

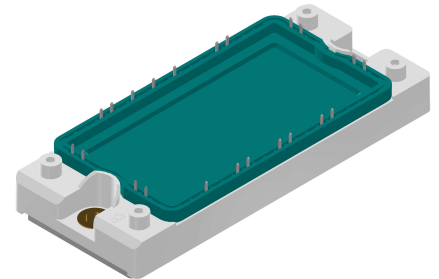
Thyristor Module

3~ Rectifier	Brake Chopper
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{DAV} = 150 \text{ A}$	$I_{C25} = 120 \text{ A}$
$I_{FSM} = 700 \text{ A}$	$V_{CE(sat)} = 1.8 \text{ V}$

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

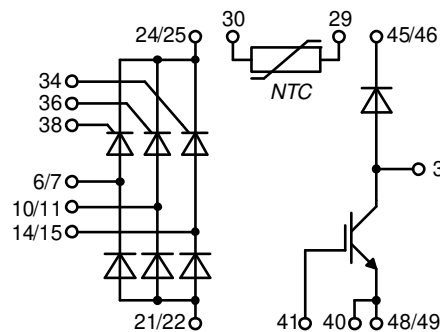
Part number

VVZB135-16ioXT



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
- NTC

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: DCB ceramic
- Reduced weight
- Advanced power cycling

Disclaimer Notice

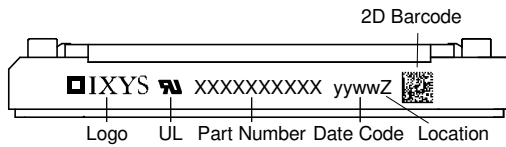
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Rectifier				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1700	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1600	V	
I_{RD}	reverse current, drain current	$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}C$		100	μA	
		$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 150^{\circ}C$		20	mA	
V_T	forward voltage drop	$I_T = 50\text{ A}$	$T_{VJ} = 25^{\circ}C$		1.32	V	
		$I_T = 150\text{ A}$			1.92	V	
		$I_T = 50\text{ A}$	$T_{VJ} = 125^{\circ}C$		1.26	V	
		$I_T = 150\text{ A}$			1.96	V	
I_{DAV}	bridge output current	$T_C = 85^{\circ}C$ rectangular $d = 1/3$	$T_{VJ} = 150^{\circ}C$		150	A	
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0.88	V	
r_T	slope resistance				7.3	m Ω	
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		$T_C = 25^{\circ}C$		190	W	
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		700	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		755	A	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		595	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		645	A	
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		2.45	kA ² s	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		2.37	kA ² s	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		1.77	kA ² s	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		1.73	kA ² s	
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}C$		32	pF	
P_{GM}	max. gate power dissipation	$t_p = 30\text{ }\mu s$	$T_C = 150^{\circ}C$		10	W	
		$t_p = 300\text{ }\mu s$			5	W	
P_{GAV}	average gate power dissipation				0.5	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 150^{\circ}C; f = 50\text{ Hz}$ repetitive, $I_T = 150\text{ A}$			150	A/ μs	
		$t_p = 200\text{ }\mu s; di_G/dt = 0.45\text{ A}/\mu s;$ $I_G = 0.45\text{ A}; V = 2/3 V_{DRM}$ non-repet., $I_T = 50\text{ A}$			500	A/ μs	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = 2/3 V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise)	$T_{VJ} = 150^{\circ}C$		1000	V/ μs	
V_{GT}	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}C$		1.4	V	
			$T_{VJ} = -40^{\circ}C$		1.6	V	
I_{GT}	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}C$		80	mA	
			$T_{VJ} = -40^{\circ}C$		200	mA	
V_{GD}	gate non-trigger voltage	$V_D = 2/3 V_{DRM}$	$T_{VJ} = 150^{\circ}C$		0.2	V	
I_{GD}	gate non-trigger current				5	mA	
I_L	latching current	$t_p = 10\text{ }\mu s$	$T_{VJ} = 25^{\circ}C$		450	mA	
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu s$					
I_H	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		100	mA	
t_{gd}	gate controlled delay time	$V_D = 1/2 V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	μs	
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu s$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 50\text{ A}; V = 2/3 V_{DRM}$ $di/dt = 10\text{ A}/\mu s$ $dv/dt = 20\text{ V}/\mu s$ $t_p = 200\text{ }\mu s$	$T_{VJ} = 125^{\circ}C$		150	μs	

