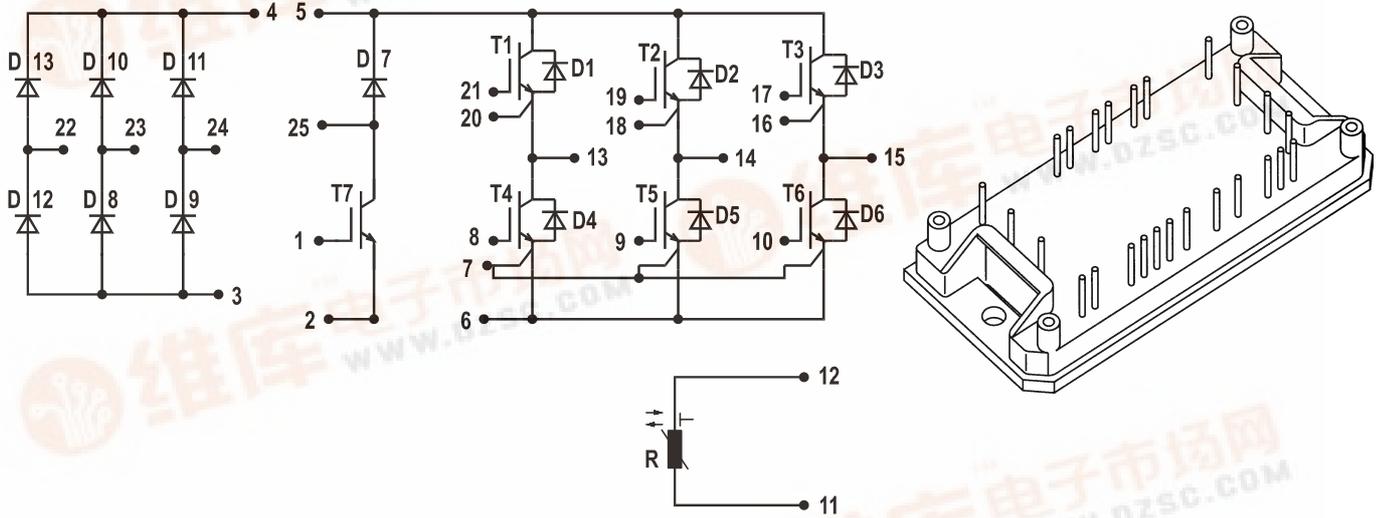


Converter - Brake - Inverter Module (CBI1)



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

Input Rectifier Bridge D8 - D13

Symbol	Conditions	Maximum Ratings	
V_{RRM}		1600	V
I_F	$T_{VJ} = 25^{\circ}C$	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	$^{\circ}C$

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** Al₂O₃ 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

