

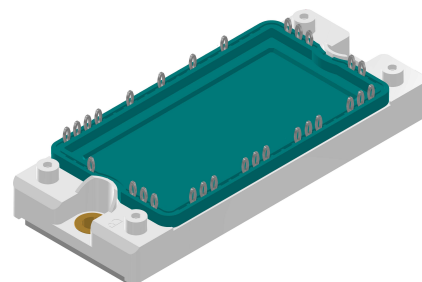
High Voltage Thyristor Module

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

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

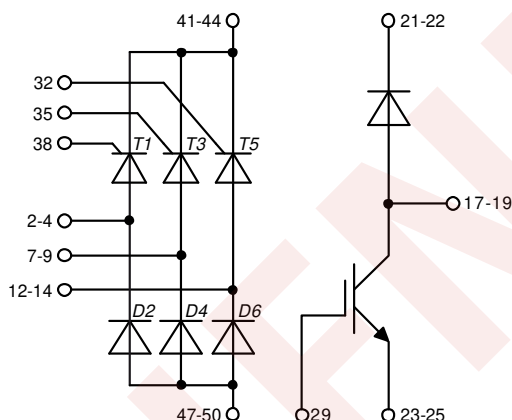
Part number

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

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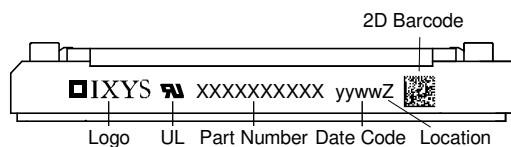


Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
V _{RSM/DSM}	max. non-repetitive reverse/forward blocking voltage	T _{VJ} = 25°C				2300	V
V _{RRM/DRM}	max. repetitive reverse/forward blocking voltage	T _{VJ} = 25°C				2200	V
I _{R/D}	reverse current, drain current	V _{R/D} = 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 rectangular d = 1/3	T _{VJ} = 150°C			120	A
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 ² t	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 = 2/3 V _{DRM} non-repet., I _T = 40 A				500	A/μs
(dv/dt) _{cr}	critical rate of rise of voltage	V = 2/3 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
I _{GT}	gate trigger current	V _D = 6 V T _{VJ} = 25°C				70	mA
						T _{VJ} = -40°C	150
V _{GD}	gate non-trigger voltage	V _D = 2/3 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 = 1/2 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 = 40 A; V = 2/3 V _{DRM} T _{VJ} = 125 °C di/dt = 10 A/μs dv/dt = 20 V/μs t _p = 200 μs			500		μs



Brake IGBT + Diode				Ratings			
Symbol	Definition	Conditions		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	$T_C = 25^{\circ}\text{C}$				113	A
I_{C80}		$T_C = 80^{\circ}\text{C}$				80	A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$				445	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 75\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		2.5	2.93	V
			$T_{VJ} = 125^{\circ}\text{C}$		3		V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 3\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	5.2	5.8	6.4	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			0.6	mA
			$T_{VJ} = 125^{\circ}\text{C}$		5		mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$				400	nA
$Q_{G(on)}$	total gate charge	$V_{CE} = 900\text{ V}; V_{GE} = 15\text{ V}; I_C = 75\text{ A}$			850		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 900\text{ V}; I_C = 75\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$		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	$V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$				
I_{CM}		$V_{CEK} = 1700\text{ V}$				150	A
SCSOA	short circuit safe operating area	$V_{CEK} = 1700\text{ V}$					
t_{SC}	short circuit duration	$V_{CE} = 720\text{ V}; V_{GE} = \pm 15$	$T_{VJ} = 125^{\circ}\text{C}$			10	μs
I_{SC}	short circuit current	$R_G = 18\ \Omega$; 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		$T_{VJ} = 25^{\circ}\text{C}$			1700	V
I_{F25}	forward current		$T_C = 25^{\circ}\text{C}$			75	A
I_{F80}			$T_C = 80^{\circ}\text{C}$			50	A
V_F	forward voltage	$I_F = 60\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			2.45	V
			$T_{VJ} = 125^{\circ}\text{C}$		2.20		V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$			0.1	mA
			$T_{VJ} = 125^{\circ}\text{C}$			1	mA
Q_{rr}	reverse recovery charge	$V_R = 900\text{ V}$ $-di_F/dt = 600\text{ A}/\mu\text{s}$ $I_F = 60\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		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

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; $I_{ISOL} \leq 1$ mA	3600			V
		t = 1 minute		3000			V



