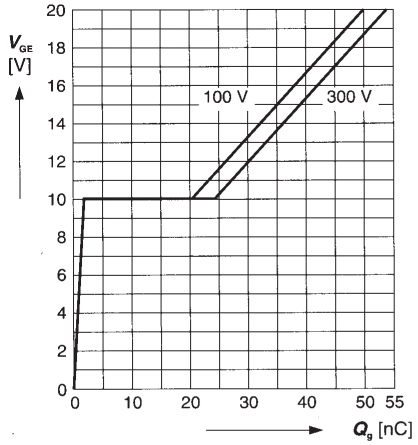
Typ. output characteristics
$I_C = f\ (V_{CE})$
parameter: t_p = 250 µs; T_j = 25 °C



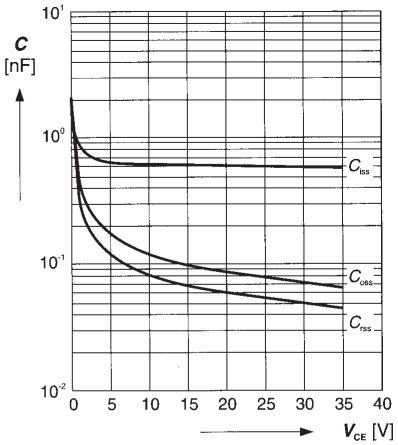
Typ. output characteristics
$I_C = f\ (V_{CE})$
parameter: t_p = 250 µs; T_j = 125 °C



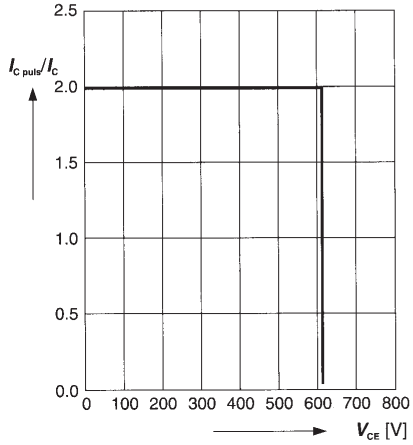
Typ. gate charge
$V_{GE} = f\ (Q_g)$
parameter: $I_{C\ puls}$ = 10 A



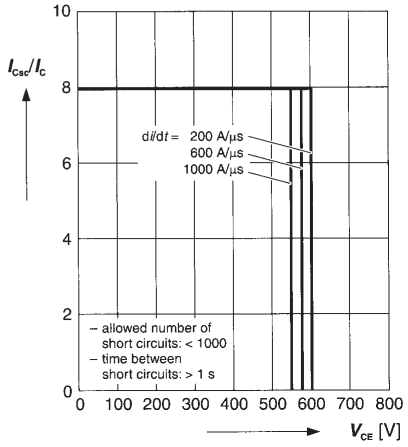
Typ. capacitances
$C = f\ (V_{CE})$
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area
$I_{C\ puls} = f\ (V_{CE})$, T_j = 150 °C
parameter: V_{GE} = 15 V

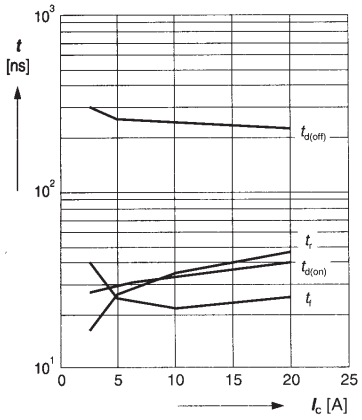


Short circuit safe operating area
$I_{Csc} = f\ (V_{CE})$, T_j = 150 °C
parameter: V_{GE} = ± 15 V ; $t_{sc} \leq$ 10 µs; L < 60 nH

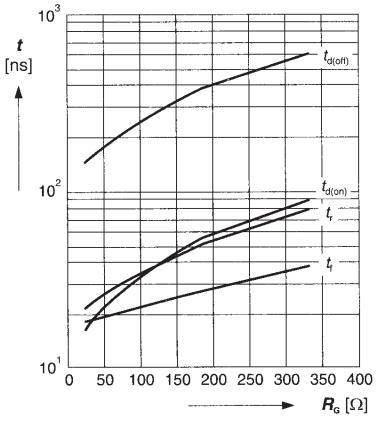


Output Inverter T1 - T6

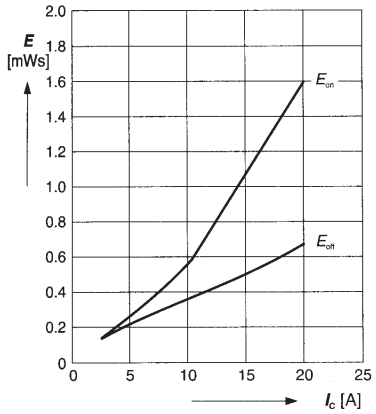
Typ. switching time
$t = f\ (I_C)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; R_G = 100 Ω



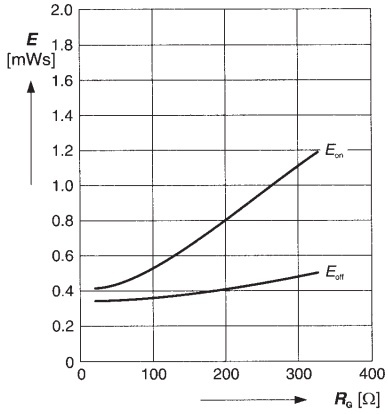
Typ. switching time
$t = f\ (R_G)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; I_C = 10 A



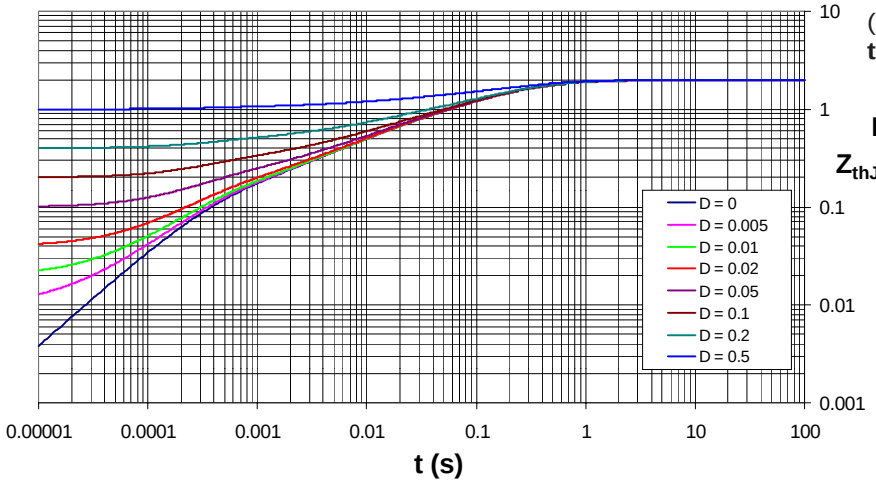
Typ. switching losses
$E = f\ (I_C)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; R_G = 100 Ω



Typ. switching losses
$E = f\ (R_G)$, inductive load, T_j = 125 °C
parameter: V_{CE} = 300 V; V_{GE} = ± 15 V; I_C = 10 A



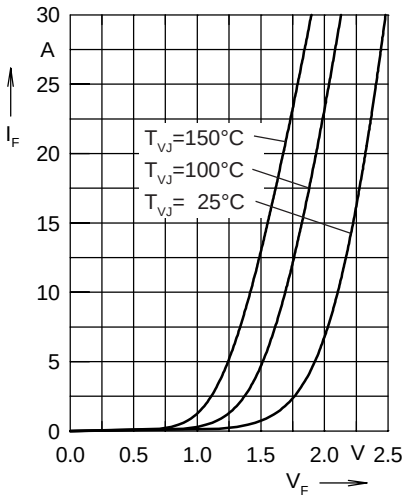
Transient thermal resistance junction to heatsink



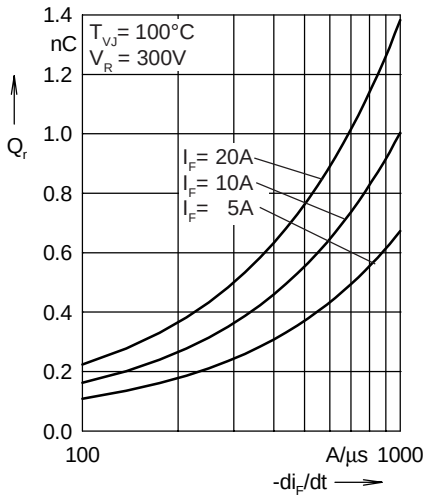
(Z_{thJH} is measured using 50 µm thermal grease)

IGBT
Z_{thJH} [K/W]

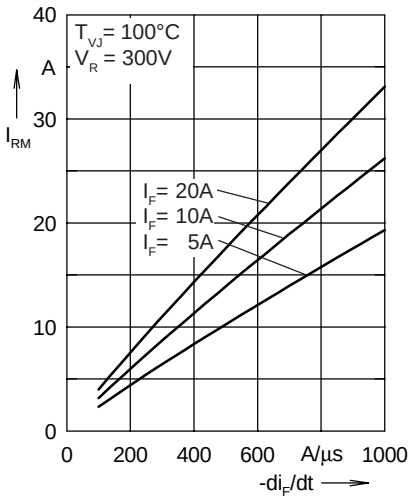
Output Inverter D1 - D6



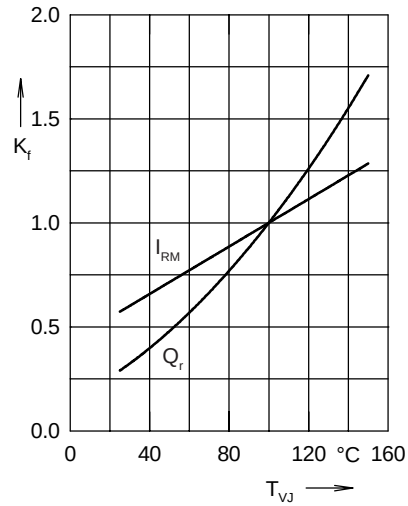
Forward current I_F versus V_F



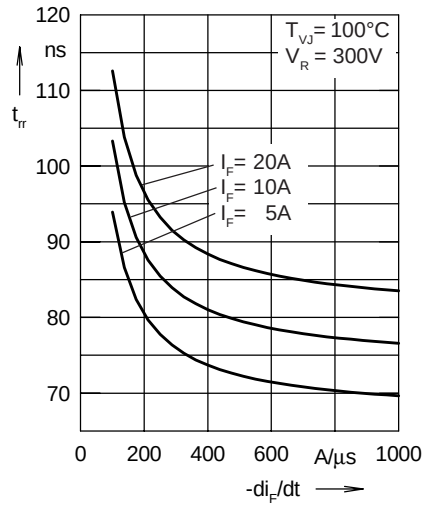
Reverse recovery charge Q_r versus $-di_F/dt$



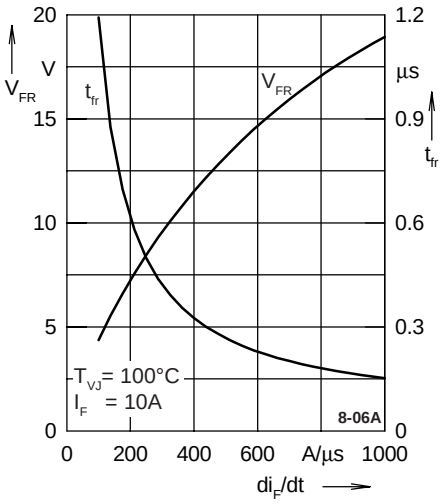
Peak reverse current I_{RM} versus $-di_F/dt$



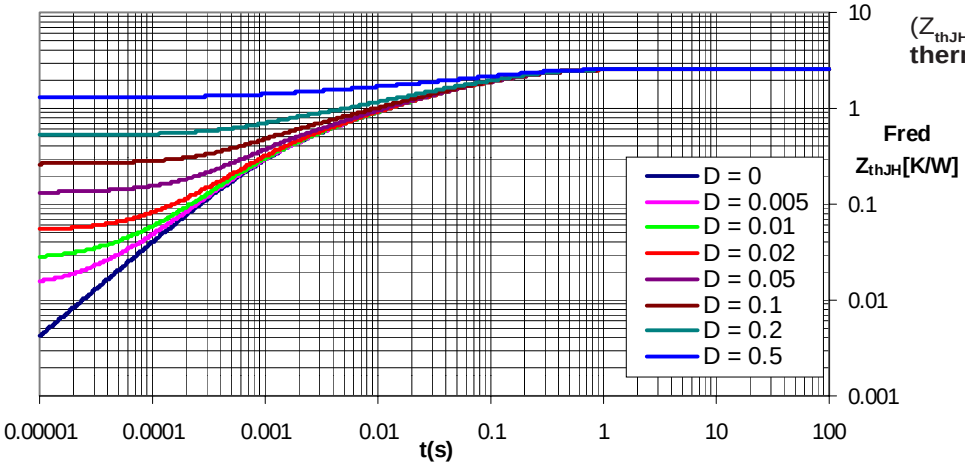
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



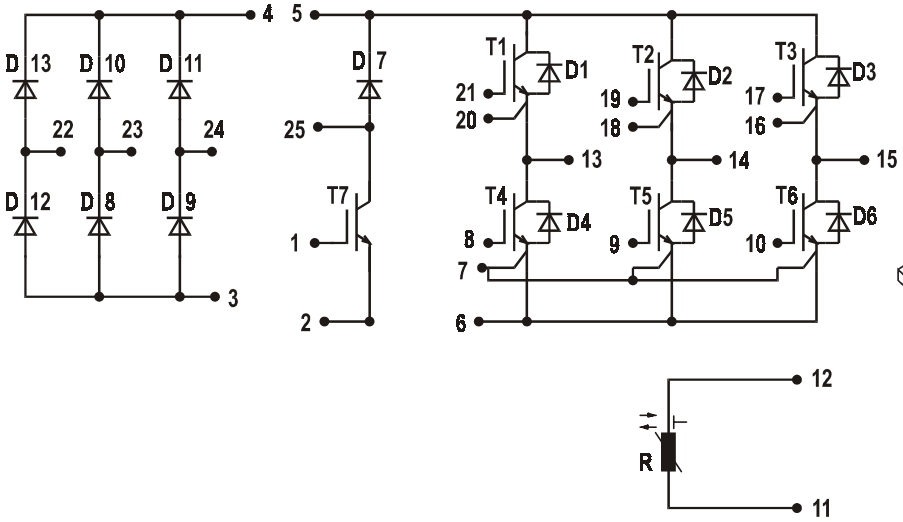
Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

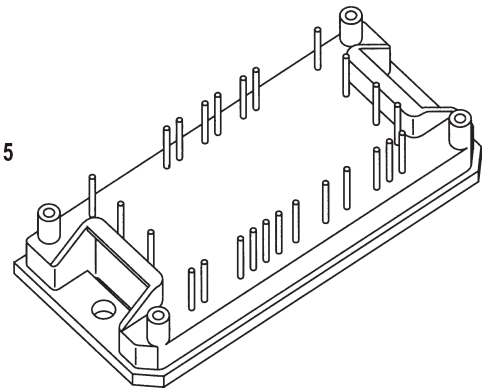


(Z_{thJH} is measured using 50 µm thermal grease)

Transient thermal resistance junction to heatsink

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1200V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 600 V I_{C25} = 11 A $V_{CE(sat)}$ = 2 V	V_{CES} = 600 V I_{C25} = 23 A $V_{CE(sat)}$ = 2.1 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1200	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

031

Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	23 13	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	46 26	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	68	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			1	mA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.4 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 15 A; T_{VJ} = 25°C T_{VJ} = 125°C		2.1 2.4	2.5 2.8	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 125°C V_{CC} = 300 V; I_C = 15 A R_G = 68 Ω; V_{GE} = ±15 V		25 25 30 200 0.5 0.7		ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		800 85 52		pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 15 A	4.5			S
Q_g	V_{CC} = 300 V; I_C = 15 A pulse; V_{GE} = 15 V		59		nC
V_F	I_F = 15 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 125°C		2 1.8		V V
t_{rr}	I_F = 15 A; V_R = -300 V; T_{VJ} = 125°C di_F/dt = -500 A/µs; V_{GE} = 0 V		0.25		µs
Q_r	I_F = 15 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -500 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		0.4 1.3		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.5 2.0		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	11 8	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	22 16	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			20	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.5 mA	3	4	5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 0.5 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 6 A; T_{VJ} = 25°C T_{VJ} = 150°C		2 2.3	2.5 2.8	V V
t_f	Inductive load, T_{VJ} = 150°C V_{CC} = 400 V; I_C = 6 A R_G = 50 Ω; V_{GE} = ±15 V		75	110	ns
t_r			30	45	ns
$t_{d(on)}$			50	80	ns
$t_{d(off)}$			250	375	ns
E_{off}			0.21		mJ
E_{on}			0.25		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		350	435	pF
C_{oss}			40	50	pF
C_{rss}			25	30	pF
g_{fs}	V_{CE} = 20 V; I_C = 6 A	4.2			S
Q_g	V_{CC} = 400 V; I_C = 6 A pulse; V_{GE} = 15 V		32.5		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 150°C		2 1.8		V V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -350 A/µs; T_{VJ} = 150°C		0.2		µs
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -350 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		0.3 0.9		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.3 2.3		°C/W °C/W

Module

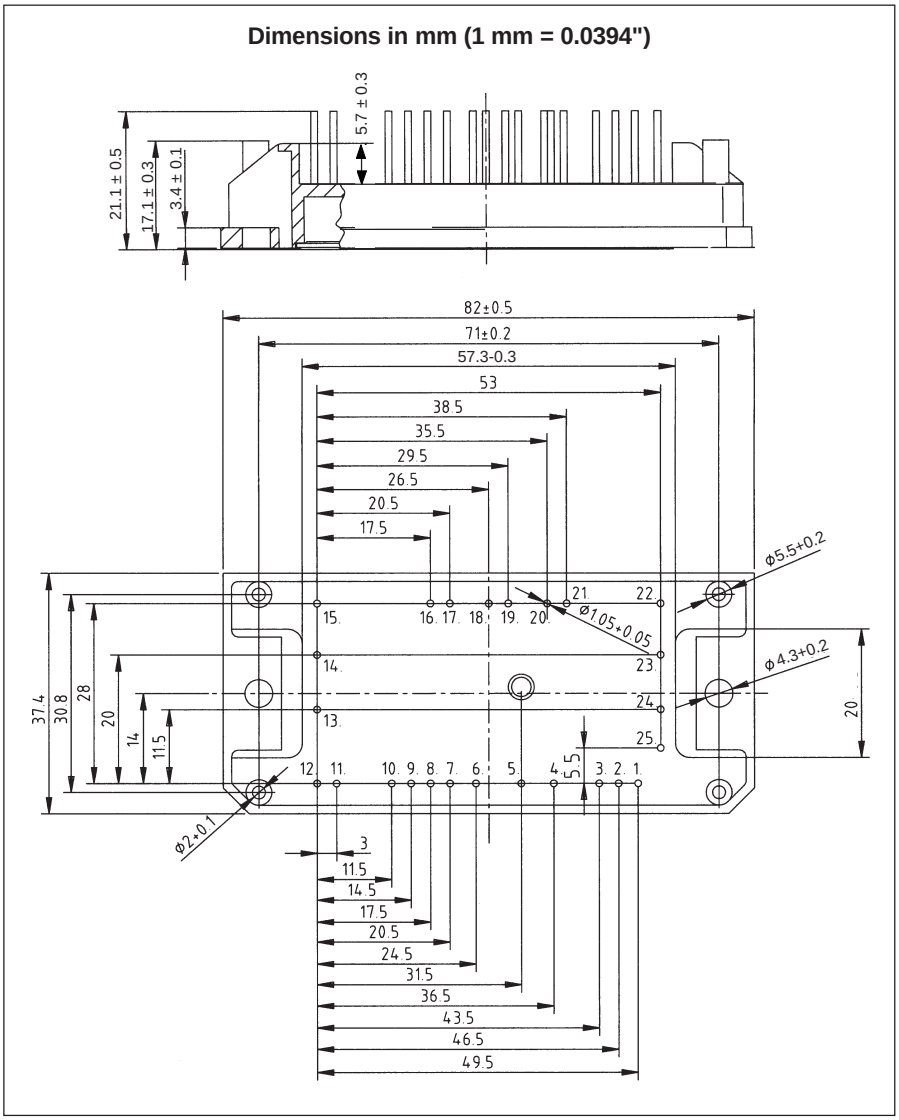
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

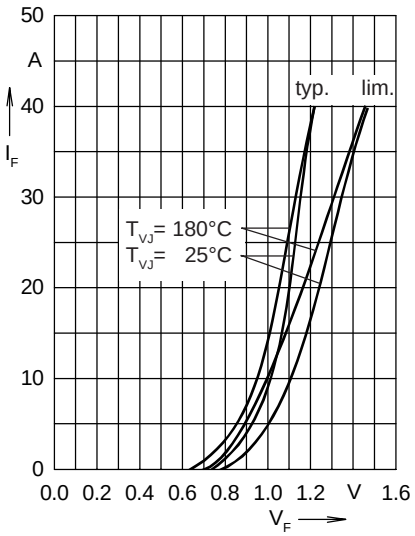
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

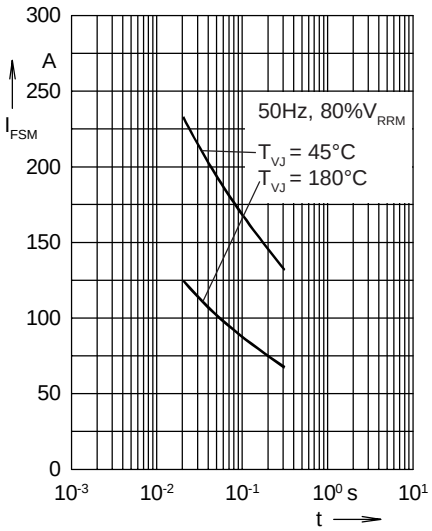
Dimensions in mm (1 mm = 0.0394")



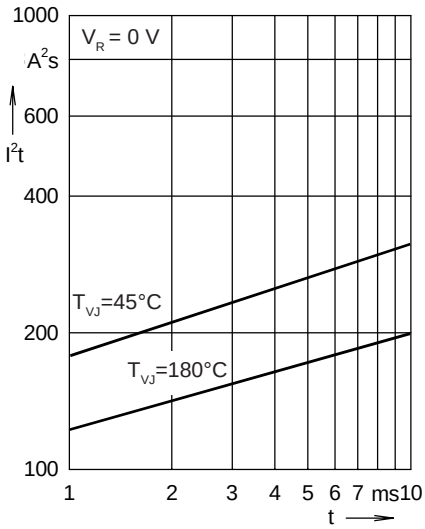
Input Rectifier Bridge D8 - D13



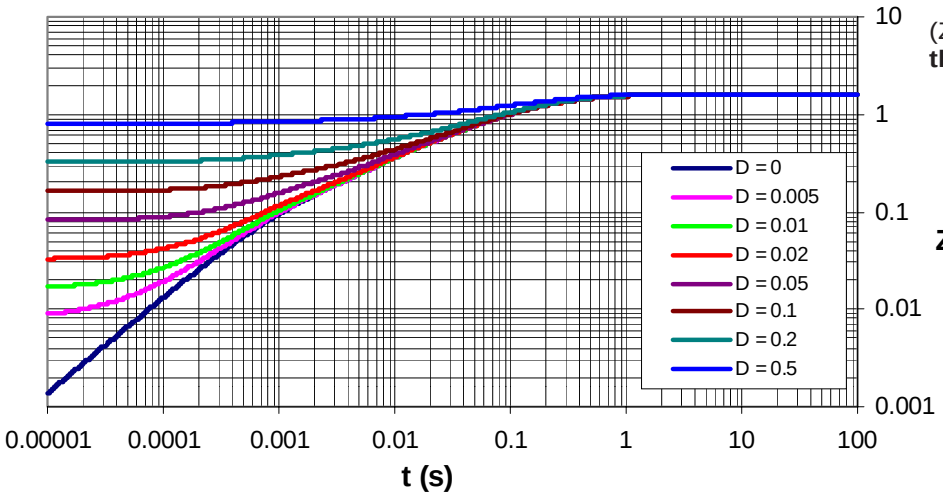
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

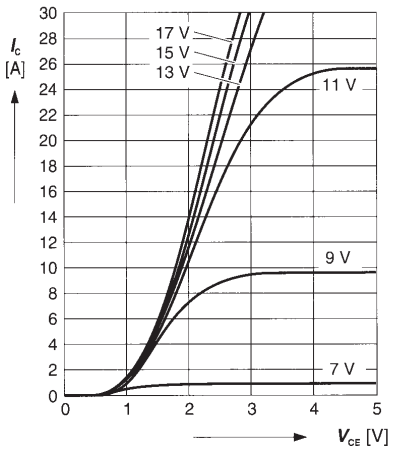


(Z_{thJH} is measured using 50 µm thermal grease)

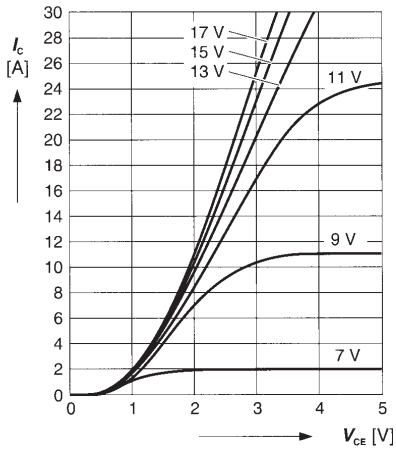
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

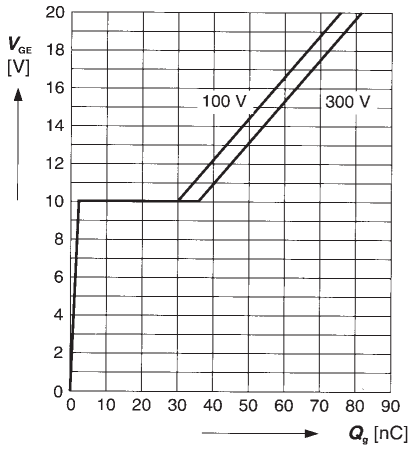
Typ. output characteristics
$I_C = f(V_{CE})$
parameter: t_p = 250 µs; T_j = 25 °C



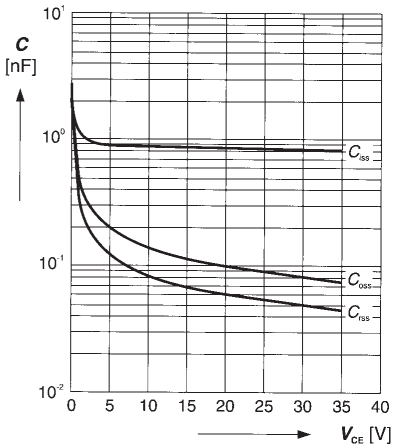
Typ. output characteristics
$I_C = f(V_{CE})$
parameter: t_p = 250 µs; T_j = 125 °C



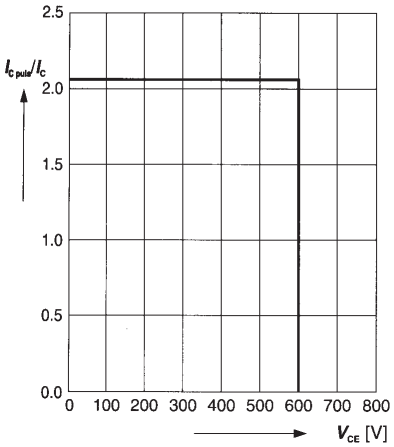
Typ. gate charge
$V_{GE} = f(Q_g)$
parameter: $I_{C\ puls}$ = 15 A



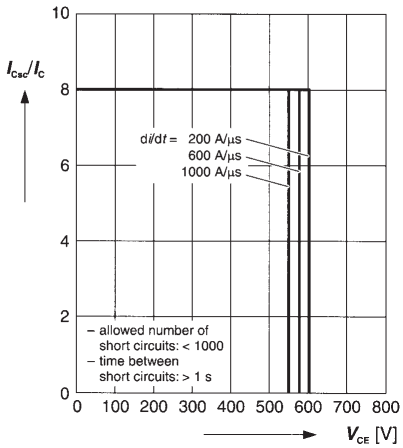
Typ. capacitances
$C = f(V_{CE})$
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area
$I_{C\ puls} = f(V_{CE})$, T_j = 150 °C
parameter: V_{GE} = 15 V

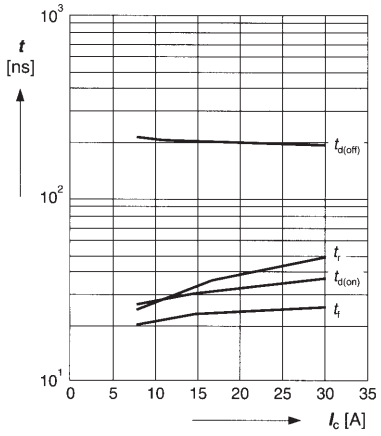


Short circuit safe operating area
$I_{Csc} = f(V_{CE})$, T_j = 150 °C
parameter: V_{GE} = ± 15 V ; t_{sc} ≤ 10 µs; L < 60 nH

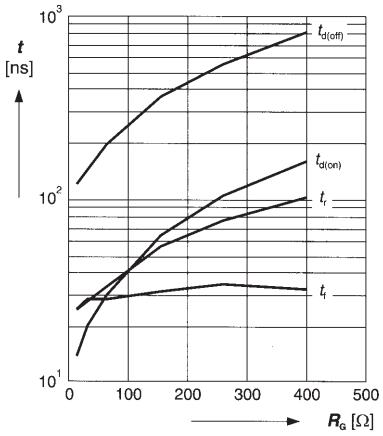


Output Inverter T1 - T6

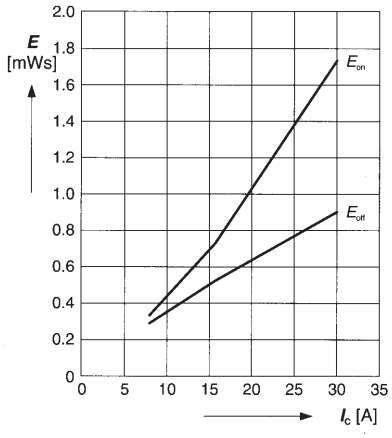
Typ. switching time
$t = f(I_C)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $R_G = 68\ \Omega$



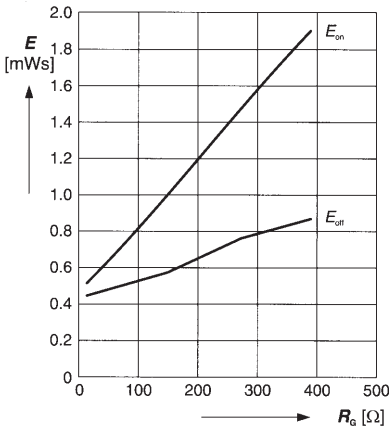
Typ. switching time
$t = f(R_G)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $I_C = 15$ A



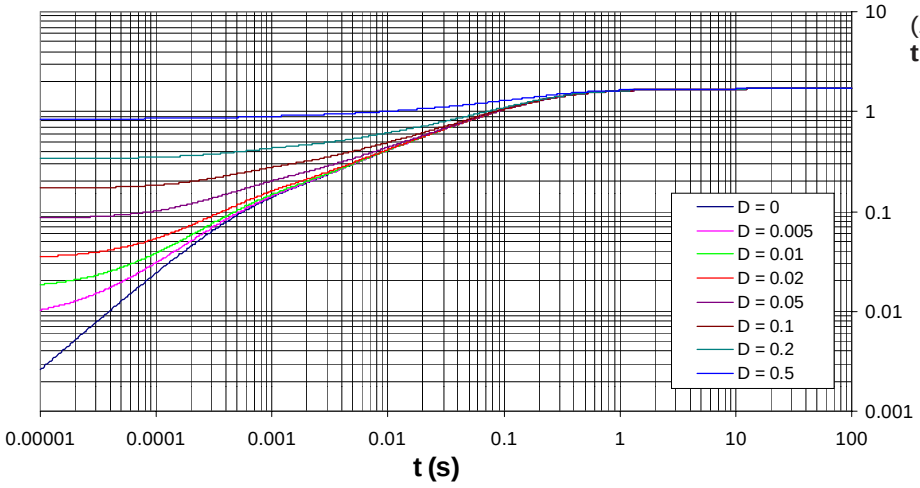
Typ. switching losses
$E = f(I_C)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $R_G = 68\ \Omega$



Typ. switching losses
$E = f(R_G)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $I_C = 15$ A



Transient thermal resistance junction to heatsink



(Z_{thJH} is measured using 50 µm thermal grease)

IGBT Z_{thJH} [K/W]

Output Inverter D1 - D6

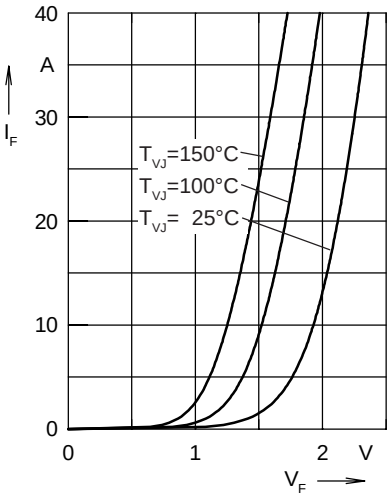


Fig. 1 Forward current I_F versus V_F

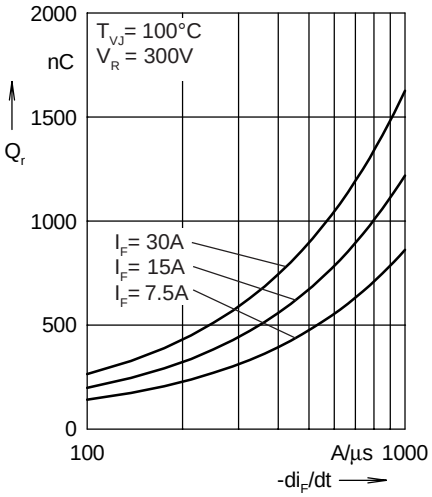


Fig. 2 Reverse recovery charge Q_r versus $-di_F/dt$

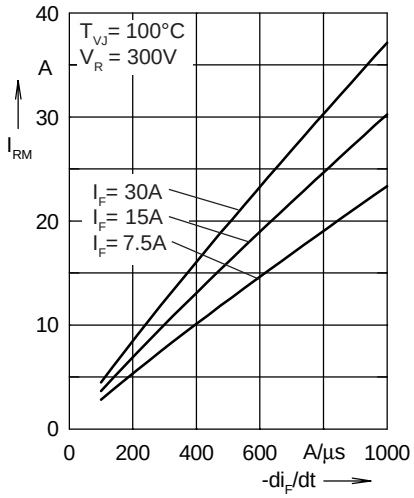


Fig. 3 Peak reverse current I_{RM} versus $-di_F/dt$

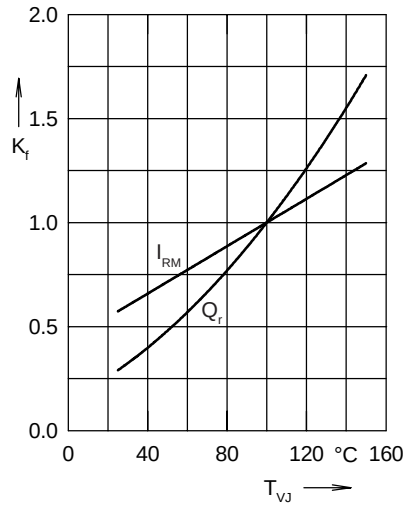


Fig. 4 Dynamic parameters Q_r, I_{RM} versus T_{VJ}

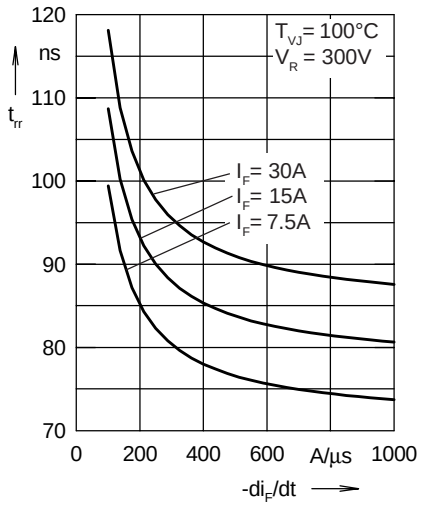


Fig. 5 Recovery time t_{rr} versus $-di_F/dt$

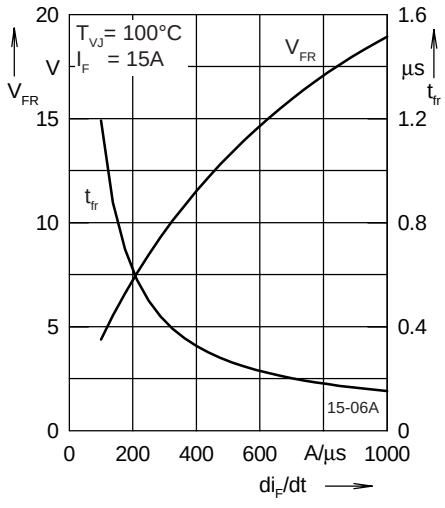
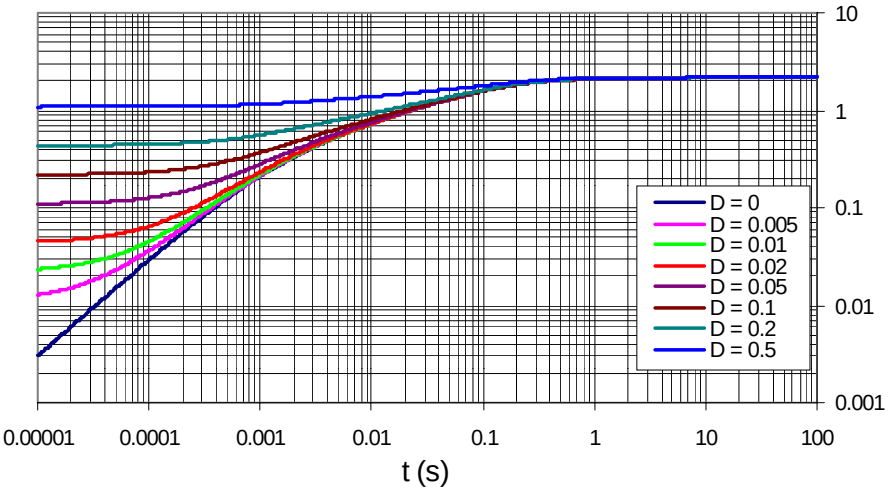


Fig. 6 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt



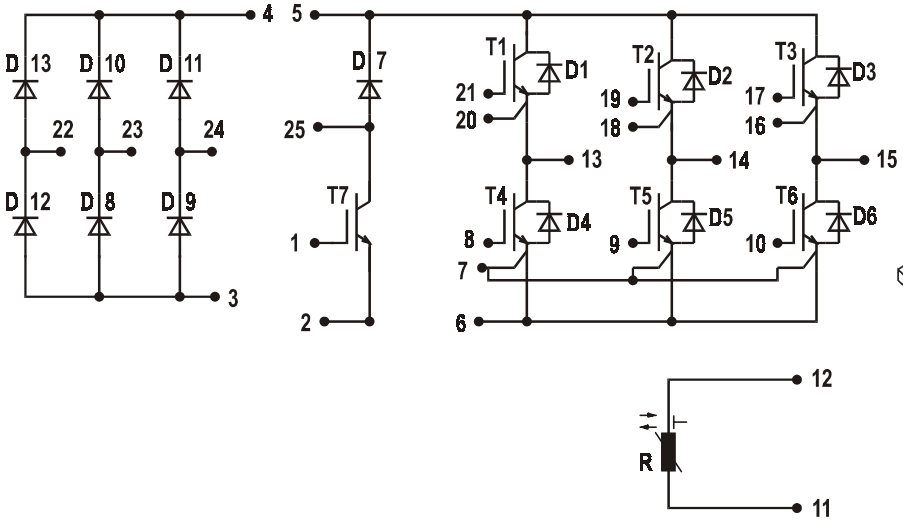
Transient thermal resistance junction to heatsink

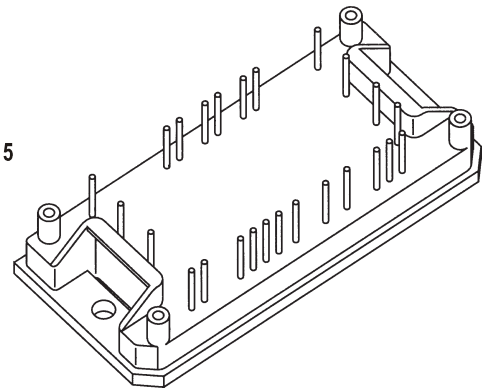
(Z_{thJH} is measured using 50 µm thermal grease)

FRED

Z_{thJH}[K/W]

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1200V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 600 V I_{C25} = 18 A $V_{CE(sat)}$ = 2.1 V	V_{CES} = 600 V I_{C25} = 27.5 A $V_{CE(sat)}$ = 2.1 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1200	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	27.5 16	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	55 32	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	77	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			1	mA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.5 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 20 A; T_{VJ} = 25°C T_{VJ} = 125°C		2.1 2.4	2.5 2.8	V V
t_f	Inductive load, T_{VJ} = 125°C V_{CC} = 300 V; I_C = 20 A R_G = 47 Ω; V_{GE} = ±15 V		30		ns
t_r			35		ns
$t_{d(on)}$			30		ns
$t_{d(off)}$			200		ns
E_{off}			0.6		mJ
E_{on}			0.75		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		1100		pF
C_{oss}			120		pF
C_{rss}			72		pF
g_{fs}	V_{CE} = 20 V; I_C = 20 A	5.5			S
Q_g	V_{CC} = 300 V; I_C = 20 A pulse; V_{GE} = 15 V		63		nC
V_F	I_F = 20 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 125°C		2 1.8		V V
t_{rr}	I_F = 20 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -600 A/µs; T_{VJ} = 125°C		0.3		µs
Q_r	I_F = 20 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -600 A/µs; V_{GE}= 0 V; T_{VJ} = 125°C		0.6 1.7		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.35 1.7		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C	18	A
	T_C = 90°C	10	A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C	36	A
	T_C = 50°C	20	A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	61	W
T_{VJ}	Free-Wheeling Diode	+150	°C
T_{VJ}	IGBT	+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			1	mA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.35 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 10 A; T_{VJ} = 25°C		2.1	2.5	V
	T_{VJ} = 125°C		2.4	2.8	V
t_f	Inductive load, T_{VJ} = 125°C		25		ns
t_r	V_{CC} = 300 V; I_C = 10 A		25		ns
$t_{d(on)}$	R_G = 100 Ω; V_{GE} = ±15 V		35		ns
$t_{d(off)}$			250		ns
E_{off}			0.38		mJ
E_{on}			0.58		mJ
C_{iss}	V_{GE} = 0 V		570		pF
C_{oss}	V_{CE} = 25 V		80		pF
C_{rss}	f = 1 MHz		55		pF
g_{fs}	V_{CE} = 20 V; I_C = 10 A	3			S
Q_g	V_{CC} = 300 V; I_C = 10 A pulse; V_{GE} = 15 V		39		nC
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C		2		V
	T_{VJ} = 125°C		1.8		V
t_{rr}	I_F = 10 A; V_R = -300 V; V_{GE} = 0 V		0.2		µs
	di_F/dt = -350 A/µs; T_{VJ} = 100°C				
Q_r	I_F = 10 A; V_R = -300 V; T_{VJ} = 25°C		0.3		µC
	di_F/dt = -350 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		0.9		µC
I_r				250	µA
R_{thJC}	IGBT (per die)		1.7		°C/W
	Diode (per die)		2.3		°C/W

Module

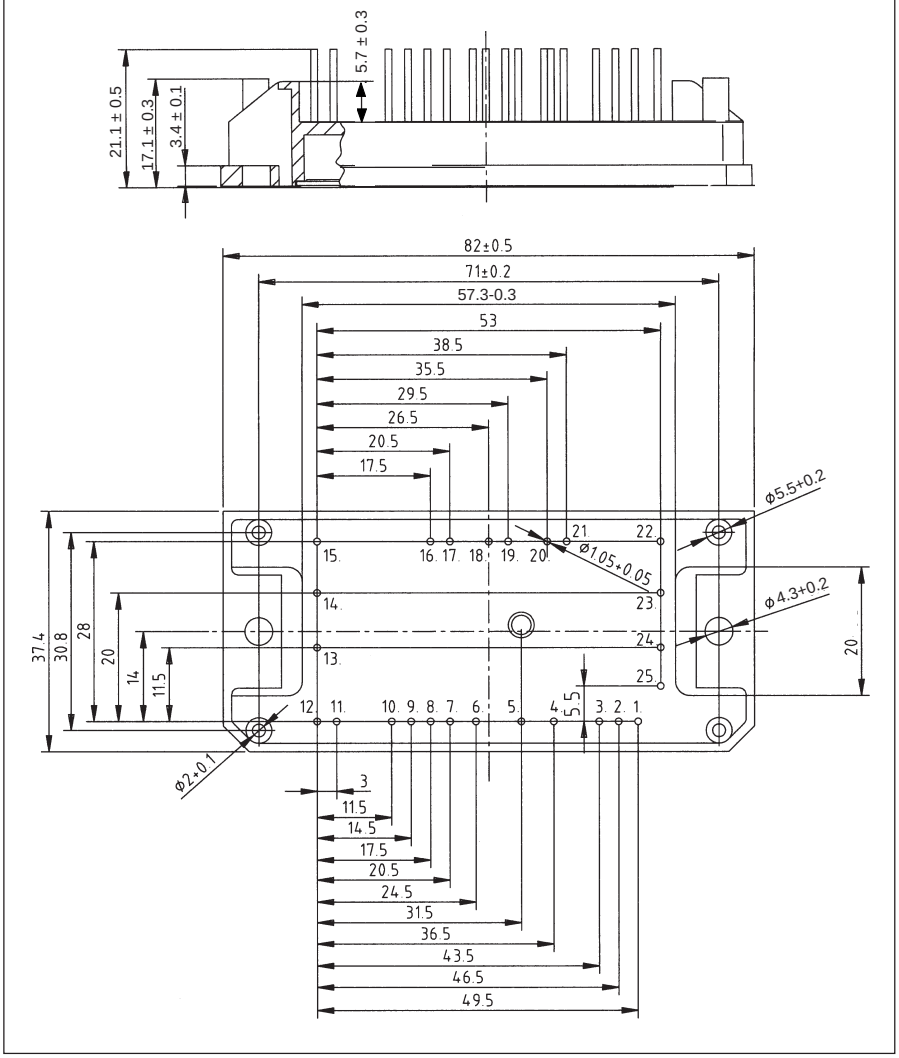
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

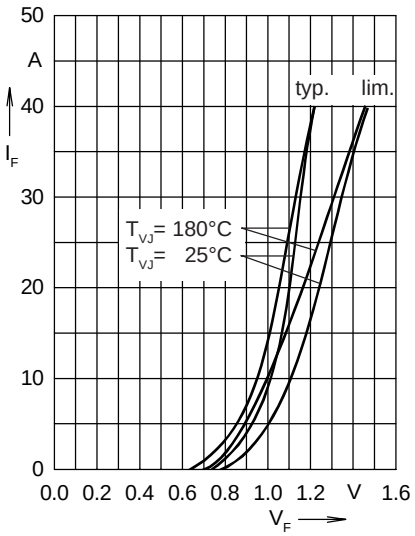
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

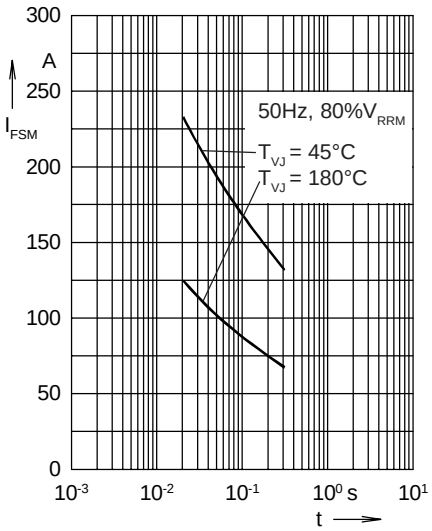
Dimensions in mm (1 mm = 0.0394")



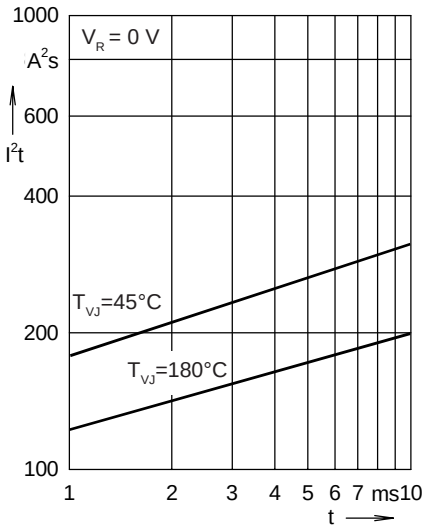
Input Rectifier Bridge D8 - D13



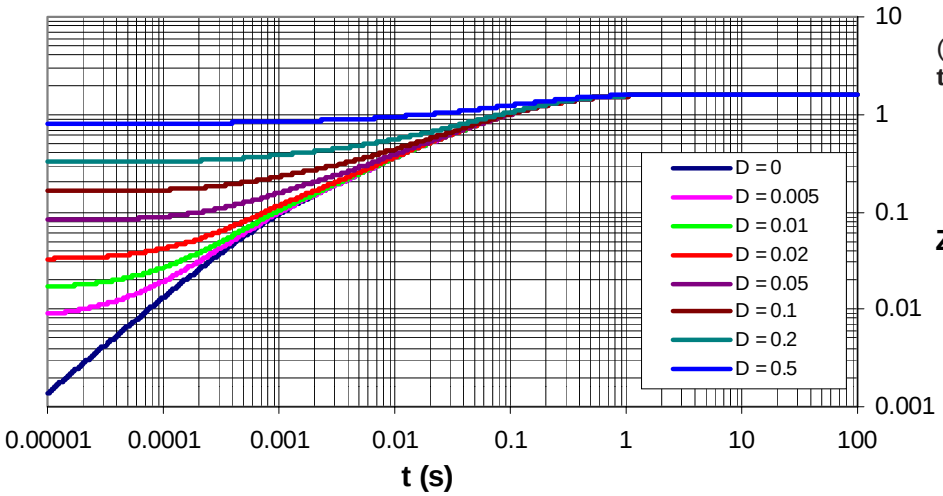
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)



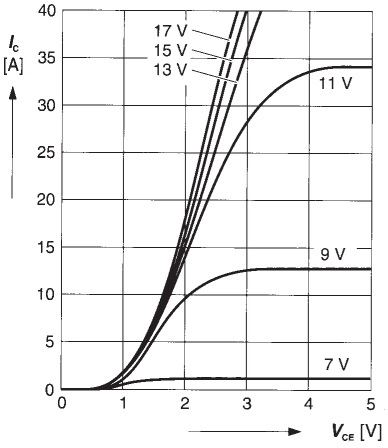
(Z_{thJH} is measured using 50 µm thermal grease)

Z_{thJH}[K/W]

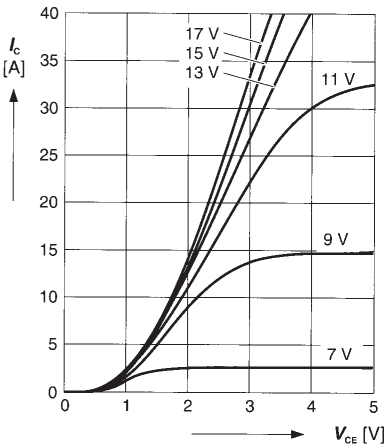
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

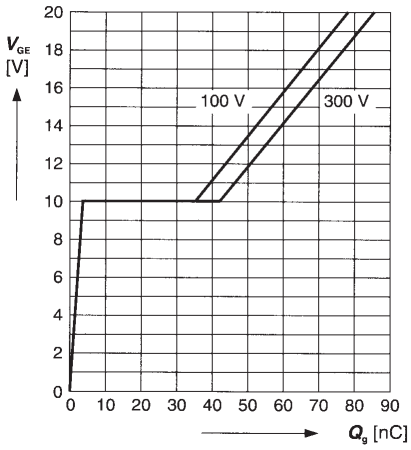
Typ. output characteristics
$I_C = f\ (V_{CE})$
parameter: t_p = 250 µs; T_j = 25 °C



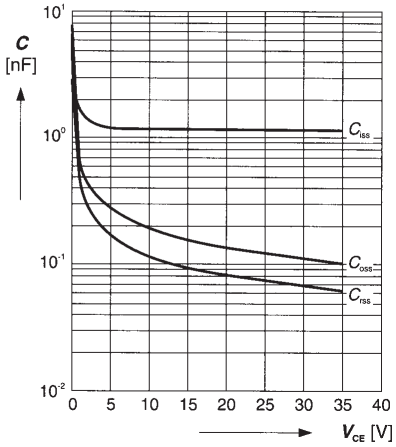
Typ. output characteristics
$I_C = f\ (V_{CE})$
parameter: t_p = 250 µs; T_j = 125 °C



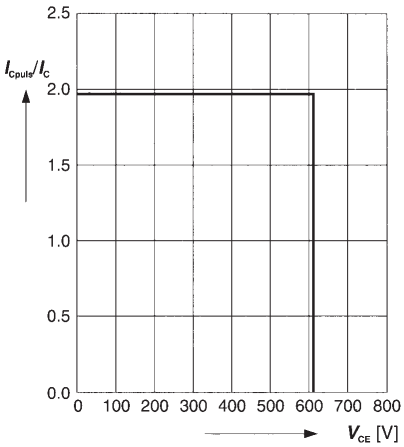
Typ. gate charge
$V_{GE} = f\ (Q_g)$
parameter: $I_{C\ puls}$ = 20 A



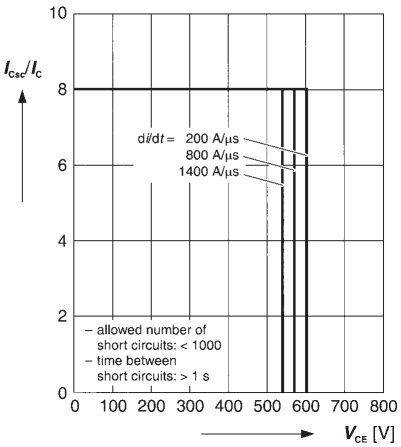
Typ. capacitances
$C = f\ (V_{CE})$
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area
$I_{C\ puls} = f\ (V_{CE})$, T_j = 150 °C
parameter: V_{GE} = 15 V

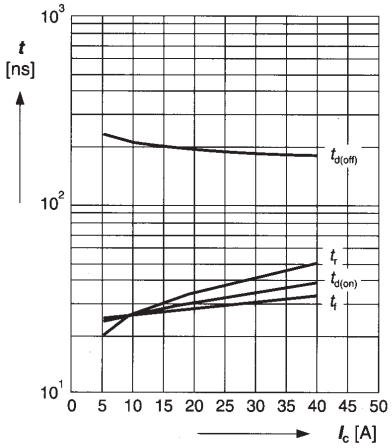


Short circuit safe operating area
$I_{Csc} = f\ (V_{CE})$, T_j = 150 °C
parameter: V_{GE} = ± 15 V ; t_{sc} ≤ 10 µs; L < 50 nH

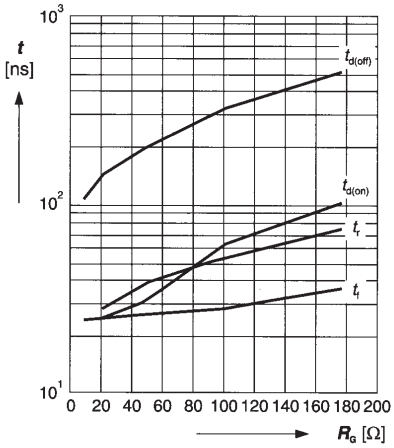


Output Inverter T1 - T6

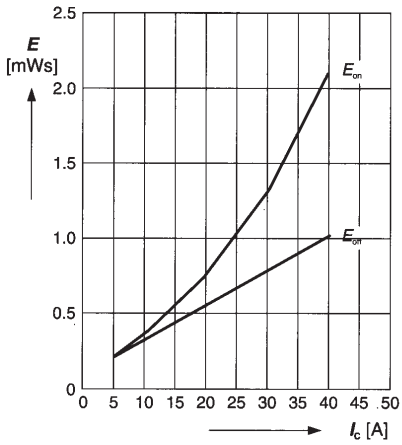
Typ. switching time
$t = f(I_C)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $R_G = 47\ \Omega$



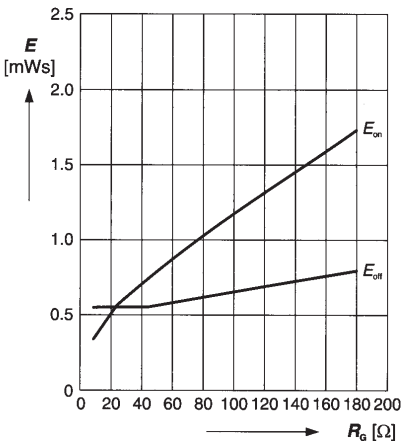
Typ. switching time
$t = f(R_G)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $I_C = 20$ A



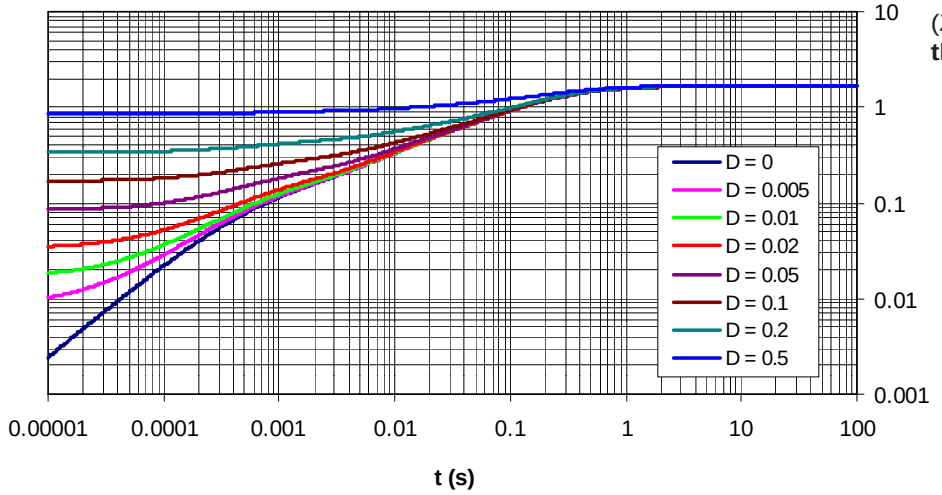
Typ. switching losses
$E = f(I_C)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $R_G = 47\ \Omega$



Typ. switching losses
$E = f(R_G)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $I_C = 20$ A



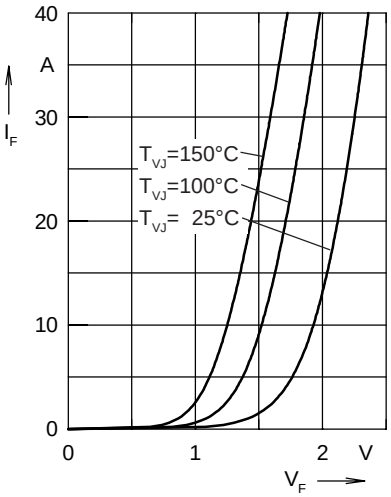
Transient thermal resistance junction to heatsink



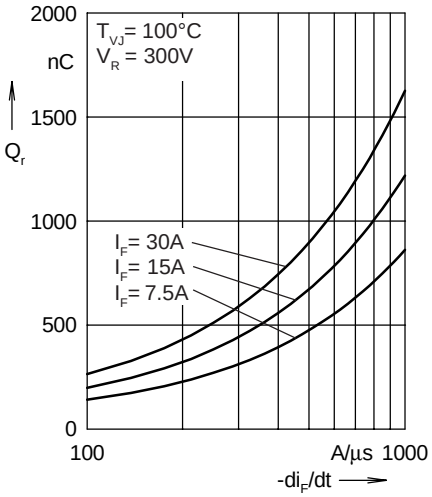
IGBT
Z_{thJH}[K/W]

(Z_{thJH} is measured using 50 µm thermal grease)

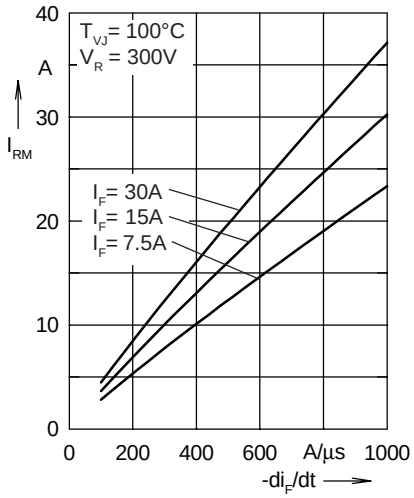
Output Inverter D1 - D6



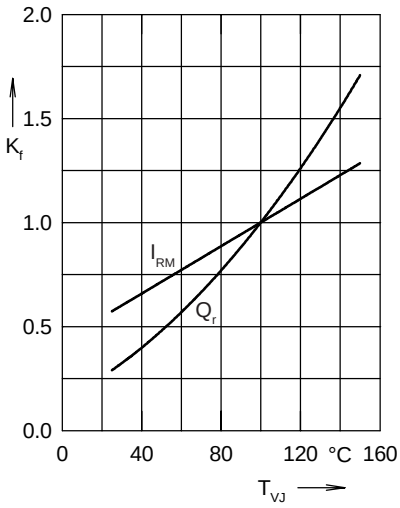
Forward current I_F versus V_F



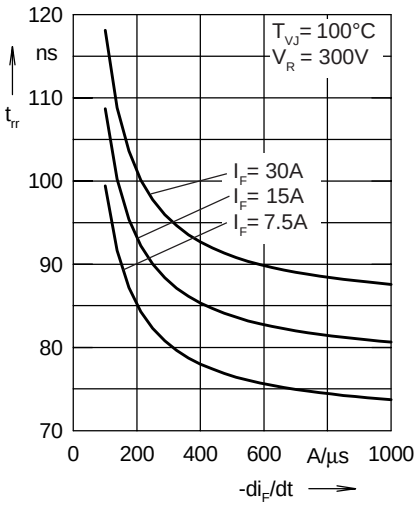
Reverse recovery charge Q_r versus -di_F/dt



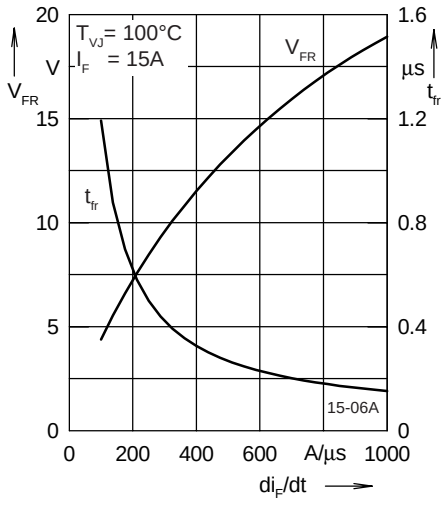
Peak reverse current I_{RM} versus -di_F/dt



