

Three Phase Rectifier Bridge

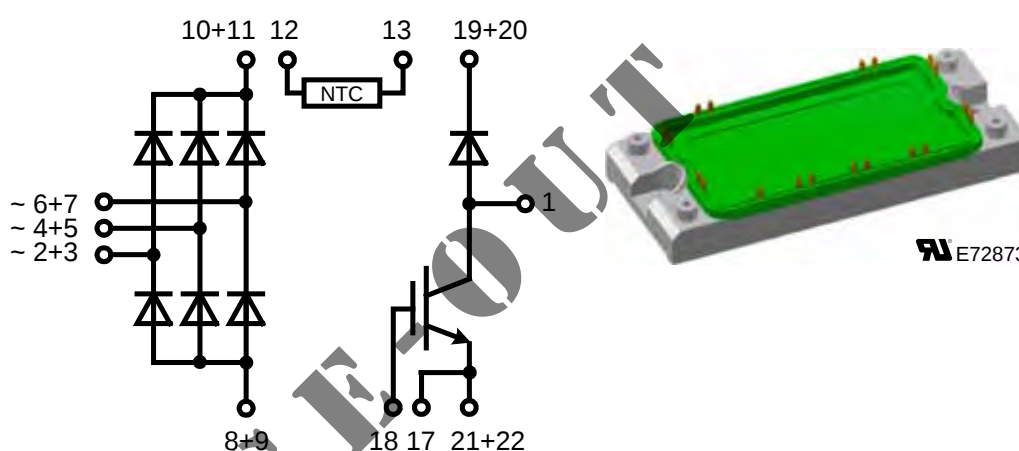
with IGBT and Fast Recovery Diode
for Braking System

Rectifier Diode	Fast Recov. Diode	IGBT
$V_{RRM} = 1600\text{ V}$	$V_{CES} = 1200\text{ V}$	$V_{CES} = 1200\text{ V}$
$I_{dAVM} = 116\text{ A}$	$V_F = 2.76\text{ V}$	$I_{C80} = 67\text{ A}$
$I_{FSM} = 700\text{ A}$	$I_{FSM} = 200\text{ A}$	$V_{CEsat} = 3.5\text{ V}$

Preliminary data

Part name (Marking on product)

VUB116-16NO1



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

Recommended replacement:
VUB 116-16NOXT

IGBT

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{CES}	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$ 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	$T_C = 25^{\circ}\text{C}$		95	A
I_{C80}		DC	$T_C = 80^{\circ}\text{C}$		67	A
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$		380	W
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 100\text{ A}$; $V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		3.5	V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 8\text{ mA}$	$T_{VJ} = 25^{\circ}\text{C}$	4.5	6.45	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}$; $V_{GE} = 0\text{ V}$ $V_{CE} = 0.8 \cdot V_{CES}$; $V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$		0.1 0.5	mA mA
C_{ies}	input capacitance	$V_{CE} = 25\text{ V}$; $V_{GE} = 0\text{ V}$; $f = 1\text{ MHz}$		3.8		nF
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 720\text{ V}$; $I_C = 50\text{ A}$ $V_{GE} = \pm 15\text{ V}$; $R_G = 22\ \Omega$; $L = 100\ \mu\text{H}$	$T_{VJ} = 125^{\circ}\text{C}$	150		ns
$t_{d(off)}$	turn-off delay time			680		ns
E_{on}	turn-on energy per pulse			6		mJ
E_{off}	turn-off energy per pulse			4		mJ
I_{CM}	reverse bias safe operating area	RBSOA; $V_{GE} = \pm 15\text{ V}$; $R_G = 22\ \Omega$; $L = 100\ \mu\text{H}$	$T_{VJ} = 125^{\circ}\text{C}$	100		A
V_{CEK}		clamped inductive load;	$\leq V_{CES} - L_S \cdot di/dt$			V
t_{SC} (SCSOA)	short circuit safe operating area	$V_{CE} = 720\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 22\ \Omega$; non-repetitive	$T_{VJ} = 125^{\circ}\text{C}$		10	μs
RBSOA	reverse bias safe operating area	$V_{CE} = 1200\text{ V}$; $V_{GE} = \pm 15\text{ V}$; $R_G = 22\ \Omega$; $L = 100\ \mu\text{H}$; clamped inductive load	$T_{VJ} = 125^{\circ}\text{C}$		100	A
R_{thJC}	thermal resistance junction to case				0.33	K/W
R_{thCH}	thermal resistance case to heatsink			0.33		K/W

