

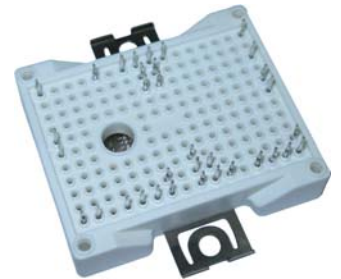
XPT IGBT Module

3~ Rectifier	Brake Chopper	3~ Inverter
$V_{RRM} = 1600\text{ V}$	$V_{CES} = 1200\text{ V}$	$V_{CES} = 1200\text{ V}$
$I_{DAV} = 70\text{ A}$	$I_{C25} = 28\text{ A}$	$I_{C25} = 28\text{ A}$
$I_{FSM} = 270\text{ A}$	$V_{CE(sat)} = 1.8\text{ V}$	$V_{CE(sat)} = 1.8\text{ V}$

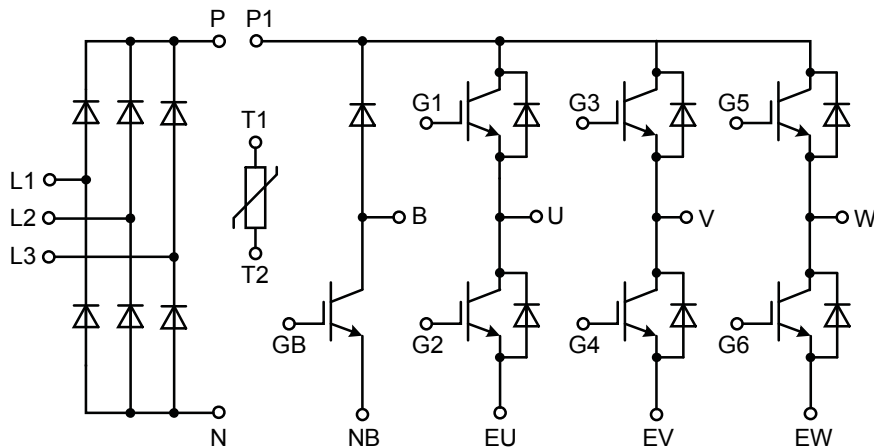
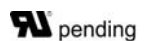
6-Pack + 3~ Rectifier Bridge & Brake Unit + NTC

Part number

MIXA20WB1200TMI



Backside: isolated



Features / Advantages:

- Easy paralleling due to the positive temperature coefficient of the on-state voltage
- Rugged XPT design (Xtreme light Punch Through) results in:
 - short circuit rated for 10 μsec .
 - very low gate charge
 - low EMI
 - square RBSOA @ 3x I_c
- Thin wafer technology combined with the XPT design results in a competitive low $V_{CE(sat)}$
- SONIC™ diode
 - fast and soft reverse recovery
 - low operating forward voltage

Applications:

- AC motor drives
- Solar inverter
- Medical equipment
- Uninterruptible power supply
- Air-conditioning systems
- Welding equipment
- Switched-mode and resonant-mode power supplies
- Inductive heating, cookers
- Pumps, Fans

Package: MiniPack2B

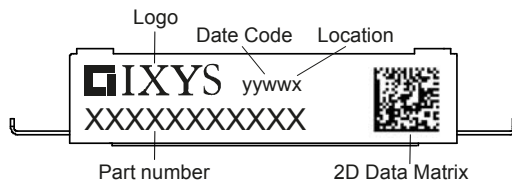
- Isolation Voltage: 3000 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0

Rectifier				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
V_{RSM}	max. non-repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}C$			1700	V	
V_{RRM}	max. repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}C$			1600	V	
I_R	reverse current	$V_R = 1600 V$	$T_{VJ} = 25^{\circ}C$		10	μA	
		$V_R = 1600 V$	$T_{VJ} = 125^{\circ}C$		1	mA	
V_F	forward voltage drop	$I_F = 20 A$	$T_{VJ} = 25^{\circ}C$		1.19	V	
					1.54	V	
		$I_F = 40 A$	$T_{VJ} = 125^{\circ}C$		1.12	V	
					1.59	V	
I_{DAV}	bridge output current	$T_C = 80^{\circ}C$ rectangular $d = 1/3$	$T_{VJ} = 150^{\circ}C$		70	A	
V_{FO}	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0.86	V	
r_F	slope resistance				12.3	m Ω	
R_{thJC}	thermal resistance junction to case				1.8	K/W	
R_{thCH}	thermal resistance case to heatsink			0.35		K/W	
P_{tot}	total power dissipation		$T_C = 25^{\circ}C$		70	W	
I_{FSM}	max. forward surge current	$t = 10 \text{ ms; (50 Hz), sine}$	$T_{VJ} = 45^{\circ}C$		270	A	
		$t = 8,3 \text{ ms; (60 Hz), sine}$	$V_R = 0 V$		290	A	
		$t = 10 \text{ ms; (50 Hz), sine}$	$T_{VJ} = 150^{\circ}C$		230	A	
		$t = 8,3 \text{ ms; (60 Hz), sine}$	$V_R = 0 V$		250	A	
I^2t	value for fusing	$t = 10 \text{ ms; (50 Hz), sine}$	$T_{VJ} = 45^{\circ}C$		365	A ² s	
		$t = 8,3 \text{ ms; (60 Hz), sine}$	$V_R = 0 V$		350	A ² s	
		$t = 10 \text{ ms; (50 Hz), sine}$	$T_{VJ} = 150^{\circ}C$		265	A ² s	
		$t = 8,3 \text{ ms; (60 Hz), sine}$	$V_R = 0 V$		260	A ² s	
C_J	junction capacitance	$V_R = 400 V; f = 1 \text{ MHz}$	$T_{VJ} = 25^{\circ}C$		10	pF	