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	$^{\circ}C/W$

Output Inverter T1 - T6, D1 - D6

Symbol	Conditions	Maximum Ratings	
V_{CES}	$T_{VJ} = 25^{\circ}\text{C}$	1200	V
V_{CGR}	$T_{VJ} = 25^{\circ}\text{C}; R_{GE} = 20\text{k}\Omega$	1200	V
V_{GE}	$T_{VJ} = 25^{\circ}\text{C}$	± 20	V
I_C	$T_C = 25^{\circ}\text{C}$	13	A
	$T_C = 90^{\circ}\text{C}$	8	A
I_{CM}	$t_p = 1 \text{ ms} = 1\% \text{ duty cycle}; T_C = 25^{\circ}\text{C}$	26	A
		$T_C = 90^{\circ}\text{C}$	16
t_{SC}	$V_{CE} = 600 \text{ V}; T_{VJ} = 25^{\circ}\text{C}; T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	67	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}	$V_{GE} = 0 \text{ V}; V_{CE} = 1000 \text{ V}$		1	100 μA
I_{GES}	$V_{CE} = 0 \text{ V}; V_{GE} = 25 \text{ V}$		0.1	100 nA
$V_{GE(th)}$	$V_{GE} = V_{CE}; I_C = 0.3 \text{ mA}$	4.5	5.5	6.5 V
$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}; I_C = 10 \text{ mA}; T_{VJ} = -40^{\circ}\text{C}$	1200		V
V_{CEsat}	$V_{GE} = 15 \text{ V}; I_C = 5 \text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$		2.8	3.3 V
			4	4.5 V
t_f	$\left. \begin{array}{l} \text{Inductive load, } T_{VJ} = 125^{\circ}\text{C} \\ V_{CC} = 600 \text{ V}; I_C = 5 \text{ A} \\ R_G = 100 \Omega; V_{GE} = \pm 15 \text{ V} \end{array} \right\}$		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}	$\left. \begin{array}{l} V_{GE} = 0 \text{ V} \\ V_{CE} = 25 \text{ V} \\ f = 1 \text{ MHz} \end{array} \right\}$		650	pF
		C_{oss}	50	pF
		C_{rss}	20	pF
g_{fs}	$V_{CE} = 20 \text{ V}; I_C = 1.5 \text{ A}$	1.7	2.5	S
Q_g	$V_{CC} = 800 \text{ V}; I_C = 6 \text{ A pulse}; V_{GE} = 15 \text{ V}$		48	nC
V_F	$I_F = 4 \text{ A}; V_{GE} = 0 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 100^{\circ}\text{C}$		2.3	3 V
			2	V
t_{rr}	$I_F = 4 \text{ A}; V_{GE} = 0 \text{ V}; T_{VJ} = 100^{\circ}\text{C}$ $V_R = -300 \text{ V}; di_F/dt = -800 \text{ A}/\mu\text{s}$		55	ns
Q_r	$I_F = 4 \text{ A}; V_R = -300 \text{ V}; V_{GE} = 0 \text{ V}$ $di_F/dt = -800 \text{ A}/\mu\text{s}$		0.8	μC
I_r				250 μA
R_{thJC}	IGBT	(per die)	1.55	$^{\circ}\text{C}/\text{W}$
	Diode	(per die)	2.25	$^{\circ}\text{C}/\text{W}$

Brake Chopper T7, D7

Symbol	Conditions	Maximum Ratings	
V_{CES}	$T_{VJ} = 25^{\circ}\text{C}$	1200	V
V_{CGR}	$T_{VJ} = 25^{\circ}\text{C}; R_{GE} = 20\text{k}\Omega$	1200	V
V_{GE}	$T_{VJ} = 25^{\circ}\text{C}$	± 20	V
I_C	$T_C = 25^{\circ}\text{C}$	3.6	A
	$T_C = 90^{\circ}\text{C}$	2.4	A
I_{CM}	$t_p = 1 \text{ ms} = 1\% \text{ duty cycle}; T_C = 25^{\circ}\text{C}$ $T_C = 110^{\circ}\text{C}$	7.2	A
		4.8	A
t_{SC}	$V_{CE} = 600 \text{ V}; T_{VJ} = 125^{\circ}\text{C}$ 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}	$V_{GE} = 0 \text{ V}; V_{CE} = 1000 \text{ V}$		1	25 μA
I_{GES}	$V_{CE} = 0 \text{ V}; V_{GE} = 25 \text{ V}$		0.1	100 nA
$V_{GE(th)}$	$V_{GE} = V_{CE}; I_C = 0.1 \text{ mA}$	4.5	5.5	6.5 V
$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}; I_C = 10 \text{ mA}; T_{VJ} = -40^{\circ}\text{C}$	1200		V
V_{CEsat}	$V_{GE} = 15 \text{ V}; I_C = 1.5 \text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$		2.8	3.3 V
			4	4.5 V
t_f t_r	Inductive load, $T_{VJ} = 125^{\circ}\text{C}$		100	ns
			85	ns
$t_{d(on)}$	$V_{CC} = 600 \text{ V}; I_C = 1.5 \text{ A}$ $R_G = 100 \Omega; V_{GE} = \pm 15 \text{ V}$		80	ns
$t_{d(off)}$			290	ns
E_{off}			0.12	mJ
E_{on}			0.34	mJ
C_{iss} C_{oss} C_{rss}	$V_{GE} = 0 \text{ V}$ $V_{CE} = 25 \text{ V}$ $f = 1 \text{ MHz}$		225	pF
			25	pF
			13	pF
g_{fs}	$V_{CE} = 20 \text{ V}; I_C = 1.5 \text{ A}$		0.6	S
Q_g	$V_{CC} = 800 \text{ V}; I_C = 1 \text{ A pulse}; V_{GE} = 15 \text{ V}$		24.1	nC
V_F	$I_F = 4 \text{ A}; V_{GE} = 0 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 100^{\circ}\text{C}$		2.3	V
			2	V
t_{rr}	$I_F = 4 \text{ A}; V_{GE} = 0 \text{ V}; T_{VJ} = 100^{\circ}\text{C}$ $V_R = -300 \text{ V}; di_F/dt = -800 \text{ A}/\mu\text{s}$		55	ns
Q_r	$I_F = 4 \text{ A}; V_R = -300 \text{ V}; V_{GE} = 0 \text{ V}$ $di_F/dt = -800 \text{ A}/\mu\text{s}$		0.8	μC
I_r				250 μA
R_{thJC}	IGBT (per die)		2.3	$^{\circ}\text{C}/\text{W}$
	Diode (per die)		2.25	$^{\circ}\text{C}/\text{W}$

