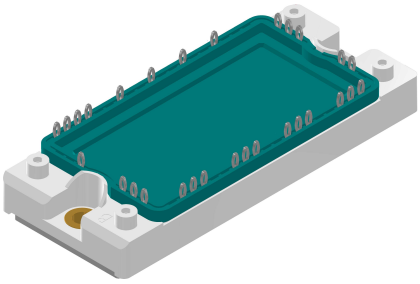
High Voltage Thyristor Module

3~ Rectifier	Brake Chopper
V_{RRM} = 2200 V	V_{CES} = 1700 V
I_{DAV} = 120 A	I_{C25} = 113 A
I_{FSM} = 500 A	$V_{CE(sat)}$ = 2.5 V

3~ Rectifier Bridge, half-controlled (high-side) + Brake Unit

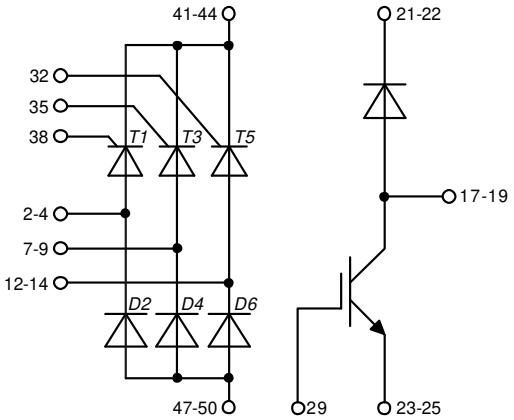
Part number

MCNA120UI2200PED



Backside: isolated

E72873



Features / Advantages:

- Thyristor/Standard Rectifier for line frequency
- Planar passivated chips
- Long-term stability
- Low forward voltage drop
- Copper base plate with Direct Copper Bonded Al2O3-ceramic
- Improved temperature and power cycling

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

Disclaimer Notice

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at www.littelfuse.com/disclaimer-electronics.

© 2019 IXYS all rights reserved

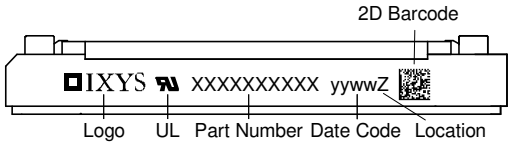
Rectifier				Ratings			
Symbol	**Definition**	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
$V_{RSM/DSM}$	*max. non-repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			2300	V
$V_{RRM/DRM}$	*max. repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			2200	V
$I_{R/D}$	*reverse current, drain current*	$V_{R/D}$ = 2200 V	T_{VJ} = 25°C			50	µA
		$V_{R/D}$ = 2200 V	T_{VJ} = 125°C			10	mA
V_T	*forward voltage drop*	I_T = 40 A	T_{VJ} = 25°C			1.33	V
		I_T = 120 A				2.05	V
		I_T = 40 A	T_{VJ} = 125°C			1.36	V
		I_T = 120 A				2.38	V
I_{DAV}	*bridge output current*	T_C = 80°C	T_{VJ} = 150°C			120	A
		rectangular d = ⅓					
V_{T0}	*threshold voltage* } *for power loss calculation only*		T_{VJ} = 150°C			0.83	V
r_T	*slope resistance*					13.6	mΩ
R_{thJC}	*thermal resistance junction to case*					0.65	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.1		K/W
P_{tot}	*total power dissipation*		T_C = 25°C			190	W
I_{TSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			500	A
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			540	A
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			425	A
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			460	A
I^2t	*value for fusing*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			1.25	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			1.22	kA²s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			905	A²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			880	A²s
C_J	*junction capacitance*	V_R = 700 V f = 1 MHz	T_{VJ} = 25°C		13		pF
P_{GM}	*max. gate power dissipation*	t_P = 30 µs	T_C = 150°C			10	W
		t_P = 300 µs				5	W
P_{GAV}	*average gate power dissipation*					0.5	W
$(di/dt)_{cr}$	*critical rate of rise of current*	T_{VJ} = 150°C; f = 50 Hz repetitive, I_T = 120 A				150	A/µs
		t_P = 200 µs; di_G/dt = 0.45 A/µs;					
		I_G = 0.45 A; V = ⅔ V_{DRM} non-repet., I_T = 40 A				500	A/µs
$(dv/dt)_{cr}$	*critical rate of rise of voltage*	V = ⅔ V_{DRM}	T_{VJ} = 150°C			1000	V/µs
		R_{GK} = ∞; method 1 (linear voltage rise)					
V_{GT}	*gate trigger voltage*	V_D = 6 V	T_{VJ} = 25°C			1.4	V
			T_{VJ} = -40°C			1.6	V
I_{GT}	*gate trigger current*	V_D = 6 V	T_{VJ} = 25°C			70	mA
			T_{VJ} = -40°C			150	mA
V_{GD}	*gate non-trigger voltage*	V_D = ⅔ V_{DRM}	T_{VJ} = 150°C			0.2	V
I_{GD}	*gate non-trigger current*					5	mA
I_L	*latching current*	t_p = 10 µs	T_{VJ} = 25°C			150	mA
		I_G = 0.45 A; di_G/dt = 0.45 A/µs					
I_H	*holding current*	V_D = 6 V R_{GK} = ∞	T_{VJ} = 25°C			100	mA
t_{gd}	*gate controlled delay time*	V_D = ½ V_{DRM}	T_{VJ} = 25°C			2	µs
		I_G = 0.45 A; di_G/dt = 0.45 A/µs					
t_q	*turn-off time*	V_R = 100 V; I_T = 40A; V = ⅔ V_{DRM}	T_{VJ} = 125 °C		500		µs
		di/dt = 10 A/µs dv/dt = 20 V/µs t_p = 200 µs					

