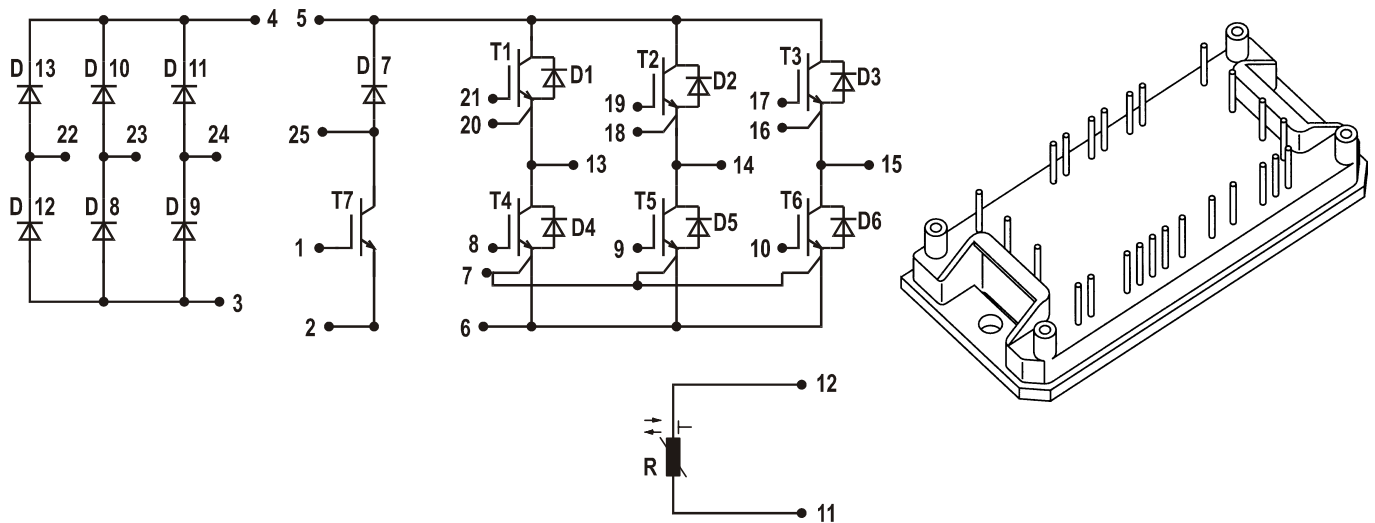


Converter - Brake - Inverter Module (CBI1)



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

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** 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

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

Output Inverter T1 - T6, D1 - D6

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	$T_C = 25^{\circ}\text{C}$	7	A
	$T_C = 90^{\circ}\text{C}$	4.5	A
I_{CM}	$t_p = 1\text{ ms} = 1\% \text{ duty cycle}; T_C = 25^{\circ}\text{C}$	14	A
		$T_C = 90^{\circ}\text{C}$	9
t_{SC}	IGBT $V_{CE} = 600\text{ V}; T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	38	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}	$V_{GE} = 0\text{ V}; V_{CE} = 600\text{ V}$			10 μA		
I_{GES}	$V_{CE} = 0\text{ V}; V_{GE} = 25\text{ V}$			100 nA		
$V_{GE(th)}$	$V_{GE} = V_{CE}; I_C = 0.2\text{ mA}$	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		
$V_{CE(sat)}$	$V_{GE} = 15\text{ V}; I_C = 4\text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$		2.0	2.5 V		
			2.3	2.8 V		
t_f	Inductive load, $T_{VJ} = 150^{\circ}\text{C}$ $V_{CC} = 400\text{ V}; I_C = 4\text{ A}$ $R_G = 50\ \Omega; V_{GE} = \pm 15\text{ V}$		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}		$V_{GE} = 0\text{ V}$ $V_{CE} = 25\text{ V}$ $f = 1\text{ MHz}$		270	340 pF	
			C_{oss}		30	40 pF
			C_{riss}		18	23 pF
g_{fs}		$V_{CE} = 20\text{ V}; I_C = 4\text{ A}$	0.8	3.2	S	
Q_g	$V_{CC} = 400\text{ V}; I_C = 6\text{ A pulse}; V_{GE} = 15\text{ V}$		24	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	V		
			1.8	V		
t_{rr}	$I_F = 10\text{ A}; V_R = -300\text{ V}; V_{GE} = 0\text{ V}$ $di_F/dt = -350\text{ A}/\mu\text{s}; T_{VJ} = 100^{\circ}\text{C}$		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	μC		
			0.9	μC		
I_r				250 μA		
R_{thJC}	IGBT (per die)		2.7	$^{\circ}\text{C}/\text{W}$		
	Diode (per die)		2.3	$^{\circ}\text{C}/\text{W}$		