Brake IGBT				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V	
V_{GES}	max. DC gate voltage				± 20	V	
V_{GEM}	max. transient gate emitter voltage				± 30	V	
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			28	A	
I_{C80}		$T_C = 80^{\circ}\text{C}$			20	A	
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			100	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 15\text{ A}; V_{GE} = 15\text{ V}$			1.8	V	
					2.1	V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.6\text{ mA}; V_{GE} = V_{CE}$	5.4	5.9	6.5	V	
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$			0.1	mA	
					0.1	mA	
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			500	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 15\text{ A}$			48	nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 15\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 56\ \Omega$					
t_r	current rise time						
$t_{d(off)}$	turn-off delay time						
t_f	current fall time						
E_{on}	turn-on energy per pulse						
E_{off}	turn-off energy per pulse						
R_{BSOA}	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 56\ \Omega$					
I_{CM}		$V_{CEK} = 1200\text{ V}$			45	A	
R_{SCSOA}	short circuit safe operating area						
t_{SC}	short circuit duration	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V}$			10	μs	
I_{SC}	short circuit current	$R_G = 56\ \Omega$; non-repetitive			60	A	
R_{thJC}	thermal resistance junction to case				1.26	K/W	
R_{thCH}	thermal resistance case to heatsink				0.42	K/W	
Brake Diode							
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V	
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			18	A	
I_{F80}		$T_C = 80^{\circ}\text{C}$			12	A	
V_F	forward voltage	$I_F = 10\text{ A}$			2.20	V	
					2.20	V	
I_R	reverse current	$V_R = V_{RRM}$			0.1	mA	
					0.2	mA	
Q_{rr}	reverse recovery charge	$V_R = 600\text{ V}$ $-di_F/dt = 250\text{ A}/\mu\text{s}$ $I_F = 10\text{ A}$					
I_{RM}	max. reverse recovery current						
t_{rr}	reverse recovery time						
E_{rec}	reverse recovery energy						
R_{thJC}	thermal resistance junction to case				2.5	K/W	
R_{thCH}	thermal resistance case to heatsink				0.83	K/W	

Inverter IGBT				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V	
V_{GES}	max. DC gate voltage				± 20	V	
V_{GEM}	max. transient gate emitter voltage				± 30	V	
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			28	A	
I_{C80}		$T_C = 80^{\circ}\text{C}$			20	A	
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			100	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 15\text{A}; V_{GE} = 15\text{V}$			1.8	V	
					2.1	V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 0.6\text{mA}; V_{GE} = V_{CE}$	5.4	5.9	6.5	V	
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{V}$			0.1	mA	
					0.1	mA	
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{V}$			500	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{V}; V_{GE} = 15\text{V}; I_C = 15\text{A}$			48	nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{V}; I_C = 15\text{A}$ $V_{GE} = \pm 15\text{V}; R_G = 56\Omega$			70	ns	
t_r	current rise time				40	ns	
$t_{d(off)}$	turn-off delay time				250	ns	
t_f	current fall time				100	ns	
E_{on}	turn-on energy per pulse				1.6	mJ	
E_{off}	turn-off energy per pulse				1.7	mJ	
R_{BSOA}	reverse bias safe operating area	$V_{GE} = \pm 15\text{V}; R_G = 56\Omega$					
I_{CM}		$V_{CEmax} = 1200\text{V}$			45	A	
R_{SCSOA}	short circuit safe operating area	$V_{CEmax} = 900\text{V}$					
t_{sc}	short circuit duration	$V_{CE} = 900\text{V}; V_{GE} = \pm 15\text{V}$			10	μs	
I_{sc}	short circuit current	$R_G = 56\Omega; \text{non-repetitive}$			60	A	
R_{thJC}	thermal resistance junction to case				1.26	K/W	
R_{thCH}	thermal resistance case to heatsink				0.42	K/W	
Inverter Diode							
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V	
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			18	A	
I_{F80}		$T_C = 80^{\circ}\text{C}$			12	A	
V_F	forward voltage	$I_F = 10\text{A}$			2.20	V	
					2.20	V	
I_R	reverse current	$V_R = V_{RRM}$			0.1	mA	
					0.2	mA	
Q_{rr}	reverse recovery charge	$V_R = 600\text{V}$ $-di_F/dt = 250\text{A}/\mu\text{s}$ $I_F = 10\text{A}; V_{GE} = 0\text{V}$			1.3	μC	
I_{RM}	max. reverse recovery current				10.5	A	
t_{rr}	reverse recovery time				350	ns	
E_{rec}	reverse recovery energy				0.4	mJ	
R_{thJC}	thermal resistance junction to case				2.5	K/W	
R_{thCH}	thermal resistance case to heatsink				0.83	K/W	