Fast Recovery Diode

				Ratings		
Symbol	Definitions	Conditions	min.	typ.	max.	Unit
V_{RRM}	max. repetitive reverse voltage	$T_{VJ} = 150^{\circ}\text{C}$			1200	V
I_{FAV}	average forward current	rect.; $d = 0.5$	$T_C = 80^{\circ}\text{C}$		27	A
I_{FRMS}	rms forward current	rect.; $d = 0.5$	$T_C = 80^{\circ}\text{C}$		38	A
I_{FSM}	max. surge forward current	$t = 10\text{ ms}$	$T_{VJ} = 45^{\circ}\text{C}$		200	A
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$		130	W
V_{F0}	threshold voltage		$T_{VJ} = 150^{\circ}\text{C}$		1.3	V
r_F	slope resistance	for power loss calculation only			16	m Ω
V_F	forward voltage	$I_F = 30\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		2.76	V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$	1	0.25	mA mA
I_{RM}	reverse recovery current	$I_F = 50\text{ A}$; $V_R = 100\text{ V}$; $di_F/dt = -100\text{ A}/\mu\text{s}$		5.5	11	A
t_{rr}	reverse recovery time	$I_F = 1\text{ A}$; $V_R = 30\text{ V}$; $di_F/dt = -200\text{ A}/\mu\text{s}$		40		ns
R_{thJC}	thermal resistance junction to case				0.9	K/W
R_{thCH}	thermal resistance case to heatsink			0.1		K/W

 $T_C = 25^{\circ}\text{C}$ unless otherwise stated

Rectifier Diode

Symbol	Conditions			Ratings		
				min.	typ.	max.
V_{RRM}	max. repetitive reverse voltage		$T_{VJ} = 25^{\circ}\text{C}$			1600 V
I_R	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$			0.1 mA 2 mA
V_F	forward voltage	$I_F = 80\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.43 V
$I_{D(AV)M}$	max. average DC output current	rectangular; $d = 1/3$; bridge	$T_C = 80^{\circ}\text{C}$			116 A
V_{F0}	threshold voltage		$T_{VJ} = 150^{\circ}\text{C}$			0.85 V
r_F	slope resistance	for power loss calculation only				7.1 mΩ
R_{thJC}	thermal resistance junction to case	per diode	$T_{VJ} = 25^{\circ}\text{C}$			0.65 K/W
R_{thCH}	thermal resistance case to heatsink		$T_{VJ} = 25^{\circ}\text{C}$			0.1 K/W
P_{tot}	total power dissipation		$T_{VJ} = 25^{\circ}\text{C}$			190 W
I_{FSM}	max. forward surge current	$t = 10\text{ ms (50Hz)}$ $V_R = 0\text{ V}$	$T_{VJ} = 45^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$			700 A 610 A
I^2t	value for fusing	$t = 10\text{ ms (50Hz)}$ $V_R = 0\text{ V}$	$T_{VJ} = 45^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$			2450 A ² s 1860 A ² s

Temperature Sensor NTC

Symbol	Definitions	Conditions		Ratings			Unit
				min.	typ.	max.	
R_{25}	resistance		$T_C = 25^{\circ}\text{C}$	4.75	5.0	5.25	kΩ
$B_{25/85}$					3375		K

