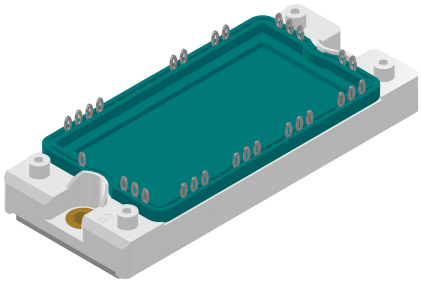
Standard Rectifier Module

3~ Rectifier			Brake Chopper		
V_{RRM}	=	1600 V	V_{CES}	=	1200 V
I_{DAV}	=	360 A	I_{C25}	=	250 A
I_{FSM}	=	1900 A	$V_{CE(sat)}$	=	1.7 V

3~ Rectifier Bridge + Brake Unit + NTC

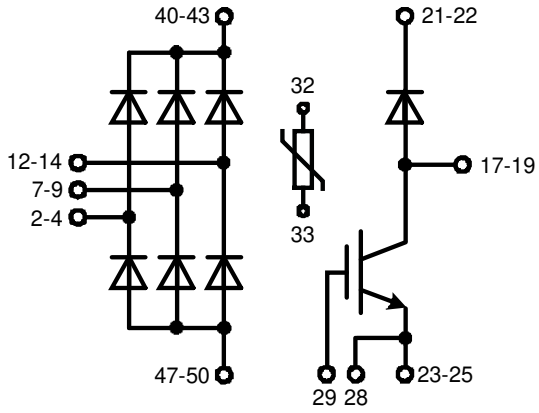
Part number

MDMA360UB1600PTED



Backside: isolated

E72873



Features / Advantages:

- Package with DCB ceramic
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current
- NTC

Applications:

- 3~ Rectifier with brake unit for drive inverters

Package: E2-Pack

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- PressFit-Pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

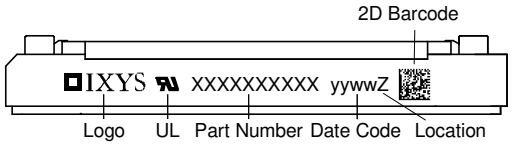
Rectifier

Symbol	Definition	Conditions		Ratings min.	typ.	max.	Unit
V_{RSM}	*max. non-repetitive reverse blocking voltage*		T_{VJ} = 25°C			1700	V
V_{RRM}	*max. repetitive reverse blocking voltage*		T_{VJ} = 25°C			1600	V
I_R	*reverse current*	V_R = 1600 V	T_{VJ} = 25°C			100	µA
		V_R = 1600 V	T_{VJ} = 150°C			3	mA
V_F	*forward voltage drop*	I_F = 120 A	T_{VJ} = 25°C			1.25	V
		I_F = 360 A				1.80	V
		I_F = 120 A	T_{VJ} = 125°C			1.23	V
		I_F = 360 A				1.98	V
I_{DAV}	*bridge output current*	T_C = 85°C	T_{VJ} = 150°C			360	A
		rectangular d = ⅓					
V_{F0}	*threshold voltage* } *for power loss calculation only*		T_{VJ} = 150°C			0.82	V
r_F	*slope resistance* }					3.4	mΩ
R_{thJC}	*thermal resistance junction to case*					0.25	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.1		K/W
P_{tot}	*total power dissipation*		T_C = 25°C			500	W
I_{FSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			1.90	kA
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			2.05	kA
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			1.62	kA
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			1.75	kA
I^2t	*value for fusing*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			18.1	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			17.5	kA²s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			13.0	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			12.7	kA²s
C_J	*junction capacitance*	V_R = 400 V; f = 1 MHz	T_{VJ} = 25°C		73		pF

