

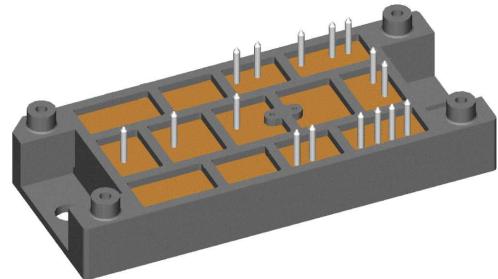
# Standard Rectifier Module

3~ Rectifier	Brake Chopper
$V_{RRM} = 1600 \text{ V}$	$V_{CES} = 1200 \text{ V}$
$I_{DAV} = 180 \text{ A}$	$I_{C25} = 250 \text{ A}$
$I_{FSM} = 1100 \text{ A}$	$V_{CE(sat)} = 1.7 \text{ V}$

## 3~ Rectifier Bridge + Brake Unit + NTC

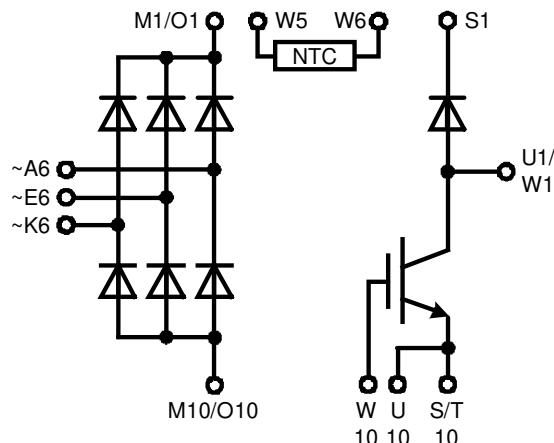
Part number

**VUB160-16NOXT**



Backside: isolated

 E72873



### Features / Advantages:

- Package with DCB ceramic base plate
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current
- X2PT - 2nd generation Xtreme light Punch Through
- Rugged X2PT design results in:
  - short circuit rated for 10  $\mu\text{sec}$ .
  - very low gate charge
  - low EMI
  - square RBSOA @ 2x  $I_c$
- Thin wafer technology combined with X2PT design results in a competitive low  $V_{CE(sat)}$  and low thermal resistance

### Applications:

- 3~ Rectifier with brake unit for drive inverters

### Package: V2-Pack

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

### Disclaimer Notice

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**Rectifier**

Symbol	Definition	Conditions	Ratings			
			min.	typ.	max.	
$V_{RSM}$	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	$V_R = 1600 \text{ V}$ $V_R = 1600 \text{ V}$	$T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		100 2	$\mu\text{A}$ mA
$V_F$	forward voltage drop	$I_F = 60 \text{ A}$ $I_F = 180 \text{ A}$ $I_F = 60 \text{ A}$ $I_F = 180 \text{ A}$	$T_{VJ} = 25^\circ\text{C}$ $T_{VJ} = 125^\circ\text{C}$		1.16 1.55 1.09 1.59	V V
$I_{DAV}$	bridge output current	$T_C = 90^\circ\text{C}$ rectangular $d = 1/3$	$T_{VJ} = 150^\circ\text{C}$		180	A
$V_{F0}$ $r_F$	threshold voltage slope resistance } for power loss calculation only		$T_{VJ} = 150^\circ\text{C}$		0.81 4.4	V $\text{m}\Omega$
$R_{thJC}$	thermal resistance junction to case				0.6	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.2		K/W
$P_{tot}$	total power dissipation		$T_C = 25^\circ\text{C}$		205	W
$I_{FSM}$	max. forward surge current	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$	$T_{VJ} = 45^\circ\text{C}$ $V_R = 0 \text{ V}$ $T_{VJ} = 150^\circ\text{C}$ $V_R = 0 \text{ V}$		1.10 1.19 935 1.01	kA kA A kA
$I^2t$	value for fusing	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$	$T_{VJ} = 45^\circ\text{C}$ $V_R = 0 \text{ V}$ $T_{VJ} = 150^\circ\text{C}$ $V_R = 0 \text{ V}$		6.05 5.89 4.37 4.25	$\text{kA}^2\text{s}$ $\text{kA}^2\text{s}$ $\text{kA}^2\text{s}$ $\text{kA}^2\text{s}$
$C_J$	junction capacitance	$V_R = 400 \text{ V}; f = 1 \text{ MHz}$	$T_{VJ} = 25^\circ\text{C}$	37		pF

