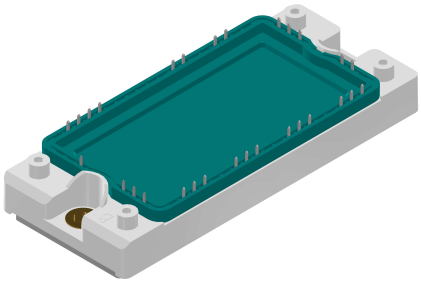
High Voltage Standard Rectifier Module

3~ Rectifier			Brake Chopper		
V_{RRM}	=	2200 V	V_{CES}	=	1700 V
I_{DAV}	=	210 A	I_{C25}	=	145 A
I_{FSM}	=	1000 A	$V_{CE(sat)}$	=	1.8 V

3~ Rectifier Bridge + Brake Unit + NTC

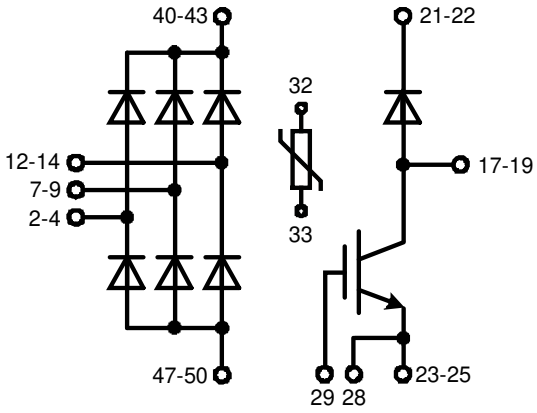
Part number

MDNA210UB2200TED



Backside: isolated

E72873



Features / Advantages:

- Brake with Infineon IGBT³

Applications:

- 3~ Rectifier with brake unit for drive inverters

Package: E2-Pack

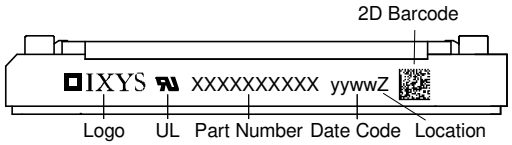
- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

Rectifier

Symbol	Definition	Conditions		Ratings min.	typ.	max.	Unit
V_{RSM}	*max. non-repetitive reverse blocking voltage*		T_{VJ} = 25°C			2300	V
V_{RRM}	*max. repetitive reverse blocking voltage*		T_{VJ} = 25°C			2200	V
I_R	*reverse current*	V_R = 2200 V	T_{VJ} = 25°C			100	µA
		V_R = 2200 V	T_{VJ} = 150°C			2	mA
V_F	*forward voltage drop*	I_F = 70 A	T_{VJ} = 25°C			1.23	V
		I_F = 210 A				1.75	V
		I_F = 70 A	T_{VJ} = 125°C			1.19	V
		I_F = 210 A				1.67	V
I_{DAV}	*bridge output current*	T_C = 85°C	T_{VJ} = 150°C			210	A
		rectangular d = ⅓					
V_{F0}	*threshold voltage* } *for power loss calculation only*		T_{VJ} = 150°C			0.82	V
r_F	*slope resistance* }					5.2	mΩ
R_{thJC}	*thermal resistance junction to case*					0.5	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.1		K/W
P_{tot}	*total power dissipation*		T_C = 25°C			250	W
I_{FSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			1.00	kA
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			1.08	kA
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			850	A
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			920	A
I^2t	*value for fusing*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			5.00	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			4.85	kA²s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			3.62	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			3.52	kA²s
C_J	*junction capacitance*	V_R = 400 V; f = 1 MHz	T_{VJ} = 25°C		33		pF

