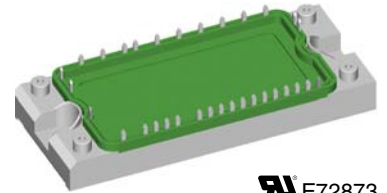
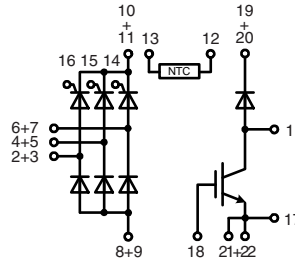


# Three Phase Rectifier Bridge with IGBT and Fast Recovery Diode for Braking System

$V_{RRM} = 1600\text{ V}$   
 $I_{dAVM} = 135\text{ A}$

$V_{RRM}$	Type
V	
1600	VVZB 135-16 NO1



E72873

See outline drawing for pin arrangement

Symbol	Conditions	Maximum Ratings		
$V_{RRM}$		1600	V	
$I_{dAVM}$	$T_C = 85^\circ\text{C}$ ; sinusoidal 120°	135	A	
$I_{FSM}$	$T_{VJ} = 45^\circ\text{C}$ ; $t = 10\text{ ms}$ ; $V_R = 0\text{ V}$	700	A	
	$T_{VJ} = 150^\circ\text{C}$ ; $t = 10\text{ ms}$ ; $V_R = 0\text{ V}$	610	A	
$I^2t$	$T_{VJ} = 45^\circ\text{C}$ ; $t = 10\text{ ms}$ ; $V_R = 0\text{ V}$	2450	A <sup>2</sup> s	
	$T_{VJ} = 150^\circ\text{C}$ ; $t = 10\text{ ms}$ ; $V_R = 0\text{ V}$	1860	A <sup>2</sup> s	
$P_{tot}$	$T_C = 25^\circ\text{C}$ per diode	190	W	
$(di/dt)_{cr}$	$T_{VJ} = T_{VJM}$ ; $f = 50\text{ Hz}$ ; $t_p = 200\text{ }\mu\text{s}$ repetitive; $I_T = 150\text{ A}$	100	A/ $\mu\text{s}$	
	$V_D = \frac{2}{3} V_{DRM}$ ; $I_G = 0.45\text{ A}$ ; $di_G/dt = 0.45\text{ A}/\mu\text{s}$ non repetitive; $I_T = I_{d(AV)}/3$	500	A/ $\mu\text{s}$	
$(dv/dt)_{cr}$	$T_{VJ} = T_{VJM}$ ; $V_{DR} = \frac{2}{3} V_{DRM}$ ; $R_{GK} = \infty$ ; method 1 (linear voltage rise)	1000	V/ $\mu\text{s}$	
$P_{GM}$	$T_{VJ} = T_{VJM}$ ; $t_p = 30\text{ }\mu\text{s}$	10	W	
	$I_T = I_{d(AV)}/3$ ; $t_p = 300\text{ }\mu\text{s}$	5	W	
$P_{GAVM}$		0.5	W	
$V_{CES}$	$T_{VJ} = 25^\circ\text{C}$ to $150^\circ\text{C}$	1200	V	
$V_{GE}$	Continuous	$\pm 20$	V	
$I_{C25}$	$T_C = 25^\circ\text{C}$ ; DC	95	A	
$I_{C80}$		$T_C = 80^\circ\text{C}$ ; DC	67	A
$I_{CM}$	$t_p = \text{Pulse width limited by } T_{VJM}$	100	A	
$P_{tot}$	$T_C = 25^\circ\text{C}$	380	W	
$V_{RRM}$	<b>Fast Recovery Diode</b>	1200	V	
$I_{FAV}$		$T_C = 80^\circ\text{C}$ ; rectangular $d = 0.5$	27	A
$I_{FRMS}$		$T_C = 80^\circ\text{C}$ ; rectangular $d = 0.5$	38	A
$I_{FRM}$		$T_C = 80^\circ\text{C}$ ; $t_p = 10\text{ }\mu\text{s}$ ; $f = 5\text{ kHz}$	tbd	A
$I_{FSM}$	$T_{VJ} = 45^\circ\text{C}$ ; $t = 10\text{ ms}$	200	A	
$P_{tot}$	$T_C = 25^\circ\text{C}$	130	W	

## Features

- Soldering connections for PCB mounting
- Convenient package outline
- Thermistor
- Isolation voltage 2500 V~