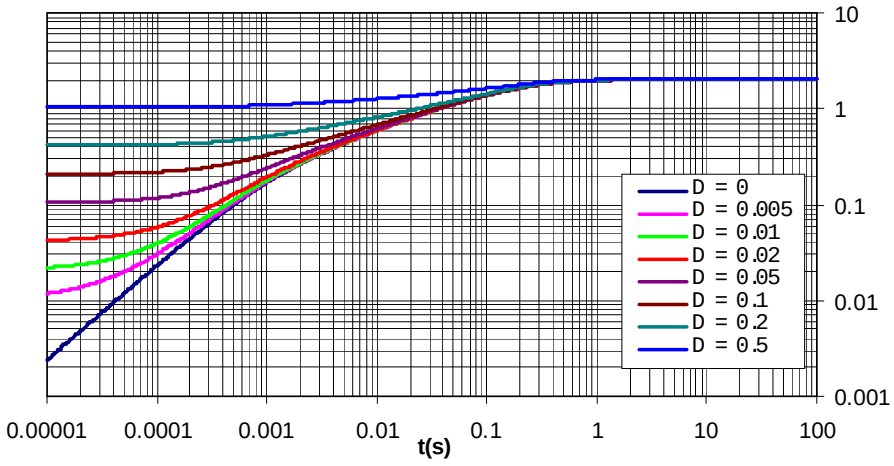
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



Recovery time t_{rr} versus -di_F/dt



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

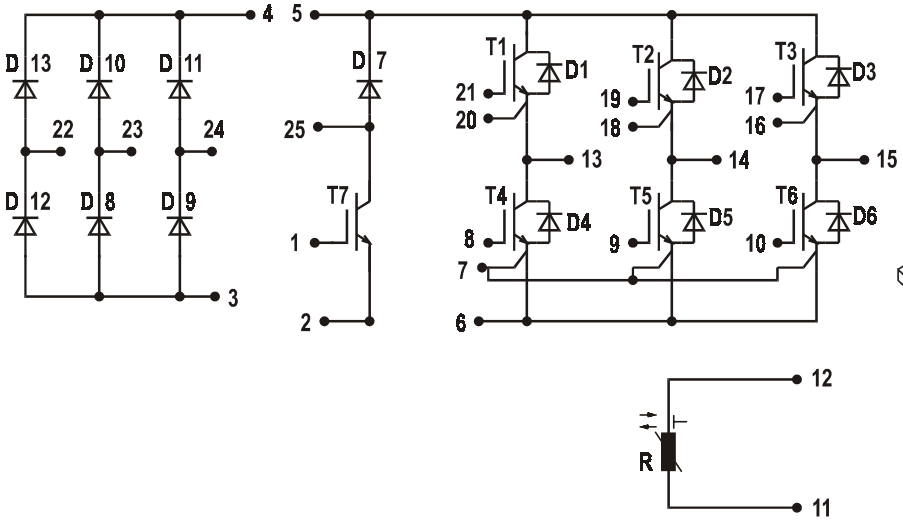


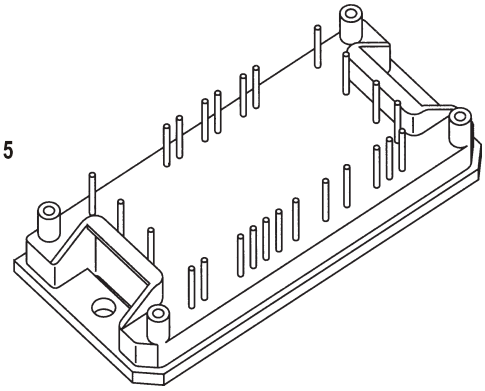
FRED
Z_{thJH} [K/W]

(Z_{thJH} **is measured using 50 µm thermal grease)**

Transient thermal resistance junction to heatsink

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1200V I_{FAVM} = 25 A I_{FSM} = 370 A	V_{CES} = 600 V I_{C25} = 23 A $V_{CE(sat)}$ = 2.1 V	V_{CES} = 600 V I_{C25} = 38 A $V_{CE(sat)}$ = 2.1 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1200	V
I_F	T_{VJ} = 25°C	55	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	25	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	370	A
i^2t	T_{VJ} = 125°C	680	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			20	µA
	T_{VJ} = 125°C			2	mA
V_F	I_F = 55 A		1.2	1.46	V
R_{thJC}	per die		1.05		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	38 22	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	76 44	A A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	104	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			1	mA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.7 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	600			V
V_{CEsat}	V_{GE} = 15 V; I_C = 30 A; T_{VJ} = 25°C T_{VJ} = 125°C		2.1 2.4	2.5 2.8	V V
t_f	Inductive load, T_{VJ} = 125°C V_{CC} = 300 V; I_C = 30 A R_G = 33 Ω; V_{GE} = ±15 V		30		ns
t_r			35		ns
$t_{d(on)}$			30		ns
$t_{d(off)}$			190		ns
E_{off}			0.8		mJ
E_{on}			1.15		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		1600		pF
C_{oss}			170		pF
C_{rss}			100		pF
g_{fs}	V_{CE} = 20 V; I_C = 30 A	8			S
Q_g	V_{CC} = 300 V; I_C = 30A pulse; V_{GE} = 15 V		92		nC
V_F	I_F = 30 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 125°C		2 1.8		V V
t_{rr}	I_F = 30 A; V_{GE} = 0 V; T_{VJ} = 125°C V_R = -300 V; di_F/dt = -800 A/µs		0.3		µs
Q_r	I_F = 30 A; V_R = -300 V; T_{VJ} = 25°C di_F/dt = -800 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		1.8 3.8		µC µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.0 1.3		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	600	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	600	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C	23	A
	T_C = 90°C	13	A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C	46	A
	T_C = 90°C	26	A
t_{SC}	IGBT V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	68	W
T_{VJ}	Free-Wheeling Diode	+150	°C
T_{VJ}	IGBT	+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 600 V			1	mA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.4 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	600			V
$V_{CE(sat)}$	V_{GE} = 15 V; I_C = 15 A; T_{VJ} = 25°C		2.1	2.5	V
	T_{VJ} = 125°C		2.4	2.8	V
t_f	Inductive load, T_{VJ} = 125°C		25		ns
t_r	V_{CC} = 300 V; I_C = 15 A		25		ns
$t_{d(on)}$	R_G = 68 Ω; V_{GE} = ±15 V		30		ns
$t_{d(off)}$			200		ns
E_{off}			0.5		mJ
E_{on}			0.7		mJ
C_{iss}	V_{GE} = 0 V		800		pF
C_{oss}	V_{CE} = 25 V		85		pF
C_{rss}	f = 1 MHz		52		pF
g_{fs}	V_{CE} = 20 V; I_C = 15 A	4.5			S
Q_g	V_{CC} = 300 V; I_C = 15 A pulse; V_{GE} = 15 V		59		nC
V_F	I_F = 15 A; V_{GE} = 0 V; T_{VJ} = 25°C		2		V
	T_{VJ} = 125°C		1.8		V
t_{rr}	I_F = 15 A; V_R = -300 V; T_{VJ} = 125°C		0.25		µs
	di_F/dt = -500 A/µs; V_{GE} = 0 V				
Q_r	I_F = 15 A; V_R = -300 V; T_{VJ} = 25°C		0.4		µC
	di_F/dt = -500 A/µs; V_{GE} = 0 V; T_{VJ} = 125°C		1.3		µC
I_r				250	µA
R_{thJC}	IGBT (per die)		1.5		°C/W
	Diode (per die)		2.0		°C/W

Module

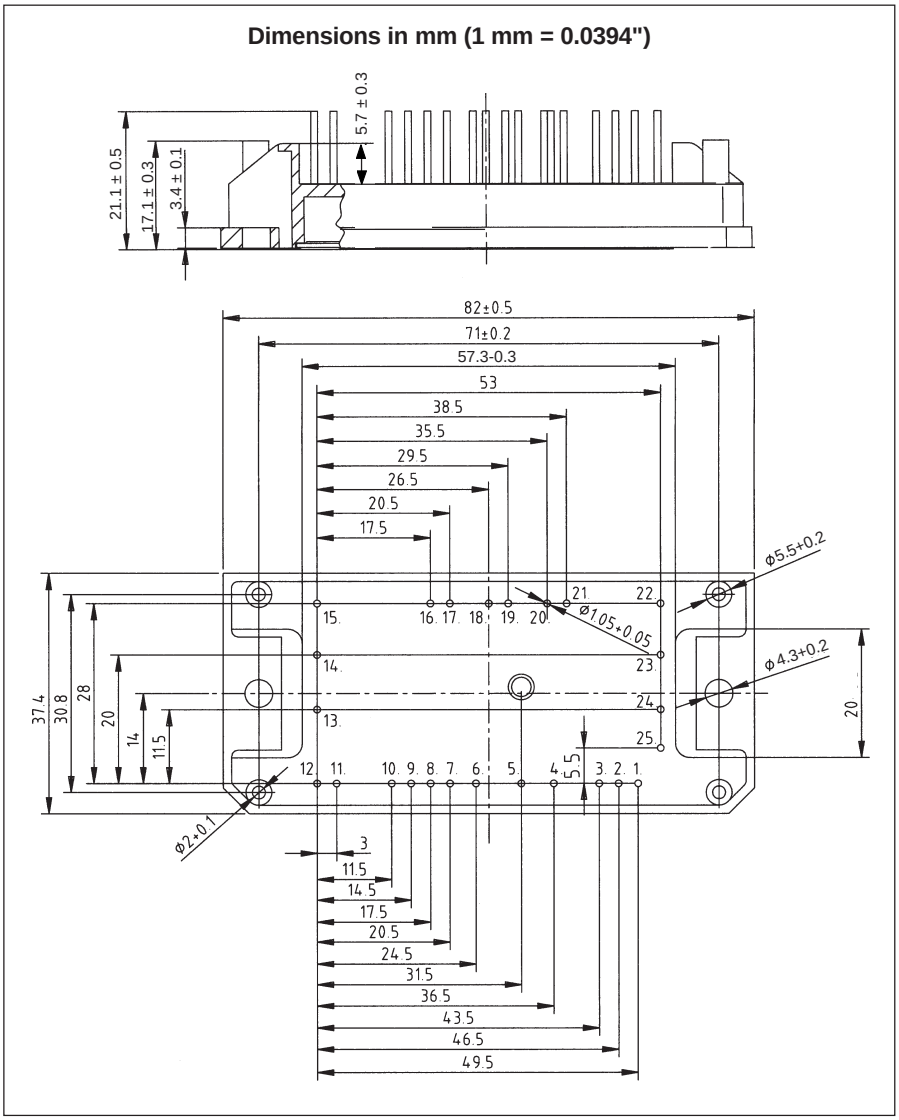
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

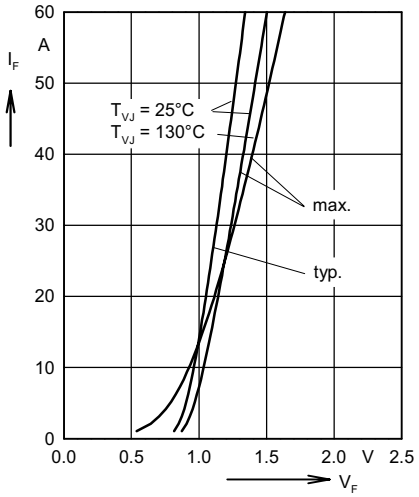
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

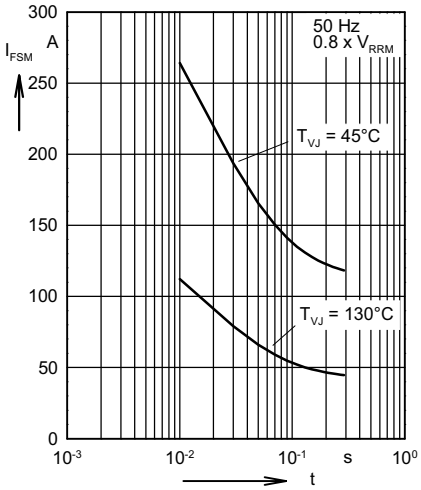
Dimensions in mm (1 mm = 0.0394")



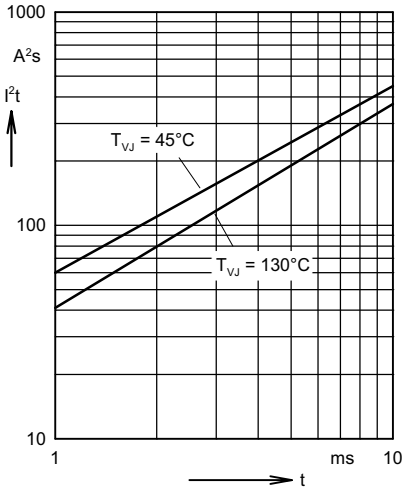
Input Rectifier Bridge D8 - D13



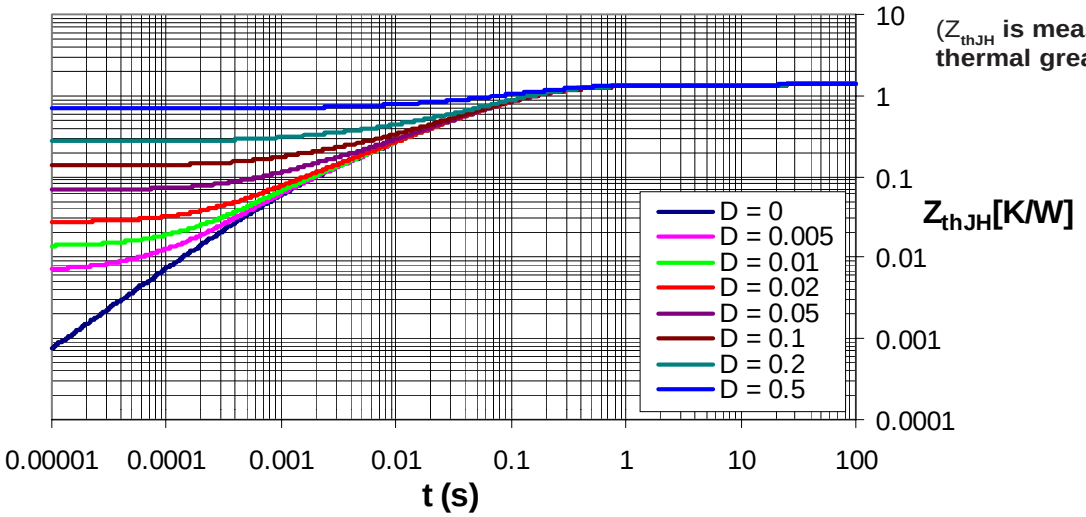
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

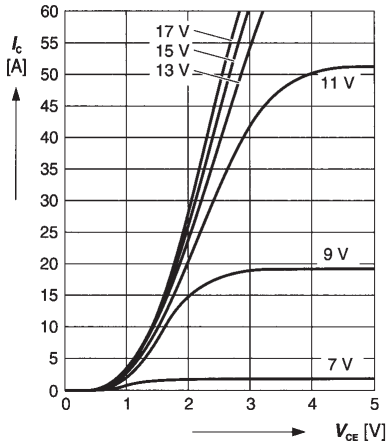


(Z_{thJH} is measured using 50 µm thermal grease)

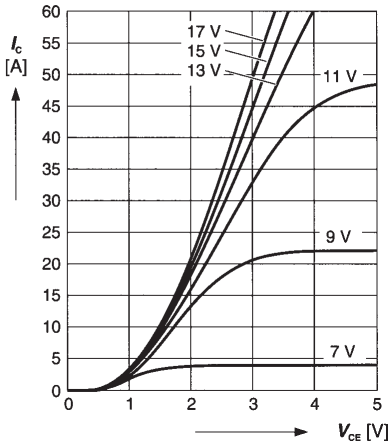
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

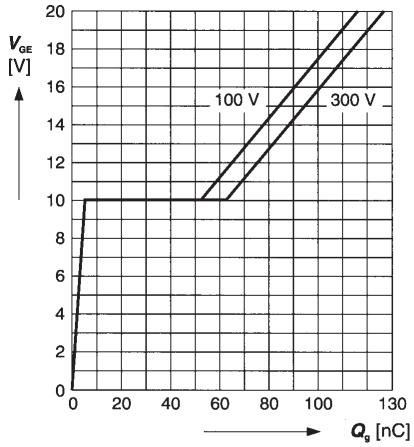
Typ. output characteristics
$I_C = f(V_{CE})$
parameter: t_p = 250 µs; T_j = 25 °C



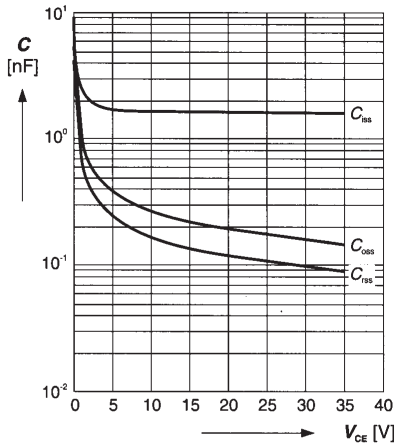
Typ. output characteristics
$I_C = f(V_{CE})$
parameter: t_p = 250 µs; T_j = 125 °C



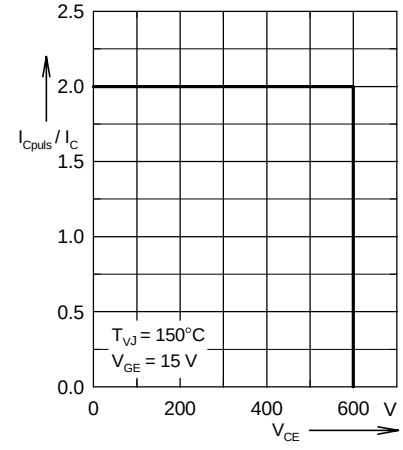
Typ. gate charge
$V_{GE} = f(Q_g)$
parameter: $I_{C\,puls}$ = 30 A



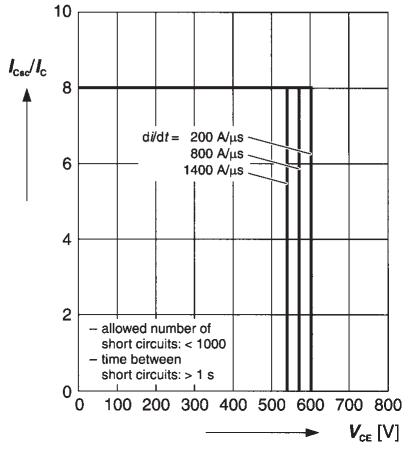
Typ. capacitances
$C = f(V_{CE})$
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area
$I_{C\,puls} = f(V_{CE})$, T_j = 150 °C
parameter: V_{GE} = 15 V

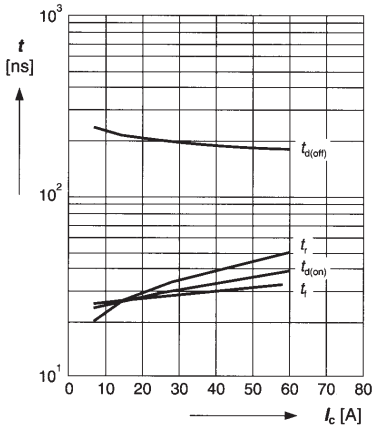


Short circuit safe operating area
$I_{Csc} = f(V_{CE})$, T_j = 150 °C
parameter: V_{GE} = ± 15 V ; $t_{sc} \leq$ 10 µs; L < 50 nH

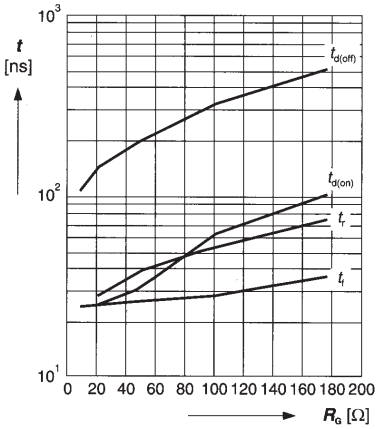


Output Inverter T1 - T6

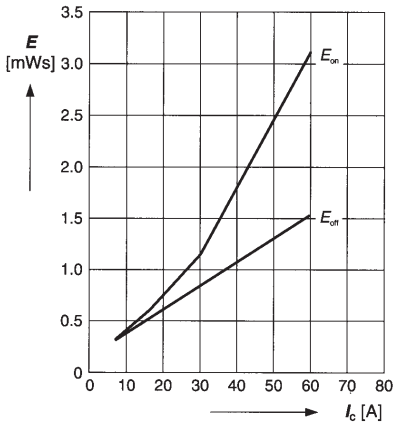
Typ. switching time
$t = f(I_C)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $R_G = 33\ \Omega$



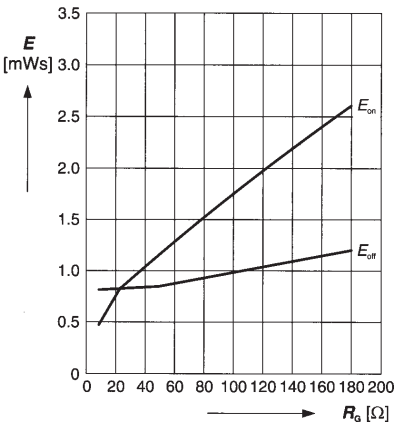
Typ. switching time
$t = f(R_G)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $I_C = 30$ A



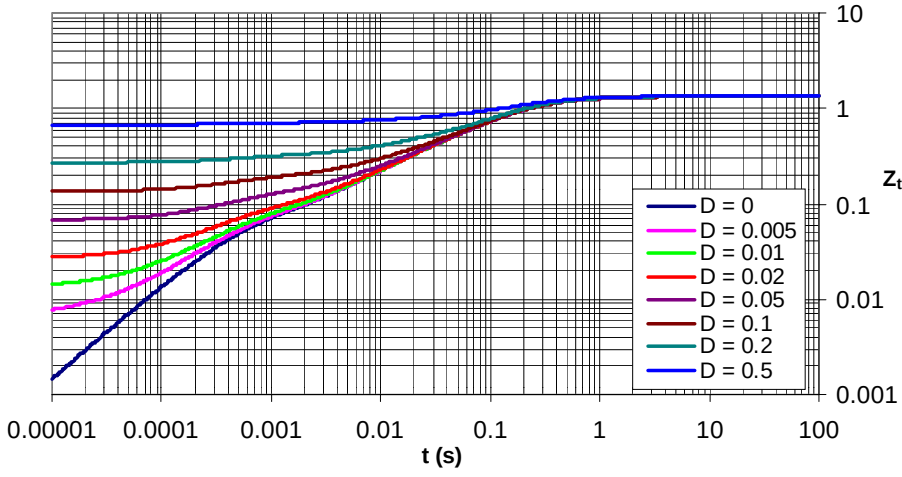
Typ. switching losses
$E = f(I_C)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $R_G = 33\ \Omega$



Typ. switching losses
$E = f(R_G)$, inductive load, $T_j = 125$ °C
parameter: $V_{CE} = 300$ V; $V_{GE} = \pm 15$ V; $I_C = 30$ A

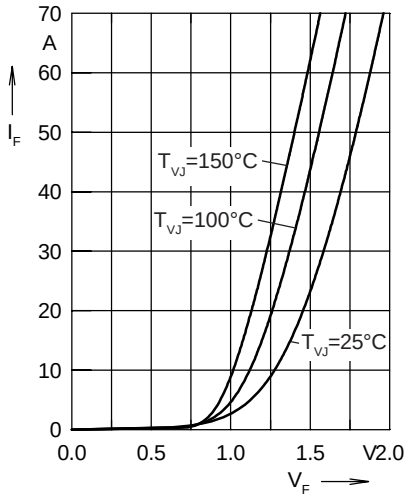


Transient thermal resistance junction to heatsink

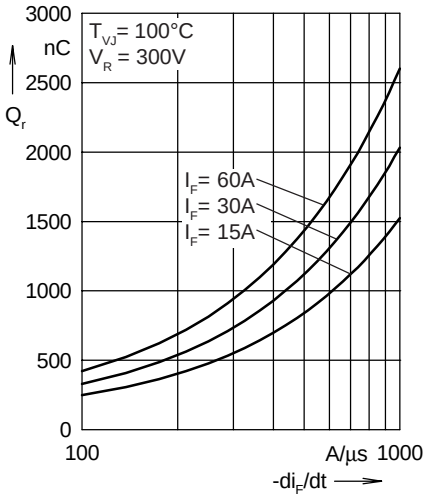


(Z_{thJH} is measured using 50 µm thermal grease)

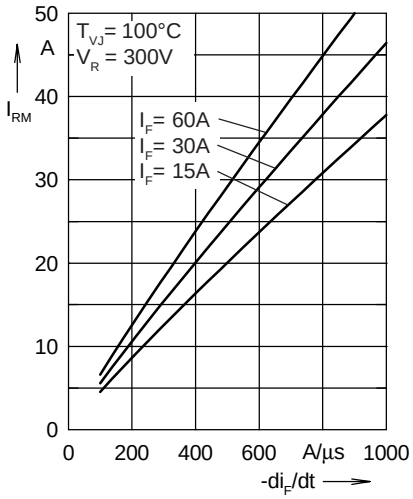
Output Inverter D1 - D6



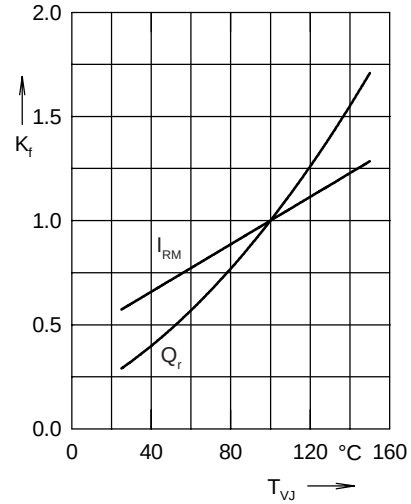
Forward current I_F versus V_F



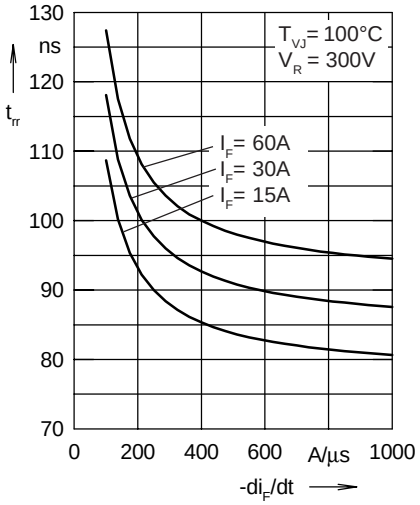
Reverse recovery charge Q_r versus $-di_F/dt$



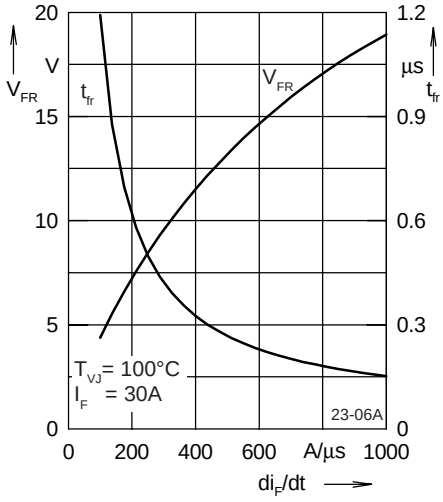
Peak reverse current I_{RM} versus $-di_F/dt$



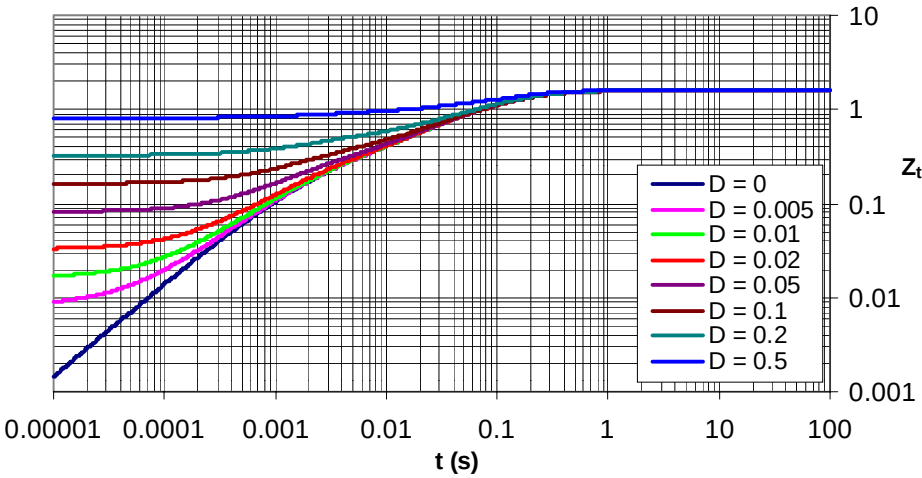
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



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



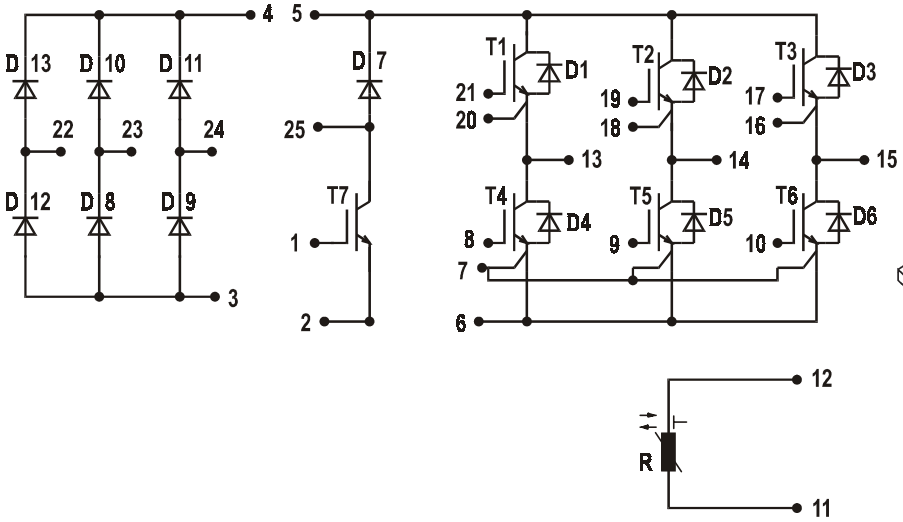
(Z_{thJH} is measured using 50 µm thermal grease)

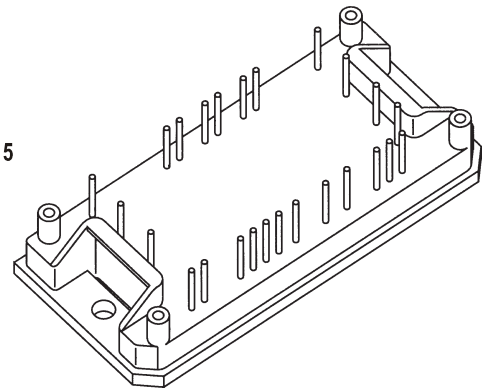
FRED

Z_{thJH} [K/W]

Transient thermal resistance junction to heatsink

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1600V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 1200 V I_{C25} = 3.6 A $V_{CE(sat)}$ = 2.8 V	V_{CES} = 1200 V I_{C25} = 3.6 A $V_{CE(sat)}$ = 2.8 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	3.6 2.4	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 110°C	7.2 4.8	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V		1	25	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V		0.1	100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.1 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 1.5 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.8 4	3.3 4.5	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 1.5 A R_G = 100 Ω; V_{GE} = ±15 V		100 58 80 290 0.12 0.34		ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		225 25 13		pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A		0.6		S
Q_g	V_{CC} = 800 V; I_C = 1 A pulse; V_{GE} = 15 V		24.1		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_r	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.3 2.25		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	3.6 2.4	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 110°C	7.2 4.8	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V		1	25	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V		0.1	100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.1 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 1.5 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.8 4	3.3 4.5	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 1.5 A R_G = 100 Ω; V_{GE} = ±15 V		100 58 80 290 0.12 0.34		ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		225 25 13		pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A		0.6		S
Q_g	V_{CC} = 800 V; I_C = 1 A pulse; V_{GE} = 15 V		24.1		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_r	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.3 2.25		°C/W °C/W

Module

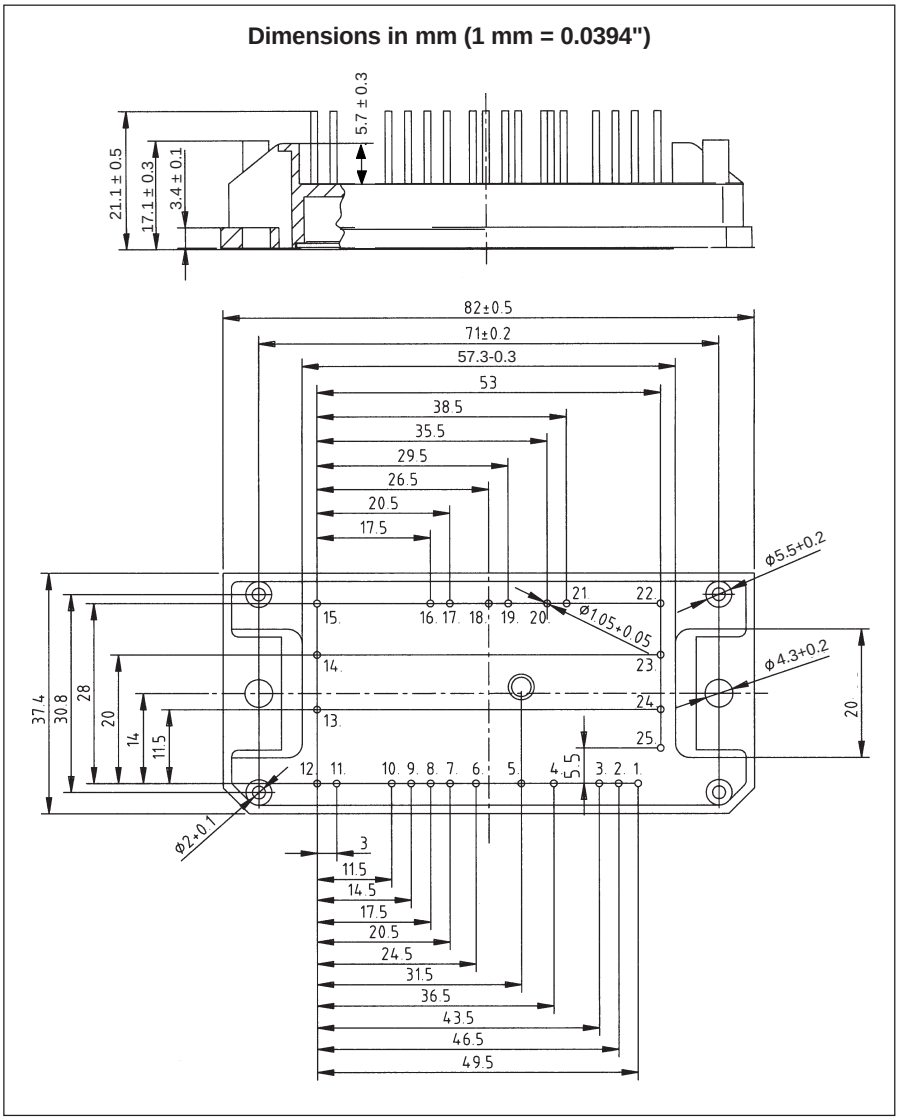
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

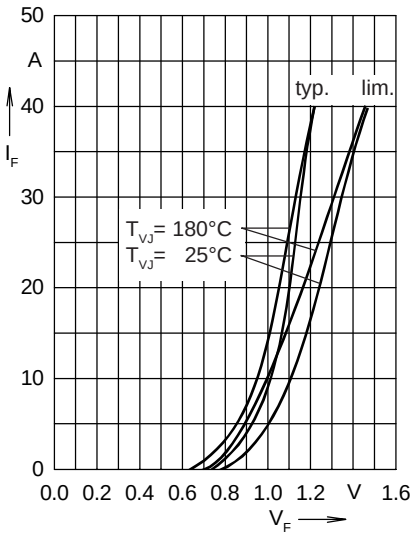
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

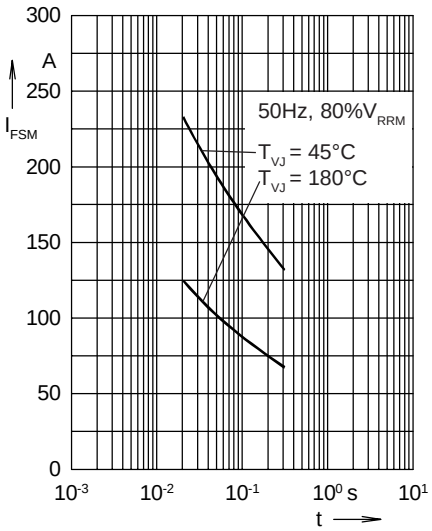
Dimensions in mm (1 mm = 0.0394")



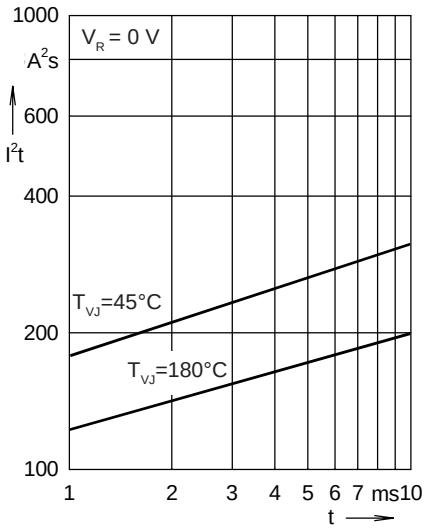
Input Rectifier Bridge D8 - D13



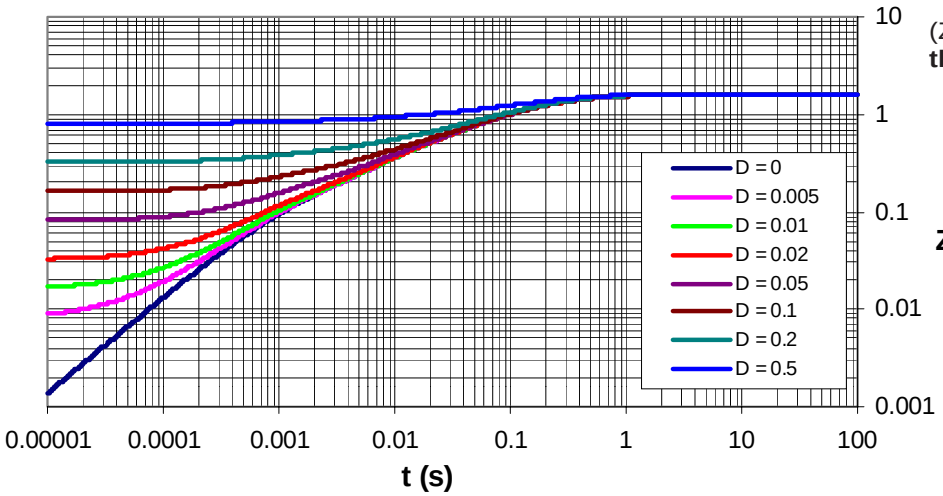
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

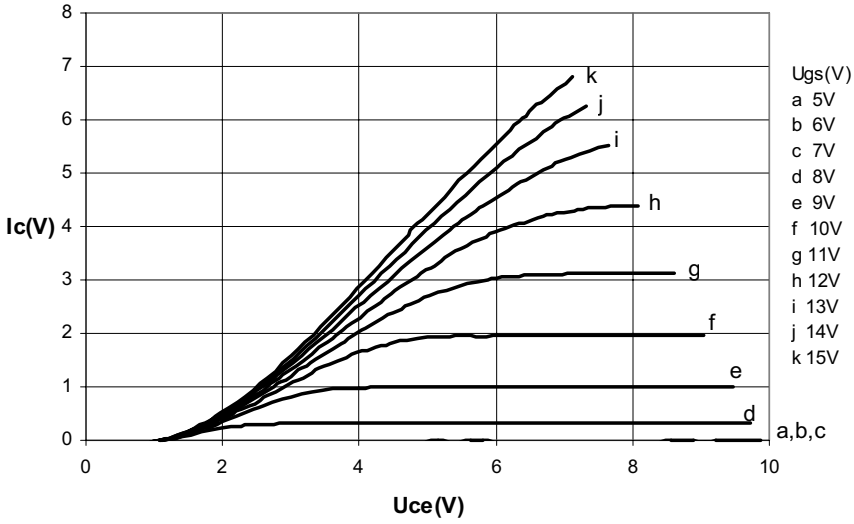


(Z_{thJH} is measured using 50 µm thermal grease)

Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

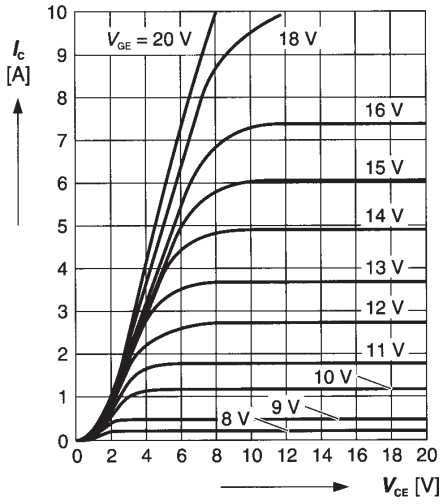
Typ. output characteristics 25°C



Typ. output characteristics

$I_C = f\ (V_{CE})$

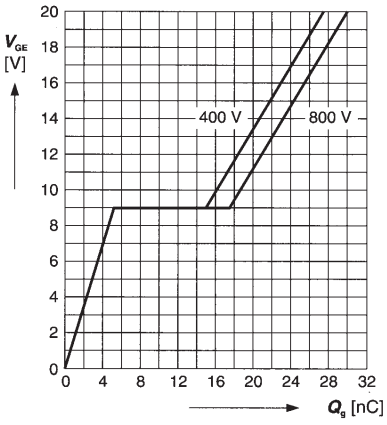
parameter: t_p = 80 µs; T_j = 125 °C



Typ. gate charge

$V_{GE} = f\ (Q_g)$

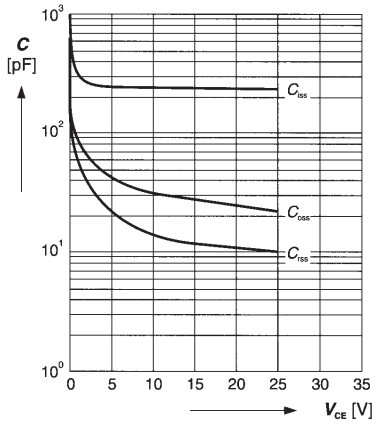
parameter: $I_{C\ puls}$ = 1 A



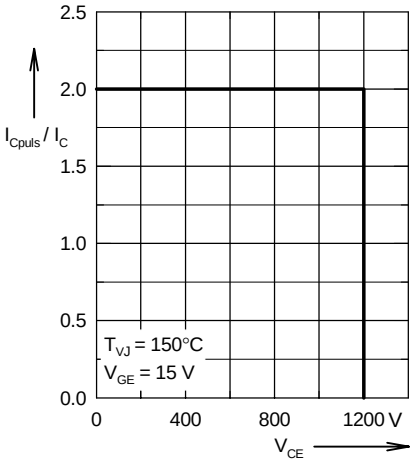
Typ. capacitances

$C = f\ (V_{CE})$

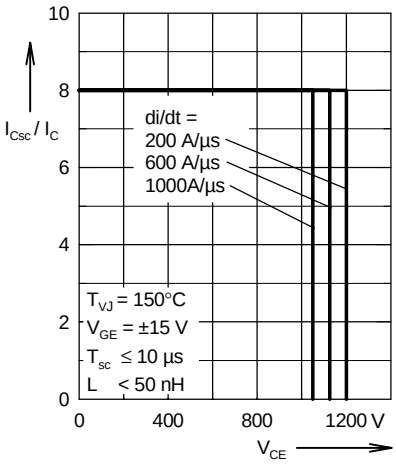
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area

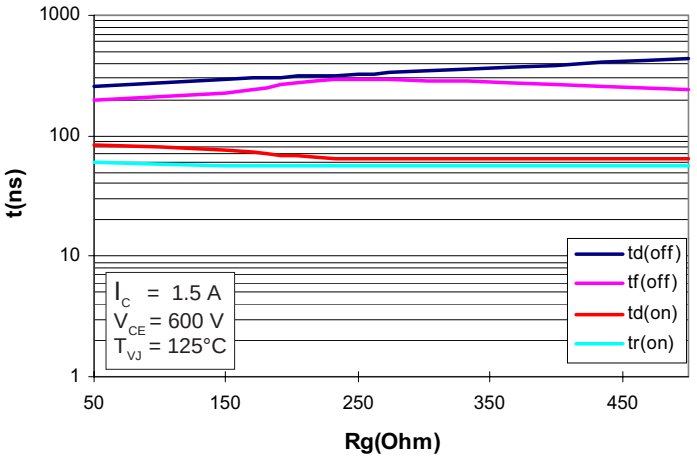


Short circuit safe operating area

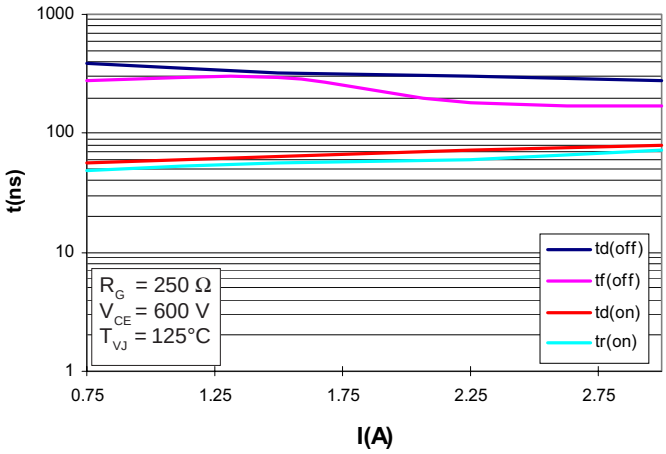


Output Inverter T1 - T6

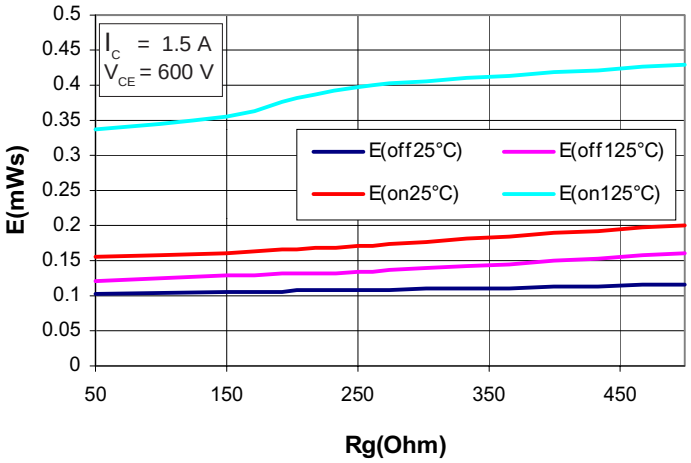
Typ. switching times



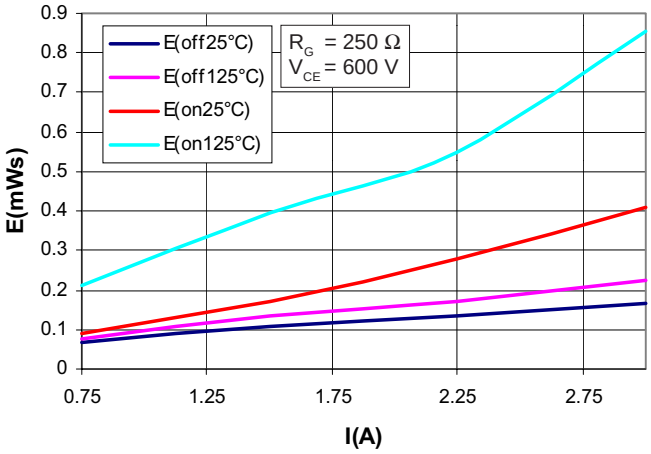
Typ. switching times



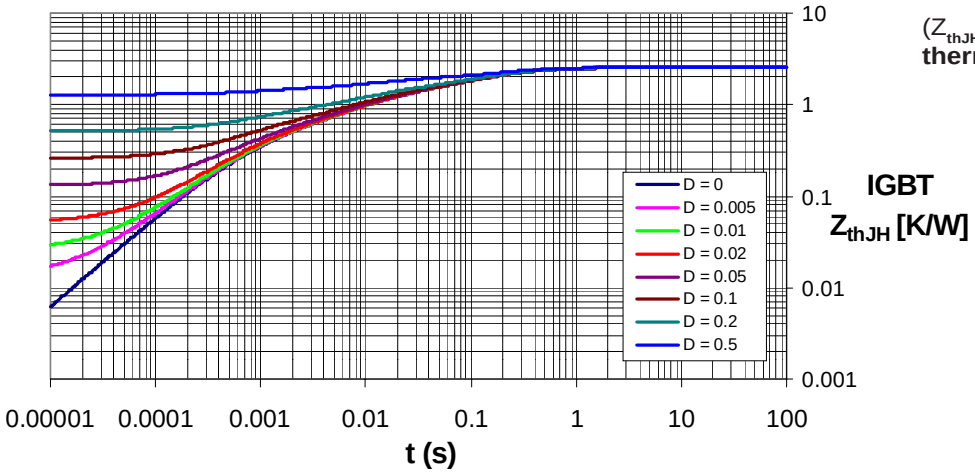
Typ. switching losses



Typ. switching losses

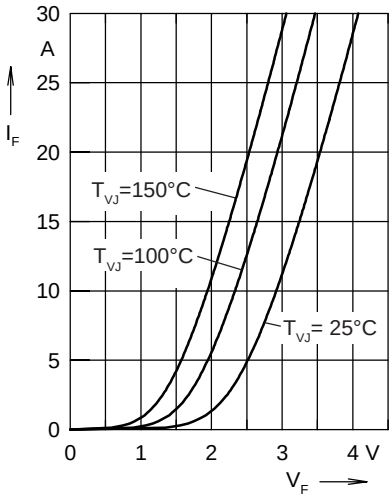


Transient thermal resistance junction to heatsink

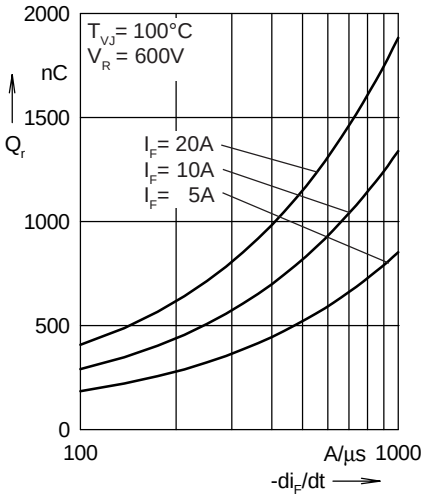


(**Z_{thJH} is measured using 50 µm thermal grease**)

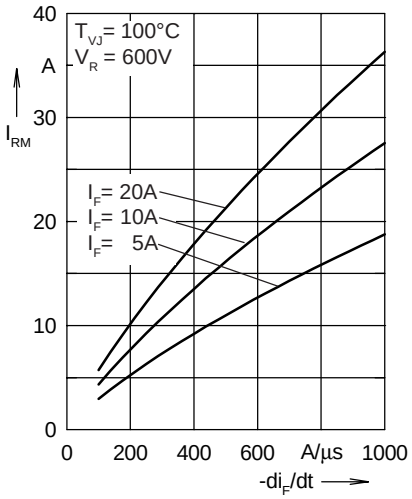
Output Inverter D1 - D6



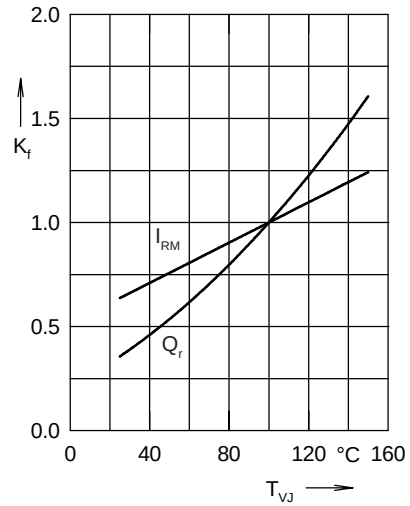
Forward current I_F versus V_F



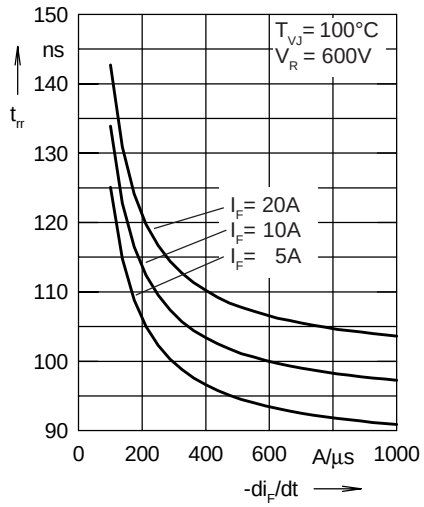
Reverse recovery charge Q versus $-di_F/dt$



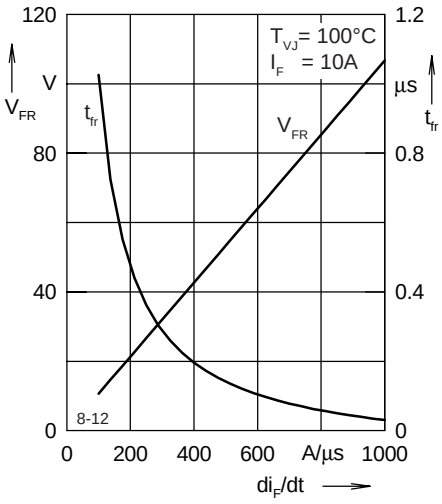
Peak reverse current I_{RM} versus $-di_F/dt$



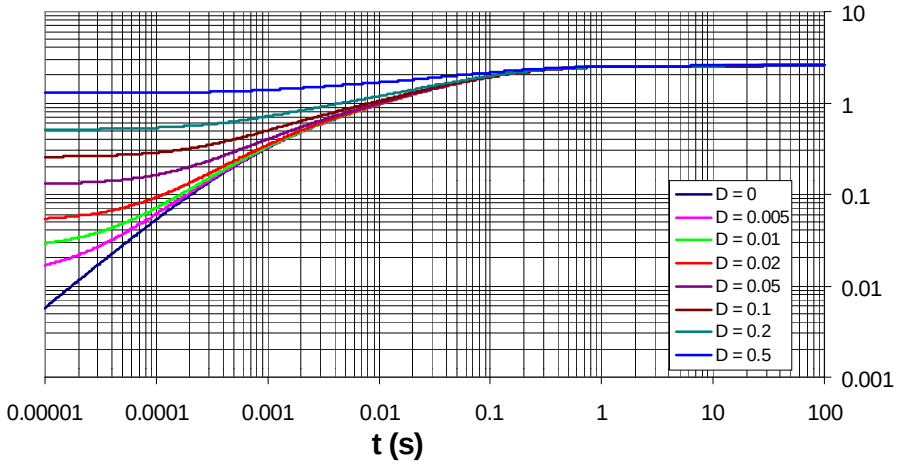
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



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



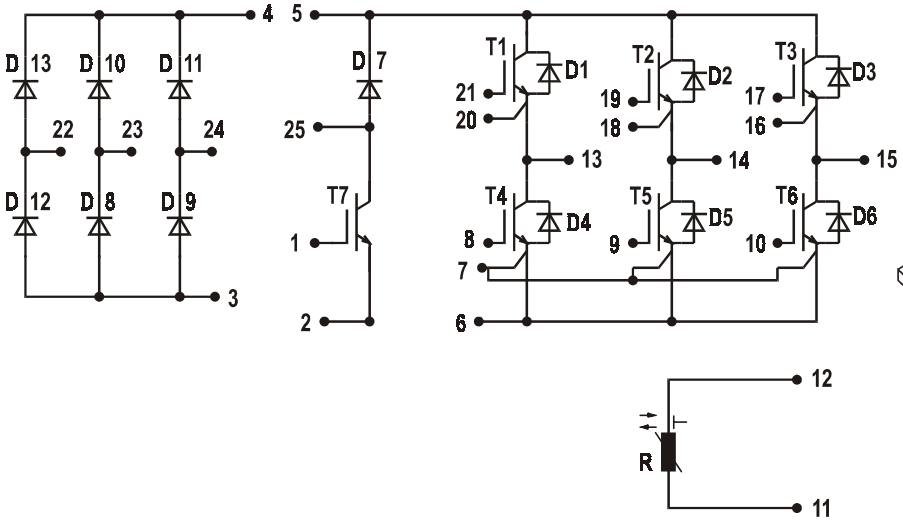
Transient thermal resistance junction to heatsink

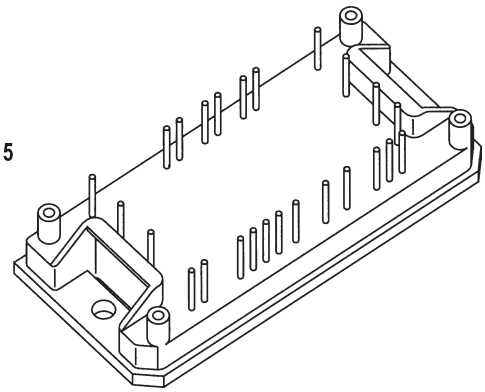
(Z_{thJH} is measured using 50 µm thermal grease)

FRED

Z_{thJH}[K/W]

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1600V I_{FAVM} = 11 A I_{FSM} = 250 A	V_{CES} = 1200 V I_{C25} = 3.6 A $V_{CE(sat)}$ = 2.8 V	V_{CES} = 1200 V I_{C25} = 13 A $V_{CE(sat)}$ = 2.8 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_F	T_{VJ} = 25°C	36	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	11	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	250	A
i^2t	T_{VJ} = 125°C	310	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			10	µA
	T_{VJ} = 125°C			3	mA
V_F	I_F = 36 A		1.15	1.4	V
R_{thJC}	per die		1.4		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	13 8	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	26 16	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 25°C; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	67	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V		1	100	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V		0.1	100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.3 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 5 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.8 4	3.3 4.5	V V
t_f	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 5 A R_G = 100 Ω; V_{GE} = ±15 V		200		ns
t_r			55		ns
$t_{d(on)}$			65		ns
$t_{d(off)}$			320		ns
E_{off}			0.4		mJ
E_{on}			0.8		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		650		pF
C_{oss}			50		pF
C_{rss}			20		pF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A	1.7	2.5		S
Q_g	V_{CC} = 800 V; I_C = 6 A pulse; V_{GE} = 15 V		48		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_r	I_F = 4 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.55 2.25		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	3.6 2.4	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 110°C	7.2 4.8	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	45	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V		1	25	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V		0.1	100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.1 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 1.5 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.8 4	3.3 4.5	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 1.5 A R_G = 100 Ω; V_{GE} = ±15 V		100 85 80 290 0.12 0.34		ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		225 25 13		pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A		0.6		S
Q_g	V_{CC} = 800 V; I_C = 1 A pulse; V_{GE} = 15 V		24.1		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_r	I_F = 4 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		2.3 2.25		°C/W °C/W

Module

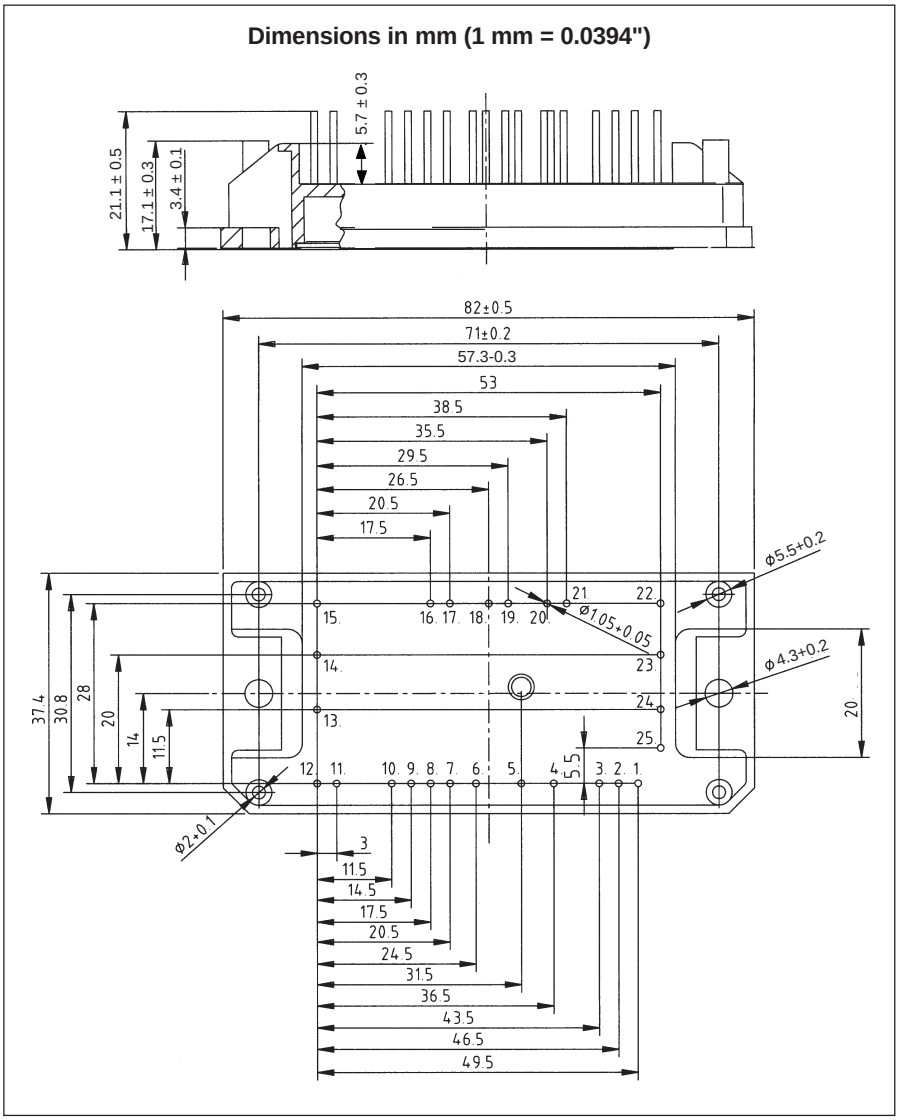
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

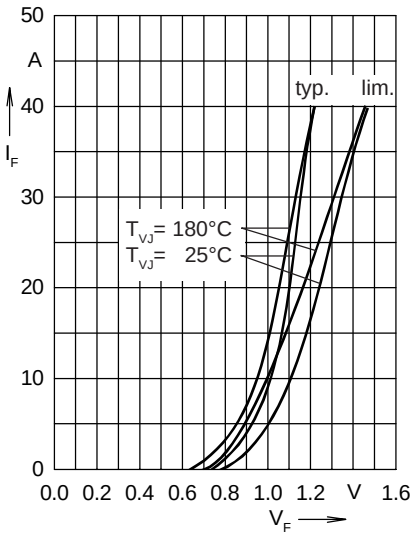
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

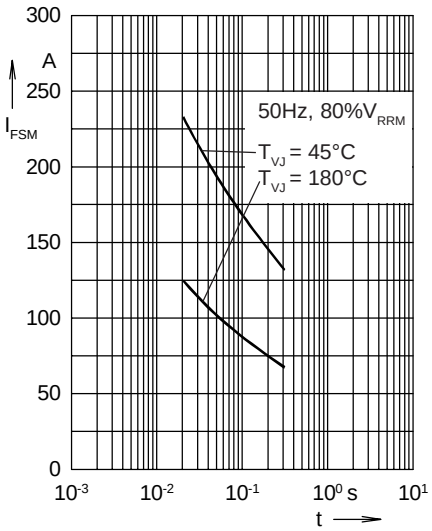
Dimensions in mm (1 mm = 0.0394")