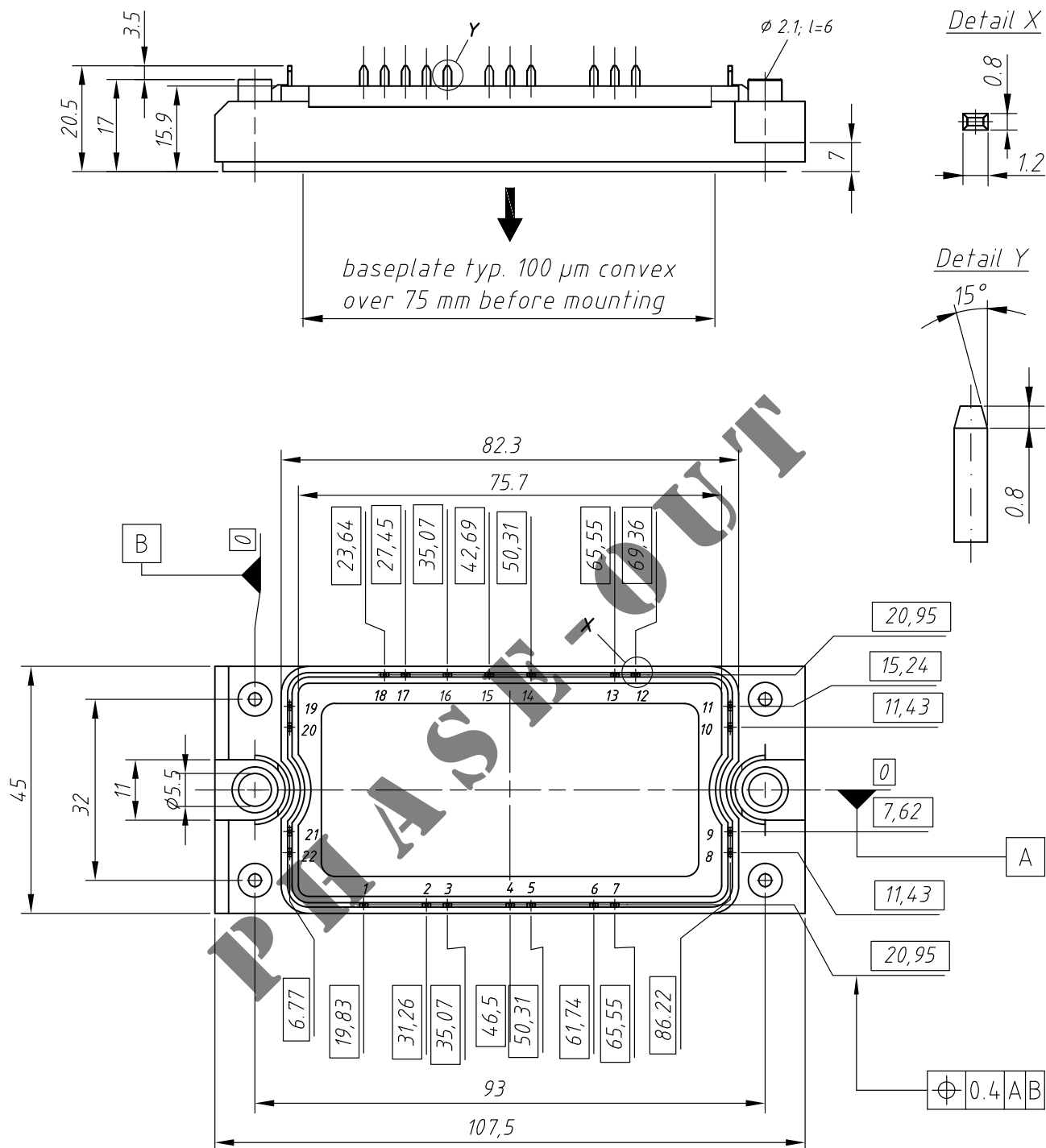
Module

Symbol	Definitions	Conditions		Ratings			Unit
				min.	typ.	max.	
T_{VJ}	operating temperature			-40		125	°C
T_{VJM}	max. virtual junction temperature					150	°C
T_{stg}	storage temperature			-40		125	°C
V_{ISOL}	isolation voltage	$I_{ISOL} \leq 1\text{ mA}; 50/60\text{ Hz};$	$t = 1\text{ min.}$ $t = 1\text{ s}$			2500 3000	V~ V~
M_d	mounting torque	(M5)		2.7		3.3	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/s ²
$R_{pin-chip}$	thermal resistance pin to chip		$T_{VJ} = 25^{\circ}\text{C}$		2		mΩ
Weight					180		g

$T_C = 25^{\circ}\text{C}$ unless otherwise stated

Outline Drawing

Dimensions in mm (1 mm = 0.0394")


Product Marking

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	VUB 116-16NO1	VUB116-16NO1	Box	6	496855