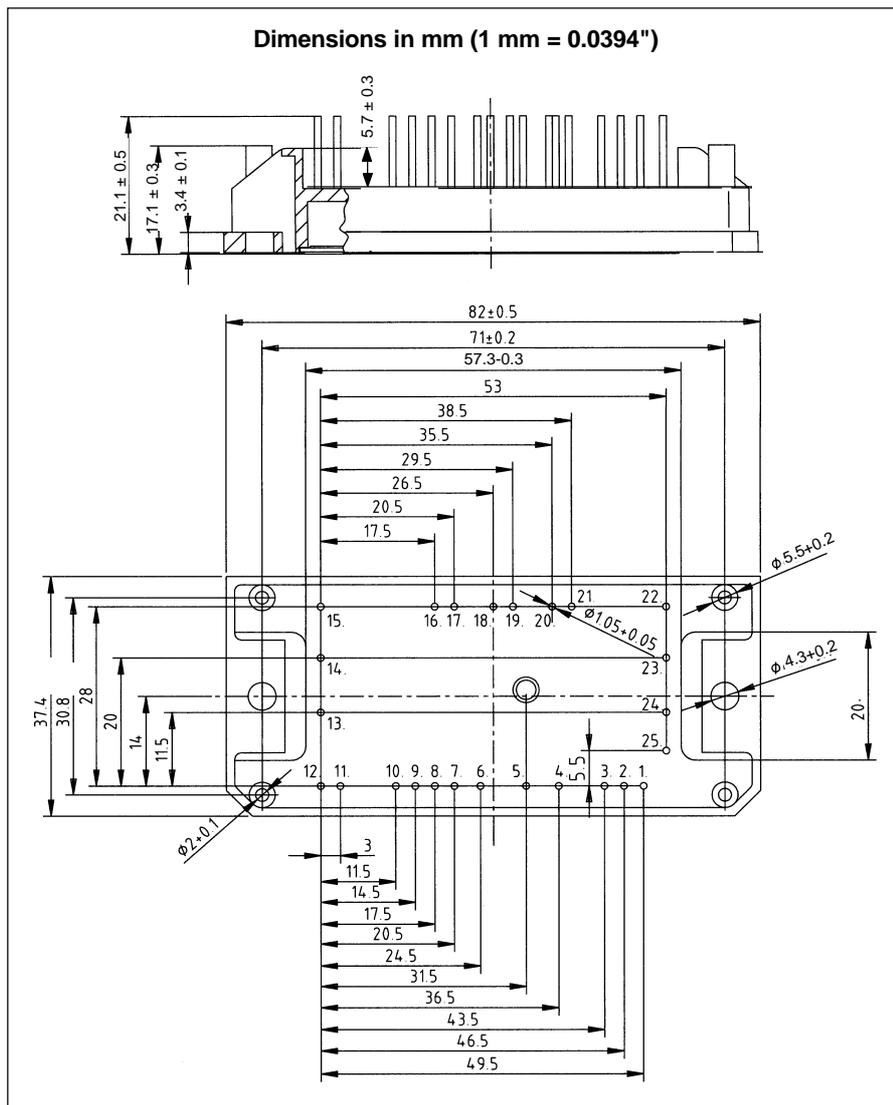
Module

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

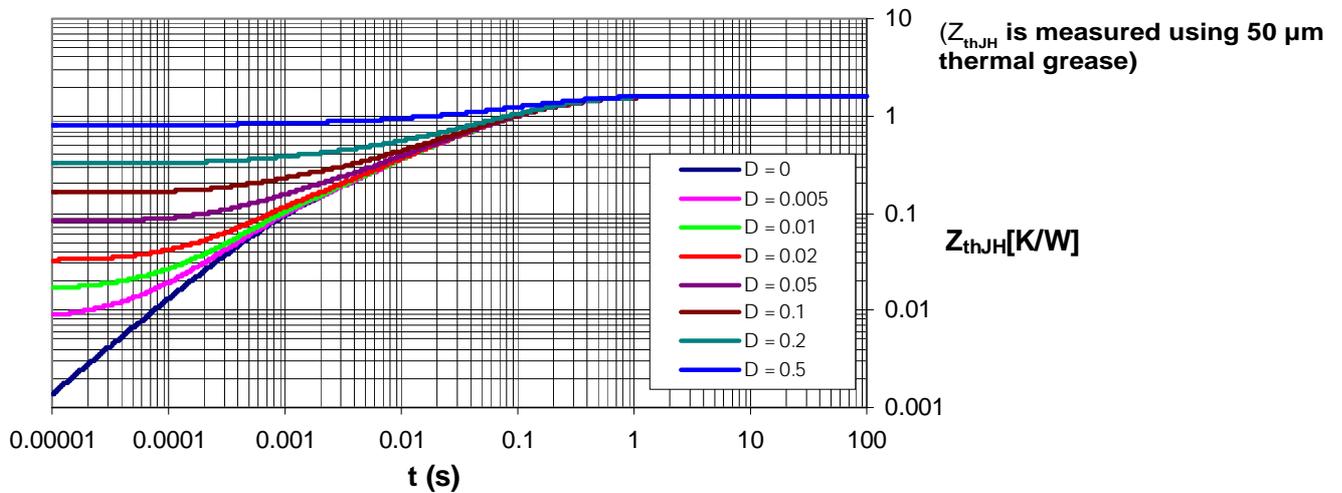