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	$T_C = 25^{\circ}\text{C}$	7	A
	$T_C = 90^{\circ}\text{C}$	4.5	A
I_{CM}	$t_p = 1 \text{ ms} = 1\% \text{ duty cycle}; T_C = 25^{\circ}\text{C}$	14	A
		$T_C = 90^{\circ}\text{C}$	9
t_{SC}	IGBT $V_{CE} = 600 \text{ V}; T_{VJ} = 125^{\circ}\text{C}$ non-repetitive	10	μs
P_{tot}	$T_C = 25^{\circ}\text{C}$	38	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		
$V_{GE(th)}$	$V_{GE} = V_{CE}; I_C = 0.2 \text{ mA}$	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		
$V_{CE(sat)}$	$V_{GE} = 15 \text{ V}; I_C = 4 \text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$		2.0	2.5 V		
			2.3	2.8 V		
t_f	Inductive load, $T_{VJ} = 150^{\circ}\text{C}$ $V_{CC} = 400 \text{ V}; I_C = 4 \text{ A}$ $R_G = 50 \Omega; V_{GE} = \pm 15 \text{ V}$		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}		$V_{GE} = 0 \text{ V}$ $V_{CE} = 25 \text{ V}$ $f = 1 \text{ MHz}$		270	340 pF	
			C_{oss}		30	40 pF
			C_{riss}		18	23 pF
g_{fs}		$V_{CE} = 20 \text{ V}; I_C = 4 \text{ A}$	0.8	3.2	S	
Q_g	$V_{CC} = 400 \text{ V}; I_C = 6 \text{ A pulse}; V_{GE} = 15 \text{ V}$		24	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	V		
			1.8	V		
t_{rr}	$I_F = 10 \text{ A}; V_R = -300 \text{ V}; V_{GE} = 0 \text{ V}$ $di_F/dt = -350 \text{ A}/\mu\text{s}; T_{VJ} = 100^{\circ}\text{C}$		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	μC		
			0.9	μC		
I_r				250 μA		
R_{thJC}	IGBT (per die)		2.7	$^{\circ}\text{C}/\text{W}$		
	Diode (per die)		2.3	$^{\circ}\text{C}/\text{W}$		