Brake IGBT				Ratings			
Symbol	Definition	Conditions	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	$T_C = 25^{\circ}\text{C}$			120	A	
I_{C80}		$T_C = 80^{\circ}\text{C}$			84	A	
P_{tot}	total power dissipation	$T_C = 25^{\circ}\text{C}$			390	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 75\text{ A}; V_{GE} = 15\text{ V}$			1.8	V	
					2.1	V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 3\text{ mA}; V_{GE} = V_{CE}$	5.5	6.0	6.5	V	
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$			0.2	mA	
					0.6	mA	
I_{GES}	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			500	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 600\text{ V}; V_{GE} = 15\text{ V}; I_C = 75\text{ A}$		230		nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600\text{ V}; I_C = 75\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 10\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$		70	ns	
t_r	current rise time				40	ns	
$t_{d(off)}$	turn-off delay time				250	ns	
t_f	current fall time				100	ns	
E_{on}	turn-on energy per pulse				6.8	mJ	
E_{off}	turn-off energy per pulse				8.3	mJ	
RBSOA	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 10\ \Omega$	$T_{VJ} = 125^{\circ}\text{C}$				
I_{CM}		$V_{CEK} = 1200\text{ V}$			225	A	
SCSOA	short circuit safe operating area	$V_{CEK} = 1200\text{ V}$					
t_{SC}	short circuit duration	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15$	$T_{VJ} = 125^{\circ}\text{C}$		10	μs	
I_{SC}	short circuit current	$R_G = 10\ \Omega$; non-repetitive		300		A	
R_{thJC}	thermal resistance junction to case				0.32	K/W	
R_{thCH}	thermal resistance case to heatsink				0.15	K/W	
Brake Diode							
V_{RRM}	max. repetitive reverse voltage		$T_{VJ} = 25^{\circ}\text{C}$		1200	V	
I_{F25}	forward current		$T_C = 25^{\circ}\text{C}$		48	A	
I_{F80}			$T_C = 80^{\circ}\text{C}$		32	A	
V_F	forward voltage	$I_F = 30\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		2.75	V	
			$T_{VJ} = 125^{\circ}\text{C}$	1.99		V	
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$		0.25	mA	
			$T_{VJ} = 125^{\circ}\text{C}$		1	mA	
Q_{rr}	reverse recovery charge	$V_R = 600\text{ V}$ $-di_f/dt = 400\text{ A}/\mu\text{s}$ $I_F = 30\text{ A}; V_{GE} = 0\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		1.8	μC	
I_{RM}	max. reverse recovery current				23	A	
t_{rr}	reverse recovery time				150	ns	
R_{thJC}	thermal resistance junction to case				0.9	K/W	
R_{thCH}	thermal resistance case to heatsink				0.3	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; $I_{ISOL} \leq 1$ mA	3600			V
		t = 1 minute	3000			V



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	VVZB135-16IOXT	VVZB135-16IOXT	Box	6	510134

Temperature Sensor NTC

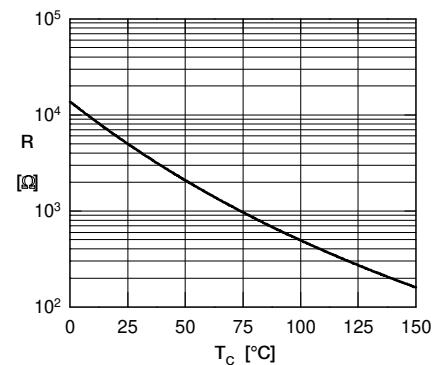
Symbol	Definition	Conditions	min.	typ.	max.	Unit
R_{25}	resistance	$T_{VJ} = 25^\circ$	4.75	5	5.25	k Ω
$B_{25/50}$	temperature coefficient			3375		K

