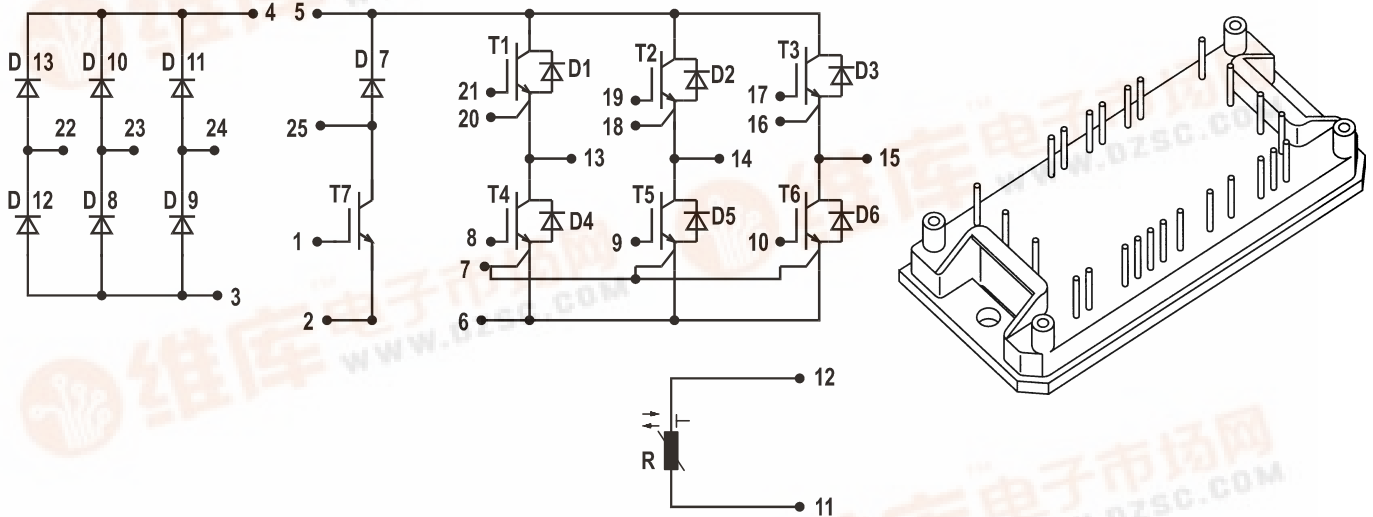


Converter - Brake - Inverter Module (CBI1)



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

Input Rectifier Bridge D8 - D13

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

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

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
- **Direct Copper Bonded** 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

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	23	A
	T _C = 90°C	13	A
I _{CM}	t _p = 1 ms = 1% duty cycle; T _C = 25°C T _C = 90°C	46	A
		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 ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
I_{CES}	$V_{GE} = 0 \text{ V}; V_{CE} = 600 \text{ V}$			1 mA
I_{GES}	$V_{CE} = 0 \text{ V}; V_{GE} = 25 \text{ V}$			100 nA
$V_{GE(th)}$	$V_{GE} = V_{CE}; I_C = 0.4 \text{ mA}$	4.5	5.5	6.5 V
$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}; I_C = 10 \text{ mA}; T_{VJ} = -40^{\circ}\text{C}$	600		V
$V_{CE(sat)}$	$V_{GE} = 15 \text{ V}; I_C = 15 \text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2.1	2.5	V
		2.4	2.8	V
t_f	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$ $V_{CC} = 300 \text{ V}; I_C = 15 \text{ A}$ $R_G = 68 \Omega; V_{GE} = \pm 15 \text{ V}$	25		ns
t_r		25		ns
$t_{d(on)}$		30		ns
$t_{d(off)}$		200		ns
E_{off}		0.5		mJ
E_{on}		0.7		mJ
C_{iss}	$V_{GE} = 0 \text{ V}$ $V_{CE} = 25 \text{ V}$ $f = 1 \text{ MHz}$	800		pF
C_{oss}		85		pF
C_{rss}		52		pF
g_{fs}	$V_{CE} = 20 \text{ V}; I_C = 15 \text{ A}$	4.5		S
Q_g	$V_{CC} = 300 \text{ V}; I_C = 15 \text{ A pulse}; V_{GE} = 15 \text{ V}$	59		nC
V_F	$I_F = 15 \text{ A}; V_{GE} = 0 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	2		V
		1.8		V
t_{rr}	$I_F = 15 \text{ A}; V_R = -300 \text{ V}; T_{VJ} = 125^{\circ}\text{C}$ $di_F/dt = -500 \text{ A}/\mu\text{s}; V_{GE} = 0 \text{ V}$	0.25		μs
Q_r	$I_F = 15 \text{ A}; V_R = -300 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$ $di_F/dt = -500 \text{ A}/\mu\text{s}; V_{GE} = 0 \text{ V}; T_{VJ} = 125^{\circ}\text{C}$	0.4		μC
		1.3		μC
I_r			250	μA
R_{thJC}	IGBT (per die)	1.5		$^{\circ}\text{C}/\text{W}$
	Diode (per die)	2.0		$^{\circ}\text{C}/\text{W}$