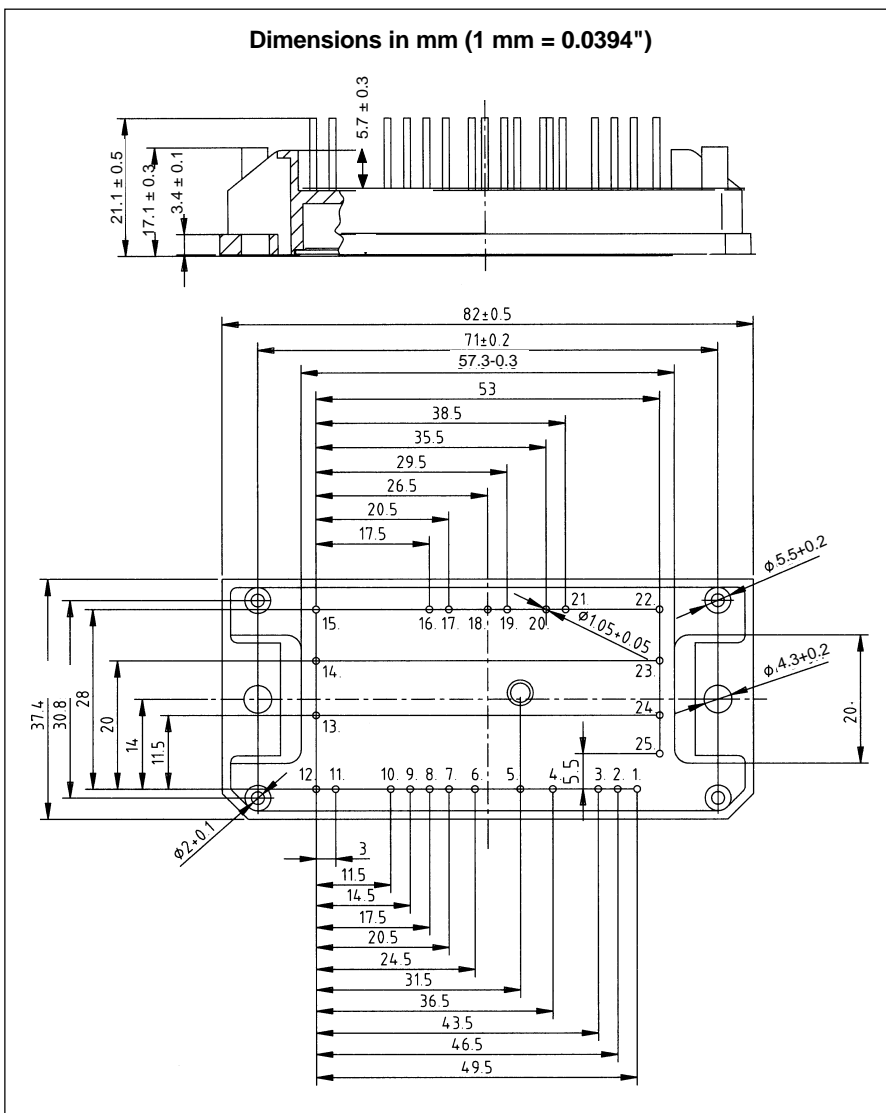
Module

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

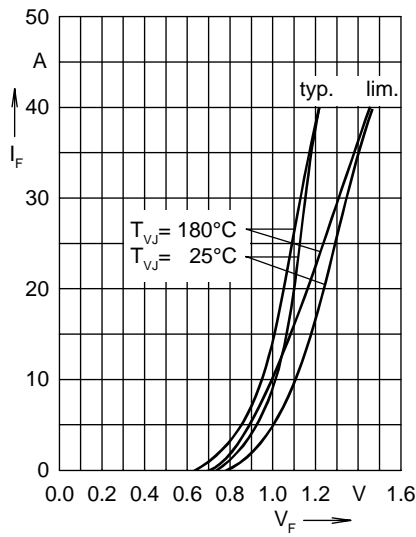
Temperature Sensor R

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

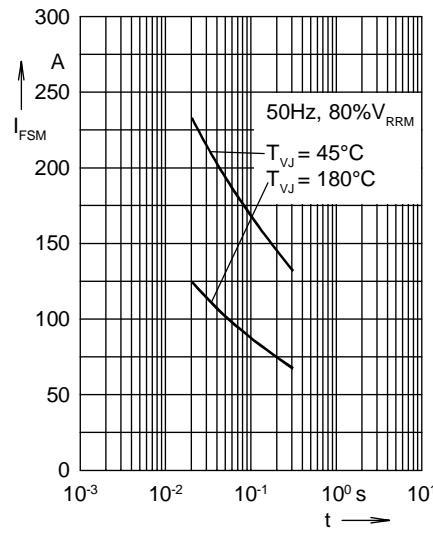
For additional data see C620/4.7k 5% S+M NTC thermistor catalog