Equivalent Circuits for Simulation

* on die level

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

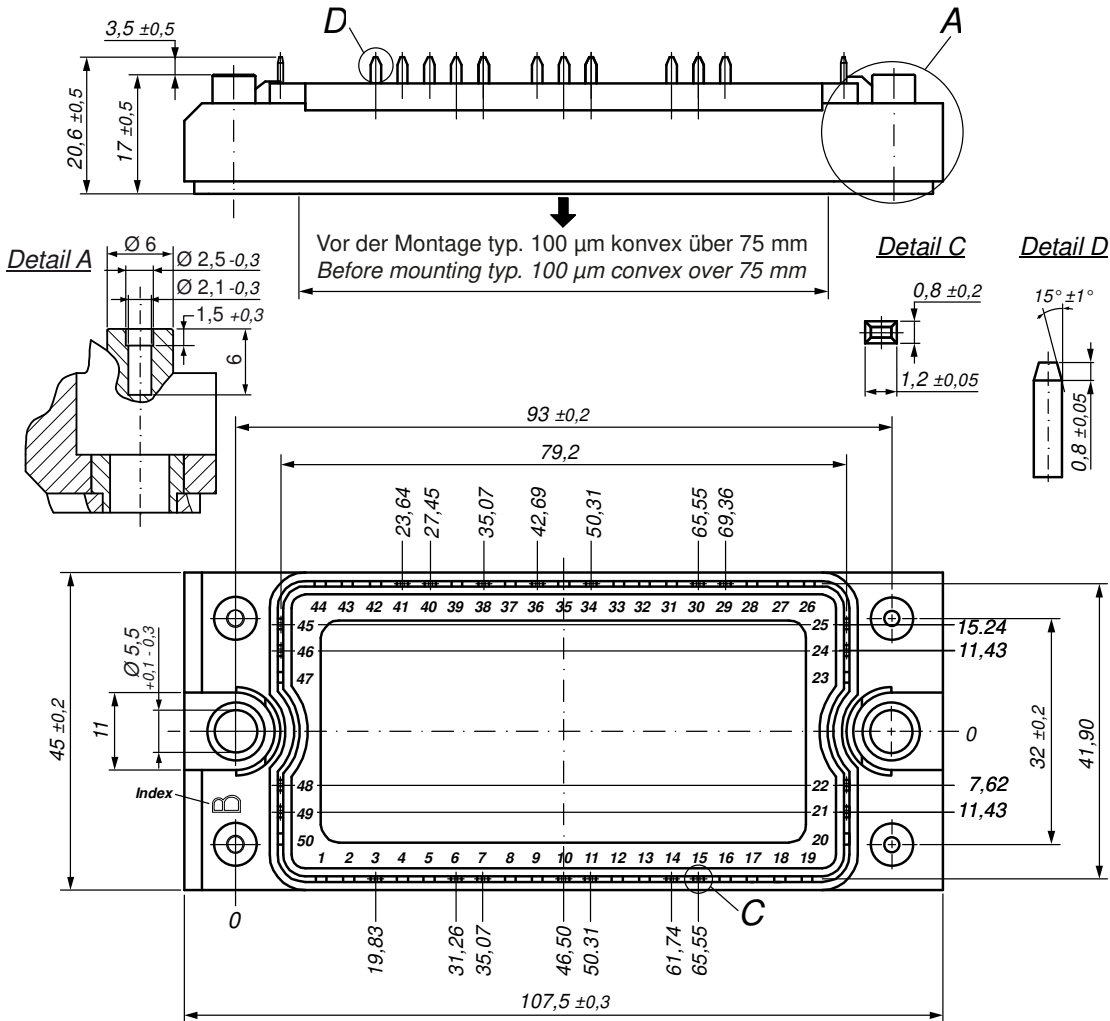
	Thyristor	Brake IGBT	Brake Diode	
V_0	0.88	1.1	1.31	V
R_0	4.1	17.9	8	m Ω