Brake IGBT + Diode				Ratings			
Symbol	**Definition**	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°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°C			145	A
I_{C80}			T_C = 80°C			100	A
P_{tot}	*total power dissipation*		T_C = 25°C			540	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 75 A; V_{GE} = 15 V	T_{VJ} = 25°C		1.8	2.16	V
			T_{VJ} = 125°C		2.1		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 4 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5.2	5.8	6.4	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		0.7		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				500	nA
$Q_{G(on)}$	*total gate charge*	V_{CE} = 900 V; V_{GE} = 15 V; I_C = 75 A			1200		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 900 V; I_C = 75 A V_{GE} = ±15 V; R_G = 3.9 Ω	T_{VJ} = 125°C		320		ns
t_r	*current rise time*				50		ns
$t_{d(off)}$	*turn-off delay time*				550		ns
t_f	*current fall time*				400		ns
E_{on}	*turn-on energy per pulse*				15		mJ
E_{off}	*turn-off energy per pulse*				18		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 3.9 Ω	T_{VJ} = 125°C				
I_{CM}		V_{CEK} = 1700 V				200	A
SCSOA	*short circuit safe operating area*	V_{CEK} = 1700 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 = 3.9 Ω; non-repetitive			400		A
R_{thJC}	*thermal resistance junction to case*					0.23	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.08		K/W
Brake Diode							
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1700	V
I_{F25}	*forward current*		T_C = 25°C			81	A
I_{F80}			T_C = 80°C			54	A
V_F	*forward voltage*	I_F = 60 A	T_{VJ} = 25°C			2.20	V
			T_{VJ} = 125°C		2.00		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 = 900 V $-di_F/dt$ = 1600 A/µs I_F = 60 A; V_{GE} = 0 V	T_{VJ} = 125°C		15		µC
I_{RM}	*max. reverse recovery current*				100		A
t_{rr}	*reverse recovery time*				550		ns
E_{rec}	*reverse recovery energy*				6.5		mJ
R_{thJC}	*thermal resistance junction to case*					0.6	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.2		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



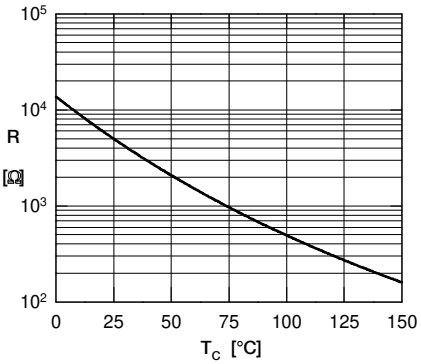
Part description

M = Module
D = Diode
N = High Voltage Standard Rectifier
A = (>= 2000V)
210 = Current Rating [A]
UB = 3~ Rectifier Bridge + Brake Unit
2200 = Reverse Voltage [V]
T = Thermistor \ Temperature sensor
ED = E2-Pack

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MDNA210UB2200TED	MDNA210UB2200TED	Box	6	526034

Temperature Sensor NTC

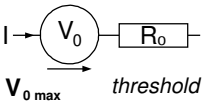
Symbol	Definition	Conditions	min.	typ.	max.	Unit
R_{25}	*resistance*	T_{VJ} = 25°	4.85	5	5.15	kΩ
$B_{25/50}$	*temperature coefficient*			3375		K



