

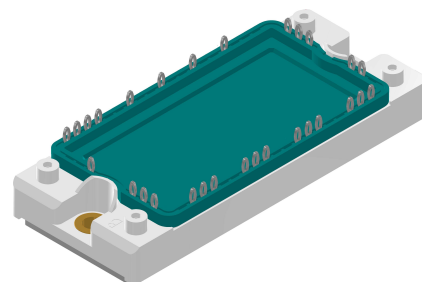
Thyristor Module

3~ Rectifier	Brake Chopper
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{DAV} = 240 \text{ A}$	$I_{C25} = 180 \text{ A}$
$I_{FSM} = 1500 \text{ A}$	$V_{CE(sat)} = 1.7 \text{ V}$

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

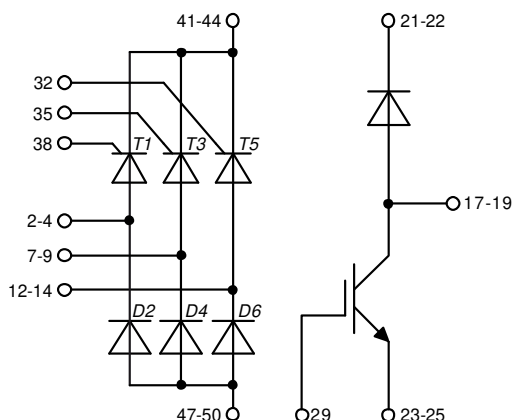
Part number

MCMA240UI1600PED



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
- X2PT - 2nd generation Xtreme light Punch Through
- Rugged X2PT design results in:
 - short circuit rated for 10 μsec .
 - very low gate charge
 - low EMI
 - square RBSOA @ 2x I_C
- Thin wafer technology combined with X2PT design results in a competitive low $V_{CE(sat)}$ and low thermal resistance

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.

Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1600	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 150^{\circ}\text{C}$			20	mA
V_T	forward voltage drop	$I_T = 80\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.27	V
		$I_T = 240\text{ A}$				1.89	V
		$I_T = 80\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.26	V
		$I_T = 240\text{ A}$				2.05	V
I_{DAV}	bridge output current	$T_C = 80^{\circ}\text{C}$ rectangular $d = 120^{\circ}$	$T_{VJ} = 150^{\circ}\text{C}$			240	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}\text{C}$			0.83	V
r_T	slope resistance					5.3	m Ω
R_{thJC}	thermal resistance junction to case					0.4	K/W
R_{thCH}	thermal resistance case to heatsink				0.1		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$			312	W
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			1.50	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1.62	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			1.28	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1.38	kA
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			11.3	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			10.9	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			8.13	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			7.87	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		74		pF
P_{GM}	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$	$T_C = 150^{\circ}\text{C}$			10	W
		$t_p = 300\text{ }\mu\text{s}$				5	W
P_{GAV}	average gate power dissipation					0.5	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 150^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 240\text{ A}$				150	A/ μs
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ $I_G = 0.45\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 80\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}\text{C}$			1000	V/ μs
		$R_{GK} = \infty$; method 1 (linear voltage rise)					
V_{GT}	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			1.5	V
			$T_{VJ} = -40^{\circ}\text{C}$			1.6	V
I_{GT}	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			95	mA
			$T_{VJ} = -40^{\circ}\text{C}$			200	mA
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}\text{C}$			0.2	V
I_{GD}	gate non-trigger current					10	mA
I_L	latching current	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			450	mA
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
I_H	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$			200	mA
t_{gd}	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$			2	μs
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 80\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$			150		μs