Brake Chopper T7, D7

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

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

Module

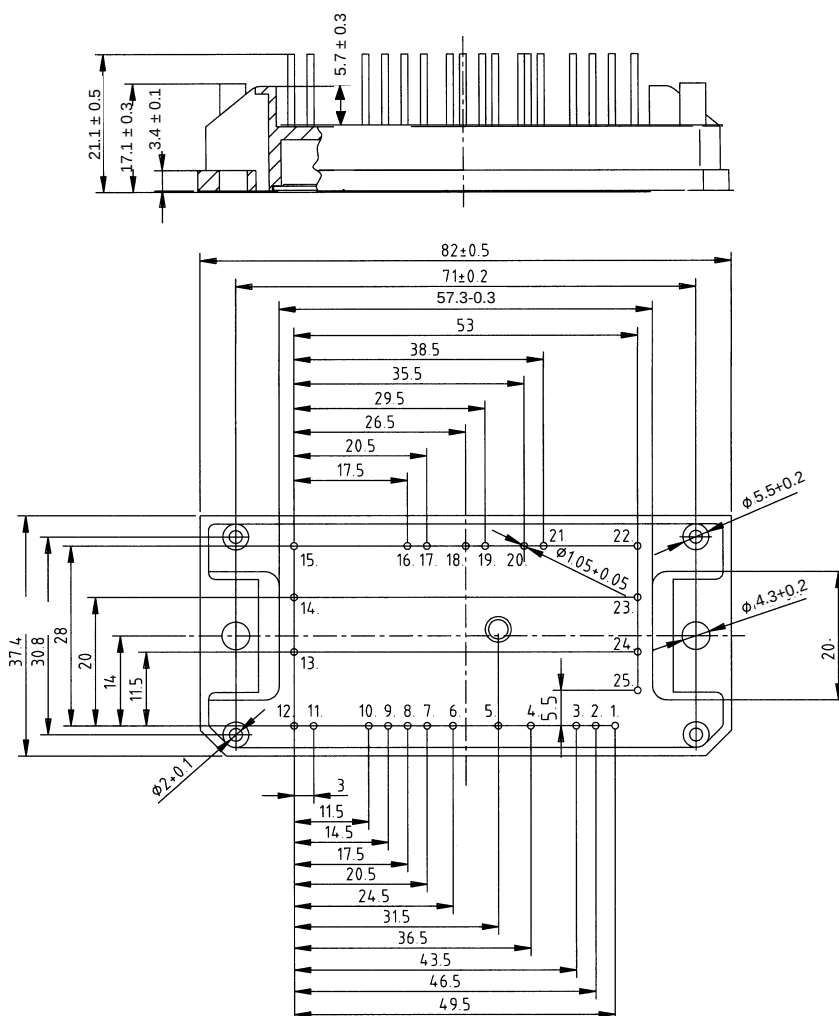
Symbol	Conditions	Maximum Ratings	
T_{stg}		-40...+125	°C
V_{ISOL}	$I_{ISOL} \leq 1 \text{ mA}$; 50/60 Hz; $t = 1 \text{ min}$	2500	V~
M_d	Mounting torque (M4)	2.0 - 2.2 18 - 20	Nm lb.in.
d_s	Creepage distance on surface	12.7	mm
d_A	Strike distance in air	12.7	mm
Weight	typ.	42	g