Typ. NTC resistance vs. temperature

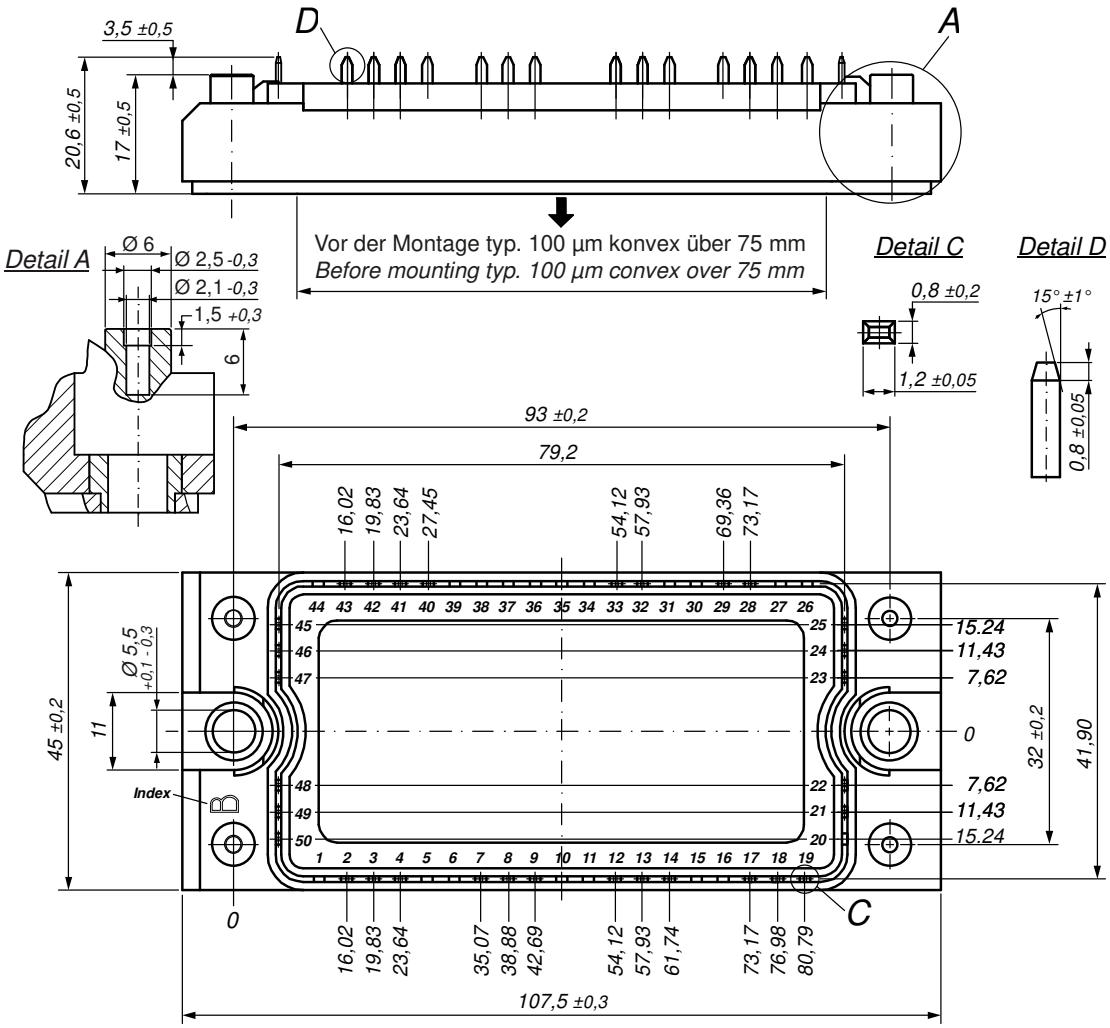
Equivalent Circuits for Simulation

** on die level* T_{VJ} = 150°C



		Rectifier	Brake IGBT +	Brake Diode	
$V_{0\ max}$	*threshold voltage*	0.82	1.1	1.22	V
$R_{0\ max}$	*slope resistance **	3.1	17.9	13	mΩ

Outlines E2-Pack

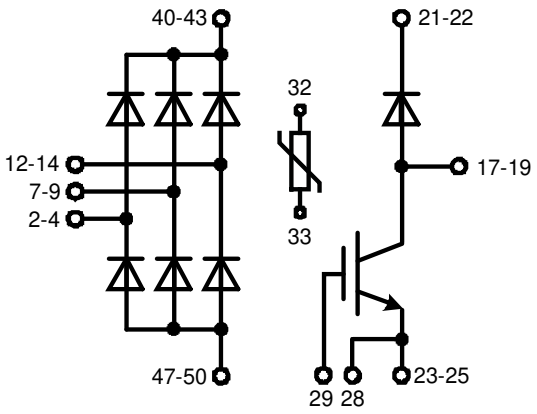


Bemerkung / ***Note:***

- Nichttolerierte 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**
- 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