© 2019 IXYS all rights reserved

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			113	A
I_{C80}			T_C = 80°C			80	A
P_{tot}	*total power dissipation*		T_C = 25°C			445	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 75 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.5	2.93	V
			T_{VJ} = 125°C		3		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 3 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			0.6	mA
			T_{VJ} = 125°C		5		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				400	nA
$Q_{G(on)}$	*total gate charge*	V_{CE} = 900 V; V_{GE} = 15 V; I_C = 75 A			850		nC
$t_{d(on)}$	*turn-on delay time*	inductive load; V_{CE} = 900 V; I_C = 75 A; V_{GE} = ±15 V; R_G = 18 Ω	T_{VJ} = 125°C		270		ns
t_r	*current rise time*				100		ns
$t_{d(off)}$	*turn-off delay time*				700		ns
t_f	*current fall time*				430		ns
E_{on}	*turn-on energy per pulse*				34		mJ
E_{off}	*turn-off energy per pulse*				17.5		mJ
RBSOA	*reverse bias safe operating area*	V_{GE} = ±15 V; R_G = 18 Ω	T_{VJ} = 125°C				
I_{CM}		V_{CEK} = 1700 V				150	A
SCSOA	*short circuit safe operating area*	V_{CEK} = 1700 V					
t_{SC}	*short circuit duration*	V_{CE} = 720 V; V_{GE} = ±15	T_{VJ} = 125°C			10	µs
I_{SC}	*short circuit current*	R_G = 18 Ω; non-repetitive			280		A
R_{thJC}	*thermal resistance junction to case*					0.28	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.1		K/W
Brake Diode							
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1700	V
I_{F25}	*forward current*		T_C = 25°C			75	A
I_{F80}			T_C = 80°C			50	A
V_F	*forward voltage*	I_F = 60 A	T_{VJ} = 25°C			2.45	V
			T_{VJ} = 125°C		2.20		V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C			0.1	mA
			T_{VJ} = 125°C			1	mA
Q_{rr}	*reverse recovery charge*	V_R = 900 V; $-di_F/dt$ = 600 A/µs; I_F = 60 A; V_{GE} = 0 V	T_{VJ} = 125°C		20		µC
I_{RM}	*max. reverse recovery current*				46		A
t_{rr}	*reverse recovery time*				1300		ns
E_{rec}	*reverse recovery energy*				10.5		mJ
R_{thJC}	*thermal resistance junction to case*					0.65	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.1		K/W

