

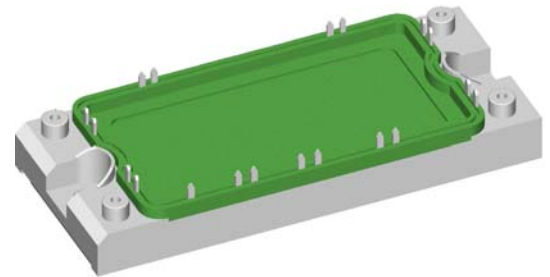
Standard Rectifier Module

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

3~ Rectifier Bridge + Brake Unit + NTC

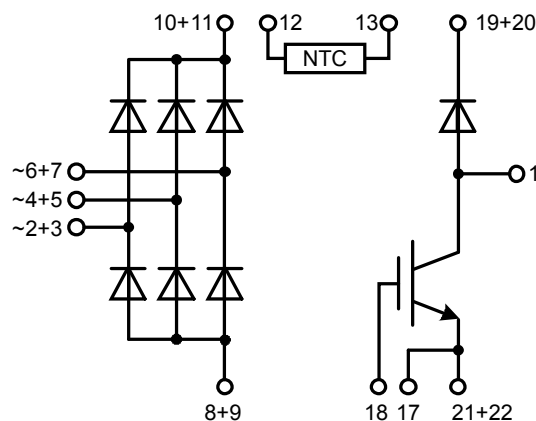
Part number

VUB116-16NOXT



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

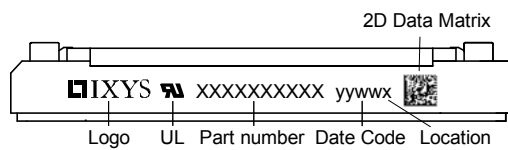
Package: E2-Pack

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling

Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
V_{RSM}	max. non-repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1700	V
V_{RRM}	max. repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1600	V
I_R	reverse current	$V_R = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_R = 1600\text{ V}$	$T_{VJ} = 150^{\circ}\text{C}$			1.5	mA
V_F	forward voltage drop	$I_F = 40\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.19	V
		$I_F = 120\text{ A}$				1.64	V
		$I_F = 40\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.12	V
		$I_F = 120\text{ A}$				1.70	V
I_{DAV}	bridge output current	$T_C = 105^{\circ}\text{C}$	$T_{VJ} = 150^{\circ}\text{C}$			120	A
		rectangular $d = \frac{1}{3}$					
V_{FO}	threshold voltage	} for power loss calculation only		$T_{VJ} = 150^{\circ}\text{C}$		0.80	V
r_F	slope resistance					7.6	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	$T_C = 25^{\circ}\text{C}$				190	W
I_{FSM}	max. forward surge current	$t = 10\text{ ms; (50 Hz), sine}$	$T_{VJ} = 45^{\circ}\text{C}$			700	A
		$t = 8,3\text{ ms; (60 Hz), sine}$	$V_R = 0\text{ V}$			755	A
		$t = 10\text{ ms; (50 Hz), sine}$	$T_{VJ} = 150^{\circ}\text{C}$			595	A
		$t = 8,3\text{ ms; (60 Hz), sine}$	$V_R = 0\text{ V}$			645	A
I^2t	value for fusing	$t = 10\text{ ms; (50 Hz), sine}$	$T_{VJ} = 45^{\circ}\text{C}$			2.45	kA ² s
		$t = 8,3\text{ ms; (60 Hz), sine}$	$V_R = 0\text{ V}$			2.37	kA ² s
		$t = 10\text{ ms; (50 Hz), sine}$	$T_{VJ} = 150^{\circ}\text{C}$			1.77	kA ² s
		$t = 8,3\text{ ms; (60 Hz), sine}$	$V_R = 0\text{ V}$			1.73	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V; } f = 1\text{ MHz}$		$T_{VJ} = 25^{\circ}\text{C}$	27		pF