Brake IGBT + Diode				Ratings			
Symbol	**Definition**	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°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°C			250	A
I_{C80}			T_C = 80°C			175	A
P_{tot}	*total power dissipation*		T_C = 25°C			780	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 150 A; V_{GE} = 15 V	T_{VJ} = 25°C		1.7	2.1	V
			T_{VJ} = 125°C		1.9		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 6 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	6	6.8	7.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.1	mA
			T_{VJ} = 125°C		1		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				500	nA
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 150 A			510		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 150 A V_{GE} = ±15 V; R_G = 4.7 Ω	T_{VJ} = 125°C		280		ns
t_r	*current rise time*				80		ns
$t_{d(off)}$	*turn-off delay time*				440		ns
t_f	*current fall time*				230		ns
E_{on}	*turn-on energy per pulse*				26		mJ
E_{off}	*turn-off energy per pulse*				15		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 4.7 Ω	T_{VJ} = 125°C				
I_{CM}		V_{CEK} = 1200 V				400	A
SCSOA	*short circuit safe operating area*	V_{CEK} = 1200 V					
t_{SC}	*short circuit duration*	V_{CE} = 900 V; V_{GE} = ±15	T_{VJ} = 125°C			10	µs
I_{SC}	*short circuit current*	R_G = 4.7 Ω; non-repetitive			600		A
R_{thJC}	*thermal resistance junction to case*					0.16	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.10		K/W

Brake Diode							
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			135	A
I_{F80}			T_C = 80°C			90	A
V_F	*forward voltage*	I_F = 100 A	T_{VJ} = 25°C			2.20	V
			T_{VJ} = 125°C		1.95		V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C			0.1	mA
			T_{VJ} = 125°C			1.2	mA
Q_{rr}	*reverse recovery charge*	V_R = 600 V $-di_F/dt$ = 1600 A/µs I_F = 100 A; V_{GE} = 0 V	T_{VJ} = 125°C		12.5		µC
I_{RM}	*max. reverse recovery current*				100		A
t_{rr}	*reverse recovery time*				350		ns
E_{rec}	*reverse recovery energy*				4		mJ
R_{thJC}	*thermal resistance junction to case*					0.4	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.10		K/W

Package E2-Pack				Ratings			
Symbol	**Definition**	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
I_{RMS}	*RMS current*	per terminal				30	A
T_{VJ}	*virtual junction temperature*			-40		150	°C
T_{op}	*operation temperature*			-40		125	°C
T_{stg}	*storage temperature*			-40		125	°C
Weight					176		g
M_D	*mounting torque*			3		6	Nm
$d_{Spp/App}$	*creepage distance on surface | striking distance through air*		*terminal to terminal*	6.0			mm
$d_{Spb/Apb}$			*terminal to backside*	12.0			mm
V_{ISOL}	*isolation voltage*	t = 1 second	50/60 Hz, RMS; I_{ISOL} ≤ 1 mA	3600			V
		t = 1 minute		3000			V



Part description

M = Module
D = Diode
M = Standard Rectifier
A = (up to 1800V)
360 = Current Rating [A]
UB = 3~ Rectifier Bridge + Brake Unit
1600 = Reverse Voltage [V]
PT = PressFit-Pin, Thermistor
ED = E2-Pack
- = Hyphen
PC = Phase Change Material

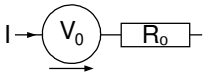
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MDMA360UB1600PTED	MDMA360UB1600PTED	Blister	28	516620
Alternative	MDMA360UB1600PTED-PC	MDMA360UB1600PTED	Blister	28	515423

Temperature Sensor NTC

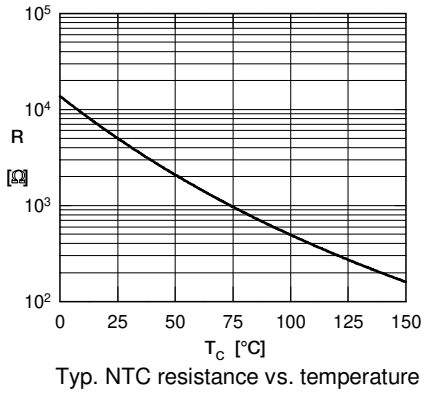
Symbol	**Definition**	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
R_{25}	*resistance*	T_{VJ} = 25°	4.85	5	5.15	kΩ
$B_{25/50}$	*temperature coefficient*			3375		K

