

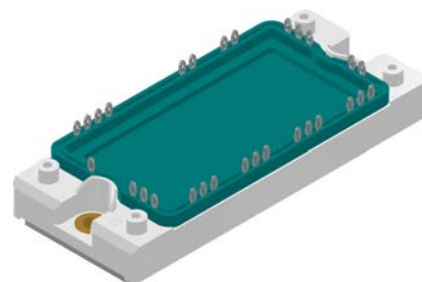
High Voltage Standard Rectifier Module

3~ Rectifier	Brake Chopper
$V_{RRM} = 2200 \text{ V}$	$V_{CES} = 1700 \text{ V}$
$I_{DAV} = 360 \text{ A}$	$I_{C25} = 200 \text{ A}$
$I_{FSM} = 1900 \text{ A}$	$V_{CE(sat)} = 2,1 \text{ V}$

3~ Rectifier Bridge + Brake Unit + NTC

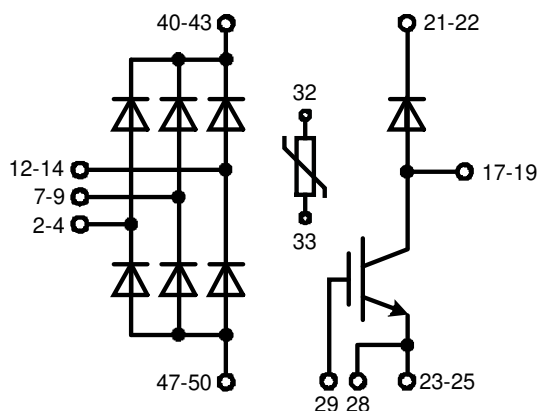
Part number

MDNA360UB2200PTED



Backside: isolated

 E72873



Features / Advantages:

- Brake with Infineon IGBT³

Applications:

- 3~ Rectifier with brake unit for drive inverters

Package: E2-Pack

- Isolation Voltage: 4300 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

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Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
V_{RSM}	max. non-repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				2300	V
V_{RRM}	max. repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				2200	V
I_R	reverse current	$V_R = 2200\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_R = 2200\text{ V}$	$T_{VJ} = 150^{\circ}\text{C}$			3	mA
V_F	forward voltage drop	$I_F = 120\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1,25	V
		$I_F = 360\text{ A}$				1,80	V
		$I_F = 120\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1,23	V
		$I_F = 360\text{ A}$				1,98	V
I_{DAV}	bridge output current	$T_C = 85^{\circ}\text{C}$ rectangular	$T_{VJ} = 150^{\circ}\text{C}$ $d = \frac{1}{3}$			360	A
V_{F0}	threshold voltage	} for power loss calculation only		$T_{VJ} = 150^{\circ}\text{C}$		0,82	V
r_F	slope resistance					3,4	m Ω
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	$T_C = 25^{\circ}\text{C}$				500	W
I_{FSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			1,90	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			2,05	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			1,62	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1,75	kA
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			18,1	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			17,5	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			13,0	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			12,7	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V}; f = 1\text{ MHz}$			73		pF