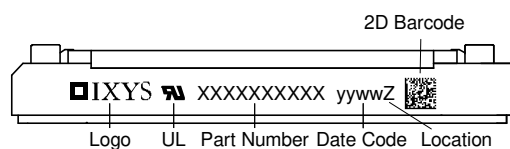
Brake IGBT + Diode

Symbol	Definition	Conditions	Ratings			
			min.	typ.	max.	Unit
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V
V_{GES}	max. DC gate voltage				± 20	V
V_{GEM}	max. transient gate emitter voltage				± 30	V
I_{C25}	collector current	$T_C = 25^{\circ}\text{C}$			180	A
I_{C80}		$T_C = 80^{\circ}\text{C}$			140	A
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			500	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 100 \text{ A}; V_{GE} = 15 \text{ V}$		1.7	2.1	V
				1.9		V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 4 \text{ mA}; V_{GE} = V_{CE}$	6	6.8	7.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0 \text{ V}$			0.1	mA
				0.1		mA
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20 \text{ V}$			500	nA
$Q_{G(on)}$	total gate charge	$V_{CE} = 600 \text{ V}; V_{GE} = 15 \text{ V}; I_C = 100 \text{ A}$		340		nC
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600 \text{ V}; I_C = 100 \text{ A}$ $V_{GE} = \pm 15 \text{ V}; R_G = 6.8 \Omega$		230		ns
t_r	current rise time			70		ns
$t_{d(off)}$	turn-off delay time			380		ns
t_f	current fall time			230		ns
E_{on}	turn-on energy per pulse			12.5		mJ
E_{off}	turn-off energy per pulse			11.5		mJ
RBSOA	reverse bias safe operating area	$V_{GE} = \pm 15 \text{ V}; R_G = 6.8 \Omega$				
I_{CM}		$V_{CEK} = 1200 \text{ V}$			300	A
SCSOA	short circuit safe operating area	$V_{CEK} = 1200 \text{ V}$				
t_{SC}	short circuit duration	$V_{CE} = 720 \text{ V}; V_{GE} = \pm 15$			10	μs
I_{SC}	short circuit current	$R_G = 6.8 \Omega$; non-repetitive		450		A
R_{thJC}	thermal resistance junction to case				0.25	K/W
R_{thCH}	thermal resistance case to heatsink			0.10		K/W

Brake Diode

V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V
I_{F25}	forward current	$T_C = 25^{\circ}\text{C}$			88	A
I_{F80}		$T_C = 80^{\circ}\text{C}$			59	A
V_F	forward voltage	$I_F = 60 \text{ A}$			2.20	V
				1.95		V
I_R	reverse current	$V_R = V_{RRM}$			0.1	mA
					1.2	mA
Q_{rr}	reverse recovery charge	$V_R = 600 \text{ V}$ $-di_F/dt = 900 \text{ A}/\mu\text{s}$ $I_F = 60 \text{ A}; V_{GE} = 0 \text{ V}$		9.6		μC
I_{RM}	max. reverse recovery current			47		A
t_{rr}	reverse recovery time			450		ns
E_{rec}	reverse recovery energy			3		mJ
R_{thJC}	thermal resistance junction to case				0.6	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				50	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)
 M = Thyristor
 A = (up to 1800V)
 240 = Current Rating [A]
 UI = 3~ Rectifier Bridge, half-controlled (high-side) + Brake Unit
 1600 = 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	MCMA240UI1600PED	MCMA240UI1600PED	Blister	28	516002
Alternative	MCMA240UI1600PED-PC	MCMA240UI1600PED	Blister	28	518136