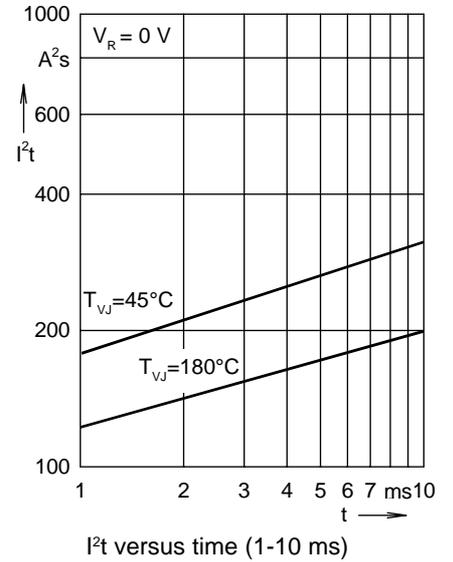
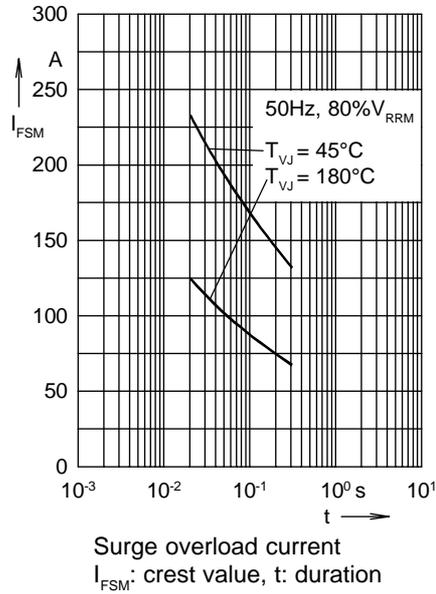
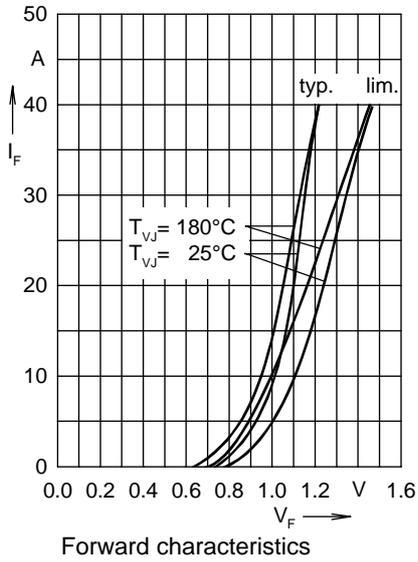
Temperature Sensor R

