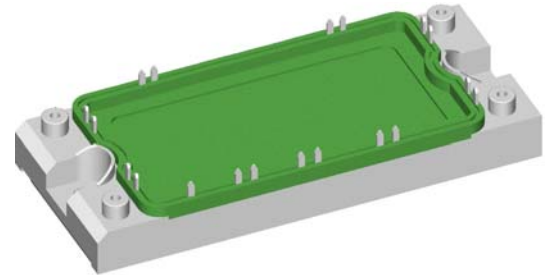


preliminary

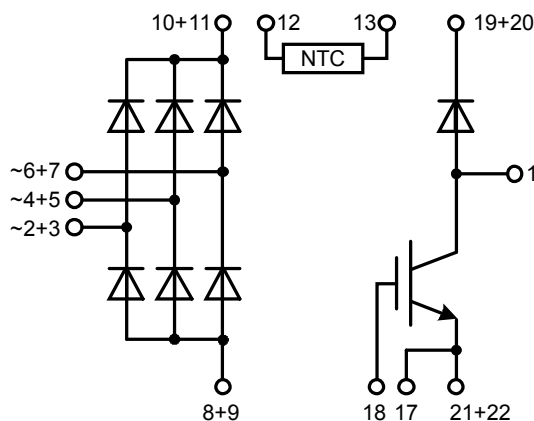
# Standard Rectifier Module

3~ Rectifier	Brake Chopper
$V_{RRM} = 2200 \text{ V}$	$V_{CES} = 1700 \text{ V}$
$I_{DAV} = 150 \text{ A}$	$I_{C25} = 113 \text{ A}$
$I_{FSM} = 1100 \text{ A}$	$V_{CE(sat)} = 1.9 \text{ V}$

## 3~ Rectifier Bridge + Brake Unit + NTC

**Part number**
**VUB135-22NO1**


Backside: isolated


**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

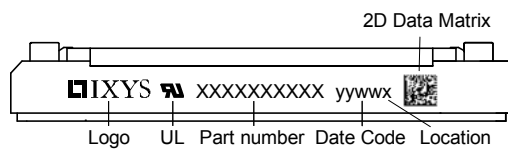
**Package: E2-Pack**

- Isolation Voltage: 3600V~
- 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					2300	V
$V_{RRM}$	max. repetitive reverse blocking voltage					2200	V
$I_R$	reverse current	$V_R = 2200$ V	$T_{VJ} = 25^\circ\text{C}$			100	$\mu\text{A}$
		$V_R = 2200$ V	$T_{VJ} = 150^\circ\text{C}$			2	mA
$V_F$	forward voltage drop	$I_F = 50$ A	$T_{VJ} = 25^\circ\text{C}$			1.20	V
		$I_F = 150$ A				1.68	V
		$I_F = 50$ A	$T_{VJ} = 125^\circ\text{C}$			1.13	V
		$I_F = 150$ A				1.74	V
$I_{DAV}$	bridge output current	$T_C = 105^\circ\text{C}$ rectangular	$T_{VJ} = 150^\circ\text{C}$ $d = \frac{1}{3}$			150	A
$V_{FO}$	threshold voltage	} for power loss calculation only				0.79	V
$r_F$	slope resistance					6.4	m $\Omega$
$R_{thJC}$	thermal resistance junction to case					0.5	K/W
$R_{thCH}$	thermal resistance case to heatsink				0.1		K/W
$P_{tot}$	total power dissipation			$T_C = 25^\circ\text{C}$		250	W
$I_{FSM}$	max. forward surge current	$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 45^\circ\text{C}$			1.10	kA
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			1.19	kA
		$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 150^\circ\text{C}$			935	A
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			1.01	kA
$I^2t$	value for fusing	$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 45^\circ\text{C}$			6.05	kA <sup>2</sup> s
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			5.89	kA <sup>2</sup> s
		$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 150^\circ\text{C}$			4.37	kA <sup>2</sup> s
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			4.25	kA <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400$ V; $f = 1$ MHz		$T_{VJ} = 25^\circ\text{C}$		37	pF