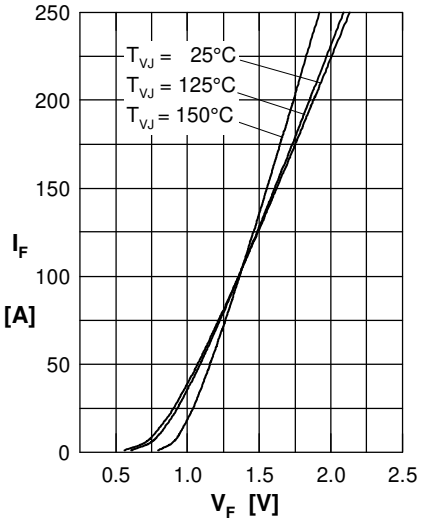


Fig. 1 Forward current versus voltage drop per diode

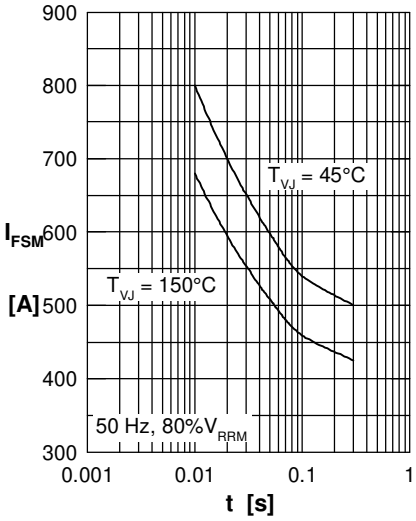


Fig. 2 Surge overload current vs. time per diode

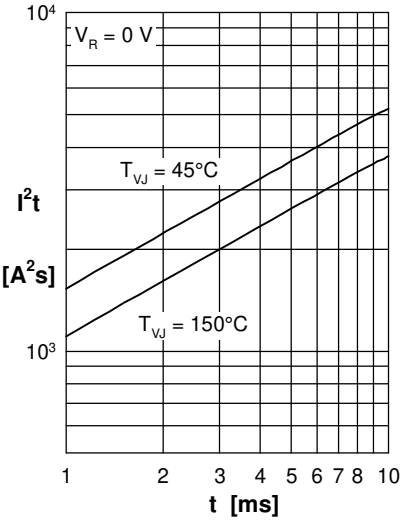


Fig. 3 I^2t versus time per diode

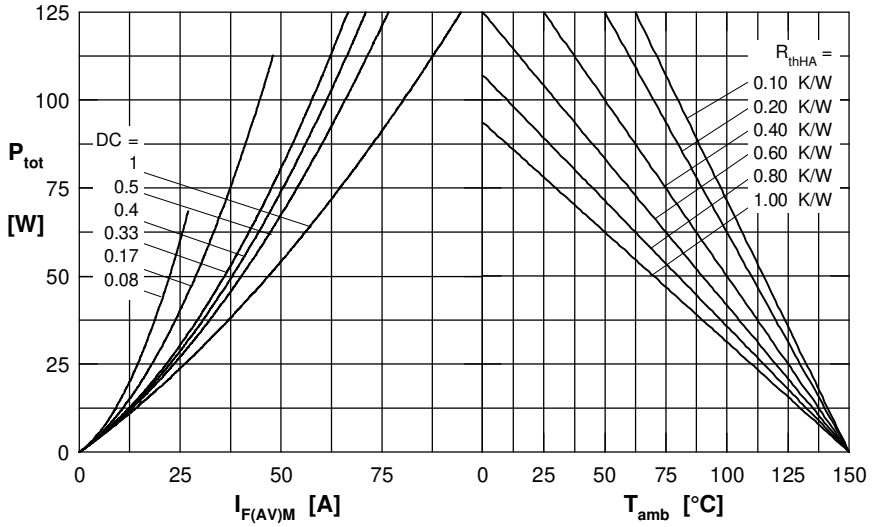


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

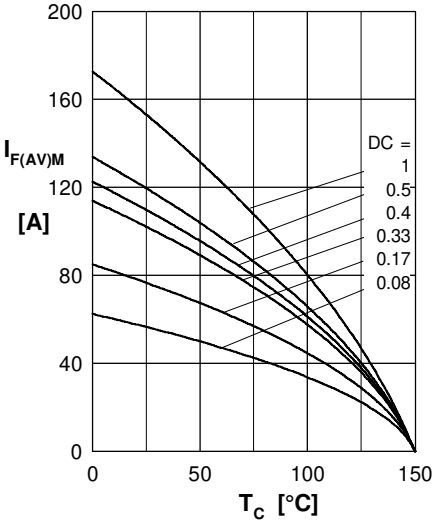


Fig. 5 Max. forward current vs. case temperature per diode

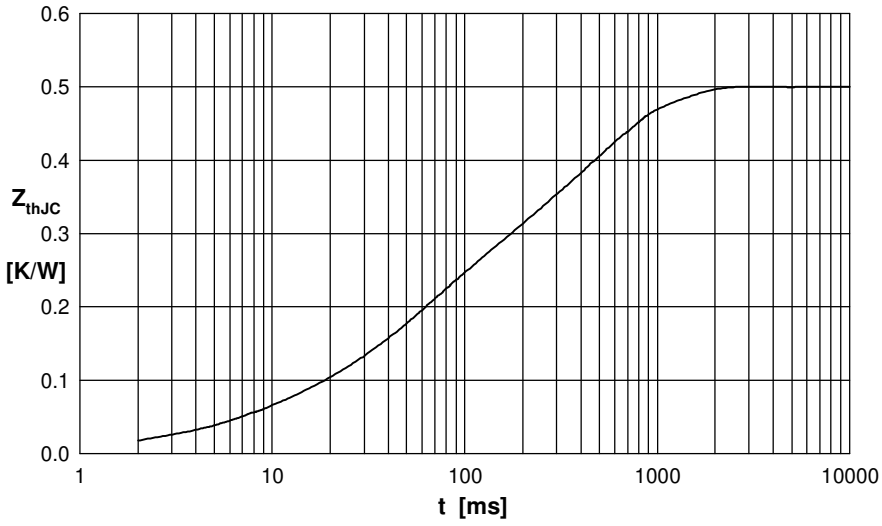


Fig. 6 Transient thermal impedance junction to case vs. time per diode

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.030	0.006
2	0.003	0.007
3	0.182	0.045
4	0.285	0.450