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	$I_C = 75\text{ A}; V_{GE} = 15\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		1.8	2.1	V
			$T_{VJ} = 125^{\circ}\text{C}$		2.1		V
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 3\text{ mA}; V_{GE} = V_{CE}$	$T_{VJ} = 25^{\circ}\text{C}$	5.5	6.0	6.5	V
I_{CES}	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			0.2	mA
			$T_{VJ} = 125^{\circ}\text{C}$		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						
t_{sc}	short circuit duration	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			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	} $V_R = 600\text{ V}$ $-di_F/dt = 400\text{ A}/\mu\text{s}$ $I_F = 30\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$		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			200	A
T _{stg}	storage temperature		-40		125	°C
T _{VJ}	virtual junction temperature		-40		150	°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	3600			V
		t = 1 minute	3000			V
		50/60 Hz, RMS; I _{ISOL} ≤ 1 mA				



Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	VUB116-16NOXT	VUB116-16NOXT	Box	6	510755

Temperature Sensor NTC

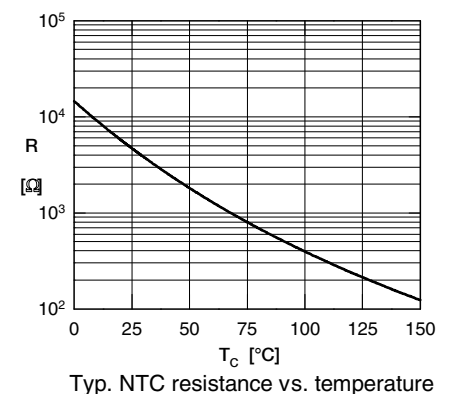
Symbol	Definition	Conditions	min.	typ.	max.	Unit
R_{25}	resistance	$T_{VJ} = 25^\circ$	4.75	5	5.25	kΩ
$B_{25/50}$	temperature coefficient			3375		K

Equivalent Circuits for Simulation

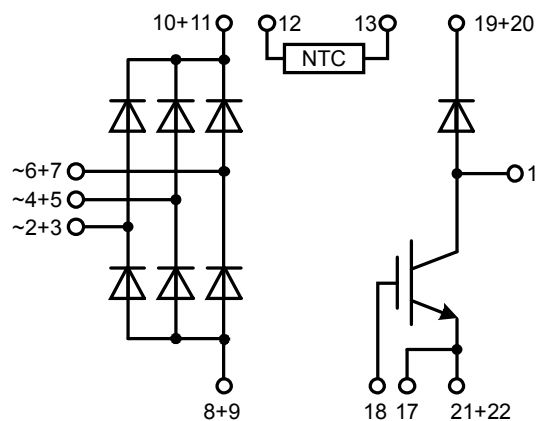
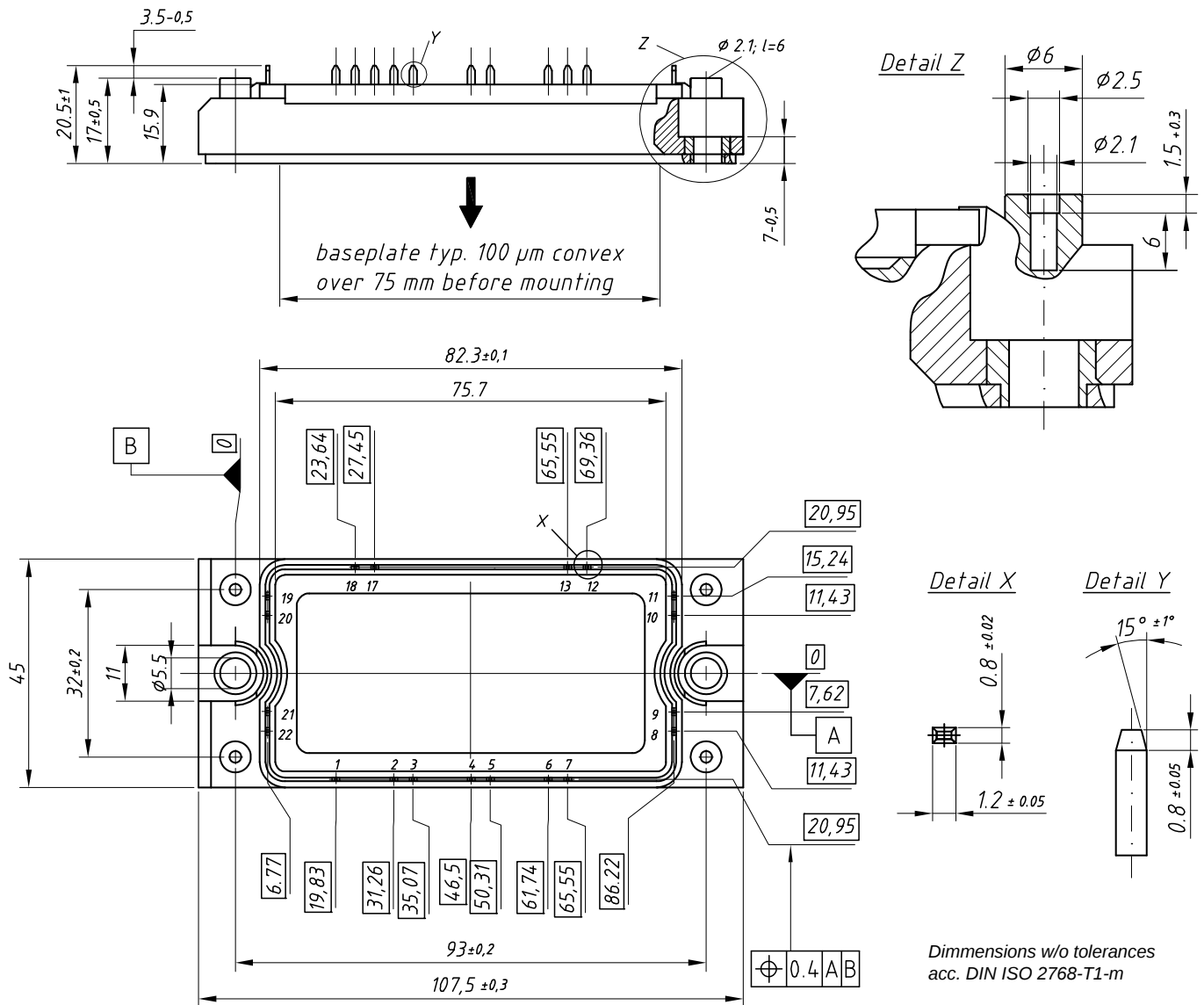
* on die level

