

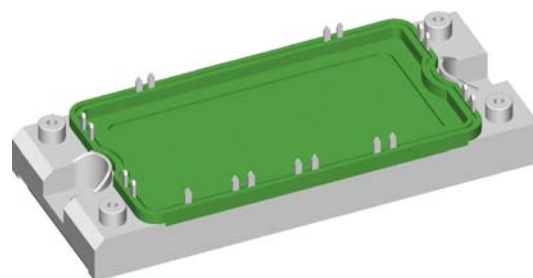
Standard Rectifier Module

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

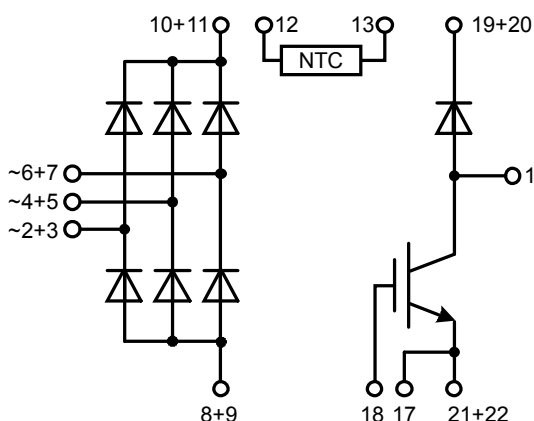
Part number

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

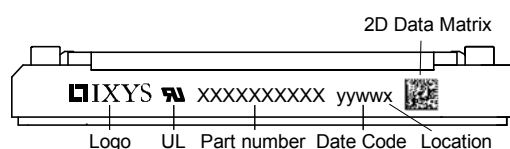
Package: E2-Pack

- 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	$T_C = 105^{\circ}\text{C}$ rectangular $d = \frac{1}{3}$	$T_{VJ} = 150^{\circ}\text{C}$			120	A
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	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			700	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			755	A
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			595	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			645	A
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			2.45	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			2.37	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			1.77	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1.73	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V}; f = 1\text{ MHz}$			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 $V_{CE} = 600\text{ V}; I_C = 75\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 10\text{ }\Omega$	$T_{VJ} = 125^{\circ}\text{C}$		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	$V_{GE} = \pm 15\text{ V}; R_G = 10\text{ }\Omega$	$T_{VJ} = 125^{\circ}\text{C}$				
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	$R_G = 10\text{ }\Omega$; 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		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

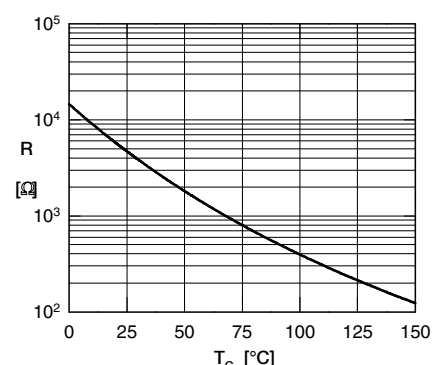
Symbol	Definition	Conditions	min.	typ.	max.	Unit
R_{25}	resistance	$T_{VJ} = 25^\circ$	4.75	5	5.25	k Ω
$B_{25/50}$	temperature coefficient			3375		K

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	m Ω



Typ. NTC resistance vs. temperature

Technical drawing of the baseplate showing top, side, and detail views with dimensions and labels.

