Three Phase Rectifier Bridge

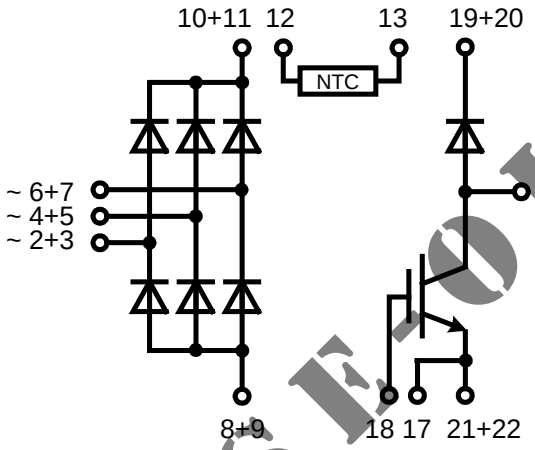
with IGBT and Fast Recovery Diode
for Braking System

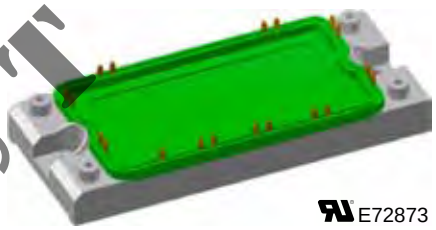
Rectifier Diode	Fast Recov. Diode	IGBT
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{dAVM} = 116 A	V_F = 2.76 V	I_{C80} = 67 A
I_{FSM} = 700 A	I_{FSM} = 200 A	V_{CEsat} = 3.5 V

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

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
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			95	A
I_{C80}		DC	T_C = 80°C			67	A
P_{tot}	*total power dissipation*		T_C = 25°C			380	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 100 A; V_{GE} = 15 V	T_{VJ} = 25°C			3.5	V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 8 mA	T_{VJ} = 25°C	4.5		6.45	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.1	mA
		V_{CE} = 0.8·V_{CES}; V_{GE} = 0 V	T_{VJ} = 125°C			0.5	mA
C_{ies}	*input capacitance*	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz			3.8		nF
$t_{d(on)}$	*turn-on delay time*	inductive load	T_{VJ} = 125°C		150		ns
$t_{d(off)}$	*turn-off delay time*	V_{CE} = 720 V; I_C = 50 A			680		ns
E_{on}	*turn-on energy per pulse*	V_{GE} = ±15 V; R_G = 22 Ω; L = 100 µH			6		mJ
E_{off}	*turn-off energy per pulse*				4		mJ
I_{CM}	*reverse bias safe operating area*	RBSOA; V_{GE} = ±15 V; R_G = 22 Ω; L = 100 µH			100		A
V_{CEK}		clamped inductive load;	T_{VJ} = 125°C		≤ V_{CES}-L_S·d_i/dt		V
t_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 22 Ω; non-repetitive	T_{VJ} = 125°C			10	µs
RBSOA	*reverse bias safe operating area*	V_{CE} = 1200 V; V_{GE} = ±15 V; R_G = 22 Ω; L = 100 µH; clamped inductive load	T_{VJ} = 125°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

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
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			27	A
I_{FRMS}	*rms forward current*	rect.; d = 0.5	T_C = 80°C			38	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				16	mΩ
V_F	*forward voltage*	I_F = 30 A	T_{VJ} = 25°C			2.76	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			5.5	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*				0.1		K/W

T_C = 25°C unless otherwise stated

Rectifier Diode

Symbol	Conditions			Ratings min.	typ.	max.	
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 25°C			1600	V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C			0.1	mA
			T_{VJ} = 150°C			2	mA
V_F	*forward voltage*	I_F = 80 A	T_{VJ} = 25°C			1.43	V
$I_{D(AV)M}$	*max. average DC output current*	rectangular; d = $^1/_3$; bridge	T_C = 80°C			116	A
V_{F0}	*threshold voltage*		T_{VJ} = 150°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°C			0.65	K/W
R_{thCH}	*thermal resistance case to heatsink*		T_{VJ} = 25°C			0.1	K/W
P_{tot}	*total power dissipation*		T_{VJ} = 25°C			190	W
I_{FSM}	*max. forward surge current*	t = 10 ms (50Hz)	T_{VJ} = 45°C			700	A
		V_R = 0 V	T_{VJ} = 150°C			610	A
I^2t	*value for fusing*	t = 10 ms (50Hz)	T_{VJ} = 45°C			2450	A^2s
		V_R = 0 V	T_{VJ} = 150°C			1860	A^2s