Typ. NTC resistance vs. temperature



Outlines E2-Pack

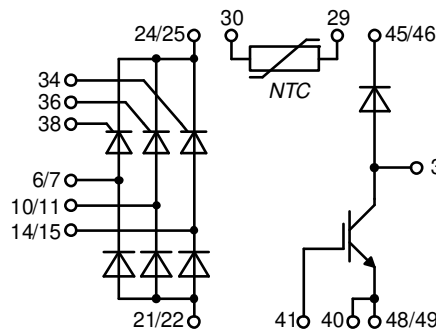


Bemerkung / Note:

- Nichttolerierete 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: $\oplus 0.1$
- Montageanleitung / Mounting instruction: www.ixys.com **Application note IXAN0024**

Detail A: PCB-Montage / Mounting on PCB ^L

- 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**



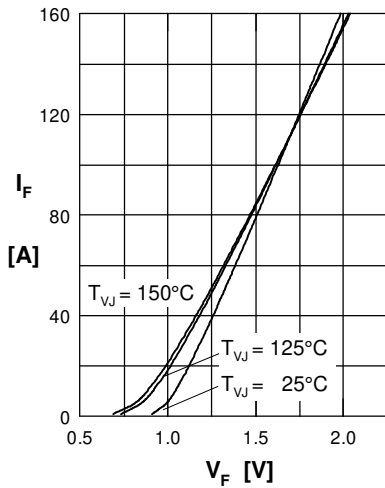
Thyristor


Fig. 1 Forward current vs. voltage drop per thyristor

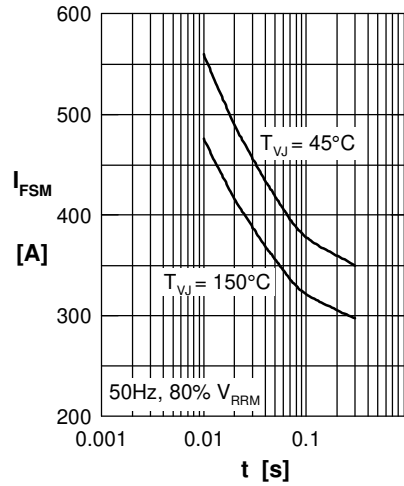


Fig. 2 Surge overload current vs. time per thyristor

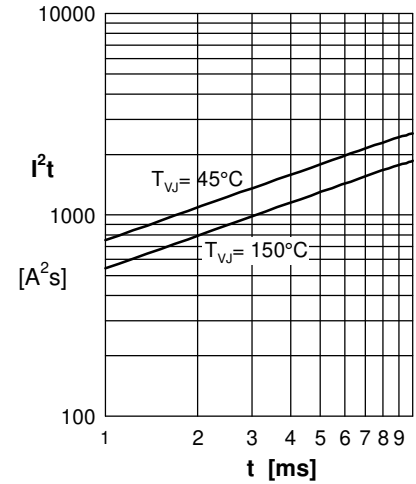
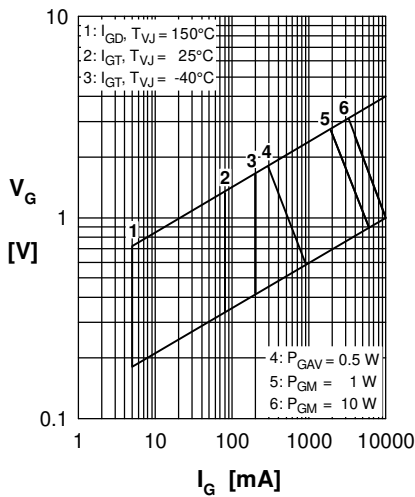

