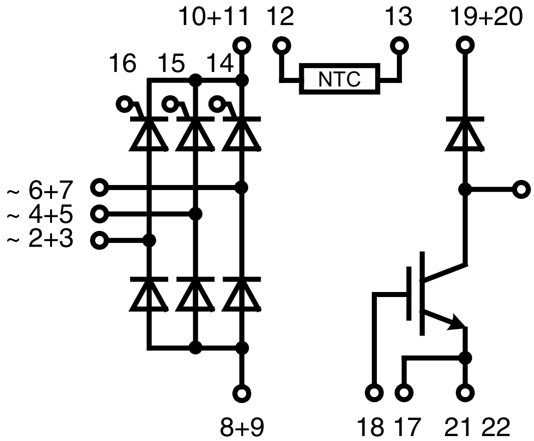
Three Phase Rectifier Bridge

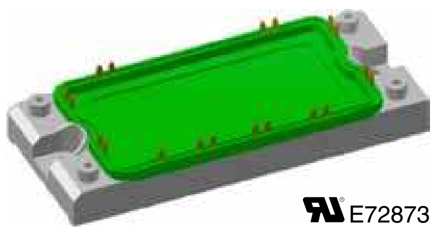
with IGBT and Fast Recovery Diode
for Braking System

Rectifier Diode	Fast Recov. Diode	IGBT
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{dAVM} = 135 A	V_F = 2.75 V	I_{C80} = 84 A
I_{FSM} = 700 A	I_{FSM} = 200 A	V_{CEsat} = 2.1 V

Part name (Marking on product)

VVZB135-16IOXT





E72873

See outline drawing for pin arrangement

Features:

- Soldering connections for PCB mounting
- Convenient package outline
- Optional NTC

Application:

- Drive Inverters with brake system

Package:

- Two functions in one package
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- UL registered, E72873

IXYS reserves the right to change limits, test conditions and dimensions.

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IGBT

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°C to 150°C			1200	V
V_{GES}	*max. DC gate voltage*	continuous		-20		+20	V
V_{GEM}	*max. transient collector gate voltage*	transient		-30		+30	V
I_{C25}	*collector current*	DC	T_C = 25°C			120	A
I_{C80}		DC	T_C = 80°C			84	A
P_{tot}	*total power dissipation*		T_C = 25°C			390	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 80 A; V_{GE} = 15 V	T_{VJ} = 25°C		1.8	2.1	V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 3 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	5.5		6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C		0.03	0.2	mA
			T_{VJ} = 125°C		0.6		mA
I_{GES}	*gate emitter leakage current*	V_{GE} = ±20 V				500	nA
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 75 A			230		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 75 A V_{GE} = ±15 V; R_G = 10 Ω	T_{VJ} = 125°C		70		ns
$t_{d(off)}$	*turn-off delay time*				250		ns
t_r	*current rise time*				40		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
I_{CM}	*reverse bias safe operating area*	RBSOA; V_{GE} = ±15 V; R_G = 10 Ω; L = 100 µH			150		A
V_{CEK}		clamped inductive load;	T_{VJ} = 125°C		$\leq V_{CES}$-L_S·d_I/dt		V
SCSOA	*short circuit safe operating area*	V_{CE} = 900 V; V_{GE} = ±15 V; R_G = 10 Ω; non-repetitive	T_{VJ} = 125°C				
t_{SC}	*short circuit duration*					10	µs
I_{SC}	*short circuit current*				300		A
RBSOA	*reverse bias safe operating area*	V_{CE} = 1200 V; V_{GE} = ±15 V; R_G = 10 Ω; L = 100 µH; clamped inductive load	T_{VJ} = 125°C			225	A
R_{thJC}	*thermal resistance junction to case*					0.32	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.15		K/W

Fast Recovery Diode

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 150°C			1200	V
I_{FAV}	*average forward current*	rect.; d = 0.5	T_C = 80°C			32	A
I_{FRMS}	*rms forward current*	rect.; d = 0.5	T_C = 80°C			45	A
I_{FSM}	*max. surge forward current*	t = 10 ms	T_{VJ} = 45°C			200	A
P_{tot}	*total power dissipation*		T_C = 25°C			130	W
V_{F0}	*threshold voltage*		T_{VJ} = 150°C			1.3	V
r_F	*slope resistance*	for power loss calculation only				17	mΩ
V_F	*forward voltage*	I_F = 30 A	T_{VJ} = 25°C			2.75	V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C			0.25	mA
			T_{VJ} = 125°C		1		mA
I_{RM}	*reverse recovery current*	I_F = 50 A; V_R = 100 V; di_F/dt = -100 A/µs			8	11	A
t_{rr}	*reverse recovery time*	I_F = 1 A; V_R = 30 V; di_F/dt = -200 A/µs			40		ns
R_{thJC}	*thermal resistance junction to case*					0.9	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.3		K/W