**Brake IGBT + Diode**

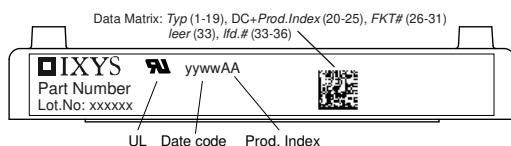
Symbol	Definition	Conditions	Ratings				
			min.	typ.	max.	Unit	
$V_{CES}$	collector emitter voltage	$T_{VJ} = 25^\circ C$			1200	V	
$V_{GES}$	max. DC gate voltage				$\pm 20$	V	
$V_{GEM}$	max. transient gate emitter voltage				$\pm 30$	V	
$I_{C25}$	collector current	$T_C = 25^\circ C$			250	A	
$I_{C80}$		$T_C = 80^\circ C$			175	A	
$P_{tot}$	total power dissipation	$T_C = 25^\circ C$			695	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 150 A; V_{GE} = 15 V$	$T_{VJ} = 25^\circ C$	1.7	2.1	V	
			$T_{VJ} = 125^\circ C$	1.9		V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 6 mA; V_{GE} = V_{CE}$	$T_{VJ} = 25^\circ C$	6	6.8	7.5	V
$I_{CES}$	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0 V$	$T_{VJ} = 25^\circ C$		0.1	mA	
			$T_{VJ} = 125^\circ C$	0.1		mA	
$I_{GES}$	gate emitter leakage current	$V_{GE} = \pm 20 V$			500	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 600 V; V_{GE} = 15 V; I_C = 150 A$		510		nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 600 V; I_C = 150 A$ $V_{GE} = \pm 15 V; R_G = 1.2 \Omega$	$T_{VJ} = 125^\circ C$	220		ns	
$t_r$	current rise time			100		ns	
$t_{d(off)}$	turn-off delay time			400		ns	
$t_f$	current fall time			220		ns	
$E_{on}$	turn-on energy per pulse			21.5		mJ	
$E_{off}$	turn-off energy per pulse			17		mJ	
<b>RBSOA</b>	reverse bias safe operating area	$V_{GE} = \pm 15 V; R_G = 1.2 \Omega$	$T_{VJ} = 125^\circ C$				
$I_{CM}$		$V_{CEK} = 1200 V$			450	A	
<b>SCSOA</b>	short circuit safe operating area	$V_{CEK} = 1200 V$					
$t_{sc}$	short circuit duration	$V_{CE} = 900 V; V_{GE} = \pm 15$	$T_{VJ} = 125^\circ C$		10	μs	
$I_{sc}$	short circuit current	$R_G = 1.2 \Omega$ ; non-repetitive		650		A	
$R_{thJC}$	thermal resistance junction to case				0.16	K/W	
$R_{thCH}$	thermal resistance case to heatsink				0.10	K/W	

**Brake Diode**

$V_{RRM}$	max. repetitive reverse voltage	$T_{VJ} = 25^\circ C$		1200	V
$I_{F25}$	forward current	$T_C = 25^\circ C$		48	A
$I_{F80}$		$T_C = 80^\circ C$		32	A
$V_F$	forward voltage	$I_F = 30 A$	$T_{VJ} = 25^\circ C$	2.75	V
			$T_{VJ} = 125^\circ C$	1.60	V
$I_R$	reverse current	$V_R = V_{RRM}$	$T_{VJ} = 25^\circ C$	0.25	mA
			$T_{VJ} = 125^\circ C$	1	mA
$Q_{rr}$	reverse recovery charge	$V_R = 600 V$ $-di_F/dt = 900 A/\mu s$ $I_F = 30 A; V_{GE} = 0 V$	$T_{VJ} = 125^\circ C$	6	μC
$I_{RM}$	max. reverse recovery current			50	A
$t_{rr}$	reverse recovery time			350	ns
$E_{rec}$	reverse recovery energy			2	mJ
$R_{thJC}$	thermal resistance junction to case			0.9	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.3	K/W