 Fig. 3 I^2t vs. time per thyristor


Fig. 4 Gate trigger characteristics

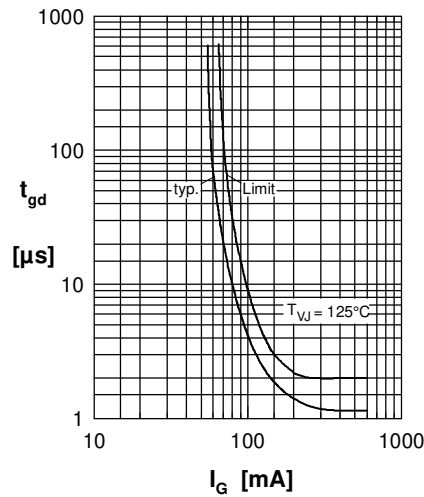


Fig. 5 Gate controlled delay time

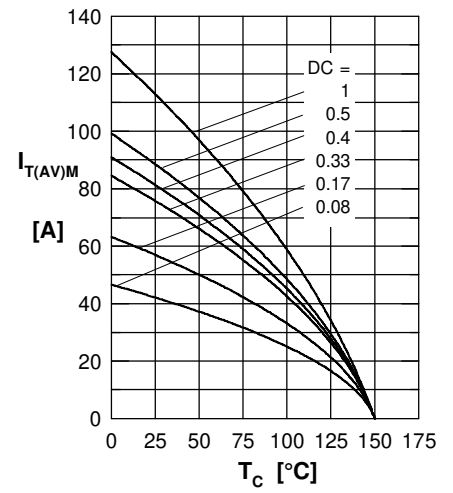


Fig. 5 Max. forward current vs. case temperature per thyristor

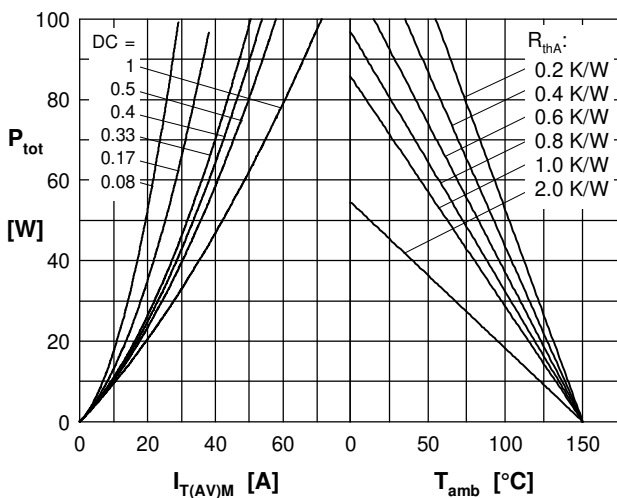


Fig. 4 Power dissipation vs. forward current and ambient temperature per thyristor