T_C = 25°C unless otherwise stated

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Rectifier Bridge

Symbol	Conditions			min.	typ.	max.	
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1600	V
$I_{D(AV)M}$	*max. average DC output current*	sine; d = $^1/_3$; bridge	T_C = 80°C			135	A
I_{FSM}	*max. forward surge current*	t = 10 ms (50Hz) V_R = 0 V	T_{VJ} = 45°C T_{VJ} = 150°C			700 610	A A
I^2t	*value for fusing*	t = 10 ms (50Hz) V_R = 0 V	T_{VJ} = 45°C T_{VJ} = 150°C			2450 1860	A^2s A^2s
P_{tot}	*total power dissipation*		T_{VJ} = 25°C			190	W
$(di/dt)_{cr}$	*critical rate of rise of current*	f = 50 Hz; t_p = 200 µs V_D = $^2/_3$ V_{DRM}; T_{VJ} = T_{VJM} I_G = 0.45 A di_G/dt = 0.45 A/µs	repetitive I_T = 150 A			100	A/µs
			non-repetitive I_T = $^1/_3$ I_{dAV}			500	A/µs
$(dv/dt)_{cr}$	*critical rate of rise of voltage*	V_D = $^2/_3$ V_{DRM}; T_{VJ} = T_{VJM} R_{GK} = ∞; method 1 (linear voltage rise)				1000	V/µs
P_{GM}	*max. gate power dissipation*	I_T = $^1/_3$ I_{dAV}; T_{VJ} = T_{VJM}	t_P = 30 µs t_P = 300 µs			10 5	W W
P_{GAVM}						0.5	W
I_R, I_D	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C T_{VJ} = 150°C			0.1 20	mA mA
V_F, V_T	*forward voltage*	I_F = 80 A	T_{VJ} = 25°C			1.43	V
V_{T0} r_T	*threshold voltage* *slope resistance*	*for power loss calculation only*	T_{VJ} = 150°C			0.85 7.1	V mΩ
V_{GT}	*gate trigger voltage*	V_D = 6 V	T_{VJ} = 25°C T_{VJ} = -40°C			1.5 1.6	V V
I_{GT}	*trigger gate current*	V_D = 6 V	T_{VJ} = 25°C T_{VJ} = -40°C			78 200	mA mA
V_{GD} I_{GD}	*gate non-trigger voltage* *non-trigger gate current*	V_D = $^2/_3$ V_{DRM}	T_{VJ} = T_{VJM}			0.2 5	V mA
I_L	*latching curent*	V_D = 6 V; t_G = 10 µs di_G/dt = 0.45 A/µs; I_G = 0.45 A				450	mA
I_H	*holding current*	V_D = 6 V; R_{GK} = ∞	T_{VJ} = T_{VJM}			100	mA
t_{gd}	*gate controlled delay time*	V_D = ½ V_{DRM}; di_G/dt = 0.45 A/µs; I_G = 0.45 A				2	µs
t_q	*turn-off time*	V_R = 100 V; V_D = $^2/_3$ V_{DRM} t_P = 200 µs; I_T = 20 A dv/dt = 15 V/µs; -di/dt = 10 A/µs	T_{VJ} = T_{VJM}			150	µs
R_{thJC}	*thermal resistance junction to case*	per rectifier				0.65	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.1		K/W

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Module

Symbol	Definitions	Conditions	T_C = 25°C unless otherwise stated	min.	typ.	max.	Unit
					Ratings		
T_{VJ}	*operating temperature*			-40		150	°C
T_{VJM}	*max. virtual junction temperature*					150	°C
T_{stg}	*storage temperature*			-40		125	°C
V_{ISOL}	*isolation voltage*	$I_{ISOL} \leq$ 1 mA; 50/60 Hz;	t = 1 min.			3000	V~
			t = 1 s			3600	V~
M_d	*mounting torque*			3		6	Nm
d_S	*creep distance on surface*			12.7			mm
d_A	*strike distance through air*			9.6			mm
a	*maximum allowable acceleration*					50	m/s²
Weight					180		g