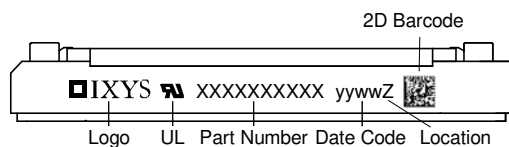

Brake IGBT + Diode

Symbol	Definition	Conditions	Ratings			
			min.	typ.	max.	Unit
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			1700	V
V_{GES}	max. DC gate voltage				± 20	V
V_{GEM}	max. transient gate emitter voltage				± 30	V
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			200	A
I_{C100}		$T_C = 100^{\circ}\text{C}$			135	A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			935	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 150 \text{ A}; V_{GE} = 15 \text{ V}$		2,1	2,8	V
				3,2		V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 4 \text{ mA}; V_{GE} = V_{CE}$	5,5	6,0	6,5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}$			0,12	mA
				2,3		mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20 \text{ V}$			500	nA
$Q_{G(on)}$	total gate charge	$V_{CE} = 900 \text{ V}; V_{GE} = 15 \text{ V}; I_C = 150 \text{ A}$		310		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 900 \text{ V}; I_C = 150 \text{ A}$ $V_{GE} = \pm 15 \text{ V}; R_G = 10 \Omega$		120		ns
t_r	current rise time			80		ns
$t_{d(off)}$	turn-off delay time			400		ns
t_f	current fall time			150		ns
E_{on}	turn-on energy per pulse			45		mJ
E_{off}	turn-off energy per pulse			50		mJ
RBSOA	reverse bias safe operating area	$V_{GE} = \pm 15 \text{ V}; R_G = 10 \Omega$				
I_{CM}		$V_{CEK} = 1700 \text{ V}$			280	A
SCSOA	short circuit safe operating area	$V_{CEK} = 1700 \text{ V}$				
t_{SC}	short circuit duration	$V_{CE} = 1300 \text{ V}; V_{GE} = \pm 15$			10	μs
I_{SC}	short circuit current	$R_G = 10 \Omega$; non-repetitive		400		A
R_{thJC}	thermal resistance junction to case				0,16	K/W
R_{thCH}	thermal resistance case to heatsink			0,25		K/W

Brake Diode

V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1700	V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			145	A
I_{F100}		$T_C = 100^{\circ}\text{C}$			90	A
V_F	forward voltage	$I_F = 100 \text{ A}$			2,20	V
				2,00		V
I_R	reverse current	$V_R = V_{RRM}$			tbd	mA
					tbd	mA
Q_{rr}	reverse recovery charge	$V_R = 900 \text{ V}$ $-di_F/dt = 2500 \text{ A}/\mu\text{s}$ $I_F = 100 \text{ A}; V_{GE} = 0 \text{ V}$		30		μC
I_{RM}	max. reverse recovery current			60		A
t_{rr}	reverse recovery time			200		ns
E_{rec}	reverse recovery energy			11		mJ
R_{thJC}	thermal resistance junction to case				0,39	K/W
R_{thCH}	thermal resistance case to heatsink			0,62		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; $I_{ISOL} \leq 1$ mA	4300			V
		t = 1 minute		3600			V



Part description

M = Module
 D = Diode
 N = High Voltage Standard Rectifier
 A = (≥ 2000 V)
 360 = Current Rating [A]
 UB = 3~ Rectifier Bridge + Brake Unit
 2200 = 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	MDNA360UB2200PTED	MDNA360UB2200PTED	Blister	28	515682
Alternative	MDNA360UB2200PTED-PC	MDNA360UB2200PTED	Blister	28	514541

Temperature Sensor NTC

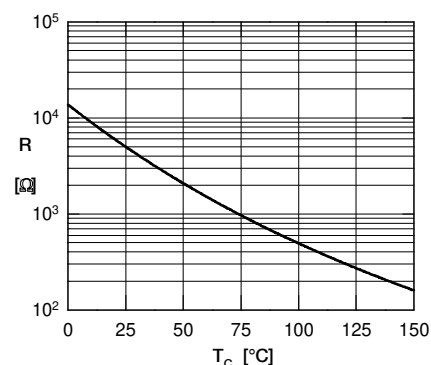
Symbol	Definition	Conditions	min.	typ.	max.	Unit
R_{25}	resistance	$T_{VJ} = 25^\circ$	4,85	5	5,15	k Ω
$B_{25/50}$	temperature coefficient			3375		K