Part description

M = Module
 C = Thyristor (SCR)
 N = High Voltage Thyristor
 A = ($\geq 2000V$)
 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

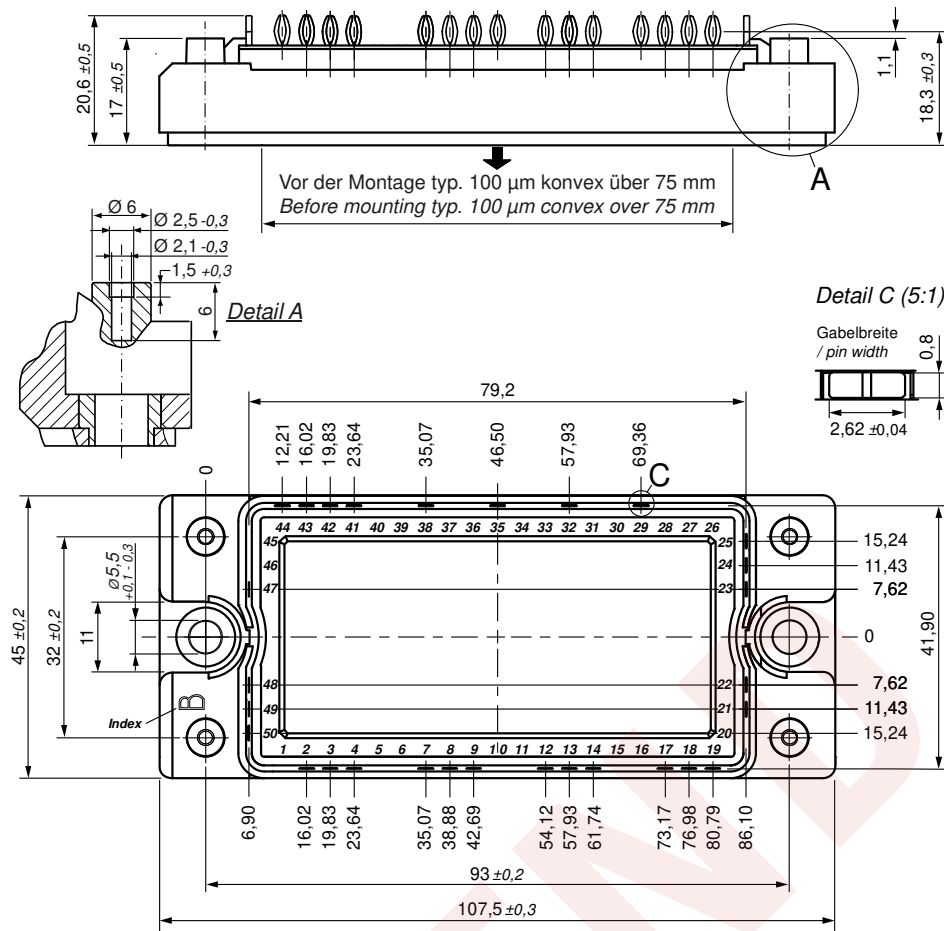
* on die level

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

		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



Outlines E2-Pack

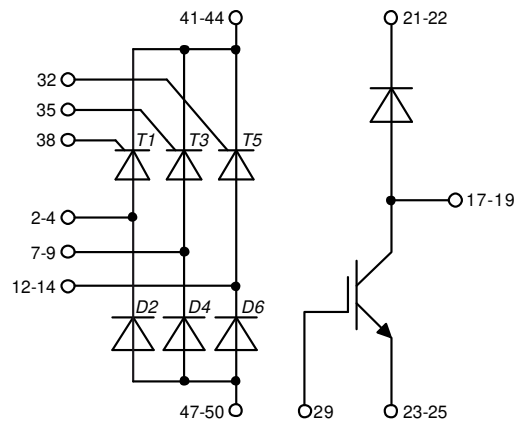


Bemerkung / Note:

- 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 PCB¹

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



Thyristor

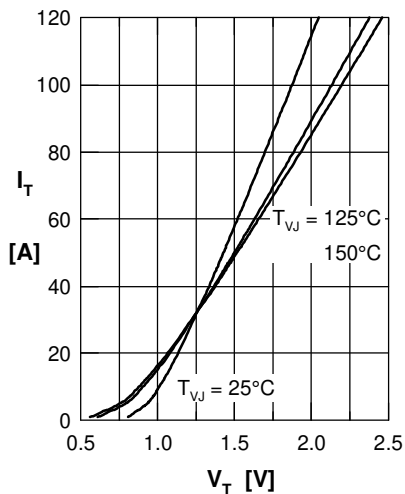


Fig. 1 Forward characteristics

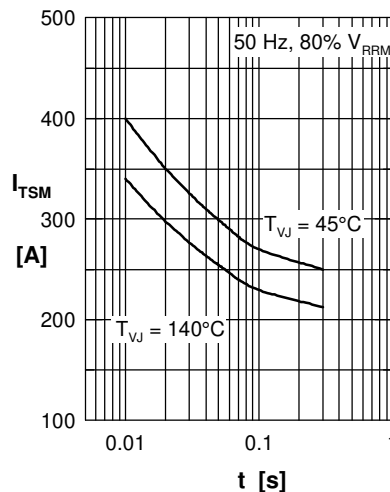


Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

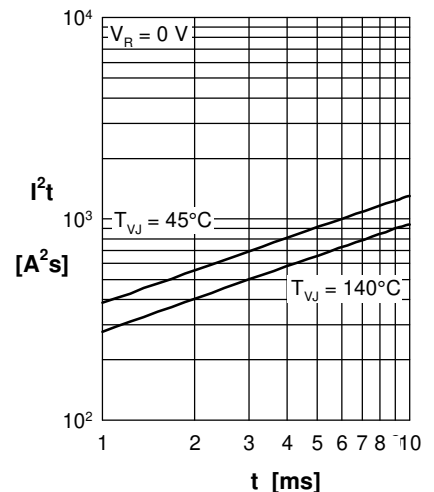


Fig. 3 I^2t versus time (1-10 s)