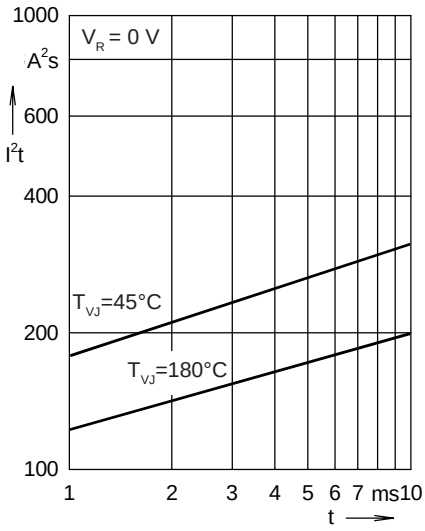
Input Rectifier Bridge D8 - D13



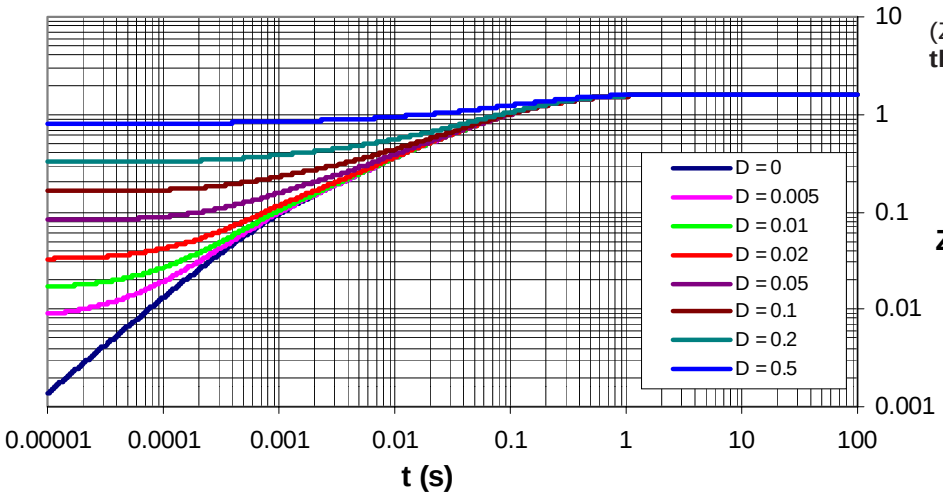
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)



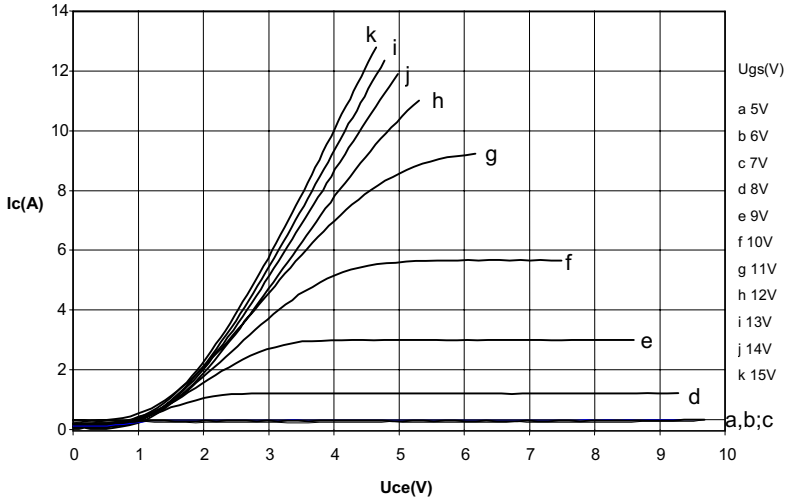
(Z_{thJH} is measured using 50 µm thermal grease)

Z_{thJH}[K/W]

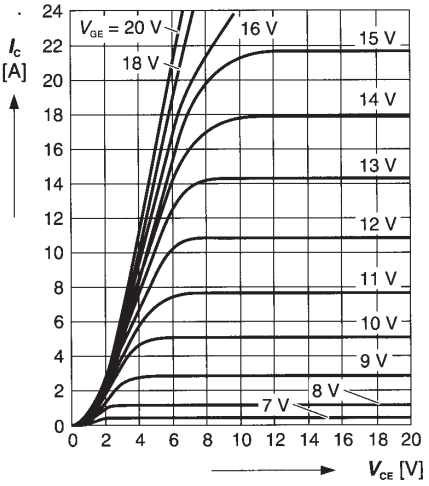
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

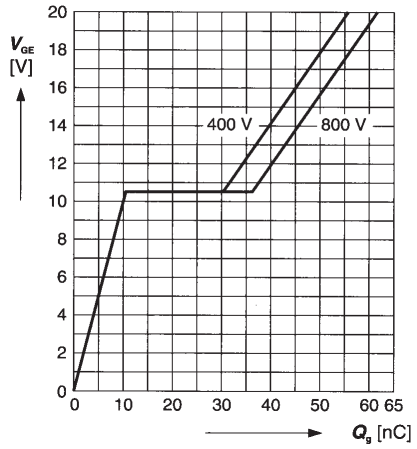
Typ. output characteristics 25°C



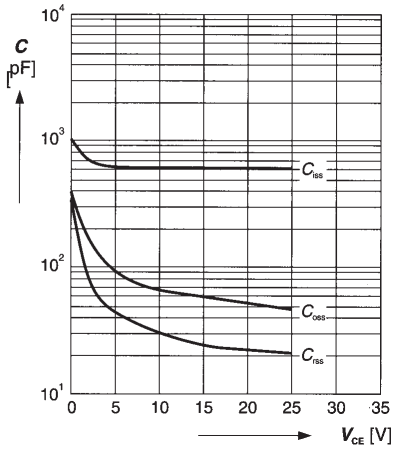
Typ. output characteristics
$I_C = f\ (V_{CE})$
parameter: t_p = 80 µs; T_j = 125 °C



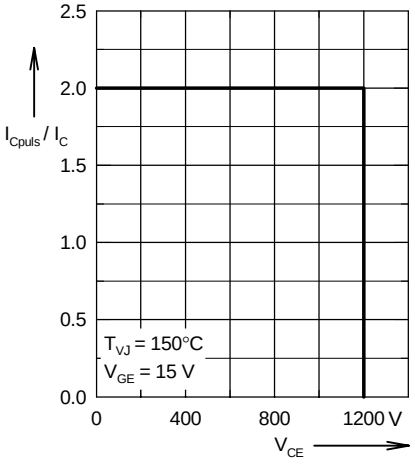
Typ. gate charge
$V_{GE} = f\ (Q_g)$
parameter: $I_{C\ puls}$ = 6 A



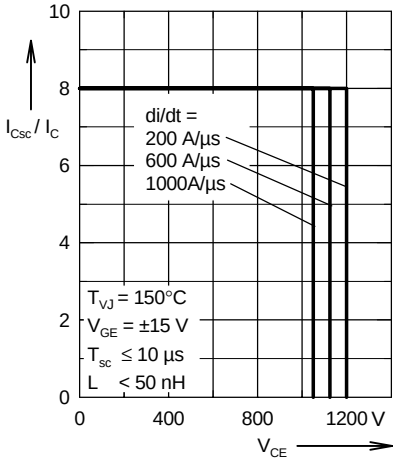
Typ. capacitances
$C = f\ (V_{CE})$
parameter: V_{GE} = 0 V ; f = 1 MHz



Reverse biased safe operating area

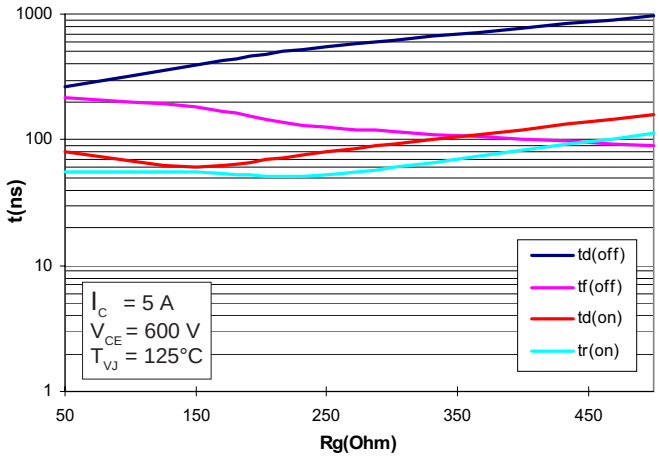


Short circuit safe operating area

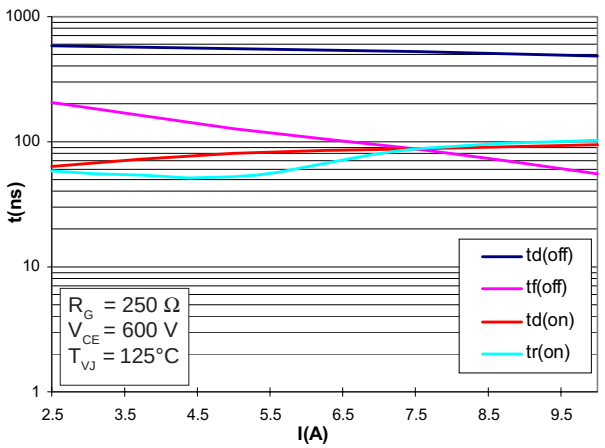


Output Inverter T1 - T6

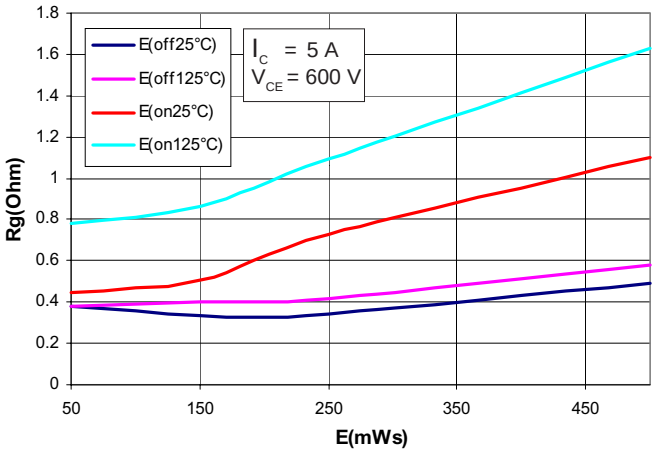
Typ.switching times



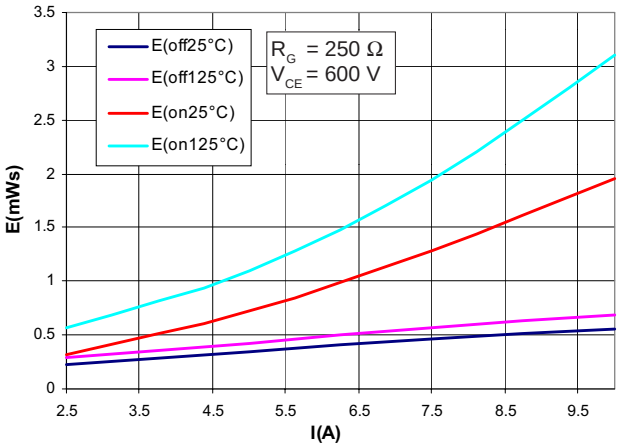
Typ. switching times



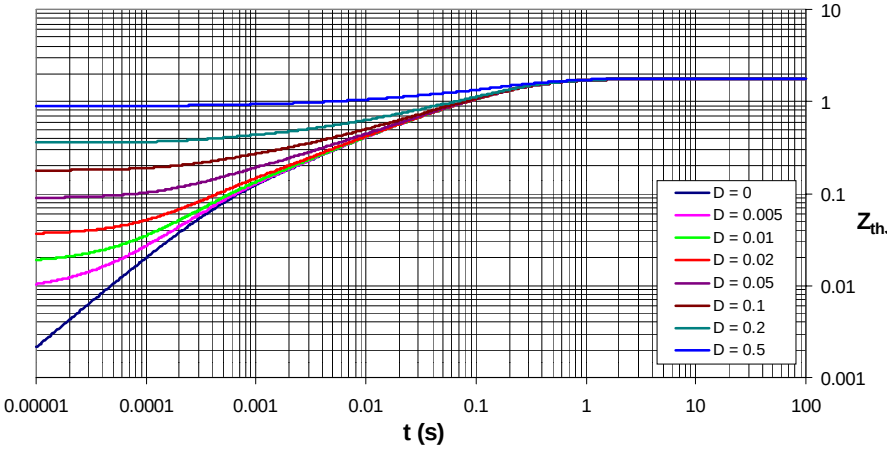
Typ. switching losses



Typ. switching losses



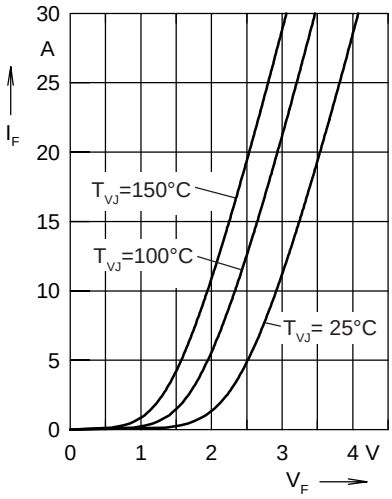
Transient thermal resistance junction to heatsink



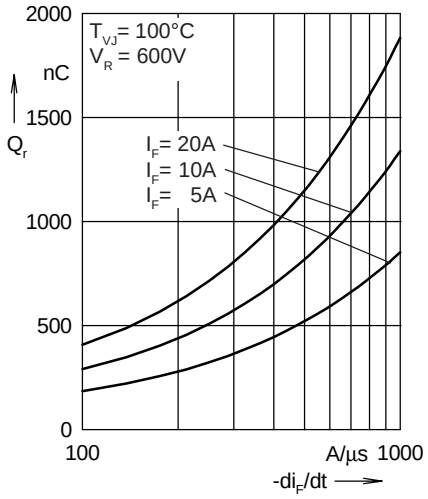
IGBT
Z_{thJH} [K/W]

(Z_{thJH} is measured using 50 µm thermal grease)

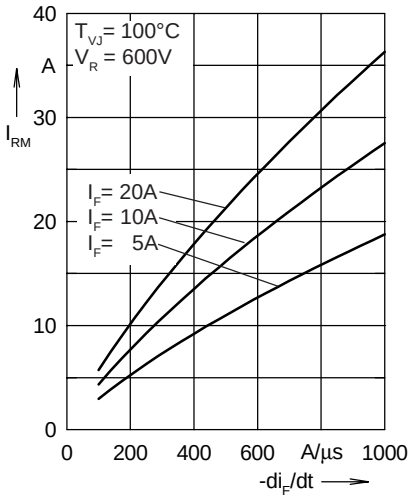
Output Inverter D1 - D6



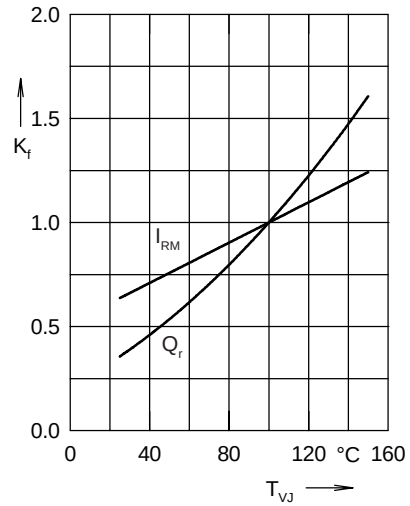
Forward current I_F versus V_F



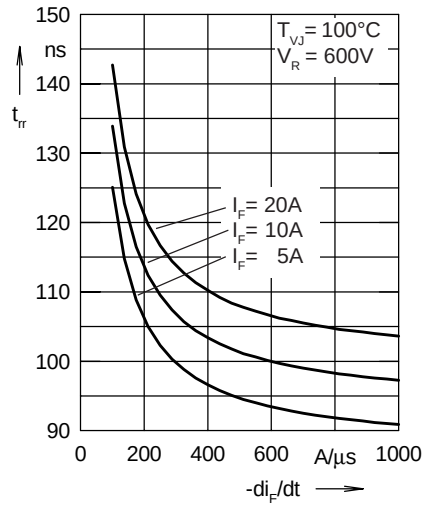
Reverse recovery charge Q versus $-di_F/dt$



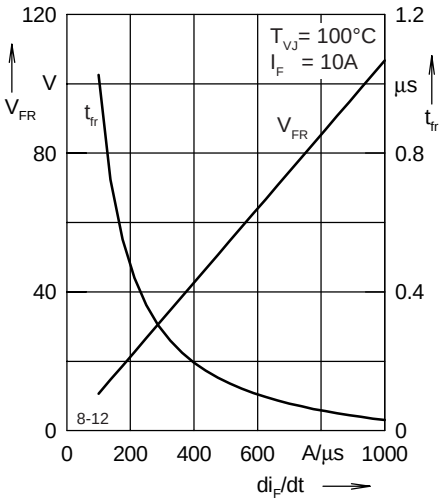
Peak reverse current I_{RM} versus $-di_F/dt$



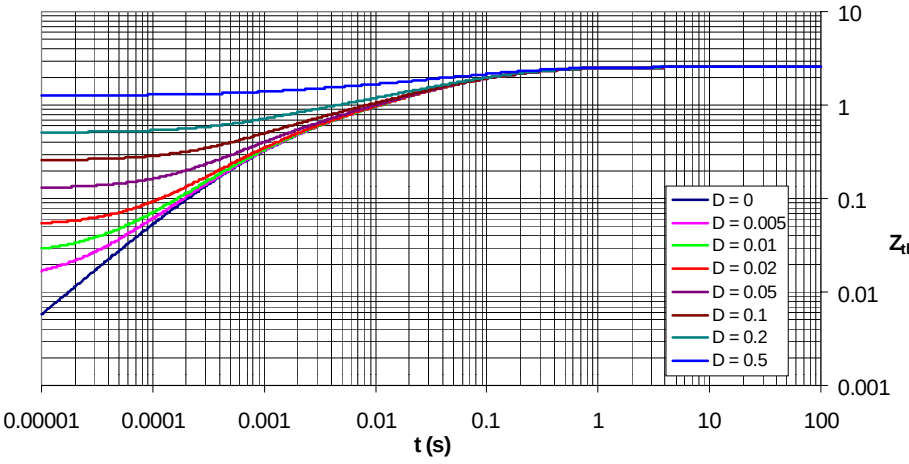
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



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



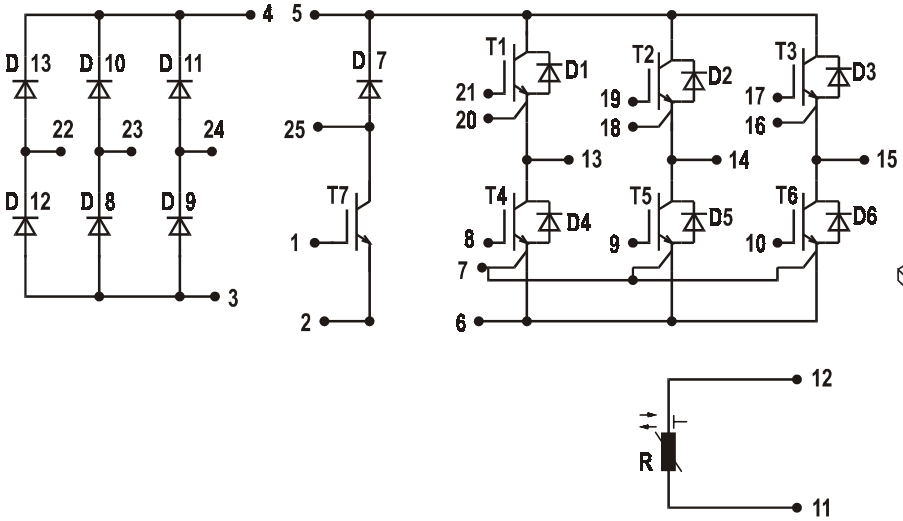
(Z_{thJH} is measured using 50 µm thermal grease)

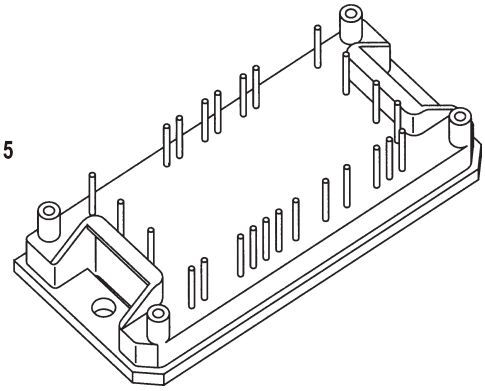
FRED

Z_{thJH}[K/W]

Transient thermal resistance junction to heatsink

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{FAVM} = 25 A	I_{C25} = 13 A	I_{C25} = 18 A
I_{FSM} = 370 A	$V_{CE(sat)}$ = 2.8 V	$V_{CE(sat)}$ = 2.8 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_F	T_{VJ} = 25°C	55	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	25	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	370	A
i^2t	T_{VJ} = 125°C	680	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			20	µA
	T_{VJ} = 125°C			2	mA
V_F	I_F = 55 A		1.2	1.46	V
R_{thJC}	per die		1.05		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	18 11.5	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	36 23	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	70	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V			500	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.35 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 10 A; T_{VJ} = 25°C T_{VJ} = 150°C			2.9 3.4	V V
t_f	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 8 A R_G = 100 Ω; V_{GE} = ±15 V		350		ns
t_r			40		ns
$t_{d(on)}$			80		ns
$t_{d(off)}$			420		ns
E_{off}			0.9		mJ
E_{on}			1.3		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		850		nF
C_{oss}			98		nF
C_{rss}			60		nF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A	1.7			S
Q_g	V_{CC} = 1000 V; I_C = 8 A pulse; V_{GE} = 15 V		58		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_r	I_F = 4 A; V_{GE} = 0 V; V_R = -300 V di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.5 2.25		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	13 8	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	26 16	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	67	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V		1	100	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V		0.1	100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.3 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 5 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.8 4	3.3 4.5	V V
t_f	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 5 A R_G = 100 Ω; V_{GE} = ±15 V		200		ns
t_r			55		ns
$t_{d(on)}$			65		ns
$t_{d(off)}$			320		ns
E_{off}			0.4		mJ
E_{on}			0.8		mJ
C_{iss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		650		pF
C_{oss}			50		pF
C_{rss}			20		pF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A	1.7	2.5		S
Q_g	V_{CC} = 800 V; I_C = 6 A pulse; V_{GE} = 15 V		48		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_{rr}	I_F = 4 A; V_R = -300 V; V_{GE} = 0 V di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.55 2.25		°C/W °C/W

Module

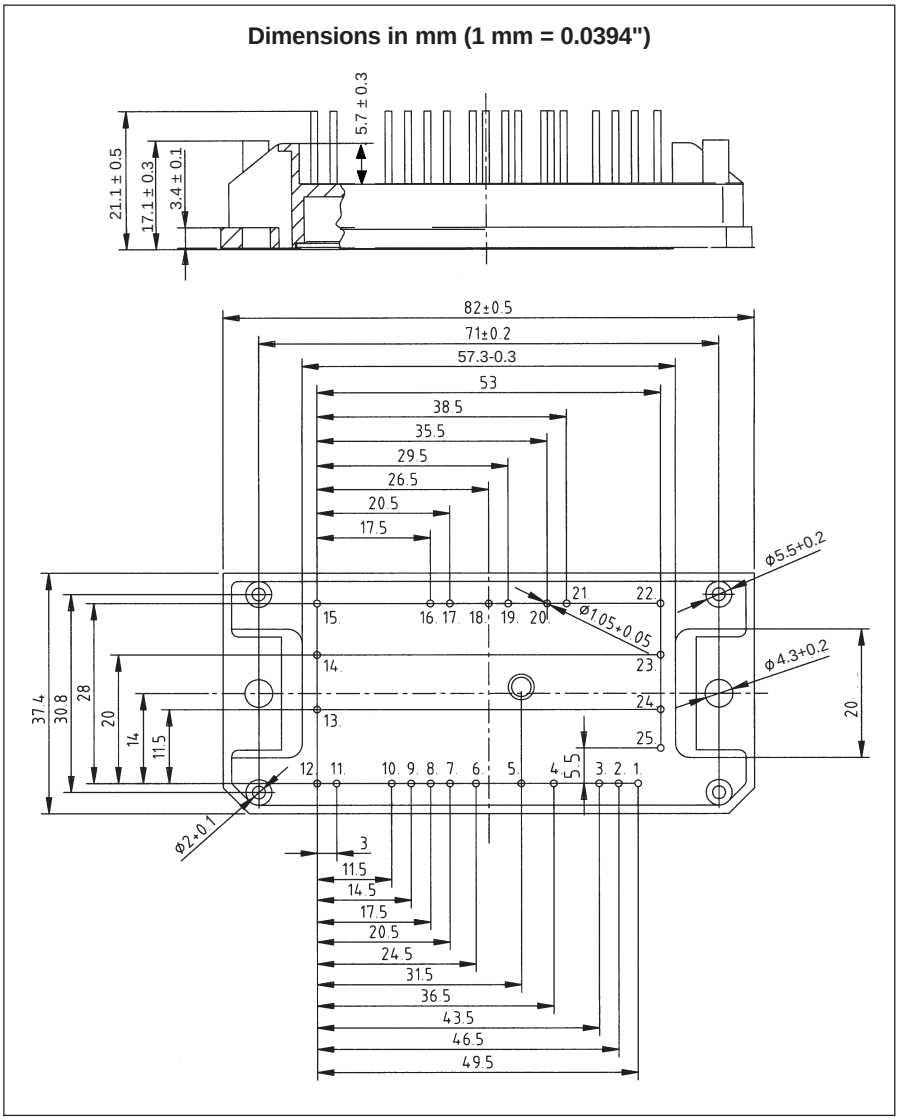
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

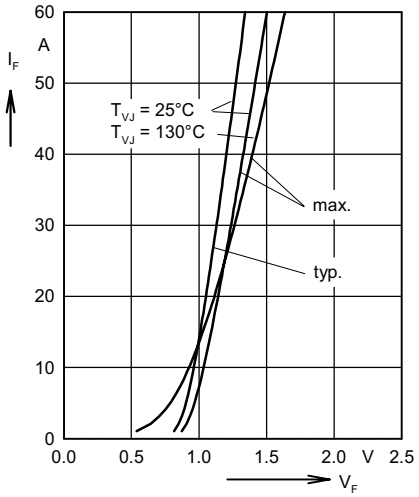
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

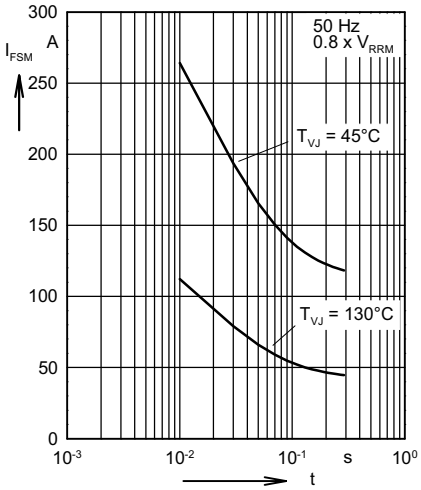
Dimensions in mm (1 mm = 0.0394")



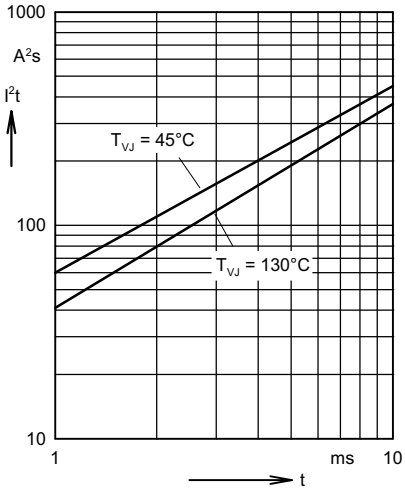
Input Rectifier Bridge D8 - D13



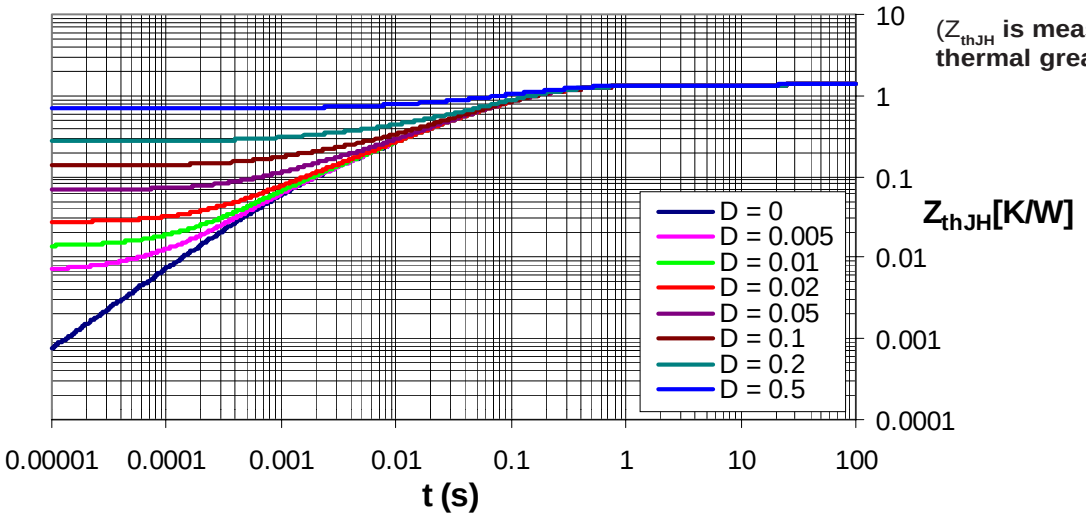
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

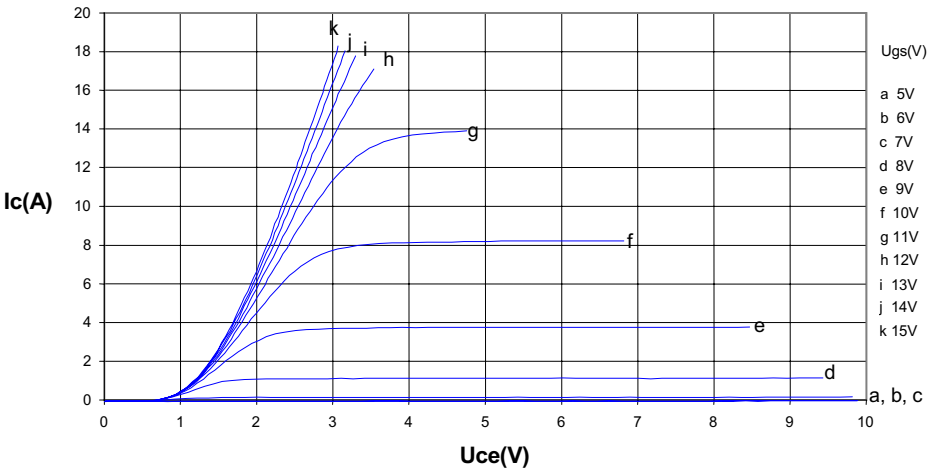


(Z_{thJH} is measured using 50 µm thermal grease)

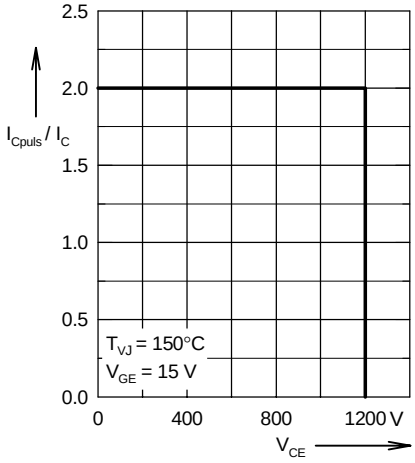
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

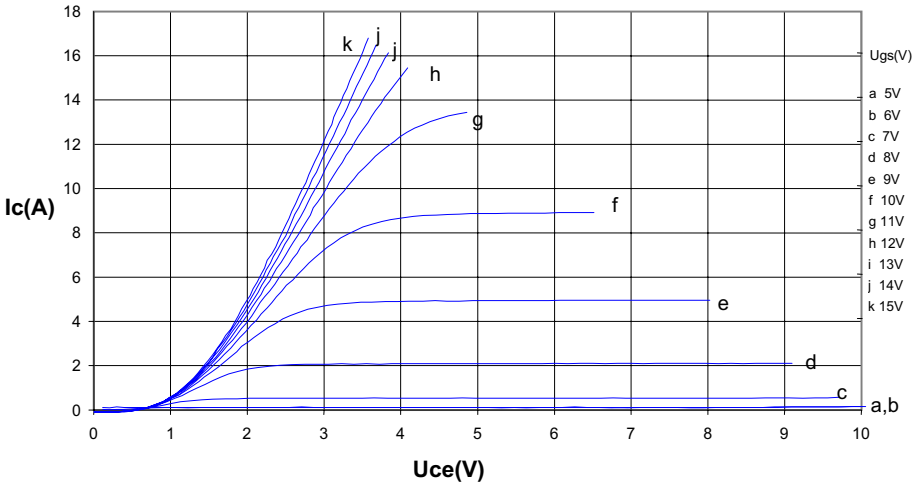
Typ. output characteristics 25°C



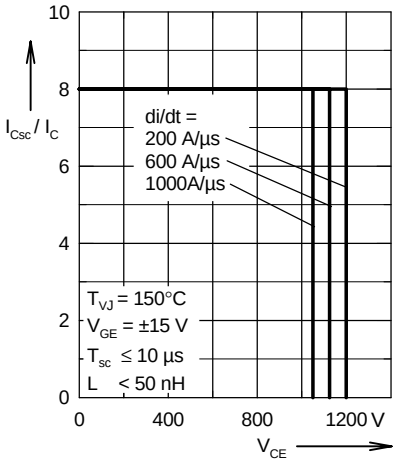
Reverse biased safe operating area



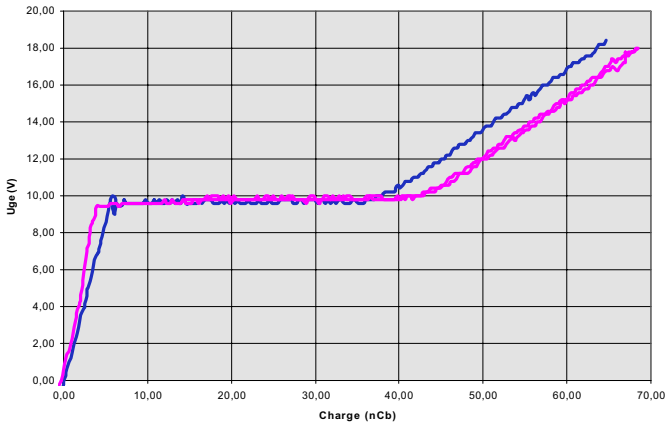
Typ. output characteristics 125°C



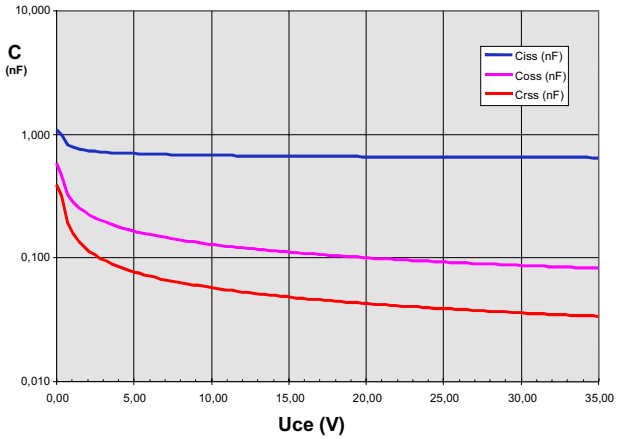
Short circuit safe operating area



Typ. gate charge

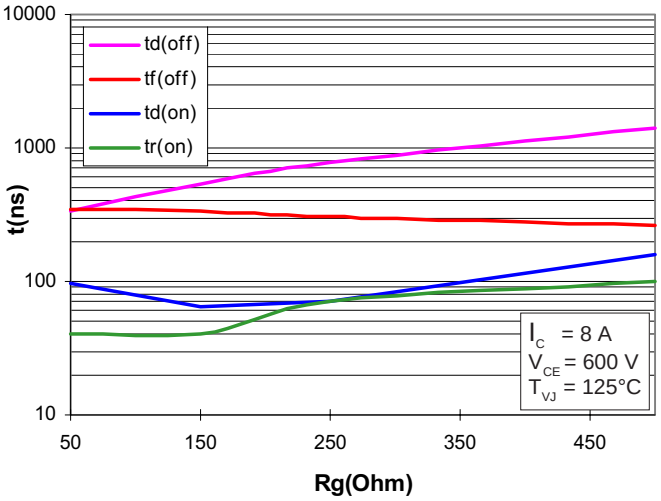


Typ. capacitances

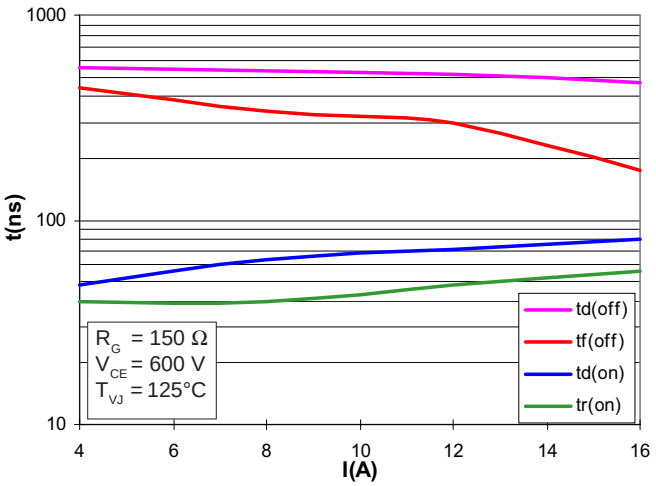


Output Inverter T1 - T6

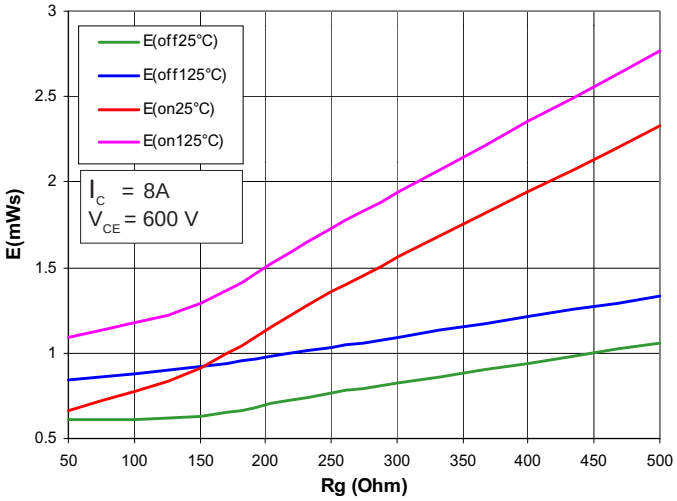
Typ. switching time



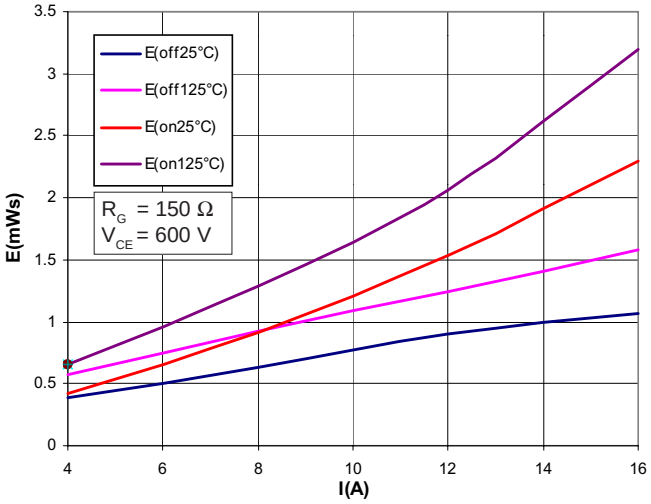
Typ.switching time



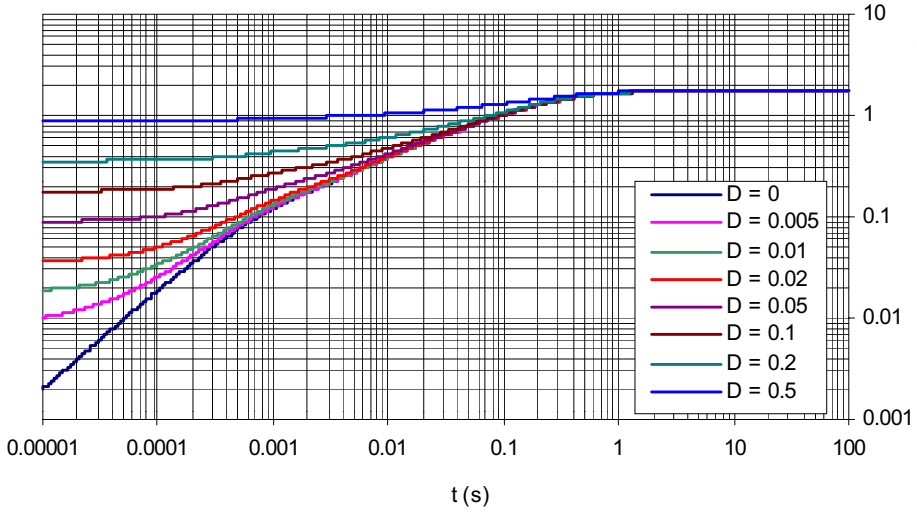
Typ. switching losses



Typ. switching losses



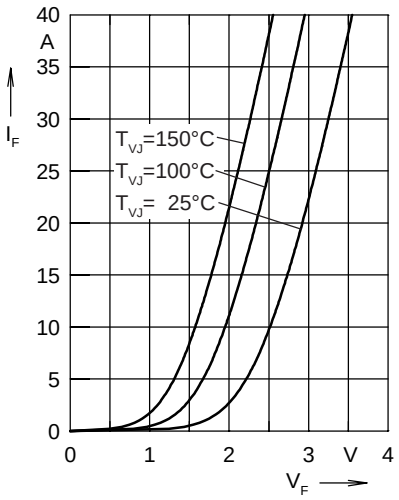
Transient thermal resistance junction to heatsink



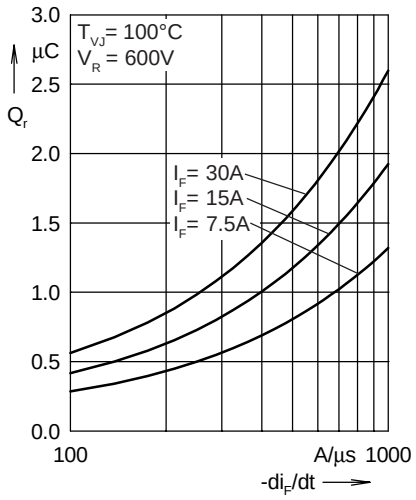
(Z_{thJH} is measured using 50 µm thermal grease)

IGBT
ZthJH [K/W]

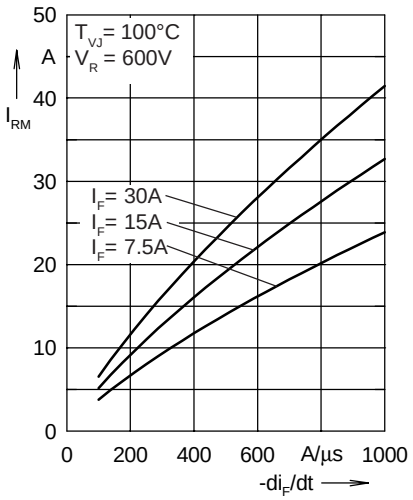
Output Inverter D1 - D6



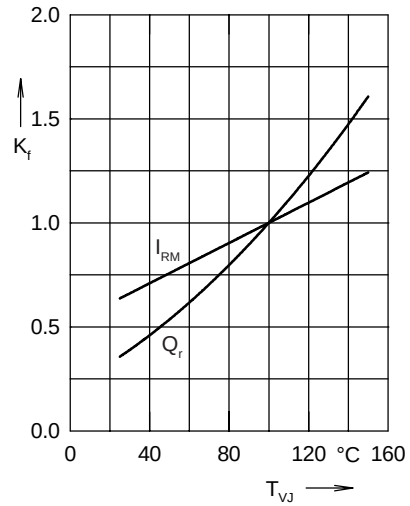
Forward current I_F versus V_F



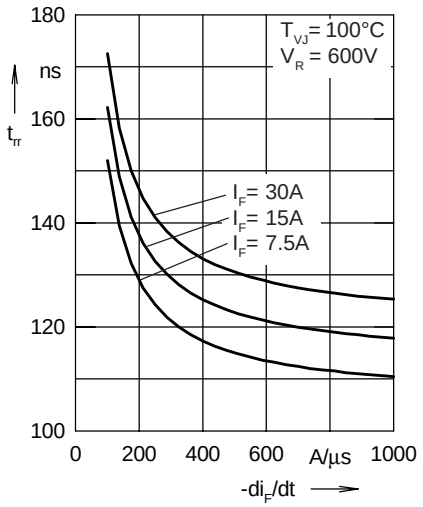
Reverse recovery charge Q_r versus $-di_F/dt$



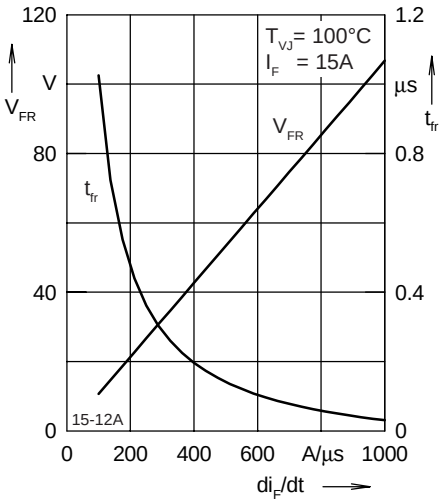
Peak reverse current I_{RM} versus $-di_F/dt$



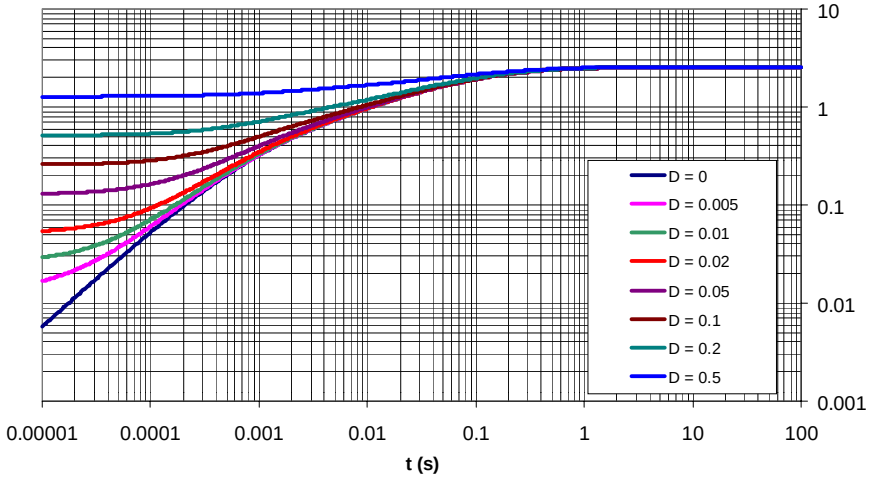
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



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



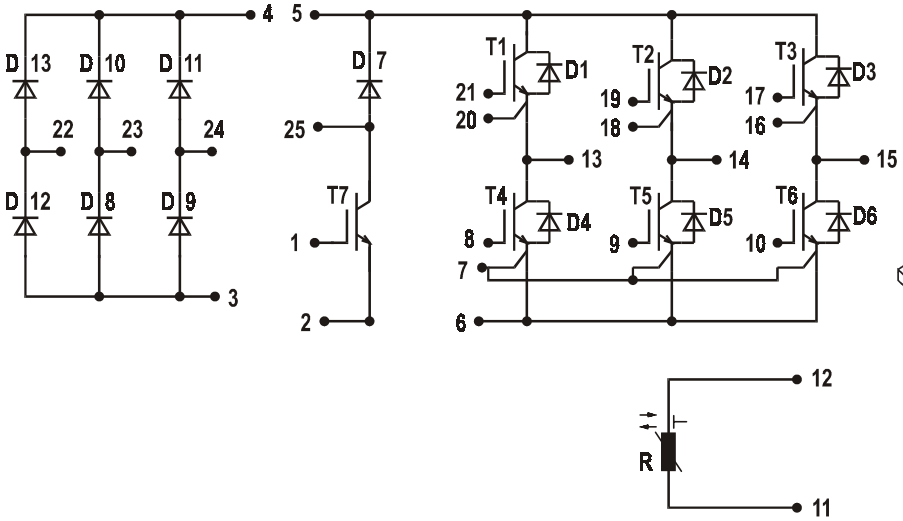
Transient thermal resistance junction to heatsink

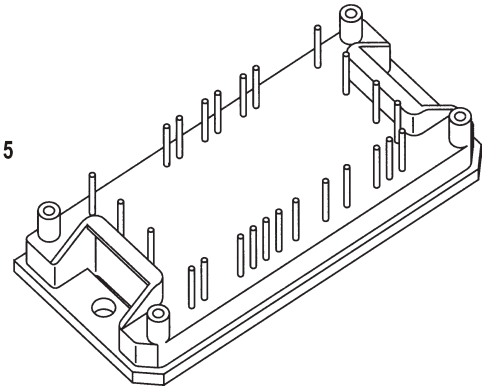
(Z_{thJH} is measured using 50 µm thermal grease)

FRED

Z_{thJH}[K/W]

Converter - Brake - Inverter Module (CBI1)





Rectifier	Brake	Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{FAVM} = 25 A	I_{C25} = 18 A	I_{C25} = 31 A
I_{FSM} = 370 A	$V_{CE(sat)}$ = 2.6 V	$V_{CE(sat)}$ = 2.2 V

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_F	T_{VJ} = 25°C	55	A
I_{FAVM}	T_{VJ} = 150°C; T_K = 70°C	25	A
I_{FSM}	T_{VJ} = 45°C; t = 10 ms sine 50 Hz	370	A
i^2t	T_{VJ} = 125°C	680	A^2s
T_{VJ}		+150	°C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_R	V_{RRM} = 1200 V; T_{VJ} = 25°C			20	µA
	T_{VJ} = 125°C			2	mA
V_F	I_F = 55 A		1.2	1.46	V
R_{thJC}	per die		1.05		°C/W

Features

- NPT IGBT technology
  Square RBSOA, no latchup
- Free wheeling diodes with Hiperfast and soft recovery behaviour
- Isolation voltage 2500 V~
- Built in temperature sense
- High level of integration:
  one module for complete drive system
- **D**irect **C**opper **B**onded Al_2O_3 ceramic base plate

Applications

- AC motor control
- AC servo and robot drives

Advantages

- No need of external isolation
- Easy to mount with two screws
- Package designed for wave soldering
- High temperature and power cycling capability

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

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Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	31 17	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	62 34	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	104	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1200 V		600	1000	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.35 mA	4.5		6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -55°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 15 A; T_{VJ} = 25°C T_{VJ} = 150°C		2.2 2.5	2.6 3.0	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 17.5 A R_G = 100 Ω; V_{GE} = ±15 V		150 70 80 580 1.2 3.0		ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		1000 200 80		pF pF pF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A		tbd		S
Q_g	V_{CC} = 800 V; I_C = 6 A pulse; V_{GE} = 15 V		108		nC
V_F	I_F = 12 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.2 1.8	2.75	V V
t_{rr}	I_F = 12 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -500 V; di_F/dt = -1000 A/µs		80		ns
Q_r	I_F = 12 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -500 Vdi_F/dt = -1000 A/µs		2.2		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.0 1.5		°C/W °C/W

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C	1200	V
V_{CGR}	T_{VJ} = 25°C; R_{GE} = 20kΩ	1200	V
V_{GE}	T_{VJ} = 25°C	±20	V
I_C	T_C = 25°C T_C = 90°C	18 11.5	A A
I_{CM}	t_p = 1 ms = 1% duty cycle; T_C = 25°C T_C = 90°C	36 23	A A
t_{SC}	V_{CE} = 600 V; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	70	W
T_{VJ} T_{VJ}	Free-Wheeling Diode IGBT	+150 +150	°C °C

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
I_{CES}	V_{GE} = 0 V; V_{CE} = 1000 V			500	µA
I_{GES}	V_{CE} = 0 V; V_{GE} = 25 V			100	nA
$V_{GE(th)}$	V_{GE} = V_{CE}; I_C = 0.35 mA	4.5	5.5	6.5	V
$V_{(BR)CES}$	V_{GE} = 0 V; I_C = 10 mA; T_{VJ} = -40°C	1200			V
V_{CEsat}	V_{GE} = 15 V; I_C = 10 A; T_{VJ} = 25°C T_{VJ} = 150°C			2.9 3.4	V V
t_f t_r $t_{d(on)}$ $t_{d(off)}$ E_{off} E_{on}	Inductive load, T_{VJ} = 125°C V_{CC} = 600 V; I_C = 8 A R_G = 100 Ω; V_{GE} = ±15 V		350 40 80 420 0.9 1.3		ns ns ns ns mJ mJ
C_{iss} C_{oss} C_{rss}	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		850 98 60		nF nF nF
g_{fs}	V_{CE} = 20 V; I_C = 1.5 A	1.7			S
Q_g	V_{CC} = 1000 V; I_C = 8 A pulse; V_{GE} = 15 V		58		nC
V_F	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 25°C T_{VJ} = 100°C		2.3 2	3	V V
t_{rr}	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		55		ns
Q_r	I_F = 4 A; V_{GE} = 0 V; T_{VJ} = 100°C V_R = -300 V; di_F/dt = -800 A/µs		0.8		µC
I_r				250	µA
R_{thJC}	IGBT (per die) Diode (per die)		1.5 2.25		°C/W °C/W

Module

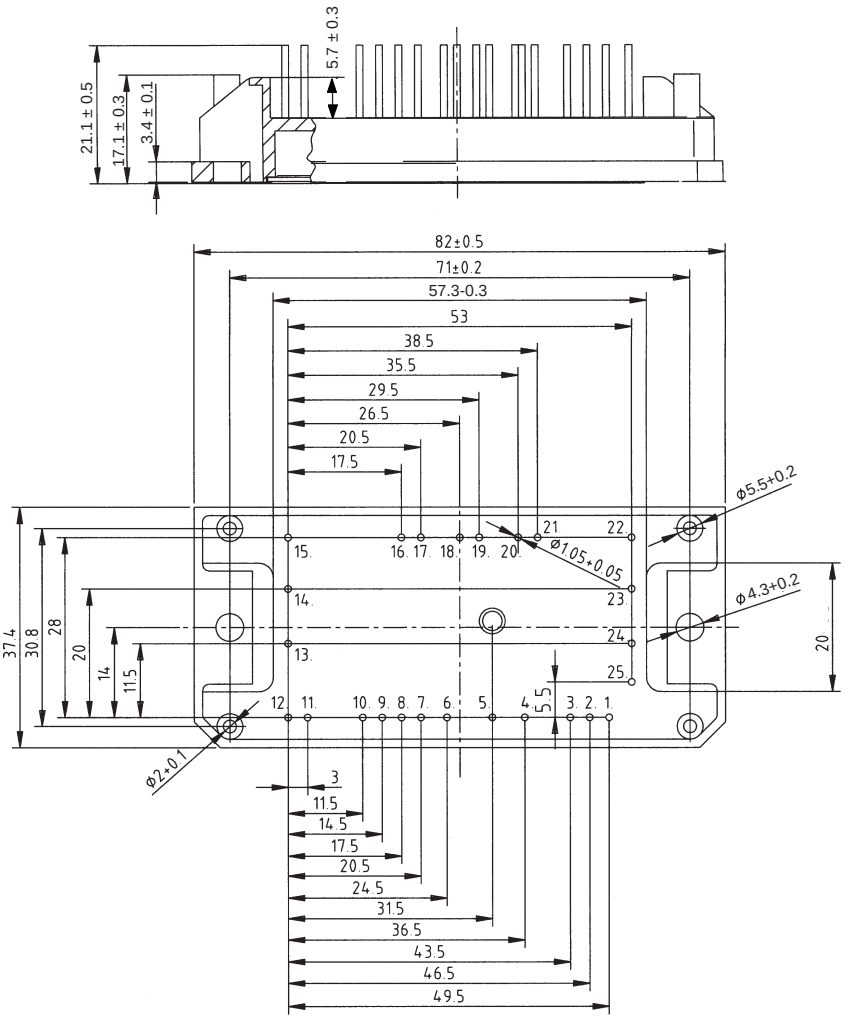
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz; t = 1 min	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_S d_A	Creepage distance on surface Strike distance in air	12.7 12.7	mm mm
Weight	typ.	42	g

Temperature Sensor R

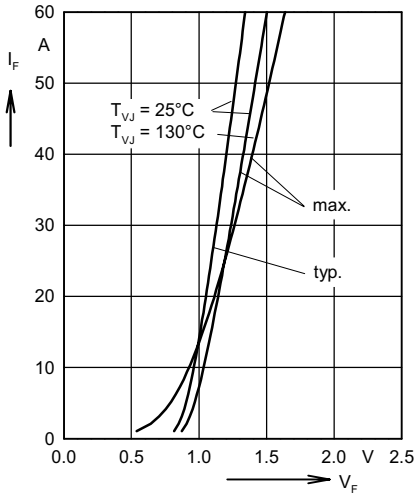
Symbol	Conditions	Maximum Ratings	
R	T_{amb} = 20°C	4.7	kΩ

For additional data see C620/4.7k 5% S+M NTC thermistor catalog

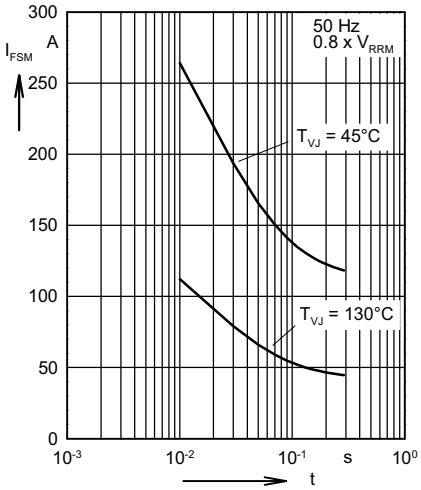
Dimensions in mm (1 mm = 0.0394")



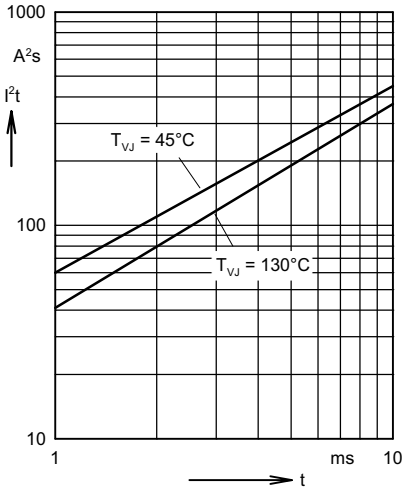
Input Rectifier Bridge D8 - D13



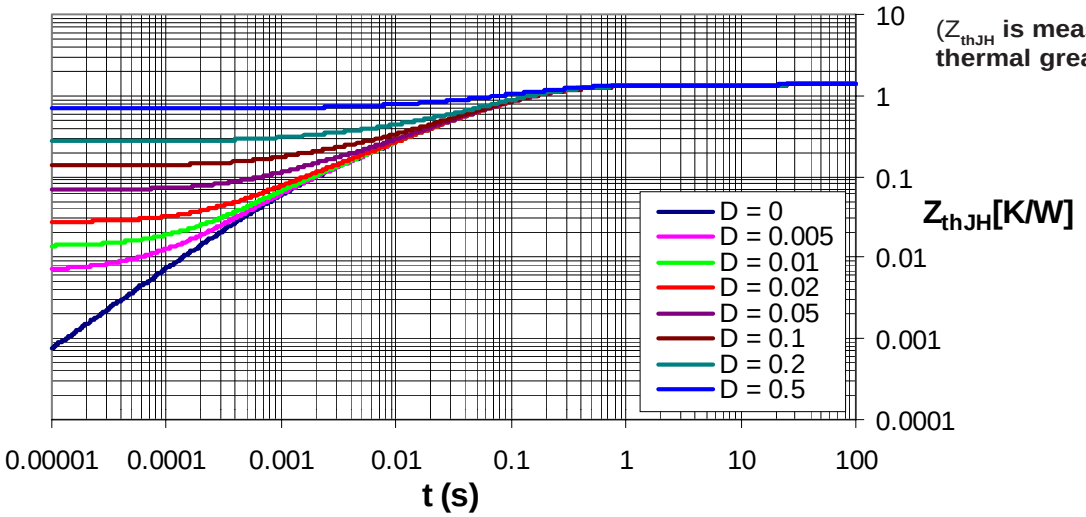
Forward characteristics



Surge overload current
I_{FSM}: crest value, t: duration



I^2t versus time (1-10 ms)

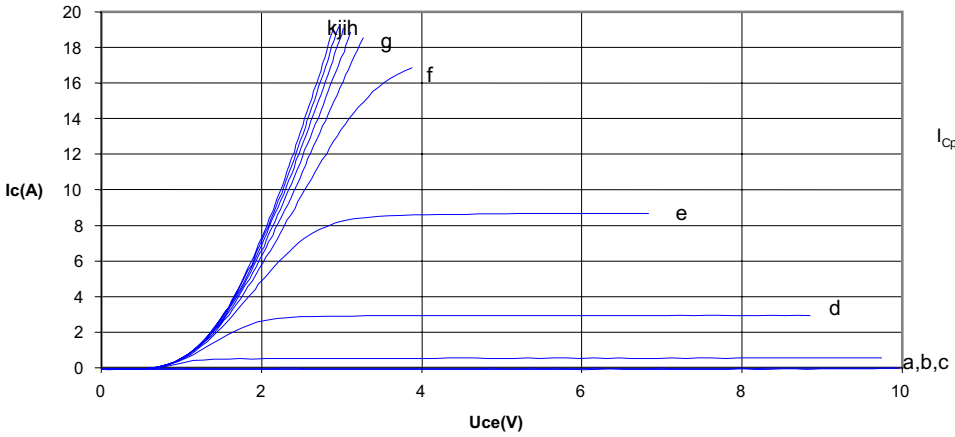


(Z_{thJH} is measured using 50 µm thermal grease)

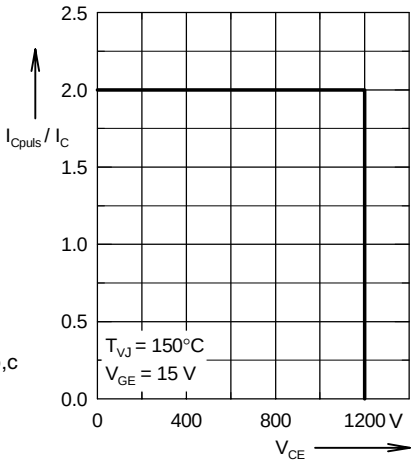
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6