Equivalent Circuits for Simulation

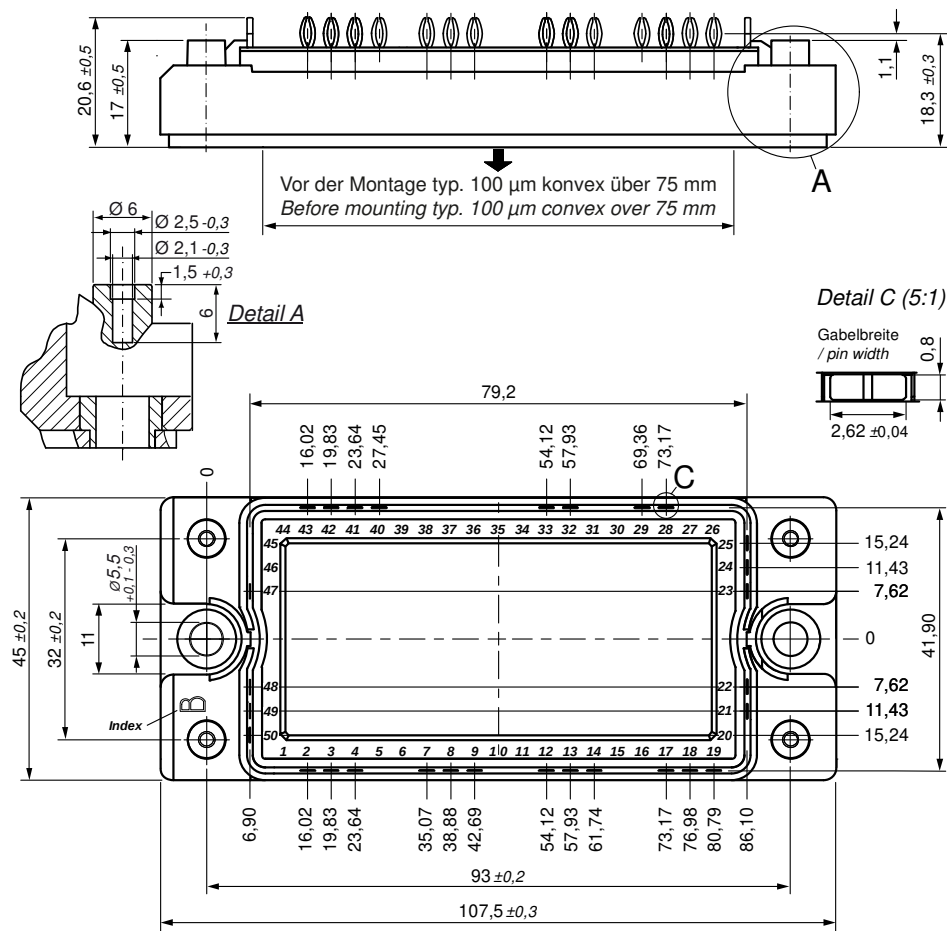
* on die level

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

		Rectifier	Brake IGBT +	Brake Diode	
V_0	threshold voltage	0,82	1,1	1,25	V
R_0	slope resistance *	1,5	9,2	8,5	m Ω



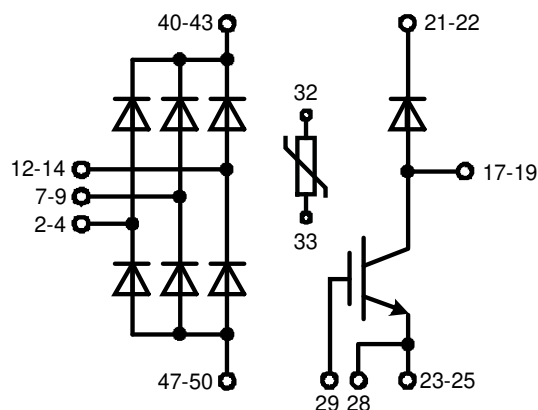
Typ. NTC resistance vs. temperature

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: $\oplus 0.1$
- 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**