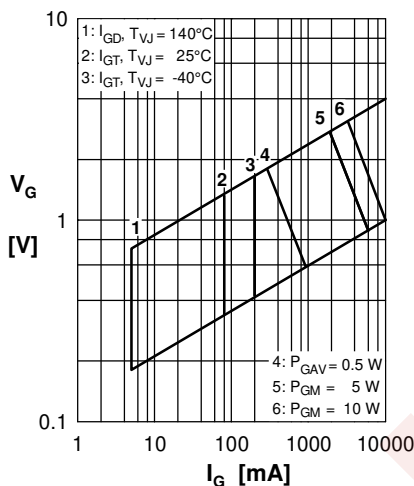


Fig. 4 Gate voltage & gate current

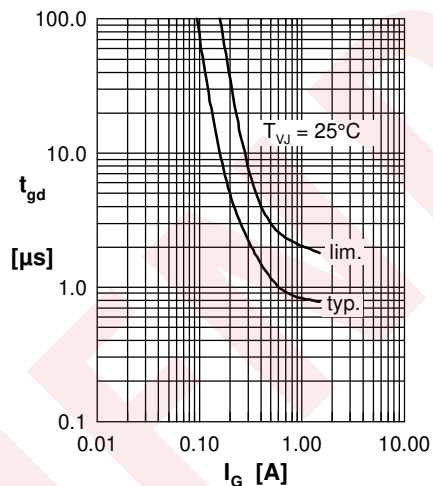


Fig. 5 Gate controlled delay time t_{gd}

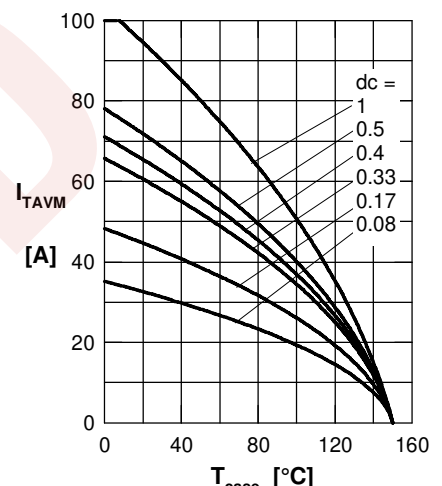


Fig. 6 Max. forward current at case temperature

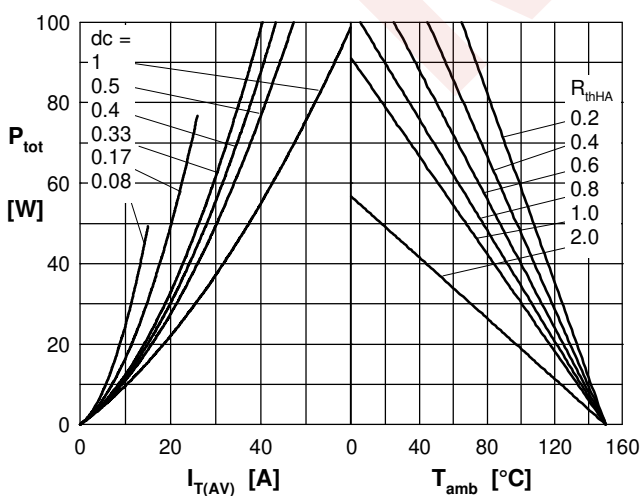


Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature

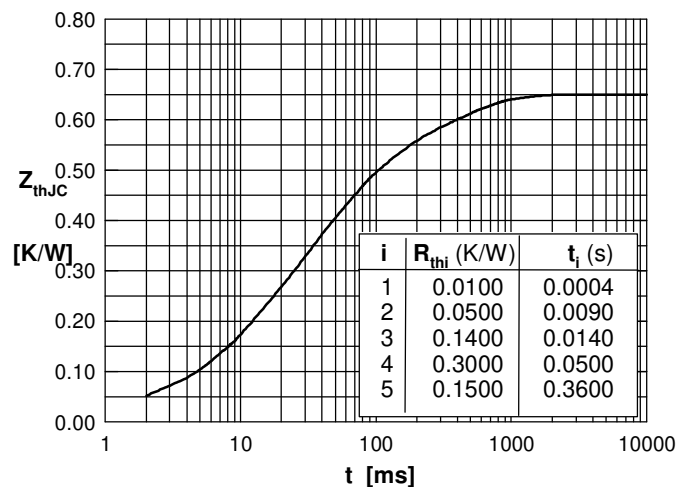


Fig. 8 Transient thermal impedance junction to case

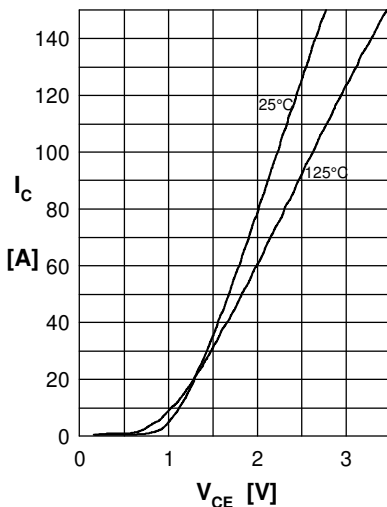
Brake IGBT + Diode


Fig.1 Output characteristics IGBT

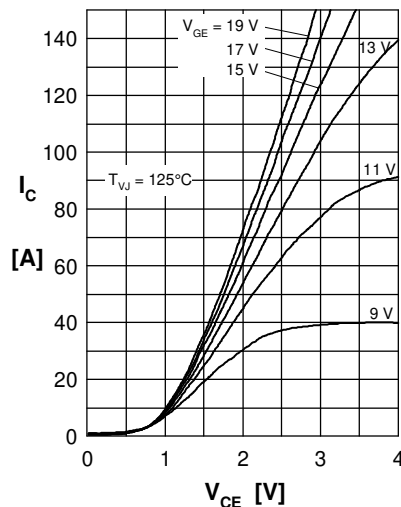


Fig.2 Typ. output characteristics IGBT