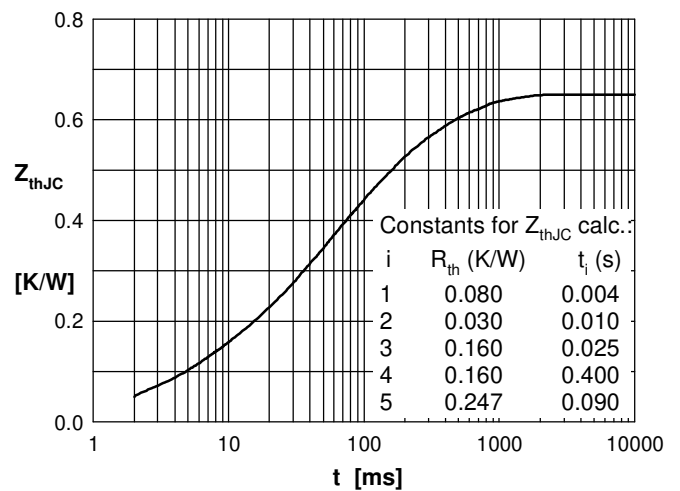


Fig. 6 Transient thermal impedance junction to case vs. time per thyristor

Brake IGBT

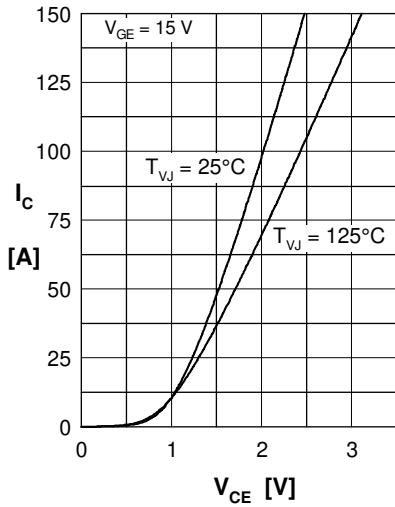


Fig. 1 Typ. output characteristics

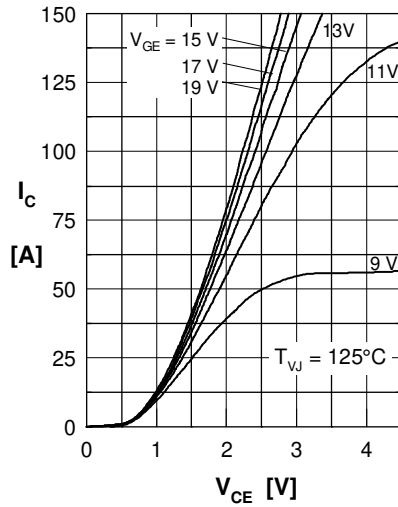


Fig. 2 Typ. output characteristics

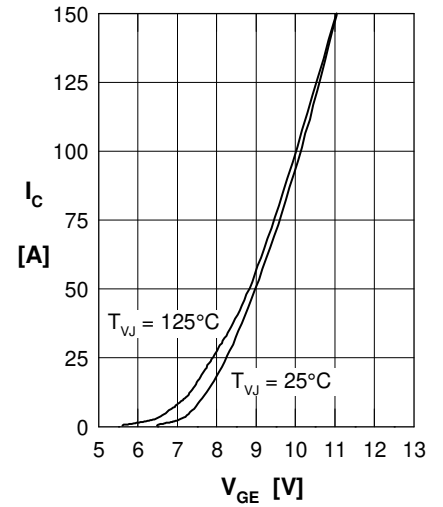


Fig. 3 Typ. transfer characteristics

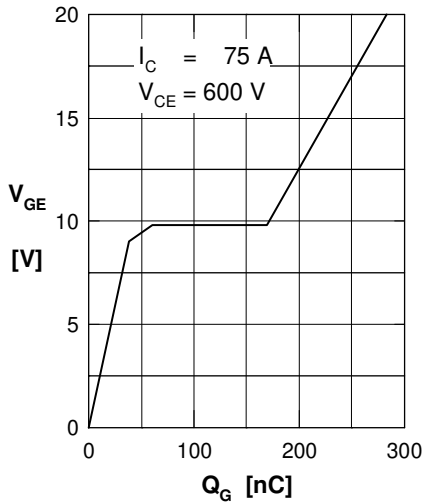


Fig. 4 Typ. turn-on gate charge

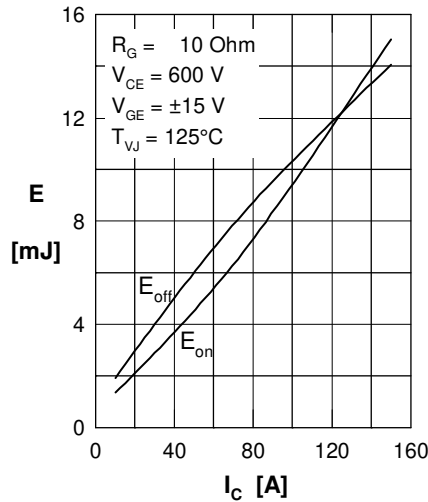