Top View Dimensions:

- Overall width: $107,5 \pm 0,3$
- Overall height: 45
- Inner width: $93 \pm 0,2$
- Inner height: $32 \pm 0,2$
- Distance from top edge to mounting holes: 11
- Mounting hole diameter: $\phi 5,5$
- Distance from side edge to mounting holes: $6,77$
- Distance from center to mounting holes: $19,83$
- Distance from center to mounting holes: $31,26$
- Distance from center to mounting holes: $35,07$
- Distance from center to mounting holes: $46,5$
- Distance from center to mounting holes: $50,31$
- Distance from center to mounting holes: $61,74$
- Distance from center to mounting holes: $65,55$
- Distance from center to mounting holes: $86,22$

Side View Dimensions:

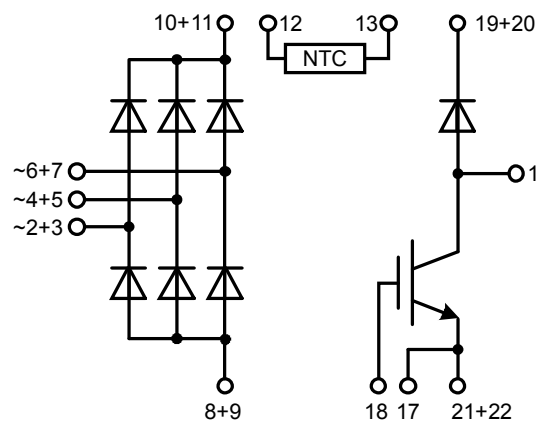
- Overall height: $20,5 \pm 1$
- Distance from top edge to mounting holes: $17 \pm 0,5$
- Distance from top edge to mounting holes: $15,9$
- Mounting hole diameter: $\phi 2,1$
- Distance from side edge to mounting holes: $3,5-0,5$
- Distance from center to mounting holes: $7-0,5$

Detail View Dimensions:

- Mounting hole diameter: $\phi 2,1$
- Distance from side edge to mounting holes: $l=6$

Labels and Notes:

- A:** $11,43$
- B:** $7,62$
- C:** $20,95$
- D:** $15,24$
- E:** $11,43$
- F:** $20,95$
- G:** $11,43$
- H:** $15,24$
- I:** $20,95$
- J:** $11,43$
- K:** $15,24$
- L:** $20,95$
- M:** $11,43$
- N:** $15,24$
- O:** $20,95$
- P:** $11,43$
- Q:** $15,24$
- R:** $20,95$
- S:** $11,43$
- T:** $15,24$
- U:** $20,95$
- V:** $11,43$
- W:** $15,24$
- X:** $20,95$
- Y:** $11,43$
- Z:** $15,24$
- AA:** $20,95$
- AB:** $11,43$
- AC:** $15,24$
- AD:** $20,95$
- AE:** $11,43$
- AF:** $15,24$
- AG:** $20,95$
- AH:** $11,43$
- AI:** $15,24$
- AJ:** $20,95$
- AK:** $11,43$
- AL:** $15,24$
- AM:** $20,95$
- AN:** $11,43$
- AO:** $15,24$
- AP:** $20,95$
- AQ:** $11,43$
- AR:** $15,24$
- AS:** $20,95$
- AT:** $11,43$
- AU:** $15,24$
- AV:** $20,95$
- AW:** $11,43$
- AX:** $15,24$
- AY:** $20,95$
- AZ:** $11,43$
- BA:** $15,24$
- BB:** $20,95$
- BC:** $11,43$
- BD:** $15,24$
- BE:** $20,95$
- BF:** $11,43$
- BG:** $15,24$
- BH:** $20,95$
- BI:** $11,43$
- BJ:** $15,24$
- BK:** $20,95$
- BL:** $11,43$
- BM:** $15,24$
- BN:** $20,95$
- BO:** $11,43$
- BP:** $15,24$
- BQ:** $20,95$
- BR:** $11,43$
- BS:** $15,24$
- BT:** $20,95$
- BU:** $11,43$
- BV:** $15,24$
- BW:** $20,95$
- BX:** $11,43$
- BY:** $15,24$
- BZ:** $20,95$
- CA:** $11,43$
- CB:** $15,24$
- CC:** $20,95$
- CD:** $11,43$
- CE:** $15,24$
- CF:** $20,95$
- CG:** $11,43$
- CH:** $15,24$
- CI:** $20,95$
- CJ:** $11,43$
- CK:** $15,24$
- CL:** $20,95$
- CM:** $11,43$
- CN:** $15,24$
- CO:** $20,95$
- CP:** $11,43$
- CQ:** $15,24$
- CR:** $20,95$
- CS:** $11,43$
- CT:** $15,24$
- CU:** $20,95$
- CV:** $11,43$
- CW:** $15,24$
- CX:** $20,95$
- CY:** $11,43$
- CZ:** $15,24$
- DA:** $20,95$
- DB:** $11,43$
- DC:** $15,24$
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- DF:** $15,24$
- DG:** $20,95$
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- DI:** $15,24$
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- DK:** $11,43$
- DL:** $15,24$
- DM:** $20,95$
- DN:** $11,43$
- DO:** $15,24$
- DP:** $20,95$
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- DR:** $15,24$
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- DU:** $15,24$
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- EX:** $20,95$
- EY:** $11,43$
- EZ:** $15,24$
- FA:** $11,43$
- FB:** $15,24$
- FC:** $20,95$