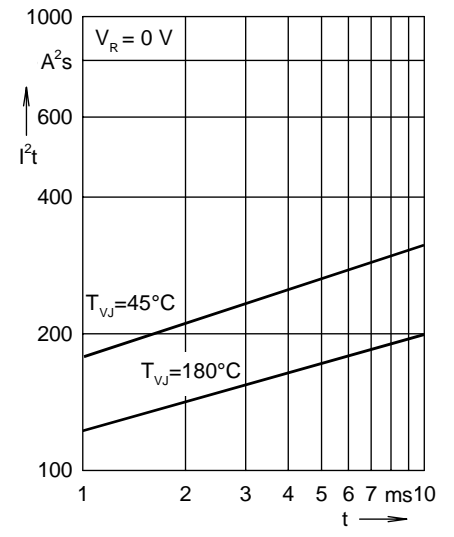
Input Rectifier Bridge D8 - D13



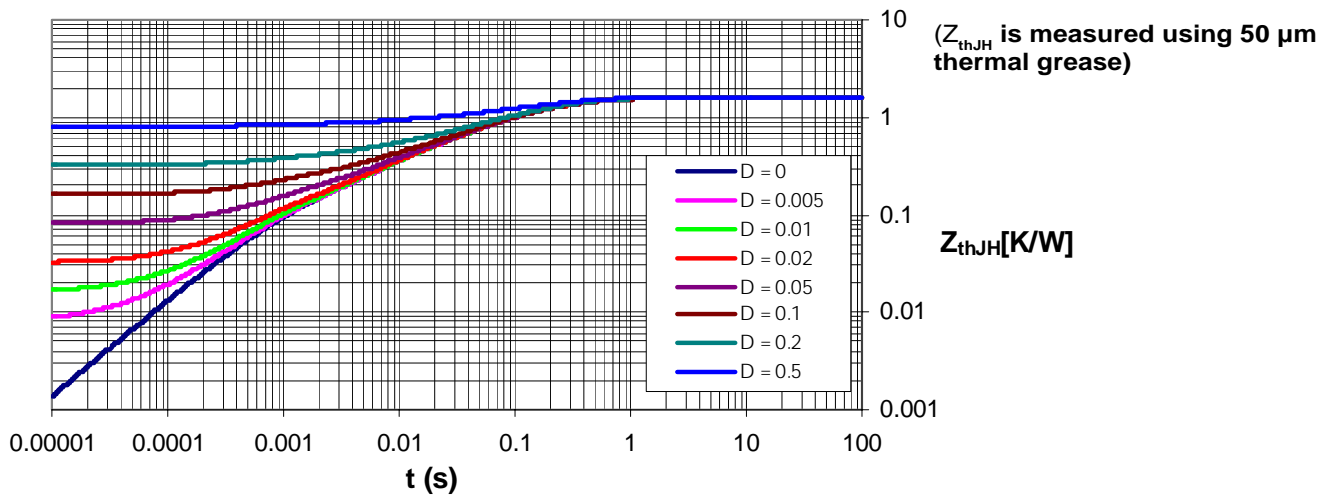
Forward characteristics



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



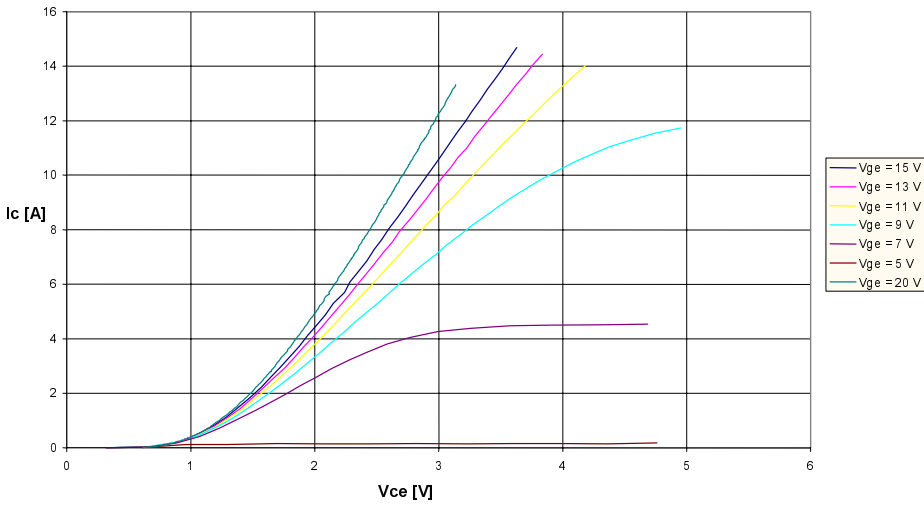
I^2t versus time (1-10 ms)