Equivalent Circuits for Simulation

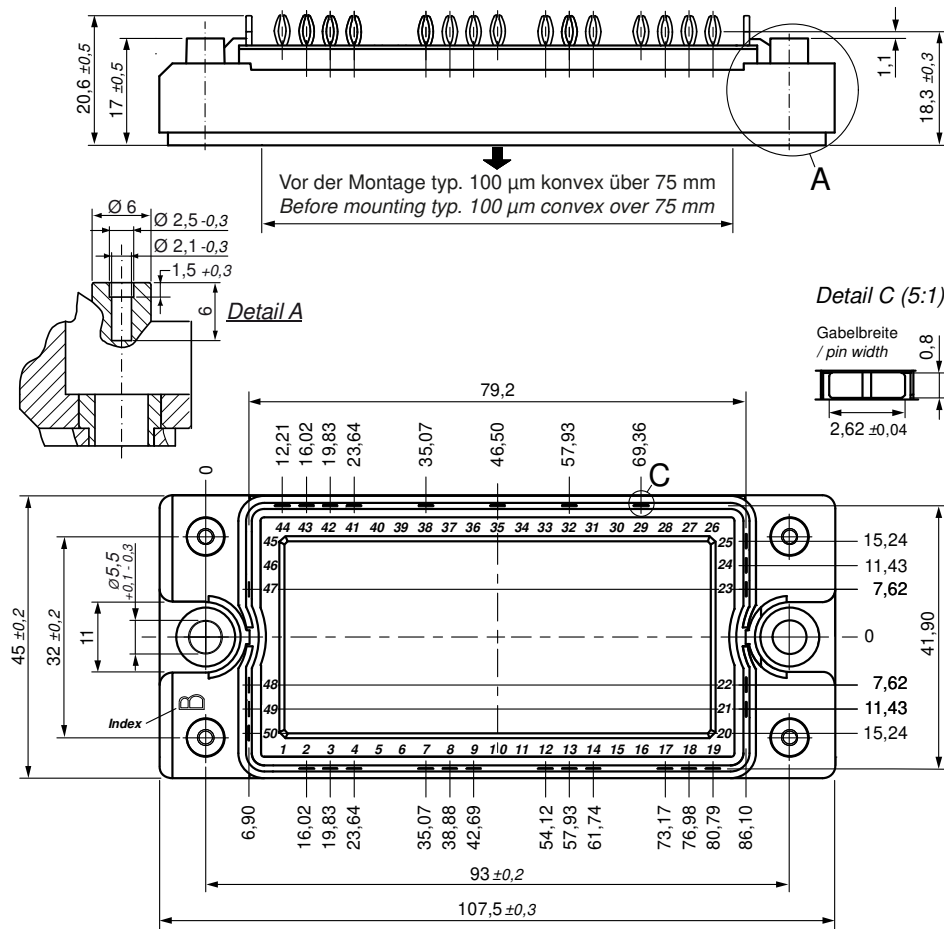
* on die level

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

		Thyristor	Brake IGBT +	Brake Diode	
$V_{0\max}$	threshold voltage	0.83	1.2	1.25	V
$R_{0\max}$	slope resistance *	2.7	11.6	8.5	mΩ



Outlines E2-Pack

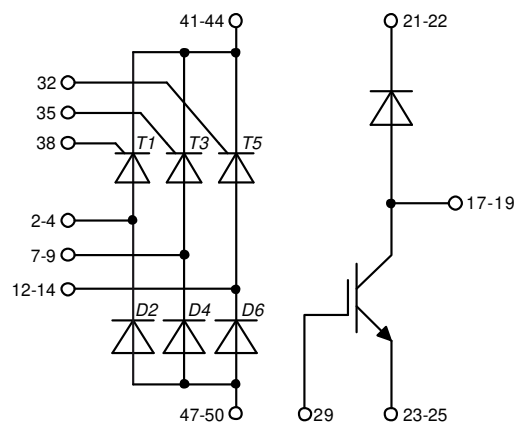


Bemerkung / Note:

- 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: $\pm 0,1$
- 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