© 2019 IXYS all rights reserved

Package	E2-Pack			Ratings			
Symbol	**Definition**	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
I_{RMS}	*RMS current*	per terminal				40	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



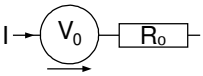
Part description

M = Module
C = Thyristor (SCR)
N = High Voltage Thyristor
A = (>= 2000V)
120 = Current Rating [A]
UI = 3~ Rectifier Bridge, half-controlled (high-side) + Brake Unit
2200 = Reverse Voltage [V]
P = PressFit-Pin
ED = E2-Pack
- = Hyphen
PC = Phase Change Material

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCNA120UI2200PED	MCNA120UI2200PED	Blister	28	521435
Alternative	MCNA120UI2200PED-PC	MCNA120UI2200PED	Blister	28	521428

Equivalent Circuits for Simulation

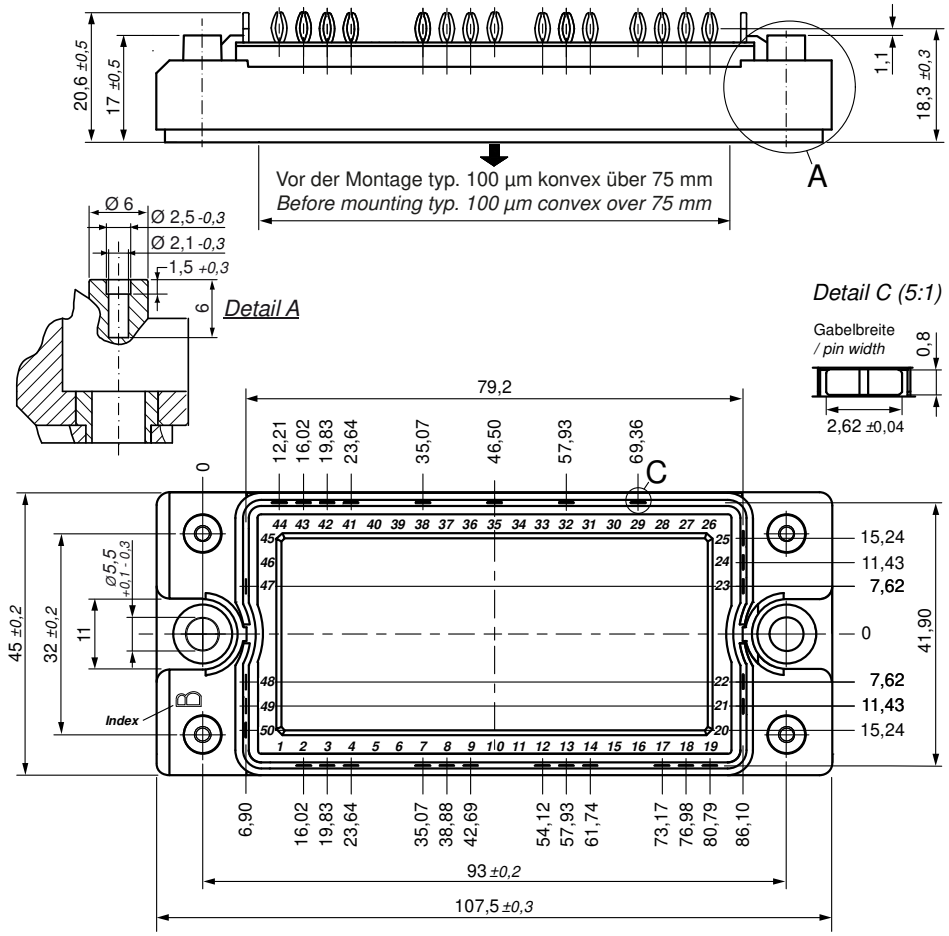
** on die level* T_{VJ} = 150°C



		Thyristor	Brake IGBT +	Brake Diode	
$V_{0\,max}$	*threshold voltage*	0.83	1.17	1.34	V
$R_{0\,max}$	*slope resistance **	10.5	25	15.2	mΩ