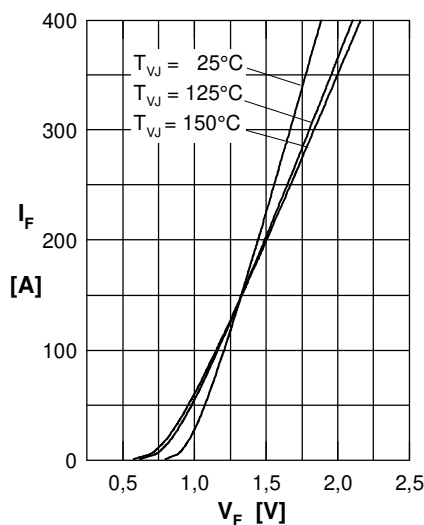
Rectifier


Fig. 1 Forward current versus voltage drop per diode

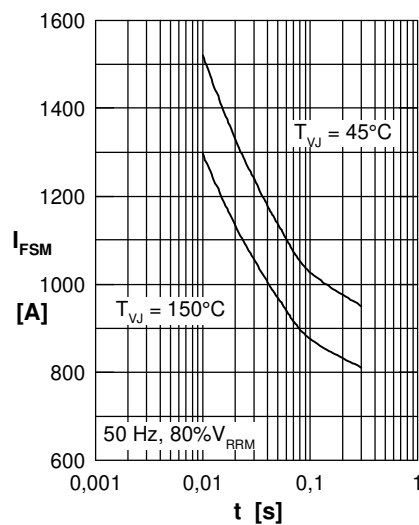


Fig. 2 Surge overload current vs. time per diode

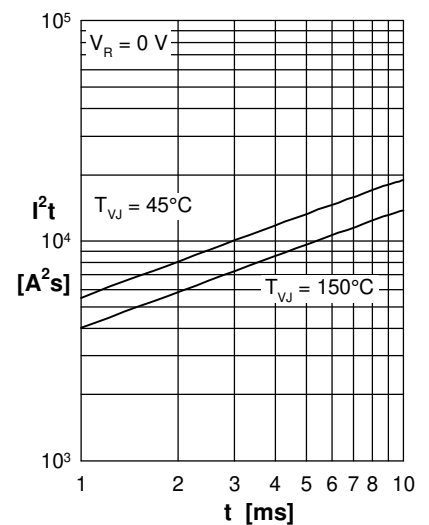
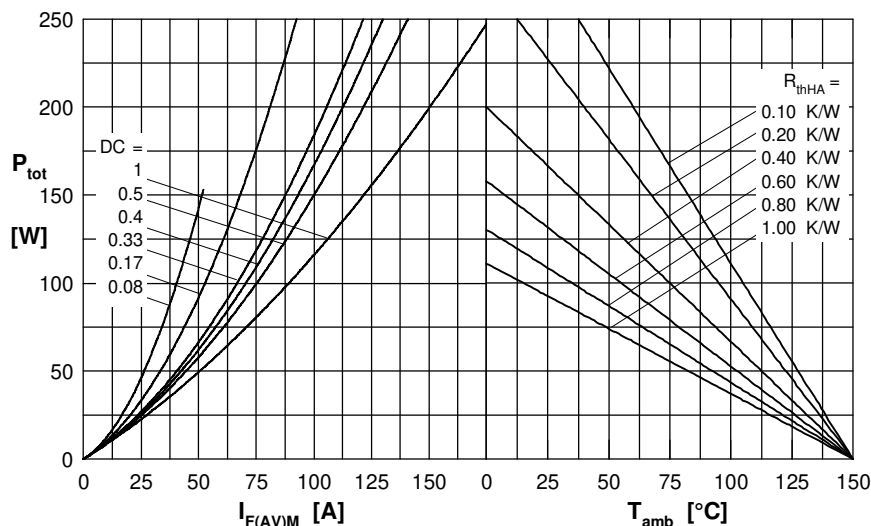