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

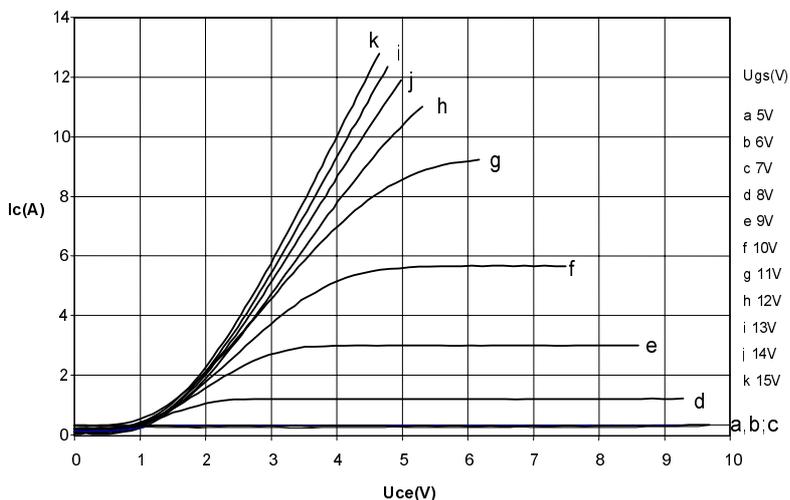


Input Rectifier Bridge D8 - D13



Output Inverter T1 - T6

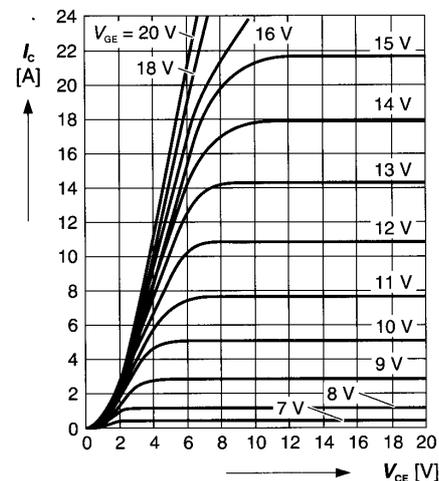
Typ. output characteristics 25°C



Typ. output characteristics

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

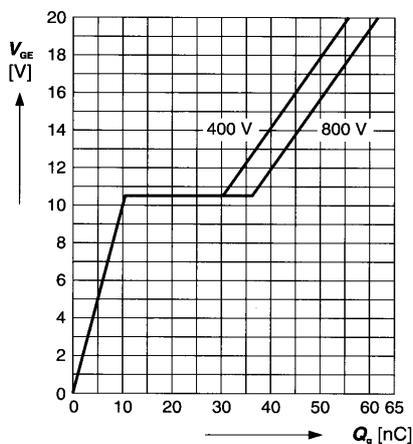
parameter: $t_p = 80 \mu s$; $T_j = 125^\circ C$



Typ. gate charge

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

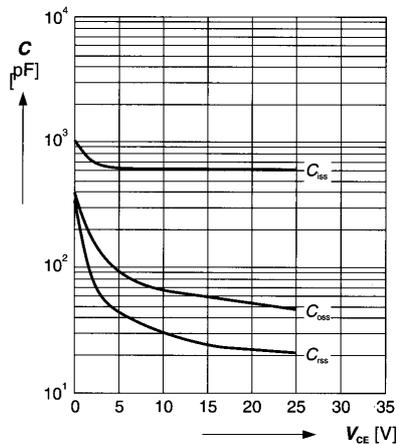
parameter: $I_{C\text{ puls}} = 6 \text{ A}$