Temperature Sensor NTC

Symbol	Definitions	Conditions		min.	typ.	max.	Unit
					Ratings		
R_{25}	*resistance*	$\left\{ R(T) = R_{25} \cdot e^{B_{25/100}\left(\frac{1}{T} - \frac{1}{298K}\right)} \right\}$	T_{VJ} = 25°C	4.75	5.0	5.25	kΩ
$B_{25/85}$					3375		K

Rectifier

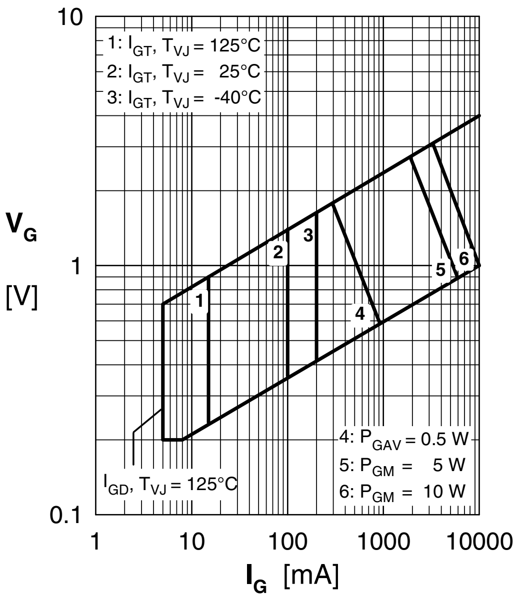

Fig. 1 Gate trigger characteristics

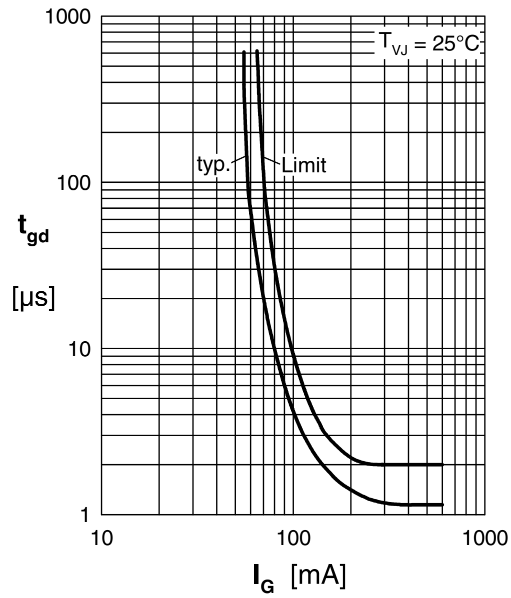

Fig. 2 Gate trigger delay time

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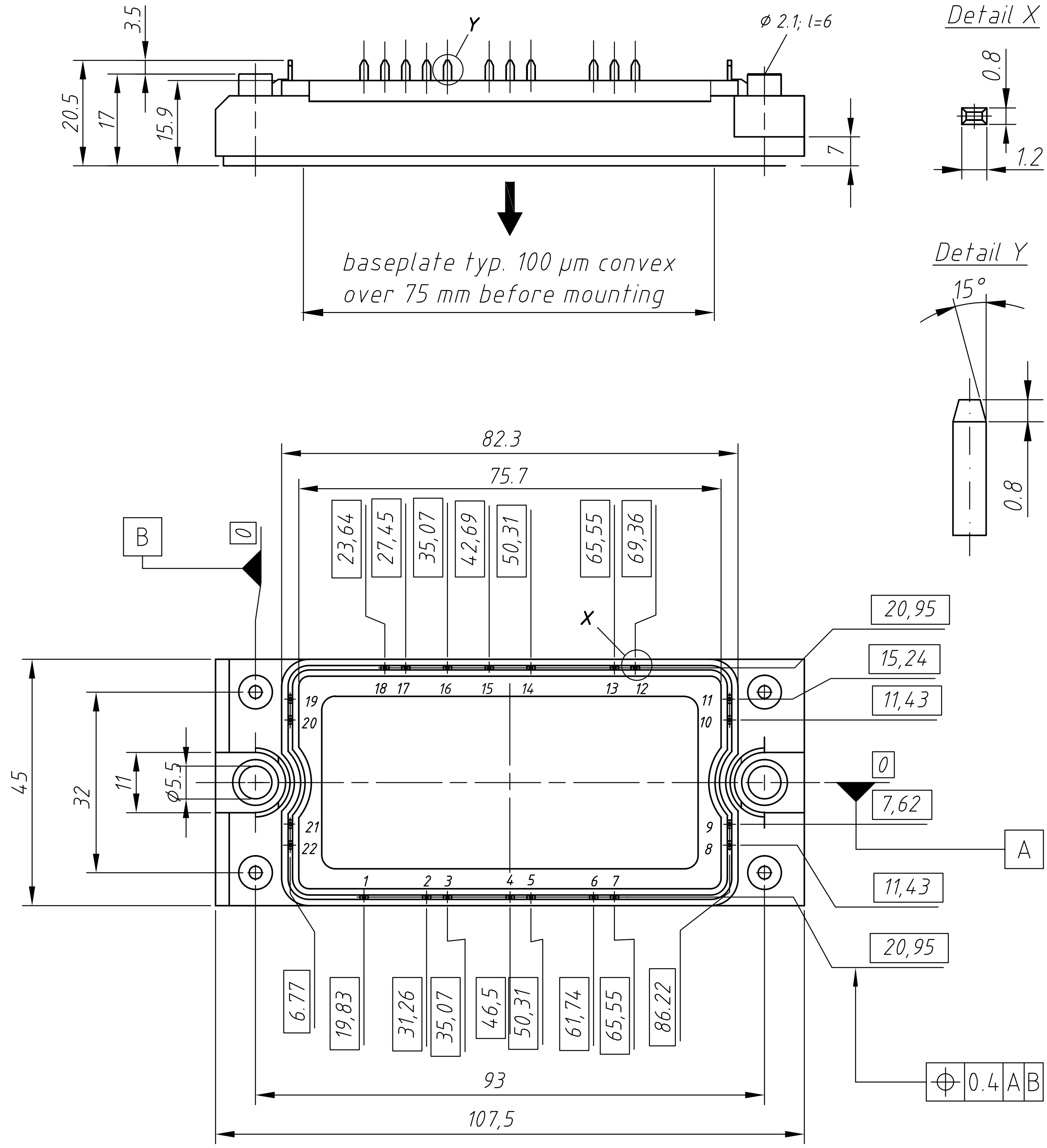
Outline Drawing

Dimensions in mm (1 mm = 0.0394")



Product Marking

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	VVZB 135-16IOXT	VVZB135-16IOXT	Box	6	510134