Brake IGBT + Diode

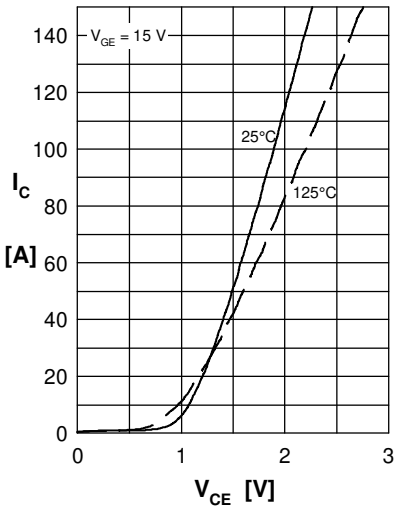


Fig.1 Output characteristics IGBT

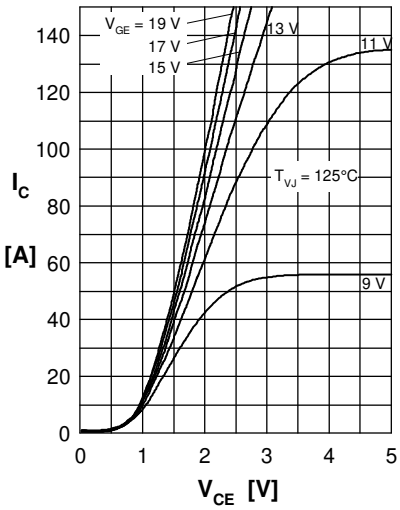


Fig.2 Typ. output characteristics IGBT

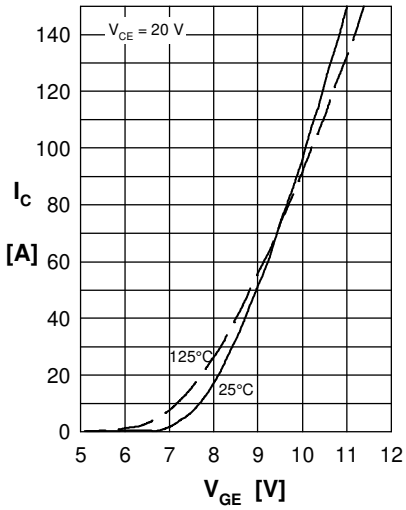


Fig. 3 Typ. transfer charact. IGBT

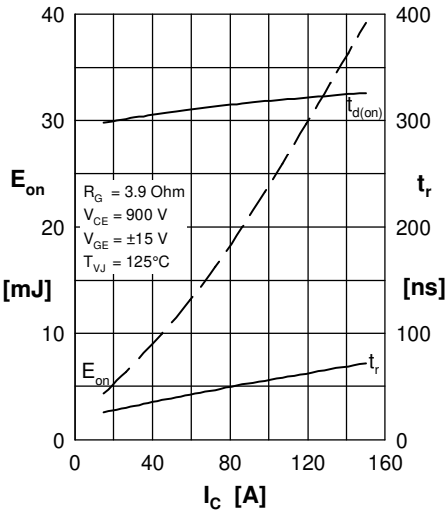


Fig. 4 Typ. turn-on energy & switch. times vs. collector current

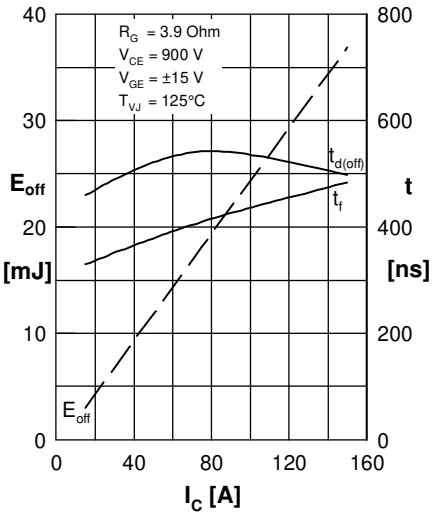