Package MiniPack2B			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
I_{RMS}	RMS current	per terminal				A
T_{VJ}	virtual junction temperature		-40		150	°C
T_{op}	operation temperature		-40		125	°C
T_{stg}	storage temperature		-40		125	°C
Weight				39		g
M_D	mounting torque		2		2.2	Nm
$d_{Spp/App}$	creepage distance on surface striking distance through air	terminal to terminal	6.3	5.0		mm
$d_{Spb/Abp}$		terminal to backside	11.5	10.0		mm
V_{ISOL}	isolation voltage	t = 1 second t = 1 minute	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	3000		V
				2500		V
$R_{pin-chip}$	resistance pin to chip	$V = V_{CEsat} + 2 \cdot R \cdot I_C$ resp. $V = V_F + 2 \cdot R \cdot I_F$		6		mΩ
T_{vjn}	max. virtual junction temperature				175	°C



Part number

- M = Module
- I = IGBT
- X = XPT IGBT
- A = Gen 1 / std
- 20 = Current Rating [A]
- WB = 6-Pack + 3~ Rectifier Bridge & Brake Unit
- 1200 = Reverse Voltage [V]
- T = Thermistor \ Temperature sensor
- MI = MiniPack2B

Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MIXA20WB1200TMI	MIXA20WB1200TMI	Blister	20	514795

Temperature Sensor NTC

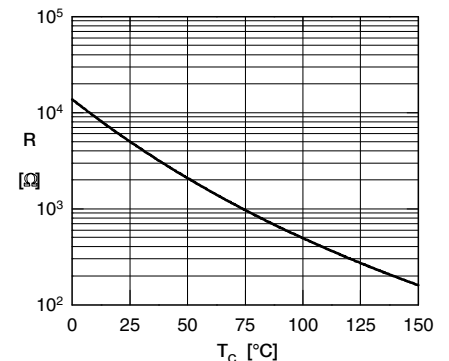
Symbol	Definition	Conditions	min.	typ.	max.	Unit
R_{25}	resistance	$T_{VJ} = 25^\circ$	4.75	5	5.25	kΩ
$B_{25/50}$	temperature coefficient			3375		K

Equivalent Circuits for Simulation

* on die level

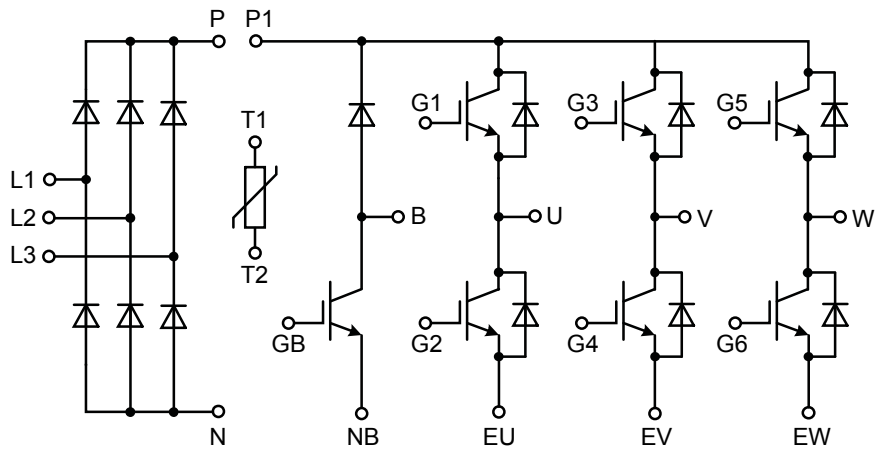
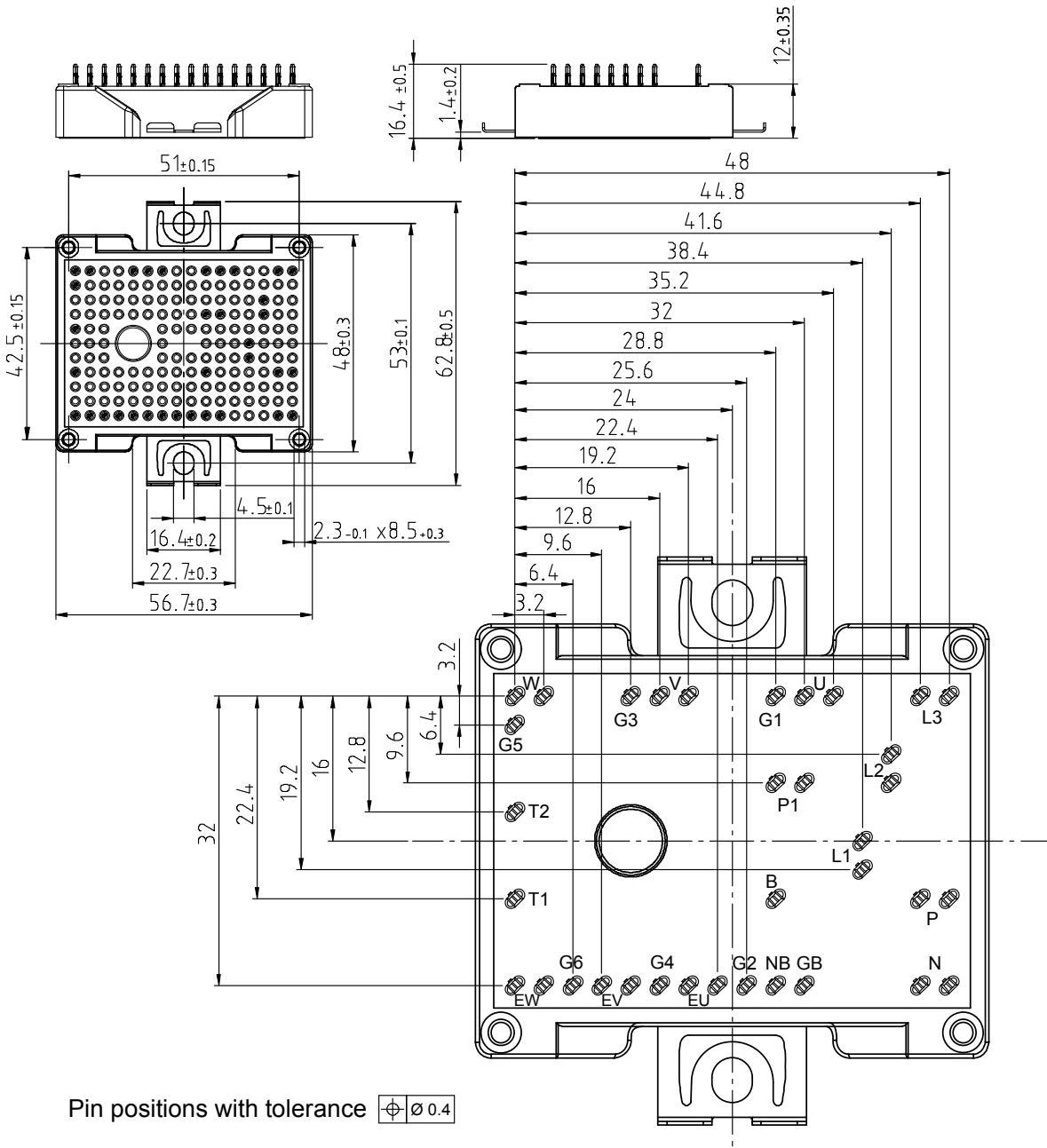
$T_{VJ} = 150^\circ\text{C}$