© 2019 IXYS all rights reserved

Outlines E2-Pack

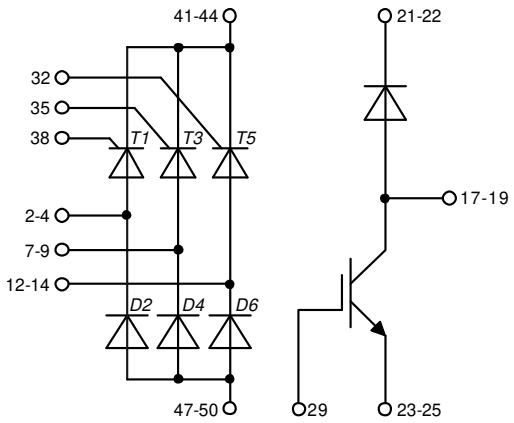


Bemerkung / ***Note:***

- 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**



© 2019 IXYS all rights reserved

Thyristor

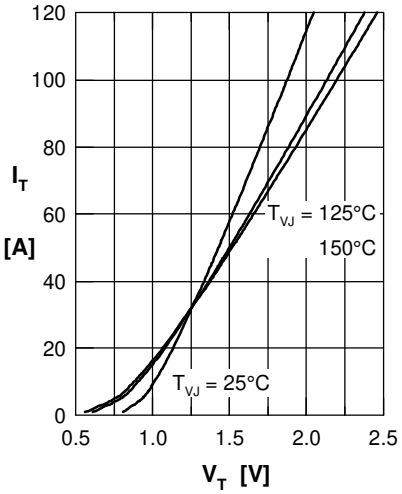


Fig. 1 Forward characteristics

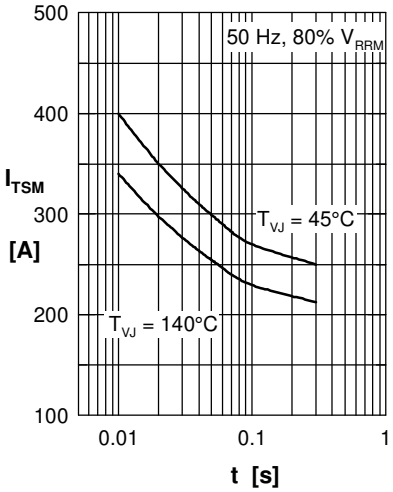


Fig. 2 Surge overload current
I_{TSM}: crest value, t: duration

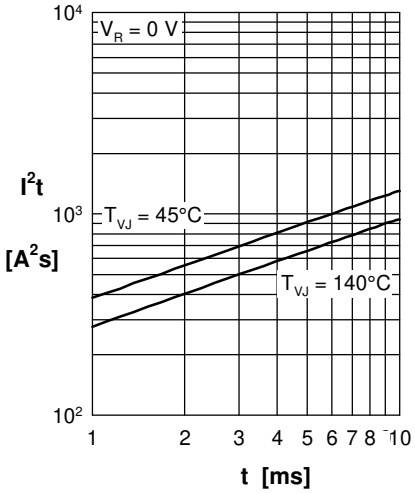


Fig. 3 I^2t versus time (1-10 s)