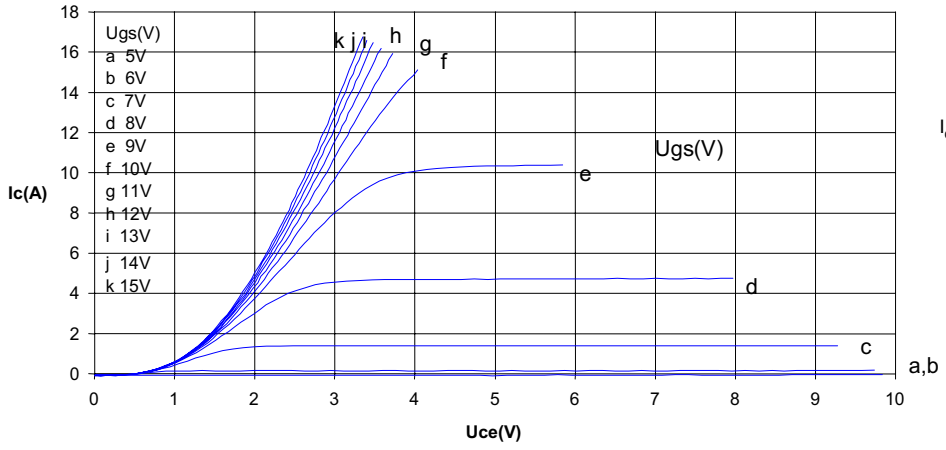
Typ. output characteristics 25°C



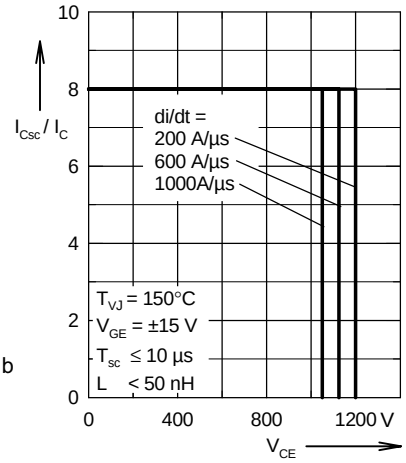
Reverse biased safe operating area



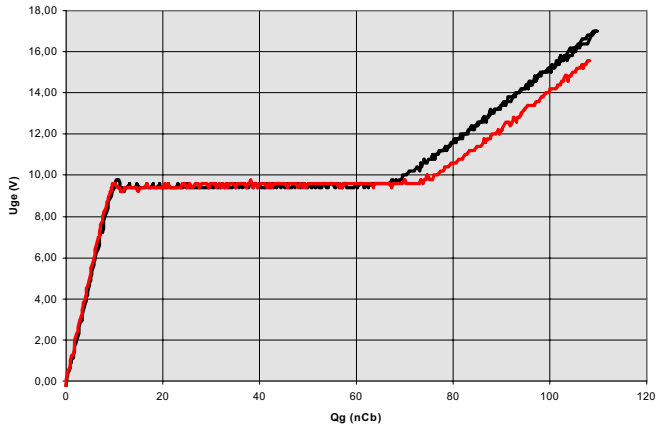
Typ. output characteristics 125°C



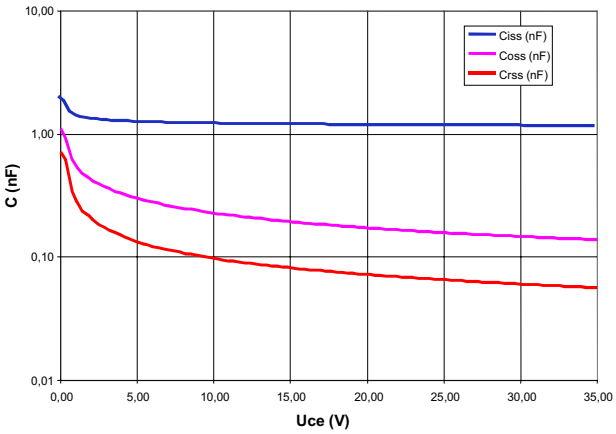
Short circuit safe operating area



Typ. gate charge

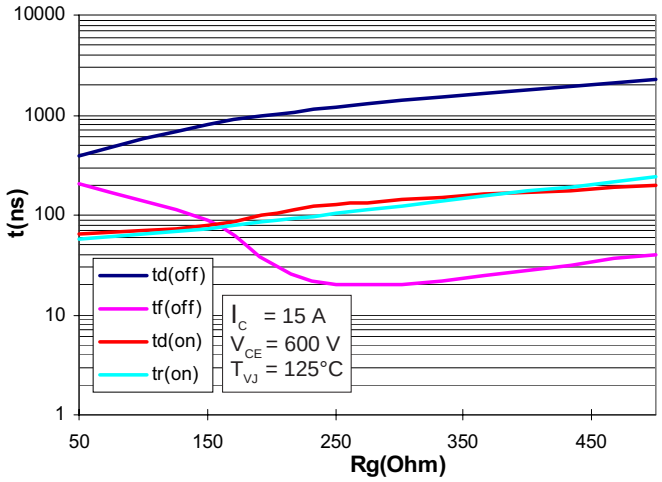


Typ. capacitances

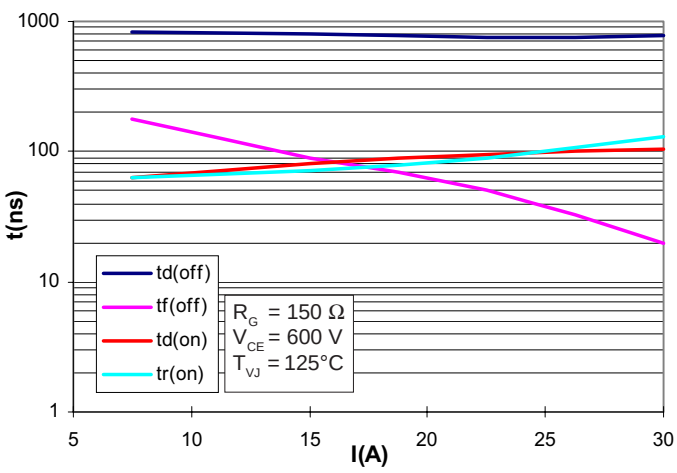


Output Inverter T1 - T6

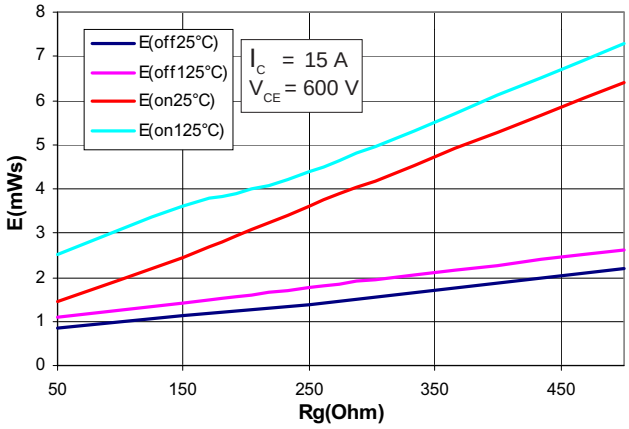
Typ. switching time



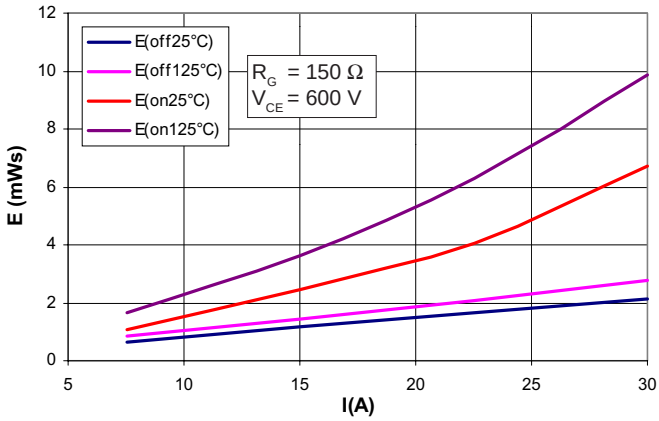
Typ. switching times



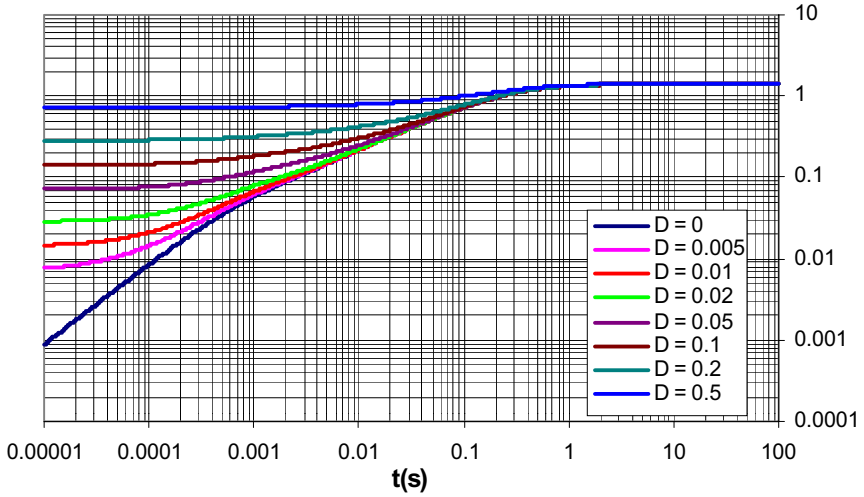
Typ. swiching losses



Typ. switching losses



Transient thermal resistance junction to heatsink

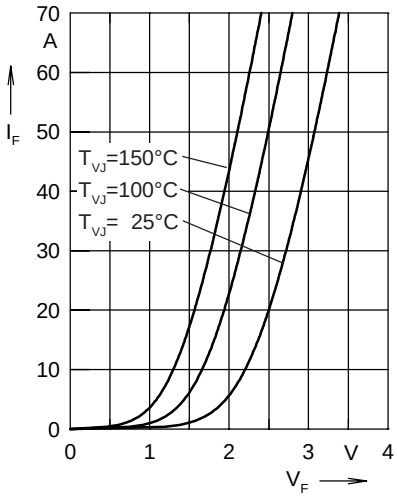


(Z_{thJH} is measured using 50 µm thermal grease)

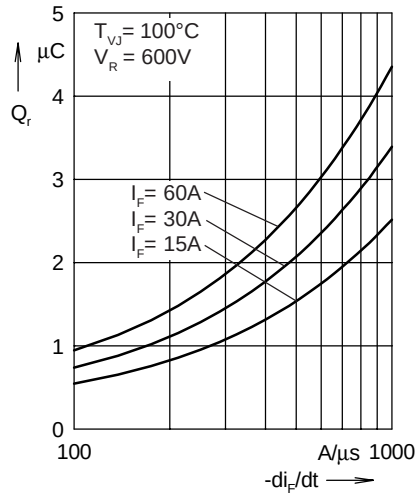
IGBT

Z_{thJH}[K/W]

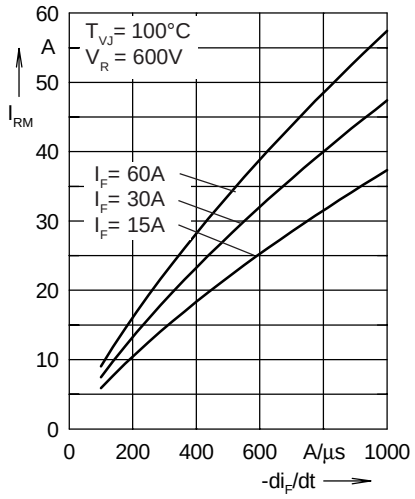
Output Inverter D1 - D6



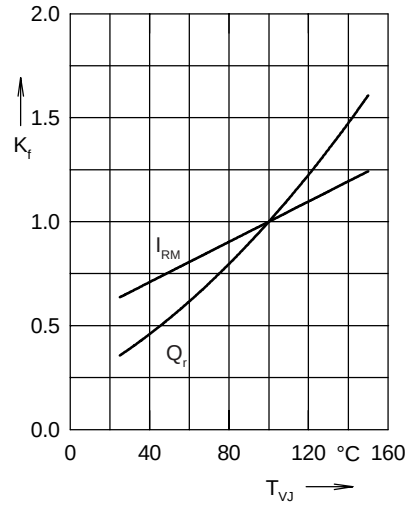
Forward current I_F versus V_F



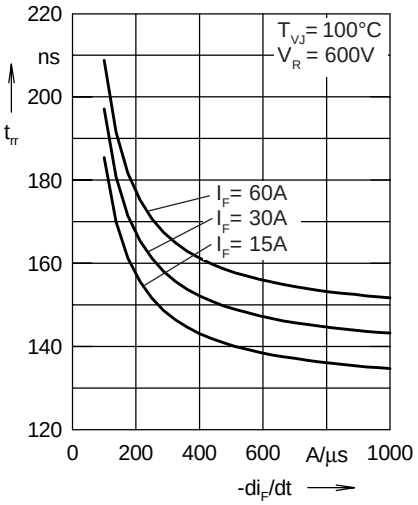
Reverse recovery charge Q_r versus $-di_F/dt$



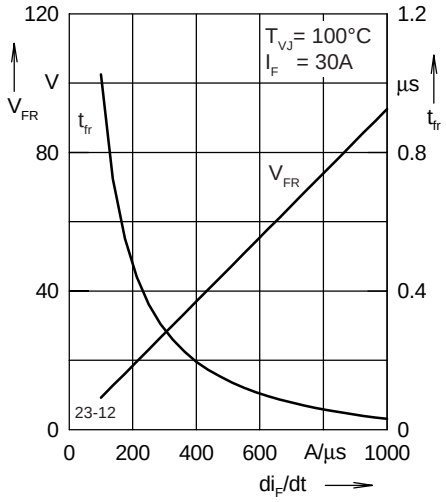
Peak reverse current I_{RM} versus $-di_F/dt$



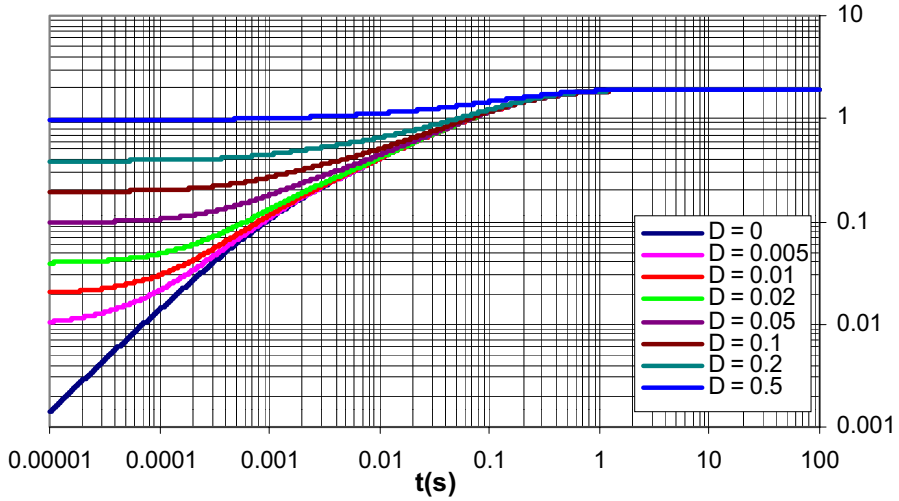
Dynamic parameters Q_r, I_{RM} versus T_{VJ}



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



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



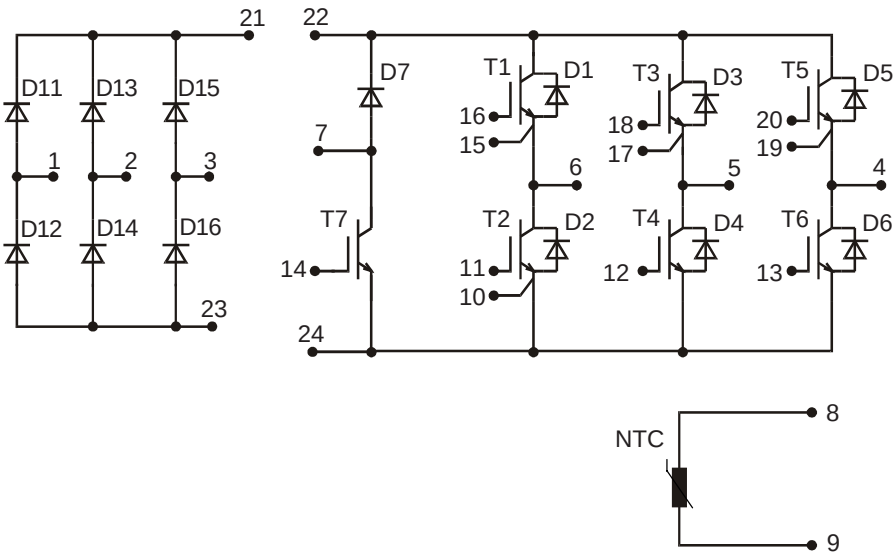
Transient thermal resistance junction to heatsink

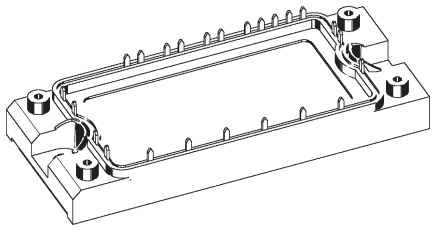
(Z_{thJH} is measured using 50 µm thermal grease)

FRED

Z_{thJH}[K/W]

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 26 A	I_{C25} = 20 A	I_{C25} = 20 A
I_{FSM} = 160 A	$V_{CE(sat)}$ = 1.9 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	19	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	18	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	160	A
P_{tot}	T_C = 25°C	85	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 10 A; T_{VJ} = 25°C		1.3	1.6	V
	T_{VJ} = 125°C		1.3		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		1		mA
t_{rr}	V_R = 100 V; I_F = 10 A; di/dt = -10 A/µs		1		µs
R_{thJC}	(per diode)			1.47	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \le V_{CES}$	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	85	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 10 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.9	2.3	V
	T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.6	mA
	T_{VJ} = 125°C		0.4		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 = 10 A V_{GE} = ±15 V; R_G = 82 Ω		35		ns
t_r			35		ns
$t_{d(off)}$			230		ns
t_f			30		ns
E_{on}			0.4		mJ
E_{off}			0.3		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		600		pF
Q_{Gon}	V_{CE}= 300V; V_{GE} = 15 V; I_C = 10 A		39		nC
R_{thJC}	(per IGBT)			1.5	K/W

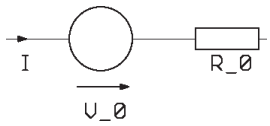
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	20	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C			2.1	V
	T_{VJ} = 125°C		1.3		V
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V; V_{GE} = 0 V		80		ns
R_{thJC}	(per diode)			3.2	K/W

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.11V; R_0 = 19 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.89 V; R_0 = 122 mΩ

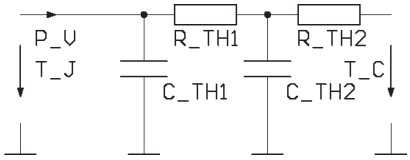
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.07 V; R_0 = 23 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.89 V; R_0 = 122 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.07 V; R_0 = 23 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.093 J/K; R_{th1} = 1.212 K/W
C_{th2} = 0.778 J/K; R_{th2} = 0.258 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.071 J/K; R_{th1} = 1.211 K/W
C_{th2} = 0.726 J/K; R_{th2} = 0.293 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

T7 / D7

IGBT (typ.)
C_{th1} = 0.071 J/K; R_{th1} = 1.211 K/W
C_{th2} = 0.726 J/K; R_{th2} = 0.293 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \leq V_{CES}$	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	85	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 10 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.9	2.3	V
	T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 10 A V_{GE} = ±15 V; R_G = 82 Ω		40		ns
t_r			40		ns
$t_{d(off)}$			230		ns
t_f			30		ns
E_{on}			0.4		mJ
E_{off}			0.3		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		600		pF
Q_{Gon}	V_{CE}= 300 V; V_{GE} = 15 V; I_C = 10 A		39		nC
R_{thJC}				1.5	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	20	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 10 A; T_{VJ} = 25°C			2.1	V
	T_{VJ} = 125°C		1.3		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V		80		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

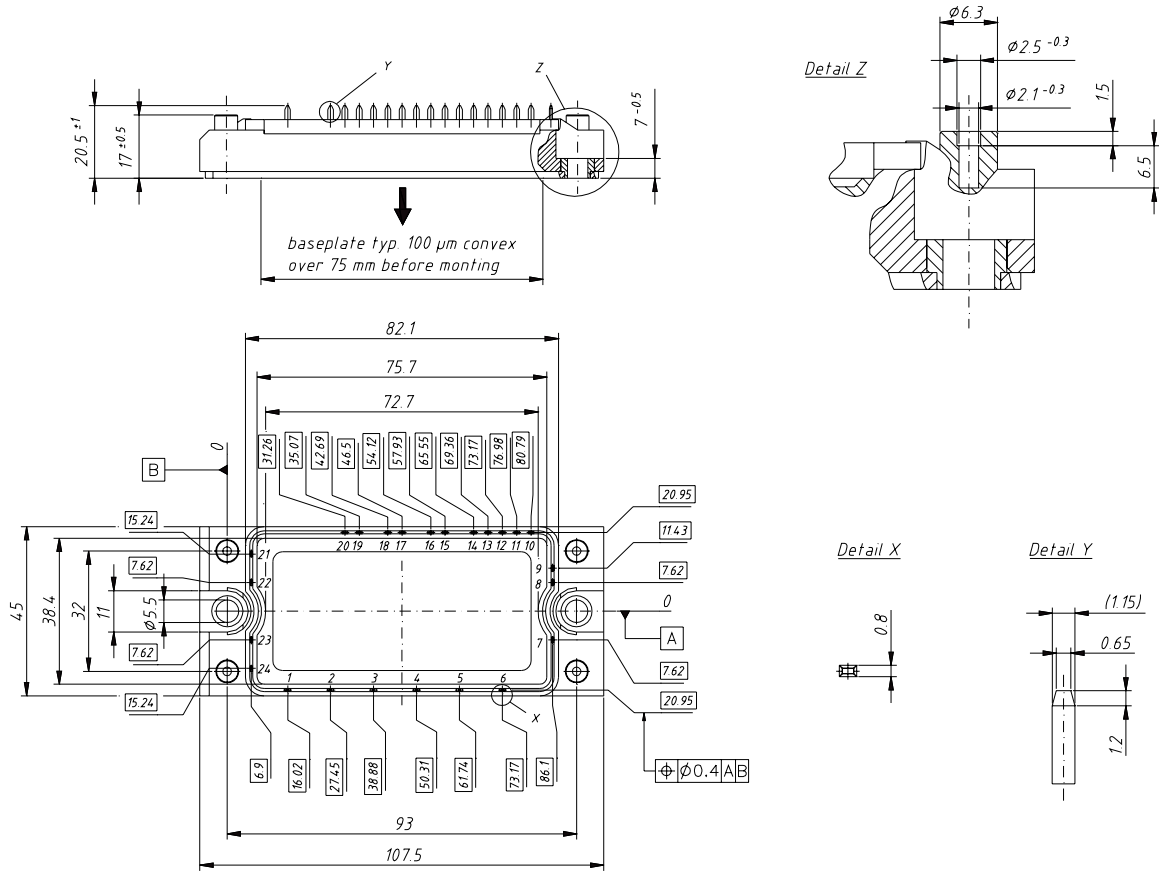
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

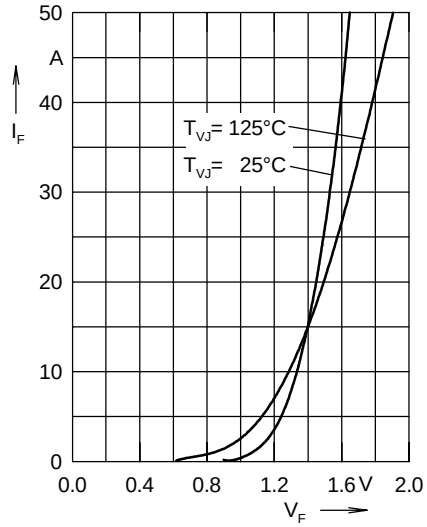


Fig. 1 Forward current versus voltage drop per diode

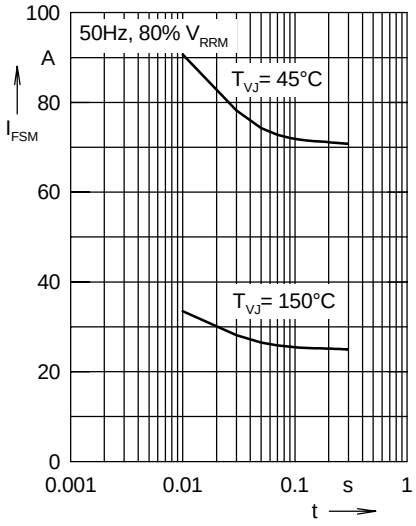


Fig. 2 Surge overload current

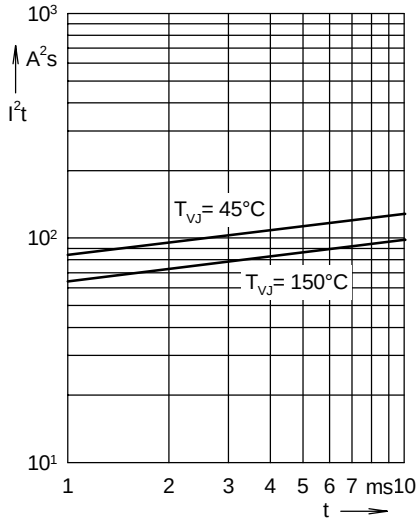


Fig. 3 I^2t versus time per diode

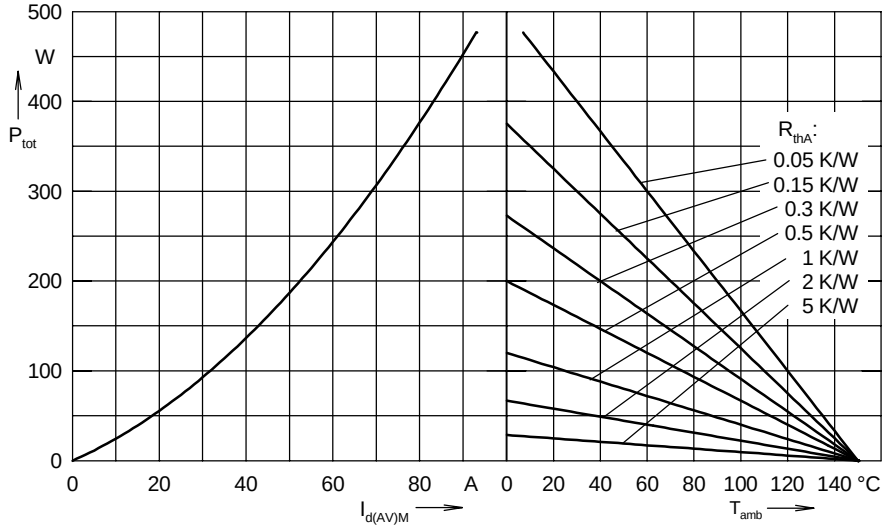


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

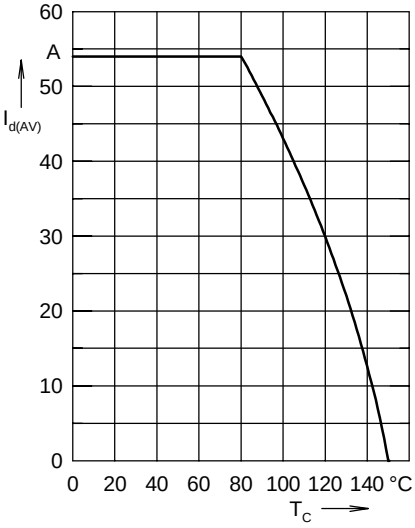


Fig. 5 Max. forward current versus case temperature

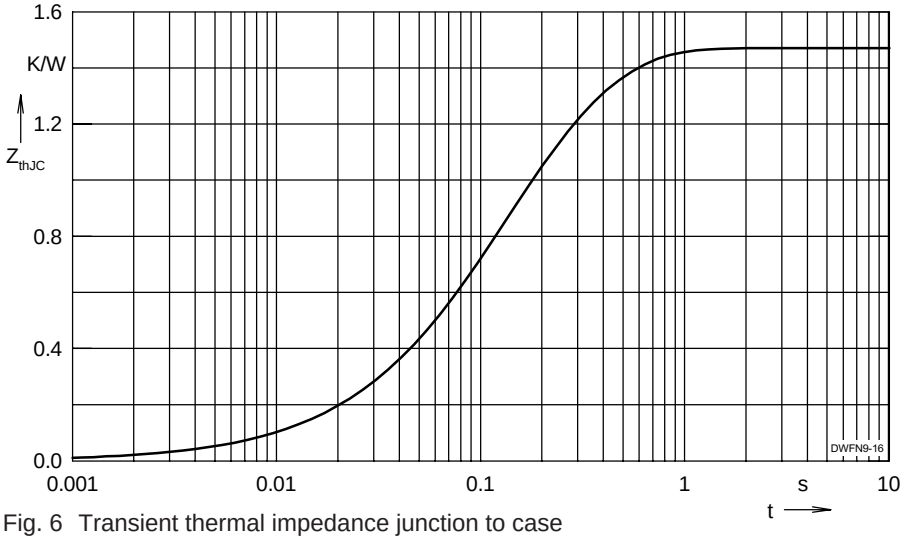


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

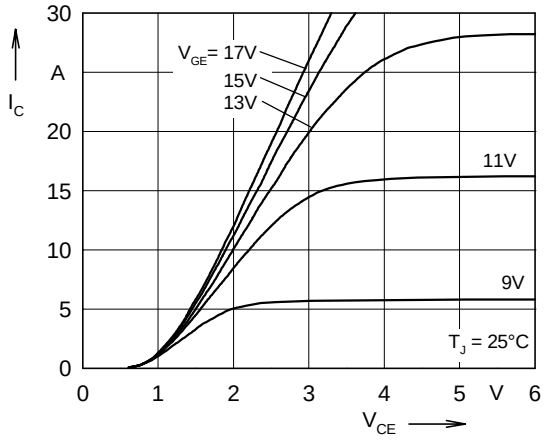


Fig. 7 Typ. output characteristics

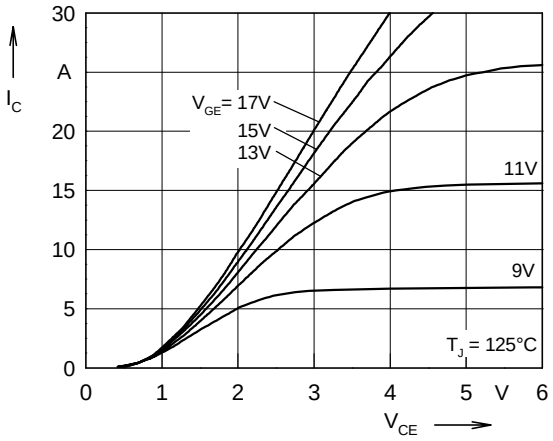


Fig. 8 Typ. output characteristics

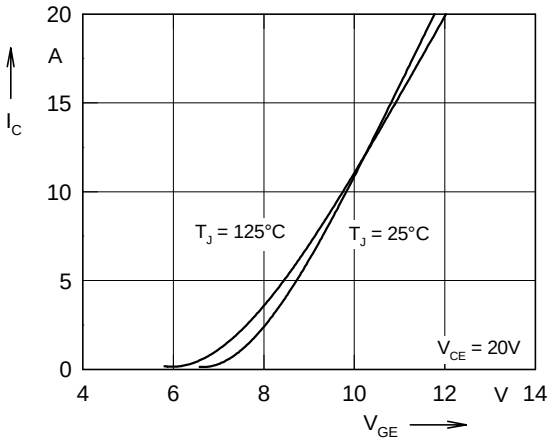


Fig. 9 Typ. transfer characteristics

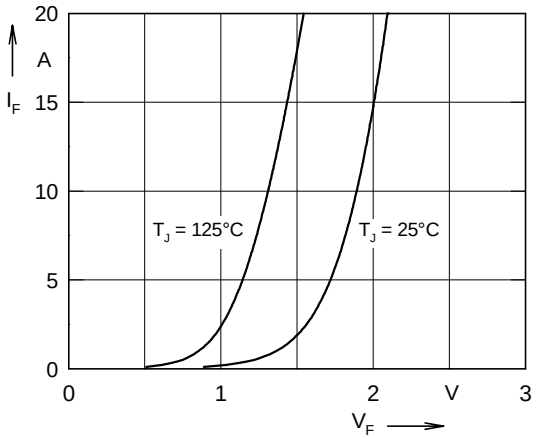


Fig. 10 Typ. forward characteristics of free wheeling diode

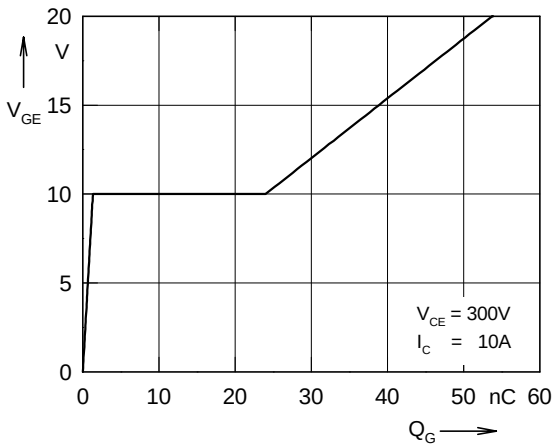


Fig. 11 Typ. turn on gate charge

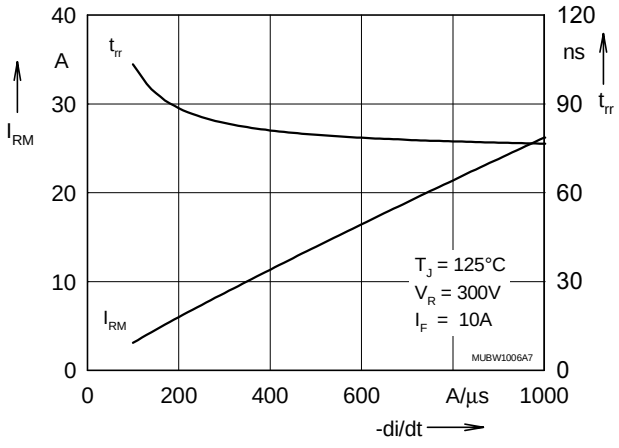


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

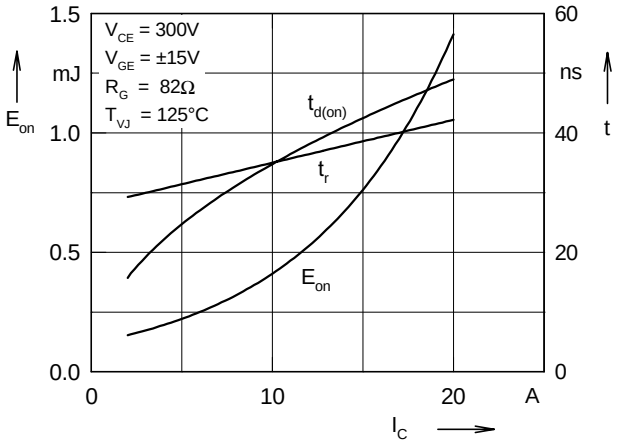


Fig. 13 Typ. turn on energy and switching times versus collector current

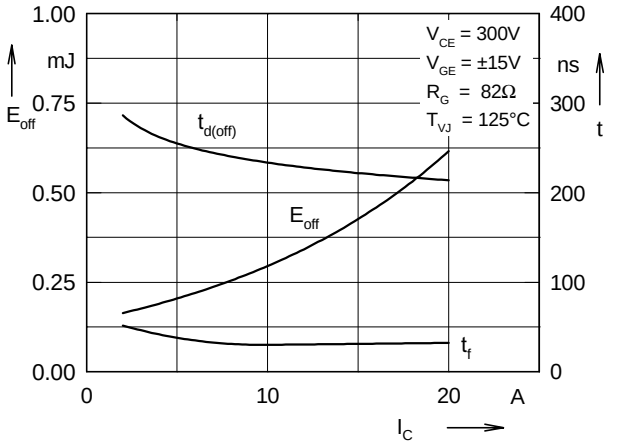


Fig. 14 Typ. turn off energy and switching times versus collector current

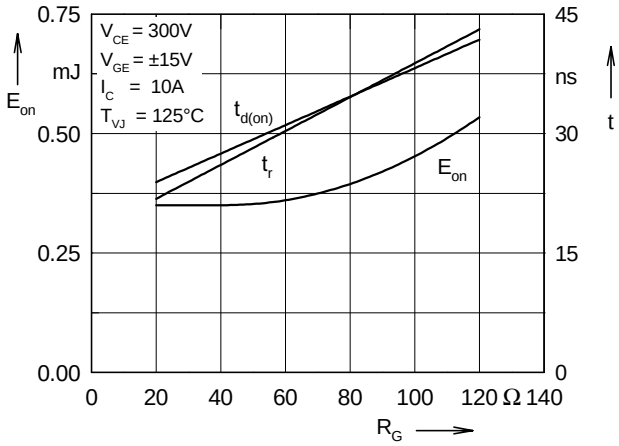


Fig. 15 Typ. turn on energy and switching times versus gate resistor

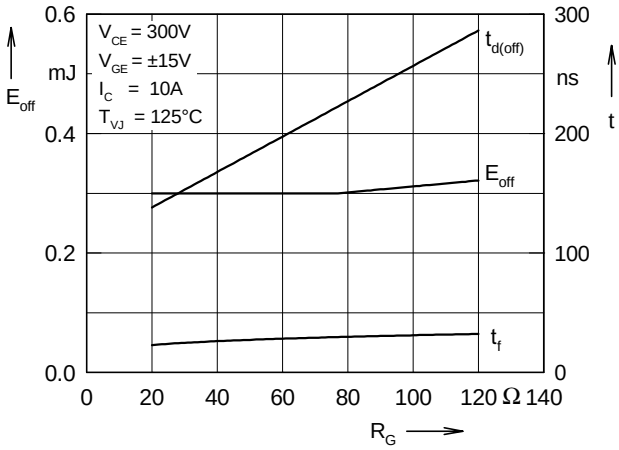


Fig.16 Typ. turn off energy and switching times versus gate resistor

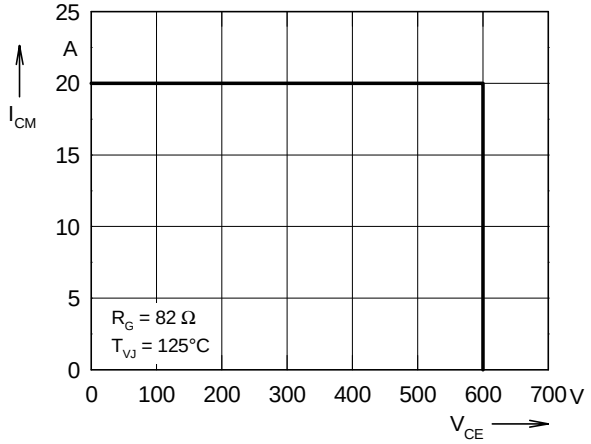


Fig. 17 Reverse biased safe operating area RBSOA

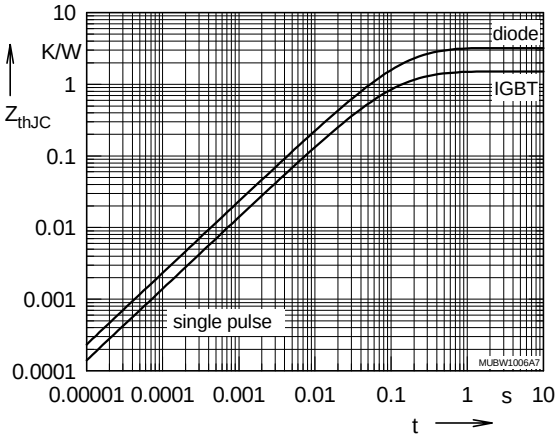


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

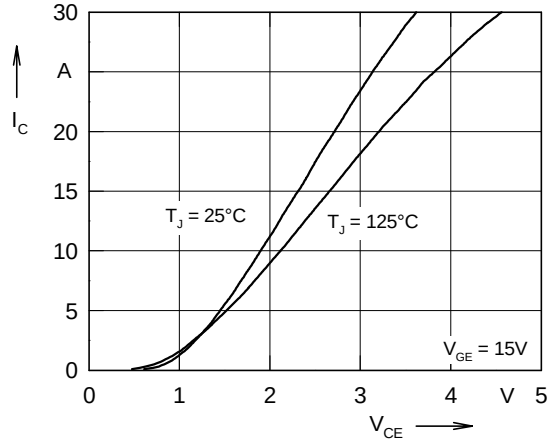


Fig. 19 Typ. output characteristics

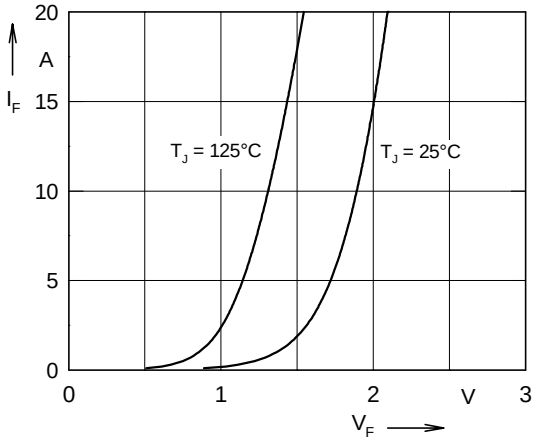


Fig. 20 Typ. forward characteristics of free wheeling diode

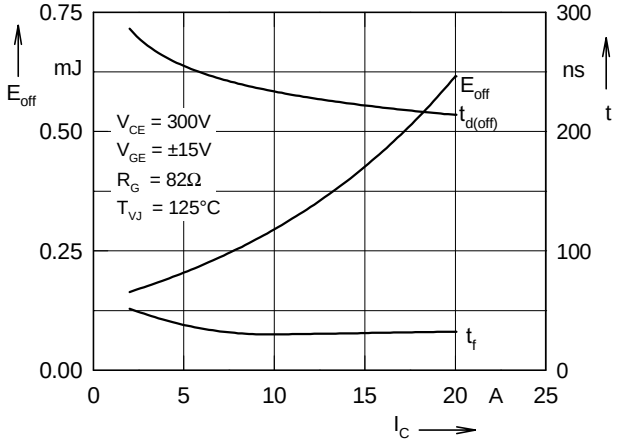


Fig. 21 Typ. turn off energy and switching times versus collector current

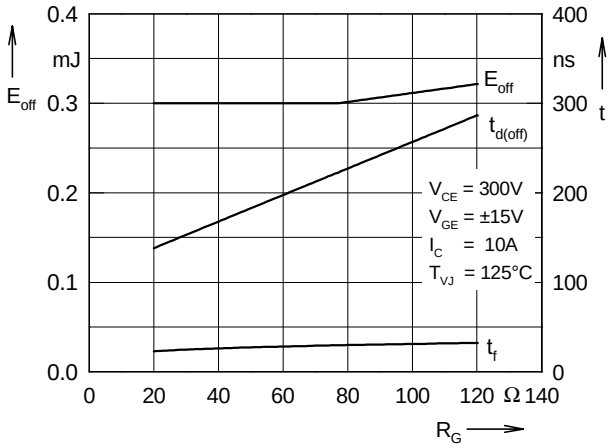


Fig. 22 Typ. turn off energy and switching times versus gate resistor

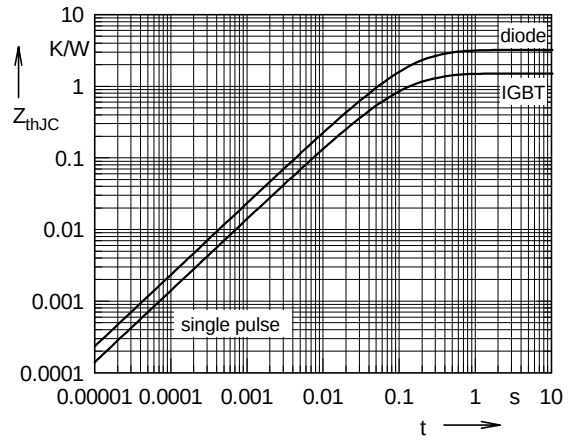


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

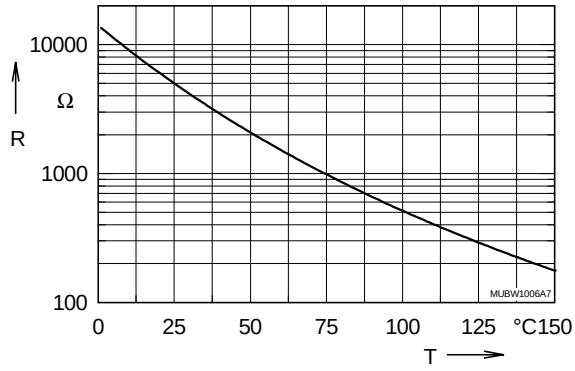
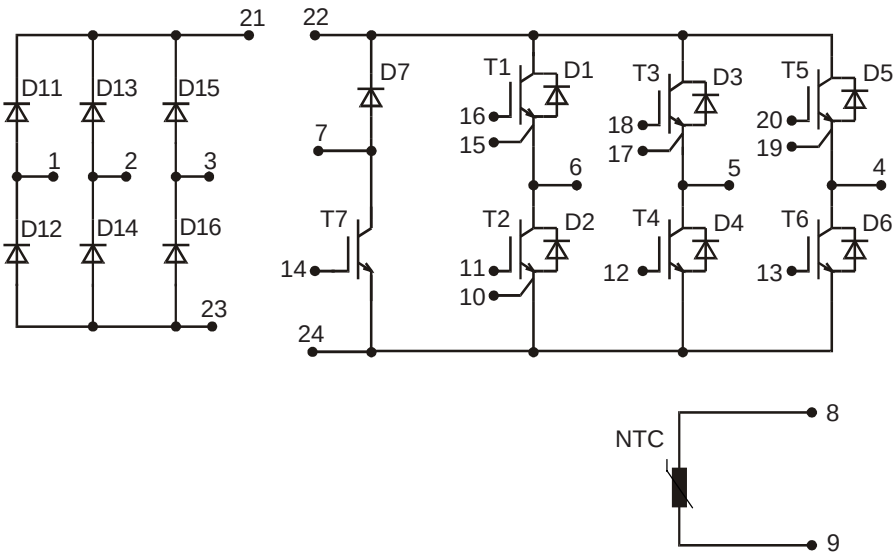
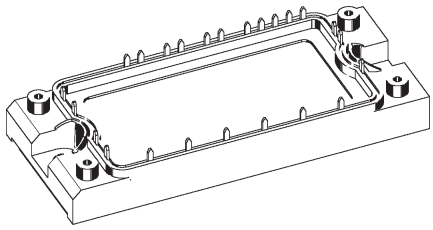


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 26 A	I_{C25} = 20 A	I_{C25} = 25 A
I_{FSM} = 160 A	$V_{CE(sat)}$ = 1.9 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	19	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	18	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	160	A
P_{tot}	T_C = 25°C	85	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 15 A; T_{VJ} = 25°C		1.4	1.6	V
	T_{VJ} = 125°C		1.4		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		1		mA
t_{rr}	V_R = 100 V; I_F = 10 A; di/dt = -10 A/µs		1		µs
R_{thJC}	(per diode)			1.47	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	25	A
I_{C80}	T_C = 80°C	18	A
RBSOA	V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 30 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	100	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		1.9	2.3	V
	T_{VJ} = 125°C		2.2		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.6	mA
	T_{VJ} = 125°C		0.4		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C		30		ns
t_r	V_{CE} = 300 V; I_C = 15 A		45		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 68 Ω		270		ns
t_f			40		ns
E_{on}			0.7		mJ
E_{off}			0.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		800		pF
Q_{Gon}	V_{CE}= 300V; V_{GE} = 15 V; I_C = 15 A		57		nC
R_{thJC}	(per IGBT)			1.3	K/W

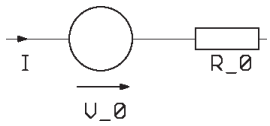
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	35	A
I_{F80}	T_C = 80°C	24	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; V_{GE} = 0 V; T_{VJ} = 25°C			2.0	V
	T_{VJ} = 125°C		1.3		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)			2.1	K/W

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.18 V; R_0 = 15 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.99 V; R_0 = 81 mΩ

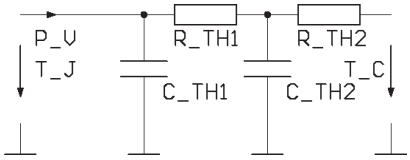
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.09V; R_0 = 12 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.89 V; R_0 = 122 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.07 V; R_0 = 23 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.093 J/K; R_{th1} = 1.212 K/W
C_{th2} = 0.778 J/K; R_{th2} = 0.258 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.077 J/K; R_{th1} = 1.111 K/W
C_{th2} = 0.732 J/K; R_{th2} = 0.279 K/W

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

T7 / D7

IGBT (typ.)
C_{th1} = 0.071 J/K; R_{th1} = 1.211 K/W
C_{th2} = 0.726 J/K; R_{th2} = 0.293 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \le V_{CES}$	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	85	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 10 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.9	2.3	V
	T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 10 A V_{GE} = ±15 V; R_G = 82 Ω		40		ns
t_r			40		ns
$t_{d(off)}$			230		ns
t_f			30		ns
E_{on}			0.4		mJ
E_{off}			0.3		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		600		pF
Q_{Gon}	V_{CE}= 300 V; V_{GE} = 15 V; I_C = 10 A		39		nC
R_{thJC}				1.5	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	20	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 10 A; T_{VJ} = 25°C			2.1	V
	T_{VJ} = 125°C		1.3		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V		80		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

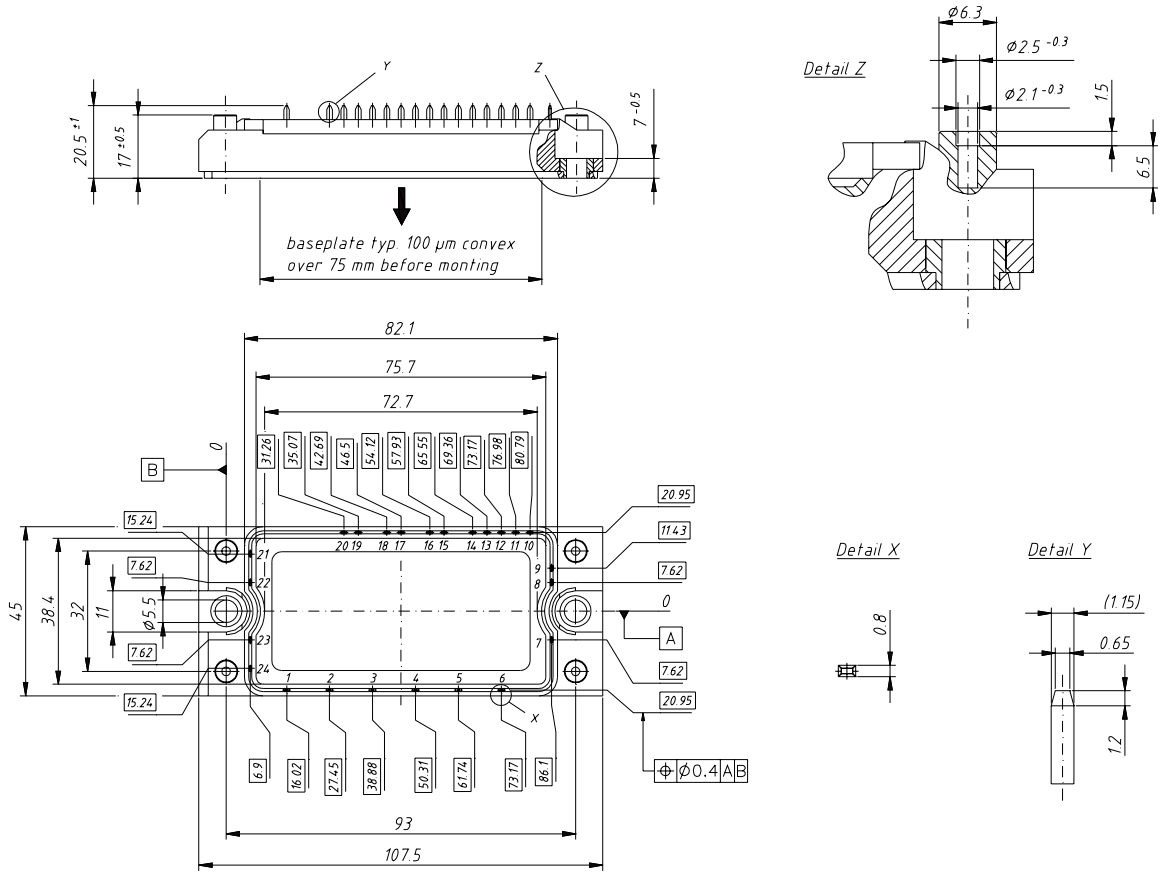
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