		Rectifier	Brake IGBT	Brake Diode	Inverter IGBT	Inverter Diode	
V_0	threshold voltage	0.86	1.1	1.25	1.1	1.25	V
R_0	slope resistance *	10	86	90	86	90	mΩ



Typ. NTC resistance vs. temperature

Outlines MiniPack2B



Rectifier V_F [V]

Fig. 1 Forward current versus voltage drop per diode

 t [s]

Fig. 2 Surge overload current

 t [ms]Fig. 3 I^2t versus time per diode

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

Fig. 5 Max. forward current versus case temperature

Fig. 6 Transient thermal impedance junction to case

Brake IGBT

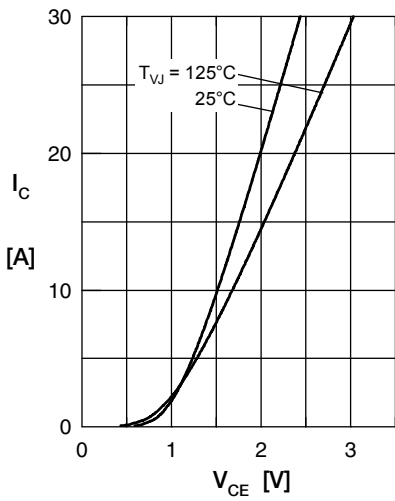


Fig. 1 Typ. output characteristics