Temperature Sensor R

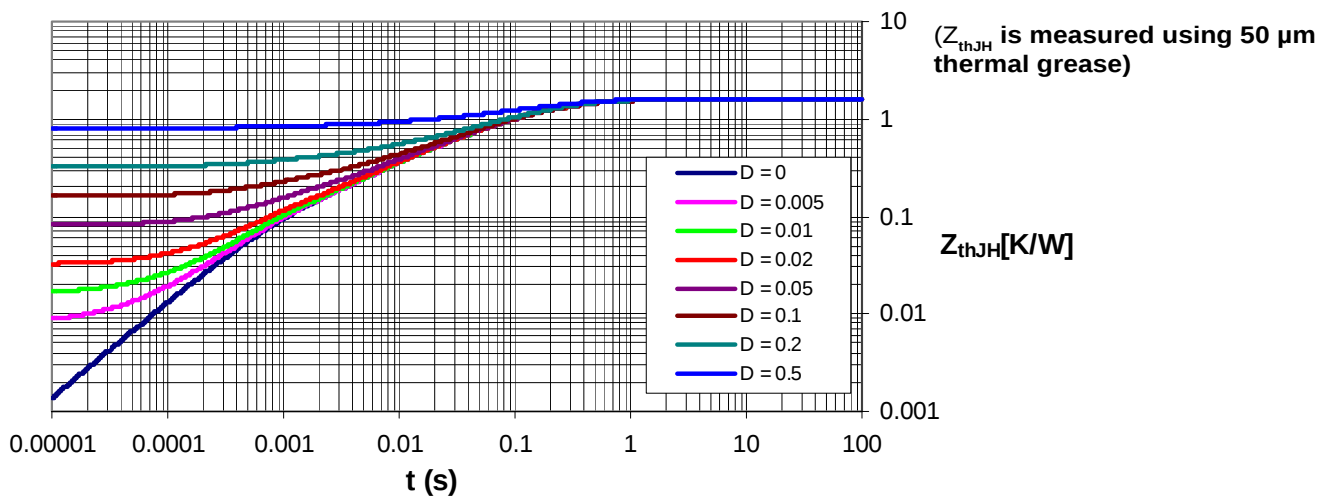
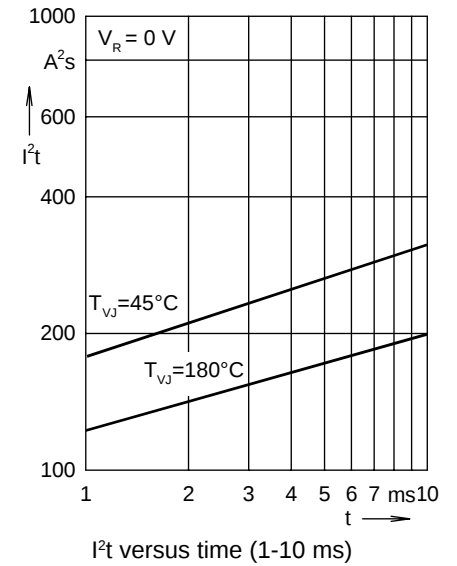
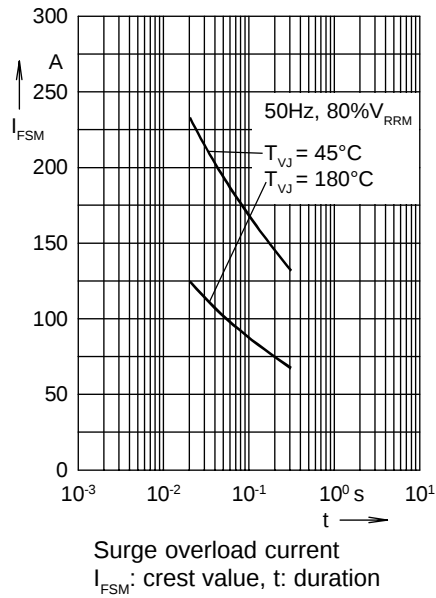
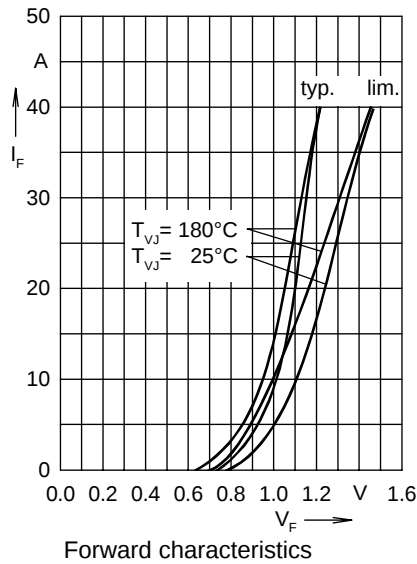
Symbol	Conditions	Maximum Ratings	
R	$T_{amb} = 20^\circ\text{C}$	4.7	k Ω