Rectifier

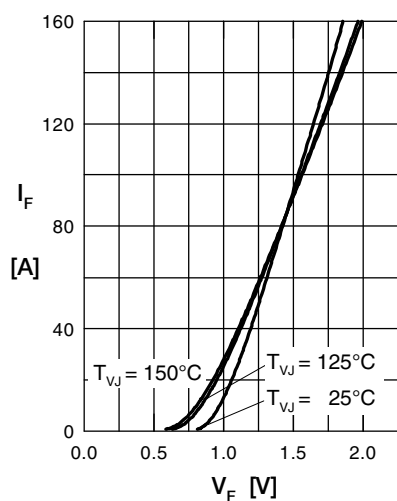


Fig. 1 Forward current versus voltage drop per diode

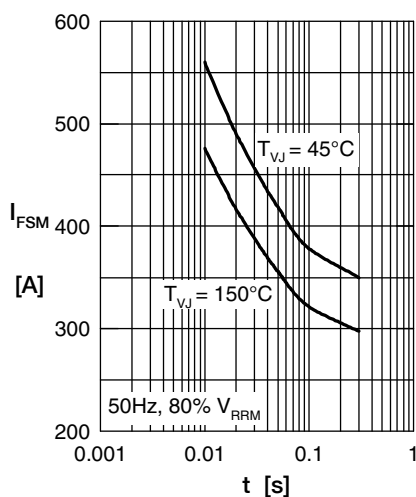


Fig. 2 Surge overload current

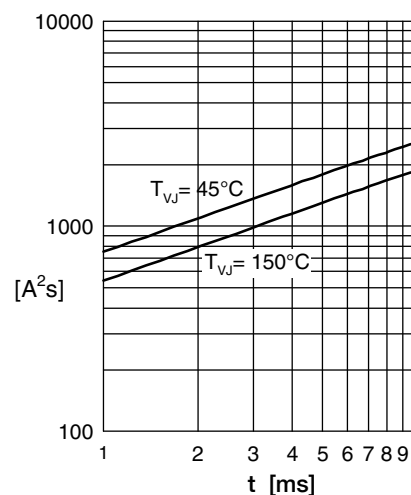


Fig. 3 I^2t versus time per diode

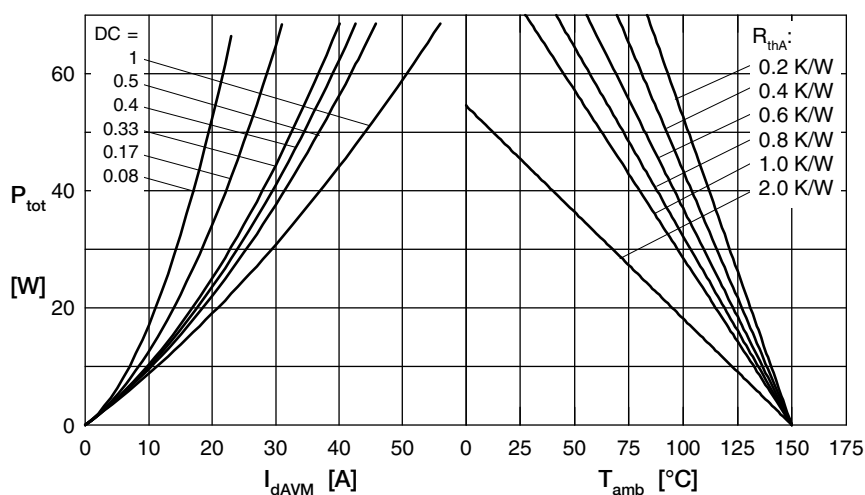


Fig. 4 Power dissipation vs. direct output current and ambient temperature