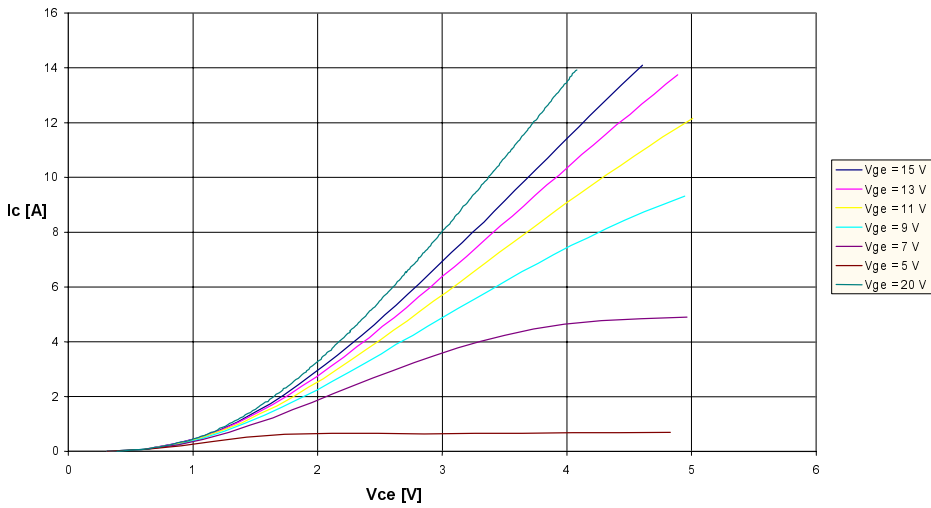
Transient thermal resistance junction to heatsink