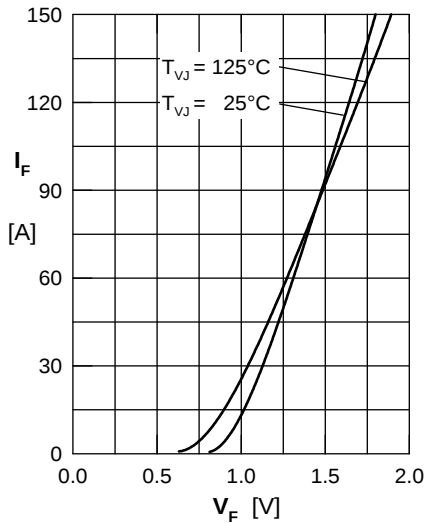


Fig. 1 Forward current vs. voltage drop per diode

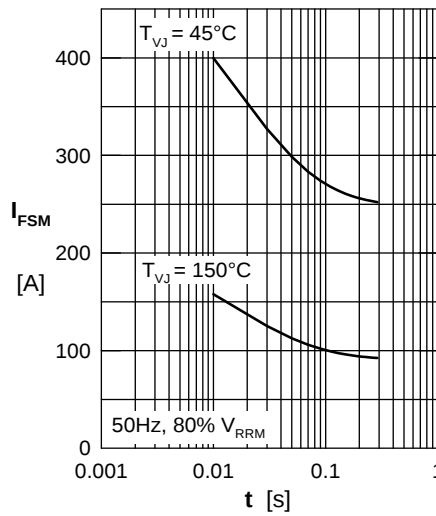


Fig. 2 Surge overload current

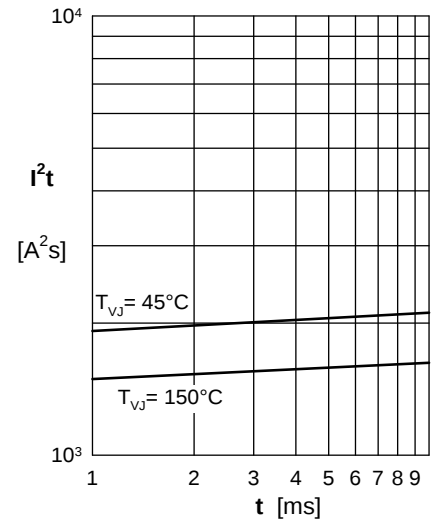


Fig. 3 I^2t versus time per diode

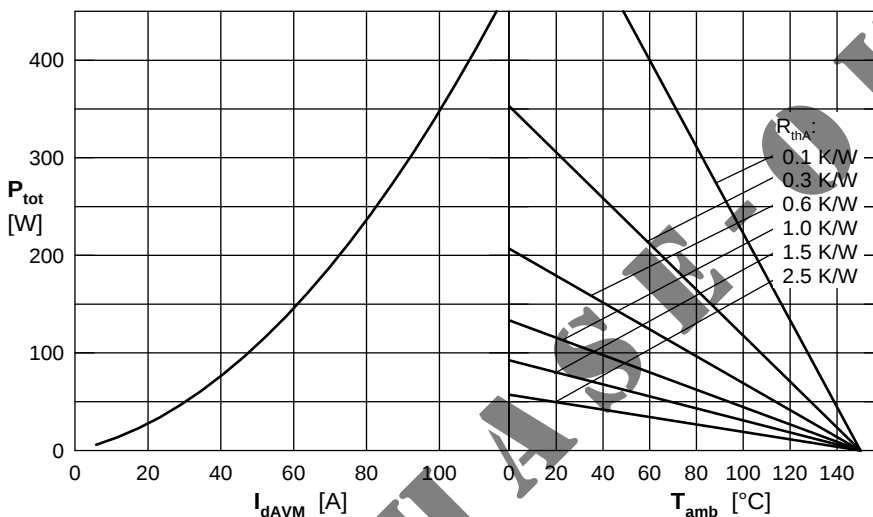


Fig. 4 Power dissipation versus direct output current and ambient temperature, sine 180°