**Package V2-Pack**

Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			100	A
$T_{VJ}$	virtual junction temperature		-40		150	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage temperature		-40		125	°C
<b>Weight</b>				76		g
$M_D$	mounting torque		2		2.5	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	$t = 1 \text{ second}$ $t = 1 \text{ minute}$	3600 50/60 Hz, RMS; $I_{ISOL} \leq 1 \text{ mA}$	3000		V



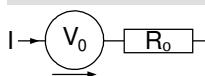
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	VUB160-16NOXT	VUB160-16NOXT	Box	6	521692

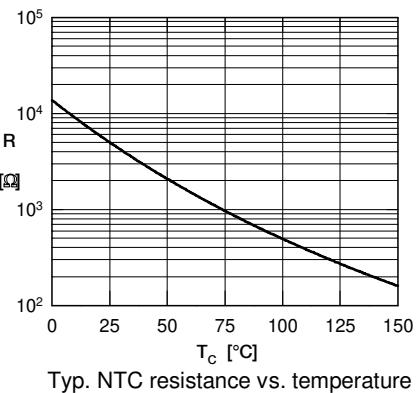
Similar Part	Package	Voltage class
VUB160-16NOX	V2-Pack	1600

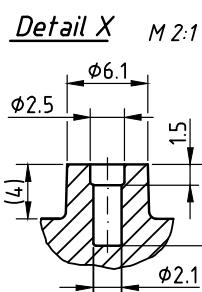
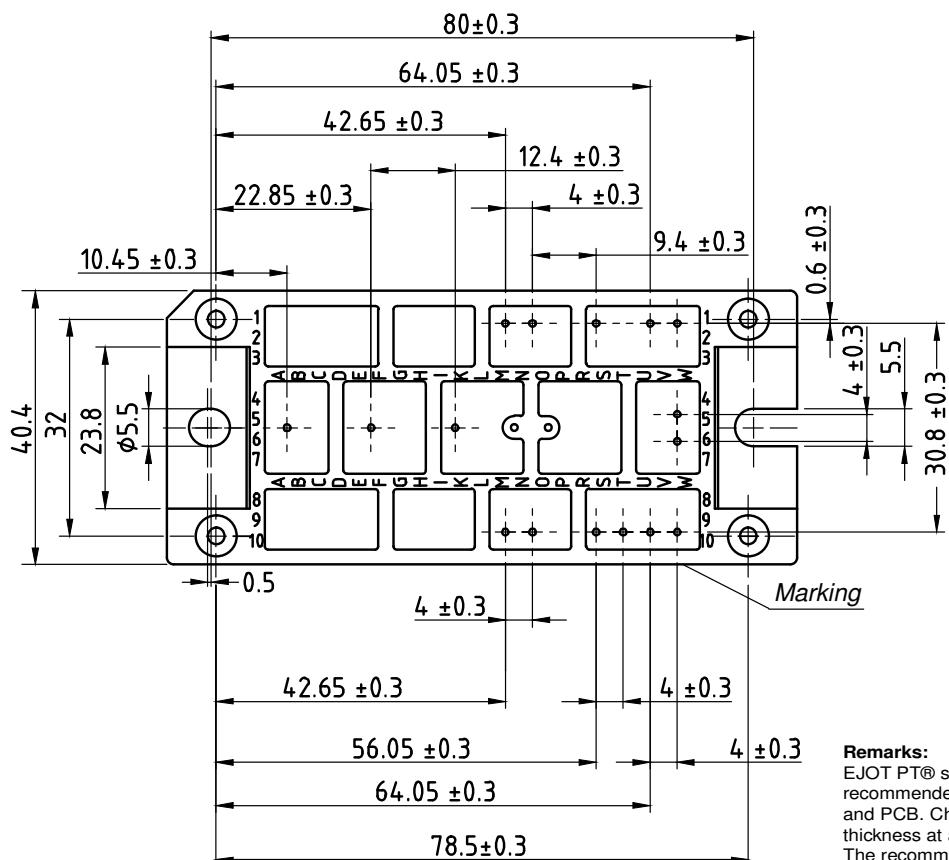
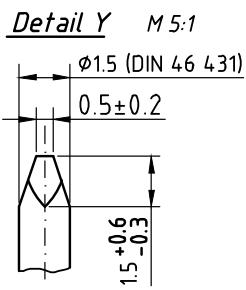
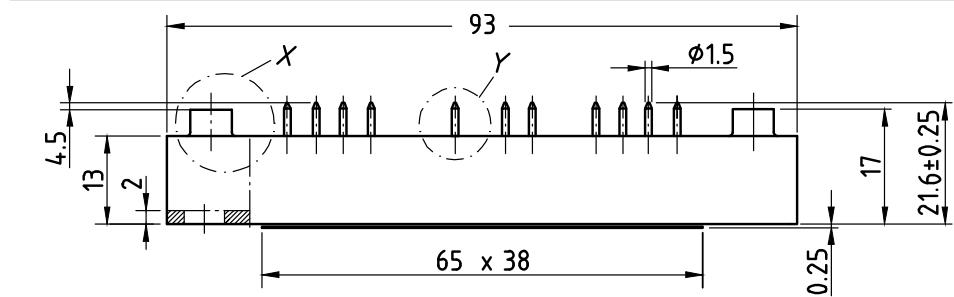
**Temperature Sensor NTC**