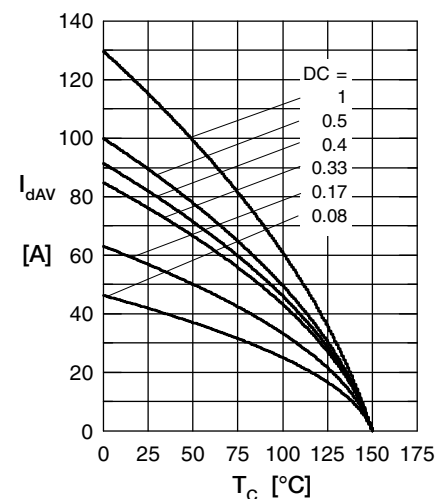


Fig. 5 Max. forward current vs. case temperature

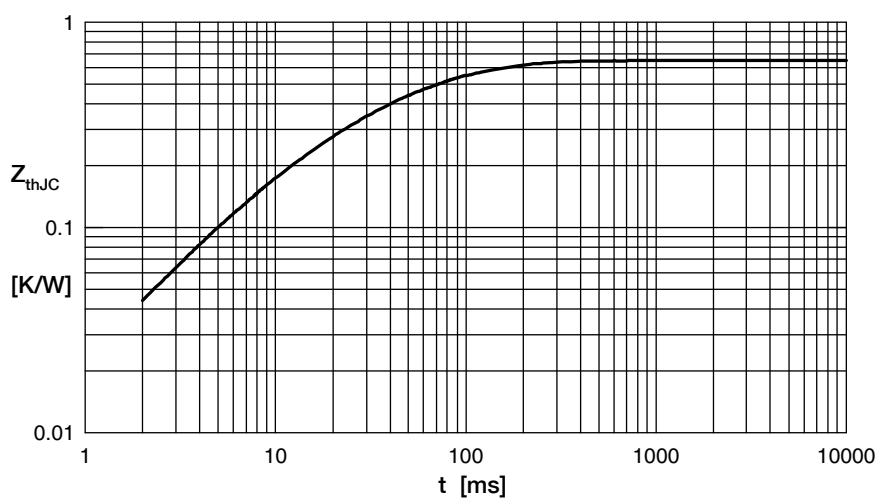


Fig. 6 Transient thermal impedance junction to case

R_i	i
0.085	0.012
0.041	0.007
0.309	0.036
0.215	0.102

Brake IGBT

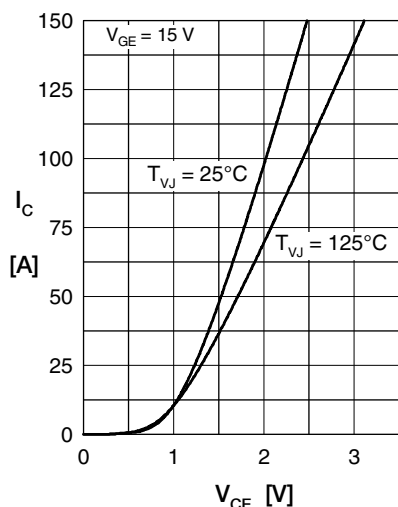


Fig. 1 Typ. output characteristics

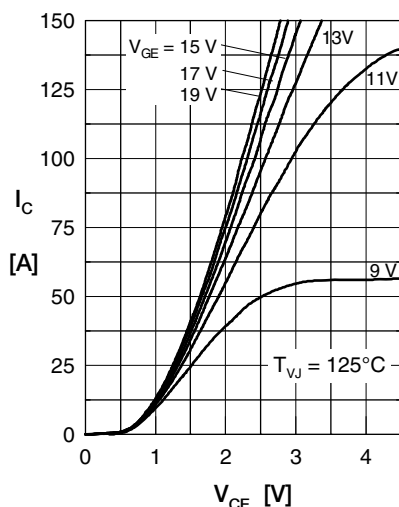


Fig. 2 Typ. output characteristics