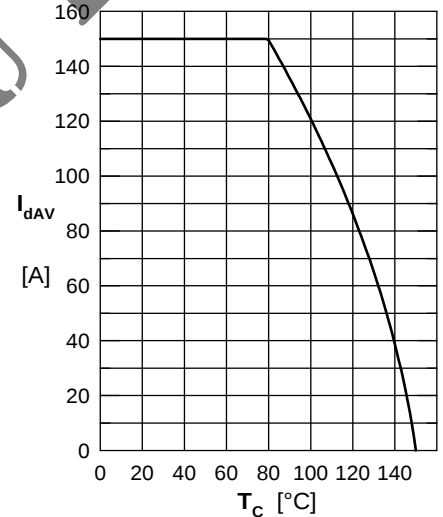


Fig. 5 Max. forward current vs. case temperature

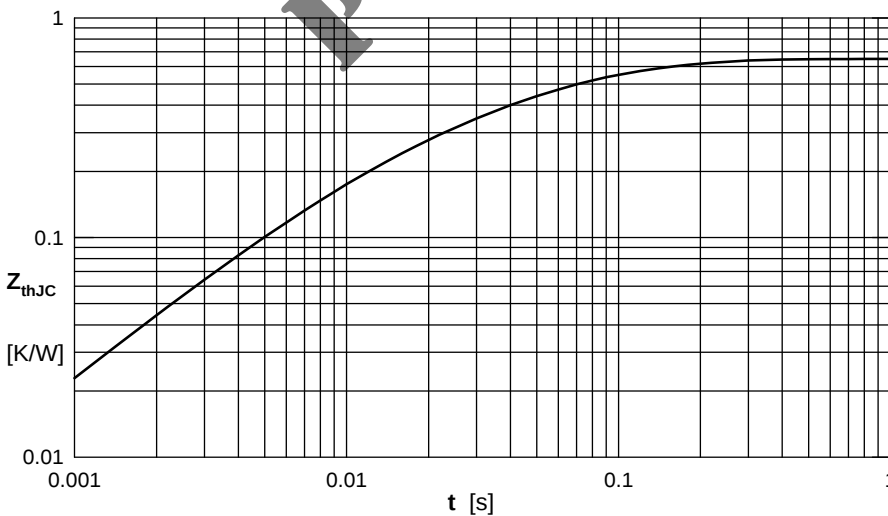


Fig. 6 Transient thermal impedance junction to case

R_i	τ_i
0.085	0.012
0.041	0.007
0.309	0.036
0.215	0.102

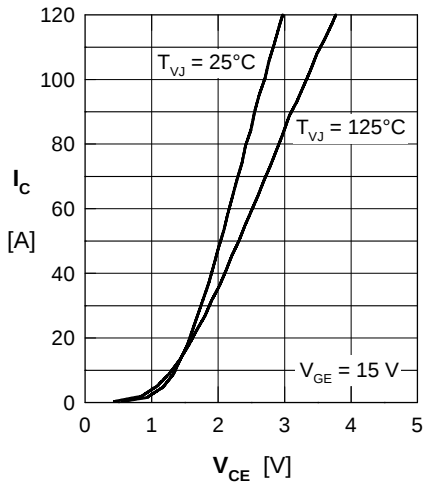


Fig. 7 Typ. output characteristics

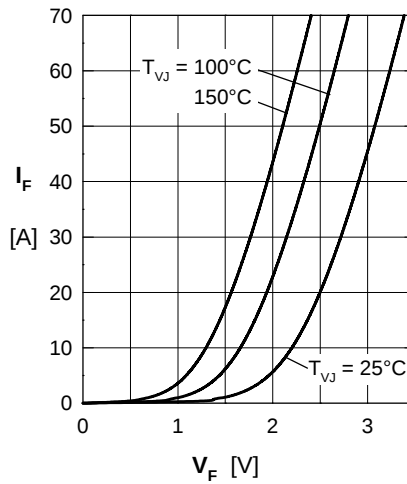


Fig. 8 Typ. forward characteristics of free wheeling diode

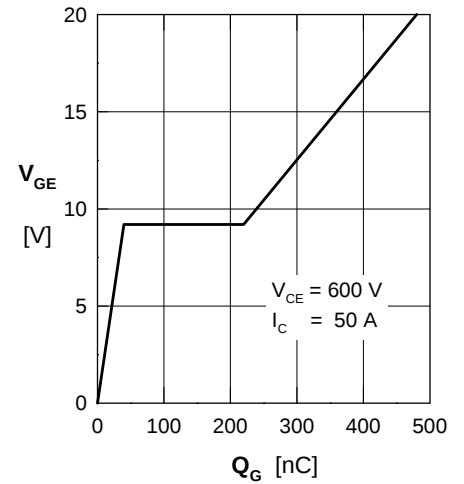