Brake IGBT				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{CES}$	collector emitter voltage	$T_{VJ} = 25^{\circ}\text{C}$			1700	V	
$V_{GES}$	max. DC gate voltage				$\pm 20$	V	
$V_{GEM}$	max. transient gate emitter voltage				$\pm 30$	V	
$I_{C25}$	collector current	$T_C = 25^{\circ}\text{C}$			113	A	
$I_{C80}$		$T_C = 80^{\circ}\text{C}$			80	A	
$P_{tot}$	total power dissipation	$T_C = 25^{\circ}\text{C}$			445	W	
$V_{CE(sat)}$	collector emitter saturation voltage	$I_C = 75\text{ A}; V_{GE} = 15\text{ V}$			1.9	V	
					2.8	V	
$V_{GE(th)}$	gate emitter threshold voltage	$I_C = 3\text{ mA}; V_{GE} = V_{CE}$	5.2	5.8	6.4	V	
$I_{CES}$	collector emitter leakage current	$V_{CE} = V_{CES}; V_{GE} = 0\text{ V}$			0.6	mA	
					0.6	mA	
$I_{GES}$	gate emitter leakage current	$V_{GE} = \pm 20\text{ V}$			400	nA	
$Q_{G(on)}$	total gate charge	$V_{CE} = 900\text{ V}; V_{GE} = 15\text{ V}; I_C = 75\text{ A}$		tbd		nC	
$t_{d(on)}$	turn-on delay time	inductive load $V_{CE} = 900\text{ V}; I_C = 75\text{ A}$ $V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega$					
$t_r$	current rise time						
$t_{d(off)}$	turn-off delay time						
$t_f$	current fall time						
$E_{on}$	turn-on energy per pulse						
$E_{off}$	turn-off energy per pulse						
$R_{BSOA}$	reverse bias safe operating area	$V_{GE} = \pm 15\text{ V}; R_G = 18\ \Omega$					
$I_{CM}$		$V_{CEK} = 1700\text{ V}$			150	A	
$R_{SCSOA}$	short circuit safe operating area						
$t_{SC}$	short circuit duration	$V_{CE} = 900\text{ V}; V_{GE} = \pm 15\text{ V}$			10	$\mu\text{s}$	
$I_{SC}$	short circuit current	$R_G = 18\ \Omega$ ; non-repetitive		tbd		A	
$R_{thJC}$	thermal resistance junction to case				0.28	K/W	
$R_{thCH}$	thermal resistance case to heatsink				0.10	K/W	
Brake Diode							
$V_{RRM}$	max. repetitive reverse voltage	$T_{VJ} = 25^{\circ}\text{C}$			1700	V	
$I_{F25}$	forward current	$T_C = 25^{\circ}\text{C}$			tbd	A	
$I_{F80}$		$T_C = 80^{\circ}\text{C}$			33	A	
$V_F$	forward voltage	$I_F = 60\text{ A}$			3.05	V	
					3.11	V	
$I_R$	reverse current	$V_R = V_{RRM}$			0.1	mA	
					6	mA	
$Q_{rr}$	reverse recovery charge	$V_R = 900\text{ V}$ $-di_F/dt = 400\text{ A}/\mu\text{s}$ $I_F = 60\text{ A}$					
$I_{RM}$	max. reverse recovery current						
$t_{rr}$	reverse recovery time						
$R_{thJC}$	thermal resistance junction to case				0.65	K/W	
$R_{thCH}$	thermal resistance case to heatsink				0.25	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
<b>Weight</b>				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



Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	VUB135-22NO1	VUB135-22NO1	Box	6	503948