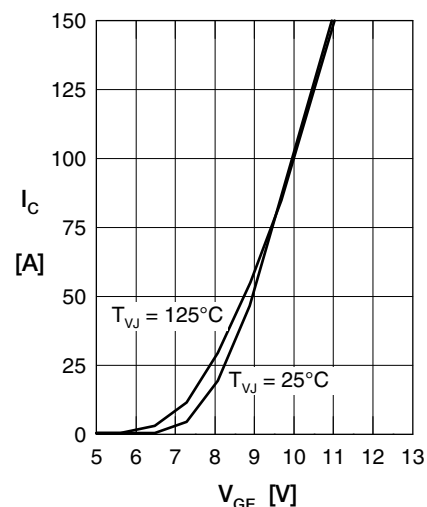


Fig. 3 Typ. transfer characteristics

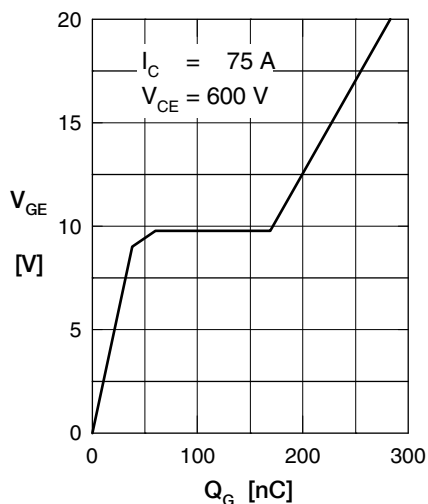


Fig. 4 Typ. turn-on gate charge

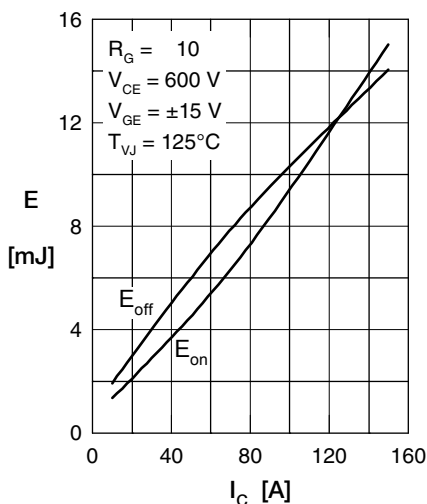


Fig. 5 Typ. switching energy versus collector current

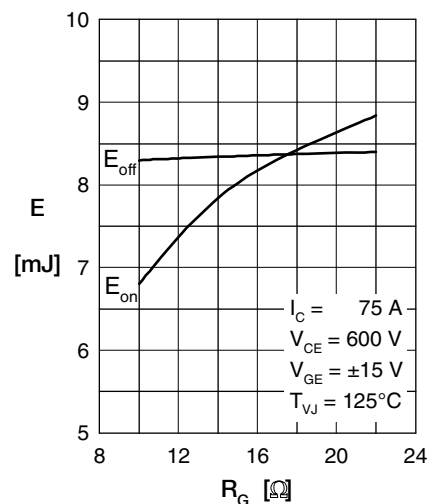


Fig. 6 Typ. switching energy versus gate resistance

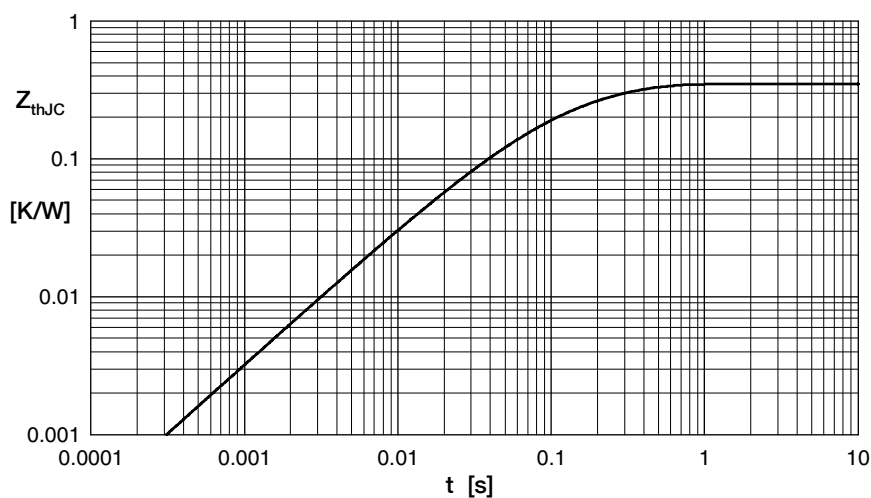