Equivalent Circuits for Simulation

** on die level* T_{VJ} = 150°C

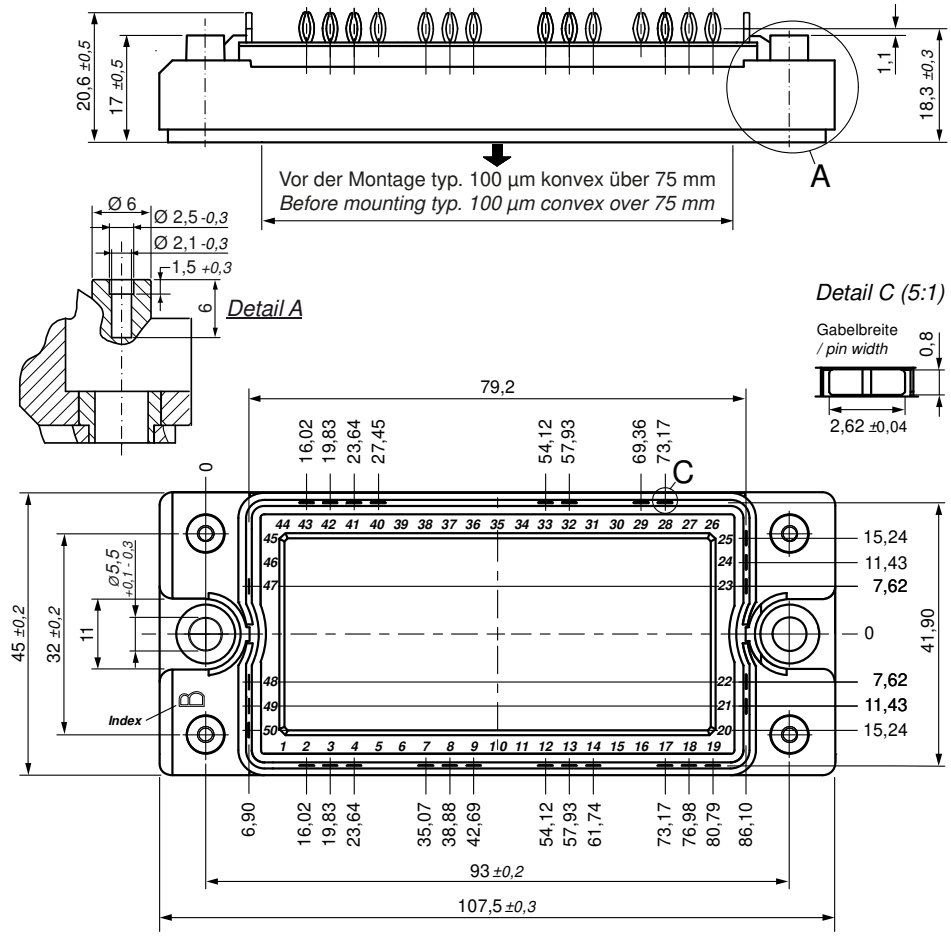


		Rectifier	**Brake IGBT +**	**Brake Diode**	
$V_{0\ max}$	*threshold voltage*	0.82	1.1	1.25	V
$R_{0\ max}$	*slope resistance **	1.5	9.2	8.5	mΩ