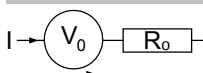
### Temperature Sensor NTC

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

### Equivalent Circuits for Simulation

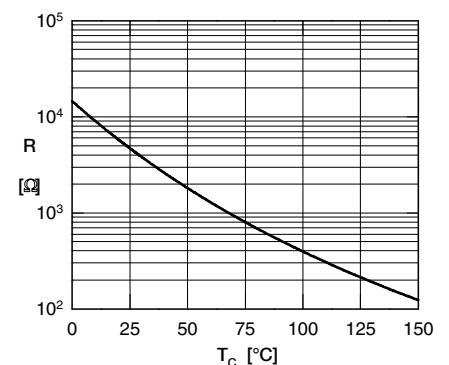
\* on die level

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



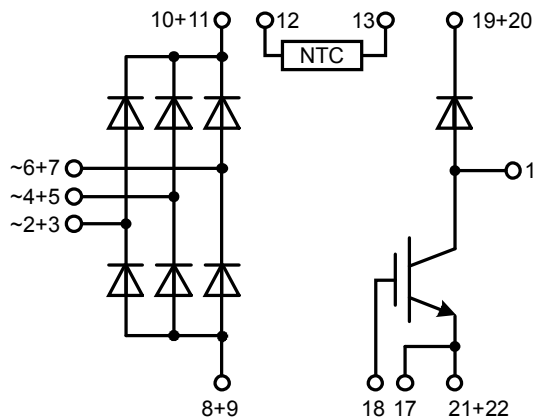
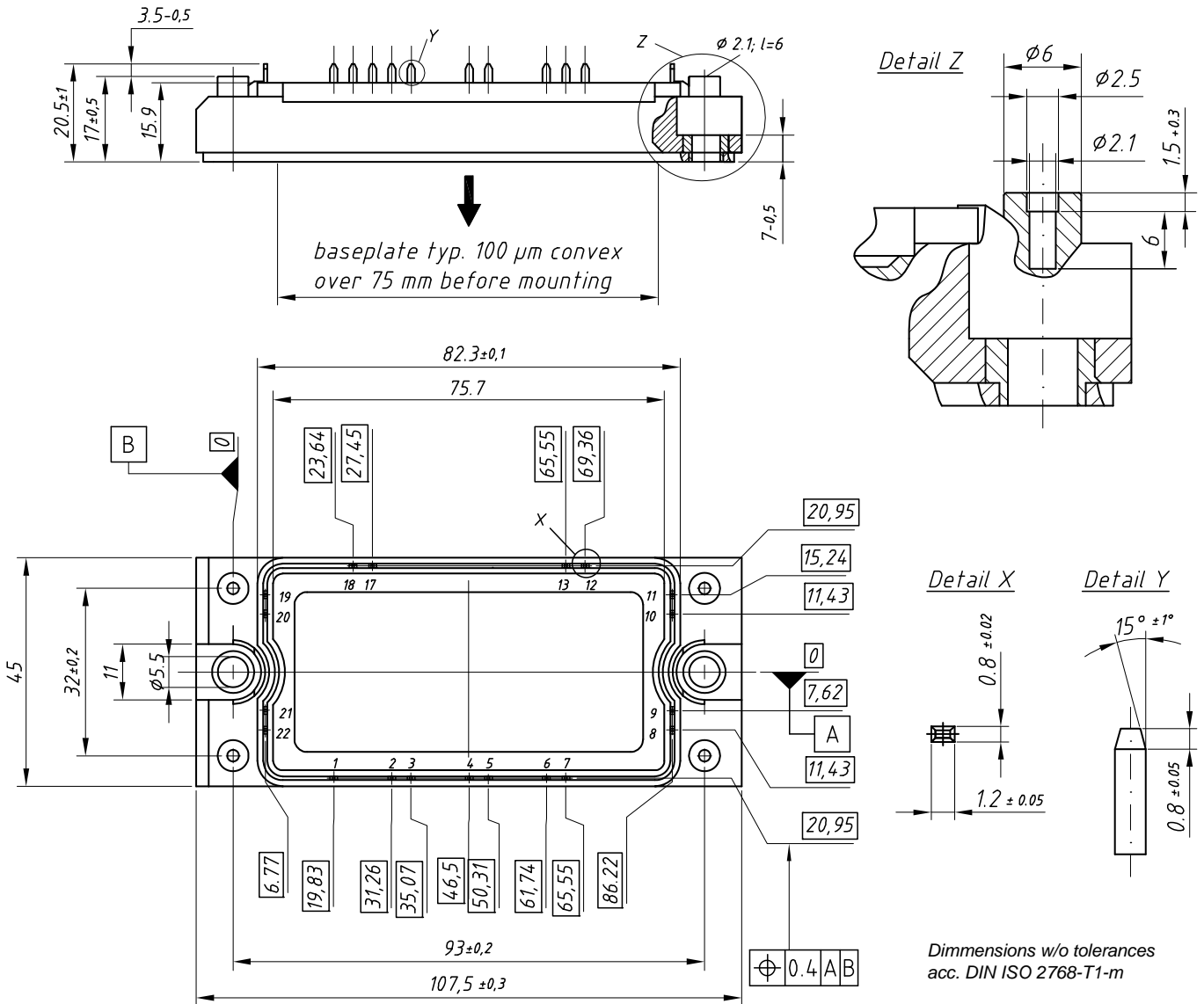
Rectifier

$V_{0\max}$	threshold voltage	0.79				V
$R_{0\max}$	slope resistance *	3.3				m $\Omega$