Temperature Sensor NTC

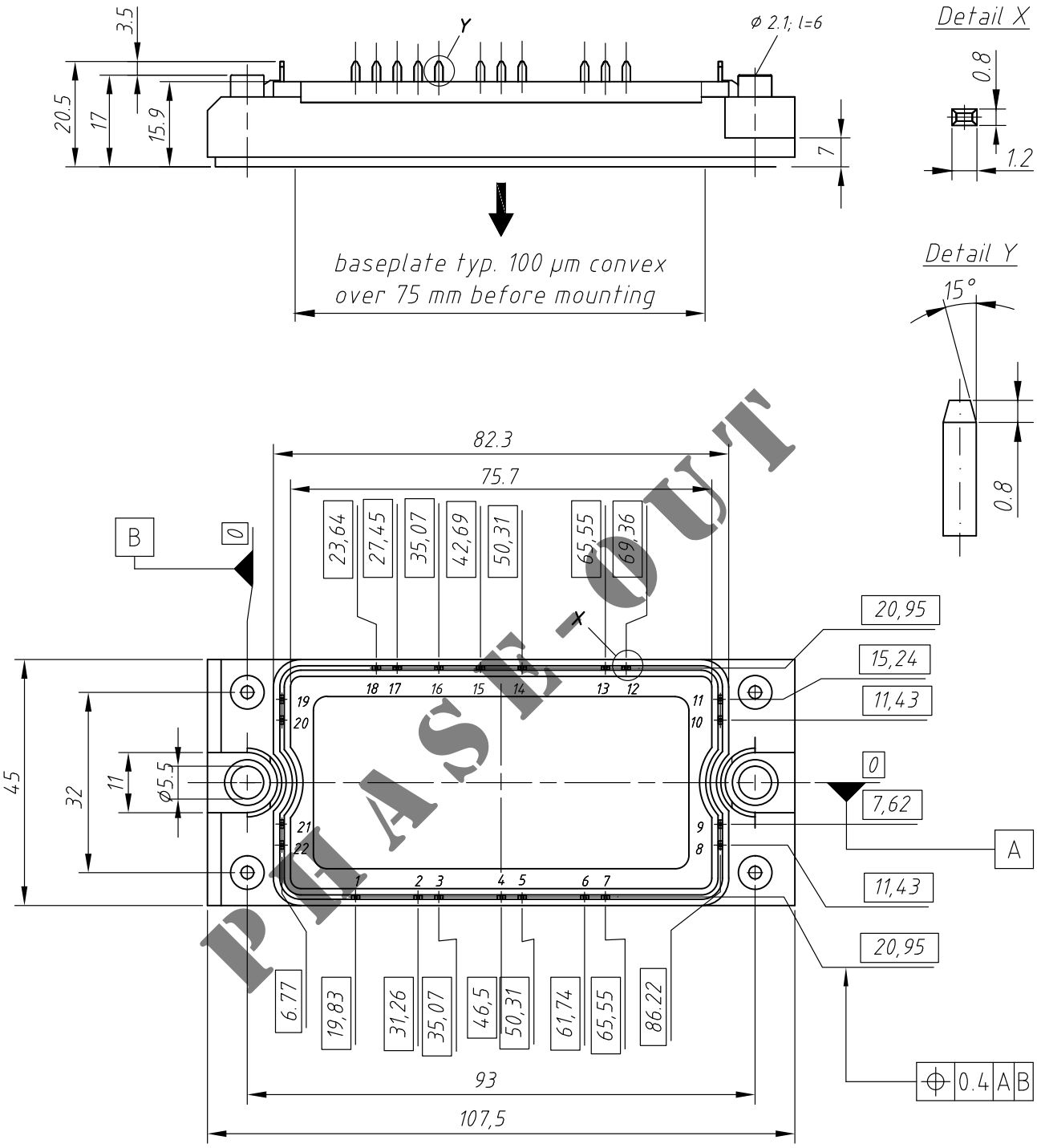
Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
R_{25}	*resistance*		T_C = 25°C	4.75	5.0	5.25	kΩ
$B_{25/85}$					3375		K

Module

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
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 mA; 50/60 Hz;	t = 1 min.			2500	V~
			t = 1 s			3000	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
$R_{pin\text{-}chip}$	*thermal resistance pin to chip*		T_{VJ} = 25°C		2		mΩ
Weight					180		g