Typ. NTC resistance vs. temperature

Outlines E2-Pack

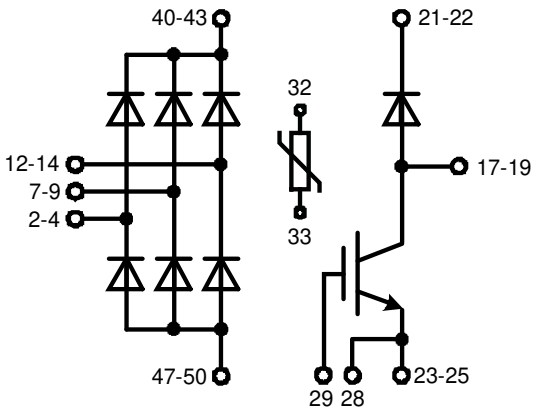


Bemerkung / ***Note:***

- Nicht tolerierte Maße nach / *Measure without tolerances according DIN ISO 2768-T1-m*
- PCB-Lochmuster / *PCB hole pattern:* **see pin position**
- Toleranz Pin-Position und PCB-Lochmuster / *Tolerance of pin position and PCB hole pattern:* ⌖ **0.1**
- Bohrlochdurchmesser / *Diameter of drill:* **Ø 2.35 mm**
- Endlochdurchmesser / *Diameter of plated holes:* **Ø 2.14 - 2.29 mm** (Cu thickness in via typ. 50 µm)
- Beschichtung / *Plating:* **chem. Sn max. 15 µm**
- Einpresskraft / *Insert Force:* per terminal with a typ. insert speed of 7 mm/s: **typ. 90 N**
- Weitere Angaben / *Further information:* www.ixys.com **Application note IXAN0077**
- Montageanleitung / *Mounting instruction:* www.ixys.com **Application note IXAN0024**

***Detail A*:** PCB-Montage / *Mounting on PCB*

- Empfohlene, selbstschneidende Schraube / *Recommended, self-tapping screw:* **EJOT PT®** (Größe / *size:* **K25**)
- Max. Schraubenlänge / *Max. screw length:* **PCB-Dicke** / **thickness + 6 mm** *(*max. Lochtiefe / *hole depth)*
- Empfohlenes Drehmoment / *Recommended mounting torque:* **1.5 Nm**