Fig. 5 Typ. switching energy versus collector current

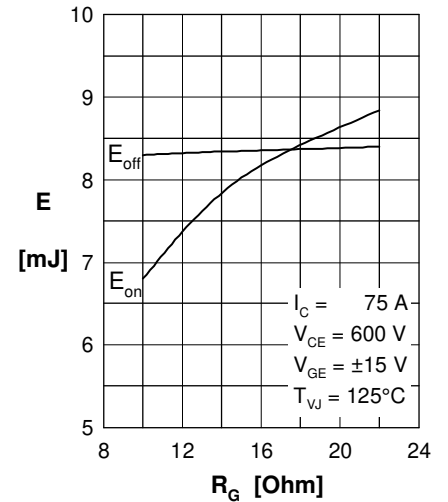


Fig. 6 Typ. switching energy versus gate resistance

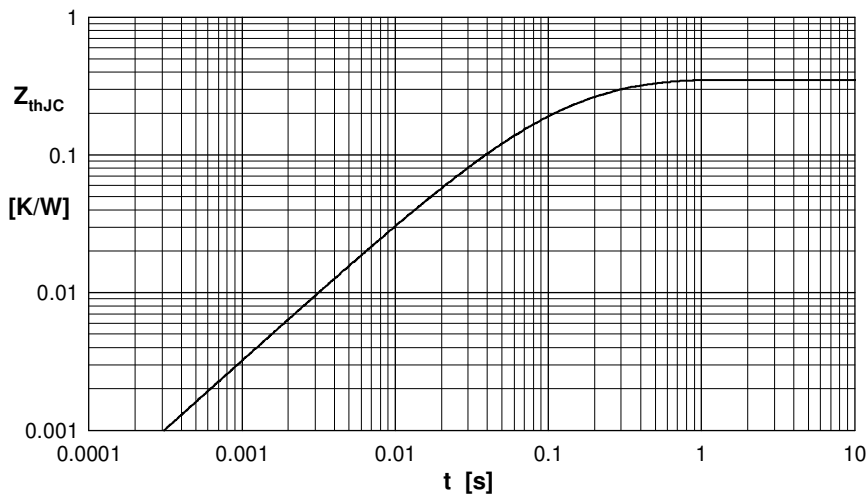


Fig. 7 Typ. transient thermal impedance junction to case

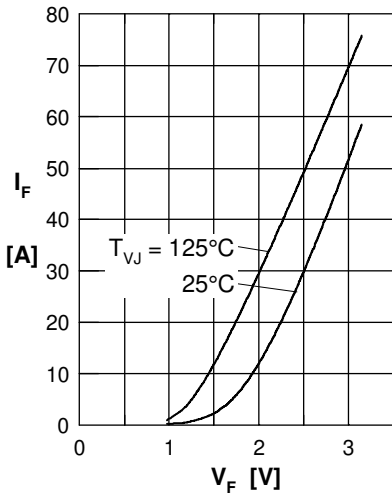
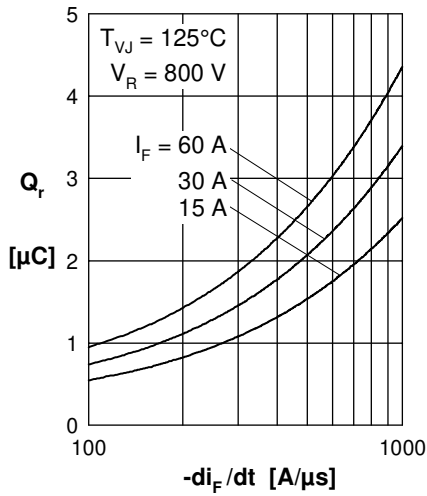
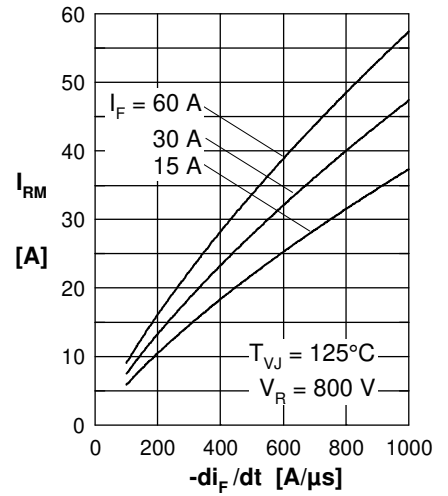
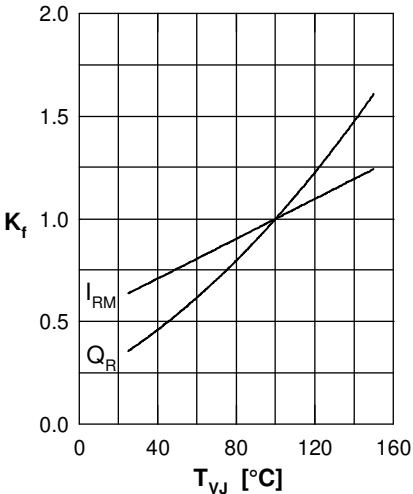
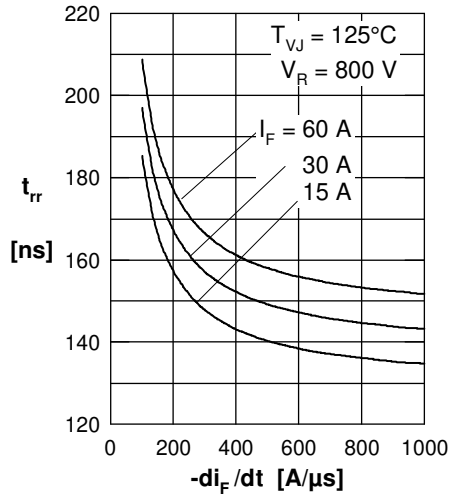