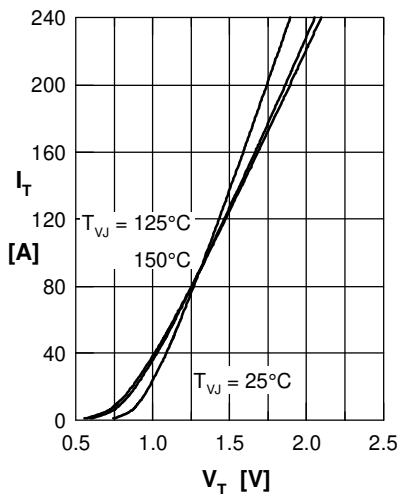


Fig. 1 Forward characteristics

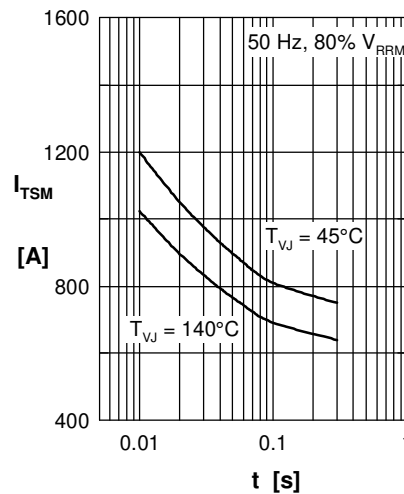


Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

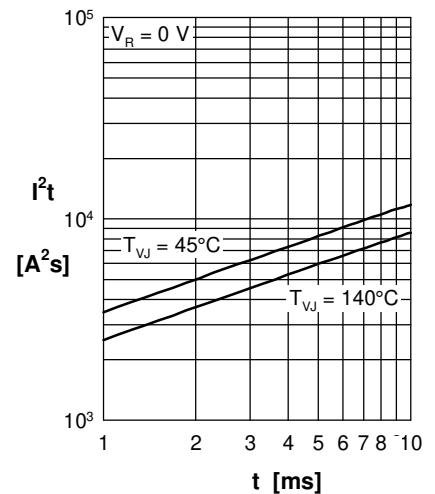


Fig. 3 I^2t versus time (1-10 s)