Rectifier

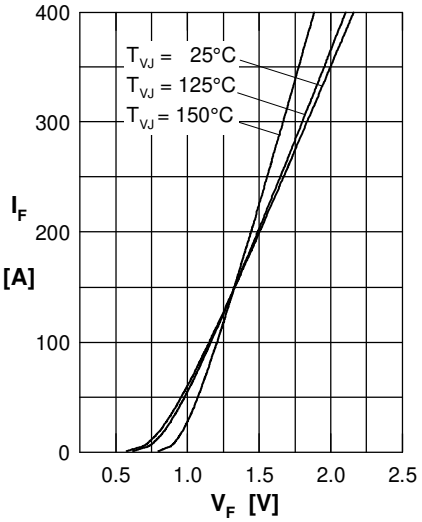


Fig. 1 Forward current versus voltage drop per diode

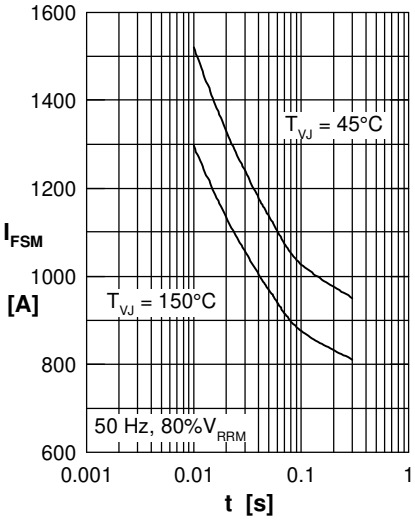


Fig. 2 Surge overload current vs. time per diode

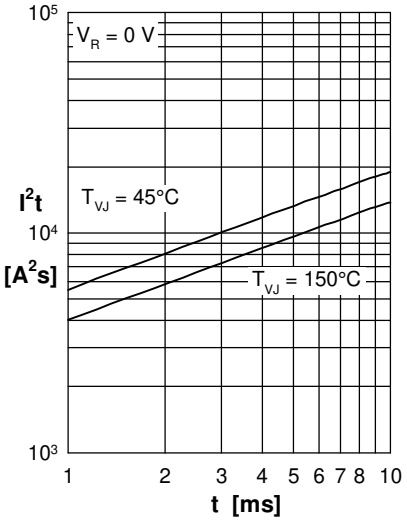


Fig. 3 I^2t versus time per diode

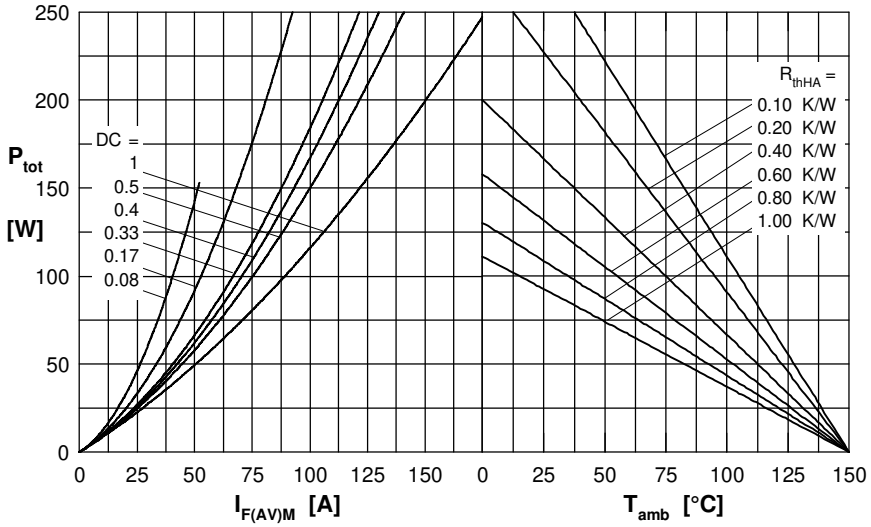


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

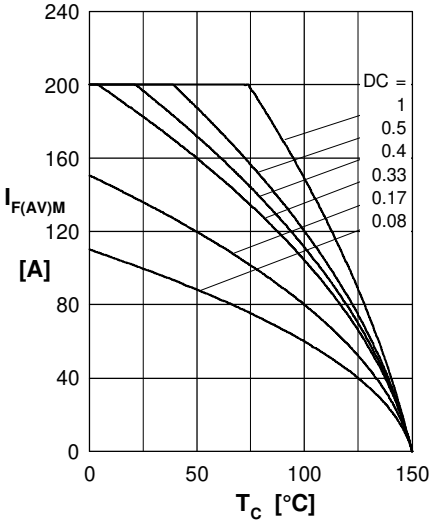


Fig. 5 Max. forward current vs. case temperature per diode

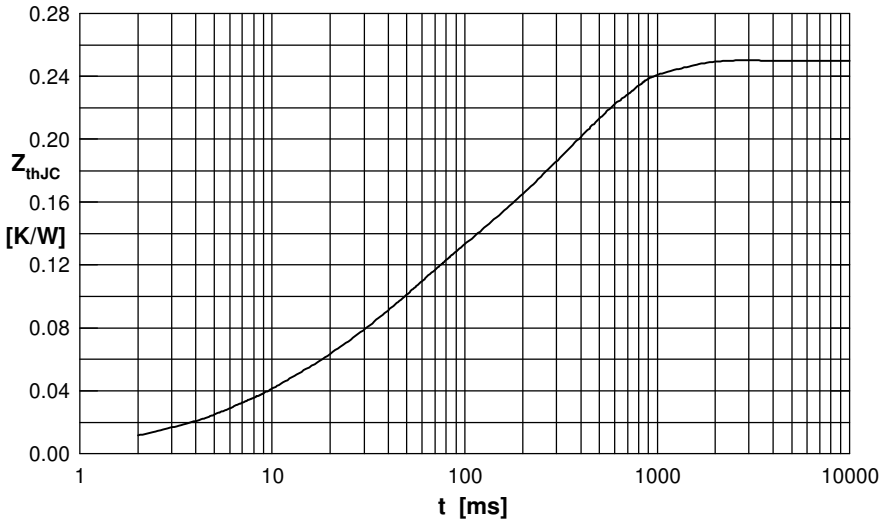


Fig. 6 Transient thermal impedance junction to case vs. time per diode

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.020	0.006
2	0.003	0.007
3	0.080	0.037
4	0.147	0.360