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Rectifier

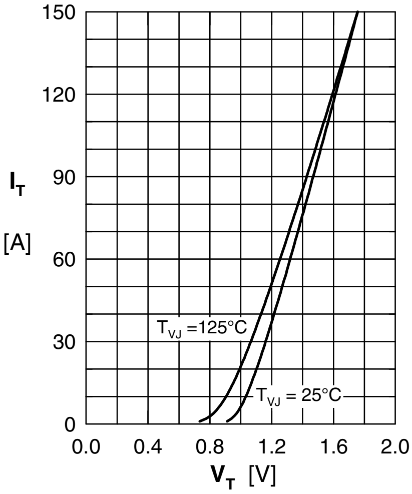

Fig.1 Forward current versus voltage drop per diode

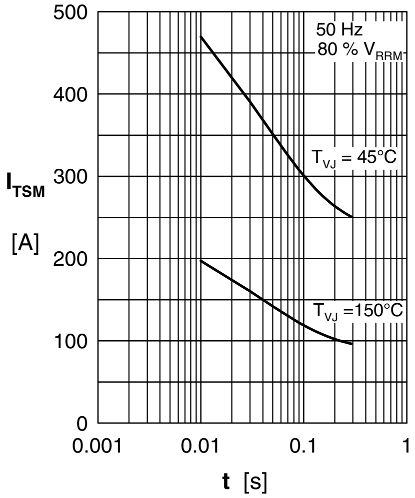

Fig.2 Surge overload current

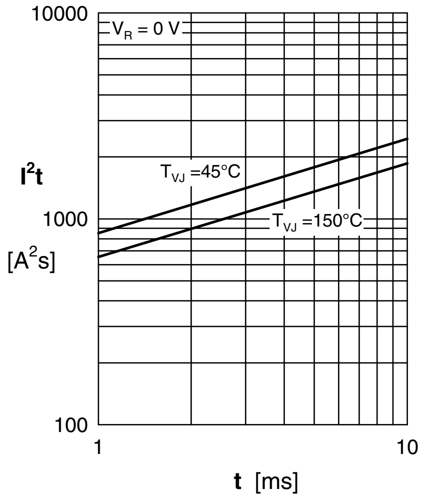

Fig.3 I^2t versus time per diode

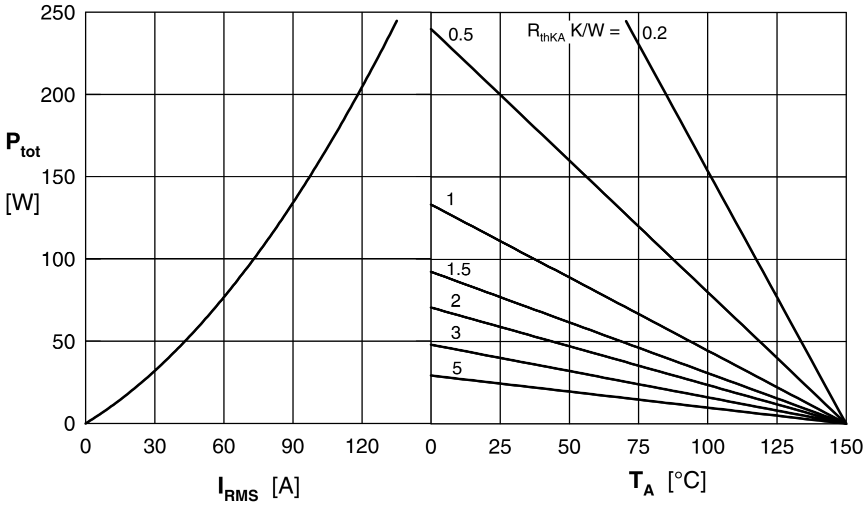

Fig.4 Power dissipation versus direct output current and ambient temperature, sine 180°