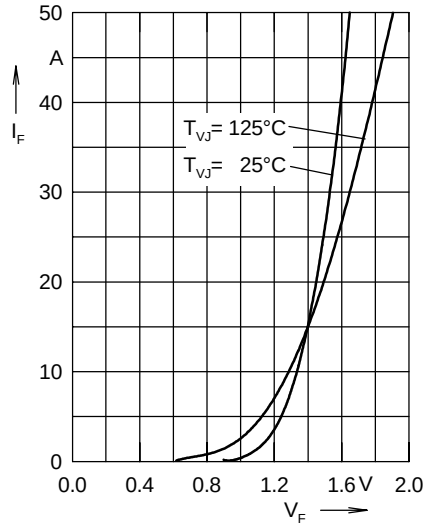


Fig. 1 Forward current versus voltage drop per diode

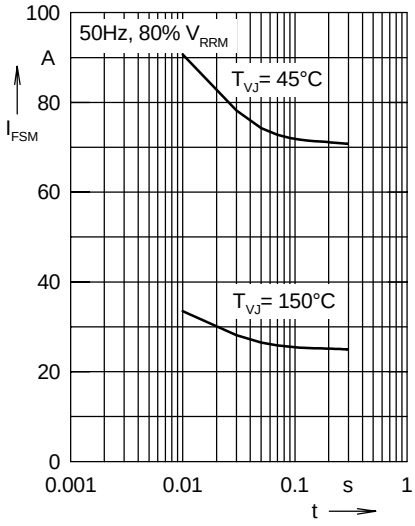


Fig. 2 Surge overload current

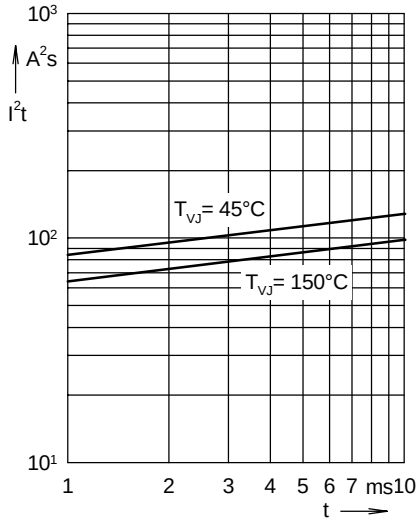


Fig. 3 I^2t versus time per diode

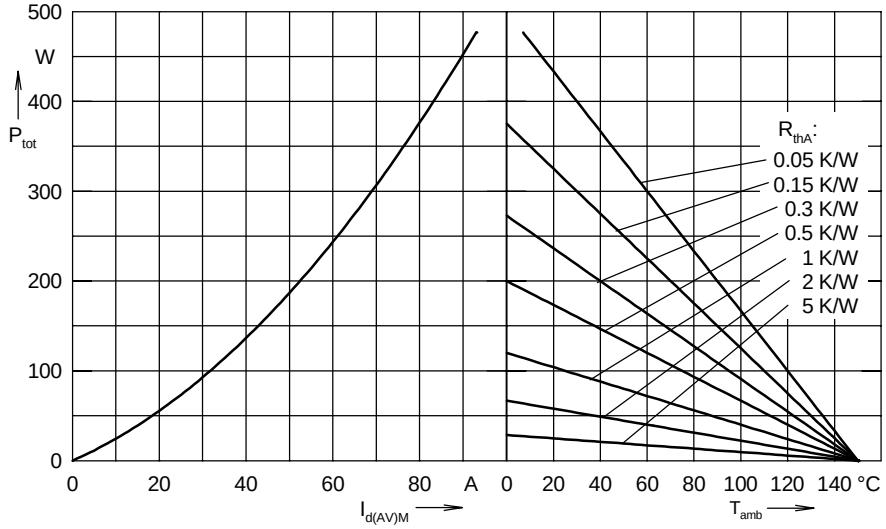


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

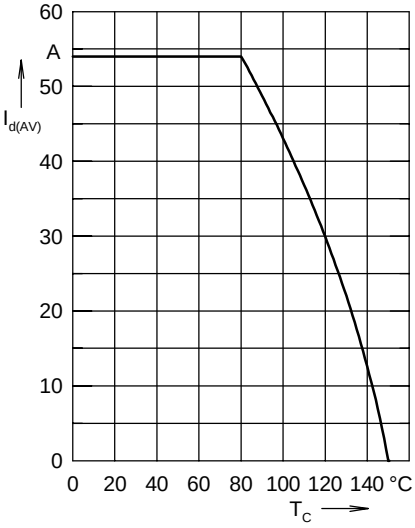


Fig. 5 Max. forward current versus case temperature

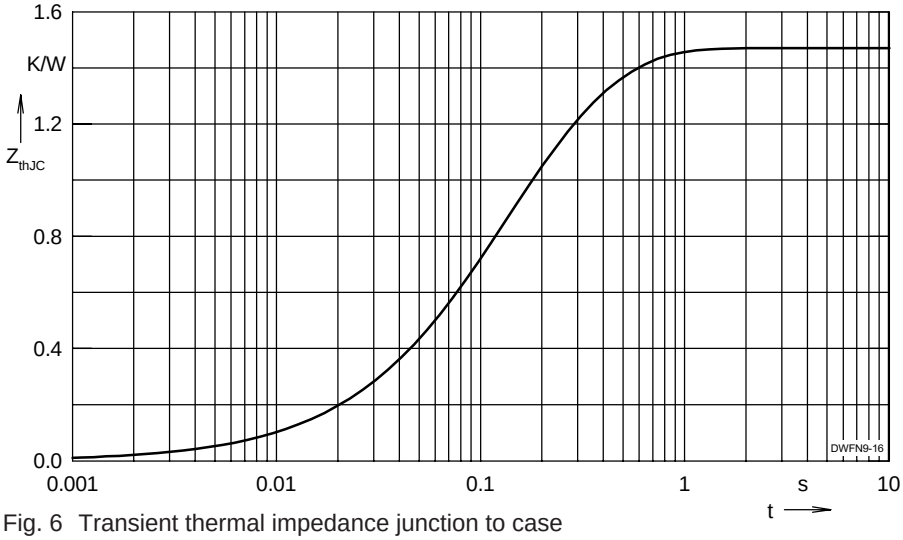


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

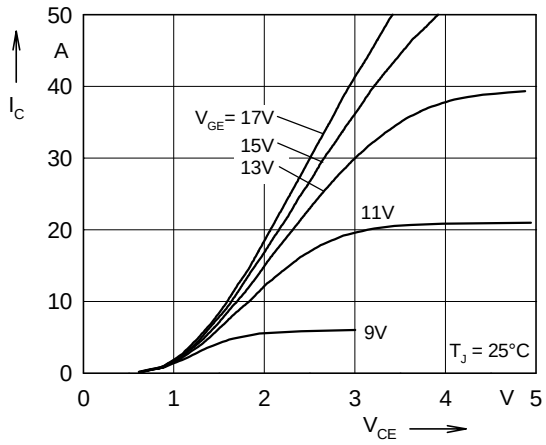


Fig. 7 Typ. output characteristics

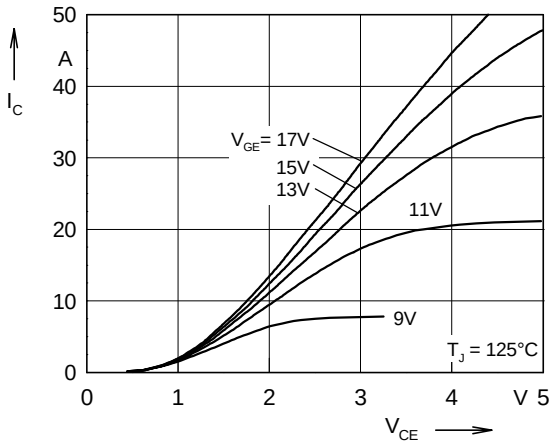


Fig. 8 Typ. output characteristics

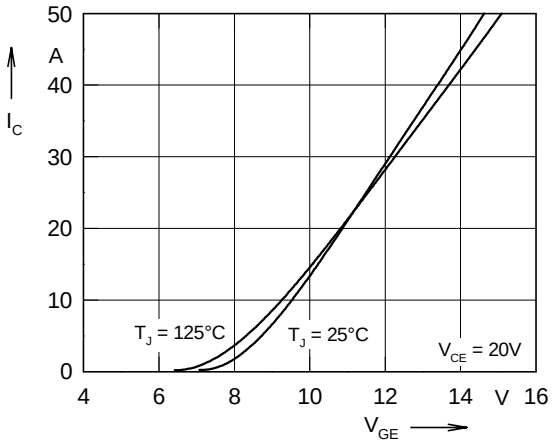


Fig. 9 Typ. transfer characteristics

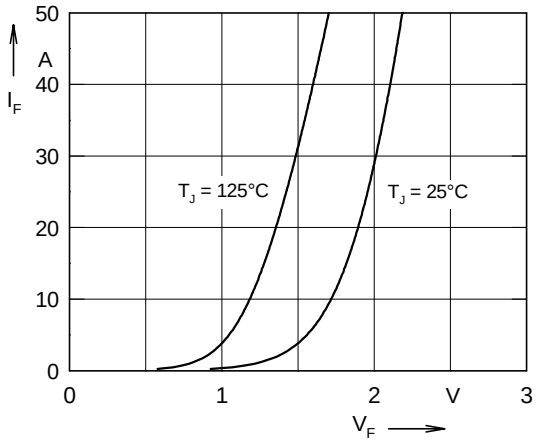


Fig. 10 Typ. forward characteristics of free wheeling diode

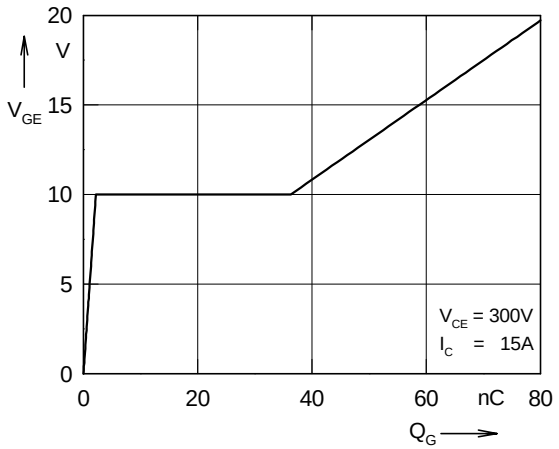


Fig. 11 Typ. turn on gate charge

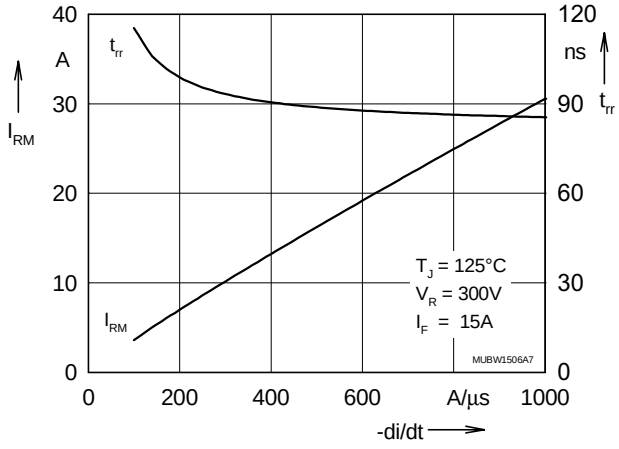


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

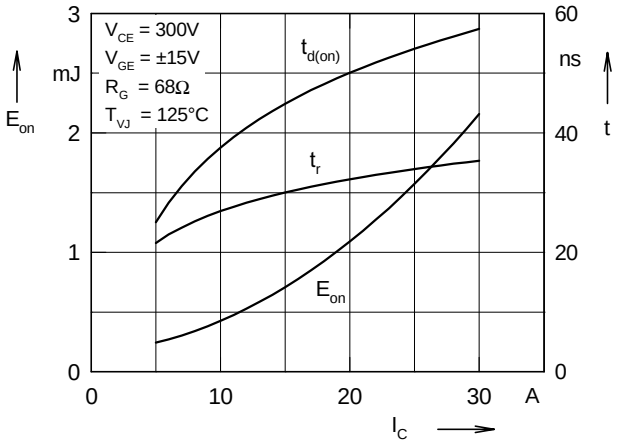


Fig. 13 Typ. turn on energy and switching times versus collector current

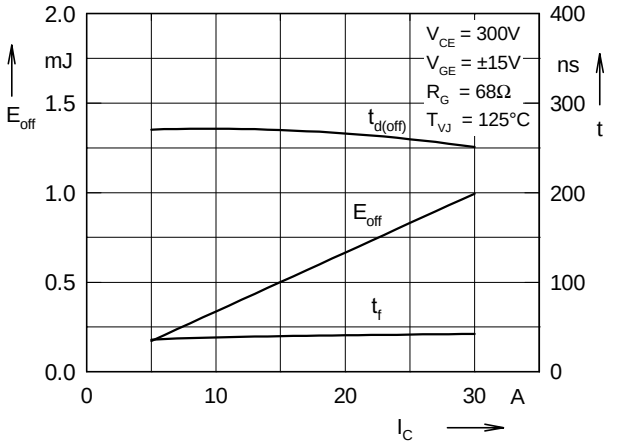


Fig. 14 Typ. turn off energy and switching times versus collector current

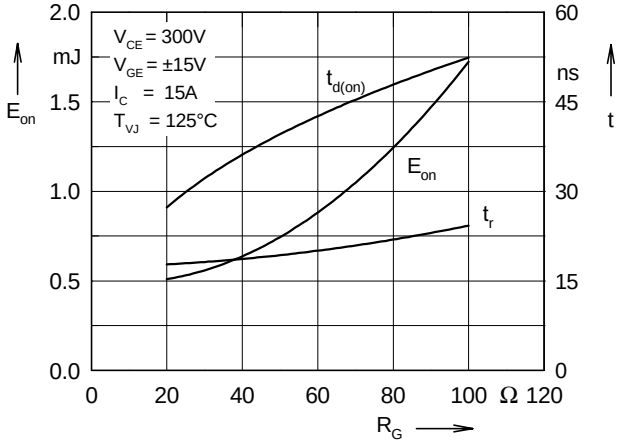


Fig. 15 Typ. turn on energy and switching times versus gate resistor

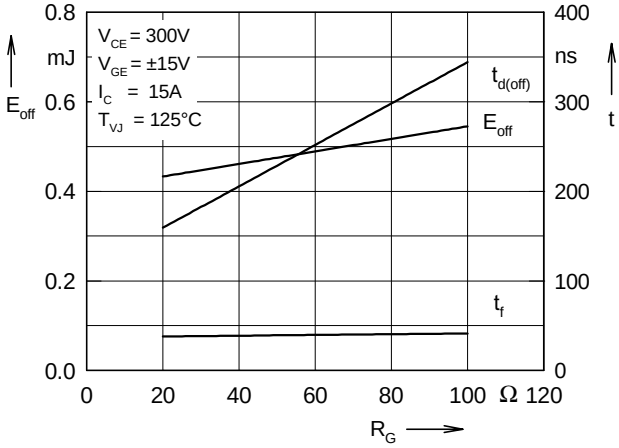


Fig.16 Typ. turn off energy and switching times versus gate resistor

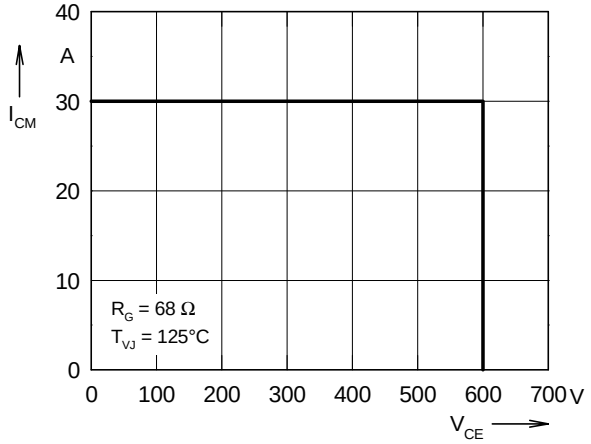


Fig. 17 Reverse biased safe operating area RBSOA

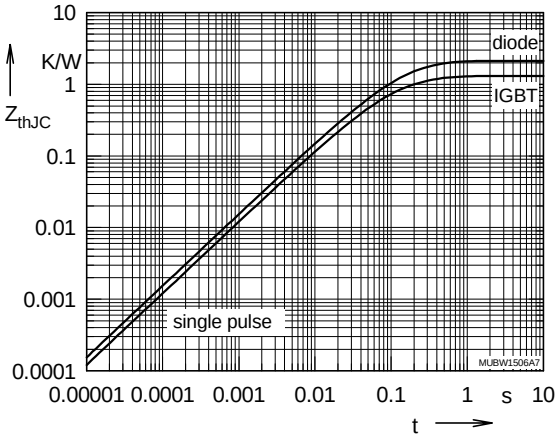


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

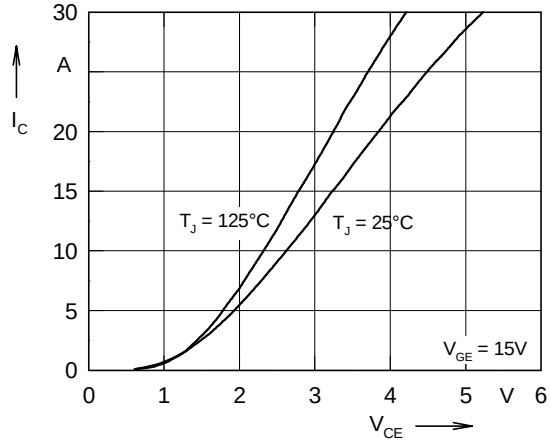


Fig. 19 Typ. output characteristics

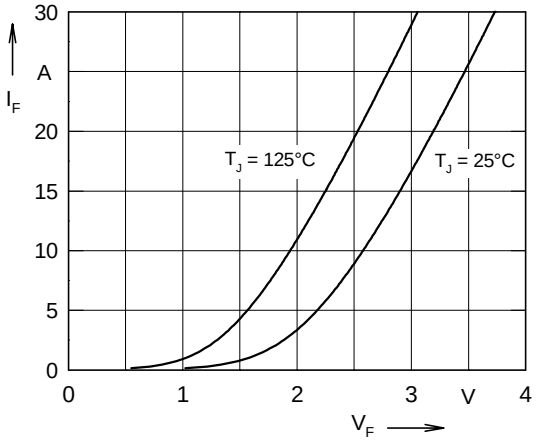


Fig. 20 Typ. forward characteristics of free wheeling diode

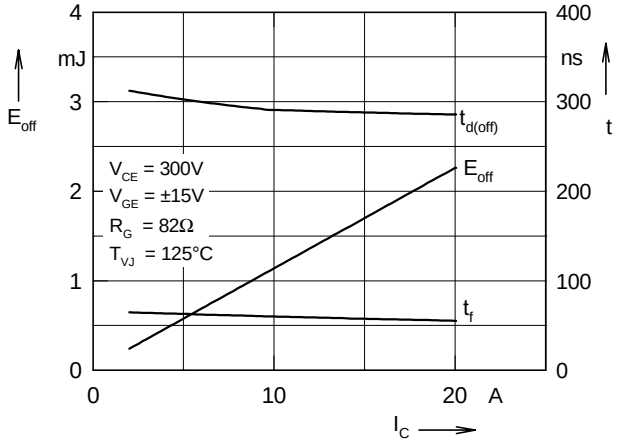


Fig. 21 Typ. turn off energy and switching times versus collector current

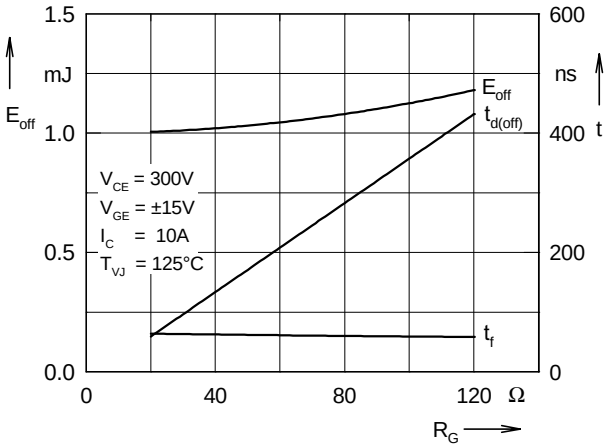


Fig. 22 Typ. turn off energy and switching times versus gate resistor

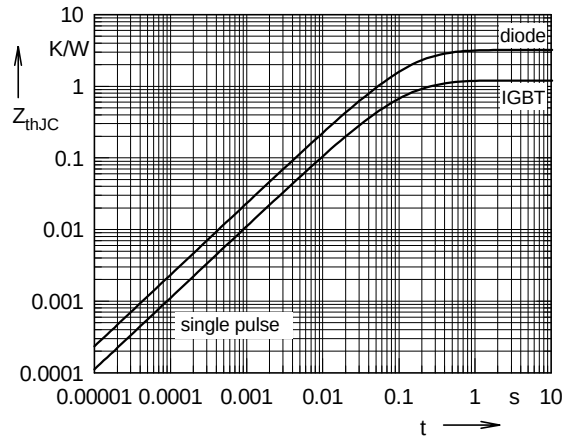


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

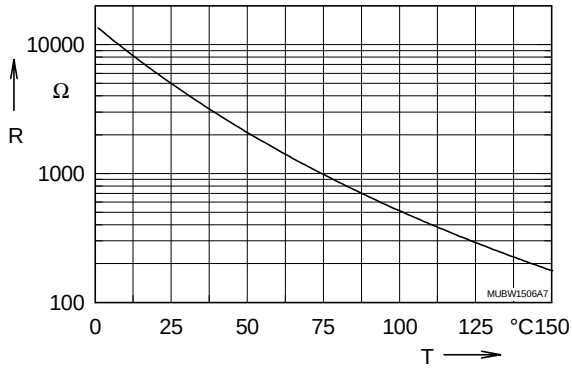
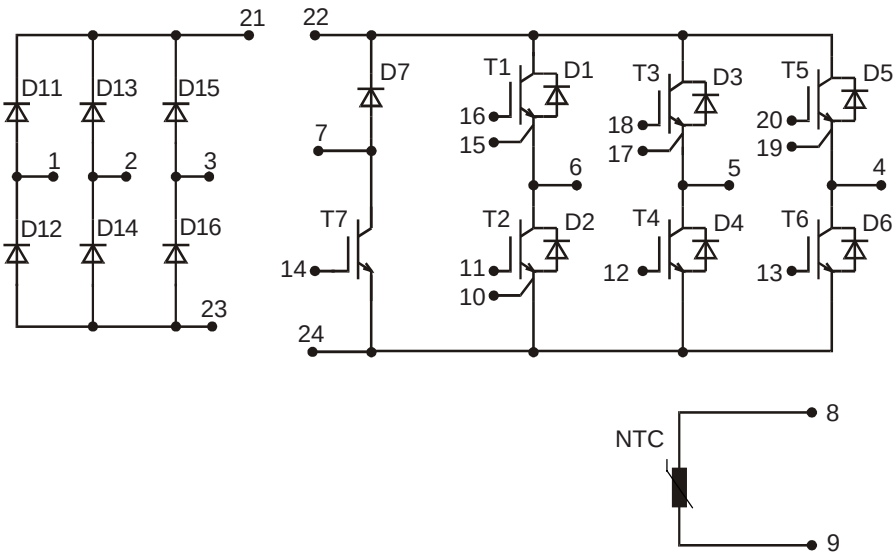
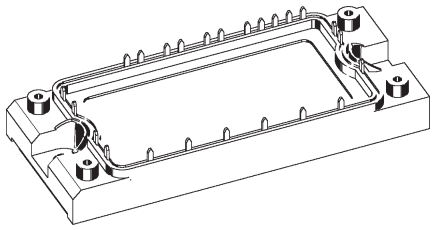


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 36 A	I_{C25} = 25 A	I_{C25} = 35 A
I_{FSM} = 300 A	$V_{CE(sat)}$ = 1.9 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	25	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	24	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	300	A
P_{tot}	T_C = 25°C	100	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 20 A; T_{VJ} = 25°C		1.4	1.6	V
	T_{VJ} = 125°C		1.3		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.15	mA
	T_{VJ} = 125°C		1.2		mA
t_{rr}	V_R = 100 V; I_F = 15 A; di/dt = -15 A/µs		1		µs
R_{thJC}	(per diode)			1.3	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	35	A
I_{C80}	T_C = 80°C	25	A
RBSOA	V_{GE} = ±15 V; R_G = 47 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 40 $V_{CEK} \le V_{CES}$	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	125	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 20 A; V_{GE} = 15 V; T_{VJ} = 25°C		1.9	2.3	V
	T_{VJ} = 125°C		2.2		V
$V_{GE(th)}$	I_C = 0.5 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.6	mA
	T_{VJ} = 125°C		0.4		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 = 20 A		55		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 47 Ω		300		ns
t_f			30		ns
E_{on}			0.92		mJ
E_{off}			0.68		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1100		pF
Q_{Gon}	V_{CE}= 300V; V_{GE} = 15 V; I_C = 20 A		65		nC
R_{thJC}	(per IGBT)			1	K/W

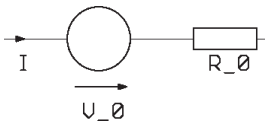
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	35	A
I_{F80}	T_C = 80°C	24	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 20 A; V_{GE} = 0 V; T_{VJ} = 25°C			2.1	V
	T_{VJ} = 125°C		1.4		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)			2.1	K/W

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.12V; R_0 = 0.11 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.9 V; R_0 = 65 mΩ

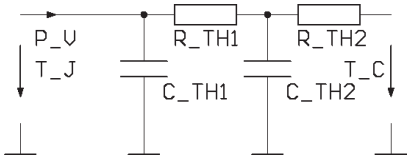
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.09 V; R_0 = 12 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.99 V; R_0 = 81 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.07 V; R_0 = 23 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.106 J/K; R_{th1} = 1.06 K/W
C_{th2} = 0.79 J/K; R_{th2} = 0.239 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.108 J/K; R_{th1} = 0.79 K/W
C_{th2} = 0.921 J/K; R_{th2} = 0.209 K/W

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

T7 / D7

IGBT (typ.)
C_{th1} = 0.077 J/K; R_{th1} = 1.111 K/W
C_{th2} = 0.732 J/K; R_{th2} = 0.279 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	25	A
I_{C80}	T_C = 80°C	18	A
RBSOA	V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 30 $V_{CEK} \leq V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	90	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		1.9	2.3	V
	T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω		30		ns
t_r			50		ns
$t_{d(off)}$			270		ns
t_f			40		ns
E_{on}			0.7		mJ
E_{off}			0.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		800		pF
Q_{Gon}	V_{CE}= 300 V; V_{GE} = 15 V; I_C = 15 A		57		nC
R_{thJC}				1.39	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	22	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; T_{VJ} = 25°C			2.2	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V		80		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

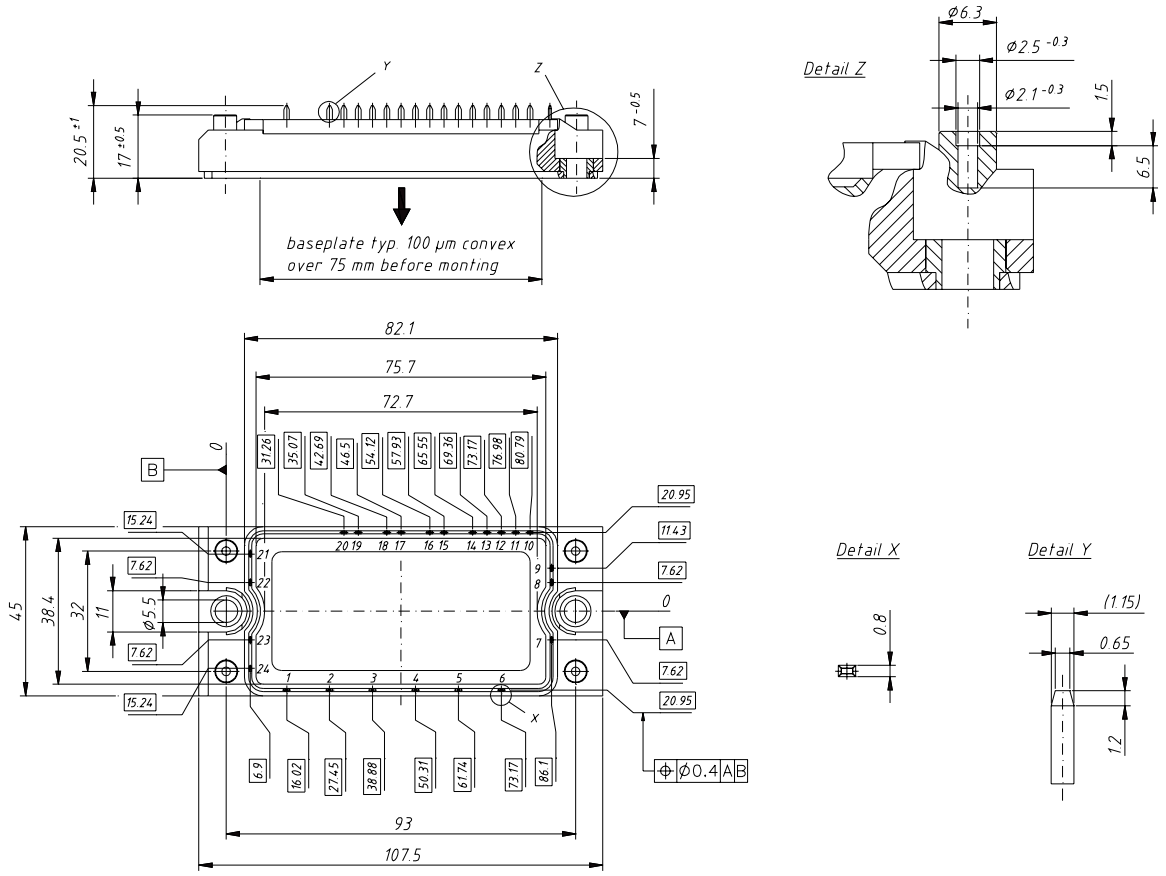
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

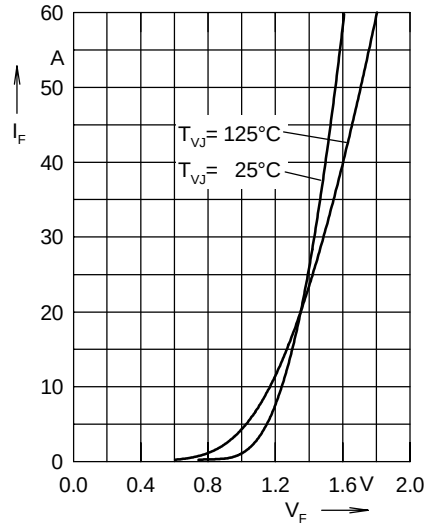


Fig. 1 Forward current versus voltage drop per diode

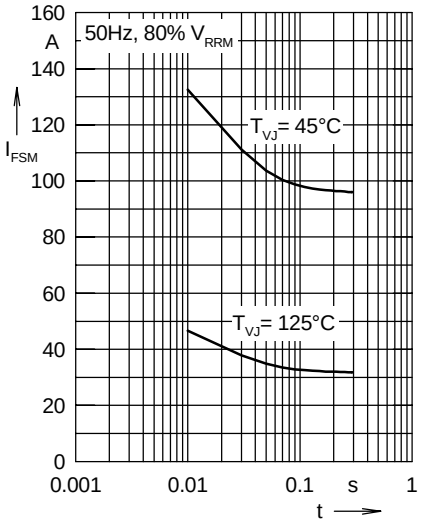


Fig. 2 Surge overload current

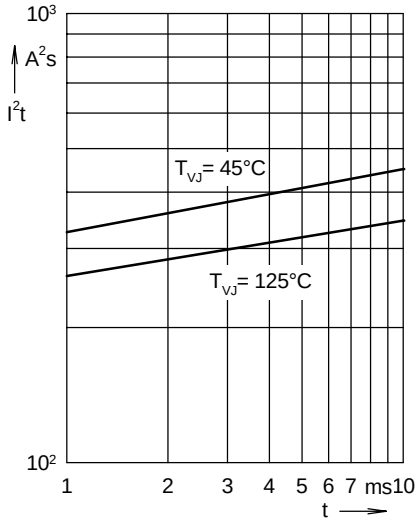


Fig. 3 I^2t versus time per diode

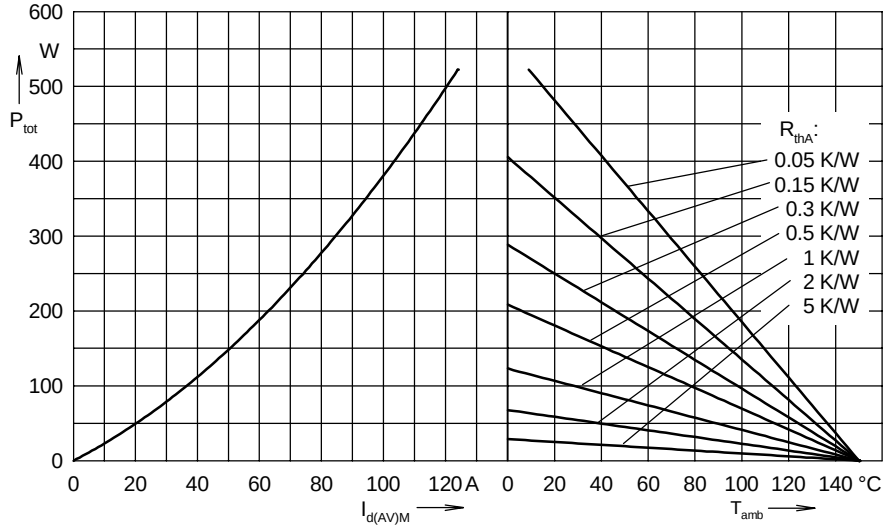


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

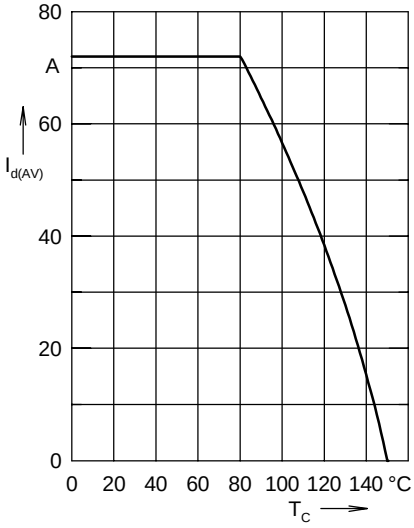


Fig. 5 Max. forward current versus case temperature

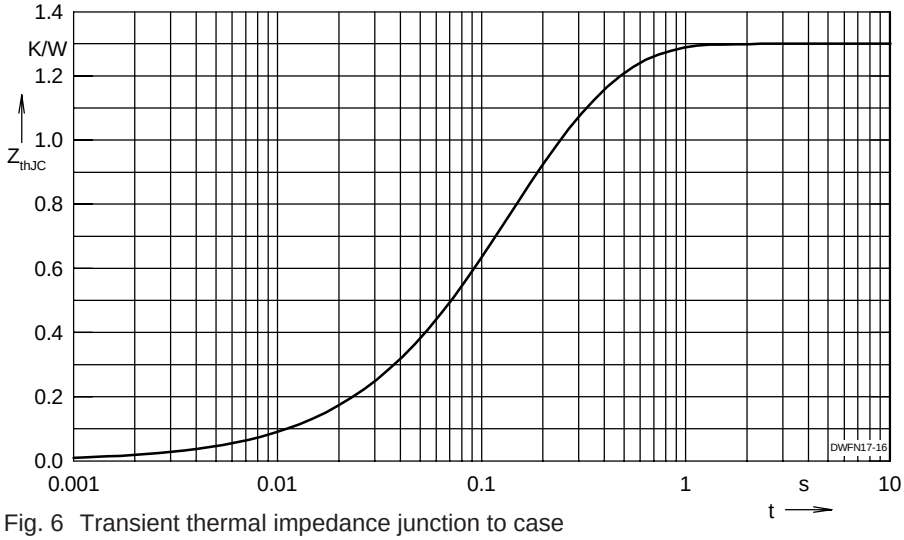


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

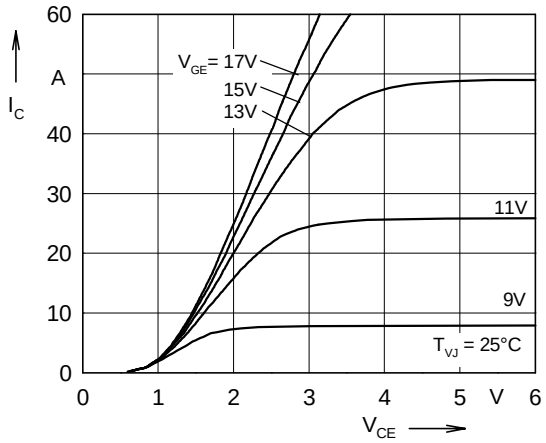


Fig. 7 Typ. output characteristics

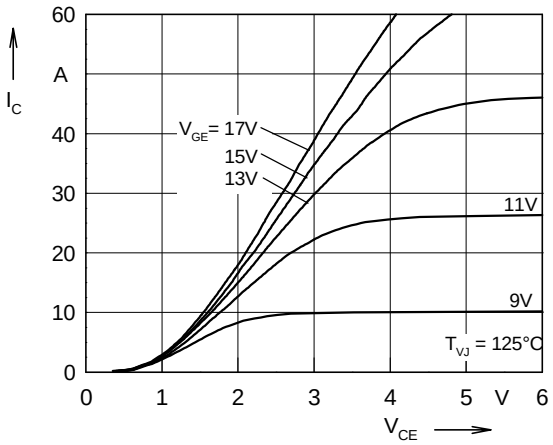


Fig. 8 Typ. output characteristics

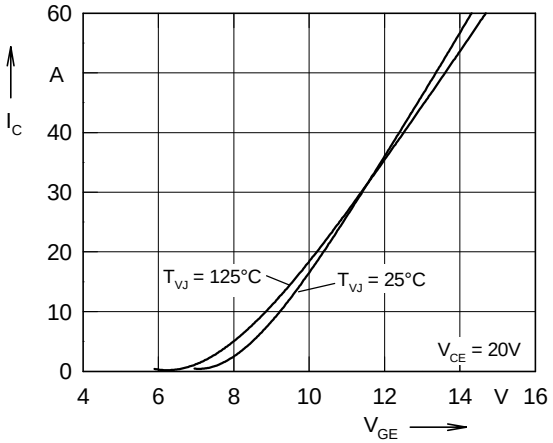


Fig. 9 Typ. transfer characteristics

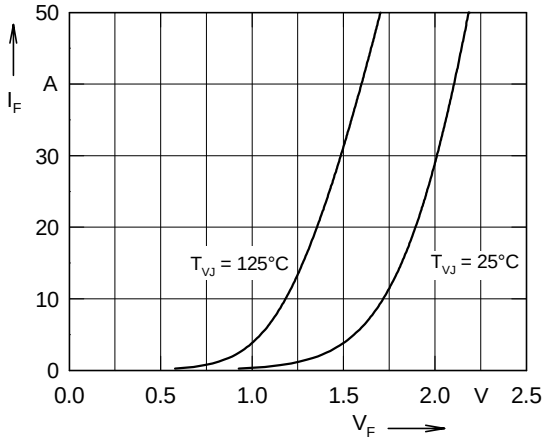


Fig. 10 Typ. forward characteristics of free wheeling diode

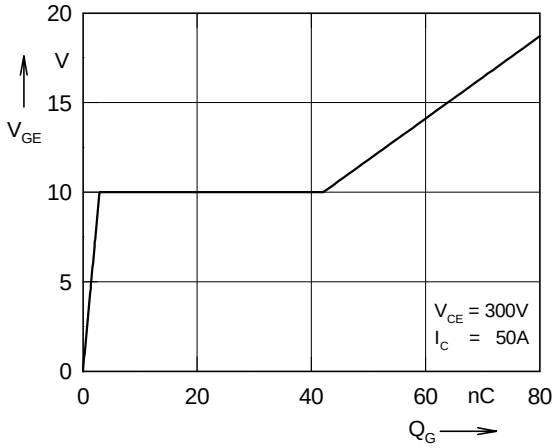


Fig. 11 Typ. turn on gate charge

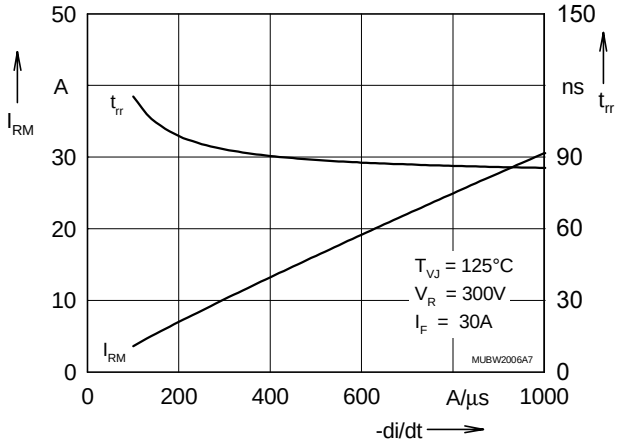


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

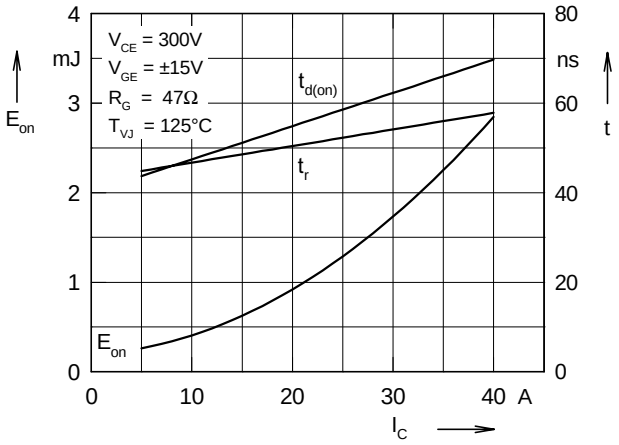


Fig. 13 Typ. turn on energy and switching times versus collector current

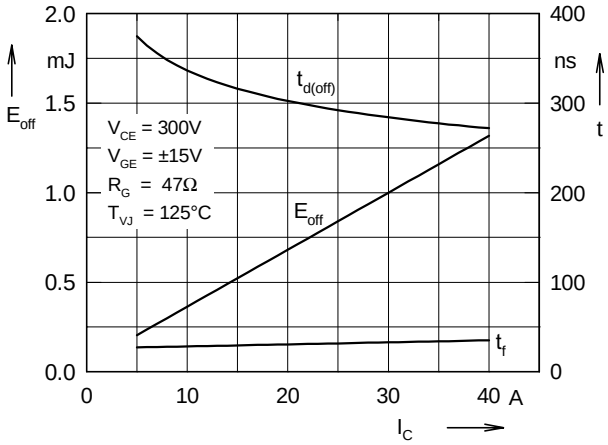


Fig. 14 Typ. turn off energy and switching times versus collector current

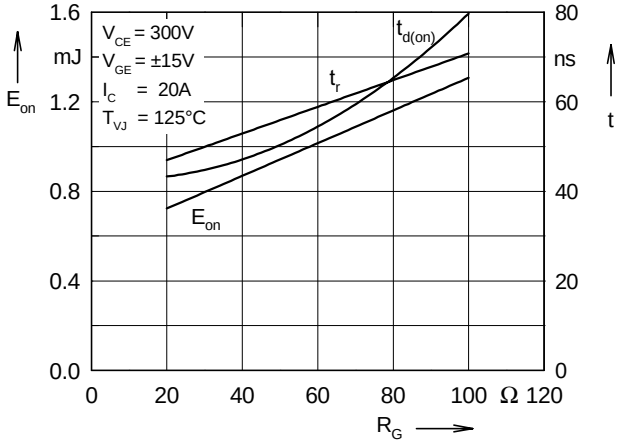


Fig. 15 Typ. turn on energy and switching times versus gate resistor

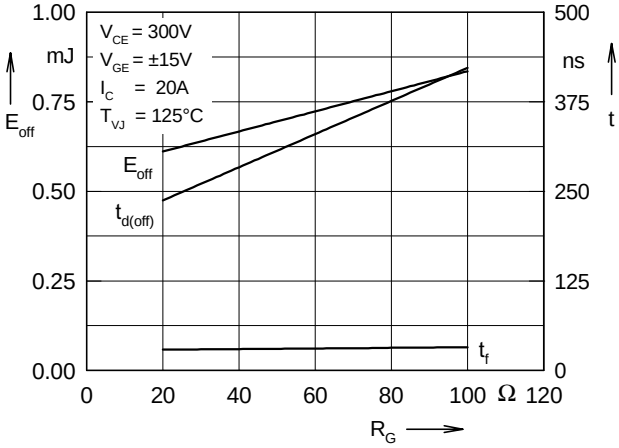


Fig.16 Typ. turn off energy and switching times versus gate resistor

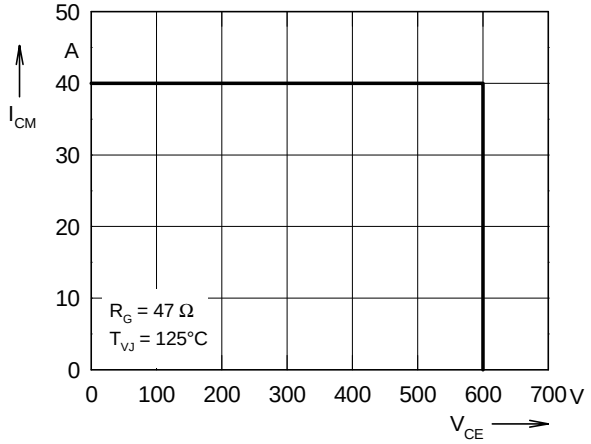


Fig. 17 Reverse biased safe operating area RBSOA

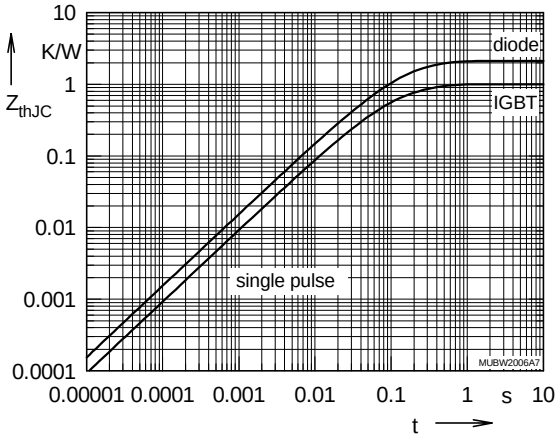


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

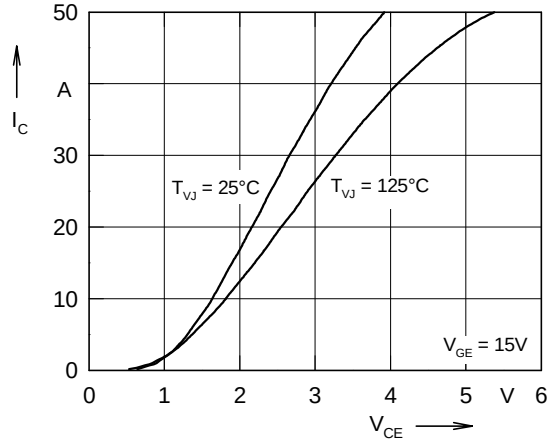


Fig. 19 Typ. output characteristics

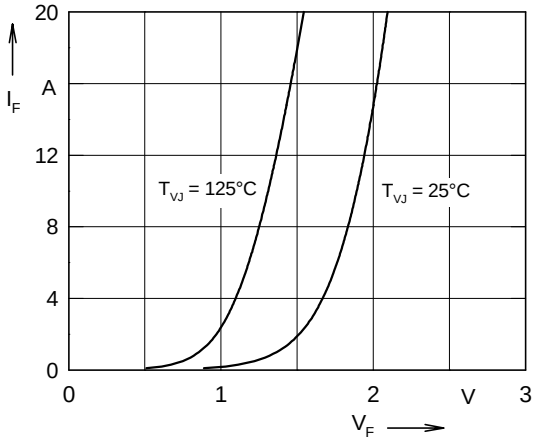


Fig. 20 Typ. forward characteristics of free wheeling diode

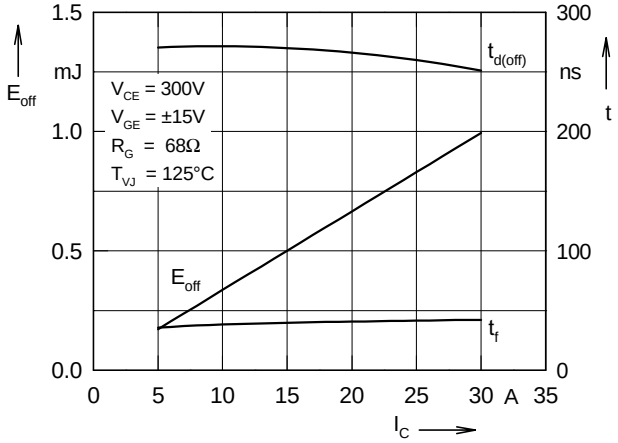


Fig. 21 Typ. turn off energy and switching times versus collector current

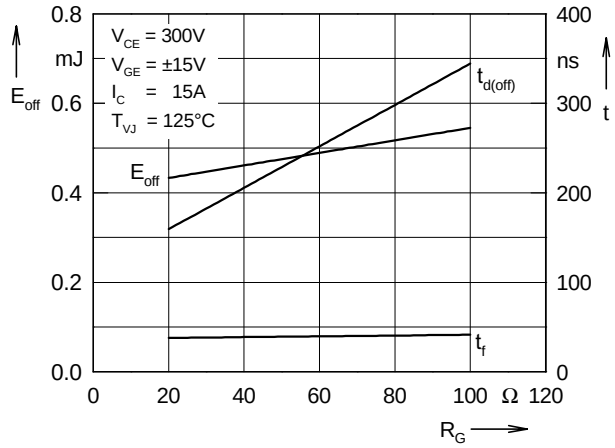


Fig. 22 Typ. turn off energy and switching times versus gate resistor

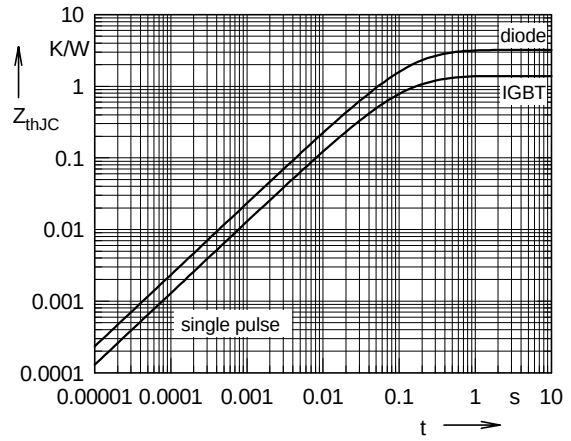


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

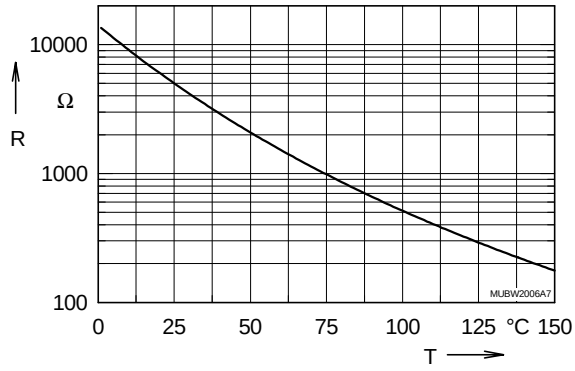
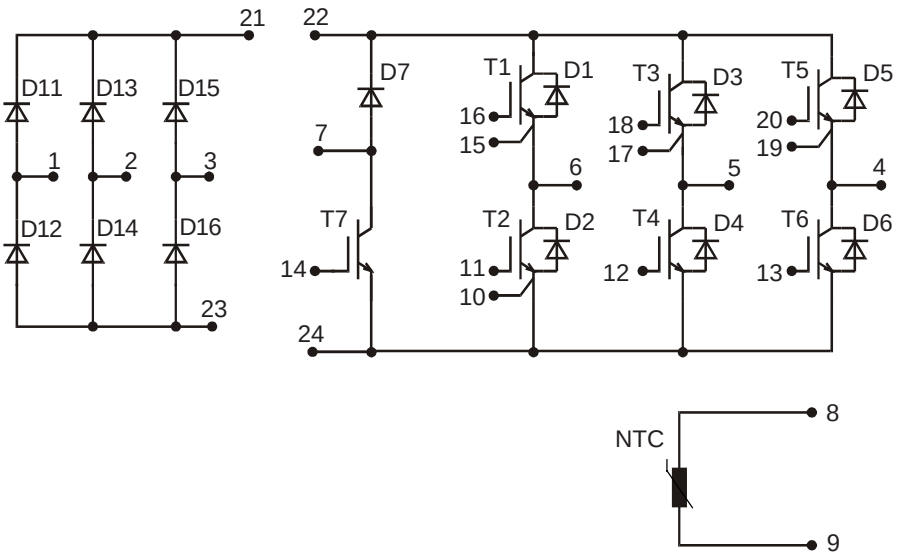
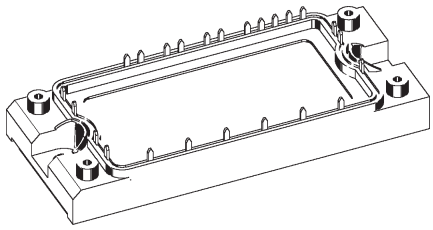


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 36 A	I_{C25} = 26 A	I_{C25} = 50A
I_{FSM} = 300 A	$V_{CE(sat)}$ = 1.9 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	25	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	24	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	300	A
P_{tot}	T_C = 25°C	100	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 30 A; T_{VJ} = 25°C		1.5	1.7	V
	T_{VJ} = 125°C		1.4		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.15	mA
	T_{VJ} = 125°C		1.2		mA
t_{rr}	V_R = 100 V; I_F = 15 A; di/dt = -15 A/µs		1		µs
R_{thJC}	(per diode)			1.3	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	50	A
I_{C80}	T_C = 80°C	35	A
RBSOA	V_{GE} = ±15 V; R_G = 33 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 60 $V_{CEK} \le V_{CES}$	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	180	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	2.3	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		0.4		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		94		nC
R_{thJC}	(per IGBT)			0.7	K/W

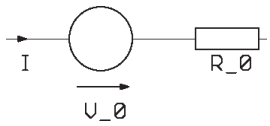
Output Inverter D1 - D6

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 = 30 A; V_{GE} = 0 V; T_{VJ} = 25°C			1.6	V
	T_{VJ} = 125°C		1.2		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

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.19 V; R_0 = 9 mΩ

T1 - T6 / D1 - D6

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

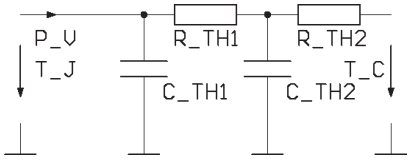
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 0.89 V; R_0 = 8 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.99 V; R_0 = 81 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.07 V; R_0 = 23 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.106 J/K; R_{th1} = 1.06 K/W
C_{th2} = 0.79 J/K; R_{th2} = 0.239 K/W

T1 - T6 / D1 - D6

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} = 0.116 J/K; R_{th1} = 0.973 K/W
C_{th2} = 0.88 J/K; R_{th2} = 0.217 K/W

T7 / D7

IGBT (typ.)
C_{th1} = 0.077 J/K; R_{th1} = 1.111 K/W
C_{th2} = 0.732 J/K; R_{th2} = 0.279 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	26	A
I_{C80}	T_C = 80°C	19	A
RBSOA	V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 30 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = V_{CES}; V_{GE} = ±15 V; R_G = 68 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	95	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		1.9	2.3	V
	T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 15 A V_{GE} = ±15 V; R_G = 68 Ω		30		ns
t_r			50		ns
$t_{d(off)}$			270		ns
t_f			40		ns
E_{on}			0.7		mJ
E_{off}			0.5		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		800		pF
Q_{Gon}	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 15 A		57		nC
R_{thJC}				1.3	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	22	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; T_{VJ} = 25°C			2.2	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V		80		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

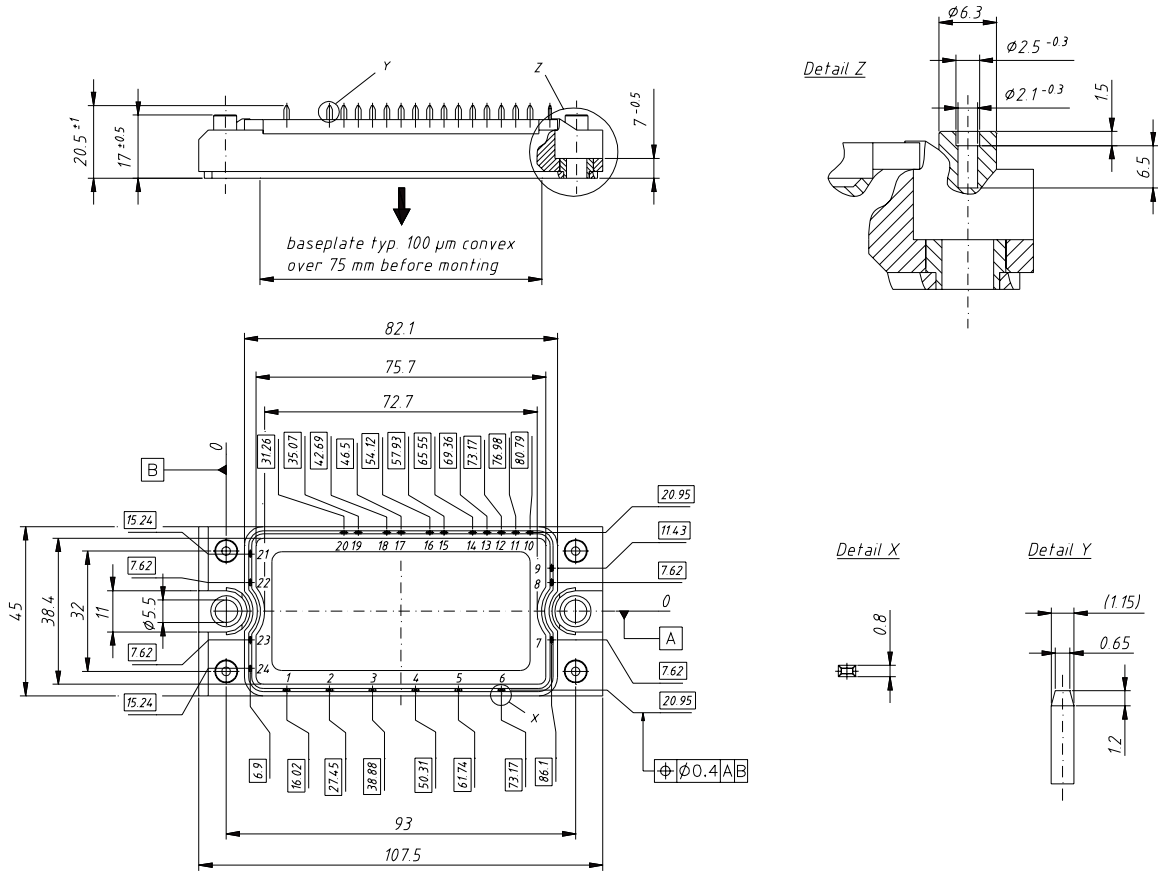
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

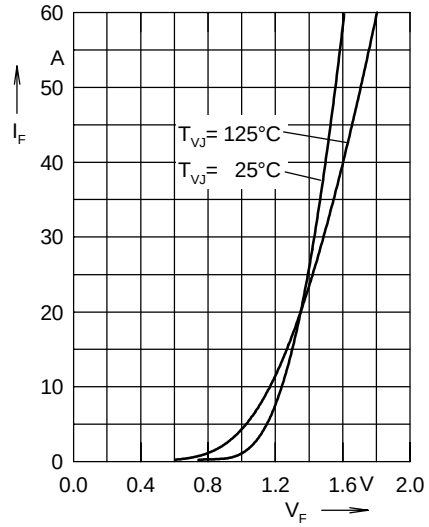


Fig. 1 Forward current versus voltage drop per diode

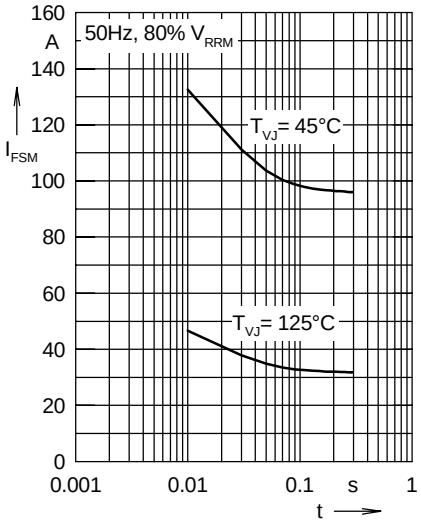


Fig. 2 Surge overload current

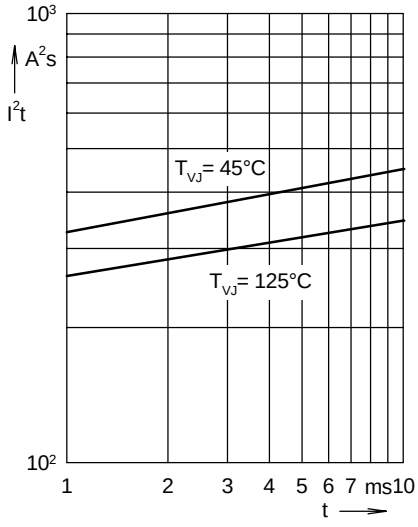


Fig. 3 I^2t versus time per diode

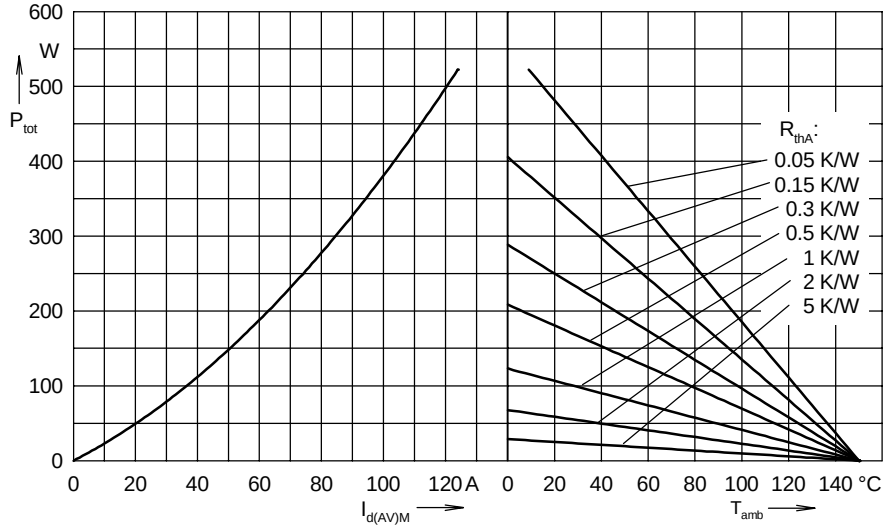


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

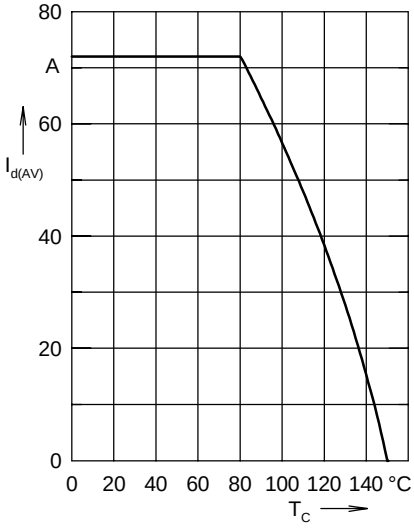


Fig. 5 Max. forward current versus case temperature

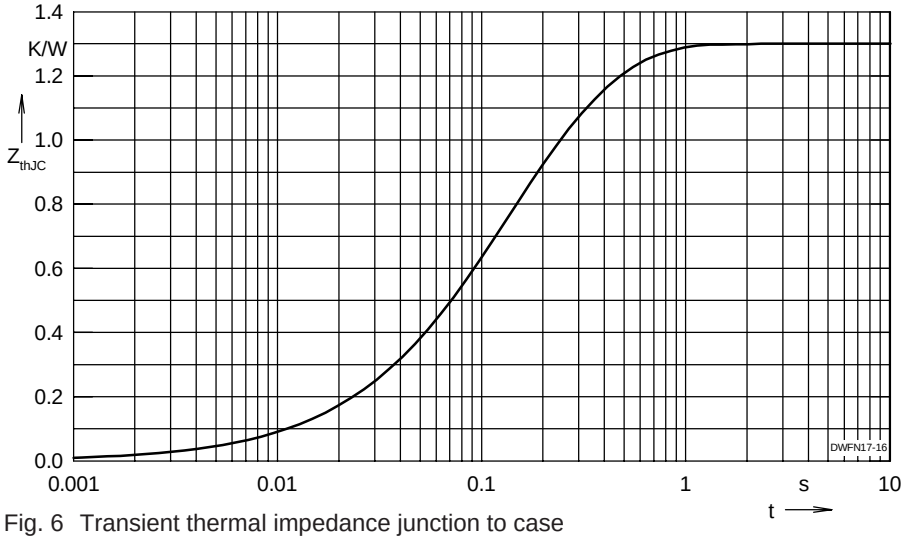


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

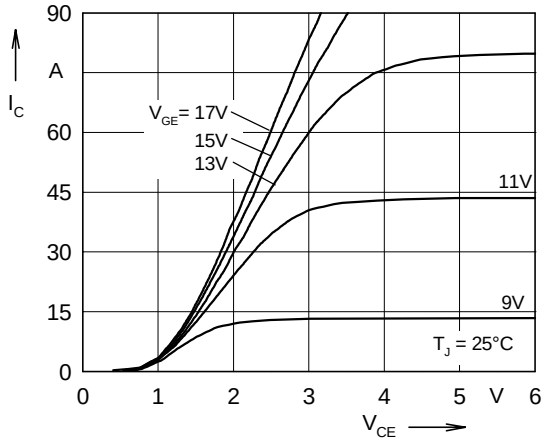


Fig. 7 Typ. output characteristics

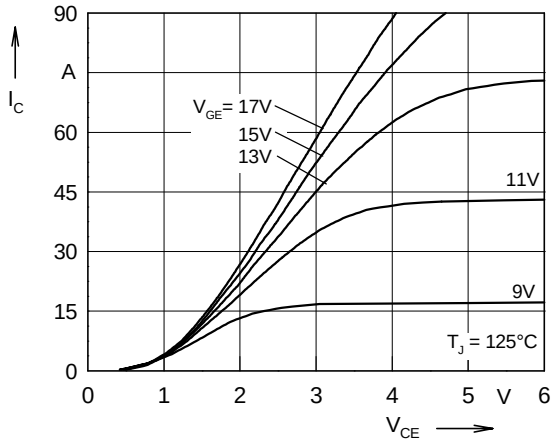


Fig. 8 Typ. output characteristics

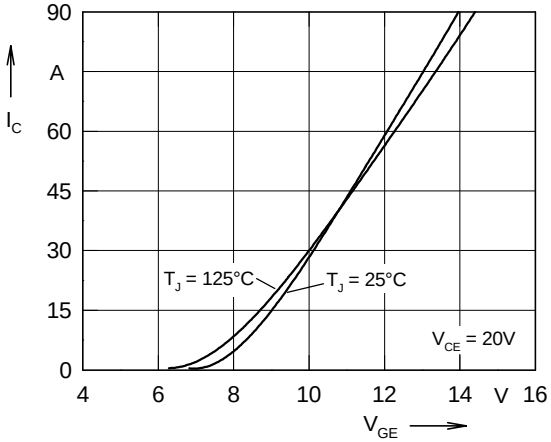


Fig. 9 Typ. transfer characteristics

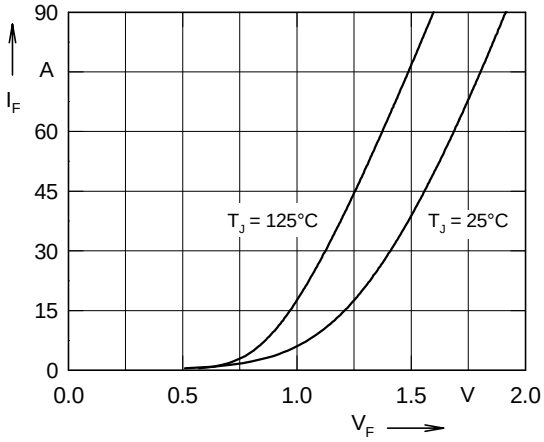


Fig. 10 Typ. forward characteristics of free wheeling diode

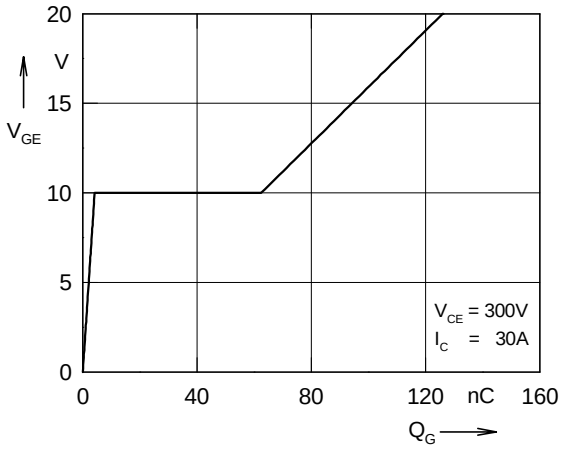


Fig. 11 Typ. turn on gate charge

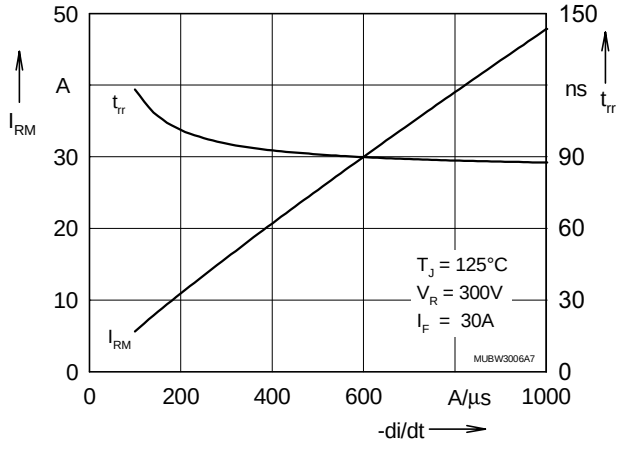


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

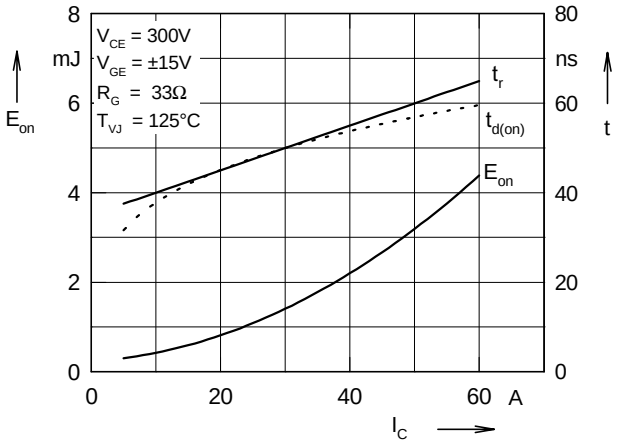


Fig. 13 Typ. turn on energy and switching times versus collector current

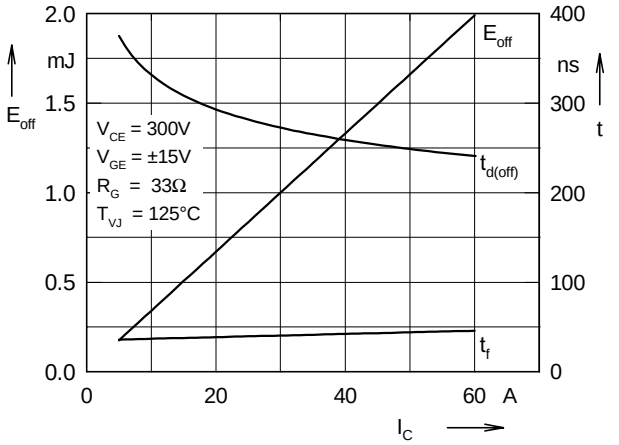


Fig. 14 Typ. turn off energy and switching times versus collector current

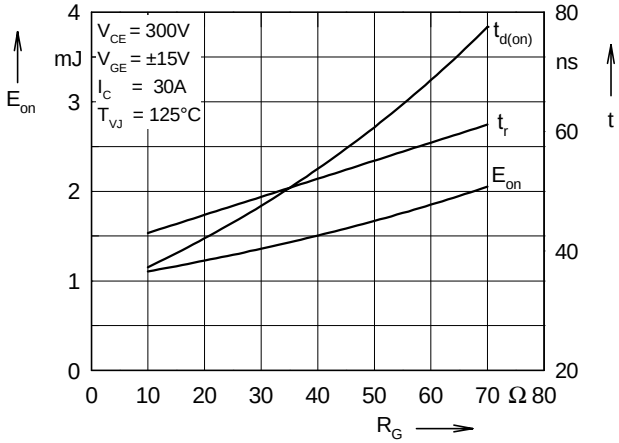


Fig. 15 Typ. turn on energy and switching times versus gate resistor

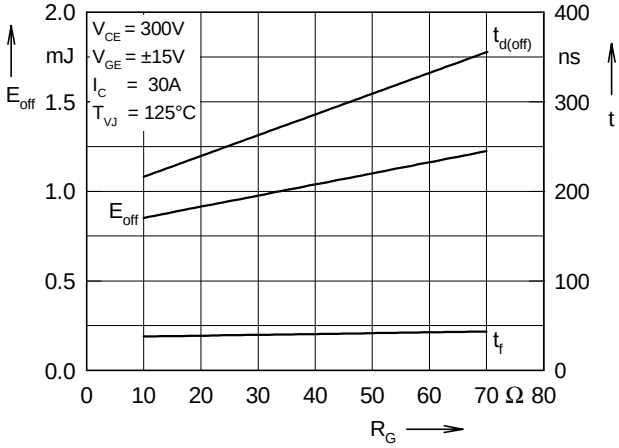


Fig.16 Typ. turn off energy and switching times versus gate resistor

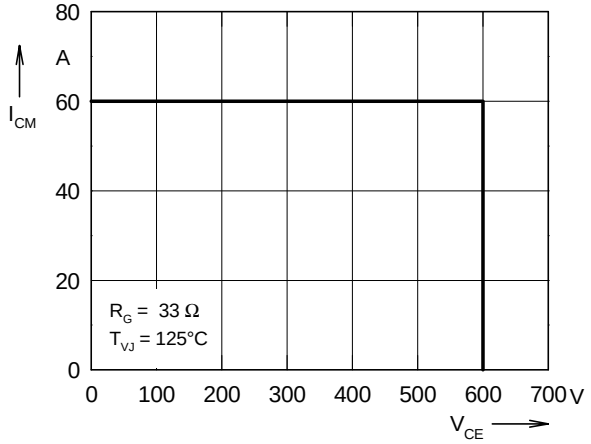


Fig. 17 Reverse biased safe operating area RBSOA

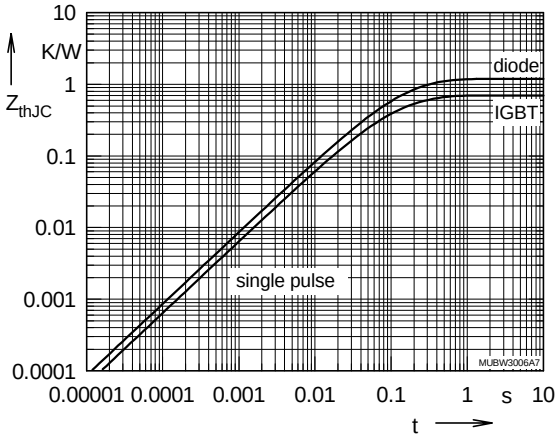


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

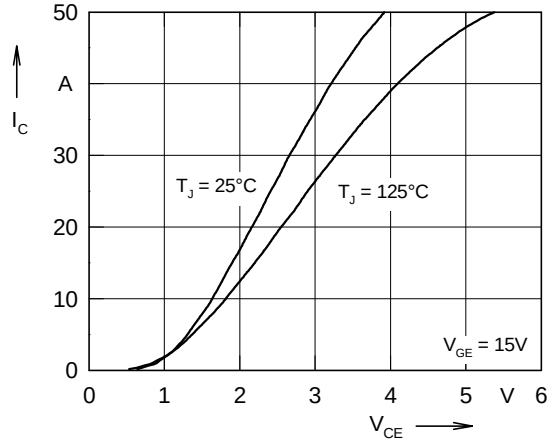


Fig. 19 Typ. output characteristics

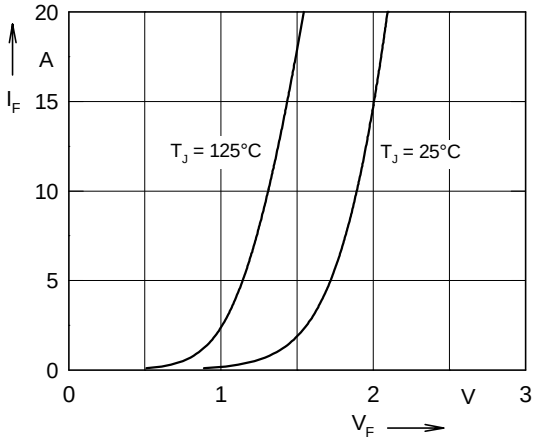


Fig. 20 Typ. forward characteristics of free wheeling diode

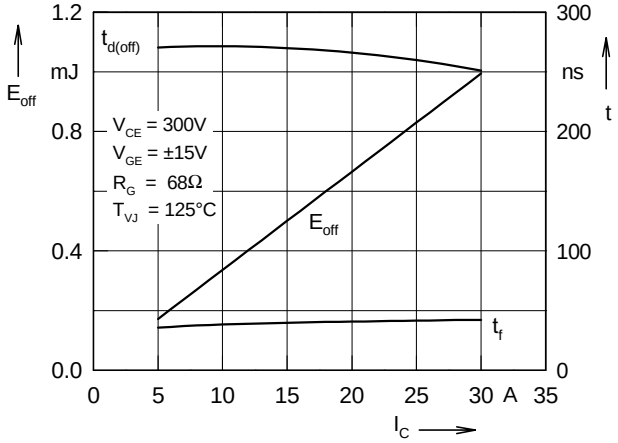


Fig. 21 Typ. turn off energy and switching times versus collector current

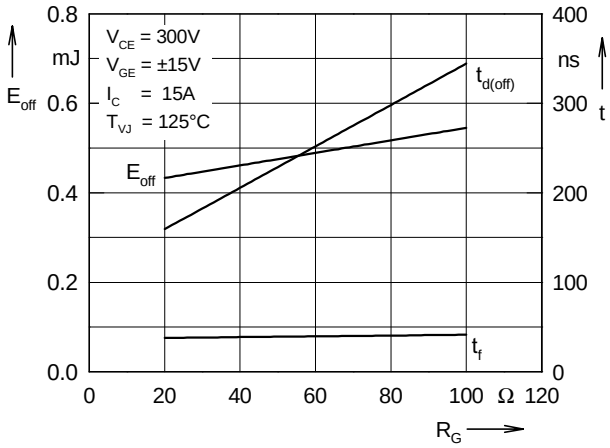


Fig. 22 Typ. turn off energy and switching times versus gate resistor

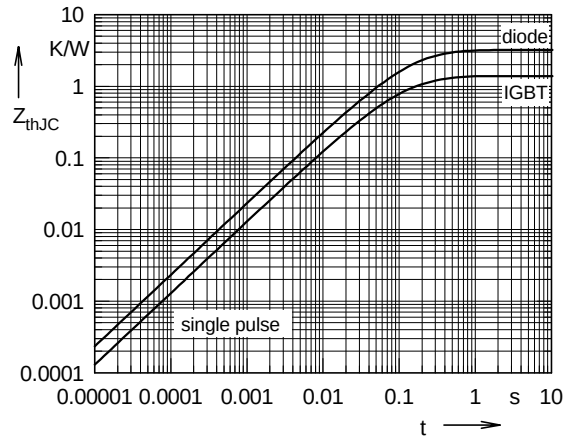


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

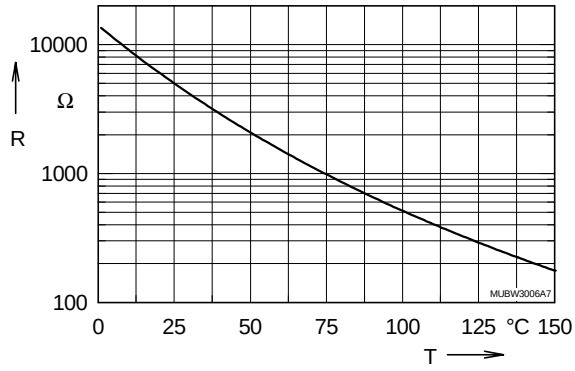
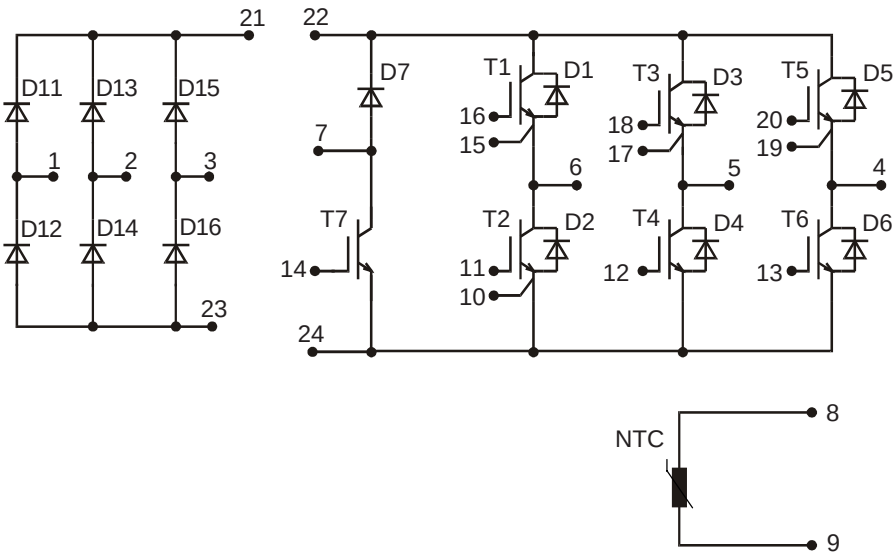
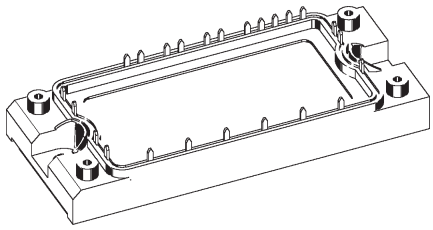