Output Inverter T1 - T6, D1 - D6

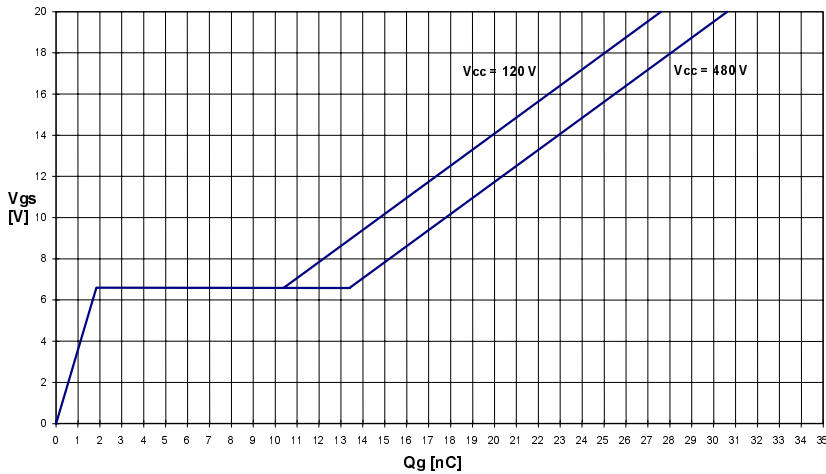
Typ. Output characteristics, 25°C



Typ. Output characteristics, 125°C

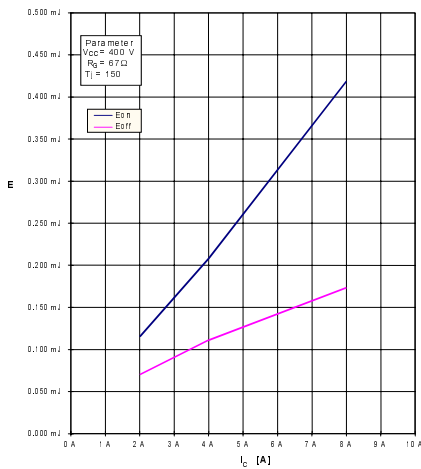


Typ. Gate-Charge

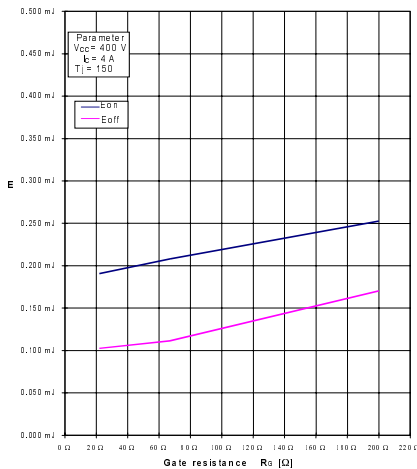


Output Inverter T1 - T6, D1 - D6

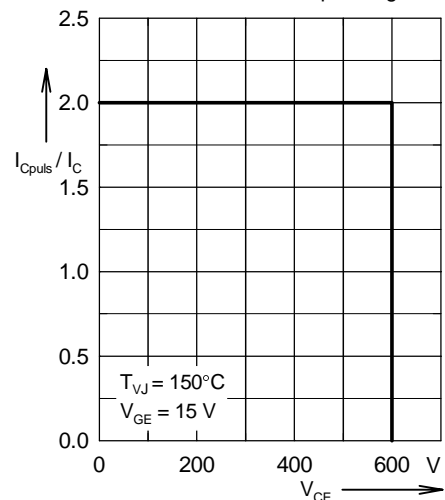
Typ. Switching losses $E=f(I_C)$



Typ. Switching losses $E=f(R_g)$

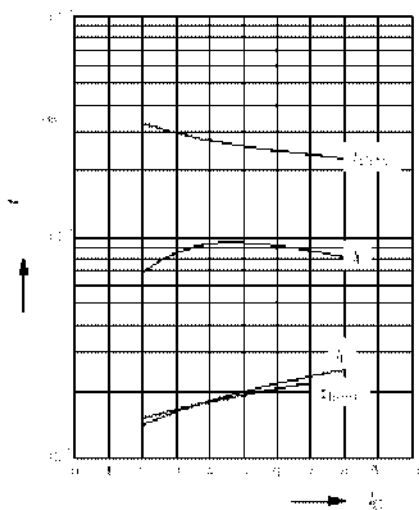


Reverse biased safe operating area



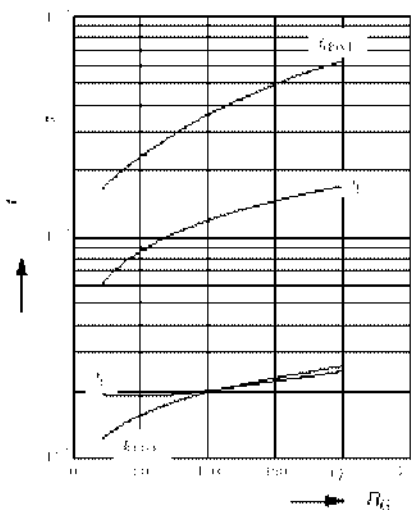
Typ. switching time

t_r (I_{L1}) inductive load, $T_j = 150^\circ\text{C}$
 par: $V_{CE} = 400\text{ V}$, $V_{GE} = 0-15\text{ V}$, $R_g = 67\ \Omega$