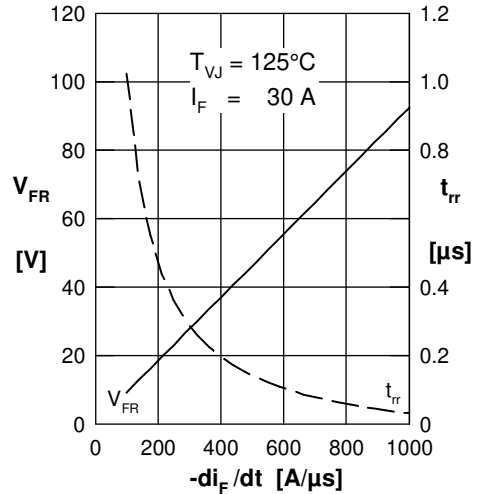
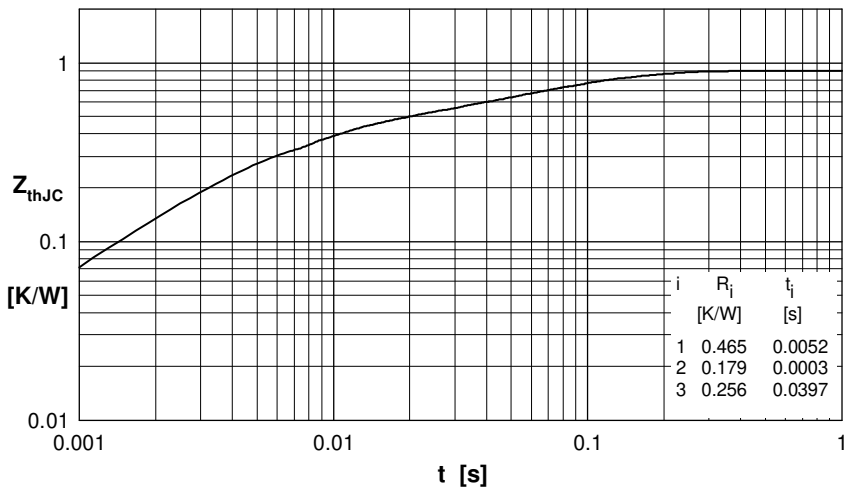
Brake Diode

 Fig. 1 Forward current I_F vs. V_F

 Fig. 2 Typ. reverse recovery charge Q_r versus $-di_F/dt$

 Fig. 3 Typ. peak reverse current I_{RM} versus $-di_F/dt$

 Fig. 4 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

 Fig. 5 Typ. recovery time t_{rr} versus $-di_F/dt$

 Fig. 6 Typ. peak forward voltage V_{FR} and t_{rr} versus di_F/dt


Fig. 7 Transient thermal impedance junction to case