Fig. 7 Typ. transient thermal impedance junction to case

Brake Diode

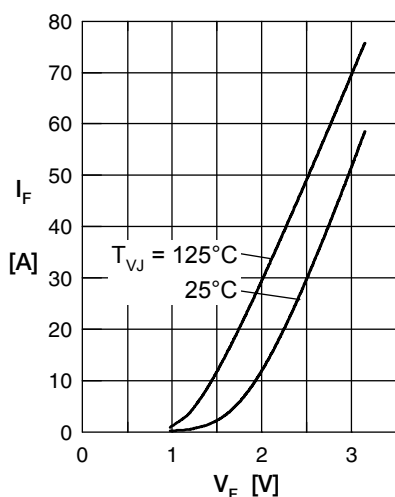


Fig. 1 Forward current I_F vs. V_F

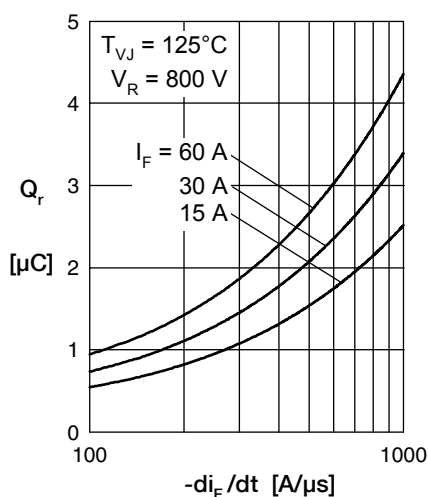


Fig. 2 Typ. reverse recovery charge Q_r versus $-di_F/dt$

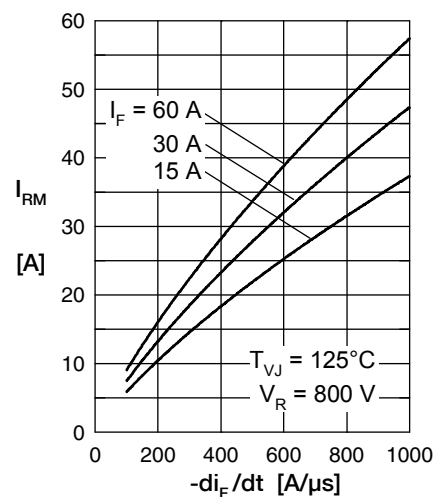


Fig. 3 Typ. peak reverse current I_{RM} versus $-di_F/dt$

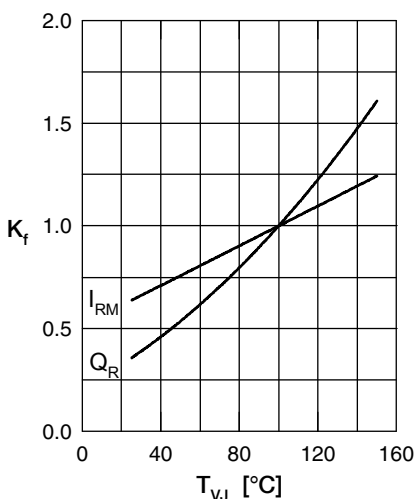