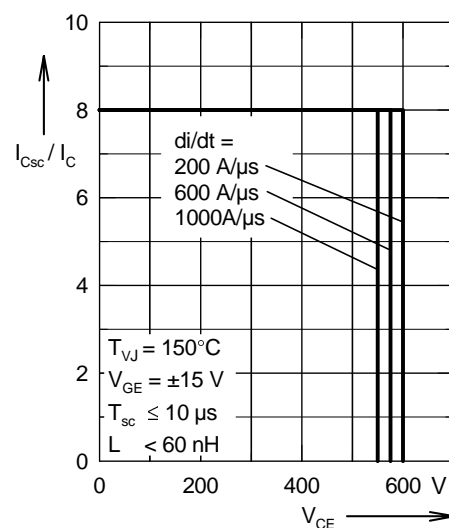


Typ. switching time

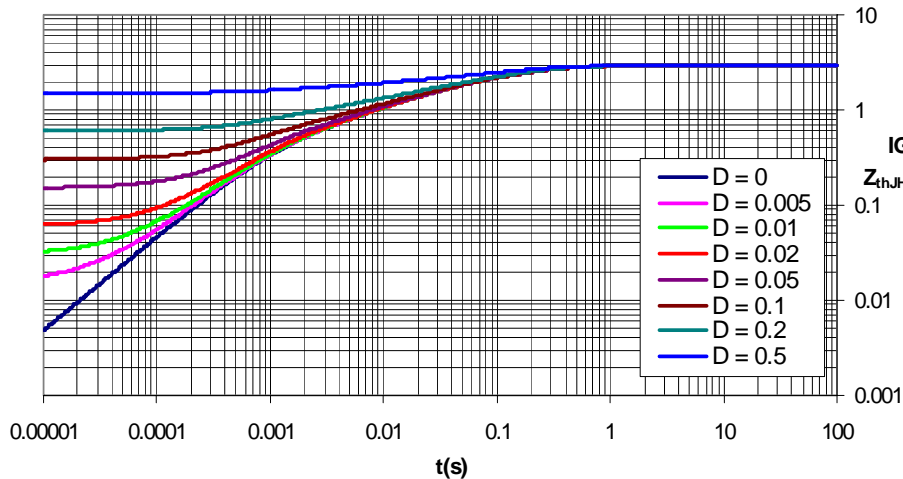
t_r (I_{L3}) inductive load, $T_j = 150^\circ\text{C}$
 par: $V_{CE} = 400\text{ V}$, $V_{GE} = 0-15\text{ V}$, $I_C = 4\text{ A}$



Short circuit safe operating area



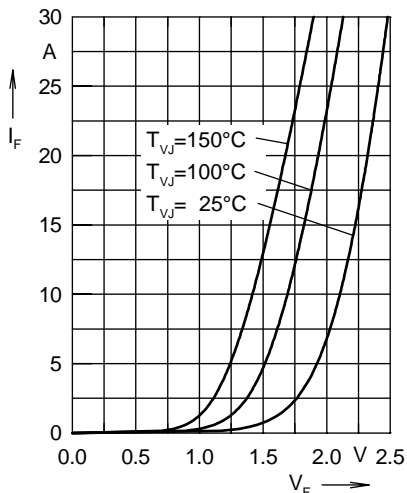
Transient thermal resistance junction to heatsink



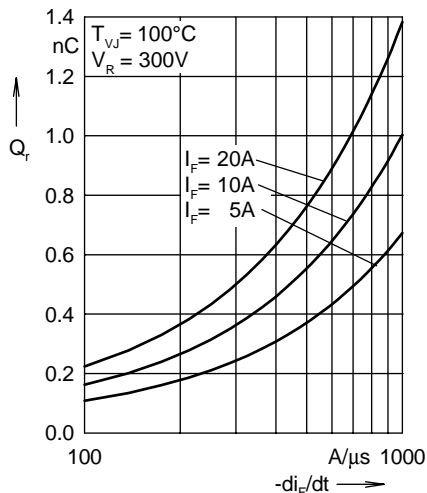
(Z_{thJH} is measured using 50 μm thermal grease)