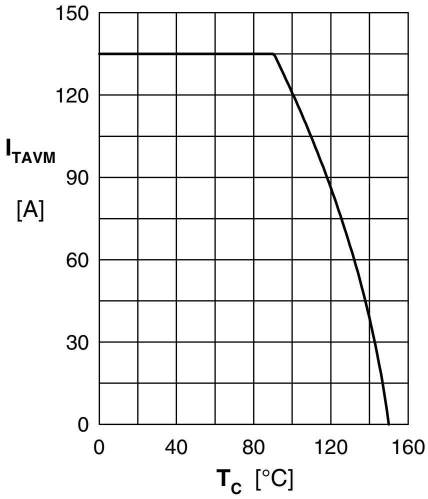

Fig.5 Max. forward current vs. case temperature

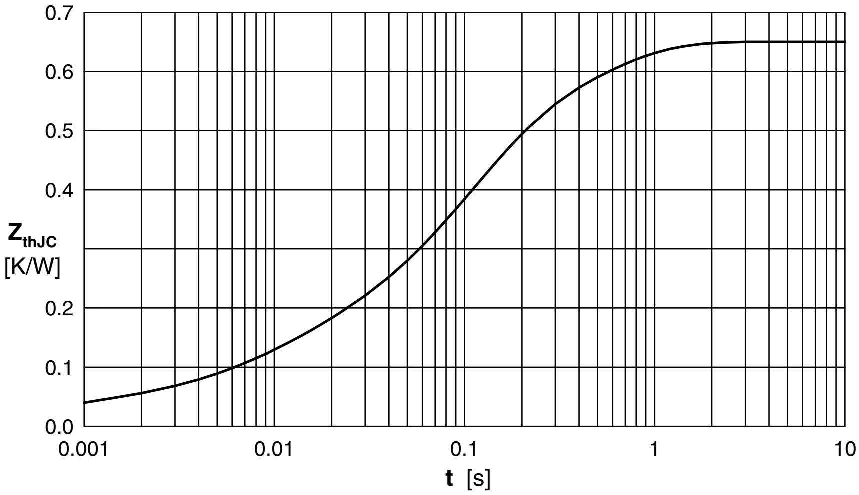

Fig.6 Transient thermal impedance junction to case

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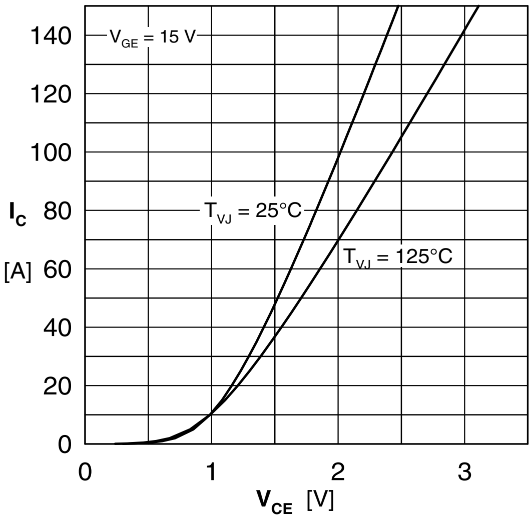