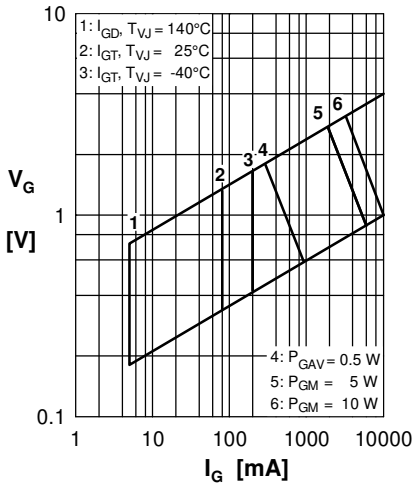


Fig. 4 Gate voltage & gate current

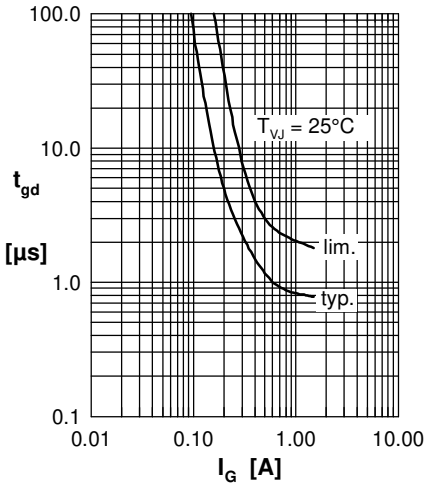


Fig. 5 Gate controlled delay time t_{gd}

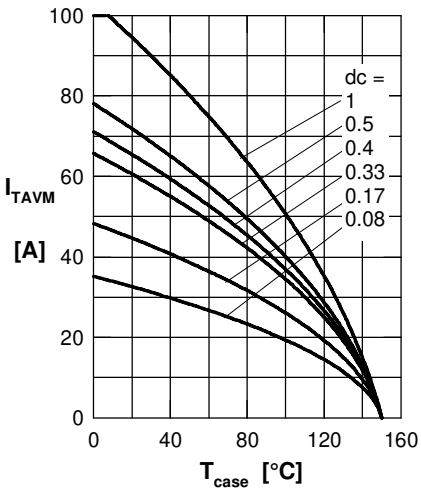


Fig. 6 Max. forward current at case temperature

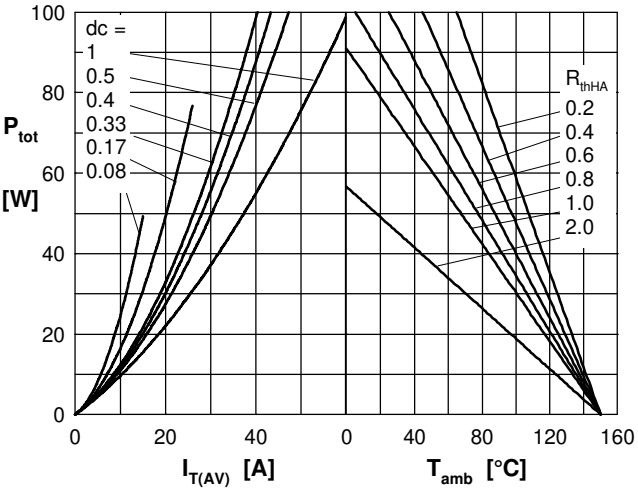
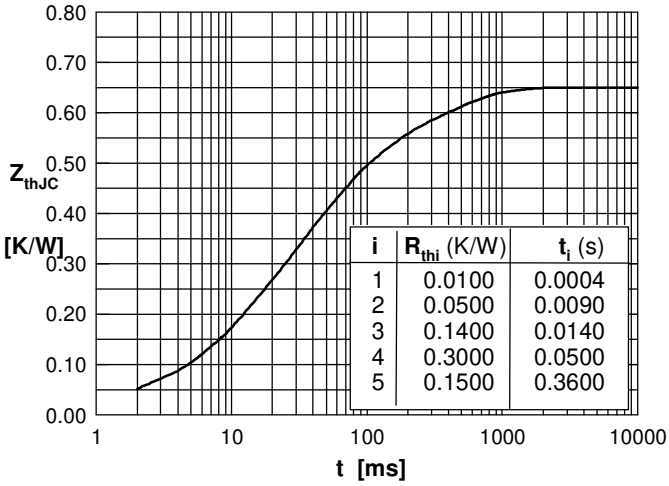


Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature



i	R_{thi} (K/W)	t_i (s)
1	0.0100	0.0004
2	0.0500	0.0090
3	0.1400	0.0140
4	0.3000	0.0500
5	0.1500	0.3600

Fig. 8 Transient thermal impedance junction to case

© 2019 IXYS all rights reserved

Brake IGBT + Diode

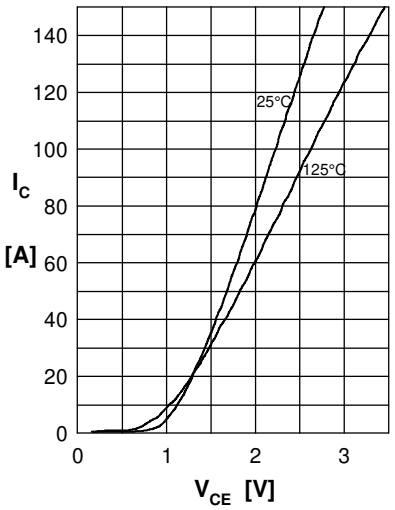


Fig.1 Output characteristics IGBT

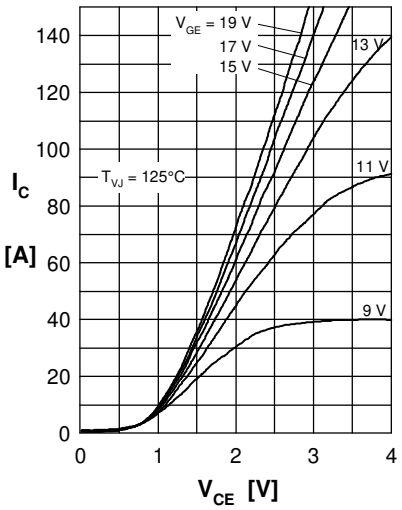


Fig.2 Typ. output characteristics IGBT

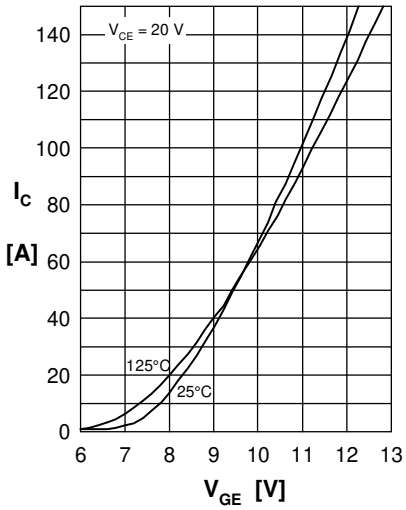


Fig. 3 Typ. transfer charact. IGBT

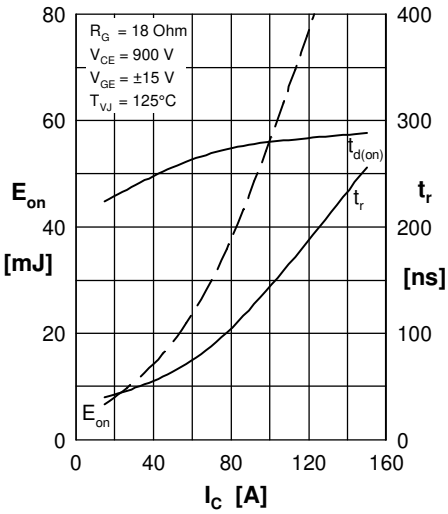