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

		Rectifier	Brake IGBT	Brake Diode	
V_0	threshold voltage	0.8	1.1	1.31	V
R_0	slope resistance *	4.5	17.9	8	mΩ



Outlines E2-Pack



Rectifier

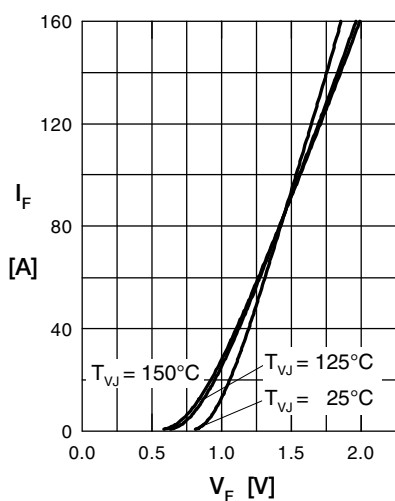


Fig. 1 Forward current versus voltage drop per diode

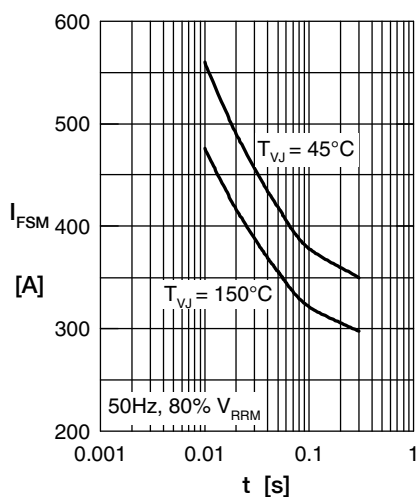


Fig. 2 Surge overload current

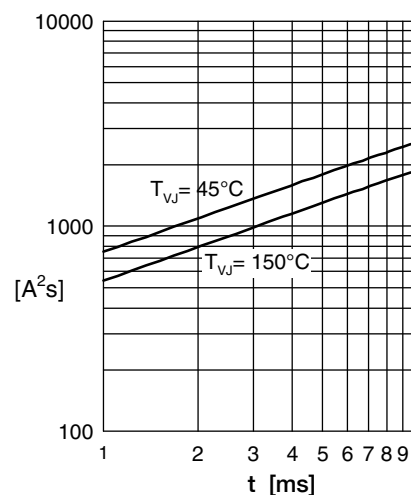


Fig. 3 I^2t versus time per diode

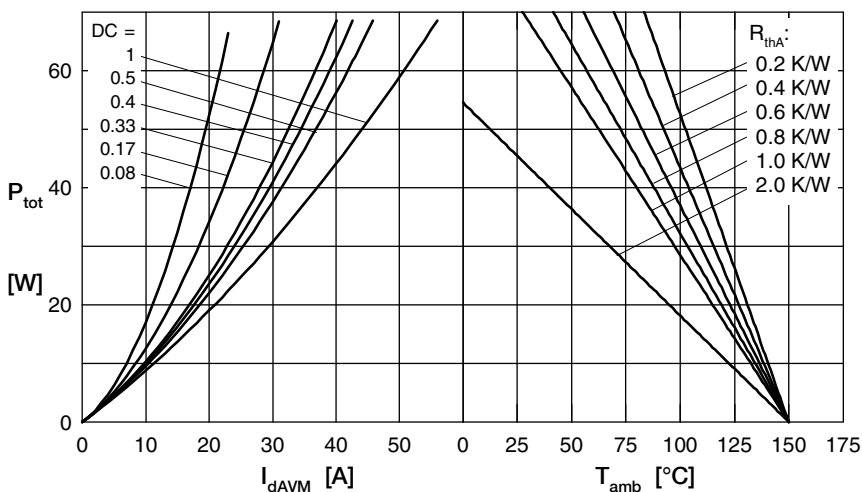


Fig. 4 Power dissipation vs. direct output current and ambient temperature