 Fig. 3 I^2t versus time per diode


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

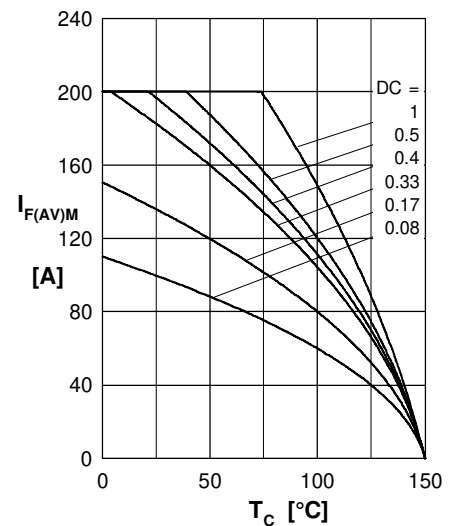


Fig. 5 Max. forward current vs. case temperature per diode

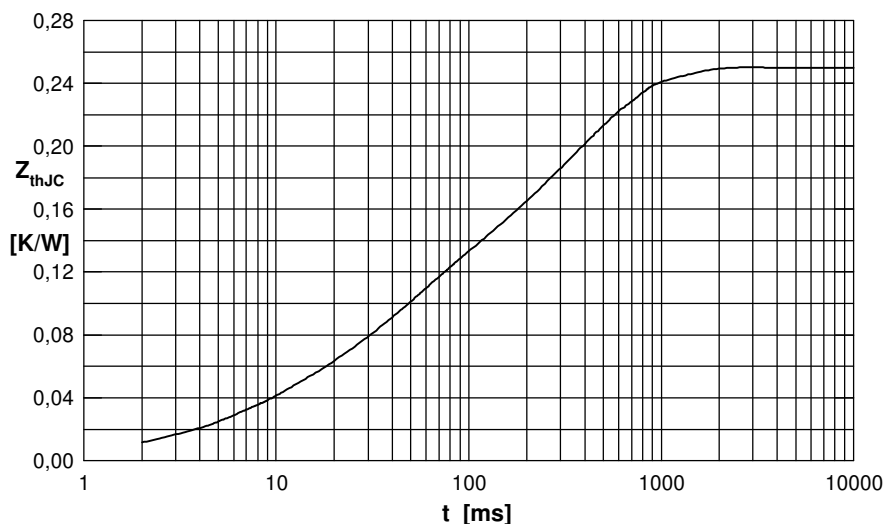


Fig. 6 Transient thermal impedance junction to case vs. time per diode

 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

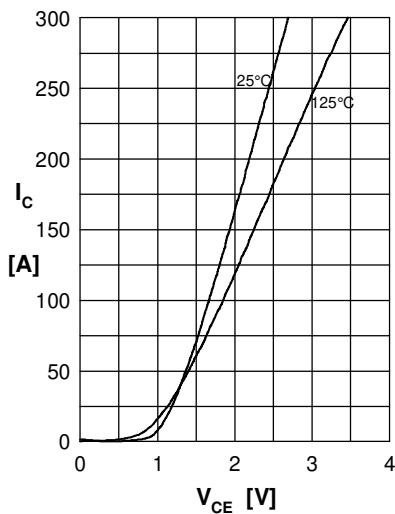
Brake IGBT + Diode


Fig. 1 Typ. output characteristics IGBT

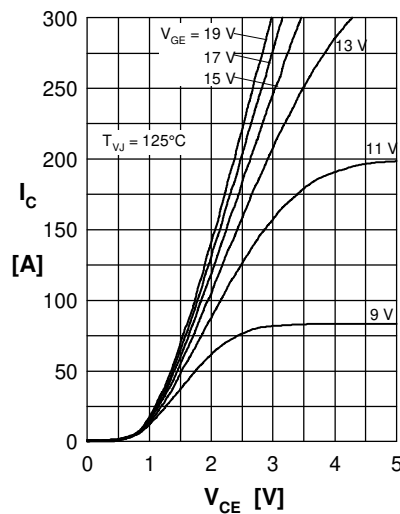


Fig. 2 Typ. output characteristics IGBT

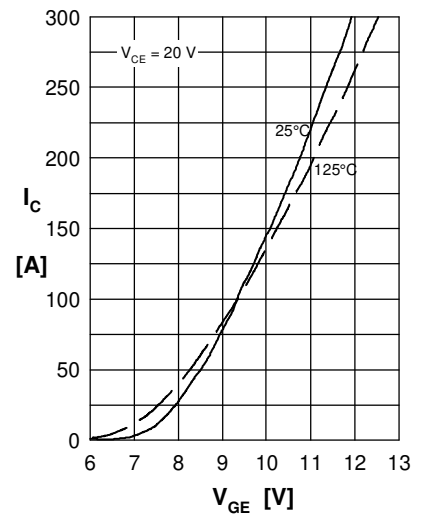


Fig. 3 Typ. transfer charact. IGBT