Fig. 1 Typ. output characteristics

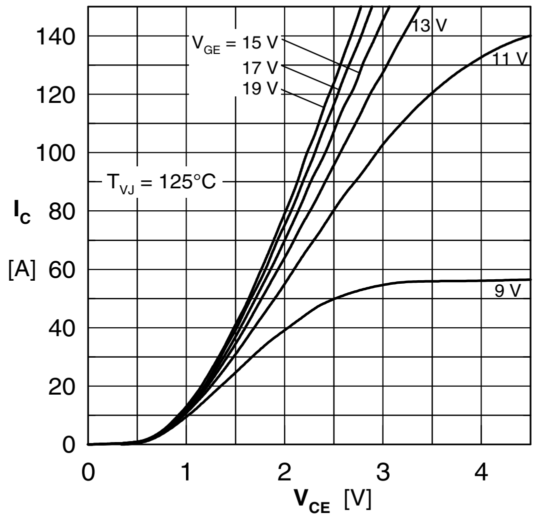

Fig. 2 Typ. output characteristics

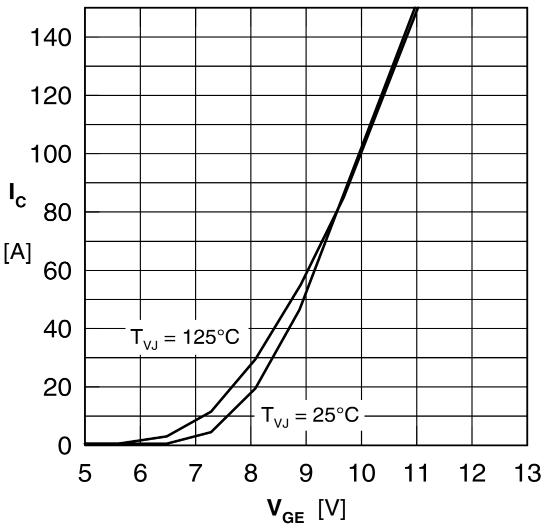

Fig. 3 Typ. transfer characteristics

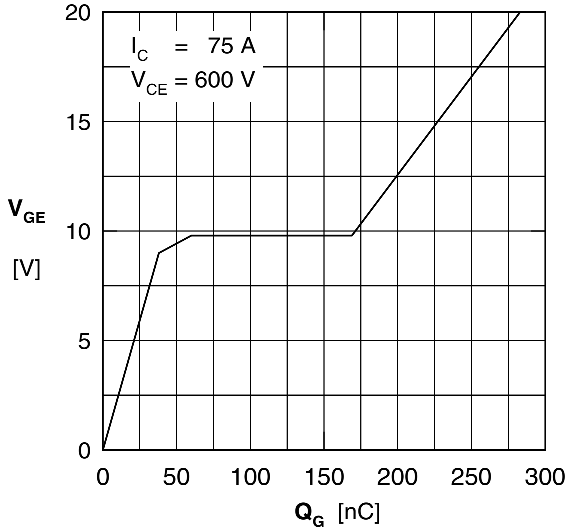

Fig. 4 Typ. turn-on gate charge

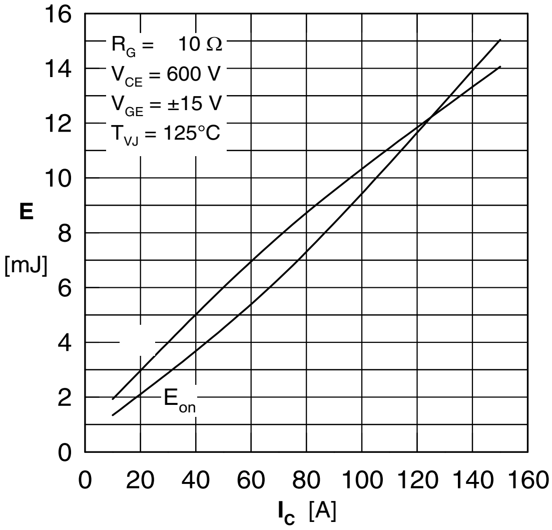

Fig. 5 Typ. switching energy vs. collector current

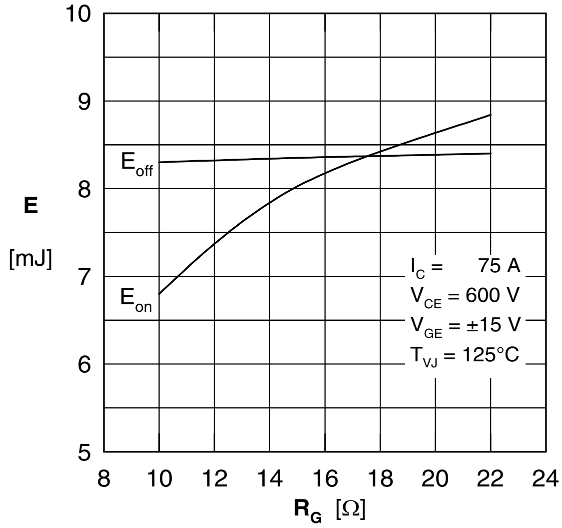

Fig. 6 Typ. switching energy vs. gate resistance

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Fast Recovery Diode