## Applications

- Drive Inverters with brake system

## Advantages

- 2 functions in one package
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability

**Recommended replacement:**

**VVZB 135-16ioXT**

Data according to IEC 60747

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

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Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$I_{R}, I_D$	$V_R = V_{RRM}; T_{VJ} = 25^{\circ}\text{C}$			0.1 mA
	$V_R = V_{RRM}; T_{VJ} = 150^{\circ}\text{C}$			20 mA
$V_F, V_T$	$I_F = 80 \text{ A}; T_{VJ} = 25^{\circ}\text{C}$			1.43 V
$V_{T0}$	for power-loss calculations only			0.85 V
$r_T$	$T_{VJ} = 150^{\circ}\text{C}$			7.1 m $\Omega$
$V_{GT}$	$V_D = 6 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$			1.5 V
	$T_{VJ} = -40^{\circ}\text{C}$			1.6 V
$I_{GT}$	$V_D = 6 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$			78 mA
	$T_{VJ} = -40^{\circ}\text{C}$			200 mA
$V_{GD}$	$T_{VJ} = T_{VJM}; V_D = \frac{2}{3} V_{DRM}$			0.2 V
$I_{GD}$	$T_{VJ} = T_{VJM}; V_D = \frac{2}{3} V_{DRM}$			5 mA
$I_L$	$V_D = 6 \text{ V}; t_G = 10 \mu\text{s};$ $di_G/dt = 0.45 \text{ A}/\mu\text{s}; I_G = 0.45 \text{ A}$			450 mA
$I_H$	$T_{VJ} = T_{VJM}; V_D = 6 \text{ V}; R_{GK} = \infty$			100 mA
$t_{gd}$	$V_D = \frac{1}{2} V_{DRM};$ $di_G/dt = 0.45 \text{ A}/\mu\text{s}; I_G = 0.45 \text{ A}$			2 $\mu\text{s}$
$t_q$	$T_{VJ} = T_{VJM}; V_R = 100 \text{ V};$ $V_D = \frac{2}{3} V_{DRM}; t_p = 200 \mu\text{s};$ $dv/dt = 15 \text{ V}/\mu\text{s}; I_T = 20 \text{ A};$ $-di/dt = 10 \text{ A}/\mu\text{s}$			150 $\mu\text{s}$
$R_{thJC}$	per diode			0.65 K/W
$R_{thCH}$			0.2	K/W
$V_{BR(CES)}$	$V_{GS} = 0 \text{ V}; I_C = 0.1 \text{ mA}$	1200		V
$V_{GE(th)}$	$I_C = 8 \text{ mA}$	4.5		6.45 V
$I_{CES}$	$V_{CE} = 1200 \text{ V}; T_{VJ} = 25^{\circ}\text{C}$			0.1 mA
	$V_{CE} = 0.8 \cdot V_{CES}; T_{VJ} = 125^{\circ}\text{C}$			0.5 mA
$V_{CEsat}$	$V_{GE} = 15 \text{ V}; I_C = 100 \text{ A}$			3.5 V
$t_{SC}(\text{SCSOA})$	$V_{GE} = 15 \text{ V}; V_{CE} = 900 \text{ V}; T_{VJ} = 125^{\circ}\text{C}$			10 $\mu\text{s}$
<b>RBSOA</b>	$V_{GE} = 15 \text{ V}; V_{CE} = 1200 \text{ V}; T_{VJ} = 125^{\circ}\text{C};$ clamped inductive load; $L = 100 \mu\text{H};$ $R_G = 22 \Omega$			100 A
$C_{ies}$	$V_{CE} = 25 \text{ V}; f = 1 \text{ MHz}; V_{GE} = 0 \text{ V}$		3.8	nF
$t_{d(on)}$	$V_{CE} = 720 \text{ V}; I_C = 50 \text{ A}$ $V_{GE} = 15 \text{ V}; R_G = 22 \Omega$ Inductive load; $L = 100 \mu\text{H};$ $T_{VJ} = 125^{\circ}\text{C}$		150	ns
$t_{d(off)}$			680	ns
$E_{on}$			6	mJ
$E_{off}$			5	mJ
$R_{thJC}$				0.33
$R_{thCH}$			0.1	K/W