IGBT
 $Z_{thJH}[\text{K/W}]$

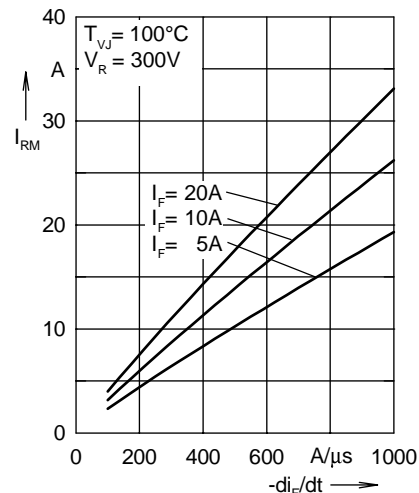
Output Inverter D1 - D6



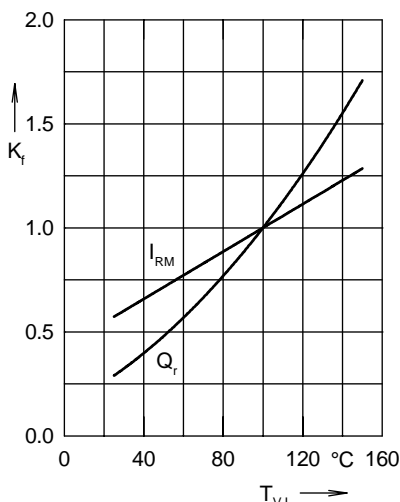
Forward current I_F versus V_F



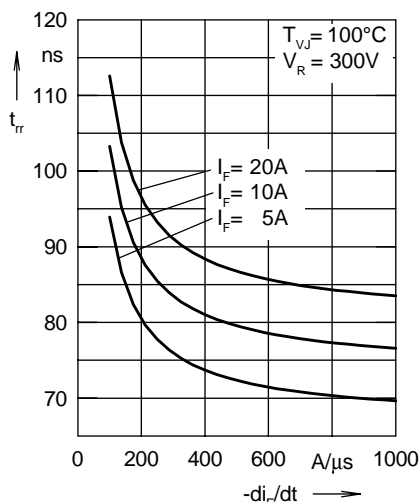
Reverse recovery charge Q_r versus $-di_F/dt$



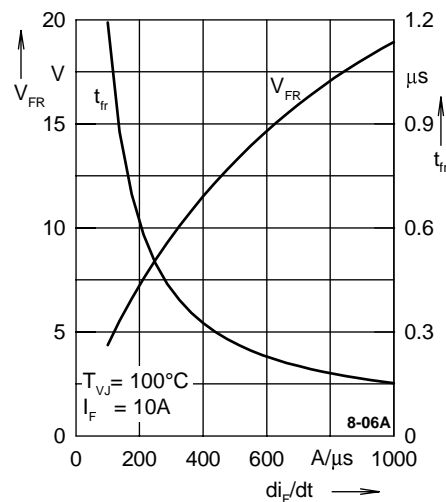
Peak reverse current I_{RM} versus $-di_F/dt$



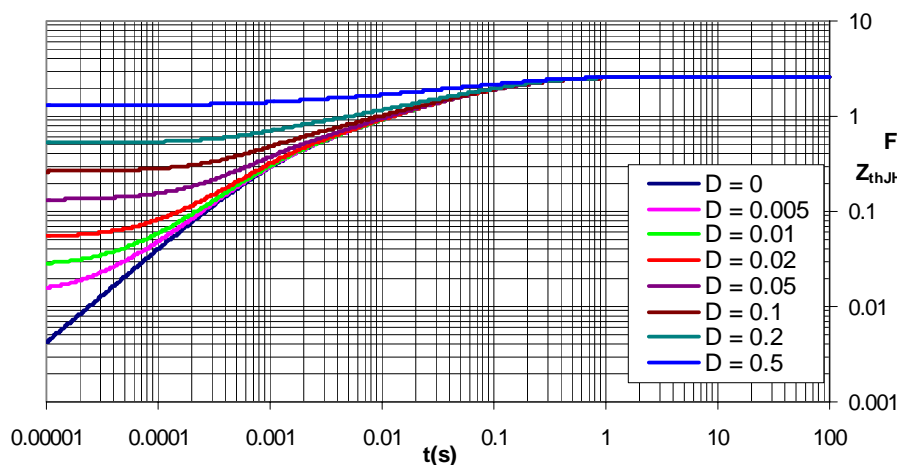
Dynamic parameters Q_r , I_{RM} versus T_{VJ}



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

($Z_{th,JH}$ is measured using 50 μm thermal grease)

Fred
 $Z_{th,JH}$ [K/W]

- D = 0
- D = 0.005
- D = 0.01
- D = 0.02
- D = 0.05
- D = 0.1
- D = 0.2
- D = 0.5