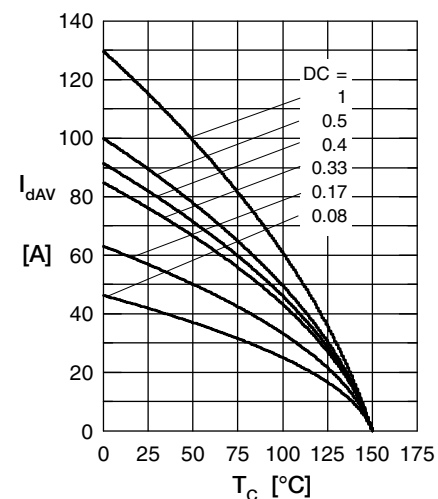


Fig. 5 Max. forward current vs. case temperature

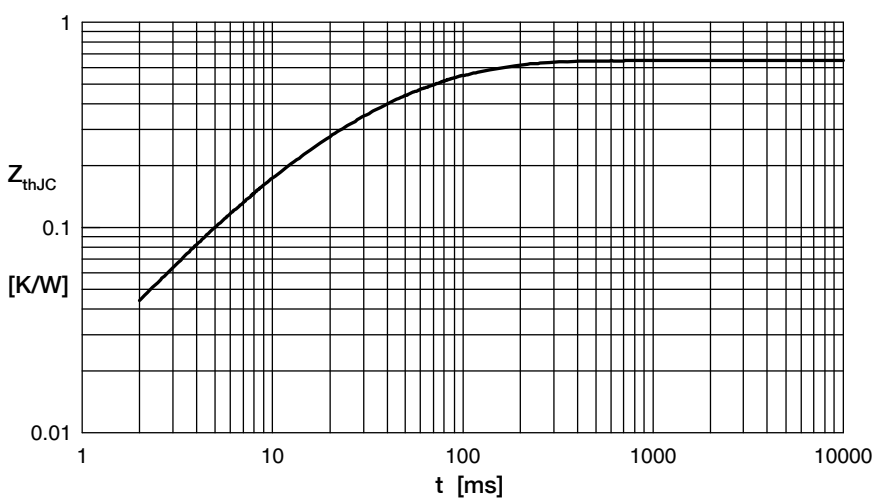


Fig. 6 Transient thermal impedance junction to case

R_i	i
0.085	0.012
0.041	0.007
0.309	0.036
0.215	0.102

Brake IGBT

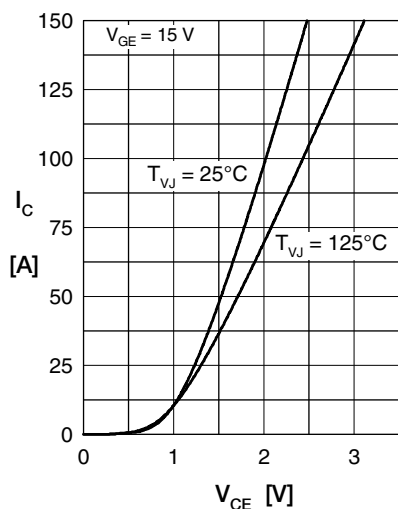


Fig. 1 Typ. output characteristics

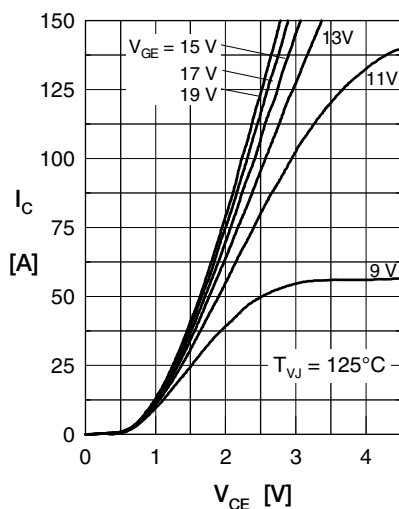


Fig. 2 Typ. output characteristics

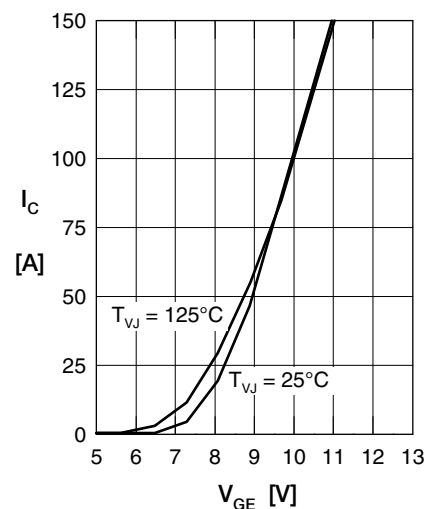


Fig. 3 Typ. transfer characteristics