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

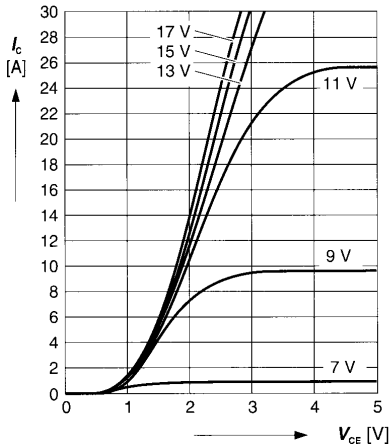


Output Inverter T1 - T6

Typ. output characteristics

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

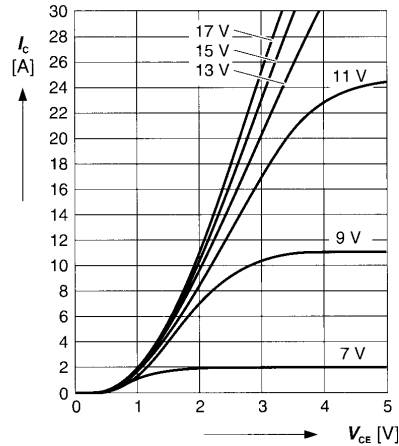
parameter: $t_p = 250 \mu s$; $T_j = 25^\circ C$



Typ. output characteristics

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

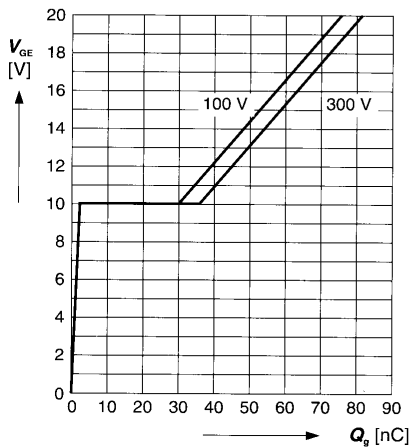
parameter: $t_p = 250 \mu s$; $T_j = 125^\circ C$