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

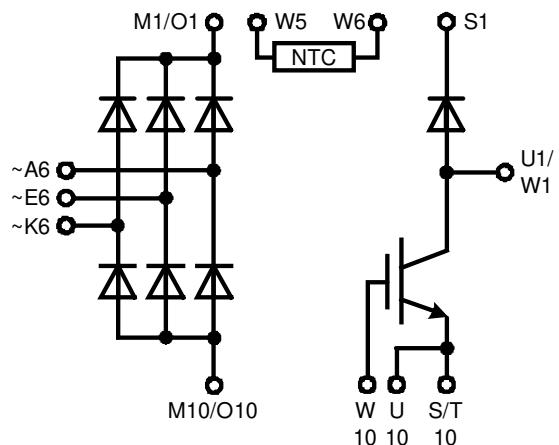
**Equivalent Circuits for Simulation**
<sup>\* on die level</sup>
 $T_{VJ} = 150^\circ\text{C}$ 

	Rectifier	Brake IGBT +	Brake Diode	
$V_{0\max}$	threshold voltage	0.81	1.1	1.31
$R_{0\max}$	slope resistance *	3.2	13.8	8



**Outlines V2-Pack**

**Remarks:**

EJOT PT® self-tapping screws of the dimension K25 are recommended for the mechanical connection between module and PCB. Choose the right length according to your board thickness at a maximum depth of 6 mm of the module holes. The recommended mounting torque is 1.5 Nm.