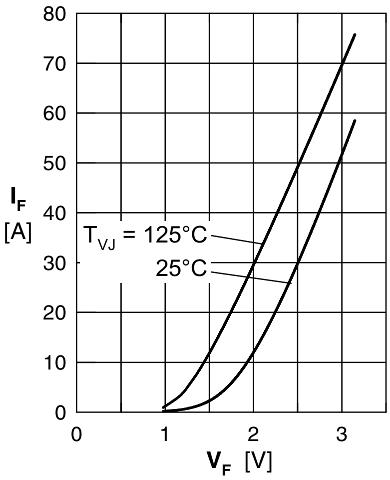


Fig. 1 Typ. forward current I_F vs. V_F

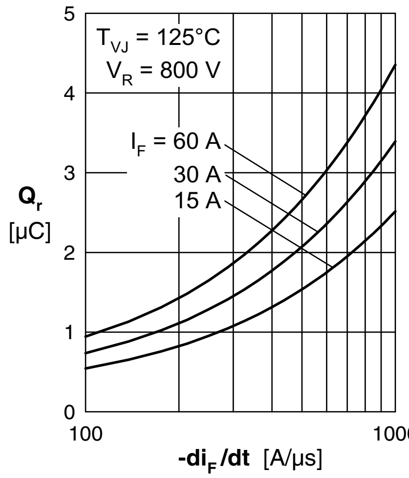


Fig. 2 Typ. reverse recovery charge Q_r versus $-di_F/dt$

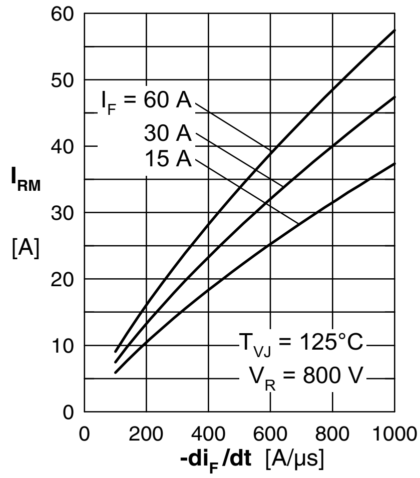


Fig. 3 Typ. peak reverse current I_{RM} versus $-di_F/dt$

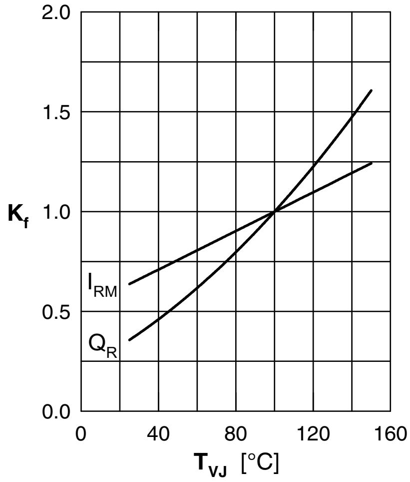


Fig. 4 Typ. dynamic parameters Q_r, I_{RM}, versus T_{VJ}

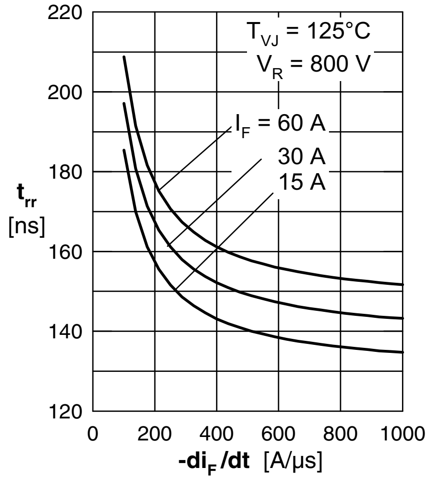


Fig. 5 Typ. recovery time t_{rr} vs. $-di_F/dt$