T_C = 25°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

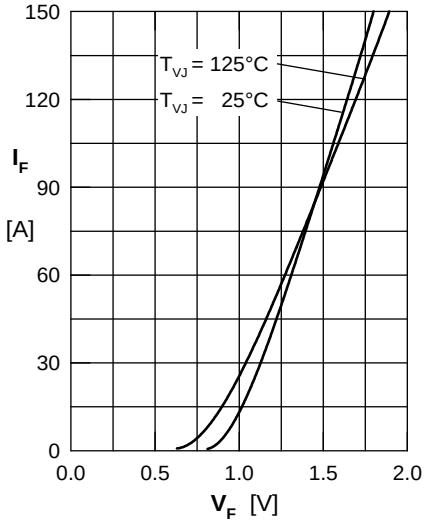


Fig. 1 Forward current vs. voltage drop per diode

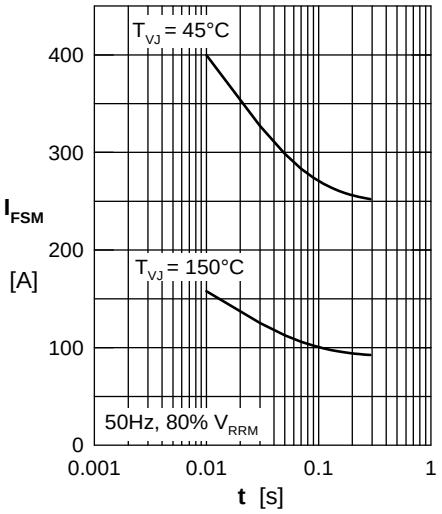


Fig. 2 Surge overload current

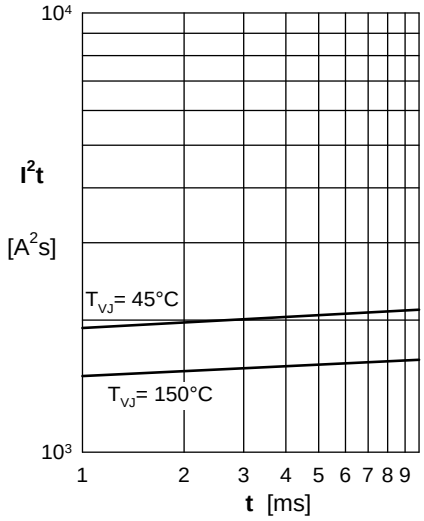


Fig. 3 I^2t versus time per diode

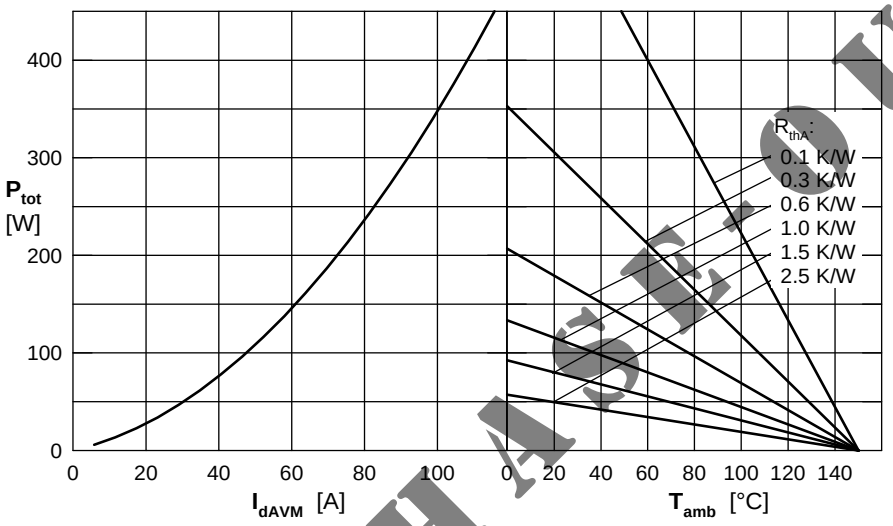


Fig. 4 Power dissipation versus direct output current and ambient temperature, sine 180°