Symbol	Conditions	Characteristic Values ( $T_{VJ} = 25^{\circ}\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
<b>Fast Recovery Diode</b>	$V_R = V_{RRM}; T_{VJ} = 25^{\circ}\text{C}$ $V_R = 1200\text{ V}; T_{VJ} = 125^{\circ}\text{C}$			0.25 mA
			1	mA
	$I_F = 30\text{ A}; T_{VJ} = 25^{\circ}\text{C}$			2.76 V
	For power-loss calculations only			1.3 V
	$T_{VJ} = 150^{\circ}\text{C}$			16 mΩ
	$I_F = 50\text{ A}; -di_F/dt = 100\text{ A}/\mu\text{s}; V_R = 100\text{ V}$	5.5		11 A
	$I_F = 1\text{ A}; -di_F/dt = 200\text{ A}/\mu\text{s}; V_R = 30\text{ V}$	40		ns
$R_{thJC}$			0.9 K/W	
$R_{thCH}$		0.25	K/W	
<b>NTC</b>	$R(T) = R_{25} \cdot e^{B_{25/100} \left( \frac{1}{T} - \frac{1}{298\text{K}} \right)}$	4.75	5.0	5.25 kΩ
			3375	K

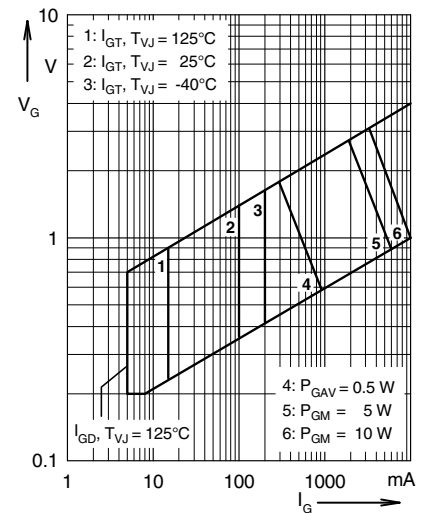


Fig. 1 Gate trigger characteristics

Symbol	Conditions	Maximum Ratings	
$T_{VJ}$		-40...+150	$^{\circ}\text{C}$
$T_{VJM}$		150	$^{\circ}\text{C}$
$T_{stg}$		-40...+125	$^{\circ}\text{C}$
<b>Module</b>	50/60 Hz; $t = 1\text{ min}$	2500	V~
	$I_{ISOL} \leq 1\text{ mA}; t = 1\text{ s}$	3000	V~
$M_d$	Mounting torque	2.7...3.3	Nm
$d_s$	Creep distance on surface	12.7	mm
$d_A$	Strike distance in air	9.6	mm
$a$	Maximum allowable acceleration	50	$\text{m}/\text{s}^2$
<b>Weight</b>	typ.	180	g

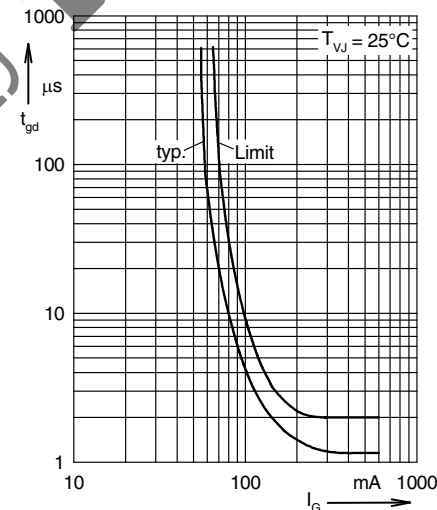
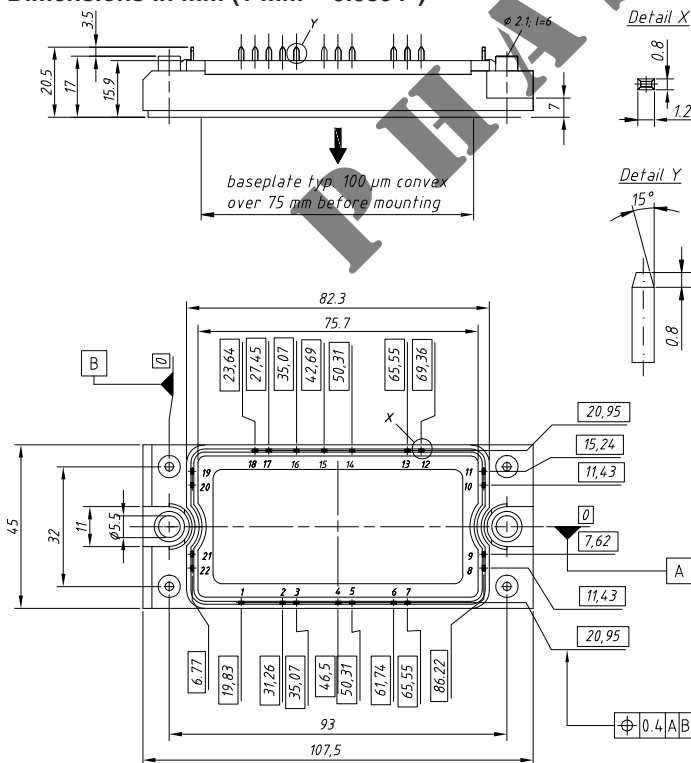


Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**



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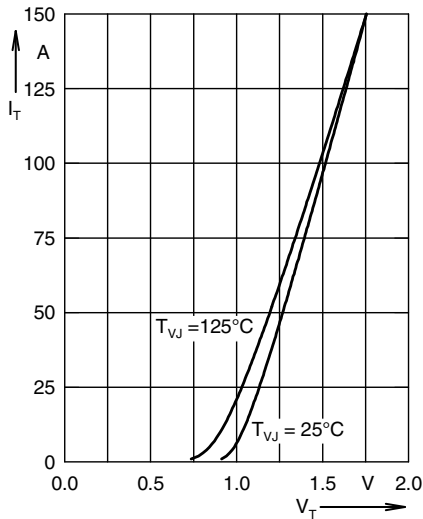


Fig. 3 Forward current versus voltage drop per leg

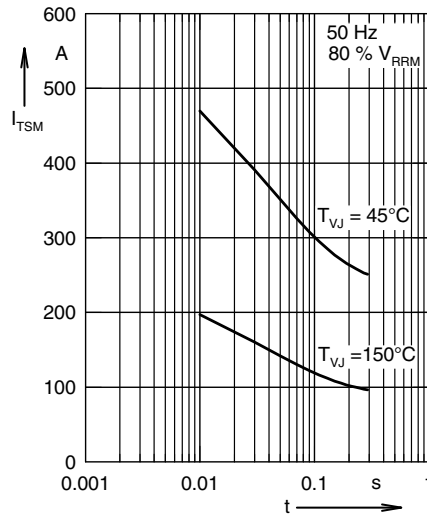


Fig. 4 Surge overload current

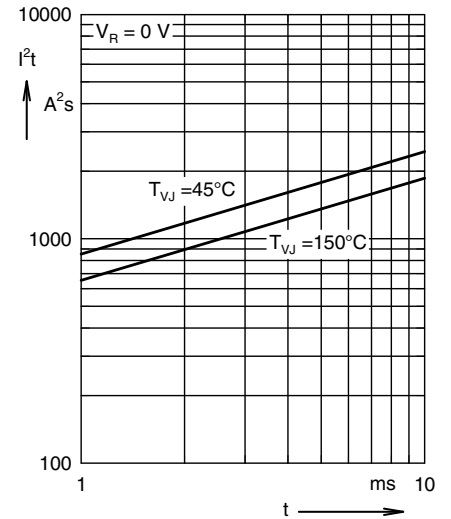


Fig. 5  $I^2t$  versus time (per thyristor/diode)