Fig. 5 Typ. turn-off energy & switch. times vs. collector current

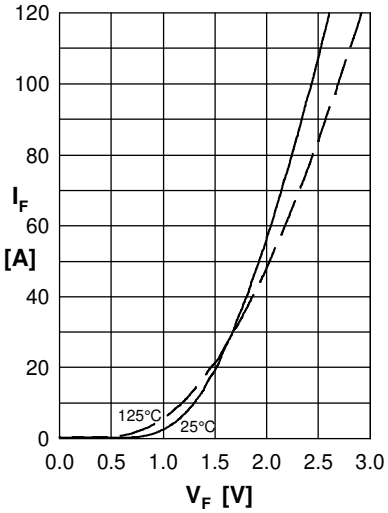


Fig. 6 Typ. forward characteristics Diode

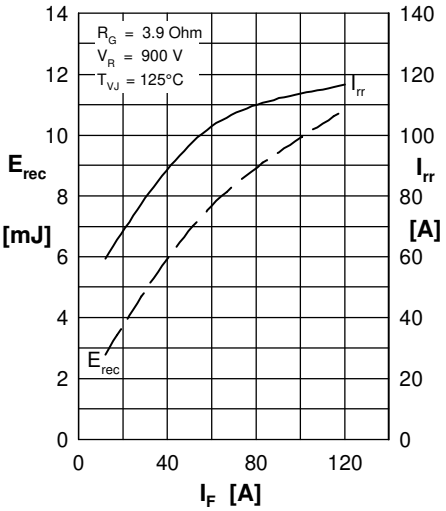


Fig. 7 Typ. reverse recovery characteristics Diode

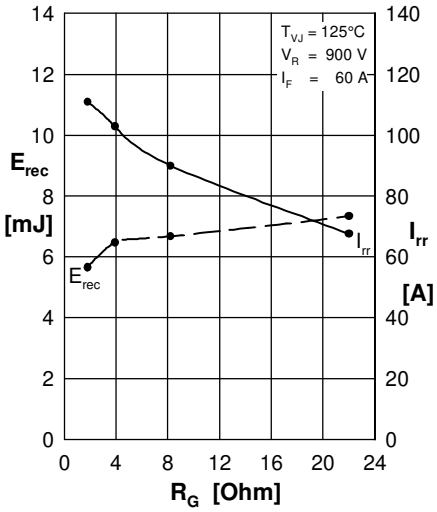


Fig. 8 Typ. reverse recovery characteristics Diode

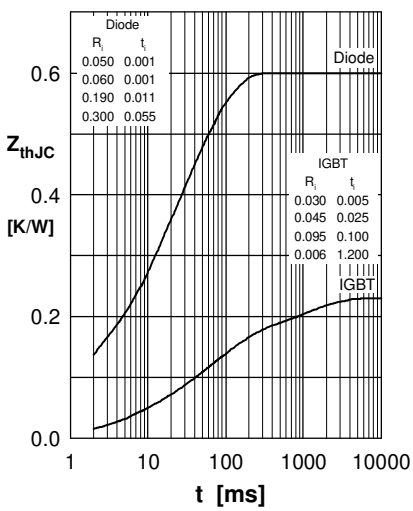


Fig. 9 Transient thermal resistance junction to case