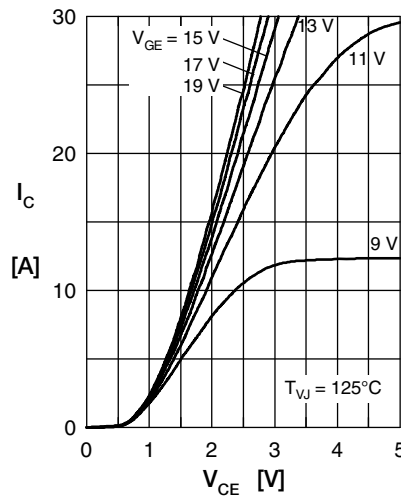


Fig. 2 Typ. output characteristics

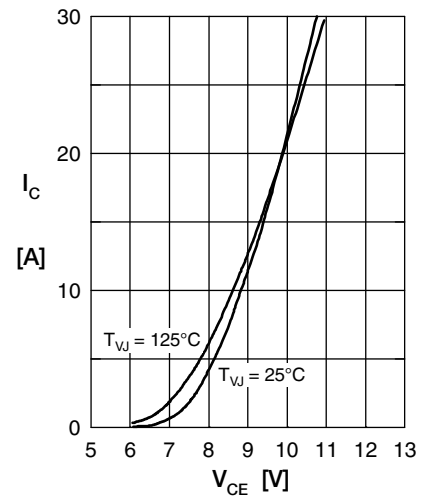


Fig. 3 Typ. transfer characteristics

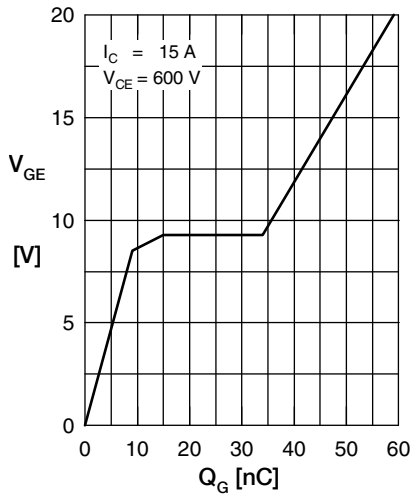


Fig. 4 Typ. turn-on gate charge

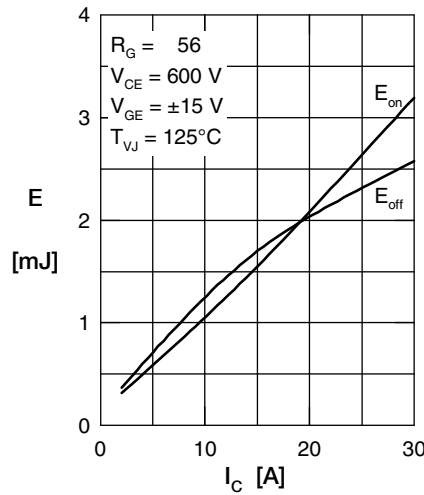


Fig. 5 Typ. switching energy vs. collector current

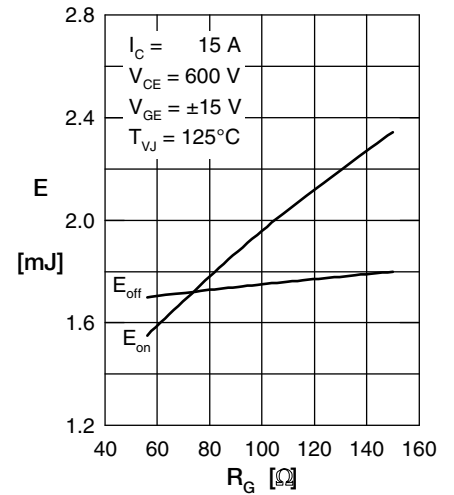


Fig. 6 Typ. switching energy versus gate resistance

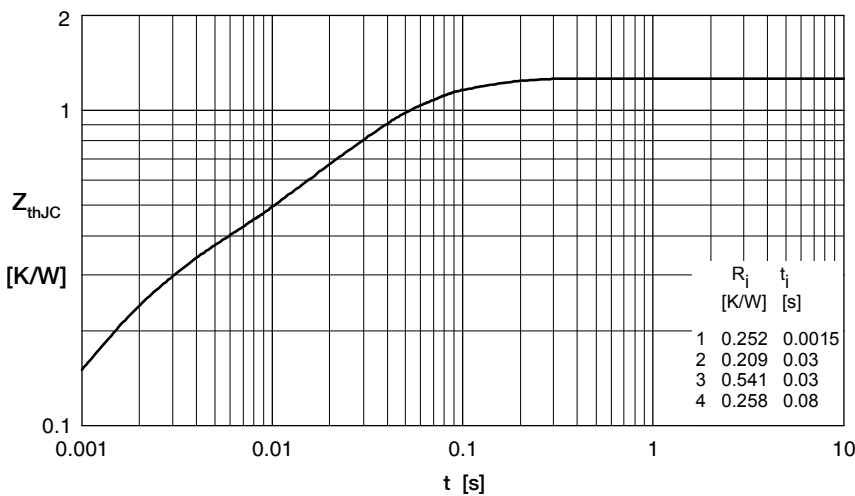


Fig. 7 Transient thermal impedance junction to case

Brake Diode

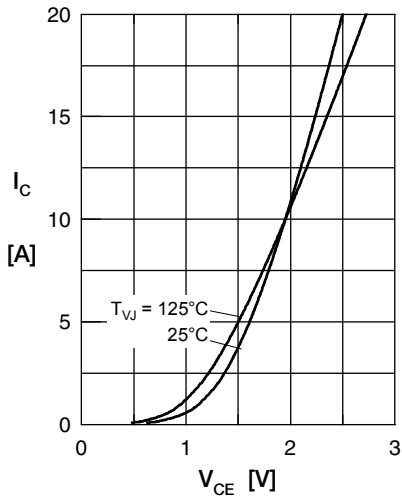


Fig. 1 Typ. Forward current versus V_F