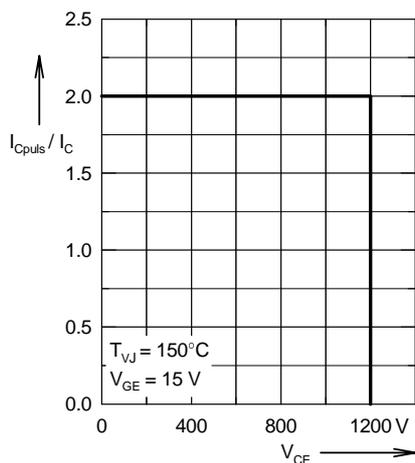
Typ. capacitances

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

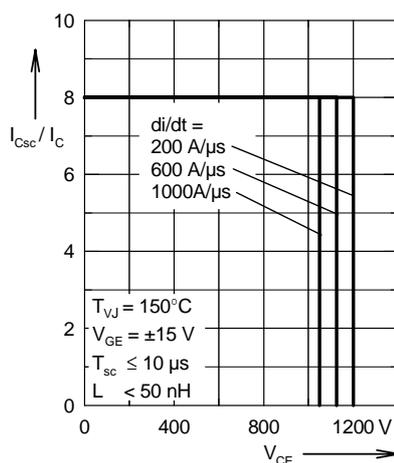
parameter: $V_{GE} = 0 \text{ V}$; $f = 1 \text{ MHz}$