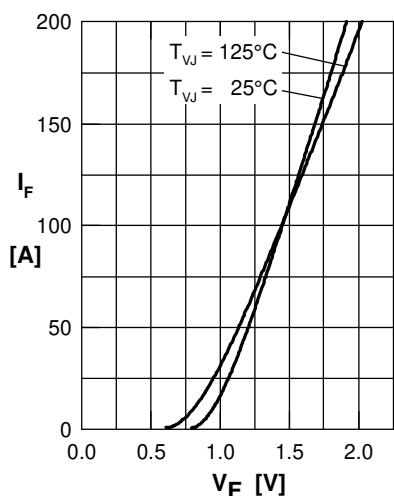
**Rectifier**


Fig. 1 Forward current vs.  
voltage drop per diode

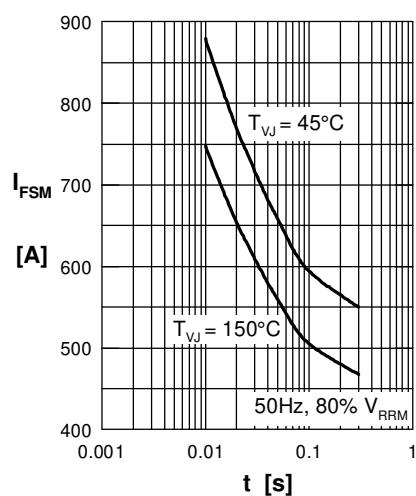


Fig. 2 Surge overload current  
vs. time per diode

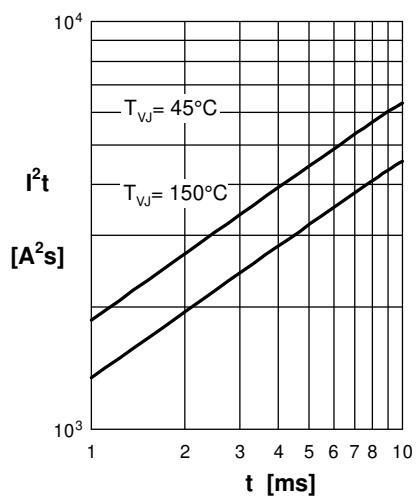


Fig. 3  $I^2t$  vs. time per diode

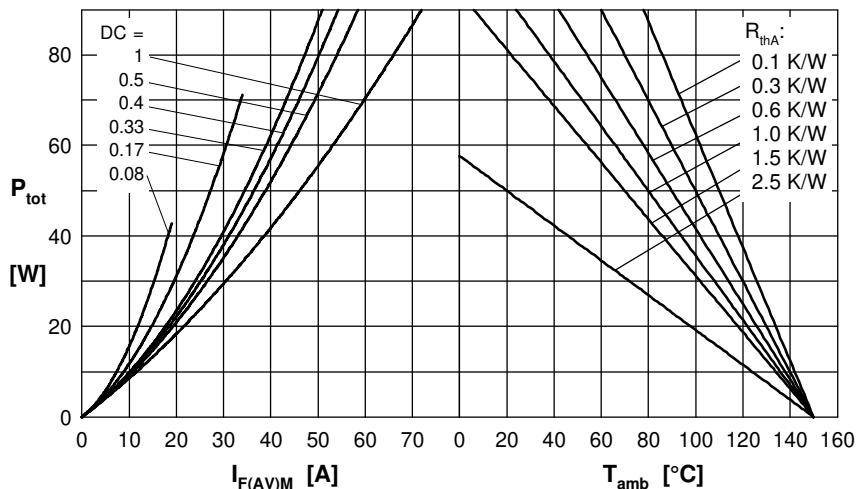


Fig. 4 Power dissipation vs. forward current  
and ambient temperature per diode