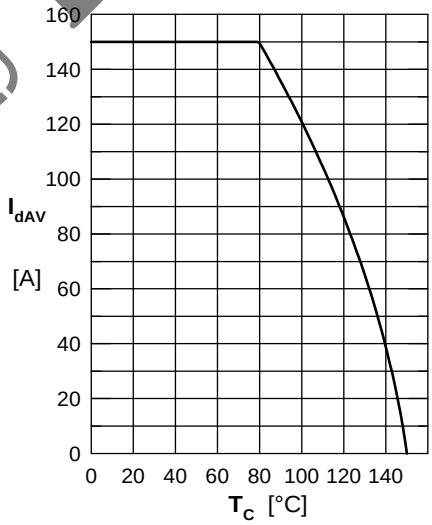


Fig. 5 Max. forward current vs. case temperature

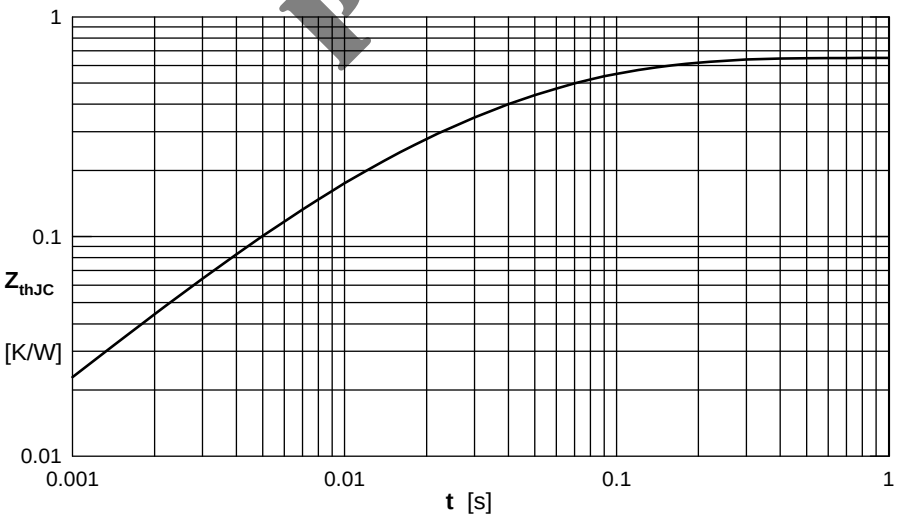


Fig. 6 Transient thermal impedance junction to case

R_i	τ_i
0.085	0.012
0.041	0.007
0.309	0.036
0.215	0.102

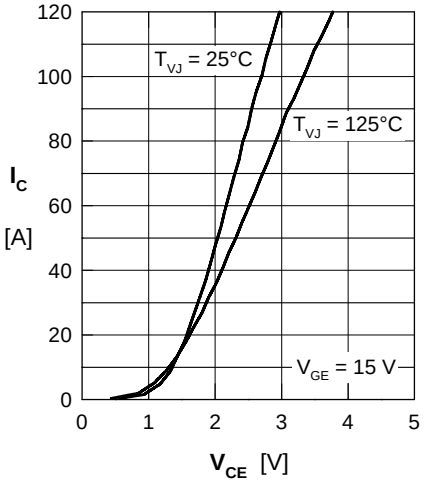


Fig. 7 Typ. output characteristics

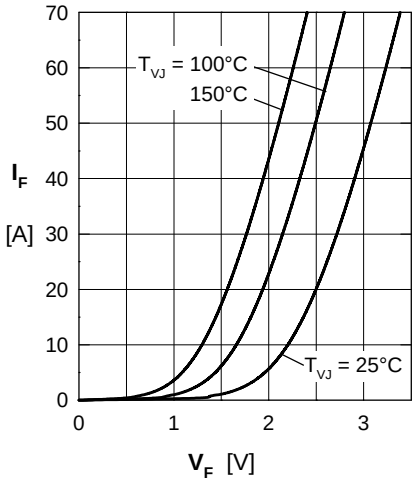


Fig. 8 Typ. forward characteristics of free wheeling diode

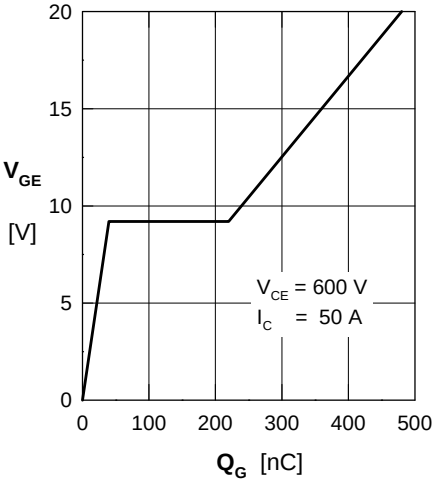