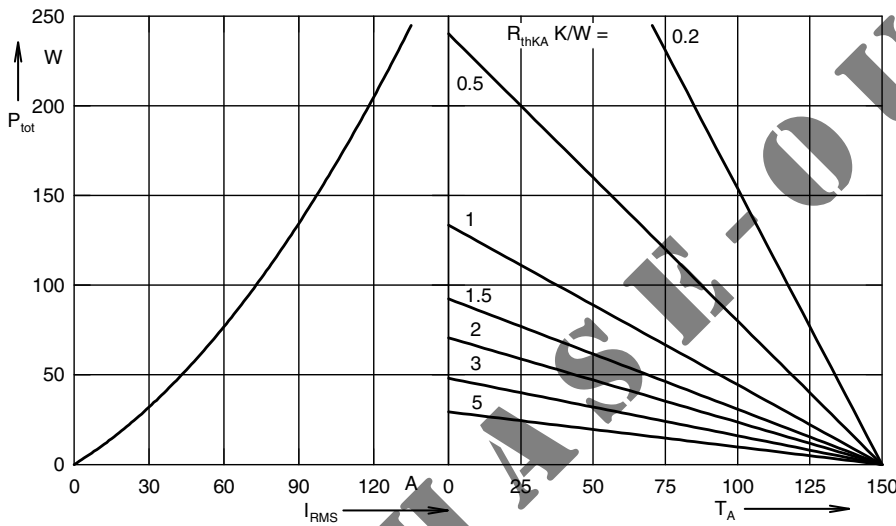


Fig. 6 Power dissipation versus direct output current and ambient temperature

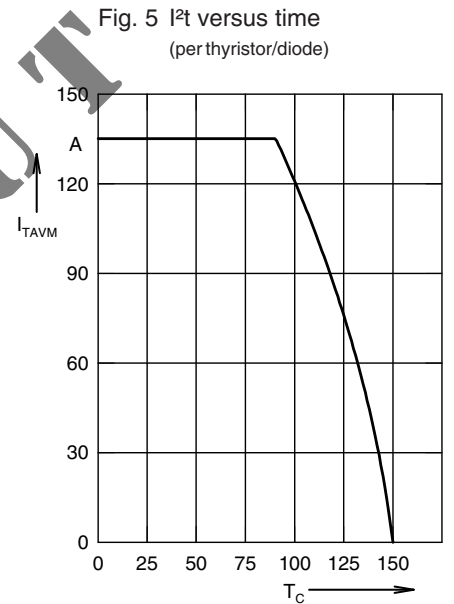


Fig. 7 Maximum forward current at case temperature

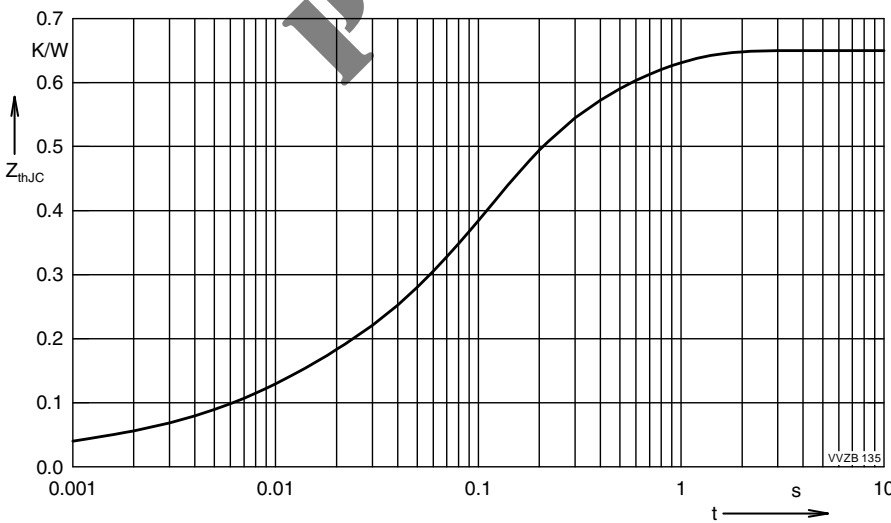


Fig. 8 Transient thermal impedance junction to case (per thyristor/diode)

Constants for $Z_{thJC}$ calculation:	
$R_{thi}$ / (K/W)	$t_i$ / (s)
0.03	0.0005
0.083	0.008
0.361	0.094
0.176	0.45