Typ. gate charge

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

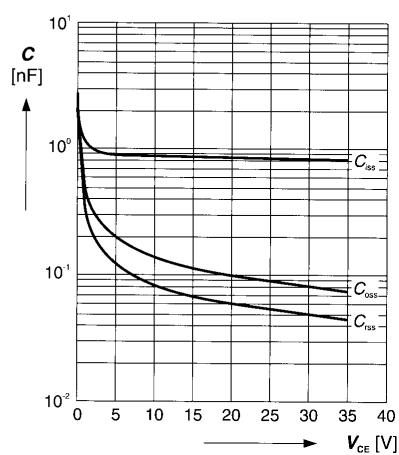
parameter: $I_{C,puls} = 15 A$



Typ. capacitances

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

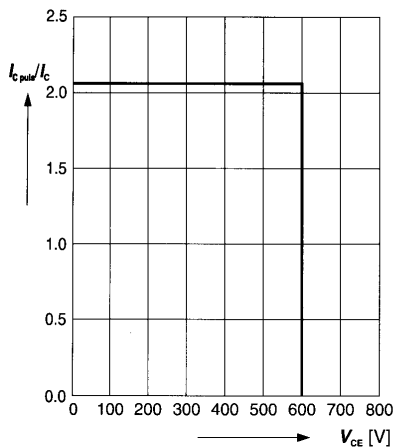
parameter: $V_{GE} = 0 V$; $f = 1 MHz$



Reverse biased safe operating area

$$I_{C,puls} = f(V_{CE}), T_j = 150^\circ C$$

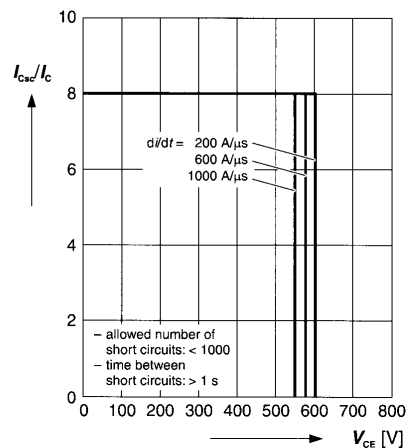
parameter: $V_{GE} = 15 V$



Short circuit safe operating area

$$I_{C,sc} = f(V_{CE}), T_j = 150^\circ C$$

parameter: $V_{GE} = \pm 15 V$; $t_{sc} \leq 10 \mu s$; $L < 60 nH$

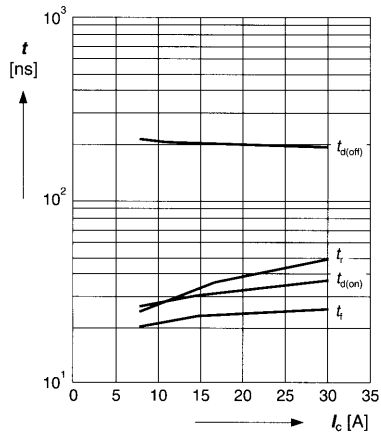


Output Inverter T1 - T6

Typ. switching time

$t = f(I_C)$, inductive load, $T_j = 125^\circ\text{C}$

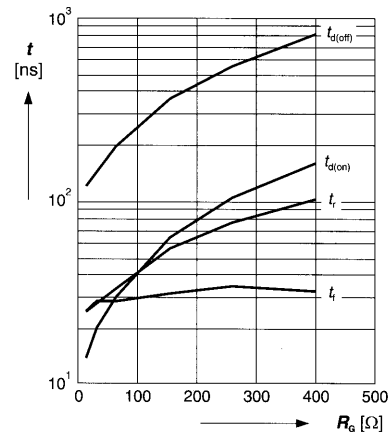
parameter: $V_{CE} = 300\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 68\ \Omega$



Typ. switching time

$t = f(R_G)$, inductive load, $T_j = 125^\circ\text{C}$

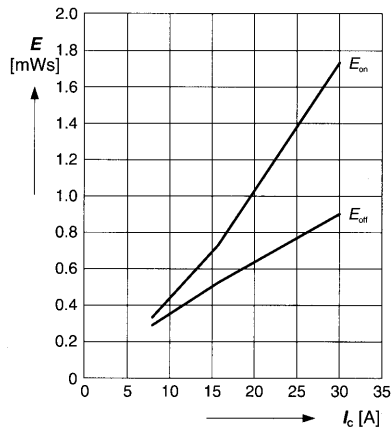
parameter: $V_{CE} = 300\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $I_C = 15\text{ A}$



Typ. switching losses

$E = f(I_C)$, inductive load, $T_j = 125^\circ\text{C}$

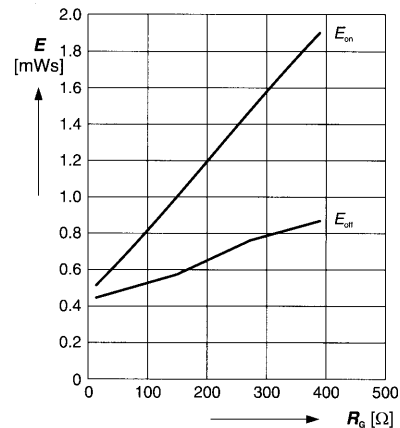
parameter: $V_{CE} = 300\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 68\ \Omega$