Fig. 9 Typ. turn on gate charge

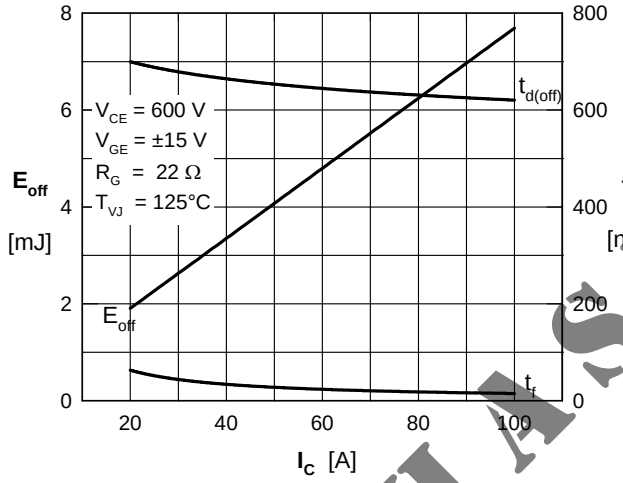


Fig. 10 Typ. turn off energy and switching times versus collector current

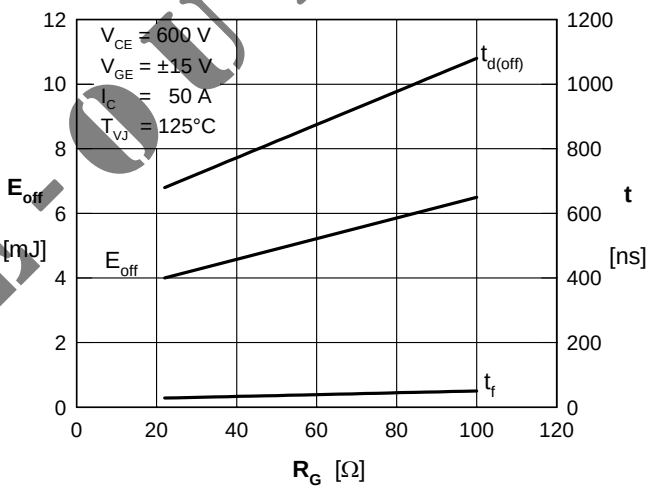


Fig. 11 Typ. turn off energy and switching times versus gate resistor

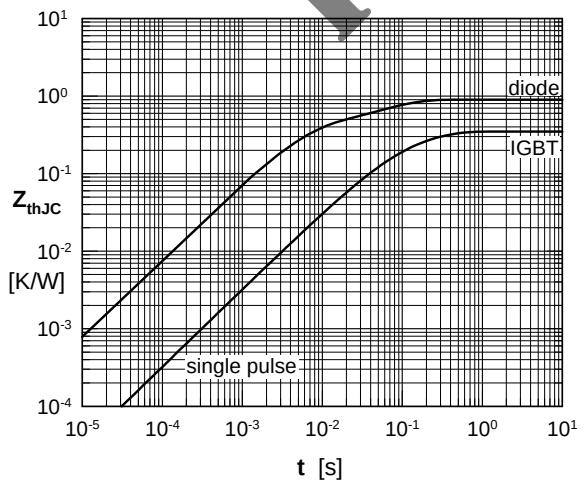


Fig. 12 Typ. transient thermal impedance

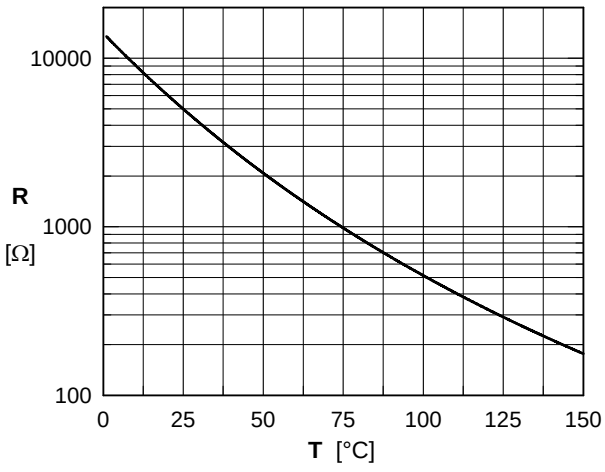


Fig. 13 Typ. thermistor resistance vs. temperature