Reverse biased safe operating area

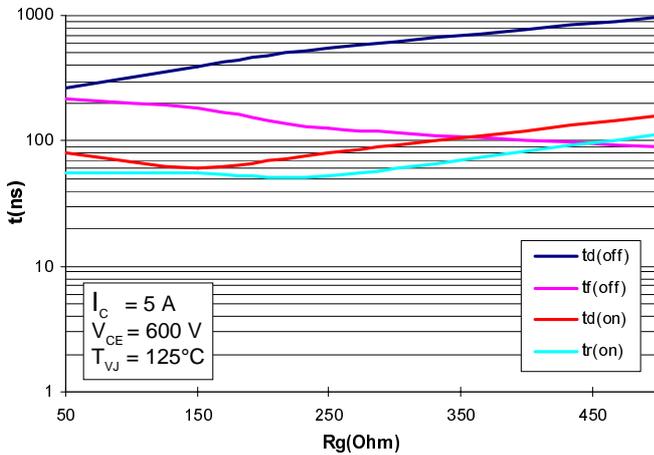


Short circuit safe operating area

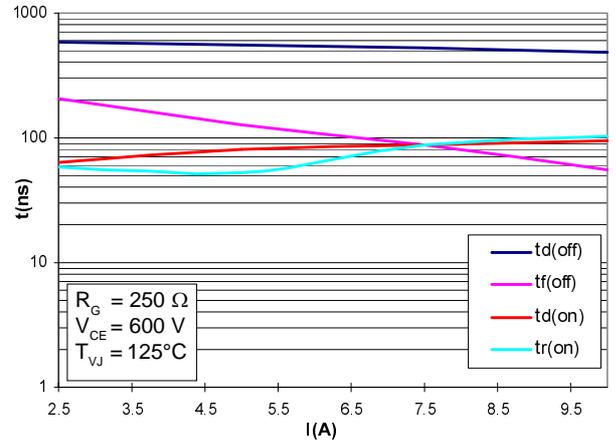


Output Inverter T1 - T6

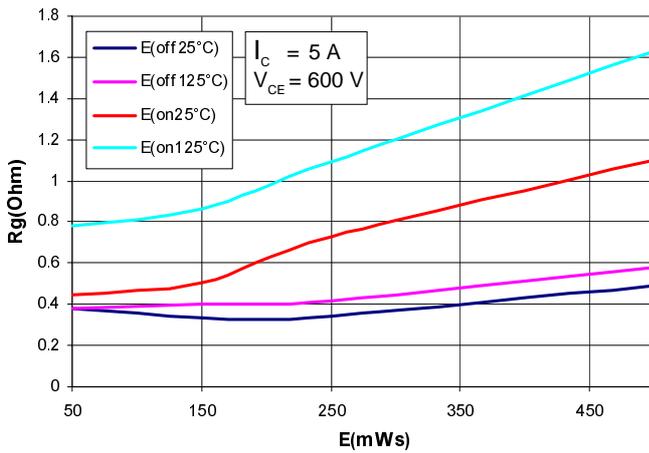
Typ. switching times



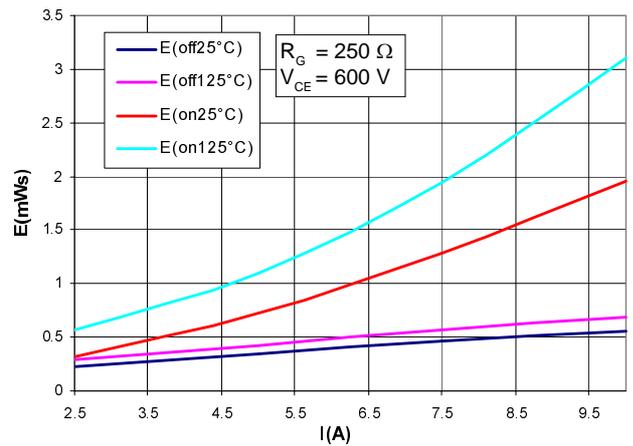
Typ. switching times



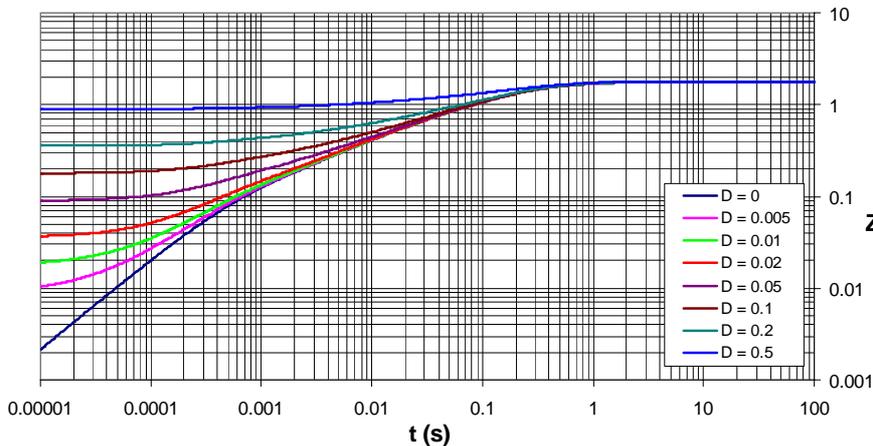
Typ. switching losses



Typ. switching losses



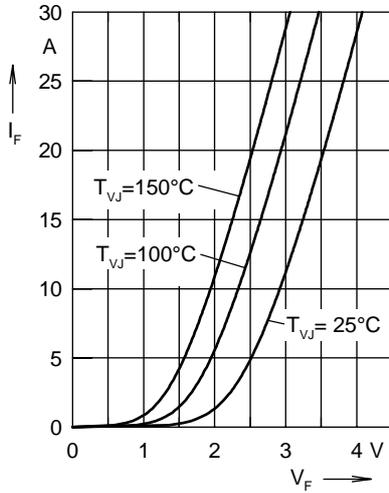
Transient thermal resistance junction to heatsink



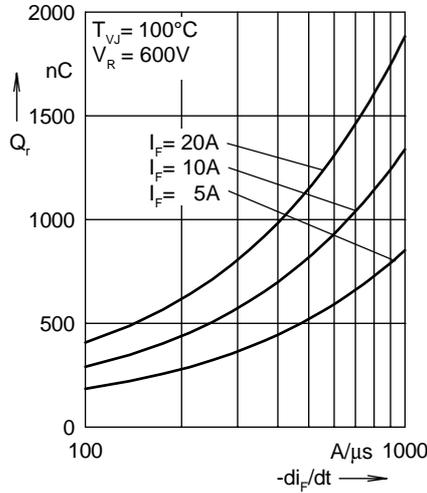
(Z_{thJH} is measured using 50 μm thermal grease)

IGBT
 Z_{thJH} [K/W]