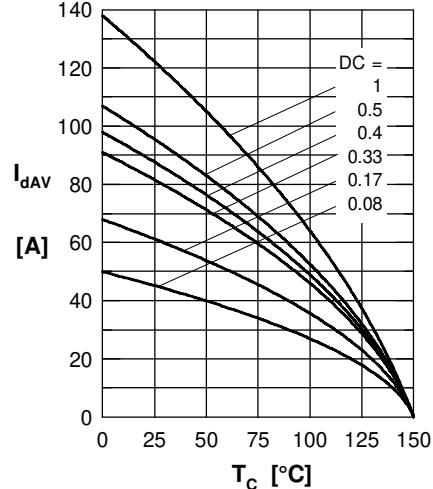


Fig. 5 Max. forward current vs.  
case temperature per diode

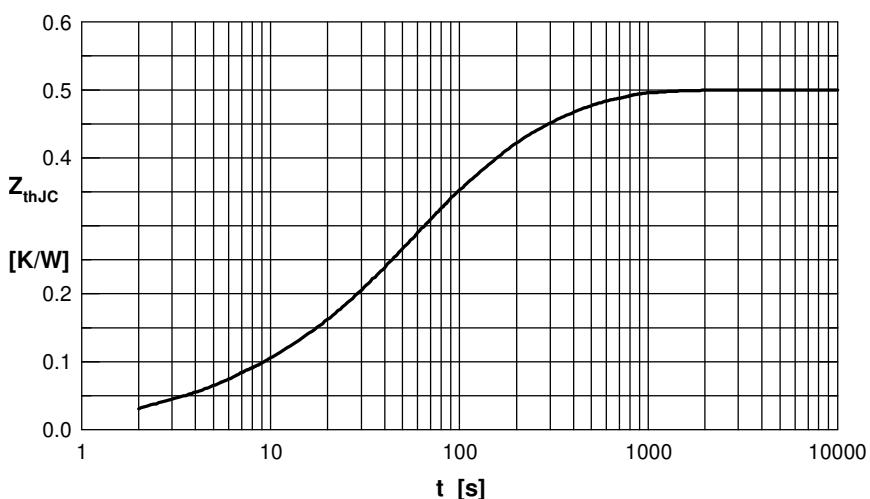
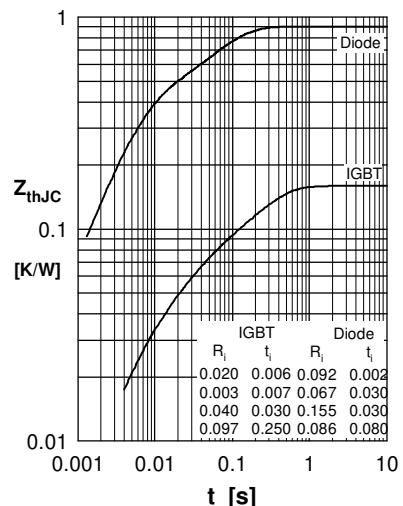
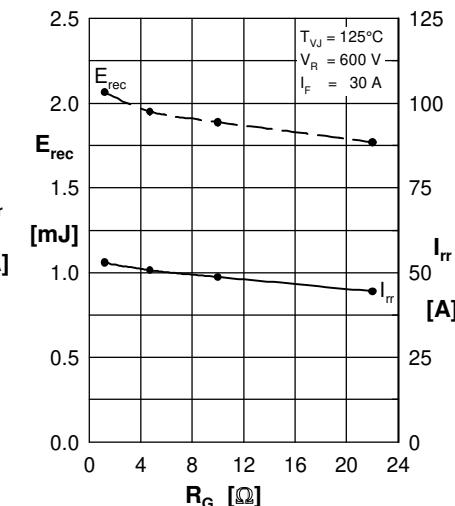
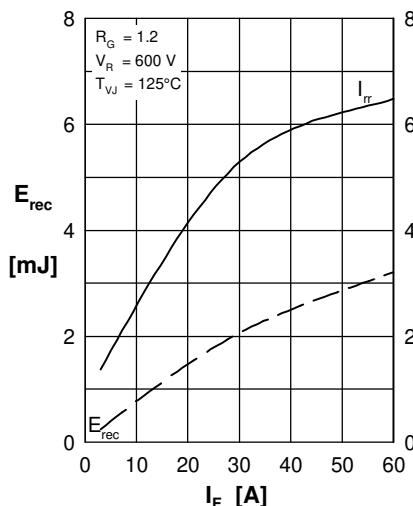
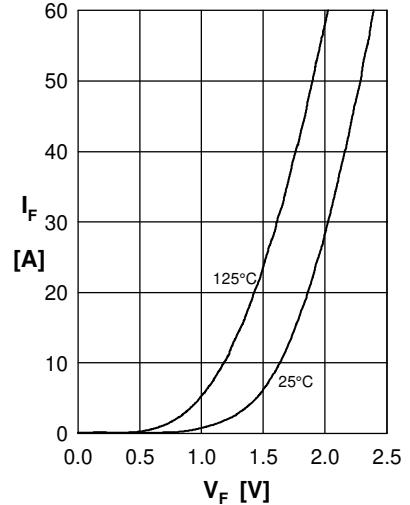
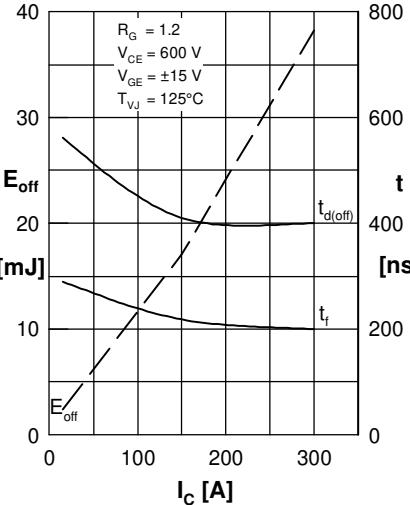
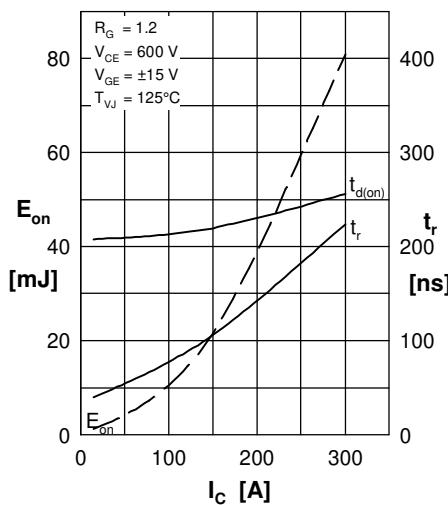
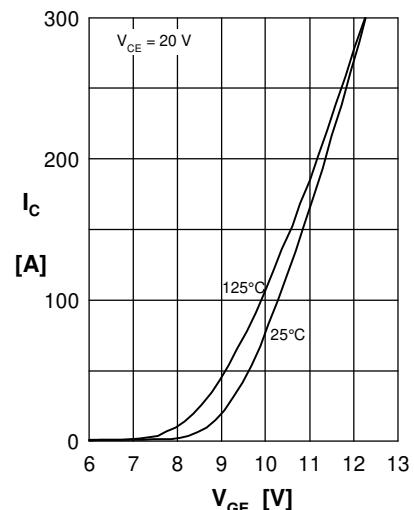