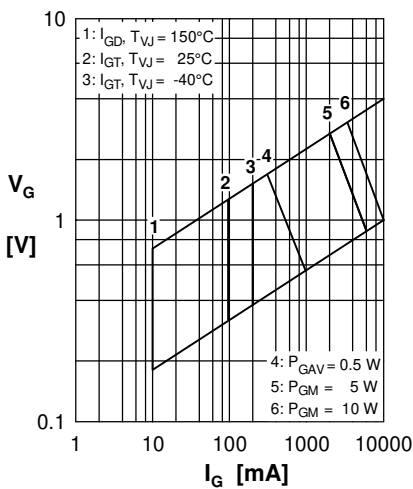


Fig. 4 Gate voltage & gate current

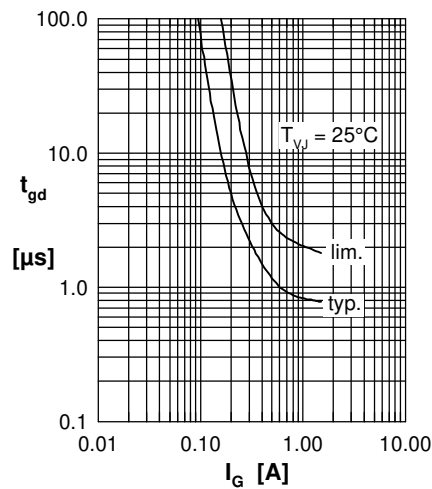


Fig. 5 Gate controlled delay time t_{gd}

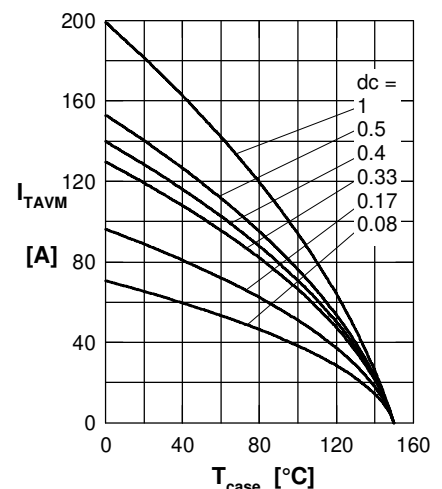


Fig. 6 Max. forward current at case temperature

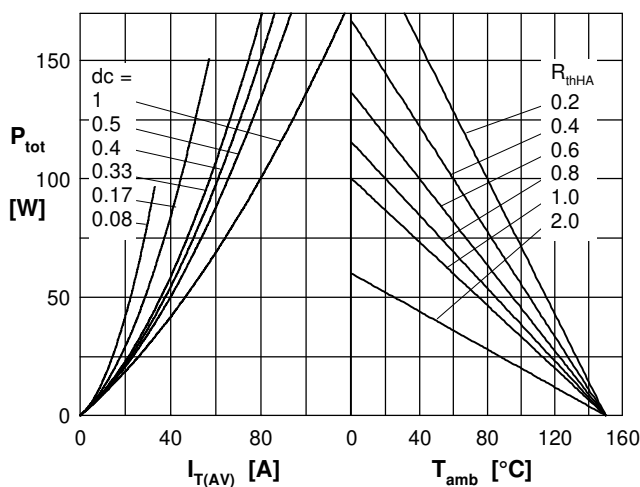


Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature

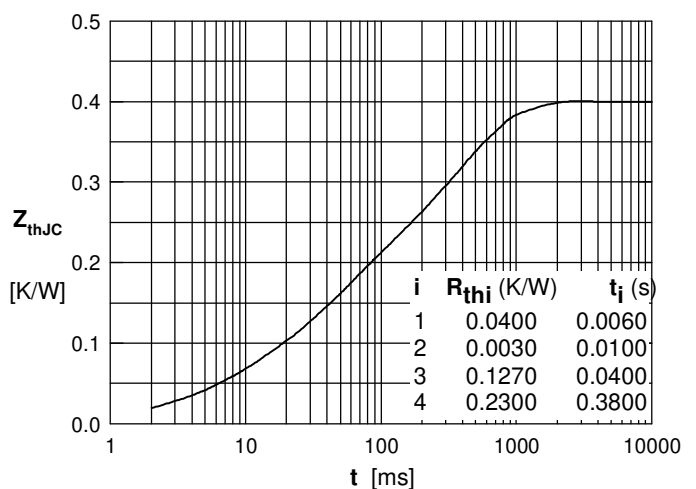


Fig. 8 Transient thermal impedance junction to case

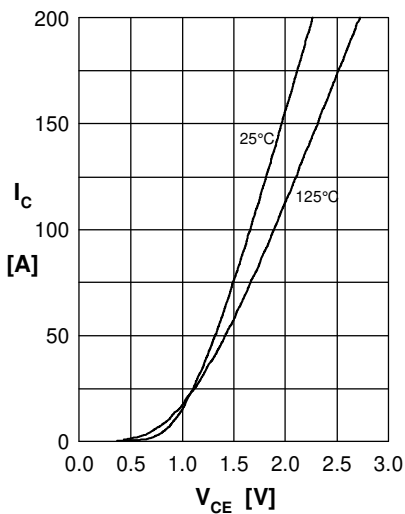
Brake IGBT + Diode


Fig.1 Output characteristics IGBT

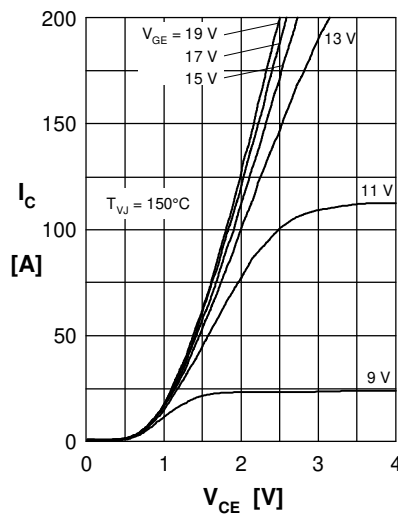


Fig.2 Typ. output characteristics IGBT