Brake IGBT + Diode

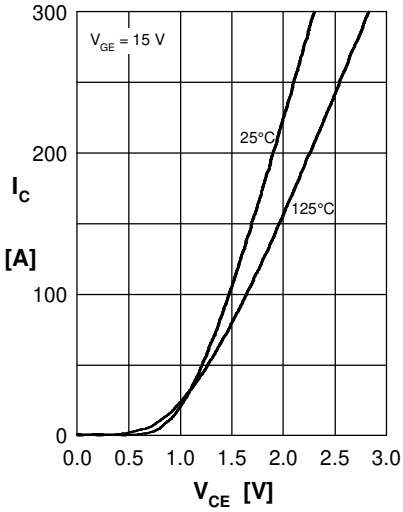


Fig.1 Output characteristics IGBT

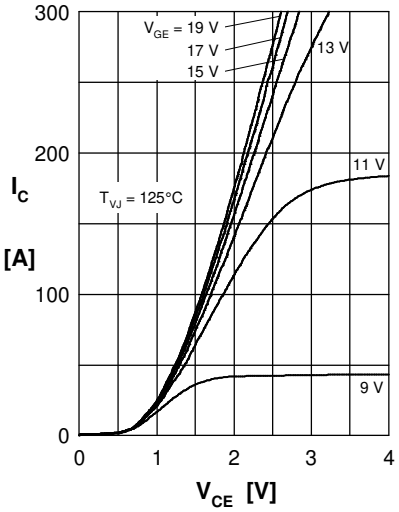


Fig.2 Typ. output characteristics IGBT

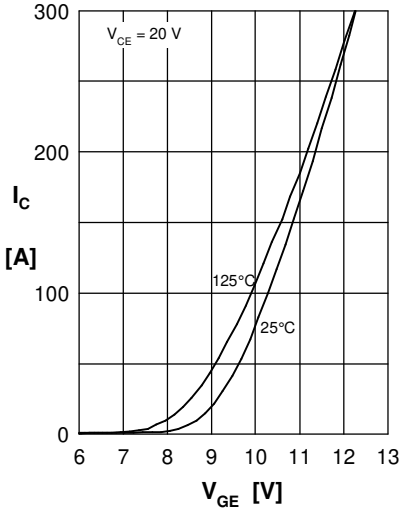


Fig. 3 Typ. transfer charact. IGBT

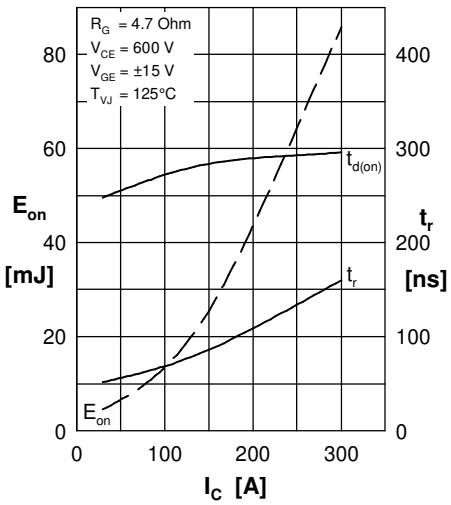


Fig. 4 Typ. turn-on energy & switch. times vs. collector current

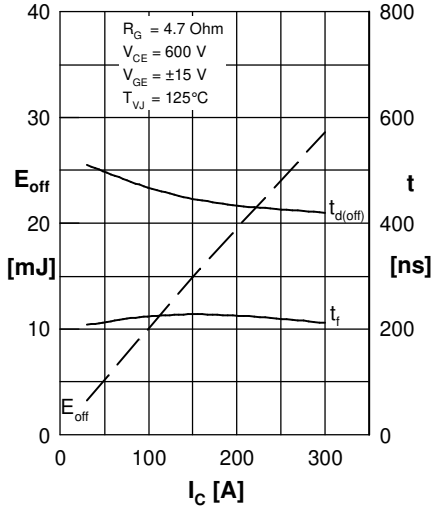