Typ. NTC resistance vs. temperature

## Outlines E2-Pack



## Rectifier

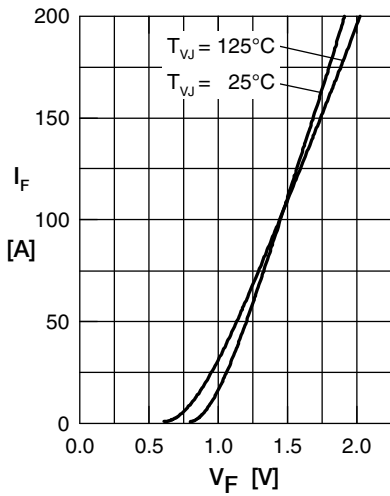


Fig. 1 Forward current vs. voltage drop per diode

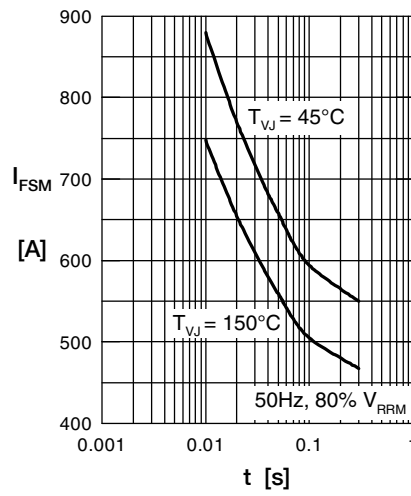


Fig. 2 Surge overload current vs. time per diode

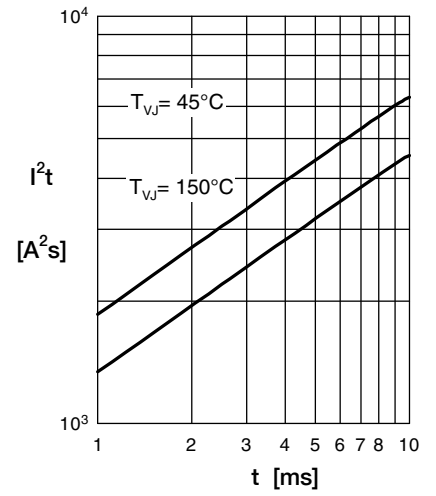


Fig. 3  $I^2t$  vs. time per diode

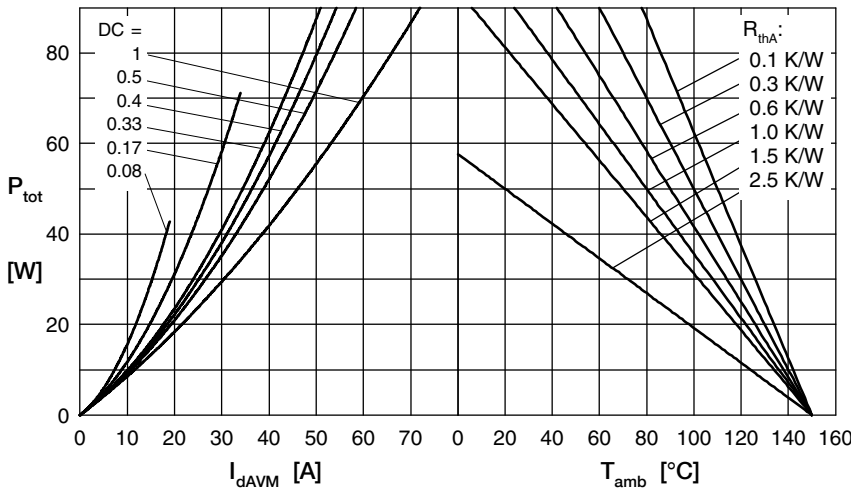


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

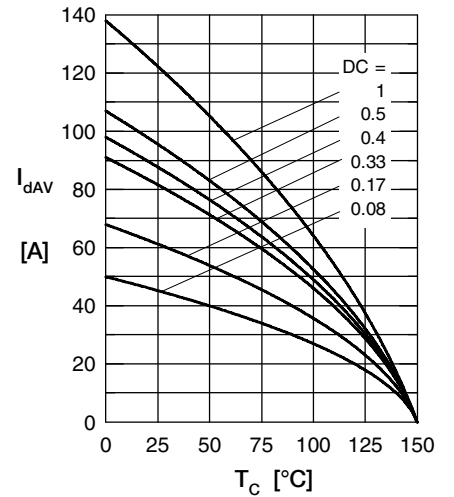


Fig. 5 Max. forward current vs. case temperature per diode

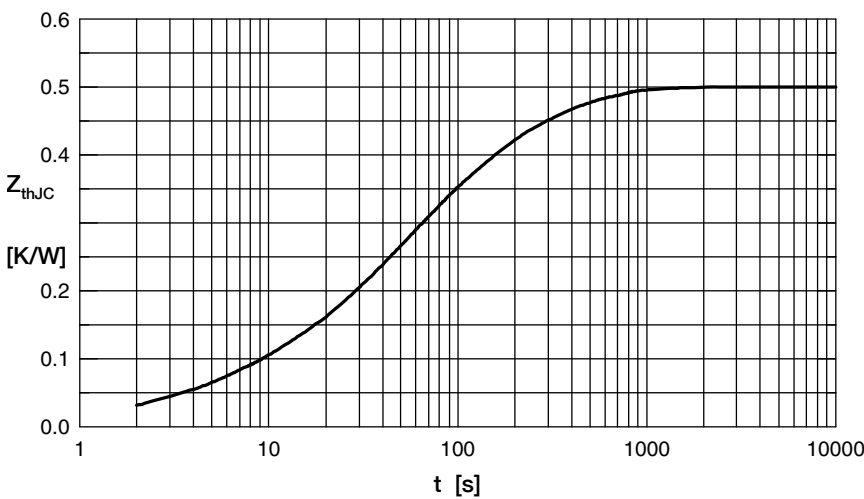


Fig. 6 Transient thermal impedance junction to case vs. time per diode

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

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