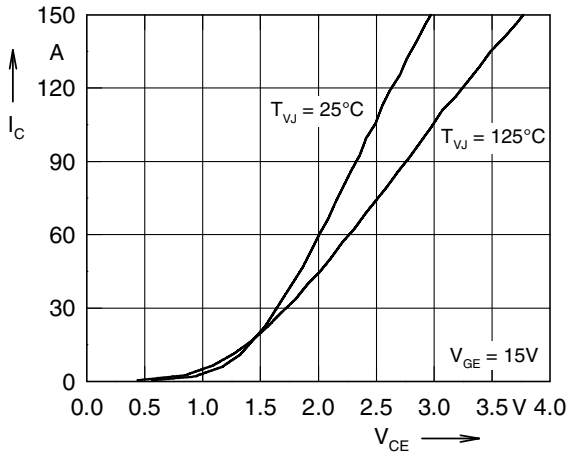


Fig. 9 Typ. output characteristics

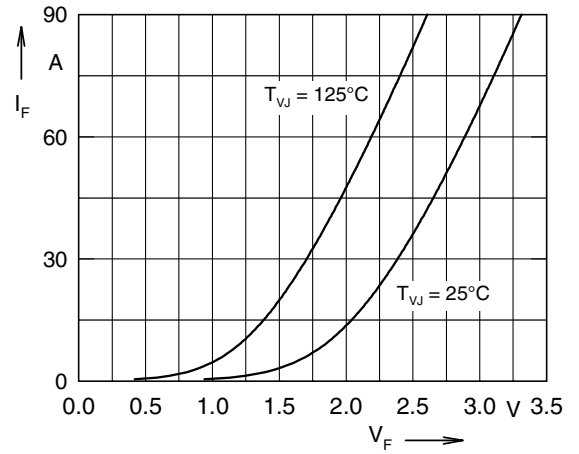


Fig. 10 Typ. forward characteristics of free wheeling diode

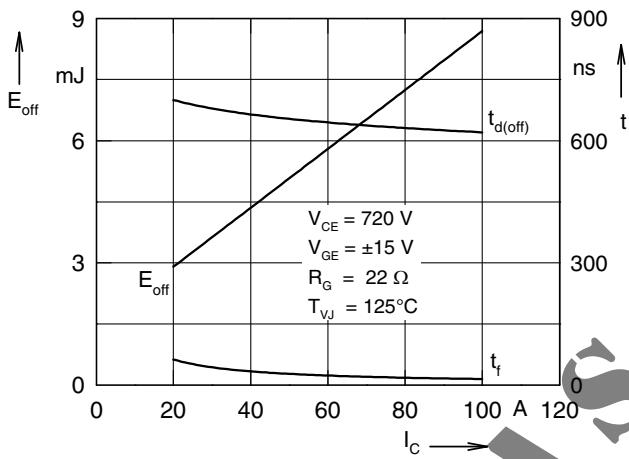


Fig. 11 Typ. turn off energy and switching times versus collector current

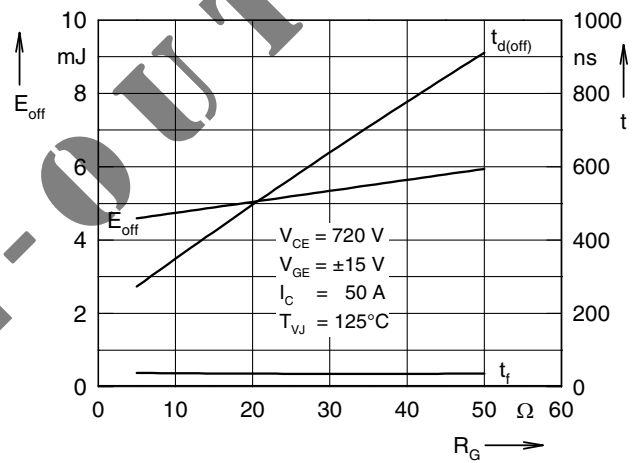


Fig. 12 Typ. turn off energy and switching times versus gate resistor

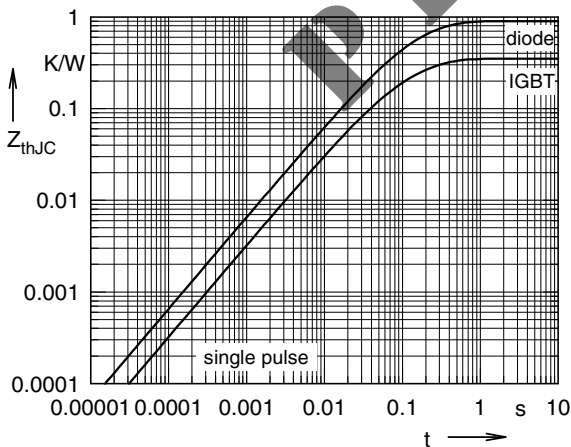


Fig. 13 Typ. transient thermal impedance

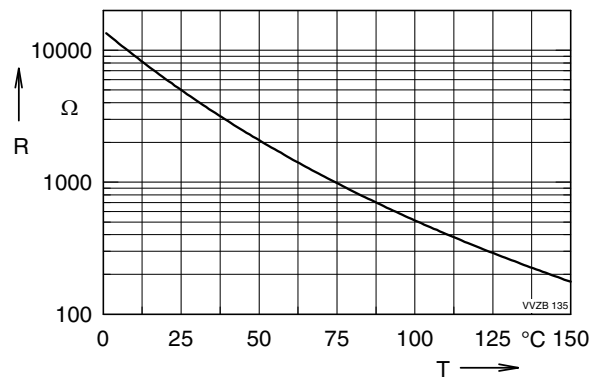


Fig. 14 Typ. thermistor resistance versus temperature