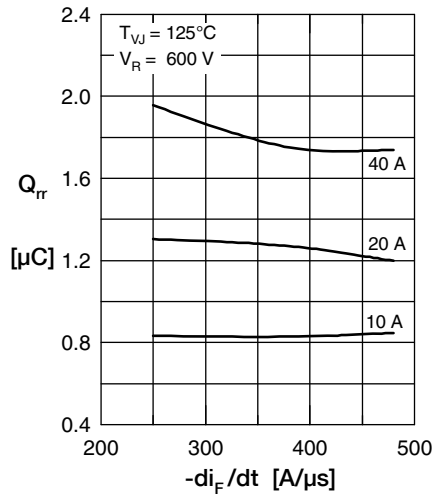


Fig. 2 Typ. reverse recovery charge Q_{rr} versus di/dt

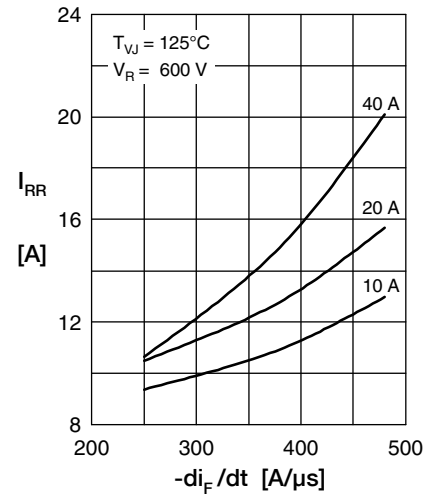


Fig. 3 Typ. peak reverse current I_{RM} versus di/dt

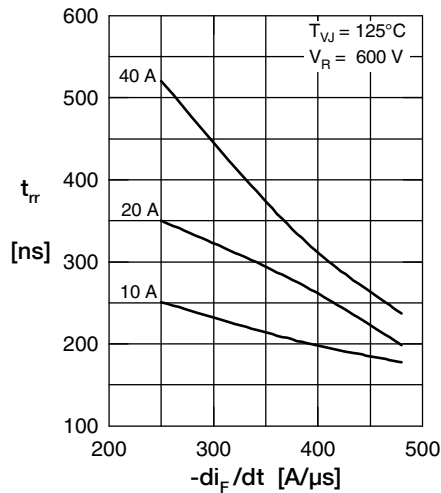


Fig. 4 Dynamic parameters Q_{rr} , I_{RM} versus T_{VJ}

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

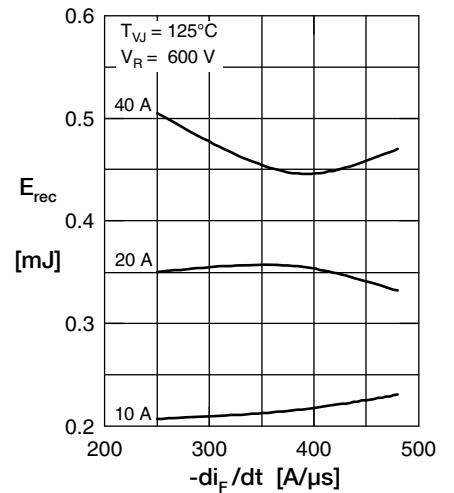


Fig. 6 Typ. recovery energy E_{rec} versus $-di/dt$

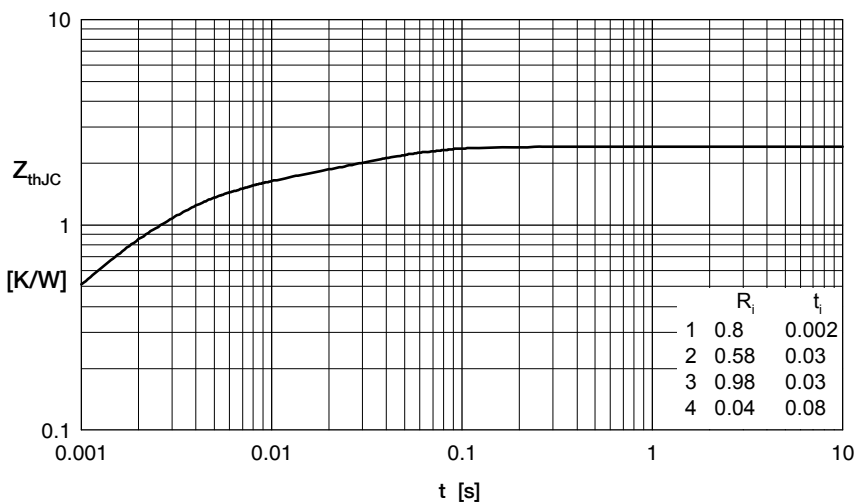


Fig. 7 Transient thermal impedance junction to case

Inverter IGBT

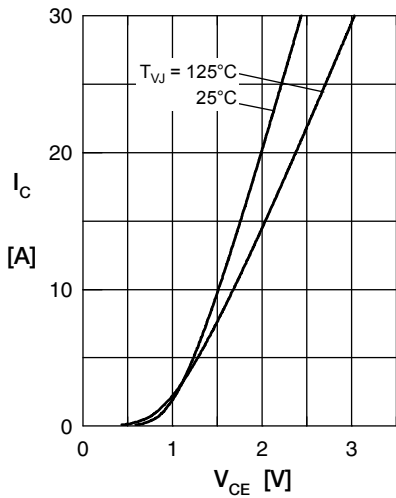