Fig. 4 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

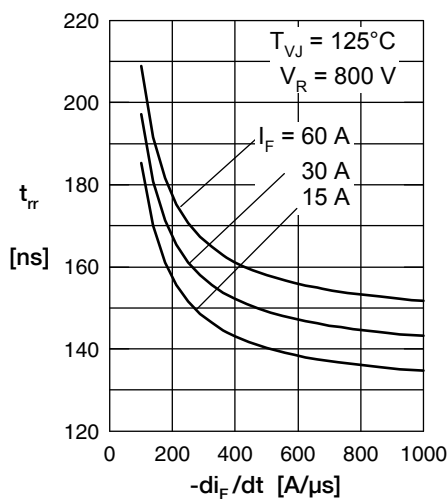


Fig. 5 Typ. recovery time t_{rr} versus $-di_F/dt$

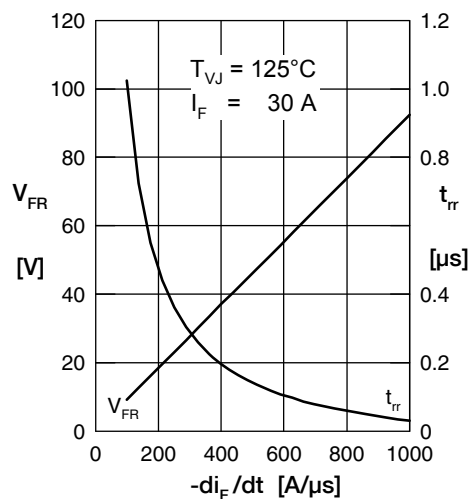


Fig. 6 Typ. peak forward voltage V_{FR} and t_{rr} versus di_F/dt

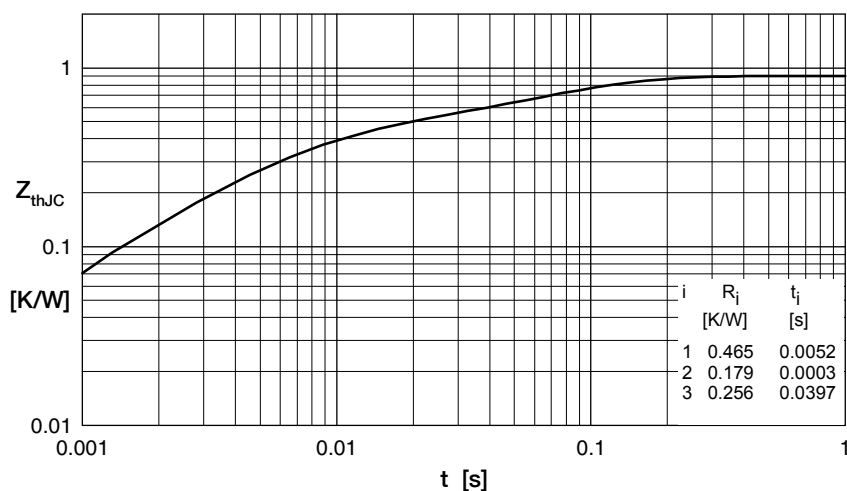


Fig. 7 Transient thermal impedance junction to case

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