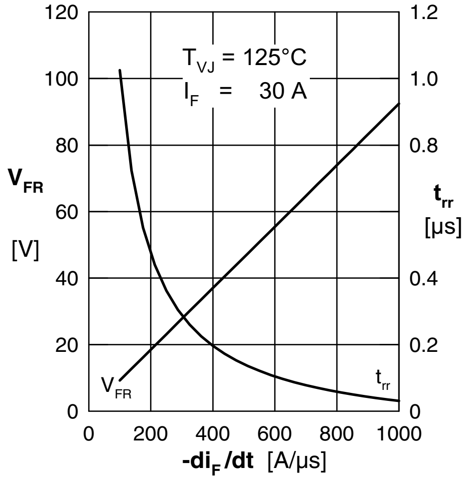
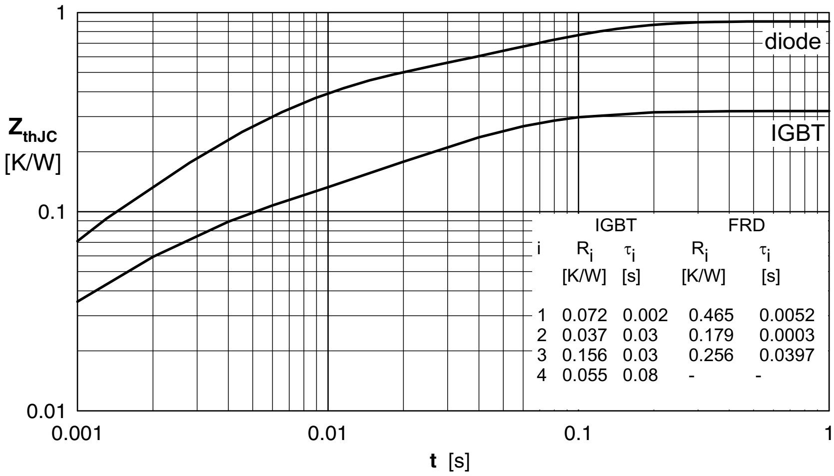


Fig. 6 Typ. peak forward voltage V_{FR} and t_{fr} versus di_F/dt



	IGBT		FRD	
i	R_i [K/W]	τ_i [s]	R_i [K/W]	τ_i [s]
1	0.072	0.002	0.465	0.0052
2	0.037	0.03	0.179	0.0003
3	0.156	0.03	0.256	0.0397
4	0.055	0.08	-	-

Fig. 7 Typ. transient thermal impedance junction to case

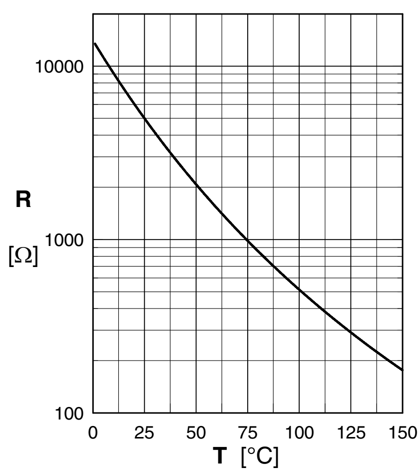


Fig. 8 Typ. thermistor resistance versus temperature

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