Fig. 9 Typ. turn on gate charge

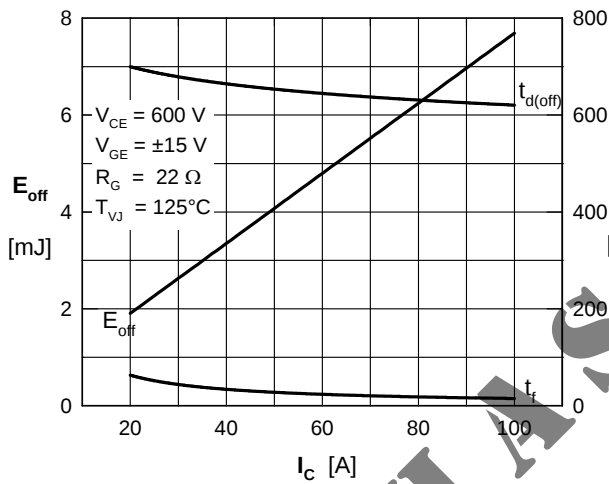


Fig. 10 Typ. turn off energy and switching times versus collector current

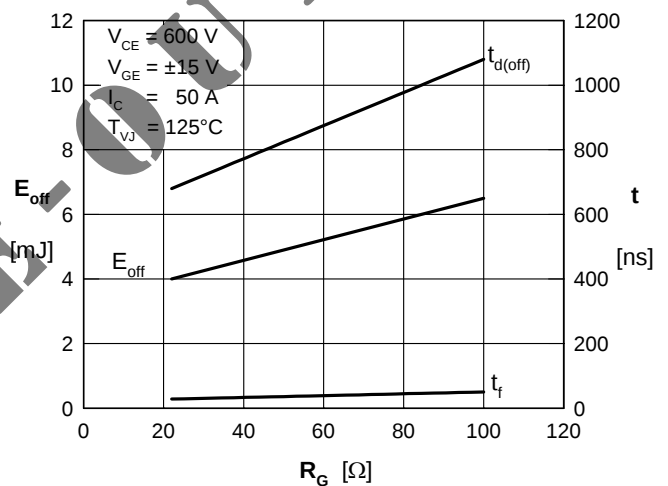


Fig. 11 Typ. turn off energy and switching times versus gate resistor

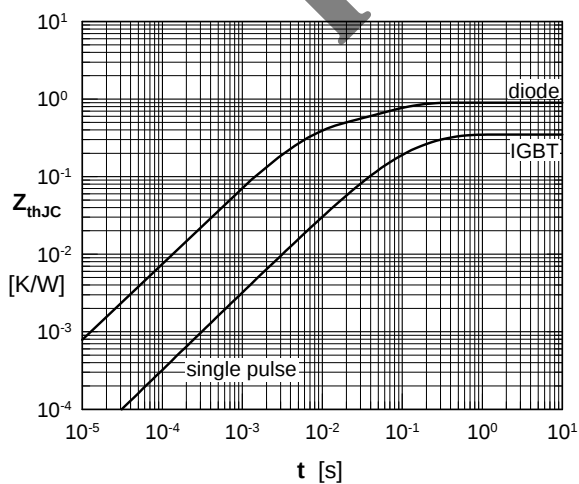


Fig. 12 Typ. transient thermal impedance

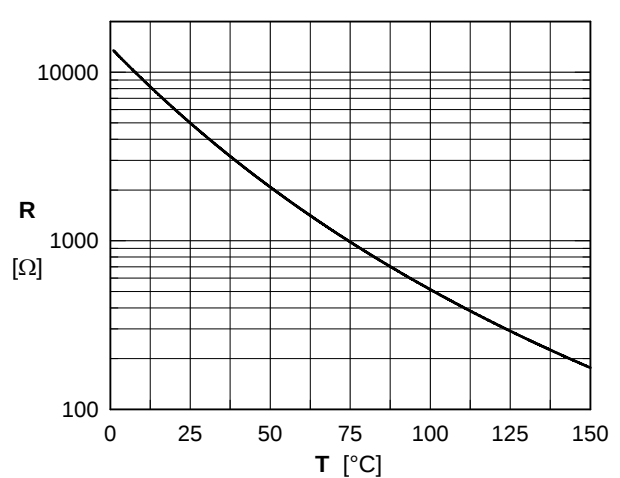


Fig. 13 Typ. thermistor resistance vs. temperature