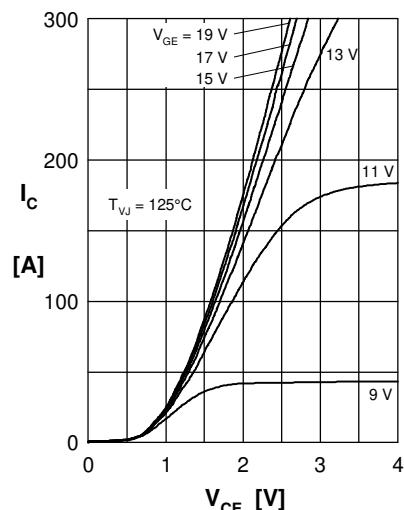
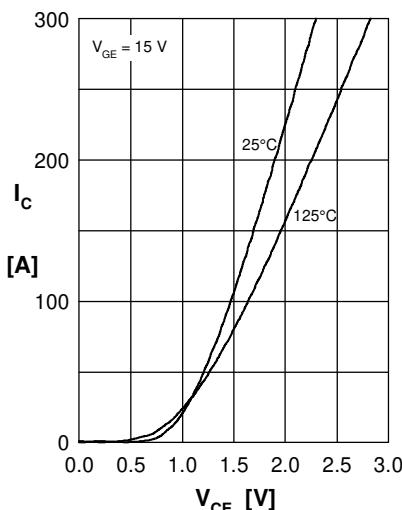


Fig. 6 Transient thermal impedance junction to case vs. time per diode

Constants for  $Z_{thJC}$  calculation:

i	$R_{th}$ (K/W)	$t_i$ (s)
1	0.040	0.004
2	0.003	0.010
3	0.140	0.030
4	0.120	0.300
5	0.197	0.080

### Brake IGBT + Diode





**Стандарт  
Электрон  
Связь**

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