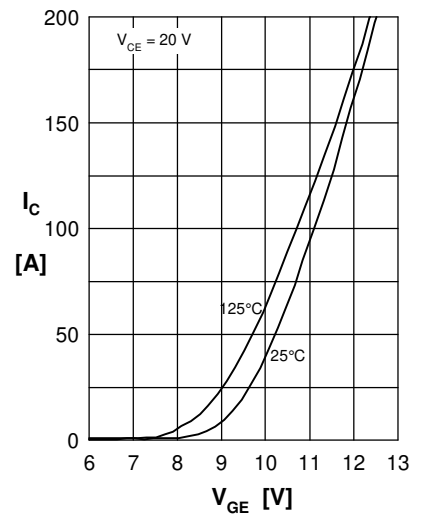


Fig.3 Typ. transfer charact. IGBT

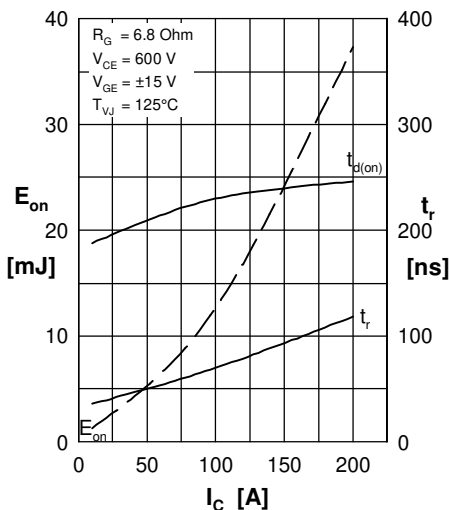


Fig.4 Typ. turn-on energy & switch. times vs. collector current

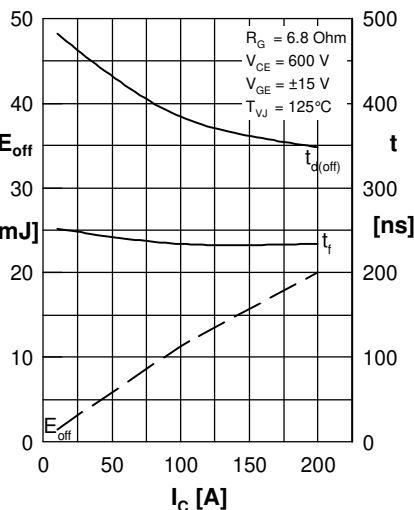


Fig.5 Typ. turn-off energy & switch. times vs. collector current

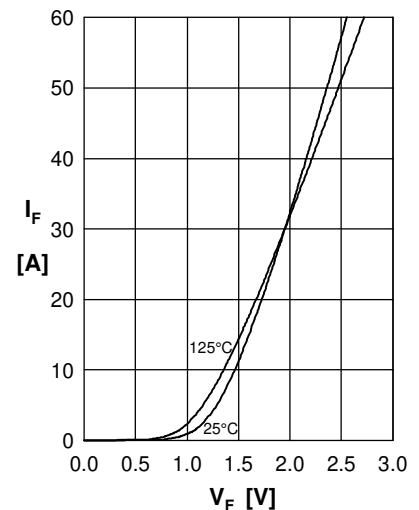
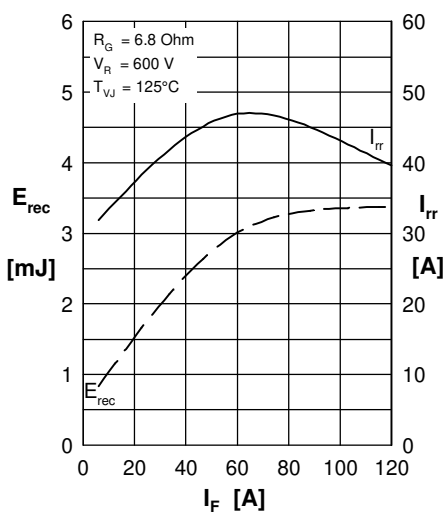

 Fig.6 Typ. forward current versus V_F


Fig.7 Typ. reverse recovery characteristics Diode

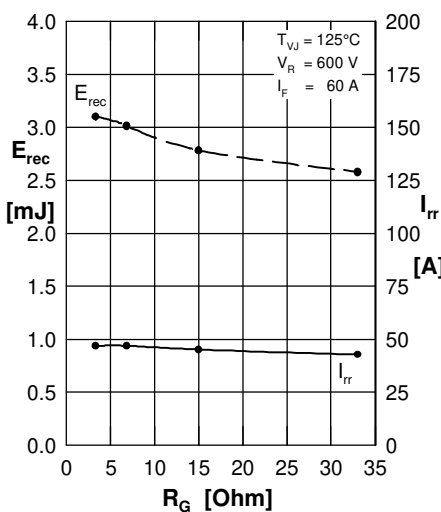


Fig.8 Typ. reverse recovery characteristics Diode

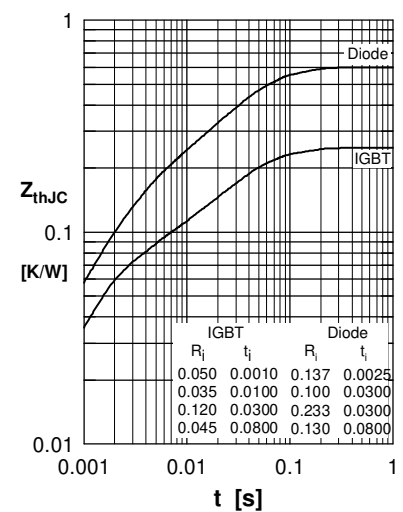


Fig.9 Transient thermal resistance junction to case