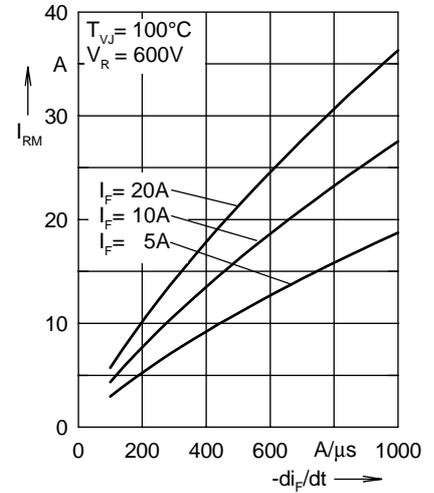
Output Inverter D1 - D6



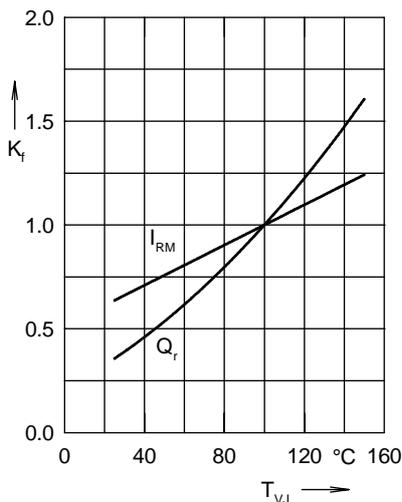
Forward current I_F versus V_F



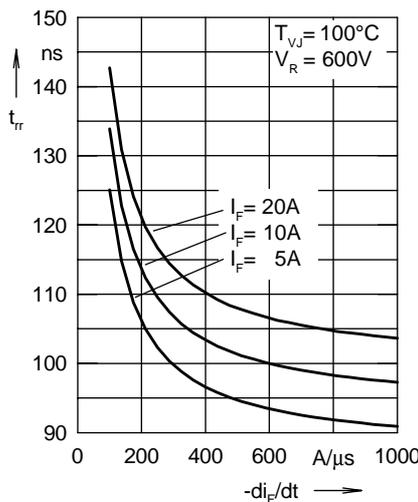
Reverse recovery charge Q_r versus $-di_F/dt$



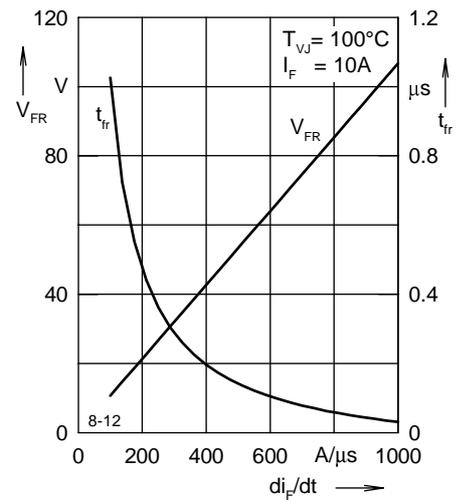
Peak reverse current I_{RM} versus $-di_F/dt$



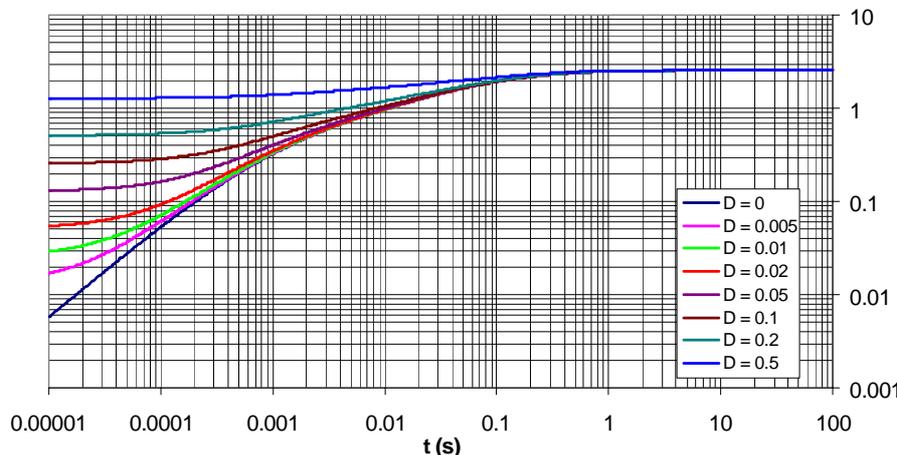
Dynamic parameters Q_r , I_{RM} versus T_{VJ}



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]