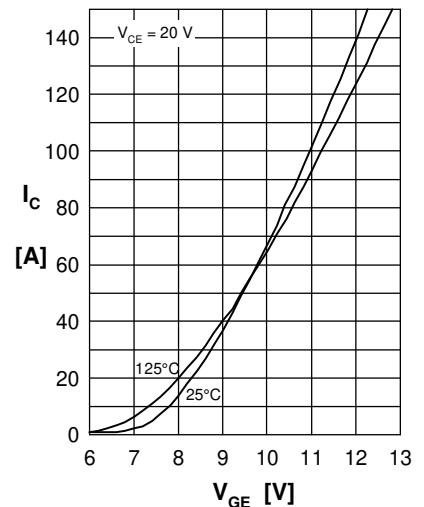


Fig.3 Typ. transfer charact. IGBT

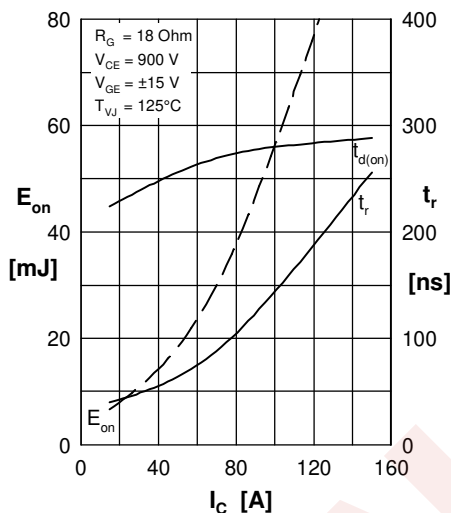


Fig.4 Typ. turn-on energy & switch. times vs. collector current

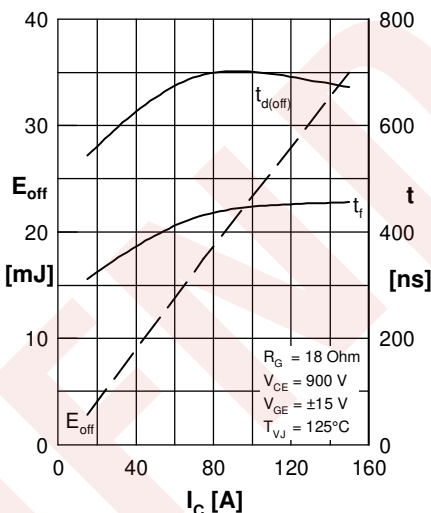


Fig.5 Typ. turn-off energy & switch. times vs. collector current

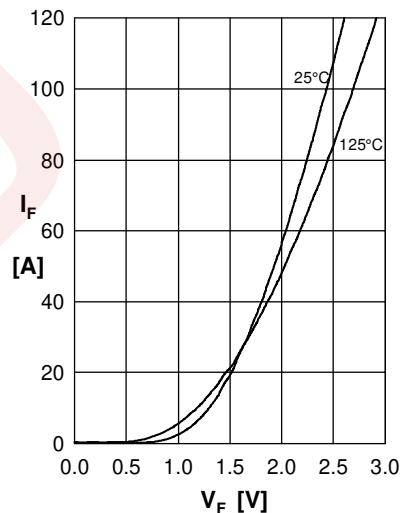


Fig.6 Typ. forward characteristics Diode

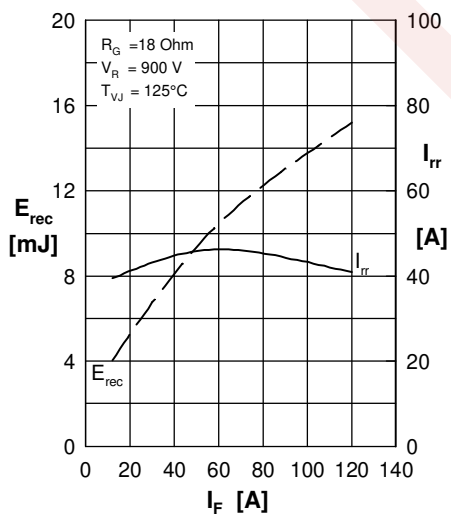


Fig.7 Typ. reverse recovery characteristics Diode

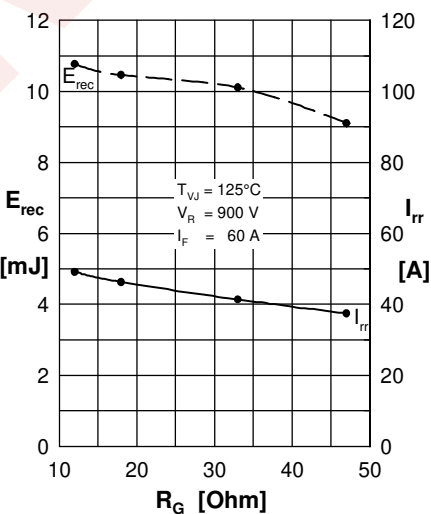


Fig.8 Typ. reverse recovery characteristics Diode

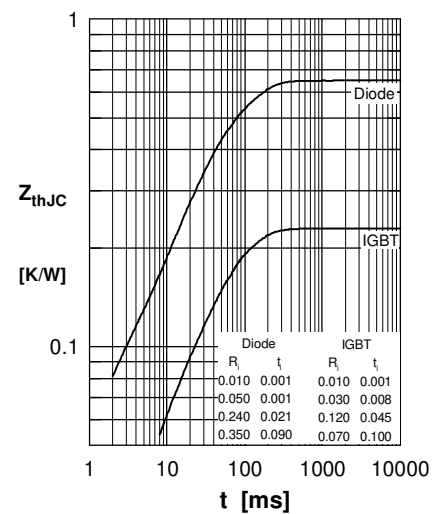


Fig.9 Transient thermal resistance junction to case