Fig. 5 Typ. turn-off energy & switch. times vs. collector current

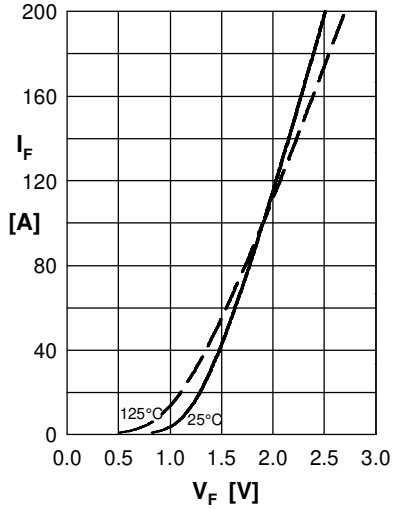


Fig. 6 Typ. forward characteristics Diode

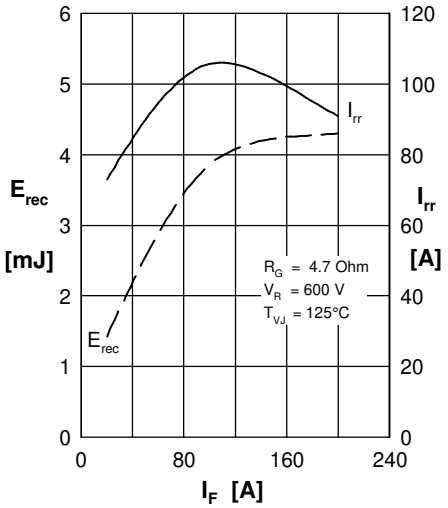


Fig. 7 Typ. reverse recovery characteristics Diode

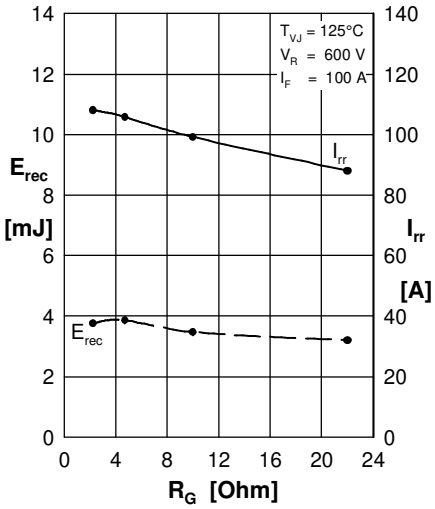


Fig. 8 Typ. reverse recovery characteristics Diode

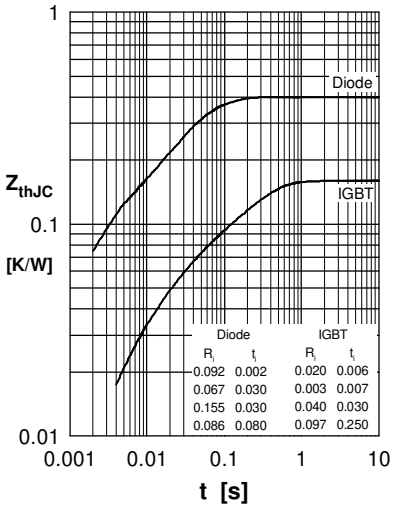


Fig. 9 Transient thermal resistance junction to case