Fig. 4 Typ. turn-on energy & switch. times vs. collector current

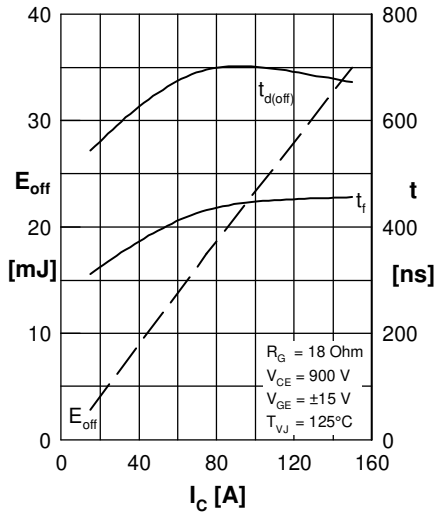


Fig. 5 Typ. turn-off energy & switch. times vs. collector current

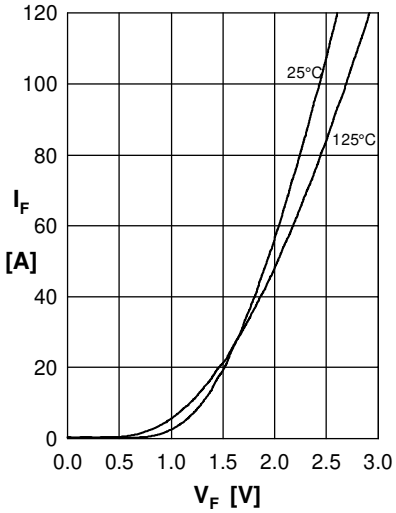


Fig. 6 Typ. forward characteristics Diode

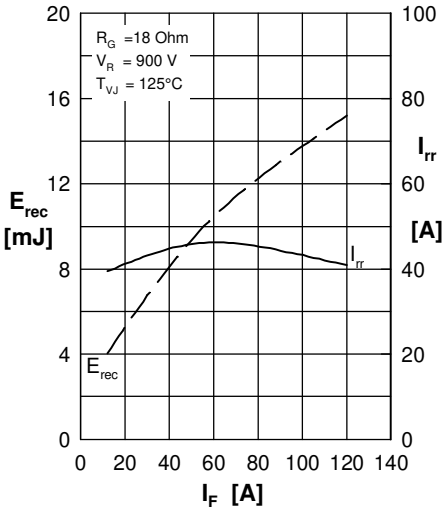


Fig. 7 Typ. reverse recovery characteristics Diode

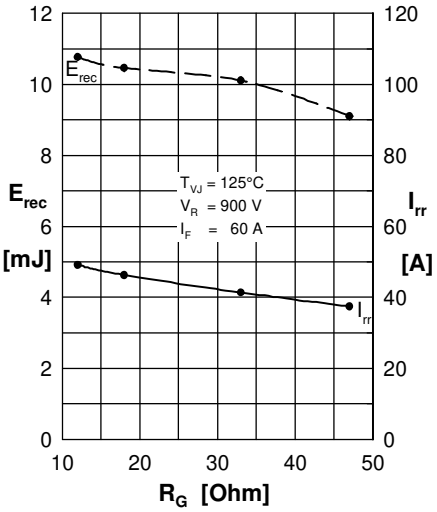


Fig. 8 Typ. reverse recovery characteristics Diode

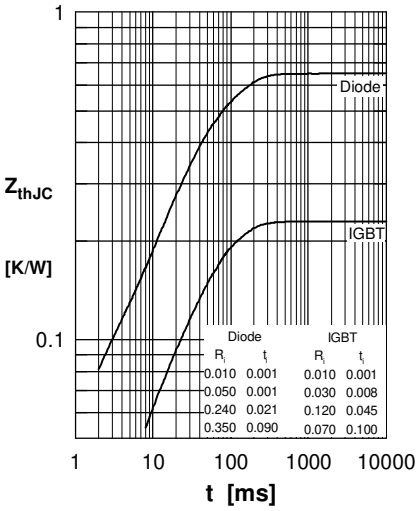


Fig. 9 Transient thermal resistance junction to case

© 2019 IXYS all rights reserved