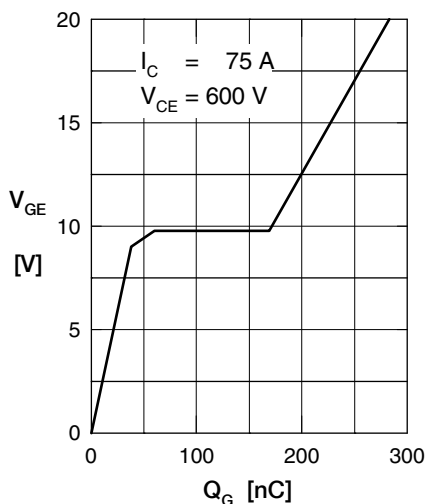


Fig. 4 Typ. turn-on gate charge

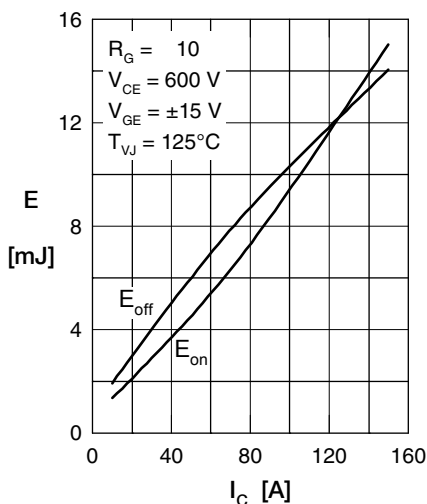


Fig. 5 Typ. switching energy versus collector current

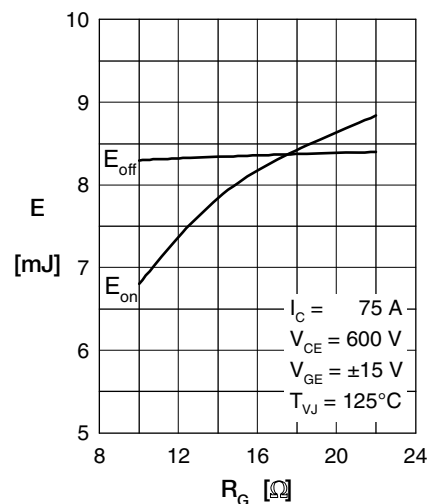


Fig. 6 Typ. switching energy versus gate resistance

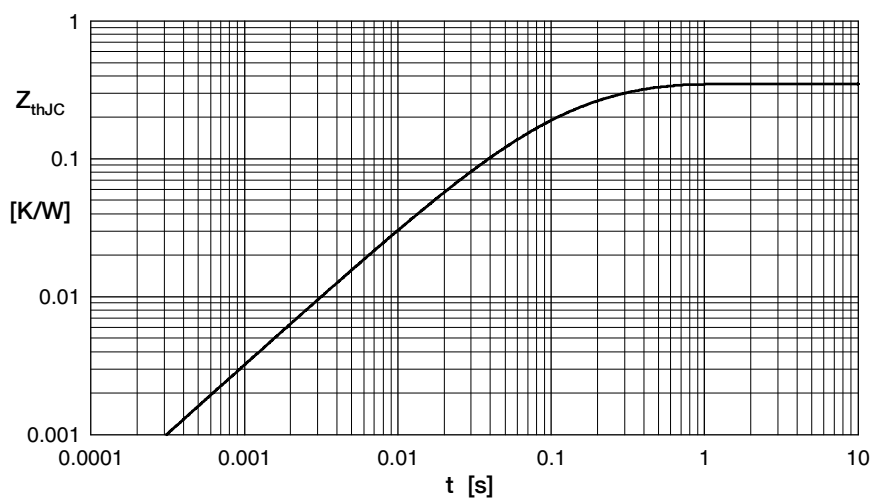


Fig. 7 Typ. transient thermal impedance junction to case

Brake Diode

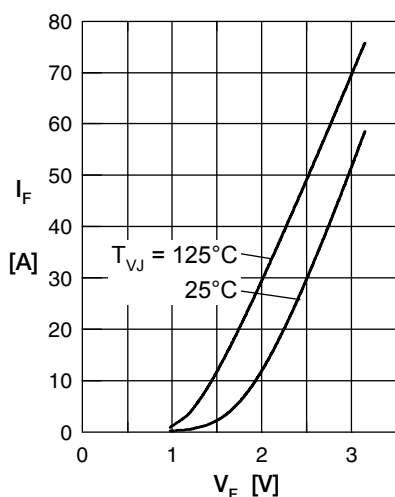


Fig. 1 Forward current I_F vs. V_F

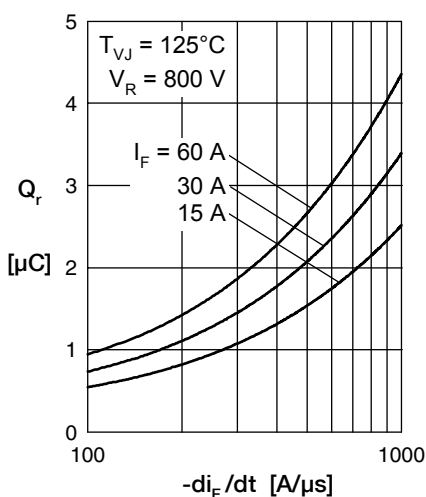


Fig. 2 Typ. reverse recovery charge Q_r versus $-di_F/dt$