Fig. 1 Typ. output characteristics

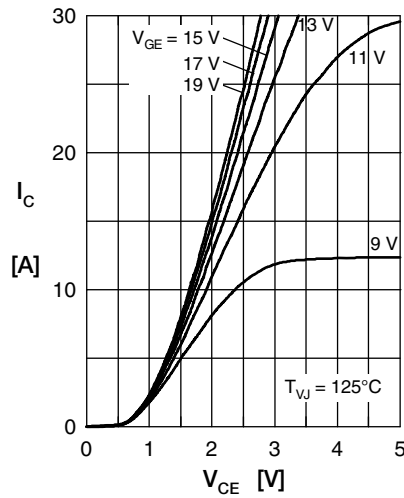


Fig. 2 Typ. output characteristics

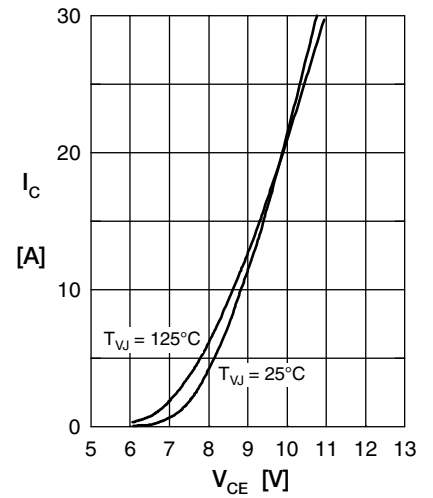


Fig. 3 Typ. transfer characteristics

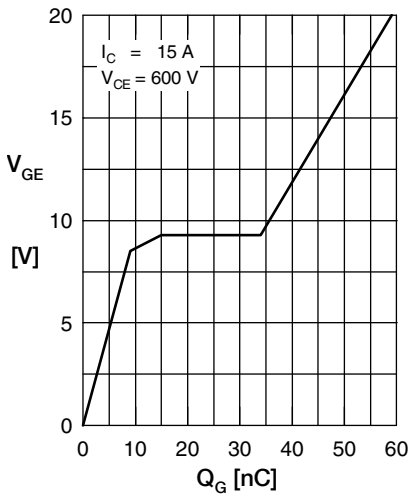


Fig. 4 Typ. turn-on gate charge

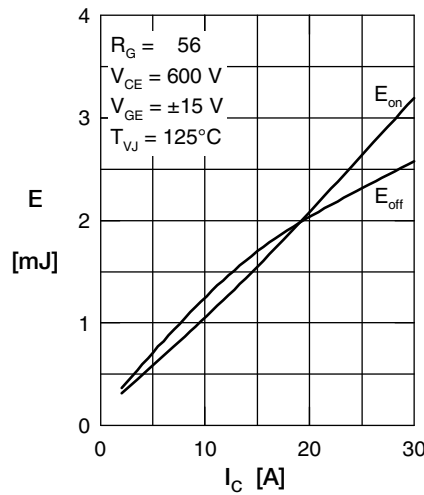


Fig. 5 Typ. switching energy vs. collector current

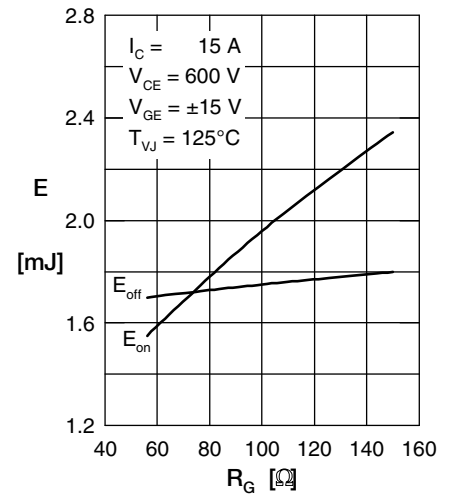


Fig. 6 Typ. switching energy versus gate resistance

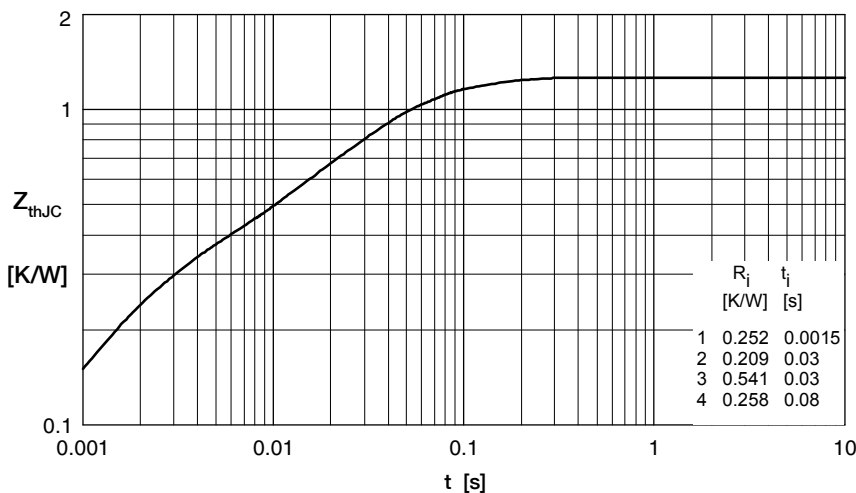


Fig. 7 Transient thermal impedance junction to case

Inverter Diode

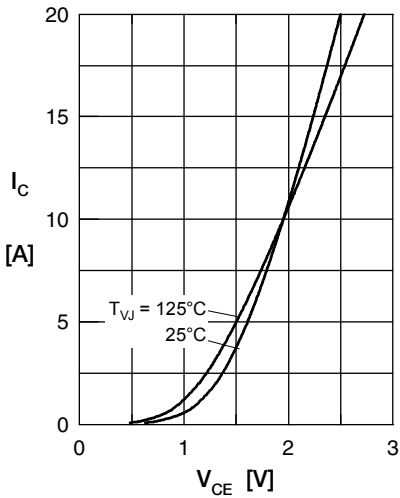