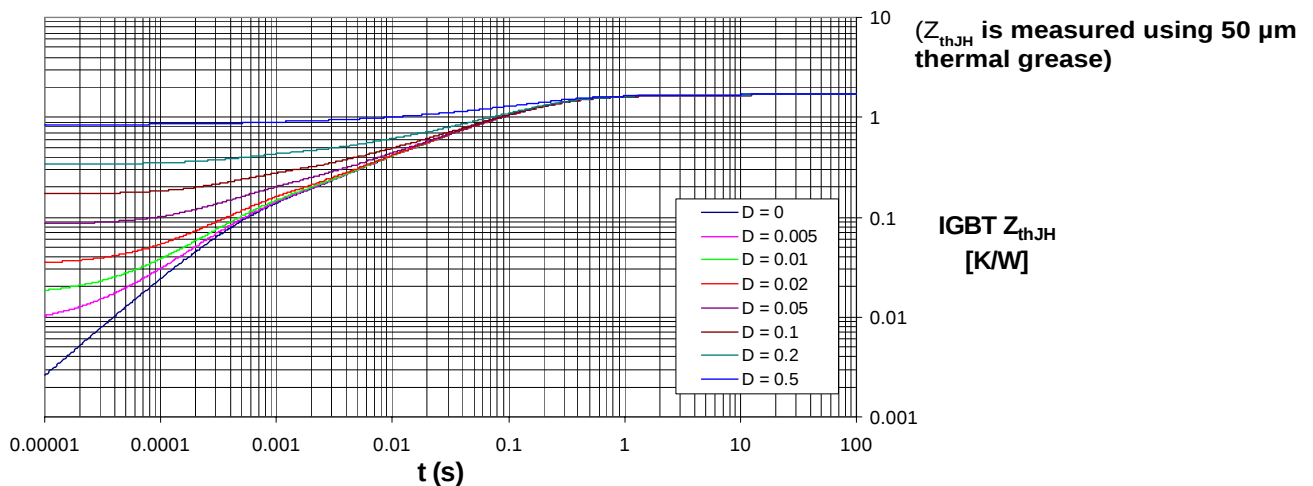
Typ. switching losses

$E = f(R_G)$, inductive load, $T_j = 125^\circ\text{C}$

parameter: $V_{CE} = 300\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $I_C = 15\text{ A}$