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 44 A	I_{C25} = 35 A	I_{C25} = 75 A
I_{FSM} = 400 A	$V_{CE(sat)}$ = 2.1 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	30	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	29	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	400	A
P_{tot}	T_C = 25°C	120	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 50 A; T_{VJ} = 25°C		1.5	1.8	V
	T_{VJ} = 125°C		1.6		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2		mA
t_{rr}	V_R = 100 V; I_F = 20 A; di/dt = -20 A/µs		1		µs
R_{thJC}	(per diode)			1.06	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	75	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} = 100 $V_{CEK} \le V_{CES}$	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	250	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			0.8	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		50		ns
t_r	V_{CE} = 300 V; I_C = 50 A		55		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 22 Ω		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)			0.5	K/W

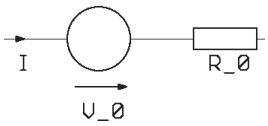
Output Inverter D1 - D6

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			1.8	V
	T_{VJ} = 125°C		1.3		V
I_{RM}	I_F = 25 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

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.0 V; R_0 = 12 mΩ

T1 - T6 / D1 - D6

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

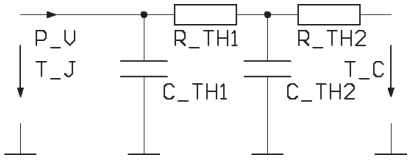
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 0.89 V; R_0 = 8 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 0.9 V; R_0 = 65 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.07 V; R_0 = 23 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.131 J/K; R_{th1} = 0.851 K/W
C_{th2} = 0.839 J/K; R_{th2} = 0.209 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.221 J/K; R_{th1} = 0.382 K/W
C_{th2} = 1.377 J/K; R_{th2} = 0.119 K/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

T7 / D7

IGBT (typ.)
C_{th1} = 0.108 J/K; R_{th1} = 0.79 K/W
C_{th2} = 0.921 J/K; R_{th2} = 0.209 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	35	A
I_{C80}	T_C = 80°C	25	A
RBSOA	V_{GE} = ±15 V; R_G = 47 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 40 $V_{CEK} \le V_{CES}$	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	125	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		2.1	2.6	V
	T_{VJ} = 125°C		2.4		V
$V_{GE(th)}$	I_C = 0.5 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		mA
I_{GES}	V_{CE} = 0 V; V_{GE} = ± 20 V			200	nA
$t_{d(on)}$	Inductive load, T_{VJ} = 125°C V_{CE} = 300 V; I_C = 25 A V_{GE} = ±15 V; R_G = 47 Ω		50		ns
t_r			60		ns
$t_{d(off)}$			300		ns
t_f			30		ns
E_{on}			1.15		mJ
E_{off}			0.85		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1100		pF
Q_{Gon}	V_{CE} = 300 V; V_{GE} = 15 V; I_C = 25 A		65		nC
R_{thJC}				1.0	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	22	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 25 A; T_{VJ} = 25°C			2.5	V
	T_{VJ} = 125°C		1.8		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V		80		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

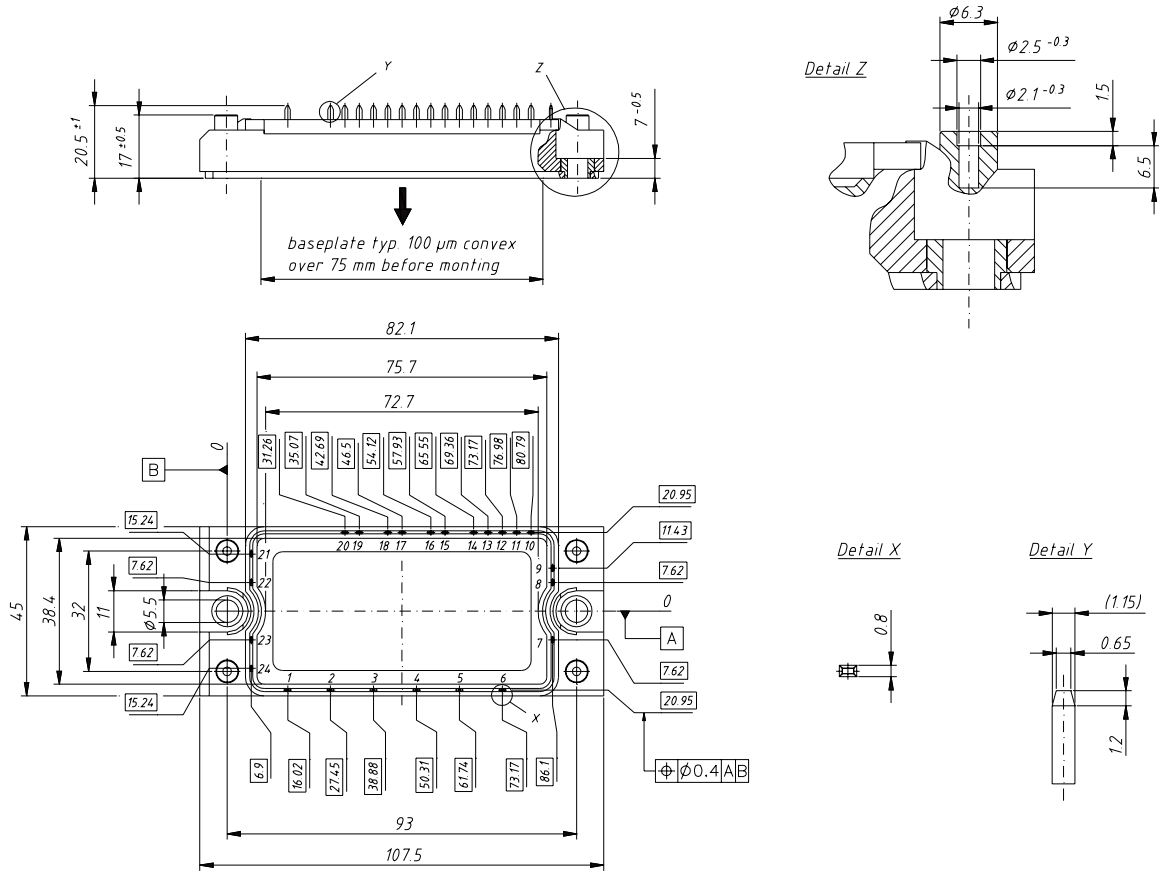
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

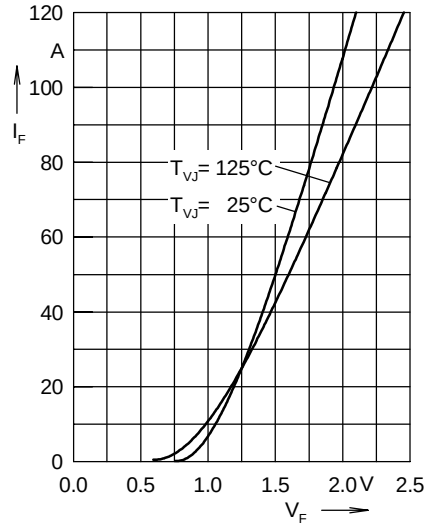


Fig. 1 Forward current versus voltage drop per diode

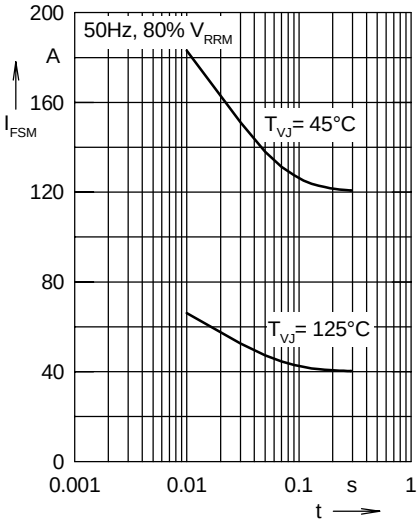


Fig. 2 Surge overload current

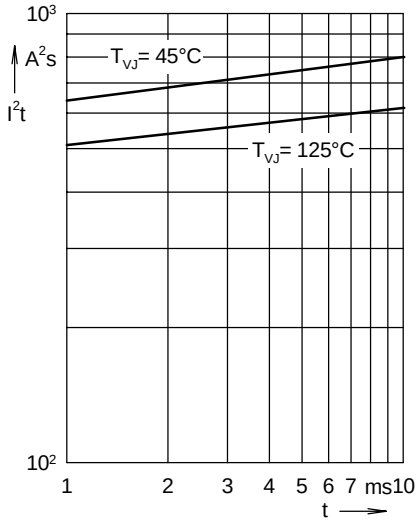


Fig. 3 I^2t versus time per diode

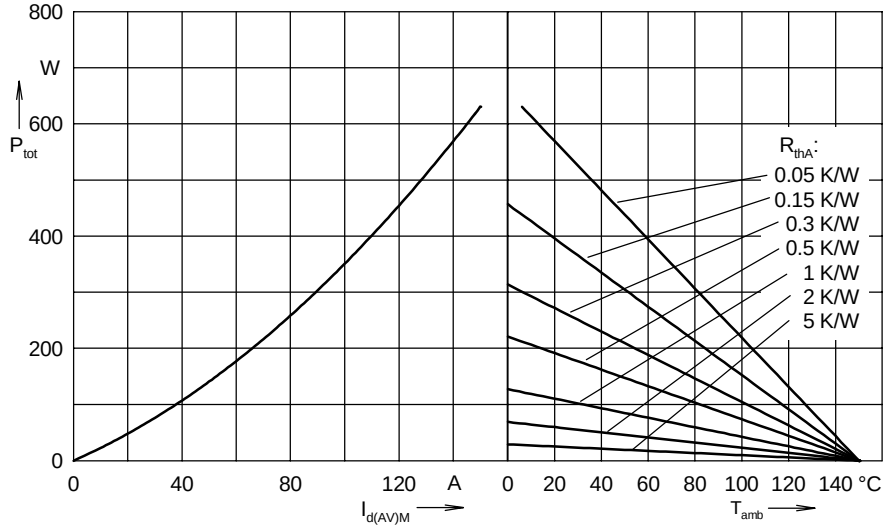


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

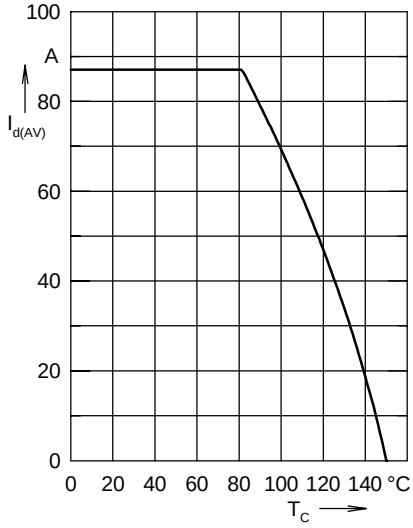


Fig. 5 Max. forward current versus case temperature

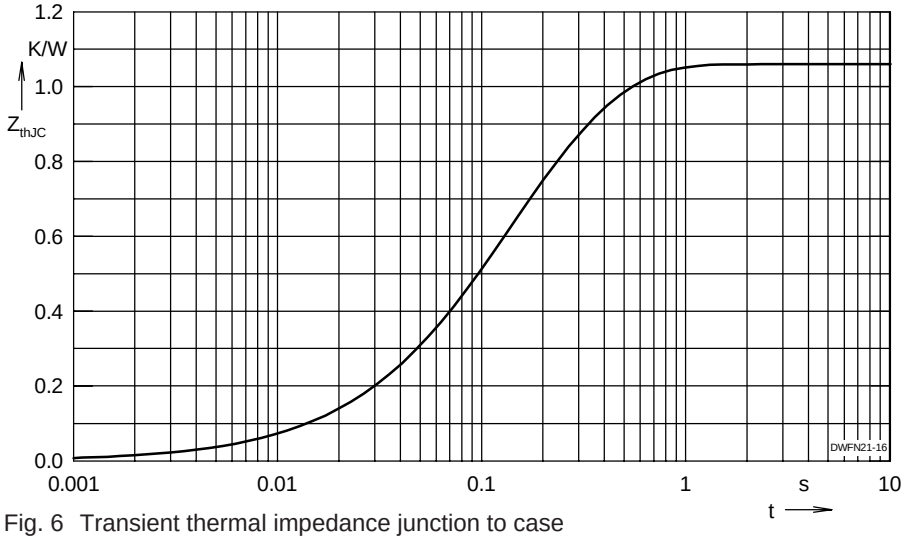


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

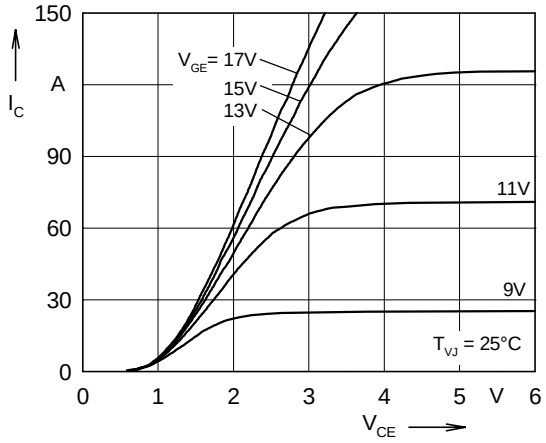


Fig. 7 Typ. output characteristics

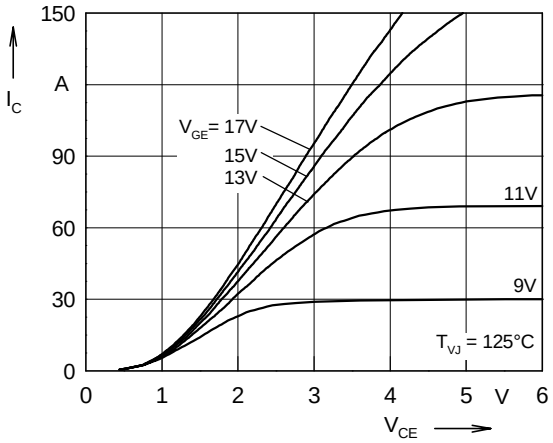


Fig. 8 Typ. output characteristics

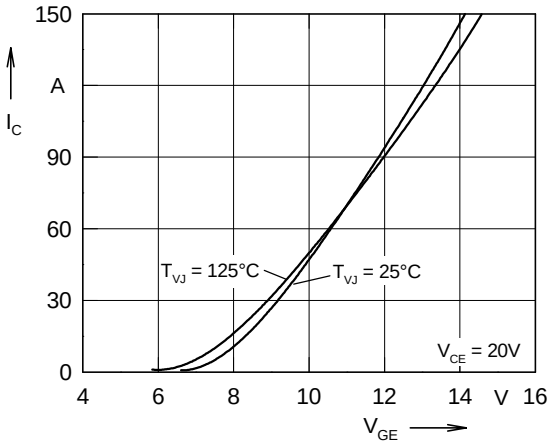


Fig. 9 Typ. transfer characteristics

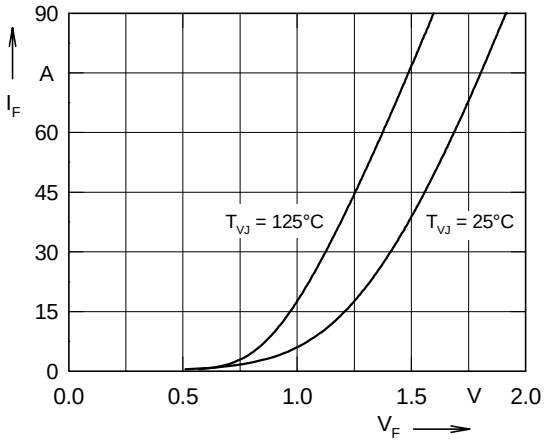


Fig. 10 Typ. forward characteristics of free wheeling diode

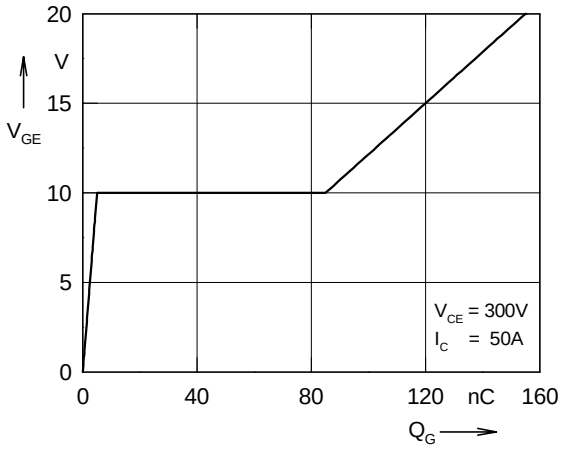


Fig. 11 Typ. turn on gate charge

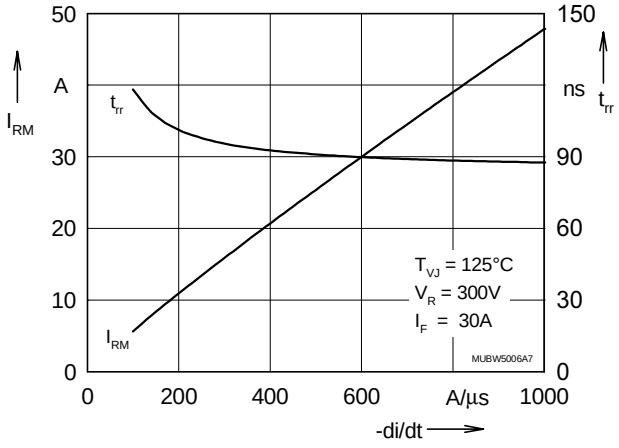


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

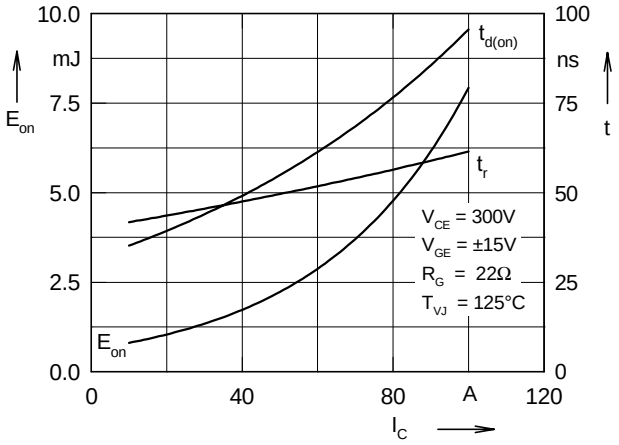


Fig. 13 Typ. turn on energy and switching times versus collector current

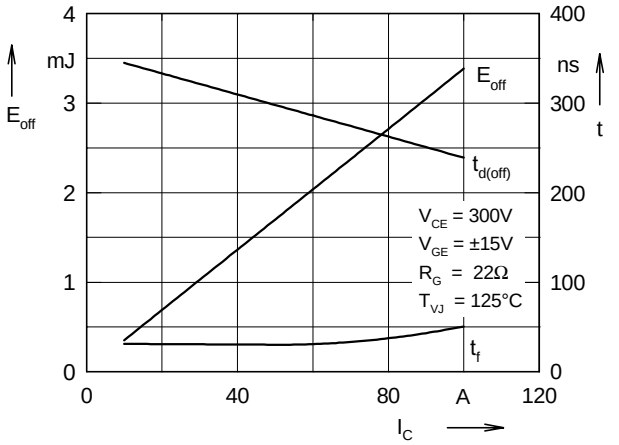


Fig. 14 Typ. turn off energy and switching times versus collector current

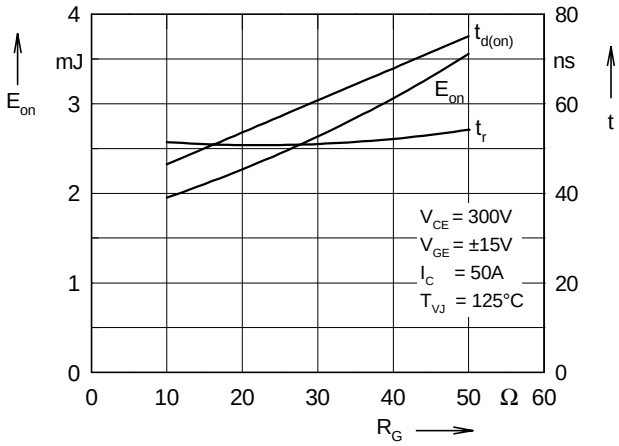


Fig. 15 Typ. turn on energy and switching times versus gate resistor

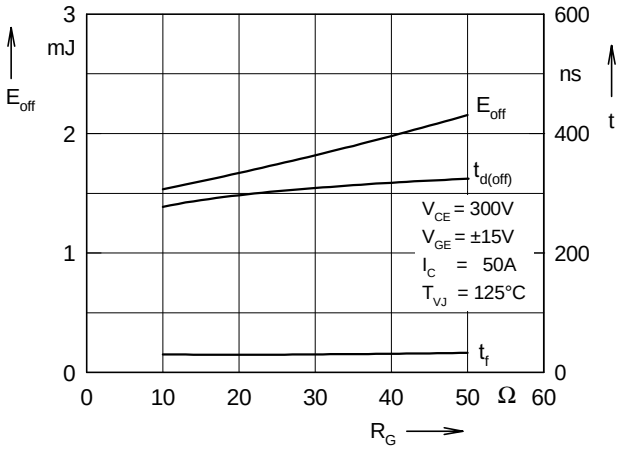


Fig.16 Typ. turn off energy and switching times versus gate resistor

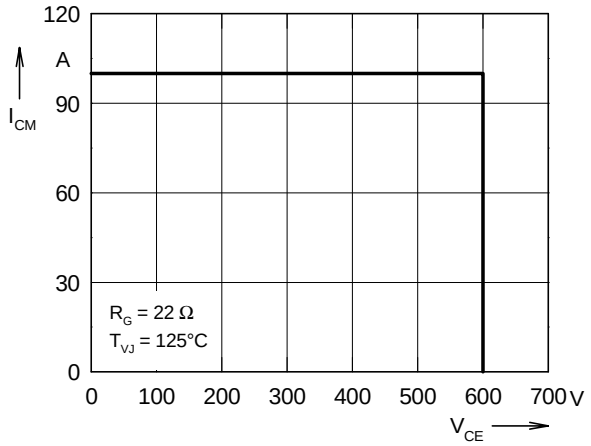


Fig. 17 Reverse biased safe operating area RBSOA

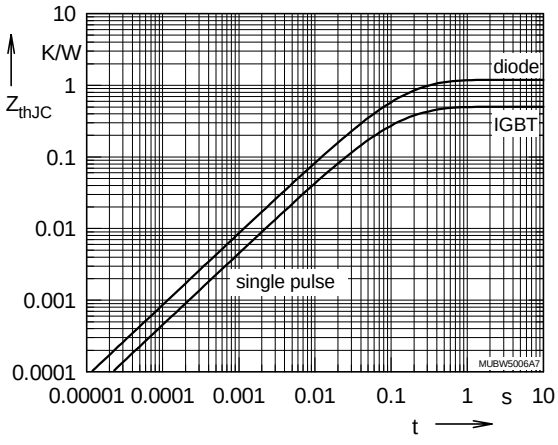


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

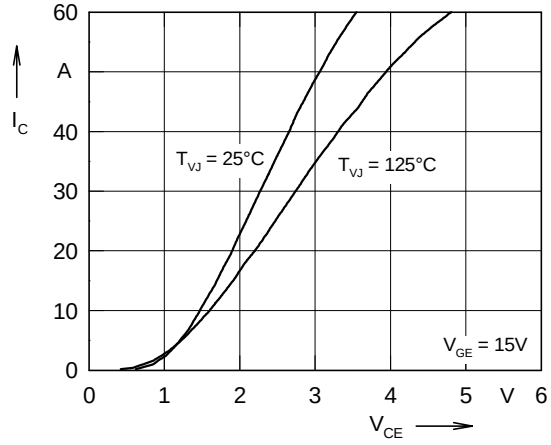


Fig. 19 Typ. output characteristics

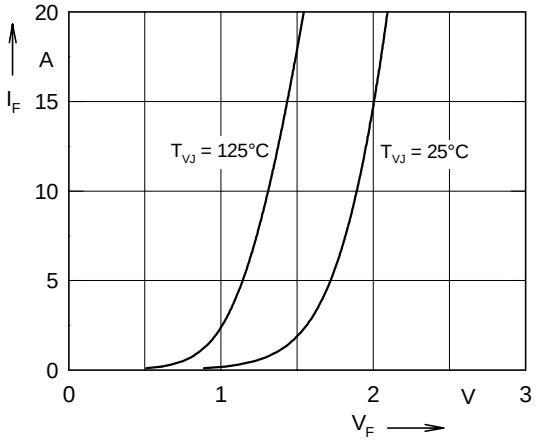


Fig. 20 Typ. forward characteristics of free wheeling diode

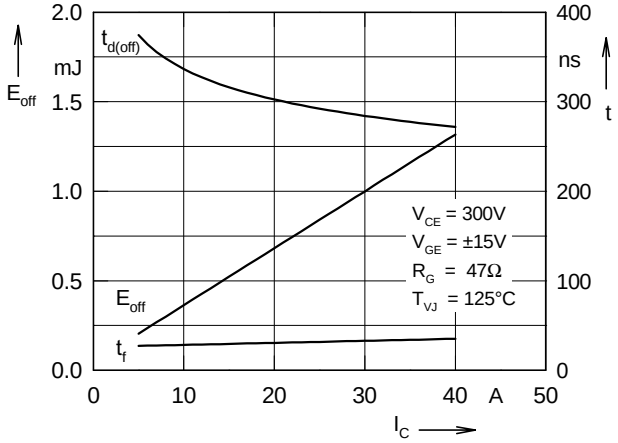


Fig. 21 Typ. turn off energy and switching times versus collector current

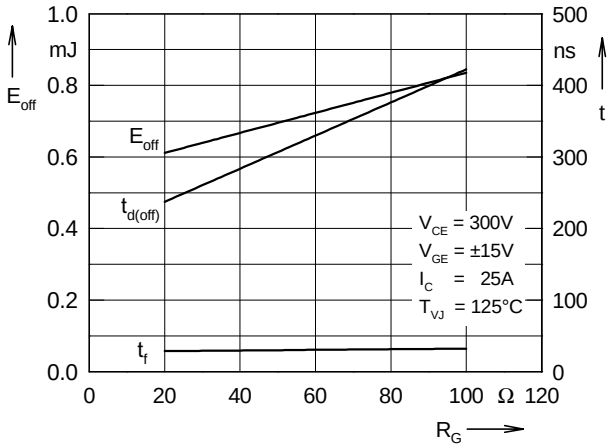


Fig. 22 Typ. turn off energy and switching times versus gate resistor

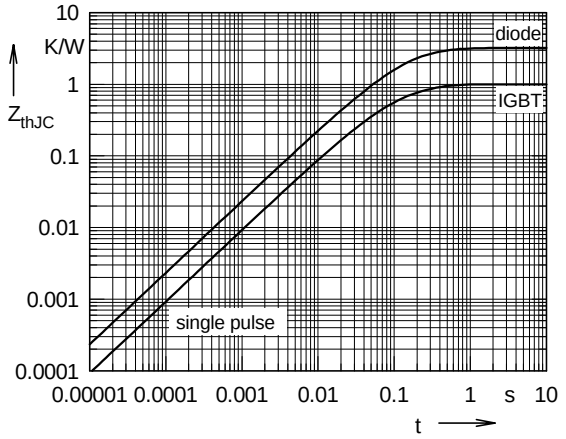


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

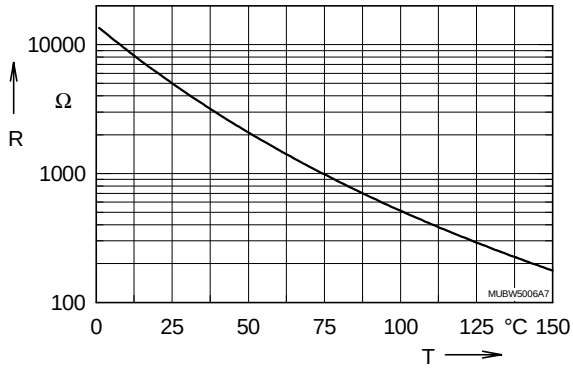
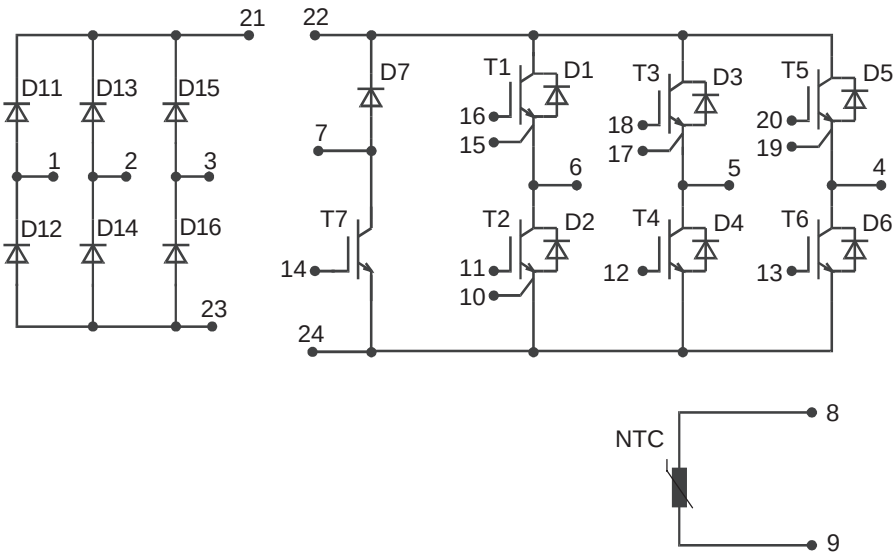
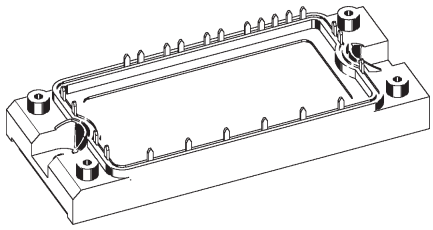


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 26 A	I_{C25} = 20 A	I_{C25} = 20 A
I_{FSM} = 160 A	$V_{CE(sat)}$ = 2.3 V	$V_{CE(sat)}$ = 2.3 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	19	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	18	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	160	A
P_{tot}	T_C = 25°C	85	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 10 A; T_{VJ} = 25°C		1.3	1.6	V
	T_{VJ} = 125°C		1.3		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		1		mA
t_{rr}	V_R = 100 V; I_F = 10 A; di/dt = -10 A/µs		1		µs
R_{thJC}	(per diode)			1.47	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	105	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 10 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.3	2.7	V
	T_{VJ} = 125°C		2.7		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.6	mA
	T_{VJ} = 125°C		0.6		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 = 10 A V_{GE} = ±15 V; R_G = 82 Ω		50		ns
t_r			40		ns
$t_{d(off)}$			290		ns
t_f			60		ns
E_{on}			1.2		mJ
E_{off}			1.1		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		600		pF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 10 A		45		nC
R_{thJC}	(per IGBT)			1.2	K/W

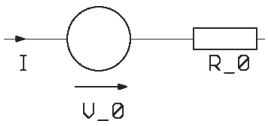
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	17	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 10 A; V_{GE} = 0 V; T_{VJ} = 25°C			2.9	V
	T_{VJ} = 125°C		1.9		V
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		110		ns
R_{thJC}	(per diode)			3.2	K/W

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.11 V; R_0 = 19 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.32V; R_0 = 131 mΩ

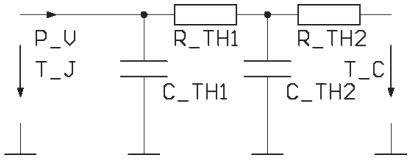
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.39 V; R_0 = 56 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.32 V; R_0 = 131 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.39 V; R_0 = 56 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.093 J/K; R_{th1} = 1.212 K/W
C_{th2} = 0.778 J/K; R_{th2} = 0.258K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.09 J/K; R_{th1} = 0.954 K/W
C_{th2} = 0.809J/K; R_{th2} = 0.246 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

T7 / D7

IGBT (typ.)
C_{th1} = 0.09 J/K; R_{th1} = 0.954 K/W
C_{th2} = 0.809 J/K; R_{th2} = 0.246 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	105	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 10 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.3	2.7	V
	T_{VJ} = 125°C		2.7		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		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} = 600 V; I_C = 10 A		40		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 82 Ω		290		ns
t_f			60		ns
E_{on}			1.2		mJ
E_{off}			1.1		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		600		pF
Q_{Gon}	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 10 A		45		nC
R_{thJC}				1.2	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	17	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 10 A; T_{VJ} = 25°C			2.9	V
	T_{VJ} = 125°C		1.9		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 600 V		110		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

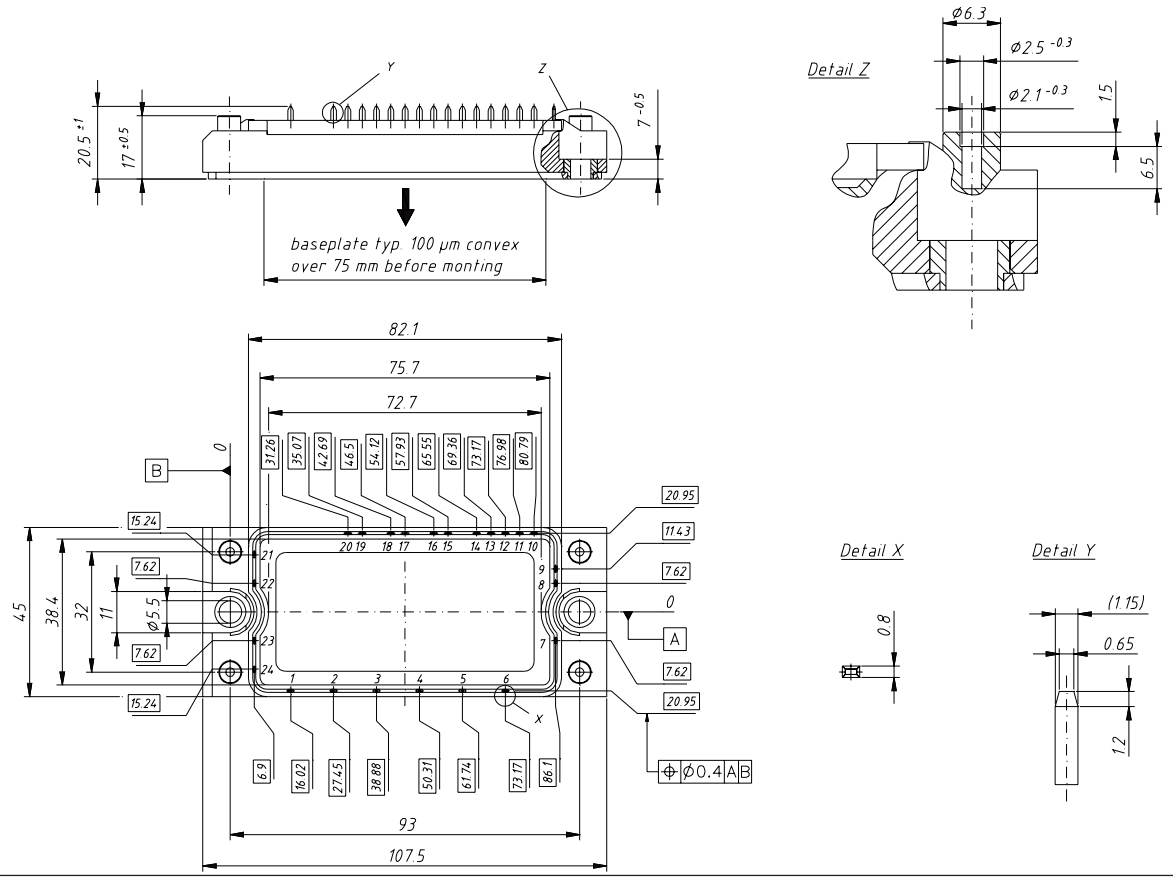
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

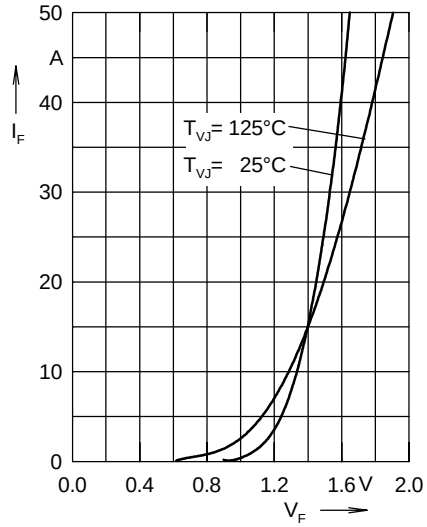


Fig. 1 Forward current versus voltage drop per diode

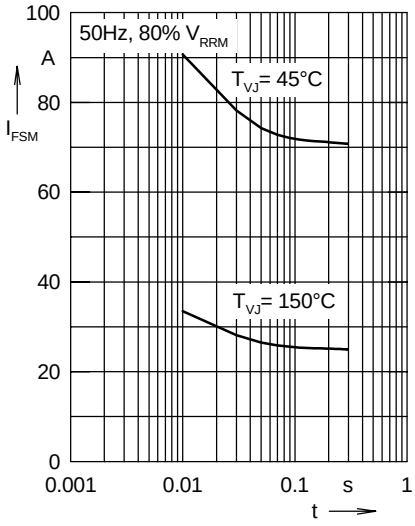


Fig. 2 Surge overload current

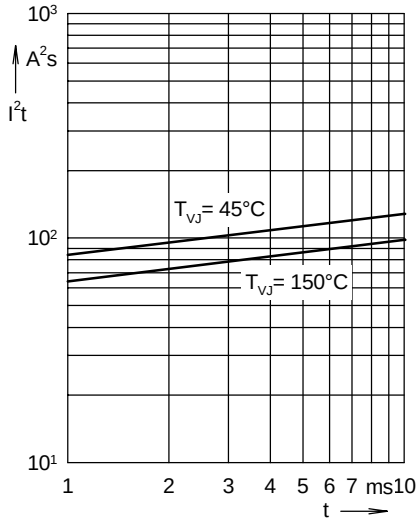


Fig. 3 I^2t versus time per diode

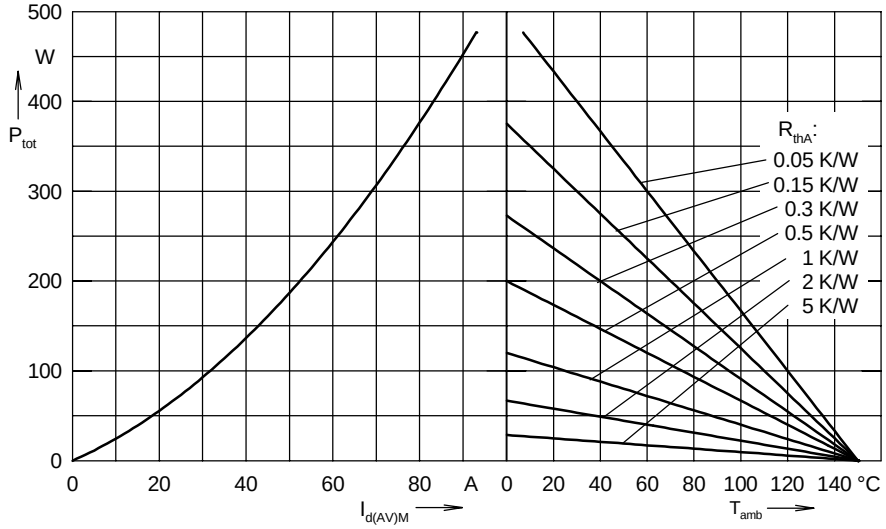


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

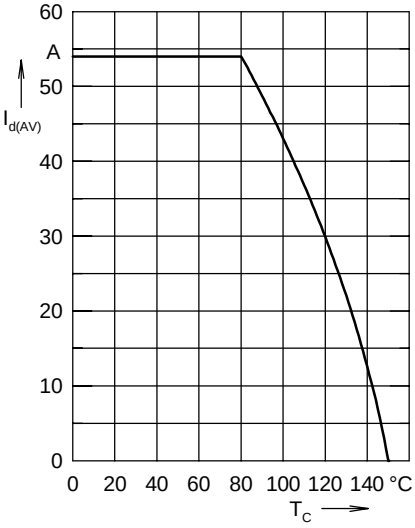


Fig. 5 Max. forward current versus case temperature

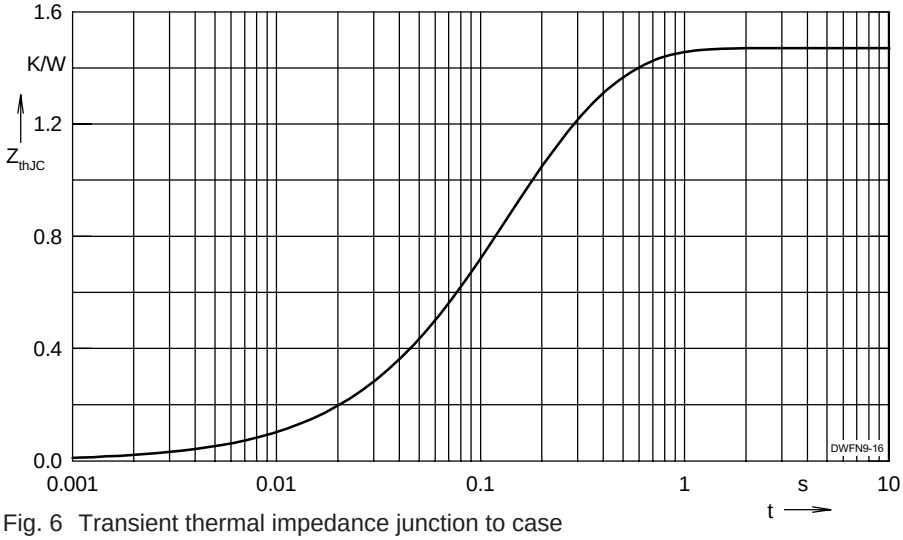


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

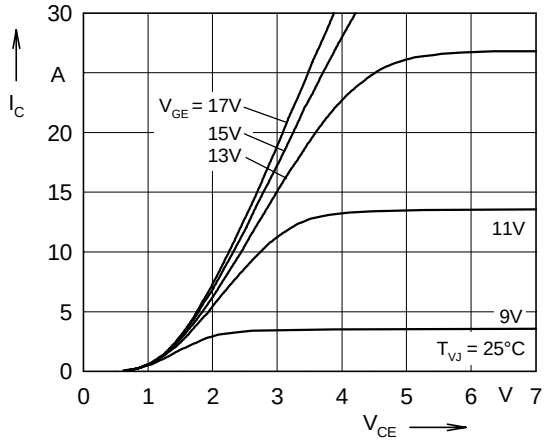


Fig. 7 Typ. output characteristics

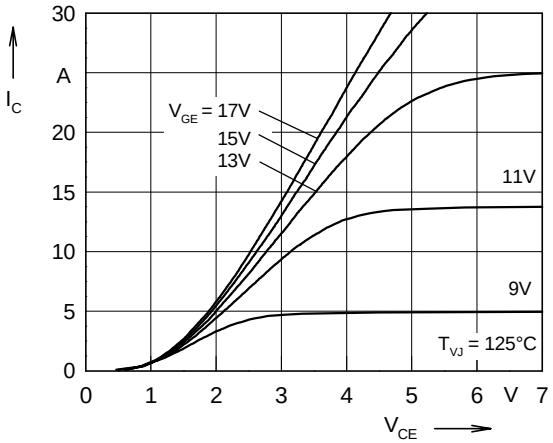


Fig. 8 Typ. output characteristics

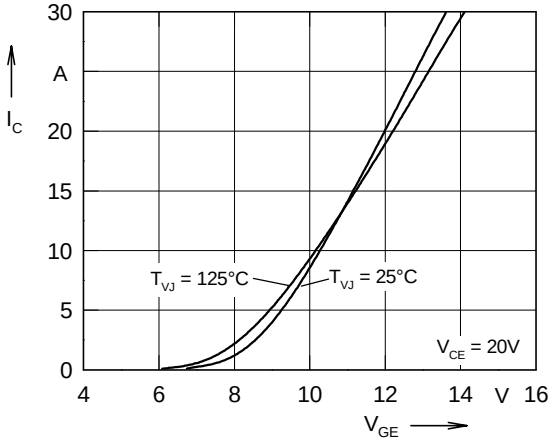


Fig. 9 Typ. transfer characteristics

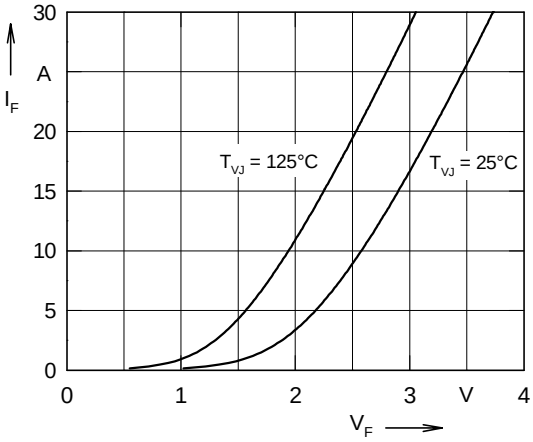


Fig. 10 Typ. forward characteristics of free wheeling diode

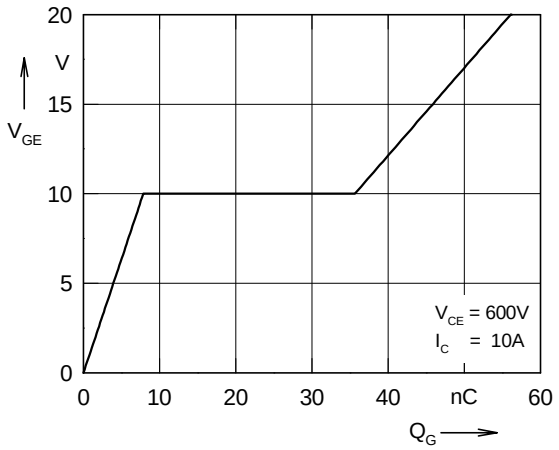


Fig. 11 Typ. turn on gate charge

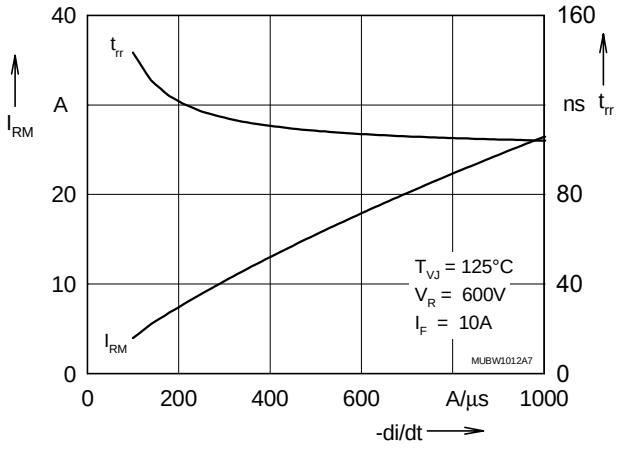


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

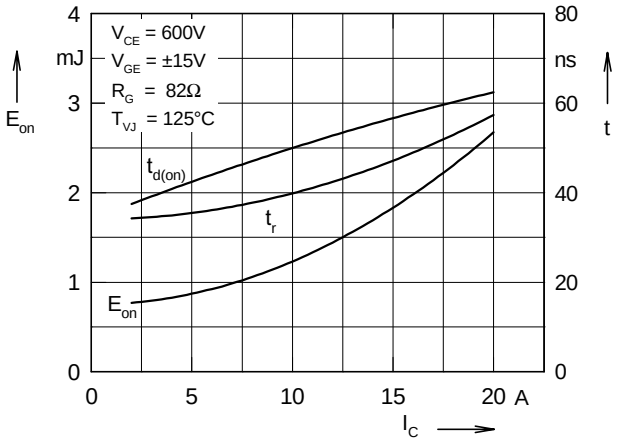


Fig. 13 Typ. turn on energy and switching times versus collector current

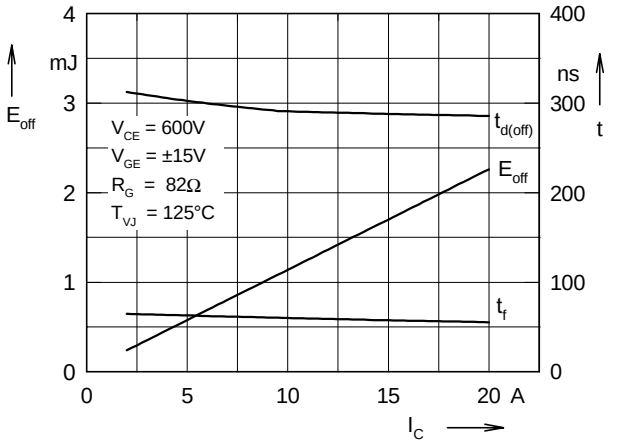


Fig. 14 Typ. turn off energy and switching times versus collector current

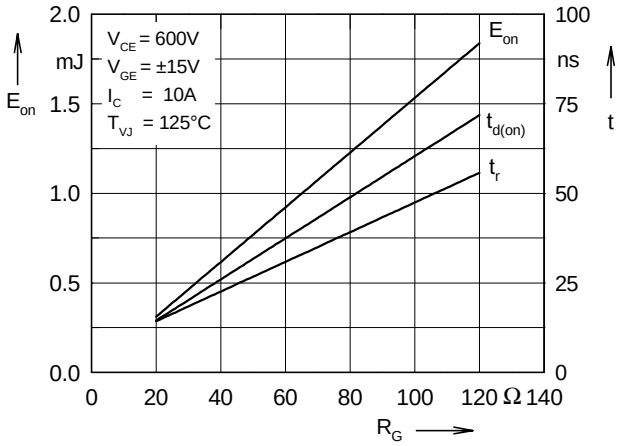


Fig. 15 Typ. turn on energy and switching times versus gate resistor

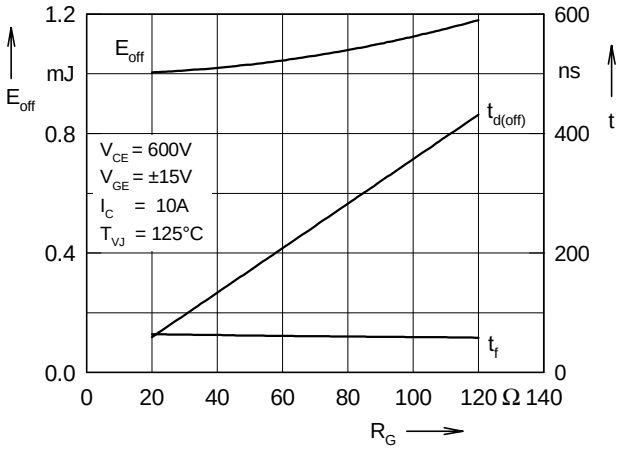


Fig.16 Typ. turn off energy and switching times versus gate resistor

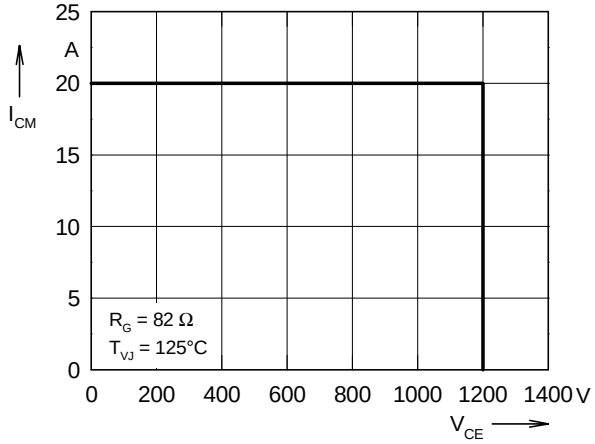


Fig. 17 Reverse biased safe operating area RBSOA

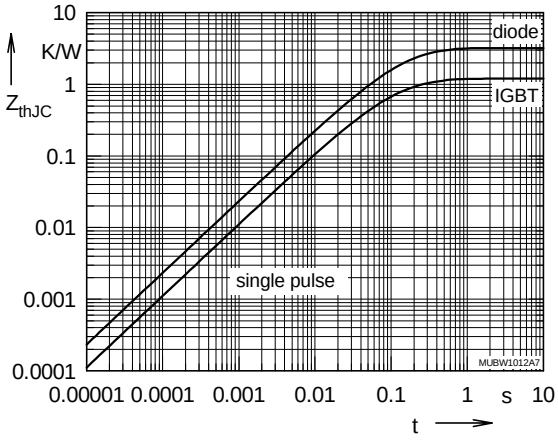


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

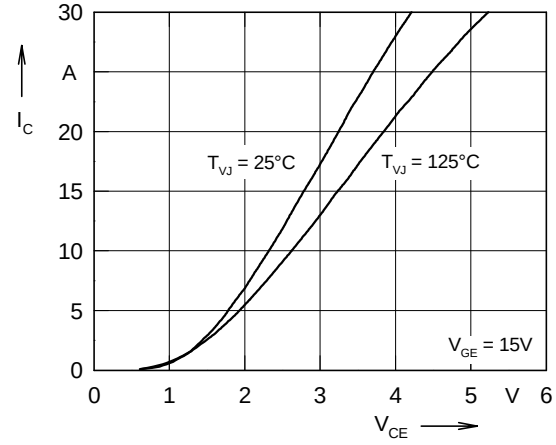


Fig. 19 Typ. output characteristics

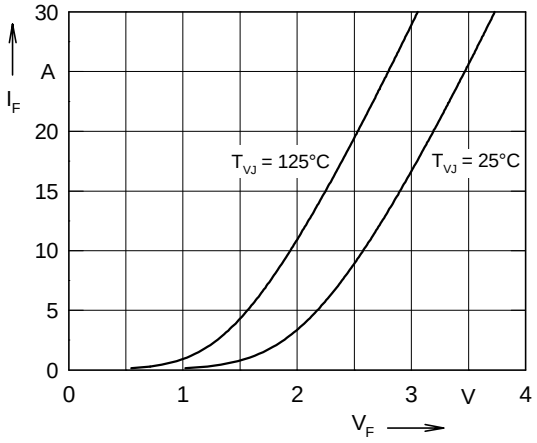


Fig. 20 Typ. forward characteristics of free wheeling diode

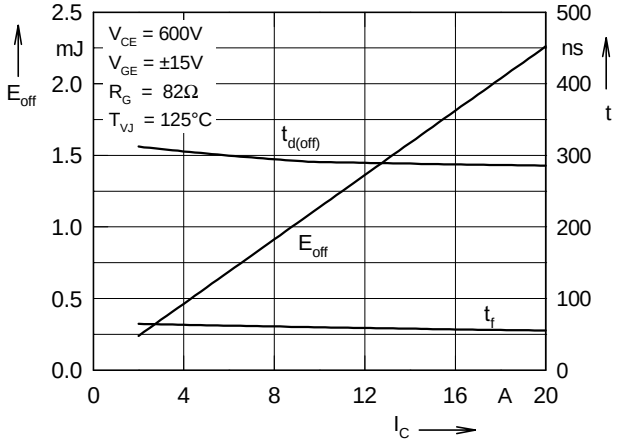


Fig. 21 Typ. turn off energy and switching times versus collector current

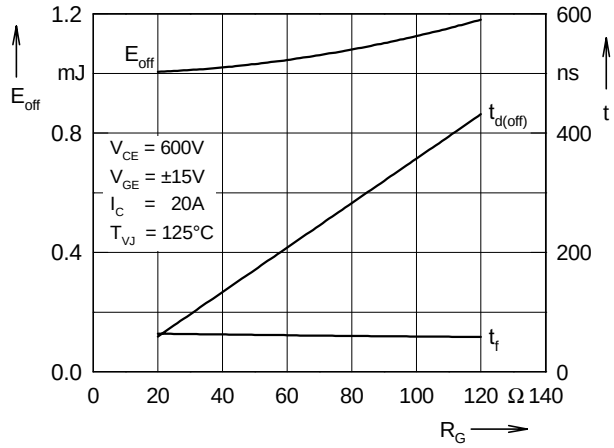


Fig. 22 Typ. turn off energy and switching times versus gate resistor

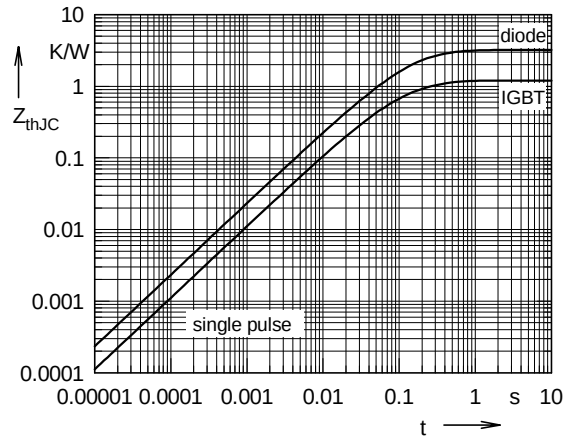


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

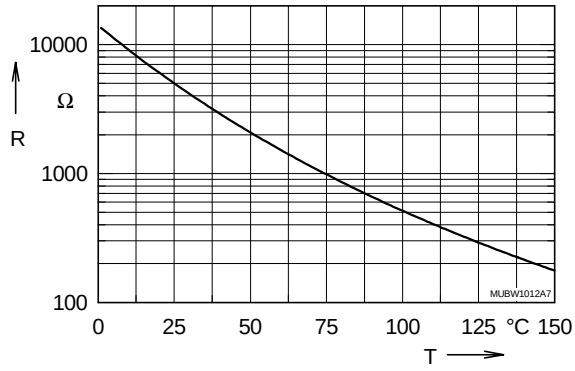
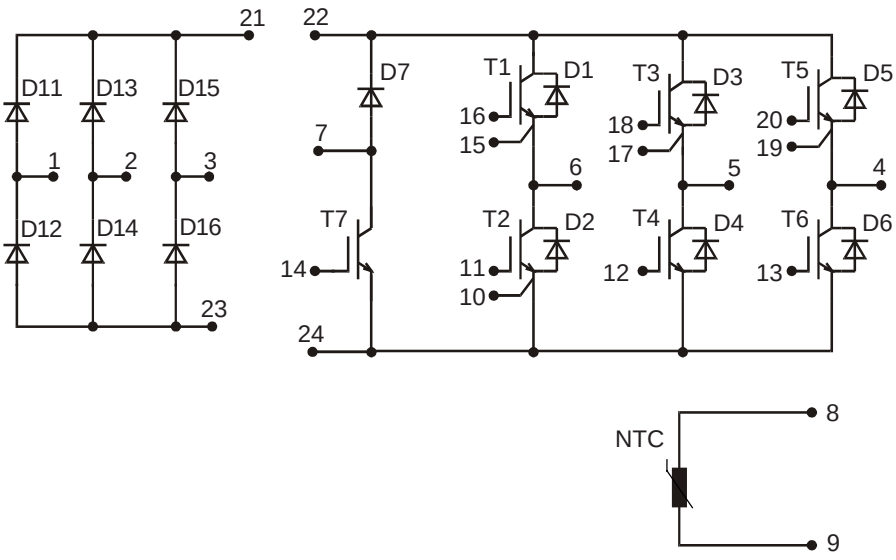
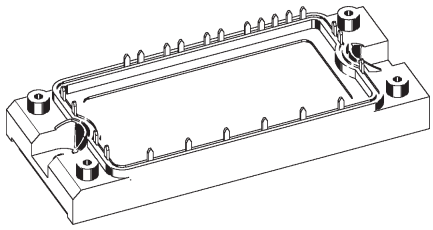