Fig. 1 Typ. Forward current versus V_F

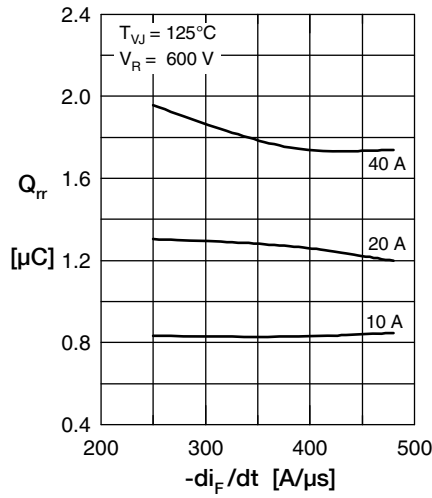


Fig. 2 Typ. reverse recovery charge Q_{rr} versus di/dt

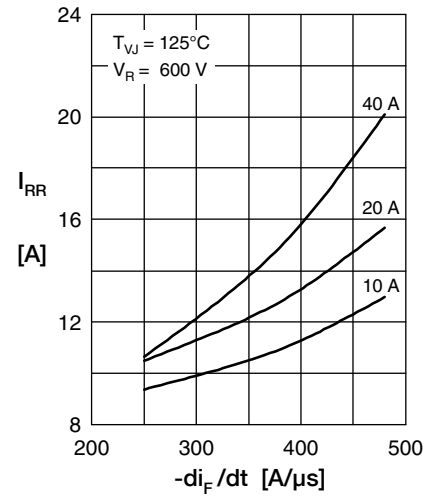


Fig. 3 Typ. peak reverse current I_{RM} versus di/dt

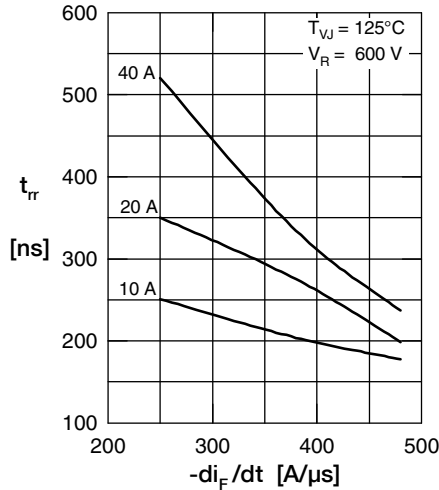


Fig. 4 Dynamic parameters Q_{rr} , I_{RM} versus T_{VJ}

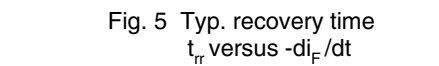


Fig. 5 Typ. recovery time t_{rr} versus $-di_F/dt$

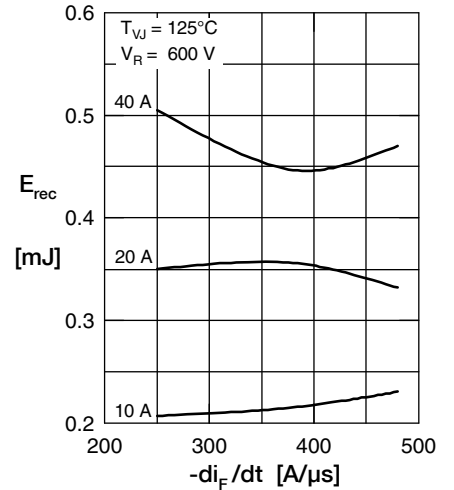


Fig. 6 Typ. recovery energy E_{rec} versus $-di/dt$

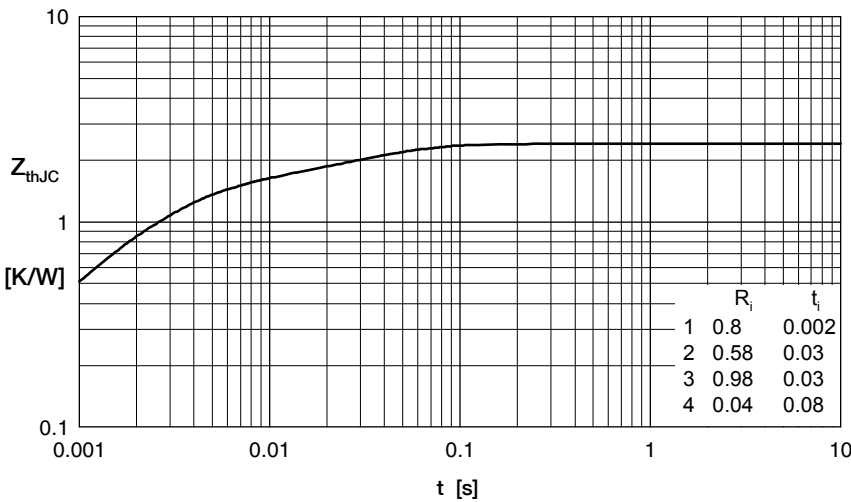


Fig. 7 Transient thermal impedance junction to case