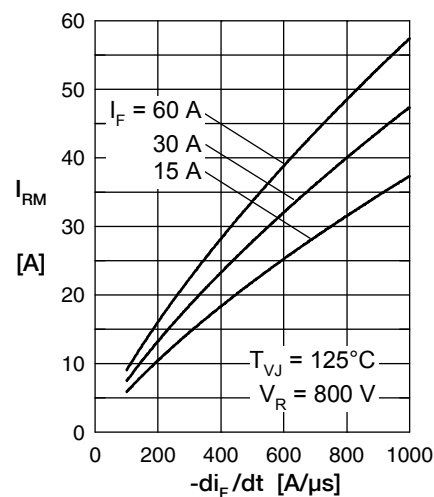


Fig. 3 Typ. peak reverse current I_{RM} versus $-di_F/dt$

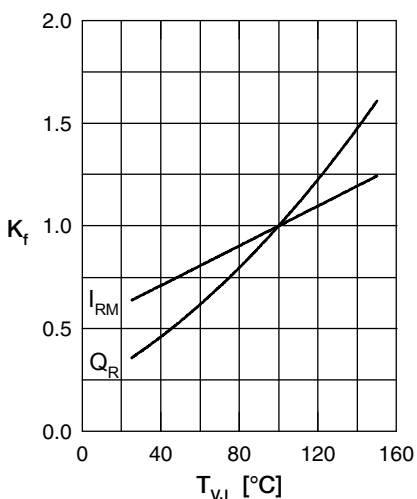


Fig. 4 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

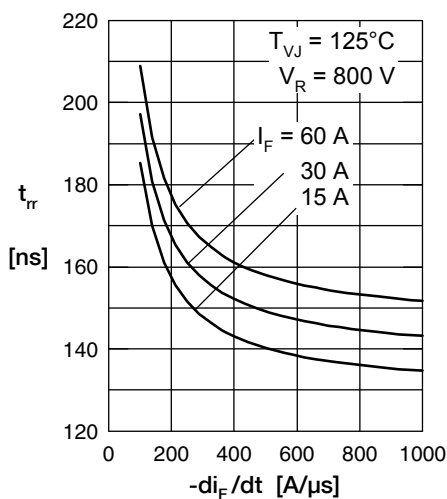


Fig. 5 Typ. recovery time t_{rr} versus $-di_F/dt$

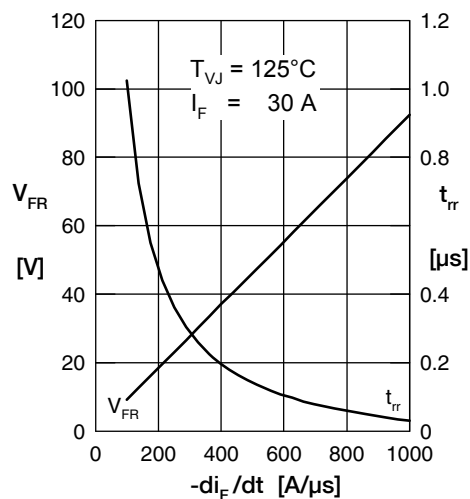


Fig. 6 Typ. peak forward voltage V_{FR} and t_{rr} versus di_F/dt

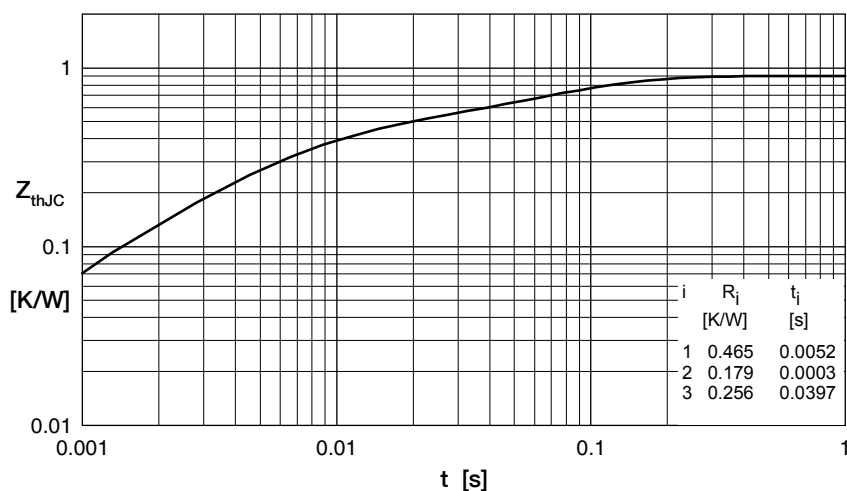


Fig. 7 Transient thermal impedance junction to case