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 36 A	I_{C25} = 20 A	I_{C25} = 35 A
I_{FSM} = 300 A	$V_{CE(sat)}$ = 2.3 V	$V_{CE(sat)}$ = 2.1 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	25	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	24	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	300	A
P_{tot}	T_C = 25°C	100	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 15 A; T_{VJ} = 25°C		1.3	1.6	V
	T_{VJ} = 125°C		1.3		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.15	mA
	T_{VJ} = 125°C		1.2		mA
t_{rr}	V_R = 100 V; I_F = 15 A; di/dt = -15 A/µs		1		µs
R_{thJC}	(per diode)			1.3	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	35	A
I_{C80}	T_C = 80°C	25	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	180	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		2.1	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		0.9		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 = 15 A		70		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 82 Ω		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)			0.7	K/W

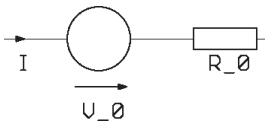
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	28	A
I_{F80}	T_C = 80°C	18	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; V_{GE} = 0 V; T_{VJ} = 25°C			2.7	V
	T_{VJ} = 125°C		1.8		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

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.08 V; R_0 = 15 mΩ

T1 - T6 / D1 - D6

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

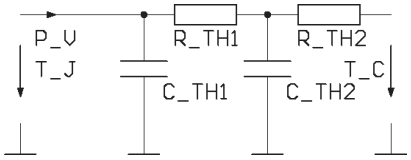
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.32 V; R_0 = 30 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.32 V; R_0 = 131 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.39 V; R_0 = 56 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.106 J/K; R_{th1} = 1.06 K/W
C_{th2} = 0.79 J/K; R_{th2} = 0.239 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.156 J/K; R_{th1} = 0.545 K/W
C_{th2} = 1.162 J/K; R_{th2} = 0.155 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

T7 / D7

IGBT (typ.)
C_{th1} = 0.09 J/K; R_{th1} = 0.954 K/W
C_{th2} = 0.809 J/K; R_{th2} = 0.246 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	105	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 10 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.3	2.7	V
	T_{VJ} = 125°C		2.7		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		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} = 600 V; I_C = 10 A		40		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 82 Ω		290		ns
t_f			60		ns
E_{on}			1.2		mJ
E_{off}			1.1		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		600		pF
Q_{Gon}	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 10 A		45		nC
R_{thJC}				1.2	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	17	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 10 A; T_{VJ} = 25°C			2.9	V
	T_{VJ} = 125°C		1.9		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 600 V		110		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

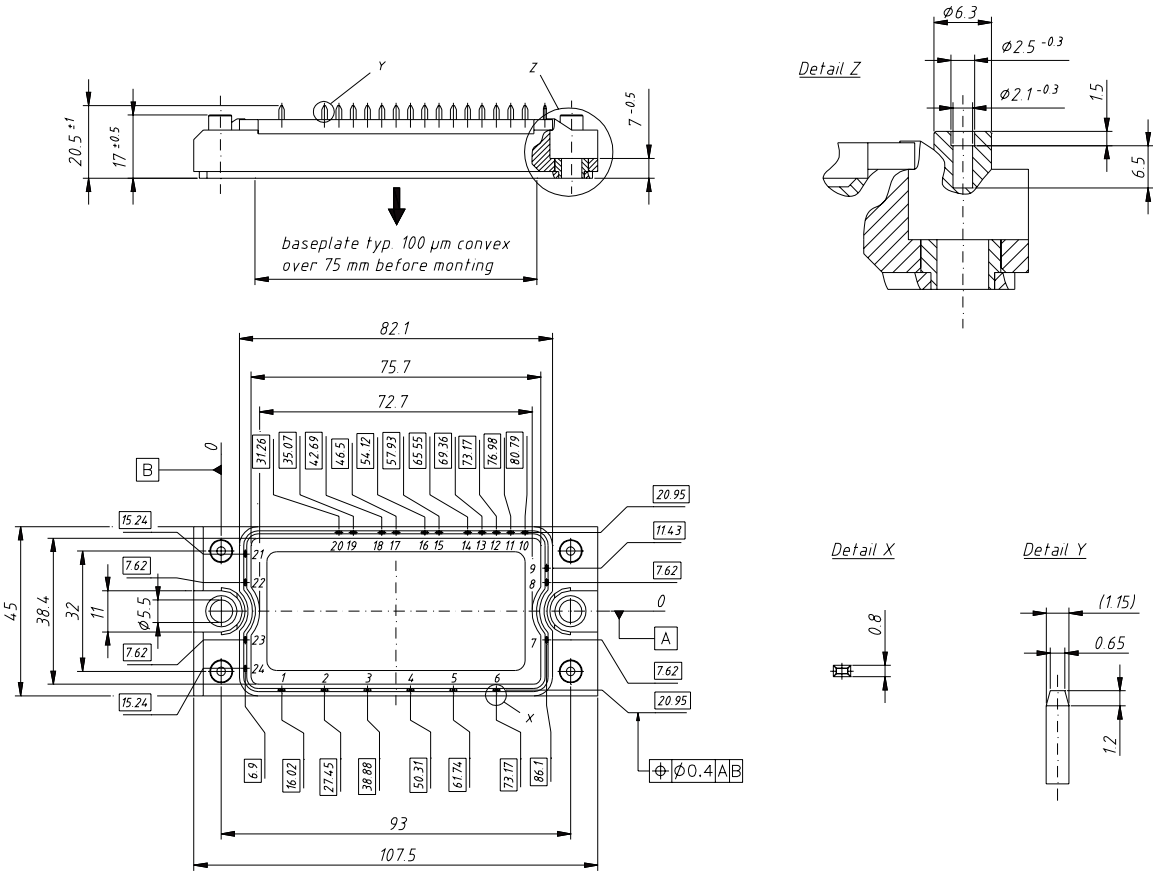
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

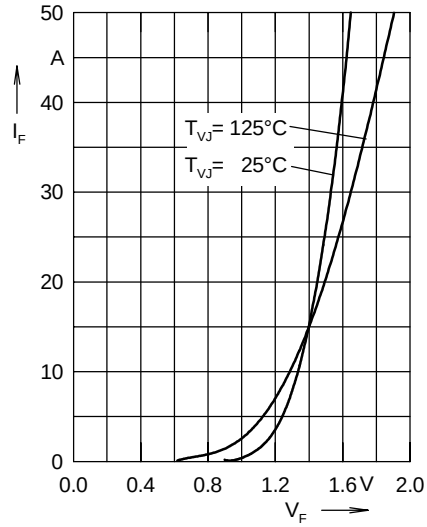


Fig. 1 Forward current versus voltage drop per diode

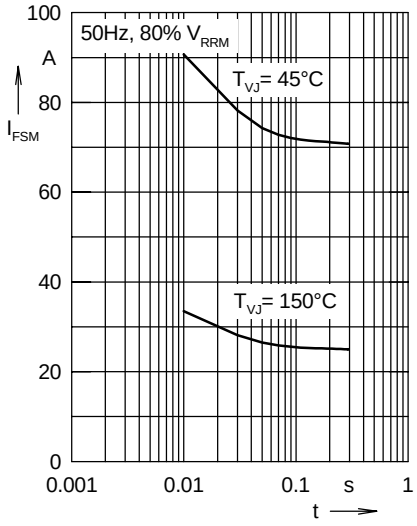


Fig. 2 Surge overload current

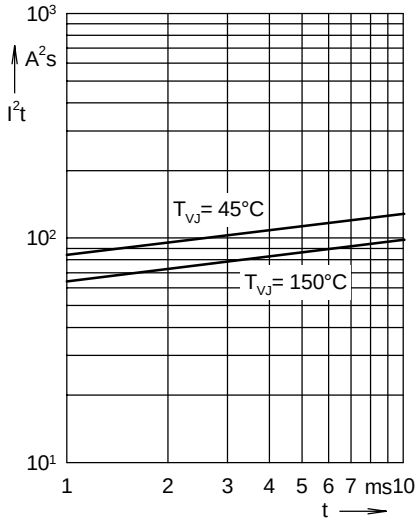


Fig. 3 I^2t versus time per diode

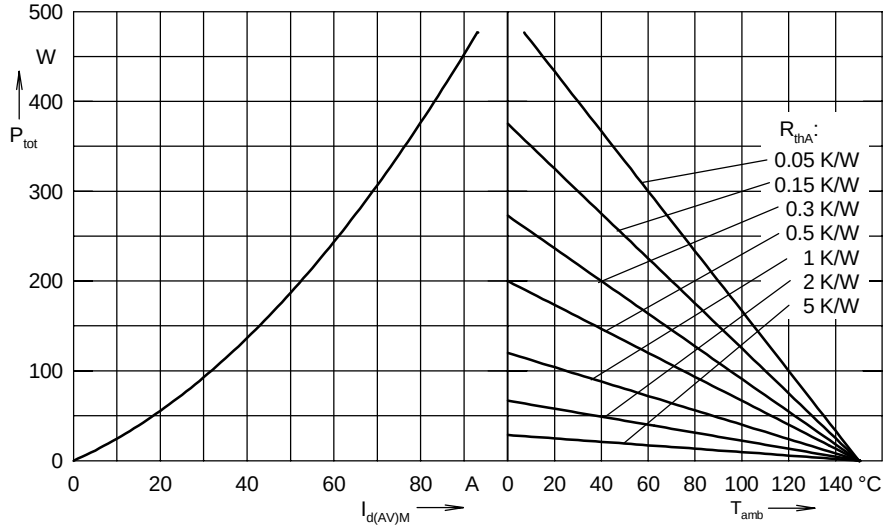


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

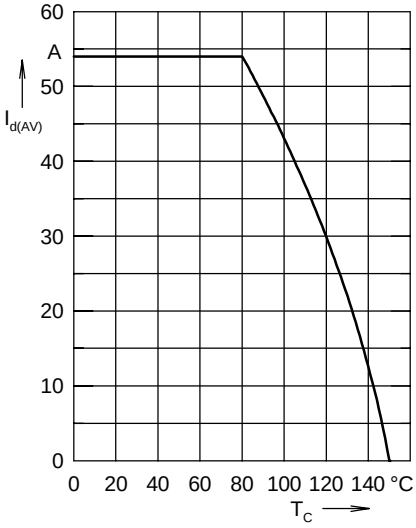


Fig. 5 Max. forward current versus case temperature

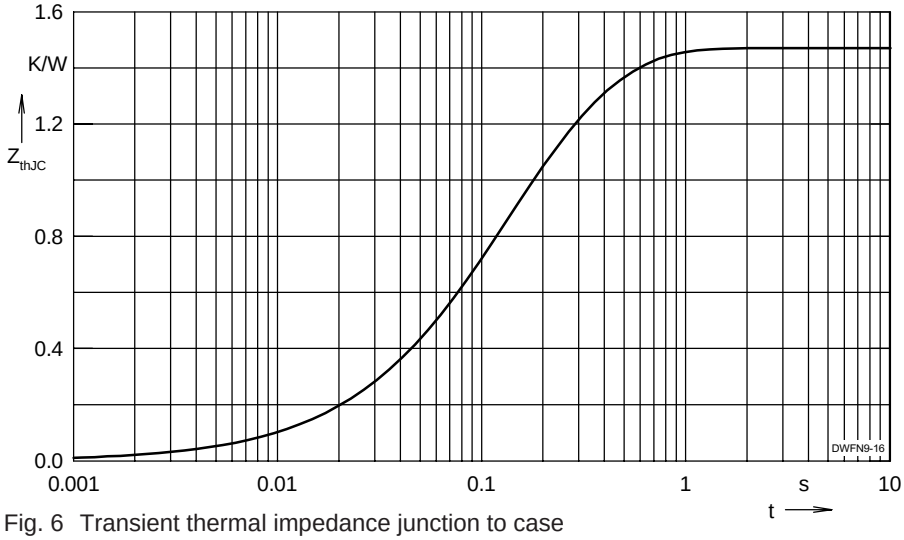


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

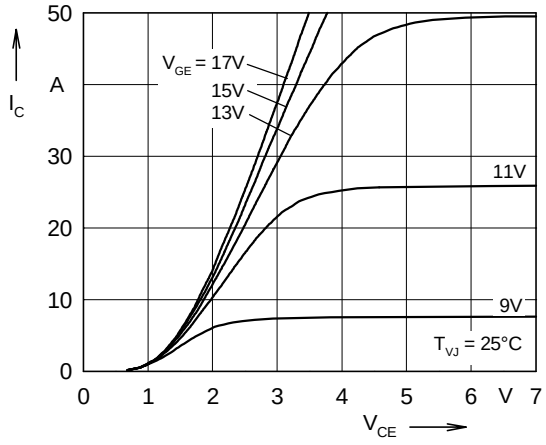


Fig. 7 Typ. output characteristics

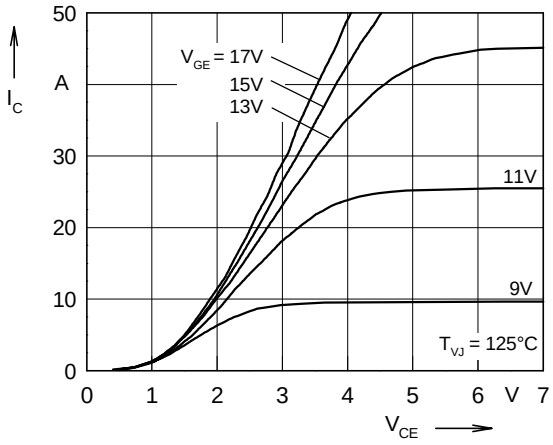


Fig. 8 Typ. output characteristics

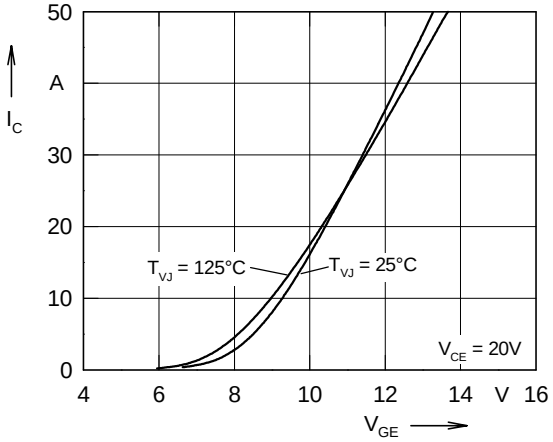


Fig. 9 Typ. transfer characteristics

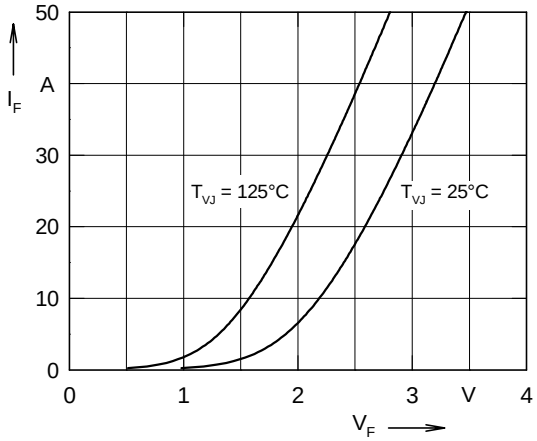


Fig. 10 Typ. forward characteristics of free wheeling diode

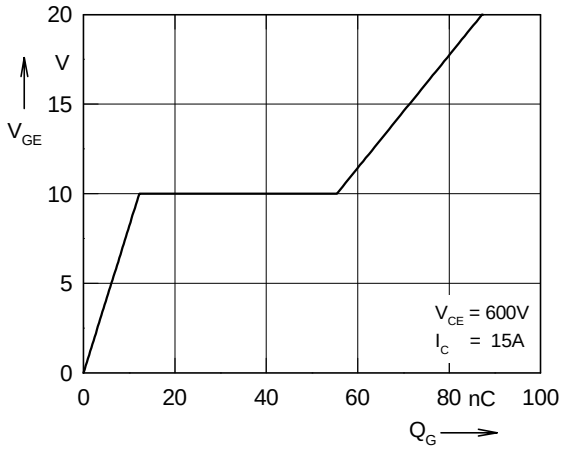


Fig. 11 Typ. turn on gate charge

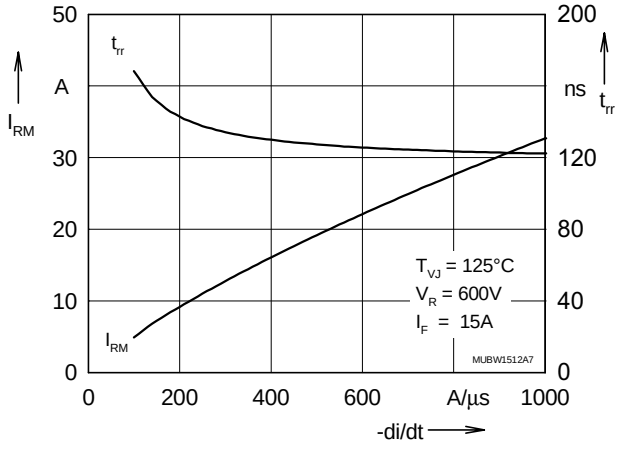


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

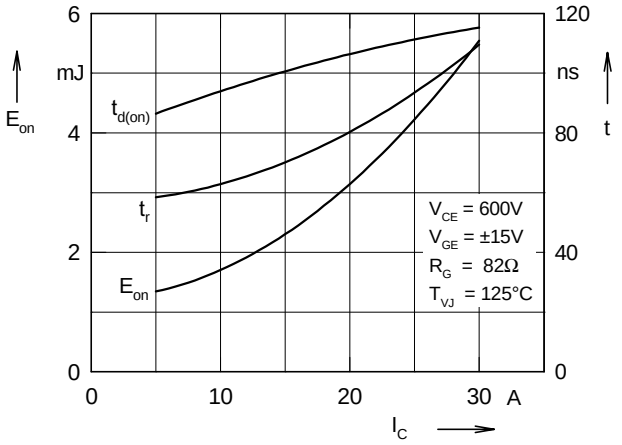


Fig. 13 Typ. turn on energy and switching times versus collector current

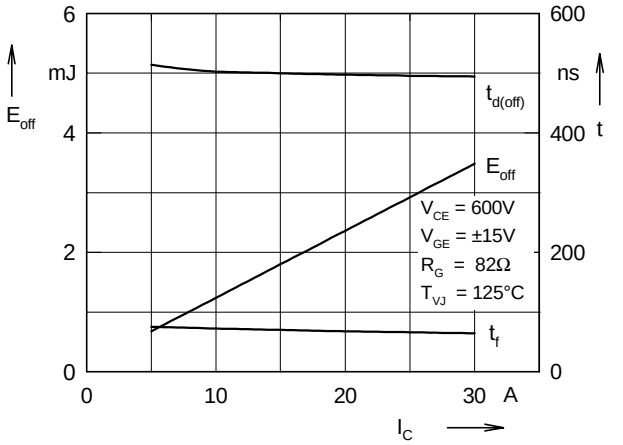


Fig. 14 Typ. turn off energy and switching times versus collector current

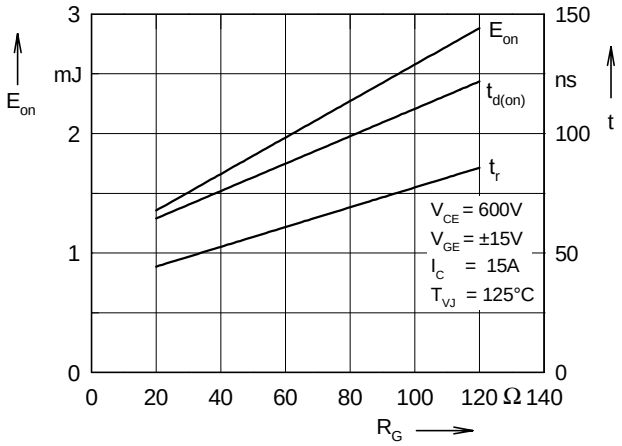


Fig. 15 Typ. turn on energy and switching times versus gate resistor

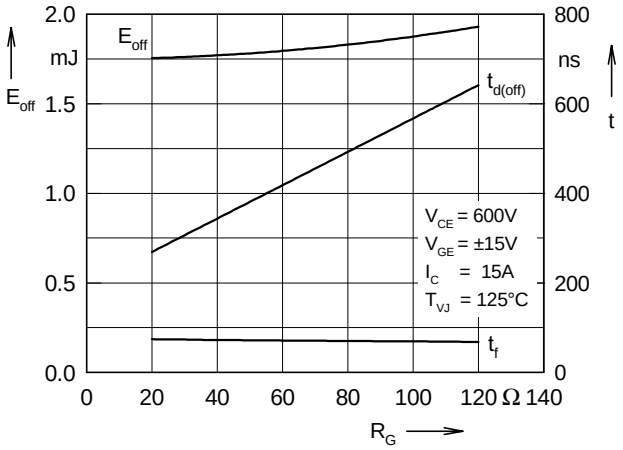


Fig.16 Typ. turn off energy and switching times versus gate resistor

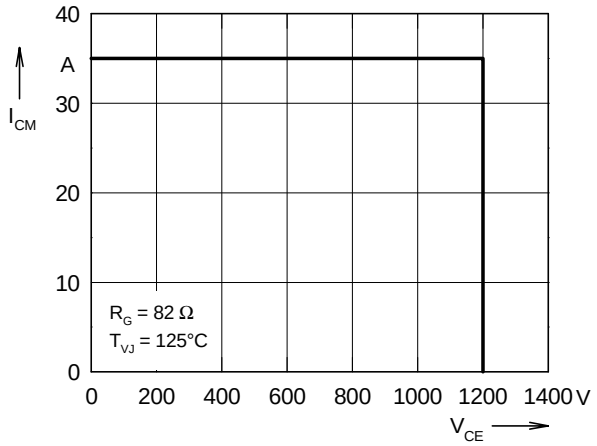


Fig. 17 Reverse biased safe operating area RBSOA

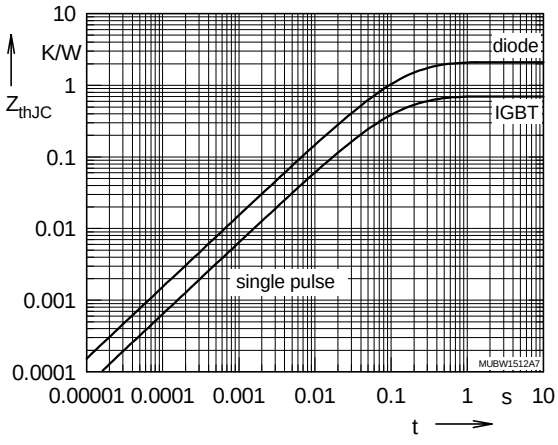


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

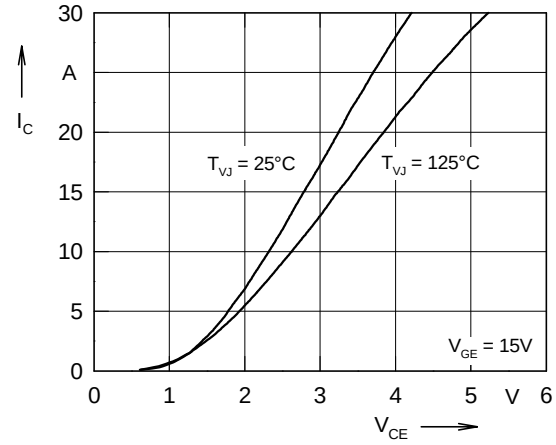


Fig. 19 Typ. output characteristics

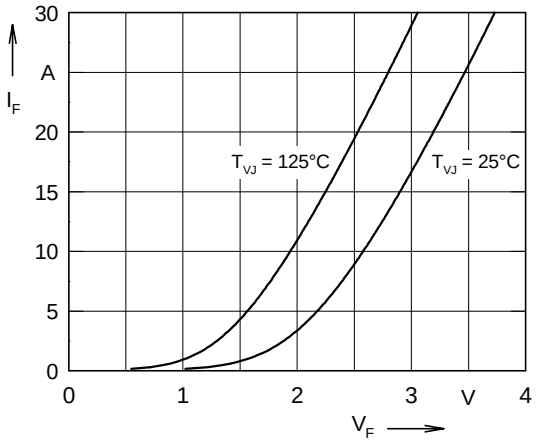


Fig. 20 Typ. forward characteristics of free wheeling diode

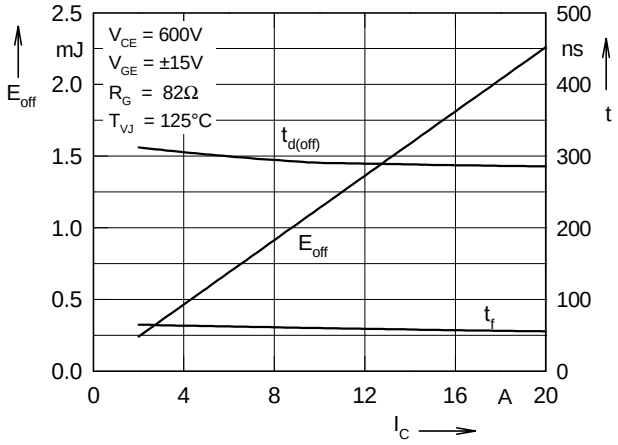


Fig. 21 Typ. turn off energy and switching times versus collector current

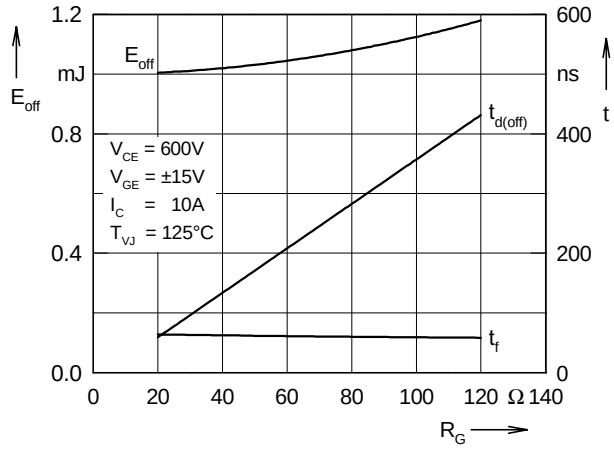


Fig. 22 Typ. turn off energy and switching times versus gate resistor

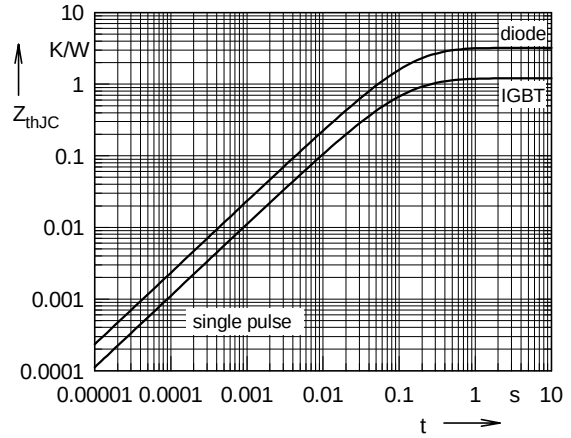


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

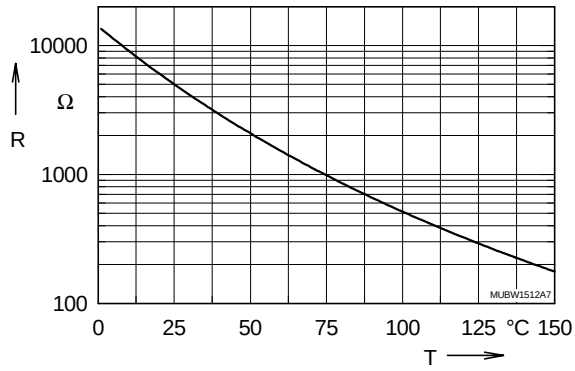
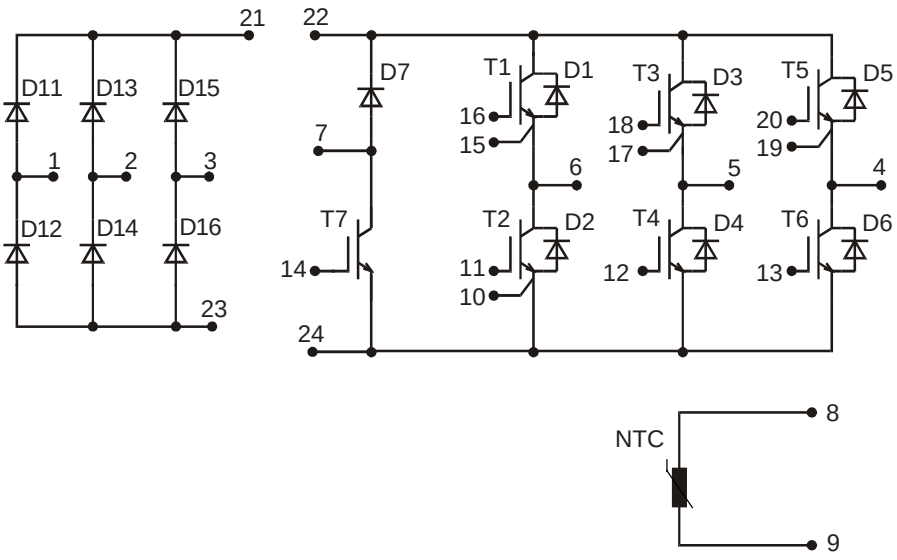
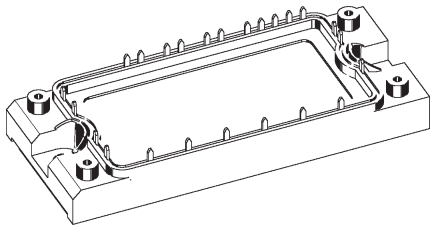


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 36 A	I_{C25} = 20 A	I_{C25} = 50 A
I_{FSM} = 300 A	$V_{CE(sat)}$ = 2.9 V	$V_{CE(sat)}$ = 2.2 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	25	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	24	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	300	A
P_{tot}	T_C = 25°C	100	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 25 A; T_{VJ} = 25°C		1.4	1.7	V
	T_{VJ} = 125°C		1.4		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.15	mA
	T_{VJ} = 125°C		1.2		mA
t_{rr}	V_R = 100 V; I_F = 15 A; di/dt = -15 A/µs		1		µs
R_{thJC}	(per diode)			1.3	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	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		2.5		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			0.9	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		100		ns
t_r	V_{CE} = 600 V; I_C = 25 A		70		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 47 Ω		500		ns
t_f			70		ns
E_{on}			2.8		mJ
E_{off}			3.8		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 = 25 A		120		nC
R_{thJC}	(per IGBT)			0.55	K/W

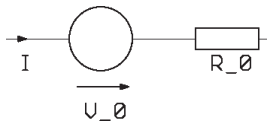
Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	28	A
I_{F80}	T_C = 80°C	18	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; V_{GE} = 0 V; T_{VJ} = 25°C			3.1	V
	T_{VJ} = 125°C		2.1		V
I_{RM}	I_F = 25 A; di_F/dt = -400A/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

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 1.16 V; R_0 = 9 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.38 V; R_0 = 46 mΩ

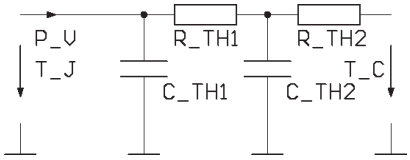
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.32 V; R_0 = 30 mΩ

T7 / D7

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.32 V; R_0 = 131 mΩ

Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.39 V; R_0 = 56 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.106 J/K; R_{th1} = 1.06 K/W
C_{th2} = 0.79 J/K; R_{th2} = 0.239 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.201 J/K; R_{th1} = 0.419 K/W
C_{th2} = 1.25 J/K; R_{th2} = 0.131 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

T7 / D7

IGBT (typ.)
C_{th1} = 0.09 J/K; R_{th1} = 0.954 K/W
C_{th2} = 0.809 J/K; R_{th2} = 0.246 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C80}	T_C = 80°C	15	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 20 $V_{CEK} \le V_{CES}$	A
t_{SC} (SCSOA)	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C non-repetitive	10	µs
P_{tot}	T_C = 25°C	105	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		2.9	3.3	V
	T_{VJ} = 125°C		3.3		V
$V_{GE(th)}$	I_C = 0.4 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		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} = 600 V; I_C = 15 A		40		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 82 Ω		290		ns
t_f			60		ns
E_{on}			1.8		mJ
E_{off}			1.6		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		600		pF
Q_{Gon}	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 15 A		45		nC
R_{thJC}				1.2	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	17	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 15 A; T_{VJ} = 25°C			3.2	V
	T_{VJ} = 125°C		2.3		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 600 V		110		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

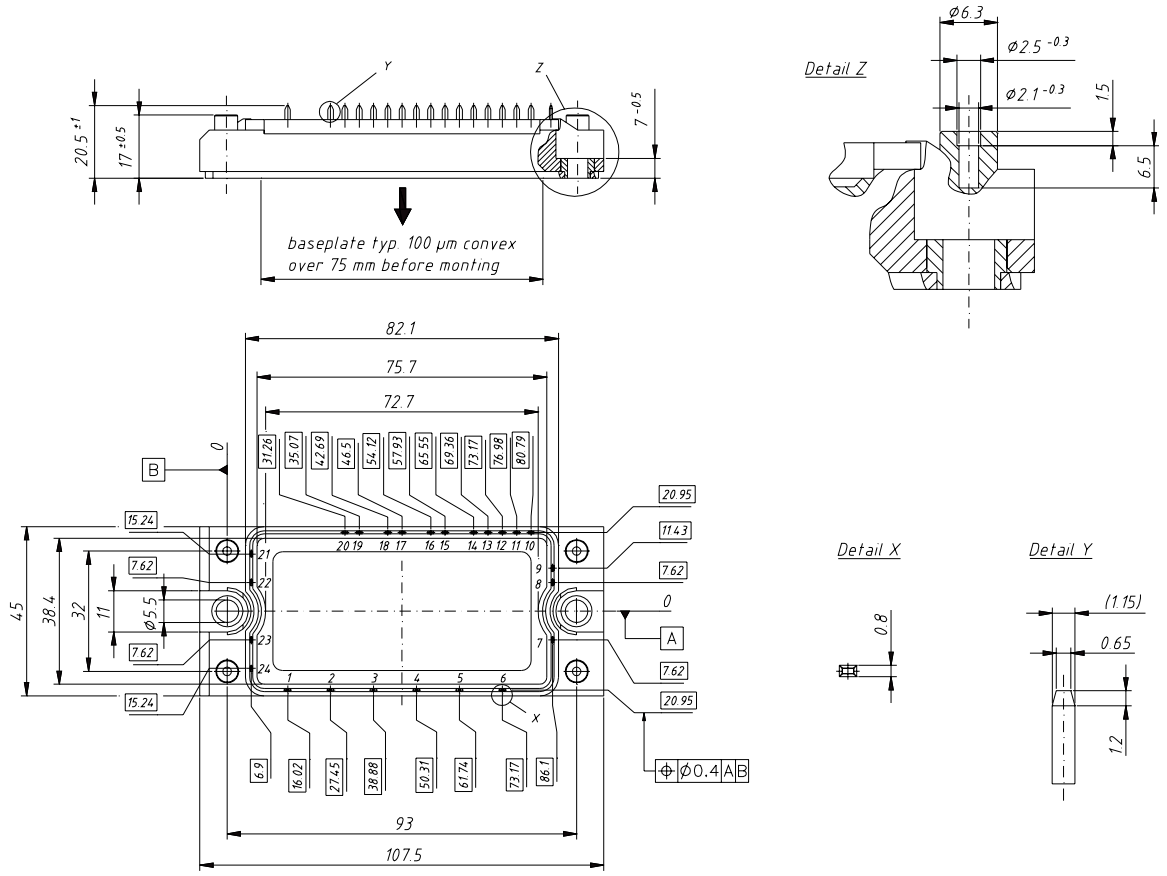
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

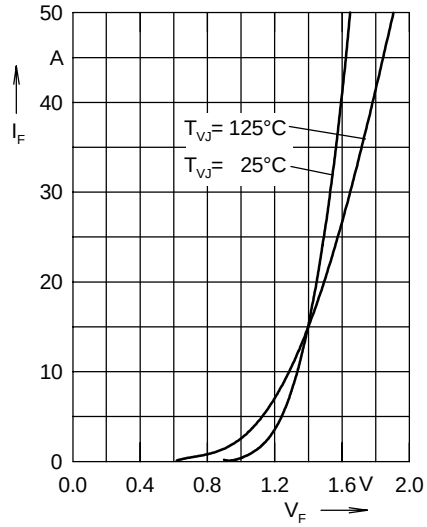


Fig. 1 Forward current versus voltage drop per diode

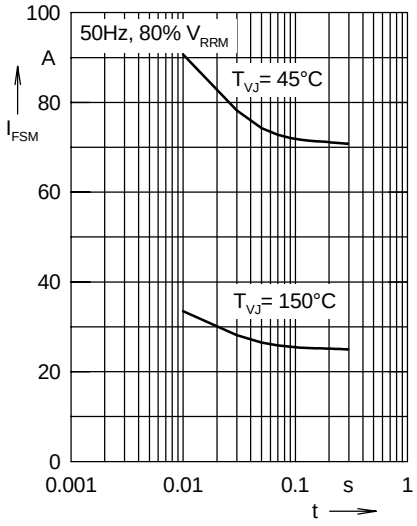


Fig. 2 Surge overload current

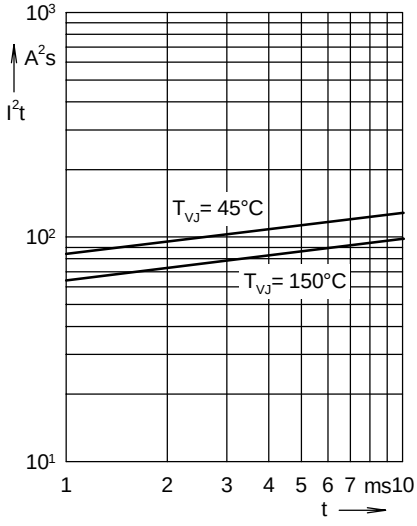


Fig. 3 I^2t versus time per diode

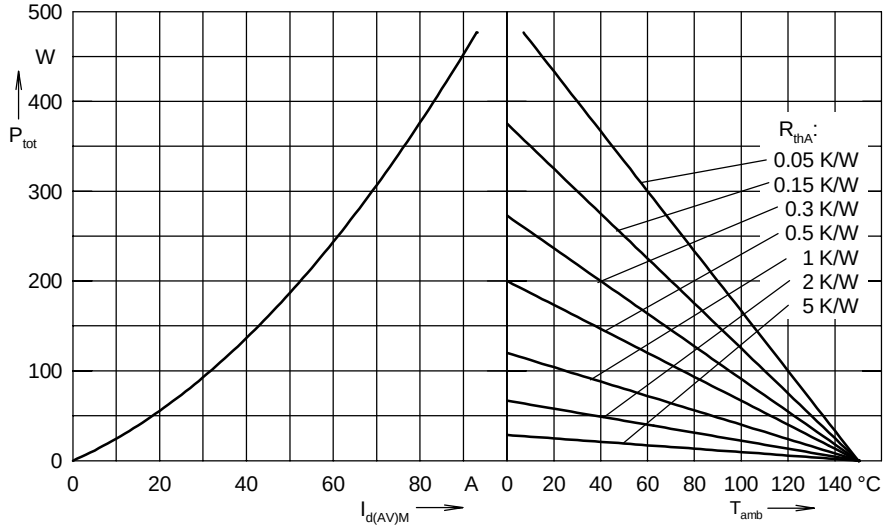


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

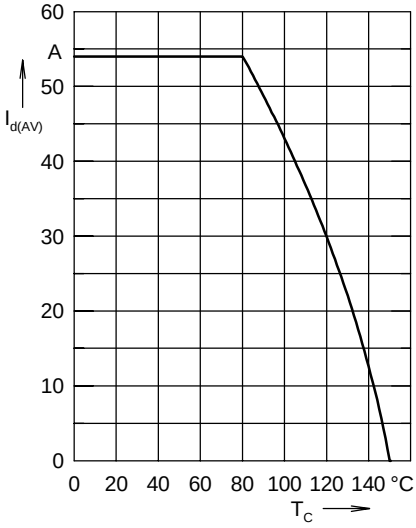


Fig. 5 Max. forward current versus case temperature

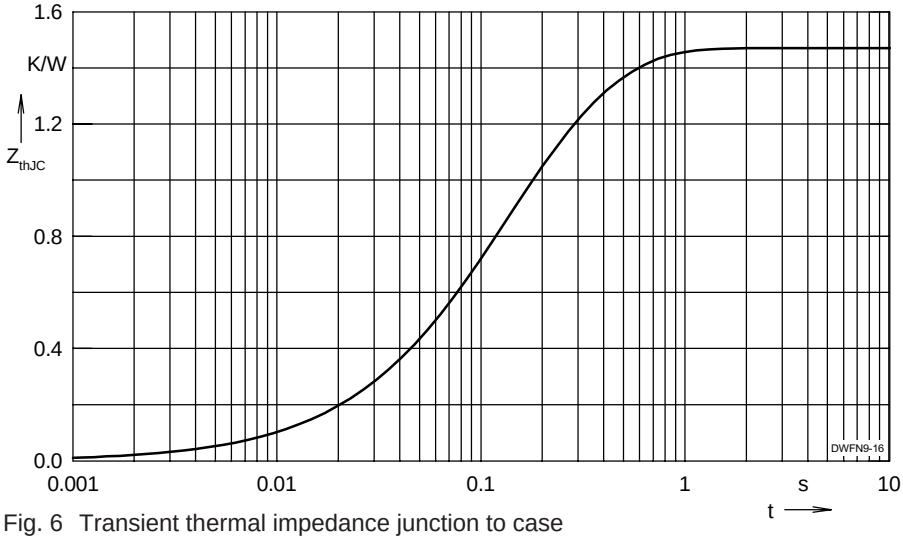


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

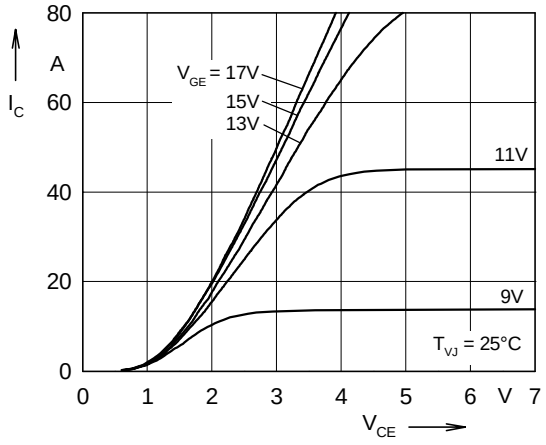


Fig. 7 Typ. output characteristics

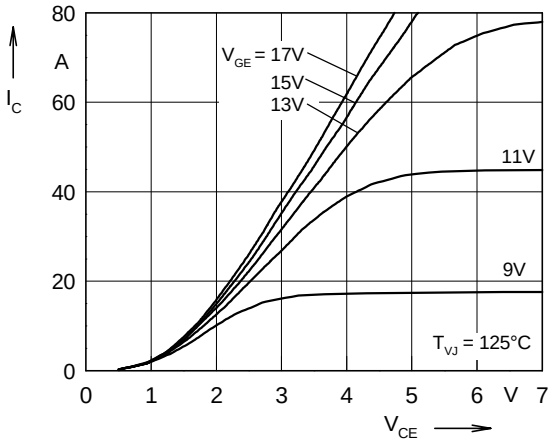


Fig. 8 Typ. output characteristics

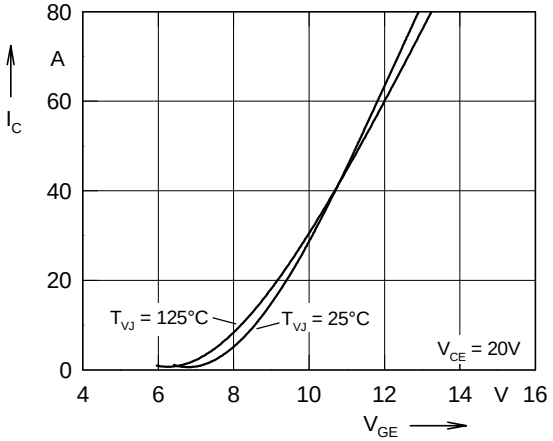


Fig. 9 Typ. transfer characteristics

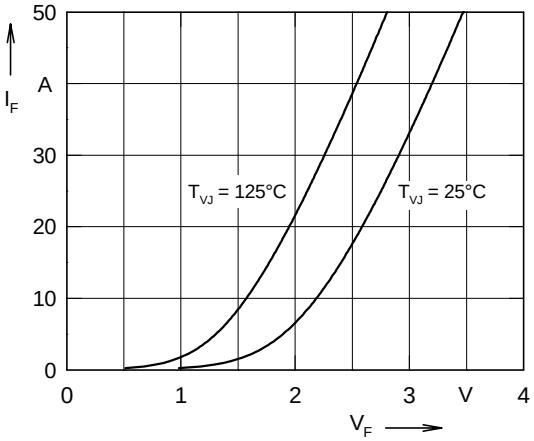


Fig. 10 Typ. forward characteristics of free wheeling diode

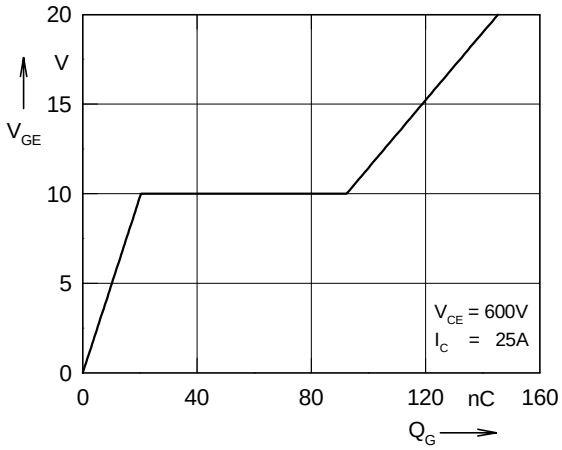


Fig. 11 Typ. turn on gate charge

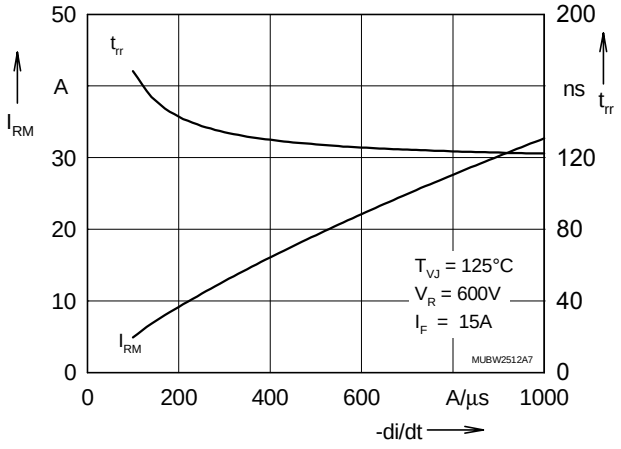


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

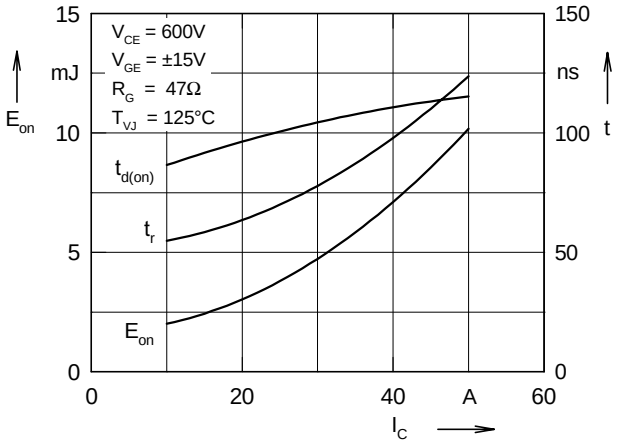


Fig. 13 Typ. turn on energy and switching times versus collector current

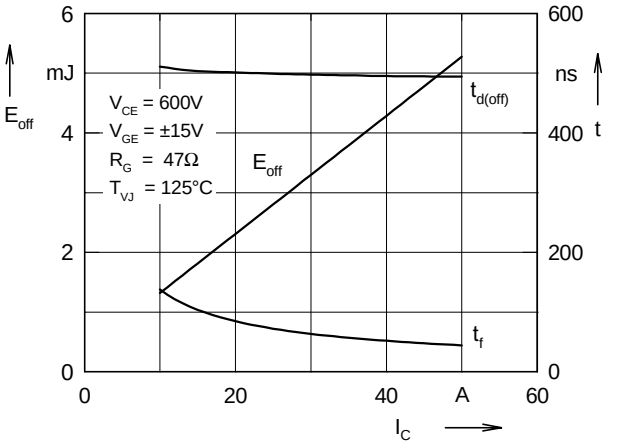


Fig. 14 Typ. turn off energy and switching times versus collector current

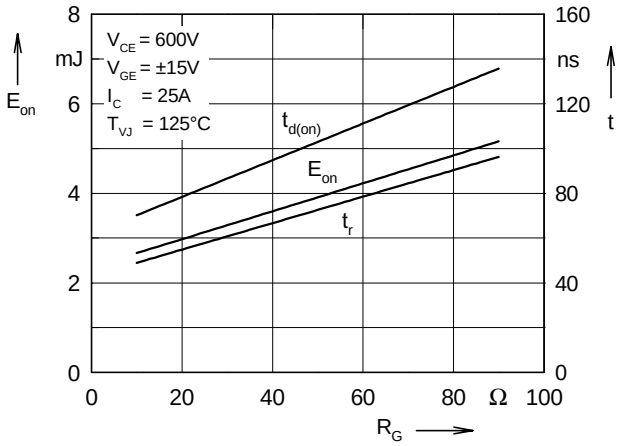


Fig. 15 Typ. turn on energy and switching times versus gate resistor

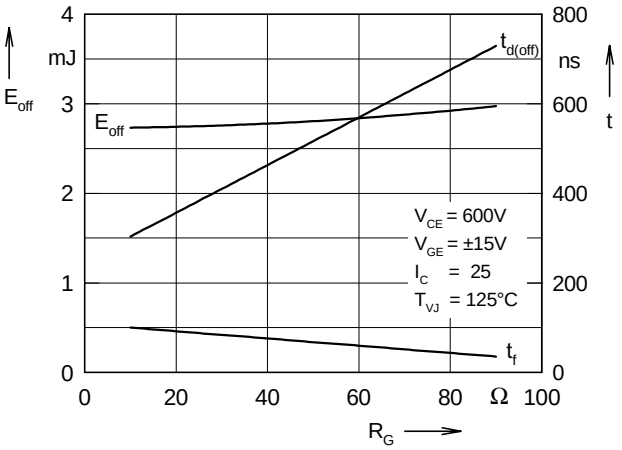


Fig.16 Typ. turn off energy and switching times versus gate resistor

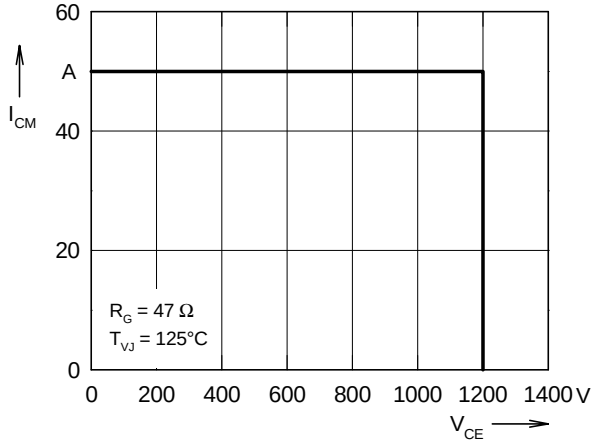


Fig. 17 Reverse biased safe operating area RBSOA

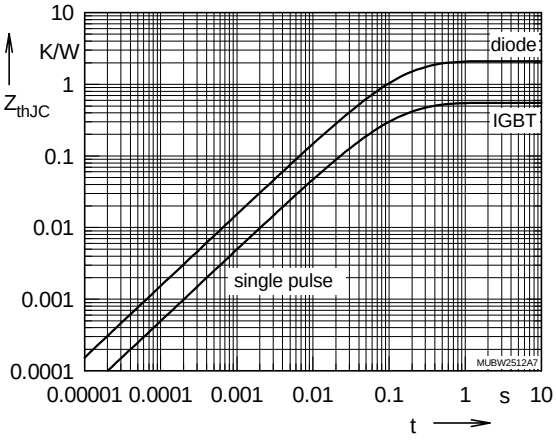


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

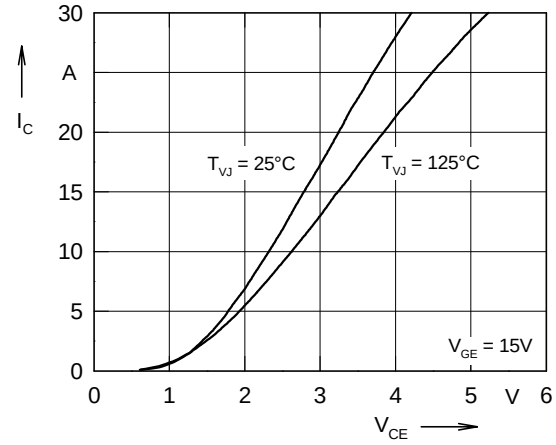


Fig. 19 Typ. output characteristics

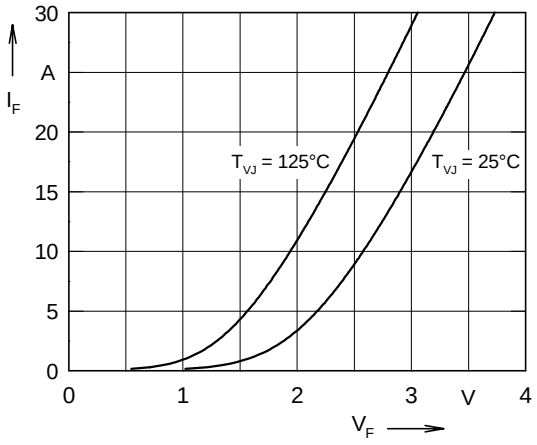


Fig. 20 Typ. forward characteristics of free wheeling diode

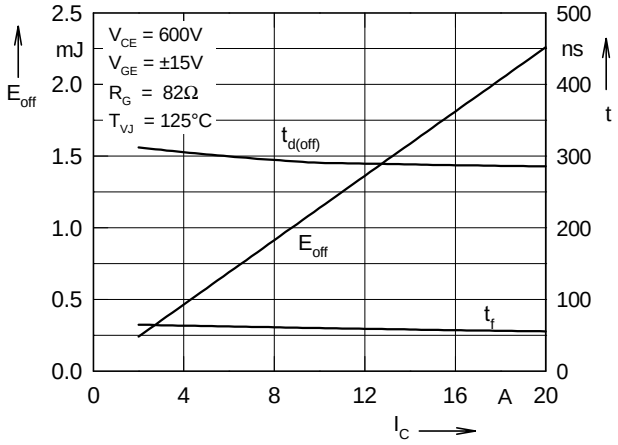


Fig. 21 Typ. turn off energy and switching times versus collector current

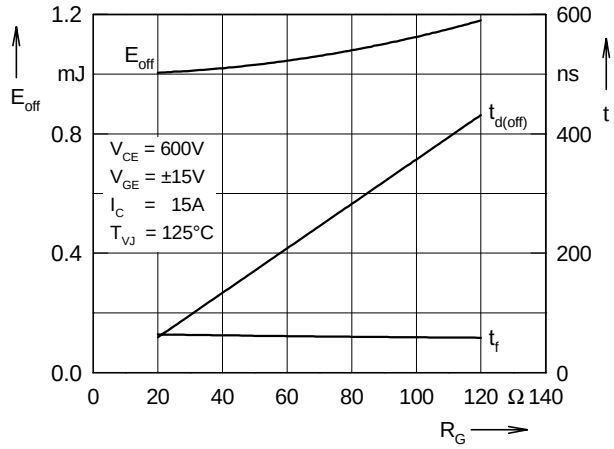


Fig. 22 Typ. turn off energy and switching times versus gate resistor

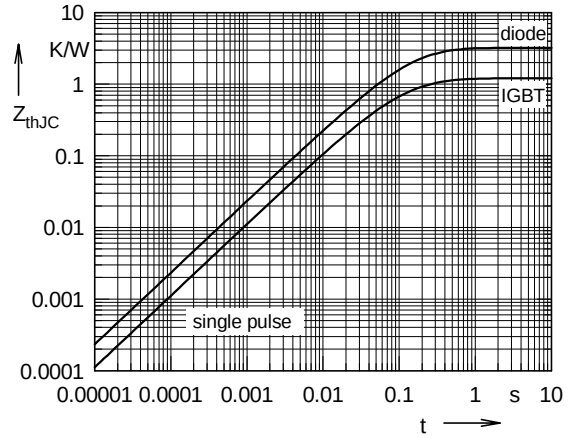


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

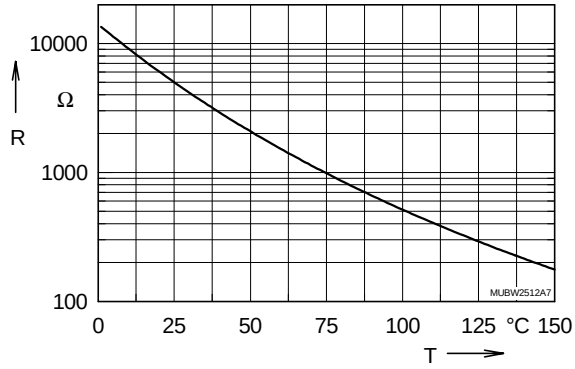
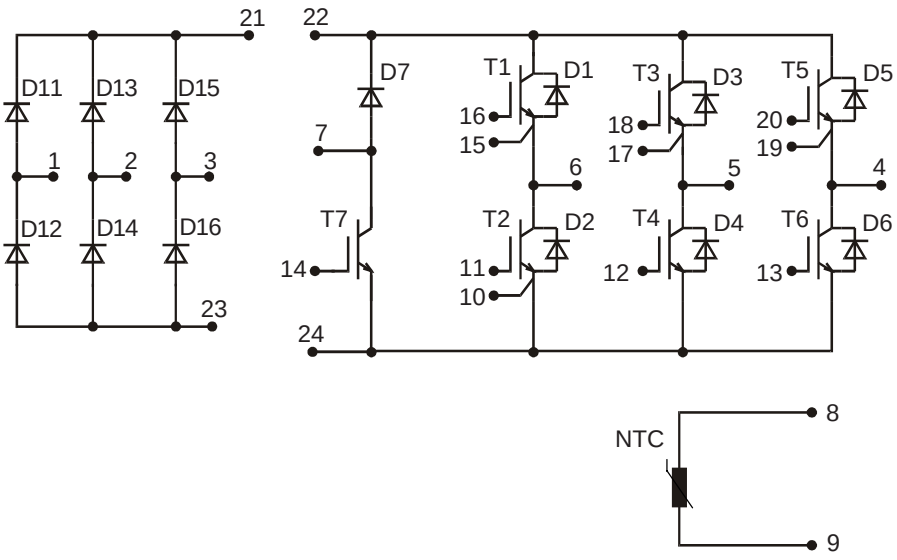
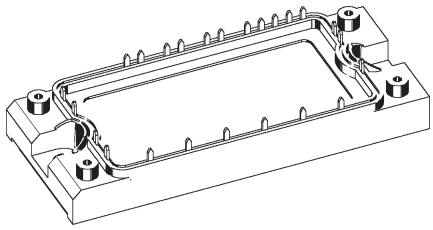


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI2)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 44 A	I_{C25} = 35 A	I_{C25} = 50 A
I_{FSM} = 400 A	$V_{CE(sat)}$ = 2.3 V	$V_{CE(sat)}$ = 2.6 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	30	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	29	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	400	A
P_{tot}	T_C = 25°C	120	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 35 A; T_{VJ} = 25°C		1.4	1.7	V
	T_{VJ} = 125°C		1.4		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2.0		mA
t_{rr}	V_R = 100 V; I_F = 20 A; di/dt = -20 A/µs		1		µs
R_{thJC}	(per diode)			1.06	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	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 = 35 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.6	3.1	V
	T_{VJ} = 125°C		2.9		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			1.1	mA
	T_{VJ} = 125°C		1		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 = 35 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}			5.3		mJ
E_{off}			3.9		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

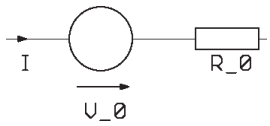
Output Inverter D1 - D6

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		1.8		V
I_{RM}	I_F = 30 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		27		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		150		ns
R_{thJC}	(per diode)			1.19	K/W

Equivalent Circuits for Simulation

Conduction



D11 - D16

Rectifier Diode (typ. at T_J = 125°C)
V_0 = 0.96 V; R_0 = 13 mΩ

T1 - T6 / D1 - D6

IGBT (typ. at V_{GE} = 15 V; T_J = 125°C)
V_0 = 1.13 V; R_0 = 50 mΩ

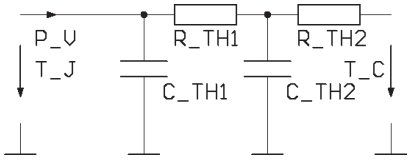
Free Wheeling Diode (typ. at T_J = 125°C)
V_0 = 1.26V; R_0 = 15 mΩ

T7 / D7

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 = 1.39 V; R_0 = 56 mΩ

Thermal Response



D11 - D16

Rectifier Diode (typ.)
C_{th1} = 0.131 J/K; R_{th1} = 0.851 K/W
C_{th2} = 0.839 J/K; R_{th2} = 0.209 K/W