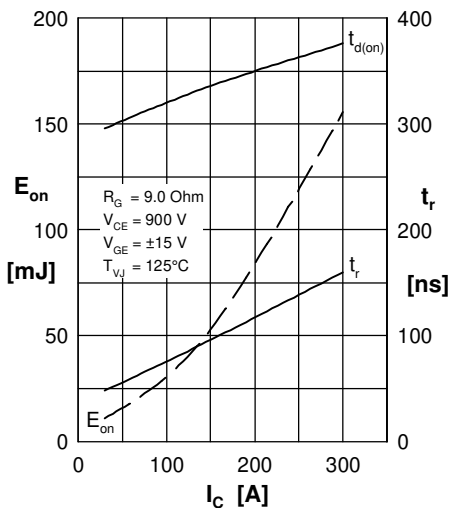


Fig. 4 Typ. turn-on energy & switch. times vs. collector current

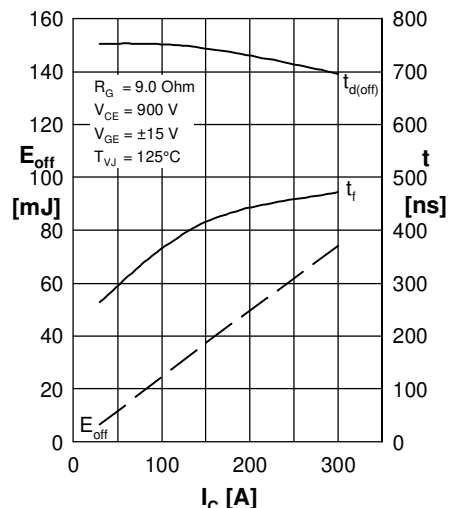


Fig. 5 Typ. turn-off energy & switch. times vs. collector current

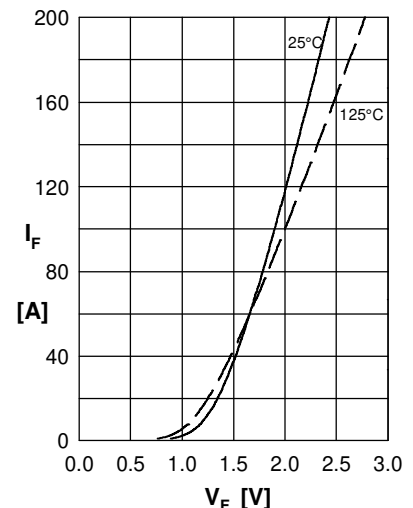


Fig. 6 Typ. forward characteristics Diode

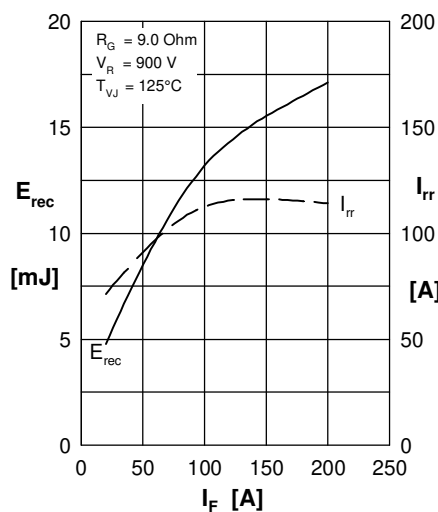


Fig. 7 Typ. reverse recovery characteristics Diode

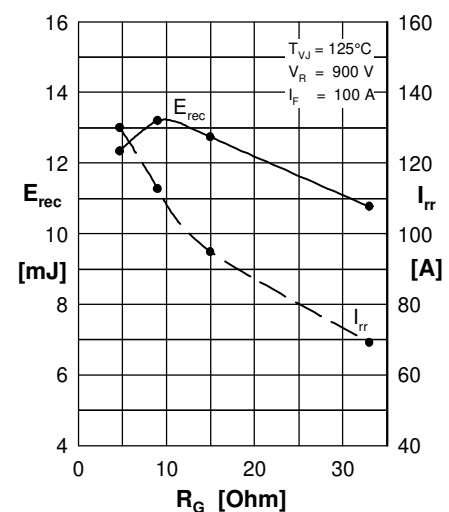


Fig. 8 Typ. reverse recovery characteristics Diode

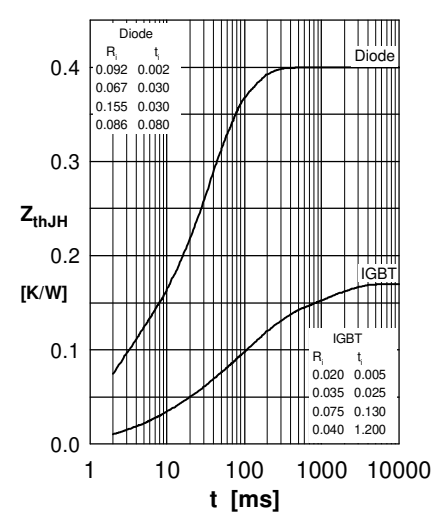


Fig. 9 Typ. transient thermal resistance junction to heatsink