Transient thermal resistance junction to heatsink



Output Inverter D1 - D6

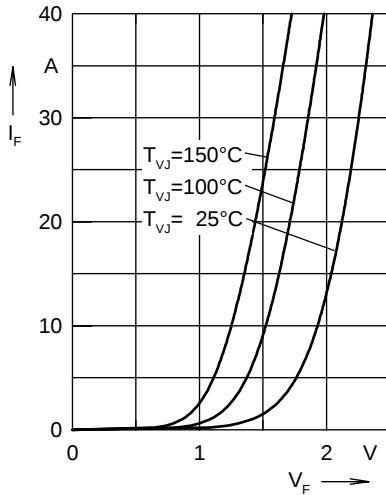


Fig. 1 Forward current I_F versus V_F

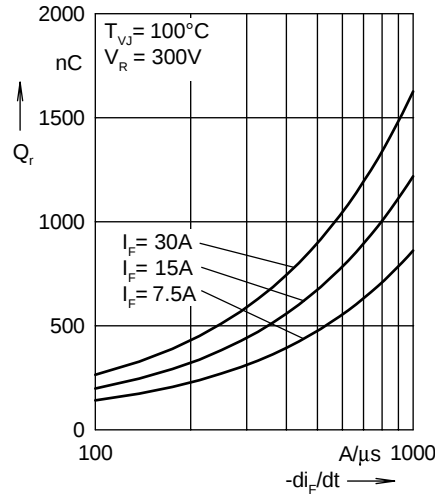


Fig. 2 Reverse recovery charge Q_r versus $-di_F/dt$

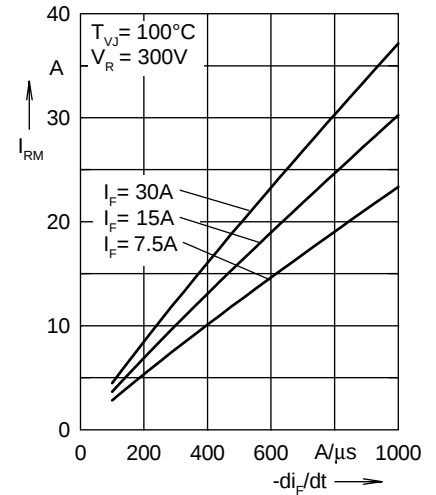


Fig. 3 Peak reverse current I_{RM} versus $-di_F/dt$

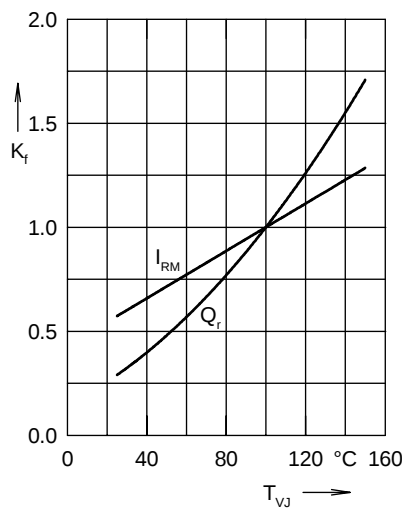


Fig. 4 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

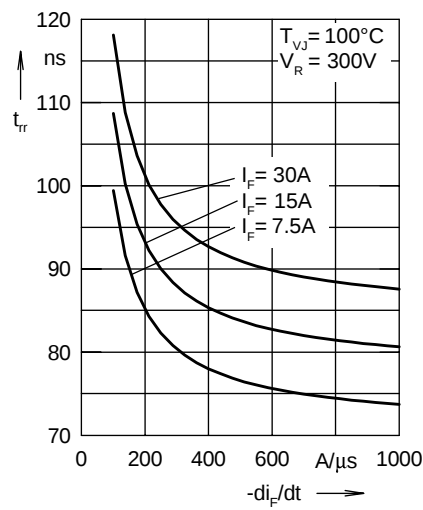


Fig. 5 Recovery time t_{tr} versus $-di_F/dt$

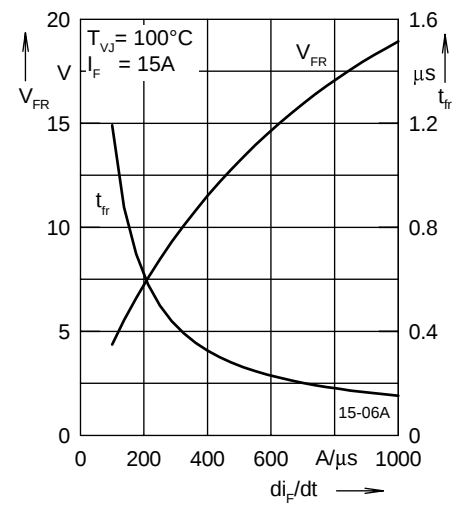
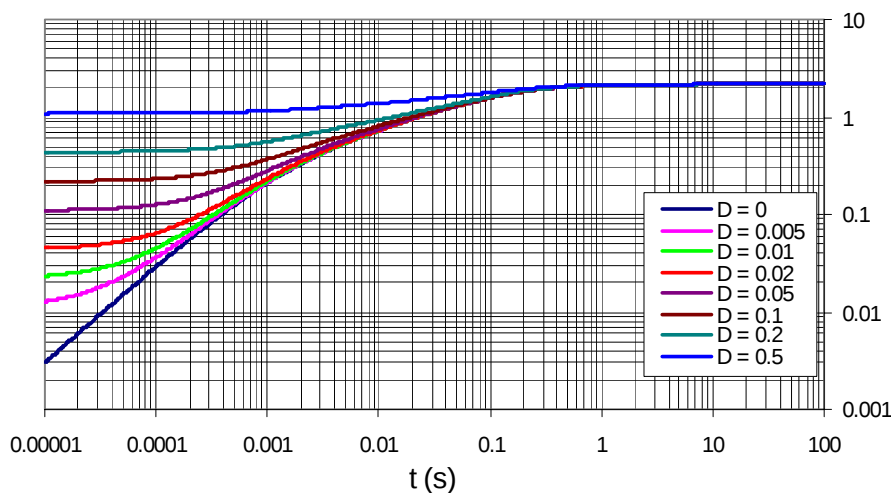


Fig. 6 Peak forward voltage V_{FR} and t_{tr} versus di_F/dt



Transient thermal resistance junction to heatsink

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

FRED
 Z_{thJH} [K/W]