T1 - T6 / D1 - D6

IGBT (typ.)
C_{th1} = 0.201 J/K; R_{th1} = 0.419 K/W
C_{th2} = 1.25 J/K; R_{th2} = 0.131 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.116 J/K; R_{th1} = 0.973 K/W
C_{th2} = 0.879 J/K; R_{th2} = 0.217 K/W

T7 / D7

IGBT (typ.)
C_{th1} = 0.156 J/K; R_{th1} = 0.545 K/W
C_{th2} = 1.162 J/K; R_{th2} = 0.155 K/W

Free Wheeling Diode (typ.)
C_{th1} = 0.043 J/K; R_{th1} = 2.738 K/W
C_{th2} = 0.54 J/K; R_{th2} = 0.462 K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	35	A
I_{C80}	T_C = 80°C	25	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	180	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 20 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.3	3	V
	T_{VJ} = 125°C		2.6		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			0.8	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 = 20 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}			3.1		mJ
E_{off}			2.4		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1000		pF
Q_{Gon}	V_{CE} = 600V; V_{GE} = 15 V; I_C = 20 A		70		nC
R_{thJC}				0.7	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	16	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 20 A; T_{VJ} = 25°C			3.6	V
	T_{VJ} = 125°C		2.6		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 20 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 600 V		110		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

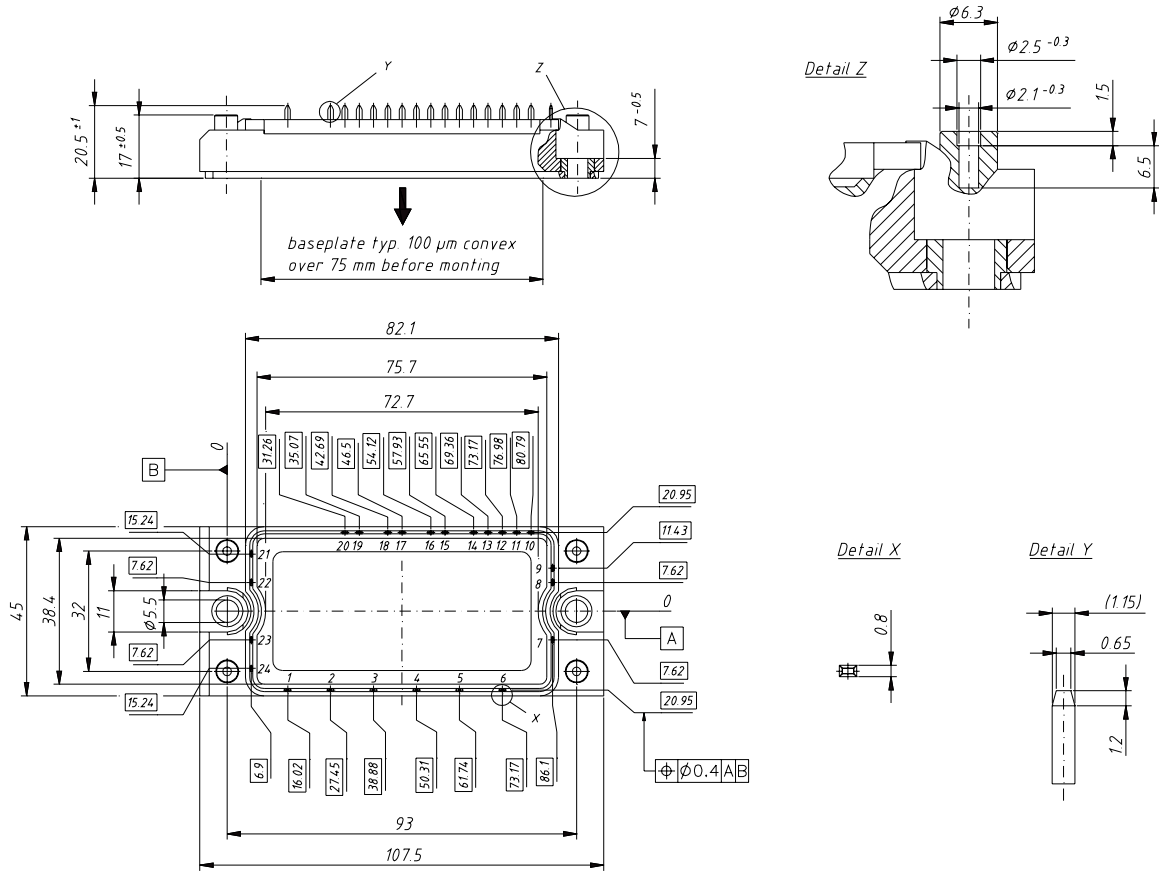
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		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.	
$R_{pin\text{-}chip}$			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

Dimensions in mm (1 mm = 0.0394")



Input Rectifier Bridge D11 - D16

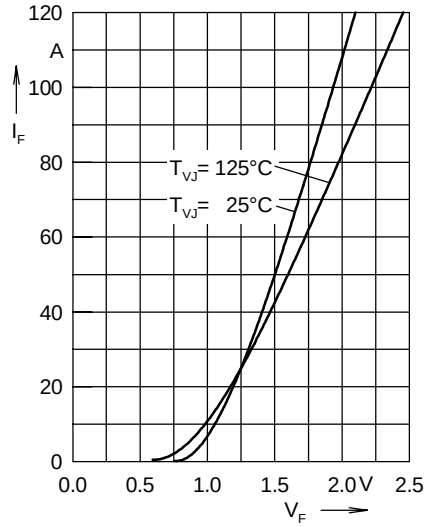


Fig. 1 Forward current versus voltage drop per diode

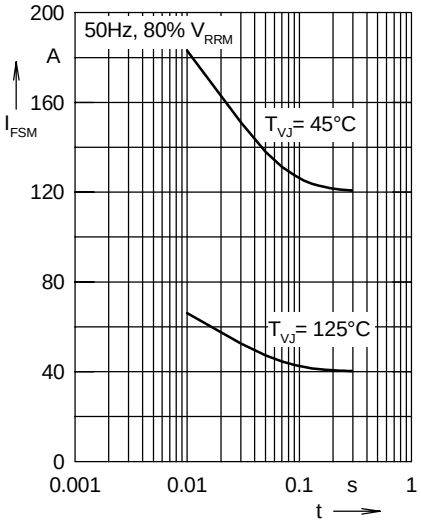


Fig. 2 Surge overload current

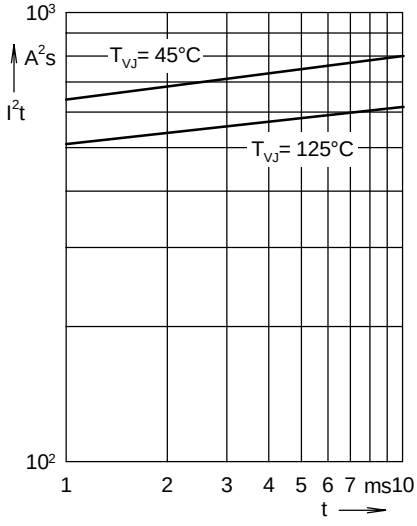


Fig. 3 I^2t versus time per diode

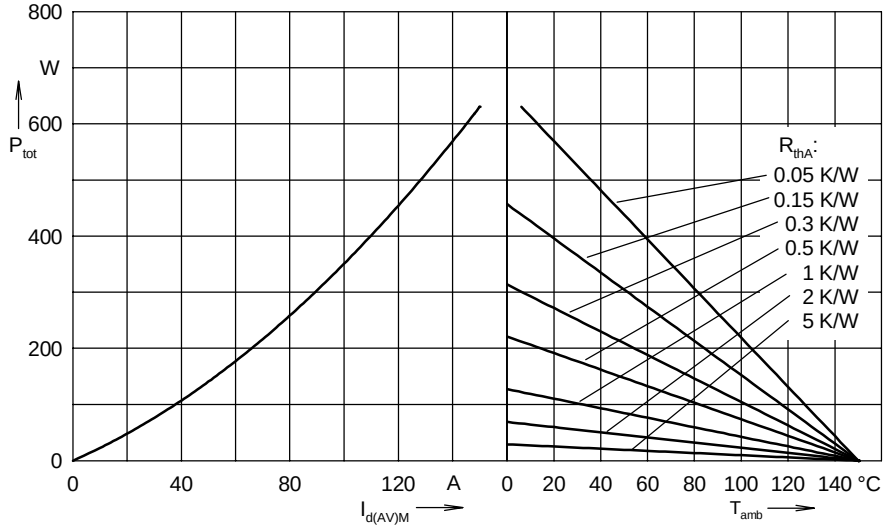


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

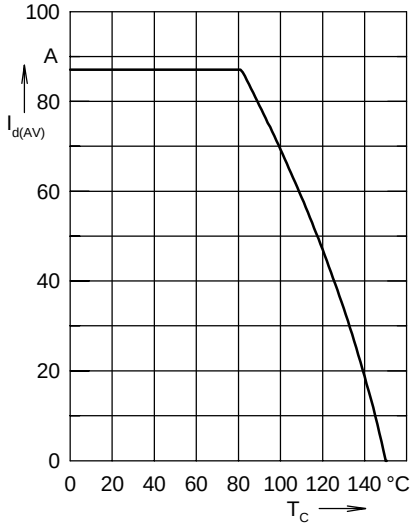


Fig. 5 Max. forward current versus case temperature

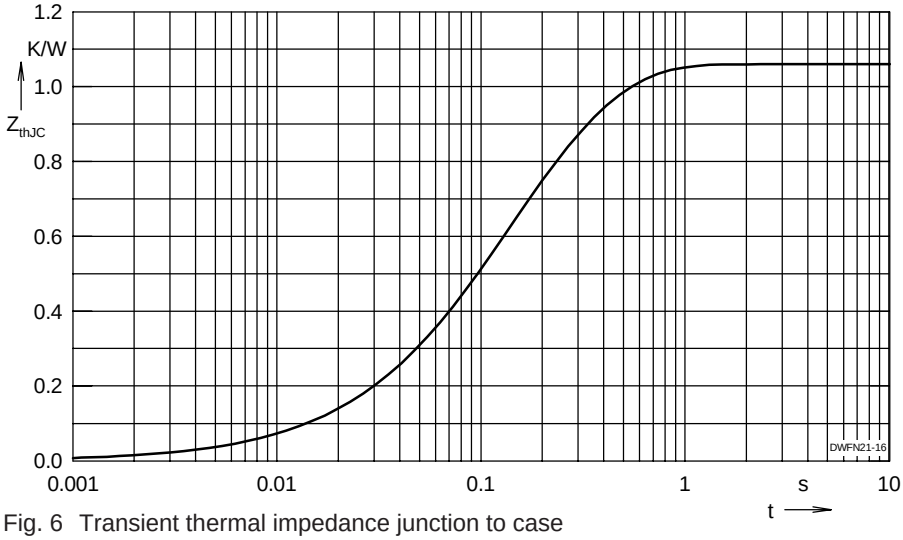


Fig. 6 Transient thermal impedance junction to case

Output Inverter T1 - T6 / D1 - D6

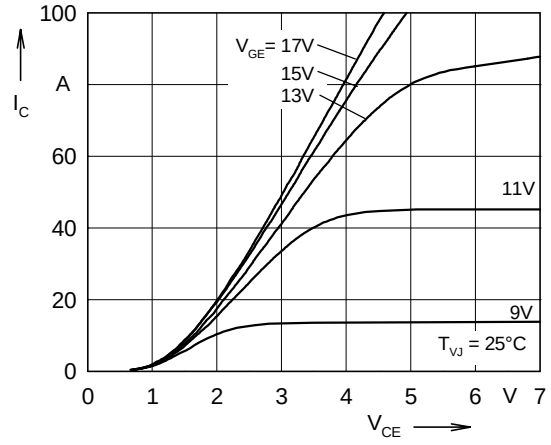


Fig. 7 Typ. output characteristics

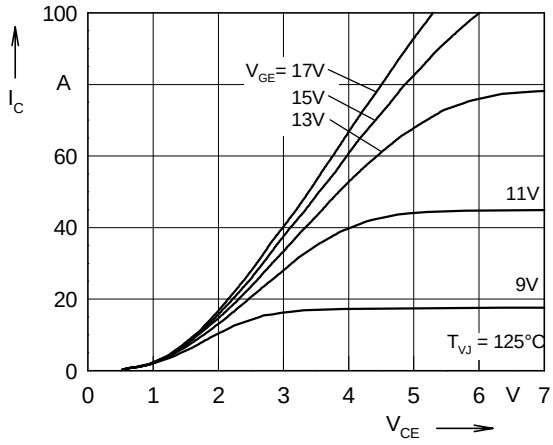


Fig. 8 Typ. output characteristics

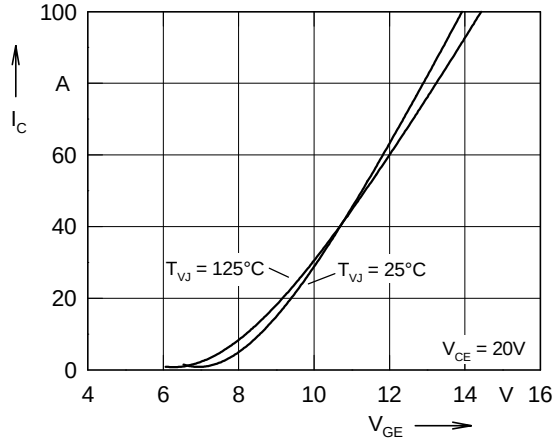


Fig. 9 Typ. transfer characteristics

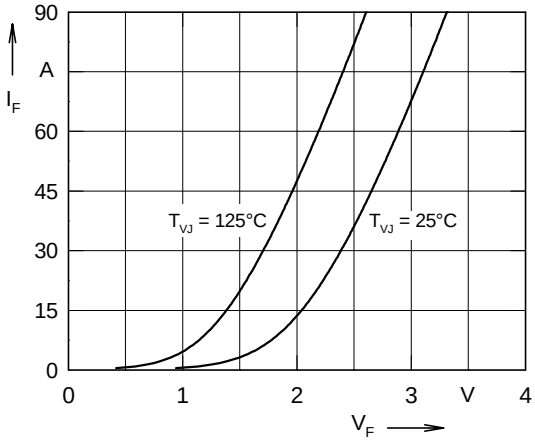


Fig. 10 Typ. forward characteristics of free wheeling diode

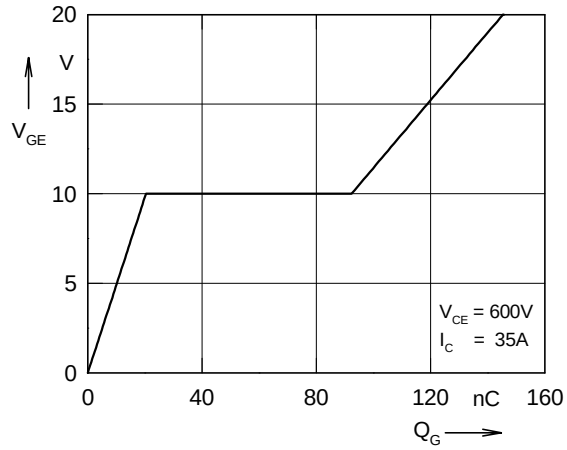


Fig. 11 Typ. turn on gate charge

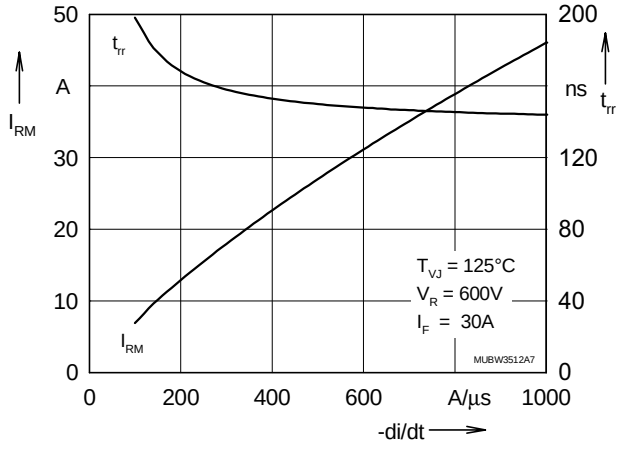


Fig. 12 Typ. turn off characteristics of free wheeling diode

Output Inverter T1 - T6 / D1 - D6

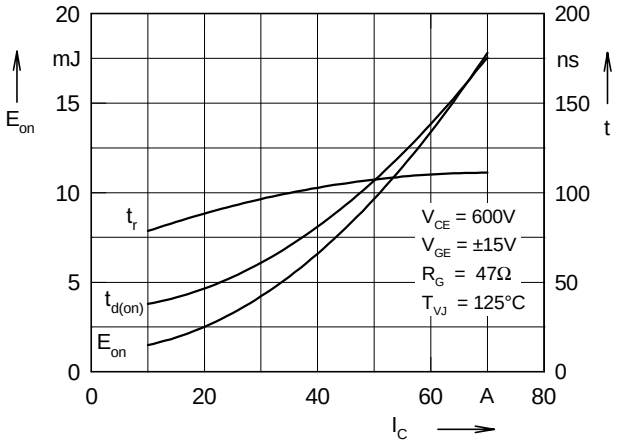


Fig. 13 Typ. turn on energy and switching times versus collector current

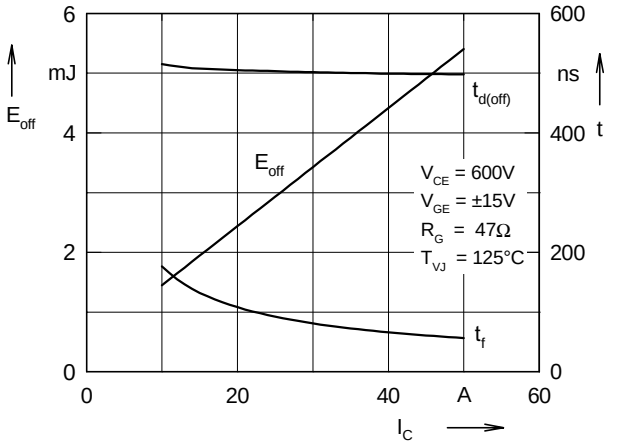


Fig. 14 Typ. turn off energy and switching times versus collector current

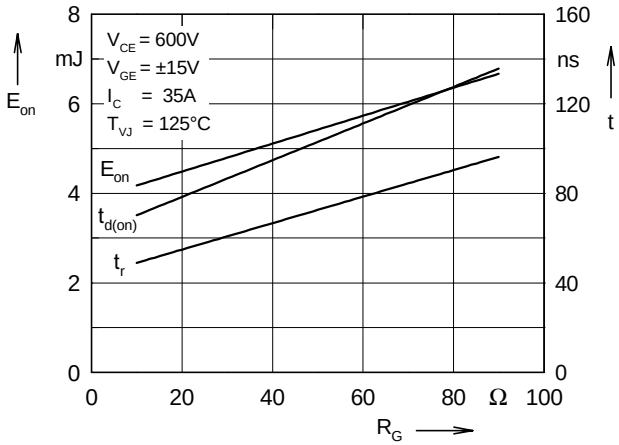


Fig. 15 Typ. turn on energy and switching times versus gate resistor

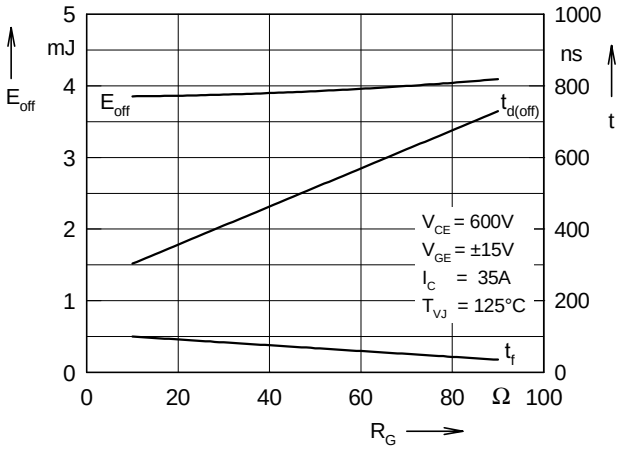


Fig.16 Typ. turn off energy and switching times versus gate resistor

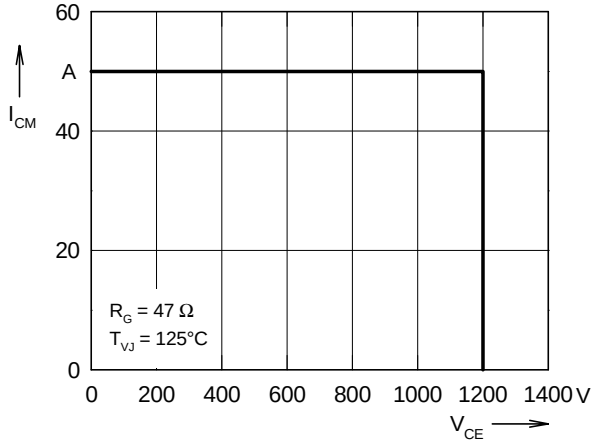


Fig. 17 Reverse biased safe operating area RBSOA

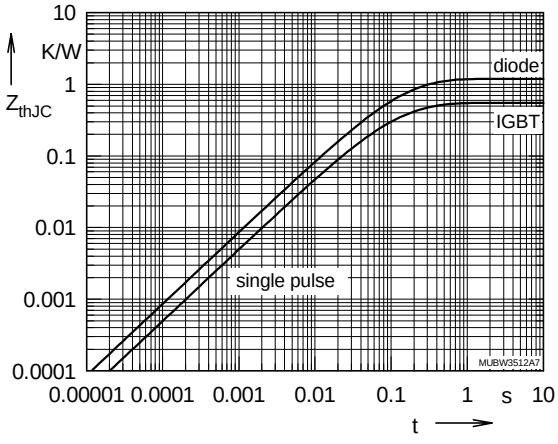


Fig. 18 Typ. transient thermal impedance

Brake Chopper T7 / D7

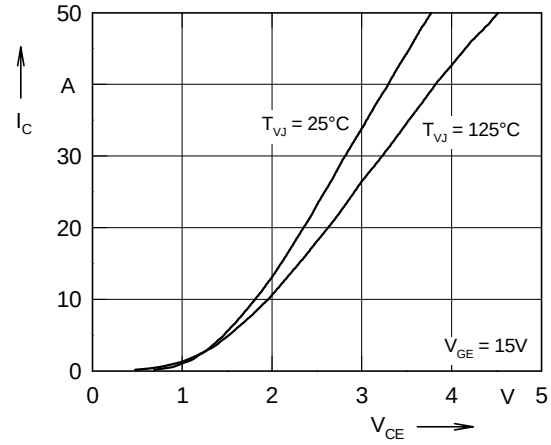


Fig. 19 Typ. output characteristics

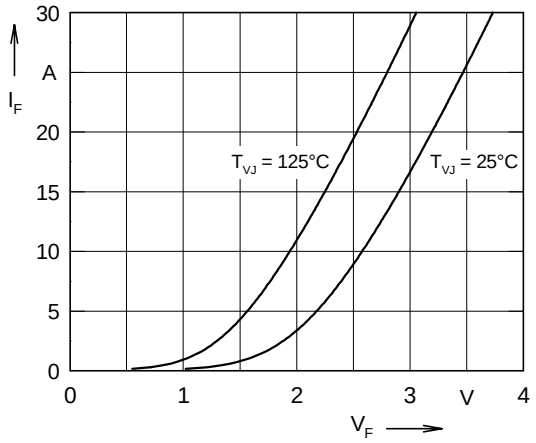


Fig. 20 Typ. forward characteristics of free wheeling diode

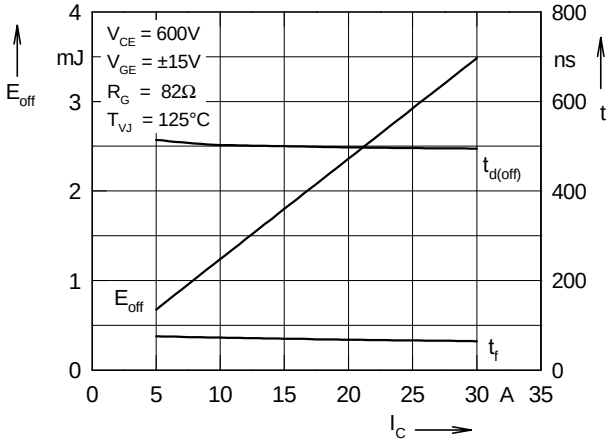


Fig. 21 Typ. turn off energy and switching times versus collector current

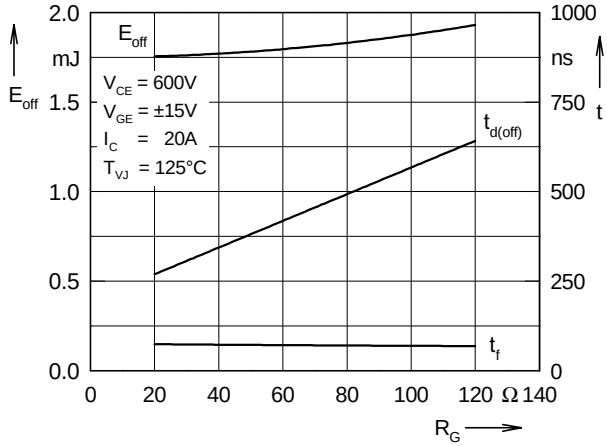


Fig. 22 Typ. turn off energy and switching times versus gate resistor

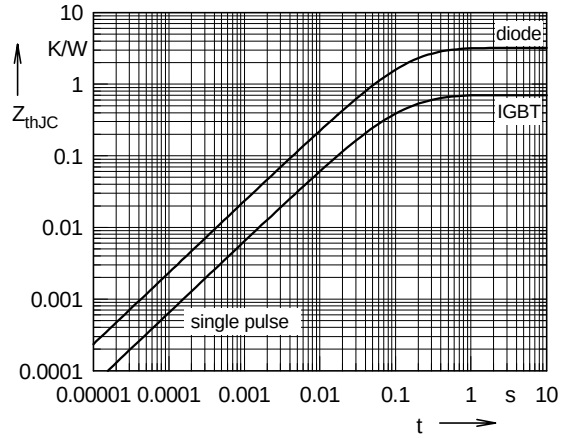


Fig. 23 Typ. transient thermal impedance

Temperature Sensor NTC

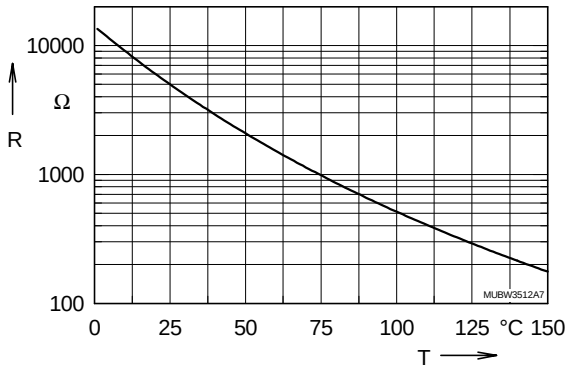
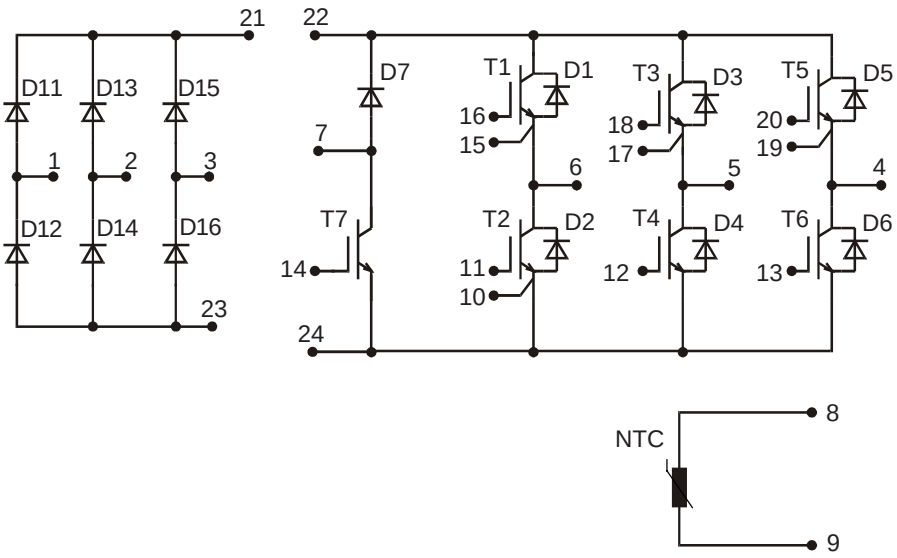
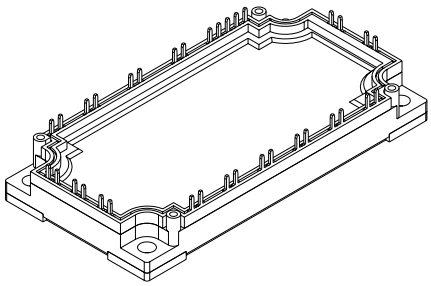


Fig. 24 Typ. thermistorresistance versus temperature

Converter - Brake - Inverter Module (CBI3)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 44 A	I_{C25} = 35 A	I_{C25} = 75 A
I_{FSM} = 400 A	$V_{CE(sat)}$ = 2.1 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	30	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	29	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	400	A
P_{tot}	T_C = 25°C	120	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 50 A; T_{VJ} = 25°C		1.4	1.8	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2		mA
t_{rr}	V_R = 100 V; I_F = 20 A; di/dt = -20 A/µs		1		µs
R_{thJC}	(per diode)			1.06	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	75	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} = 100 $V_{CEK} \leq V_{CES}$	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	250	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	2.3	V
	T_{VJ} = 125°C		2.1		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			0.8	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		50		ns
t_r	V_{CE} = 300 V; I_C = 50 A		60		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 22 Ω		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		2.8		nF
Q_{Gon}	V_{CE}= 300V; V_{GE} = 15 V; I_C = 50 A		120		nC
R_{thJC}	(per IGBT)			0.5	K/W

Output Inverter D1 - D6

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		1.5	1.7	V
	T_{VJ} = 125°C		1.3		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

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	35	A
I_{C80}	T_C = 80°C	25	A
RBSOA	V_{GE} = ±15 V; R_G = 47 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 40 $V_{CEK} \leq V_{CES}$	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	125	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		2.1	2.6	V
	T_{VJ} = 125°C		2.4		V
$V_{GE(th)}$	I_C = 0.5 mA; V_{GE} = V_{CE}	4.5		6.5	V
I_{CES}	V_{CE} = V_{CES}; V_{GE} = 0 V; T_{VJ} = 25°C			0.5	mA
	T_{VJ} = 125°C		0.3		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 = 25 A		60		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 47 Ω		300		ns
t_f			30		ns
E_{on}			1.15		mJ
E_{off}			0.85		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1.1		nF
Q_{Gon}	V_{CE}= 300 V; V_{GE} = 15 V; I_C = 25 A		65		nC
R_{thJC}				1	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	22	A
I_{F80}	T_C = 80°C	15	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 25 A; T_{VJ} = 25°C		2.2	2.5	V
	T_{VJ} = 125°C		1.7		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		11		A
t_{rr}	V_R = 300 V		80		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

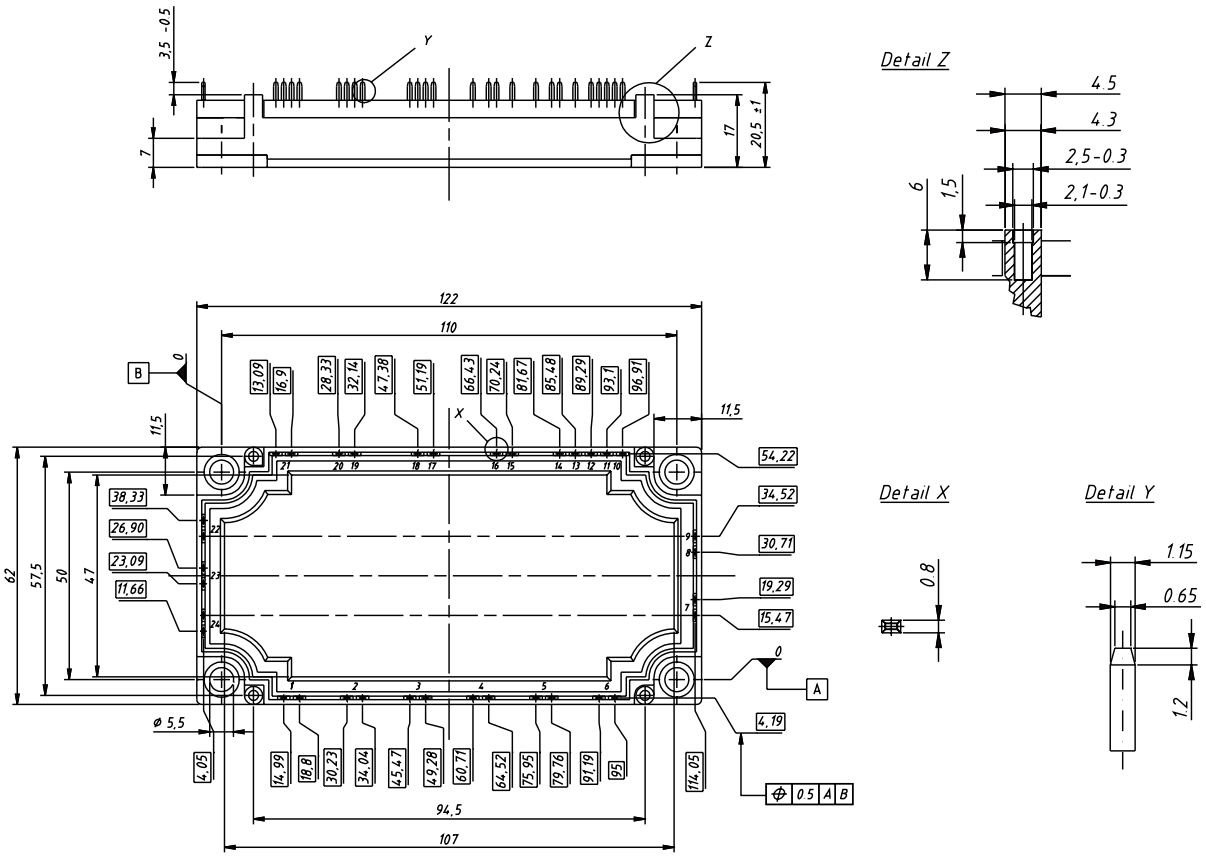
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

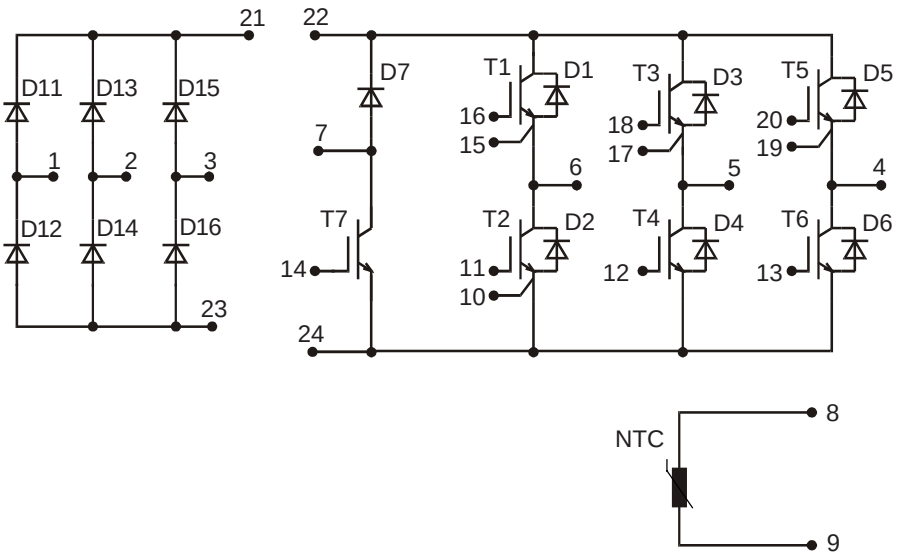
Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

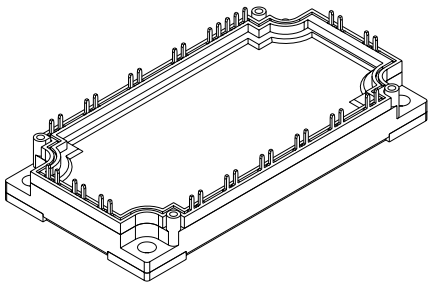
Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin\text{-}chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

Dimensions in mm (1 mm = 0.0394")



Converter - Brake - Inverter Module (CBI3)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 52 A	I_{C25} = 50 A	I_{C25} = 100 A
I_{FSM} = 500 A	$V_{CE(sat)}$ = 2.0 V	$V_{CE(sat)}$ = 2.0 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	36	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	35	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	500	A
P_{tot}	T_C = 25°C	135	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 75 A; T_{VJ} = 25°C		1.4	1.8	V
	T_{VJ} = 125°C		1.4		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2		mA
t_{rr}	V_R = 100 V; I_F = 30 A; di/dt = -30 A/µs		1		µs
R_{thJC}	(per diode)			0.94	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	100	A
I_{C80}	T_C = 80°C	65	A
RBSOA	V_{GE} = ±15 V; R_G = 15 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 150 $V_{CEK} \leq V_{CES}$	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	320	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		2.0	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			1.4	mA
	T_{VJ} = 125°C		1.5		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 = 75 A V_{GE} = ±15 V; R_G = 15 Ω		150		ns
t_r			60		ns
$t_{d(off)}$			450		ns
t_f			40		ns
E_{on}			4.0		mJ
E_{off}			3.3		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		4.2		nF
Q_{Gon}	V_{CE}= 300V; V_{GE} = 15 V; I_C = 75 A		180		nC
R_{thJC}	(per IGBT)			0.39	K/W

Output Inverter D1 - D6

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 = 75 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.7	2.0	V
	T_{VJ} = 125°C		1.2		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

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 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 = 33 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 60 $V_{CEK} \leq V_{CES}$	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	165	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		2.0	2.5	V
	T_{VJ} = 125°C		2.3		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			0.5	mA
	T_{VJ} = 125°C		0.3		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 = 35 A		50		ns
$t_{d(off)}$	V_{GE} = ±15 V; R_G = 33 Ω		270		ns
t_f			40		ns
E_{on}			1.63		mJ
E_{off}			1.17		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1.6		nF
Q_{Gon}	V_{CE}= 300 V; V_{GE} = 15 V; I_C = 25 A		94		nC
R_{thJC}				0.75	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	35	A
I_{F80}	T_C = 80°C	24	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 35 A; T_{VJ} = 25°C		2.0	2.3	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		0.1		mA
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 300 V		90		ns
R_{thJC}				2.1	K/W

Temperature Sensor NTC

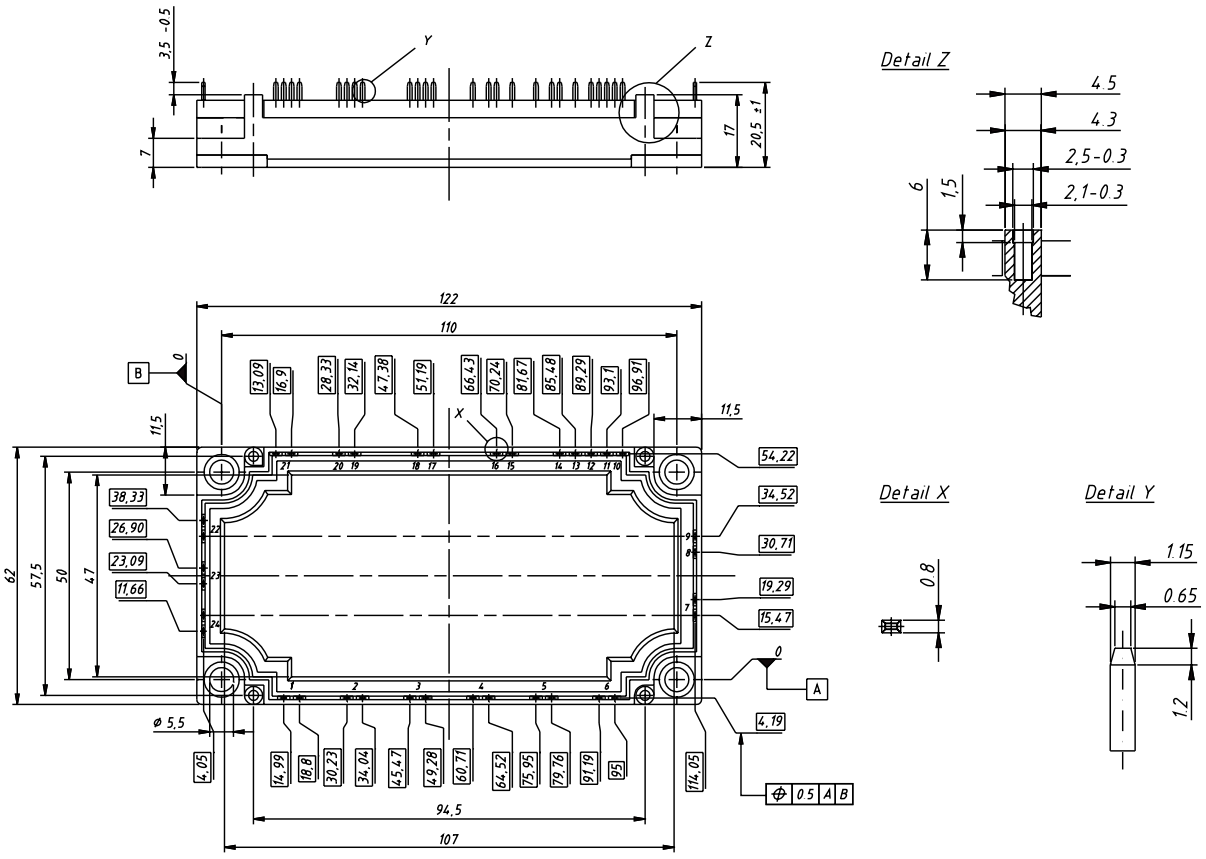
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

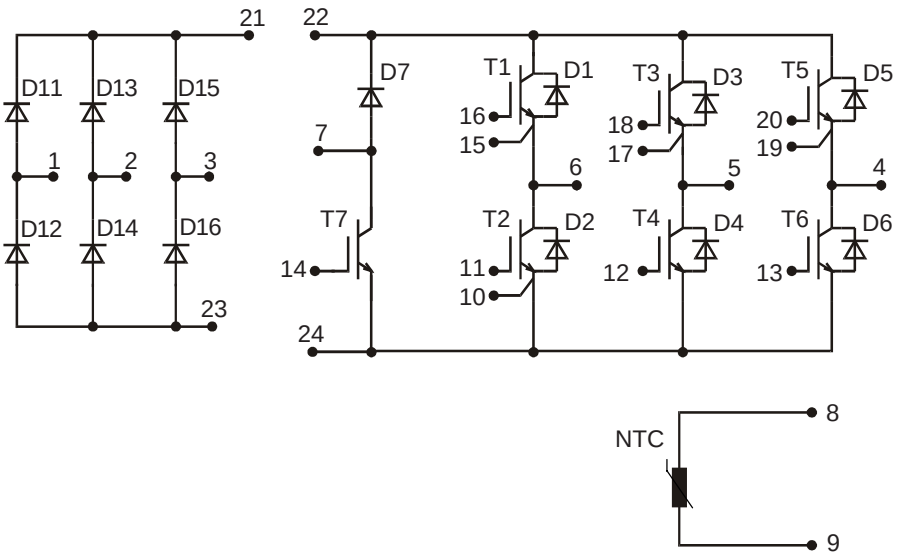
Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

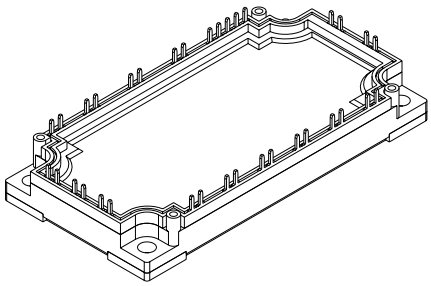
Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin-chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

Dimensions in mm (1 mm = 0.0394")



Converter - Brake - Inverter Module (CBI3)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 600 V	V_{CES} = 600 V
I_{DAVM} = 52 A	I_{C25} = 50 A	I_{C25} = 125 A
I_{FSM} = 500 A	$V_{CE(sat)}$ = 1.9 V	$V_{CE(sat)}$ = 1.9 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	36	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	35	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	500	A
P_{tot}	T_C = 25°C	135	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 100 A; T_{VJ} = 25°C		1.5	2.0	V
	T_{VJ} = 125°C		1.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2		mA
t_{rr}	V_R = 100 V; I_F = 30 A; di/dt = -30 A/µs		1		µs
R_{thJC}	(per diode)			0.94	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	125	A
I_{C80}	T_C = 80°C	85	A
RBSOA	V_{GE} = ±15 V; R_G = 2.2 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 200 $V_{CEK} \leq V_{CES}$	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		1.9	2.5	V
	T_{VJ} = 125°C		2.2		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			1.4	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		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

Output Inverter D1 - D6

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 = 60 A; V_{GE} = 0 V; T_{VJ} = 25°C		1.8	2.1	V
	T_{VJ} = 125°C		1.3		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

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	600	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	75	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} = 100 $V_{CEK} \leq V_{CES}$	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	2.3	V
	T_{VJ} = 125°C		2.1		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			0.5	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 V_{CE} = 300 V; I_C = 50 A V_{GE} = ±15 V; R_G = 22 Ω		50		ns
t_r			55		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 MH z		2.8		nF
Q_{Gon}	V_{CE}= 300 V; V_{GE} = 15 V; I_C = 50 A		120		nC
R_{thJC}				0.55	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	600	V
I_{F25}	T_C = 25°C	35	A
I_{F80}	T_C = 80°C	24	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 50 A; T_{VJ} = 25°C		2.5	2.7	V
	T_{VJ} = 125°C		2.2		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		0.1		mA
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 300 V		90		ns
R_{thJC}				2.1	K/W

Temperature Sensor NTC

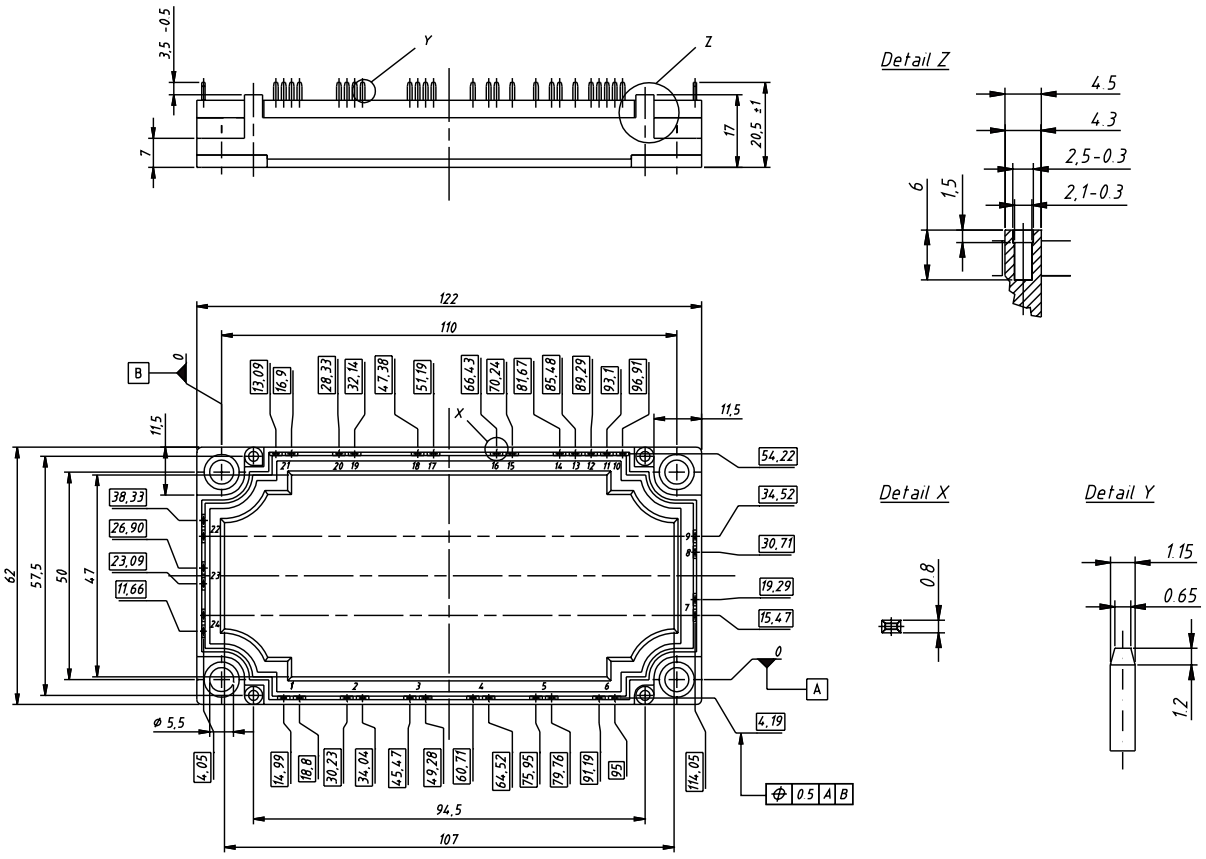
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

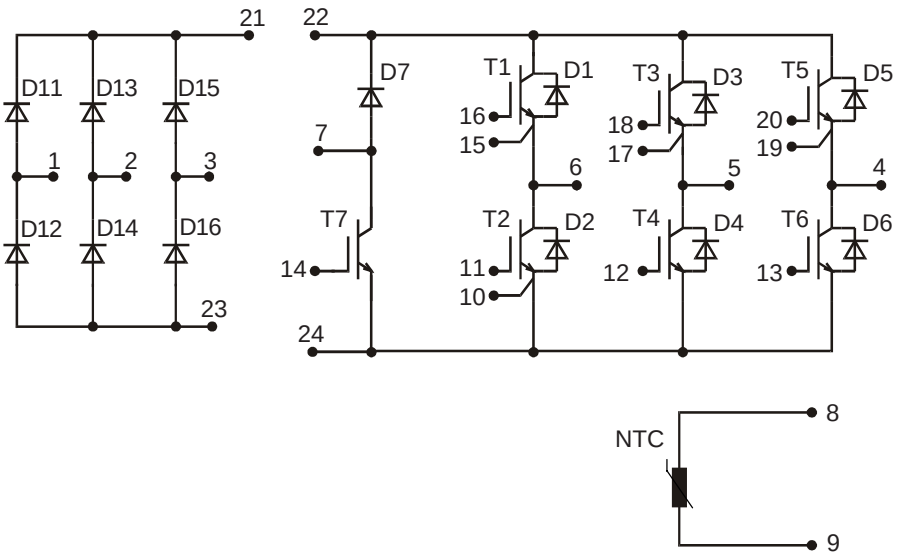
Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

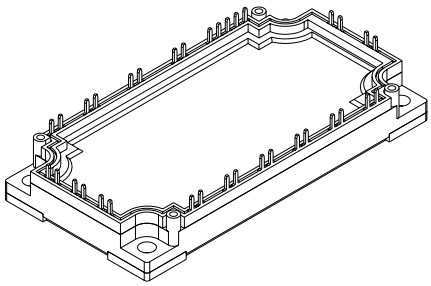
Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin\text{-}chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

Dimensions in mm (1 mm = 0.0394")



Converter - Brake - Inverter Module (CBI3)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 44 A	I_{C25} = 35 A	I_{C25} = 50 A
I_{FSM} = 400 A	$V_{CE(sat)}$ = 2.3 V	$V_{CE(sat)}$ = 2.5 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	30	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	29	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	400	A
P_{tot}	T_C = 25°C	120	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 35 A; T_{VJ} = 25°C		1.3	1.7	V
	T_{VJ} = 125°C		1.4		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2		mA
t_{rr}	V_R = 100 V; I_F = 20 A; di/dt = -20 A/µs		1		µs
R_{thJC}	(per diode)			1.06	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 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 $V_{CEK} \leq V_{CES}$	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 = 35 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.5	3.1	V
	T_{VJ} = 125°C		2.9		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			1.1	mA
	T_{VJ} = 125°C		1.0		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 = 35 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}			5.3		mJ
E_{off}			3.9		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz		1.65		nF
Q_{Gon}	V_{CE}= 600 V; V_{GE} = 15 V; I_C = 35 A		120		nC
R_{thJC}	(per IGBT)			0.55	K/W

Output Inverter D1 - D6

Symbol	Conditions	Maximum Ratings	
I_{F25}	T_C = 25°C	50	A
I_{F80}	T_C = 80°C	35	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 35 A; V_{GE} = 0 V; T_{VJ} = 25°C		2.4	2.8	V
	T_{VJ} = 125°C		1.8		V
I_{RM}	I_F = 30 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		27		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		150		ns
R_{thJC}	(per diode)			1.19	K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	35	A
I_{C80}	T_C = 80°C	25	A
RBSOA	V_{GE} = ±15 V; R_G = 82 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 35 $V_{CEK} \leq V_{CES}$	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	180	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{CE(sat)}$	I_C = 20 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.3	3.0	V
	T_{VJ} = 125°C		2.6		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			0.8	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 = 20 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}			3.1		mJ
E_{off}			2.4		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1		nF
Q_{Gon}	V_{CE}= 600 V; V_{GE} = 15 V; I_C = 20 A		70		nC
R_{thJC}				0.7	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	16	A
I_{F80}	T_C = 80°C	11	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 20 A; T_{VJ} = 25°C		3.2	3.6	V
	T_{VJ} = 125°C		2.5		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.06	mA
	T_{VJ} = 125°C		0.07		mA
I_{RM}	I_F = 10 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		13		A
t_{rr}	V_R = 600 V		110		ns
R_{thJC}				3.2	K/W

Temperature Sensor NTC

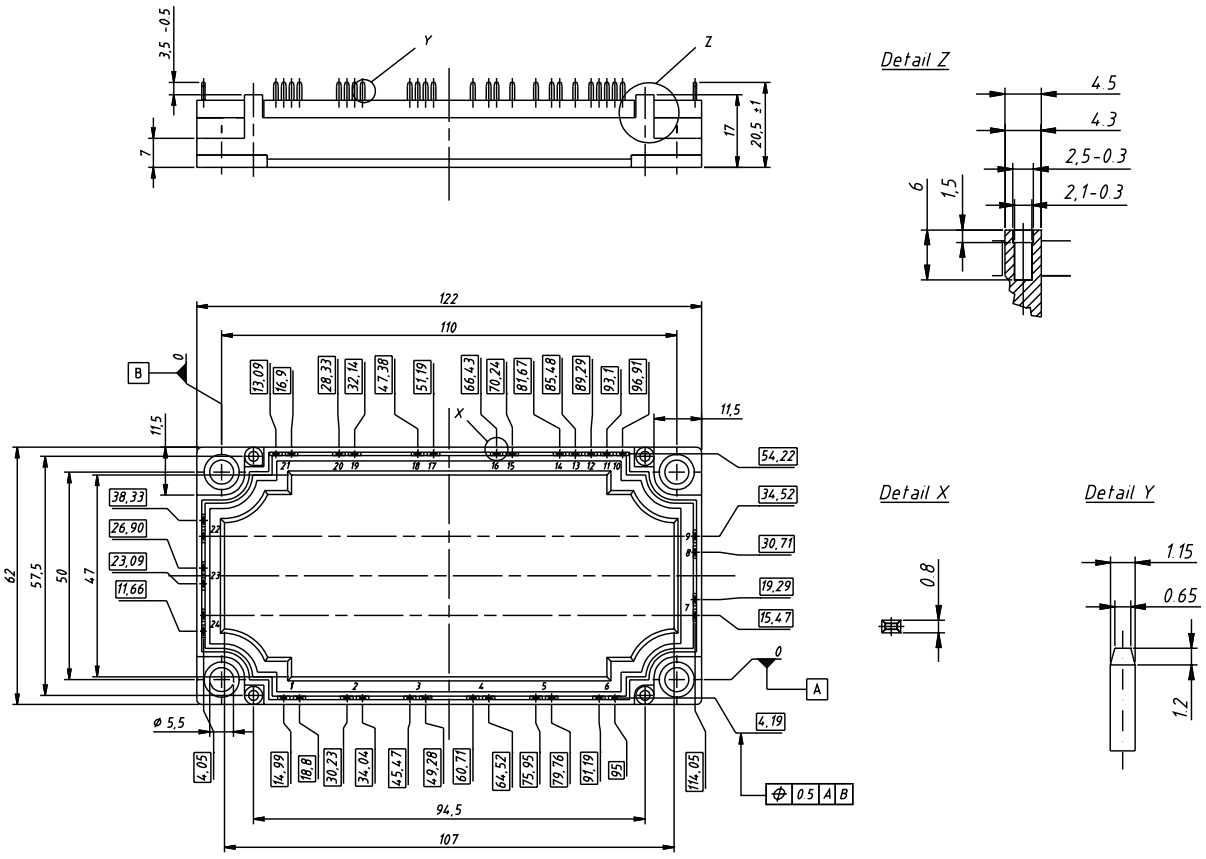
Symbol	Conditions	Characteristic Values min.	typ.	max.	
R_{25}	T = 25°C	4.75	5.0	5.25	kΩ
$B_{25/50}$			3375		K

Module

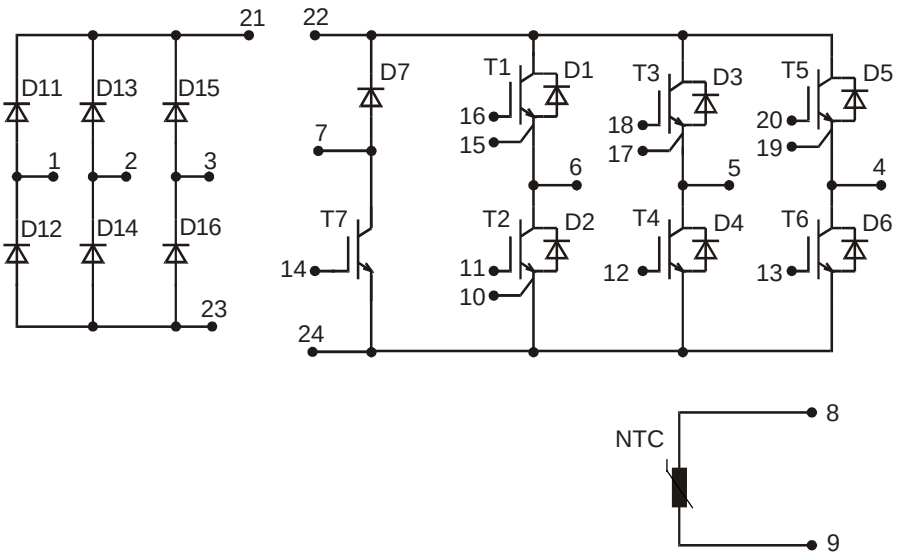
Symbol	Conditions	Maximum Ratings	
T_{VJ}		-40...+150	°C
T_{JM}		150	°C
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1$ mA; 50/60 Hz	2500	V~
M_d	Mounting torque (M5)	3 - 6	Nm

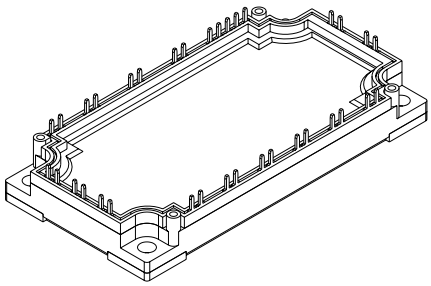
Symbol	Conditions	Characteristic Values min.	typ.	max.	
$R_{pin\text{-}chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

Dimensions in mm (1 mm = 0.0394")



Converter - Brake - Inverter Module (CBI3)





Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM} = 52 A	I_{C25} = 50 A	I_{C25} = 95 A
I_{FSM} = 500 A	$V_{CE(sat)}$ = 2.5 V	$V_{CE(sat)}$ = 2.2 V

Input Rectifier Bridge D11 - D16

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_{FAV}	T_C = 80°C; sine 180°	36	A
I_{DAVM}	T_C = 80°C; rectangular; d = 1/3	35	A
I_{FSM}	T_{VJ} = 25°C; t = 10 ms; sine 50 Hz	500	A
P_{tot}	T_C = 25°C	135	W

Symbol	Conditions	Characteristic Values (T_{VJ} = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 50 A; T_{VJ} = 25°C		1.3	1.7	V
	T_{VJ} = 125°C		1.2		V
I_R	$V_R = V_{RRM}$; T_{VJ} = 25°C			0.2	mA
	T_{VJ} = 125°C		2		mA
t_{rr}	V_R = 100 V; I_F = 30 A; di/dt = -30 A/µs		1		µs
R_{thJC}	(per diode)			0.94	K/W

Application: AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- electric braking operation

Features

- High level of integration - only one power semiconductor module required for the whole drive
- Fast rectifier diodes for enhanced EMC behaviour
- NPT IGBT technology with low saturation voltage, low switching losses, high RBSOA and short circuit ruggedness
- Epitaxial free wheeling diodes with Hiperfast and soft reverse recovery
- Industry standard package with insulated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Output Inverter T1 - T6

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 20	V
I_{C25}	T_C = 25°C	95	A
I_{C80}	T_C = 80°C	65	A
RBSOA	V_{GE} = ±15 V; R_G = 22 Ω; T_{VJ} = 125°C Clamped inductive load; L = 100 µH	I_{CM} = 100 $V_{CEK} \leq V_{CES}$	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	410	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	2.6	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			3.7	mA
	T_{VJ} = 125°C		3.1		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		3.3		nF
Q_{Gon}	V_{CE}= 600 V; V_{GE} = 15 V; I_C = 50 A		230		nC
R_{thJC}	(per IGBT)			0.3	K/W

Output Inverter D1 - D6

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		2.1	2.5	V
	T_{VJ} = 125°C		1.5		V
I_{RM}	I_F = 60 A; di_F/dt = -500 A/µs; T_{VJ} = 125°C		41		A
t_{rr}	V_R = 600 V; V_{GE} = 0 V		200		ns
R_{thJC}	(per diode)			0.61	K/W

Brake Chopper T7

Symbol	Conditions	Maximum Ratings	
V_{CES}	T_{VJ} = 25°C to 150°C	1200	V
V_{GES}	Continuous	± 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 $V_{CEK} \leq V_{CES}$	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 = 35 A; V_{GE} = 15 V; T_{VJ} = 25°C		2.5	3.1	V
	T_{VJ} = 125°C		2.9		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			0.8	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 = 35 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}			5.3		mJ
E_{off}			3.9		mJ
C_{ies}	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MH z		1.6		nF
Q_{Gon}	V_{CE}= 600 V; V_{GE} = 15 V; I_C = 25 A		120		nC
R_{thJC}				0.55	K/W

Brake Chopper D7

Symbol	Conditions	Maximum Ratings	
V_{RRM}	T_{VJ} = 25°C to 150°C	1200	V
I_{F25}	T_C = 25°C	25	A
I_{F80}	T_C = 80°C	16	A

Symbol	Conditions	Characteristic Values min.	typ.	max.	
V_F	I_F = 35 A; T_{VJ} = 25°C		3.0	3.4	V
	T_{VJ} = 125°C		2.3		V
I_R	V_R = V_{RRM}; T_{VJ} = 25°C			0.1	mA
	T_{VJ} = 125°C		0.1		mA
I_{RM}	I_F = 15 A; di_F/dt = -400 A/µs; T_{VJ} = 125°C		16		A
t_{rr}	V_R = 600 V		130		ns
R_{thJC}				2.1	K/W

Temperature Sensor NTC

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_{JM}		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.	
$R_{pin\text{-}chip}$			5		mΩ
d_S	Creepage distance on surface	6			mm
d_A	Strike distance in air	6			mm
R_{thCH}	with heatsink compound		0.01		K/W
Weight			300		g

Dimensions in mm (1 mm = 0.0394")