

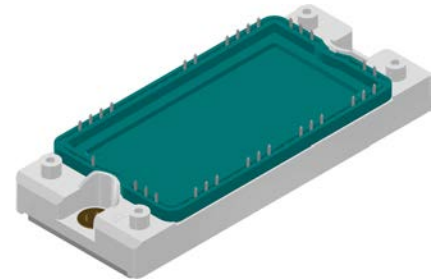
# Standard Rectifier Module

<b>3~ Rectifier</b>
$V_{RRM} = 1600\text{ V}$
$I_{DAV} = 360\text{ A}$
$I_{FSM} = 1900\text{ A}$


## 3~ Rectifier Bridge + Softstart-Thyristor

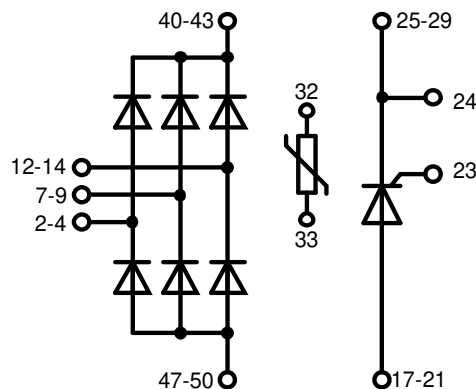
Part number

**MDMA360UC1600TED**



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

### Applications:

- Diode for main rectification plus Softstart-Thyristor
- For three phase bridge configurations
- Supplies for DC power equipment
- Input rectifiers for PWM inverter
- Battery DC power supplies
- Field supply for DC motors

### Package: E2-Pack

- Isolation Voltage: 4300 V~
- Industry standard outline
- RoHS compliant
- PressFit-Pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

### Disclaimer Notice

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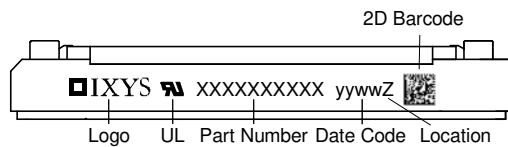
Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM}$	max. non-repetitive reverse blocking voltage					1700	V
$V_{RRM}$	max. repetitive reverse blocking voltage					1600	V
$I_R$	reverse current	$V_R = 1600$ V		$T_{VJ} = 25^\circ\text{C}$		100	$\mu\text{A}$
		$V_R = 1600$ V		$T_{VJ} = 150^\circ\text{C}$		3	mA
$V_F$	forward voltage drop	$I_F = 120$ A		$T_{VJ} = 25^\circ\text{C}$		1,25	V
		$I_F = 360$ A				1,80	V
		$I_F = 120$ A		$T_{VJ} = 125^\circ\text{C}$		1,23	V
		$I_F = 360$ A				1,98	V
$I_{DAV}$	bridge output current	$T_C = 85^\circ\text{C}$		$T_{VJ} = 150^\circ\text{C}$		360	A
		rectangular	$d = \frac{1}{3}$				
$V_{FO}$	threshold voltage			$T_{VJ} = 150^\circ\text{C}$		0,82	V
$r_F$	slope resistance					3,4	m $\Omega$
						} for power loss calculation only	
$R_{thJC}$	thermal resistance junction to case					0,25	K/W
$R_{thCH}$	thermal resistance case to heatsink				0,1		K/W
$P_{tot}$	total power dissipation			$T_C = 25^\circ\text{C}$		500	W
$I_{FSM}$	max. forward surge current	$t = 10$ ms; (50 Hz), sine		$T_{VJ} = 45^\circ\text{C}$		1,90	kA
		$t = 8,3$ ms; (60 Hz), sine		$V_R = 0$ V		2,05	kA
		$t = 10$ ms; (50 Hz), sine		$T_{VJ} = 150^\circ\text{C}$		1,62	kA
		$t = 8,3$ ms; (60 Hz), sine		$V_R = 0$ V		1,75	kA
$I^2t$	value for fusing	$t = 10$ ms; (50 Hz), sine		$T_{VJ} = 45^\circ\text{C}$		18,1	kA <sup>2</sup> s
		$t = 8,3$ ms; (60 Hz), sine		$V_R = 0$ V		17,5	kA <sup>2</sup> s
		$t = 10$ ms; (50 Hz), sine		$T_{VJ} = 150^\circ\text{C}$		13,0	kA <sup>2</sup> s
		$t = 8,3$ ms; (60 Hz), sine		$V_R = 0$ V		12,7	kA <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400$ V; $f = 1$ MHz		$T_{VJ} = 25^\circ\text{C}$		10	pF



Softstart-Thyristor			Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage				1700	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage				1600	V	
$I_{RD}$	reverse current, drain current	$V_{RD} = 1600$ V			100	$\mu$ A	
		$V_{RD} = 1600$ V			15	mA	
$V_T$	forward voltage drop	$I_T = 150$ A			1.34	V	
		$I_T = 300$ A			1.73	V	
		$I_T = 150$ A	$T_{VJ} = 125^\circ$ C			1.31	V
		$I_T = 300$ A				1.77	V
$I_{TAV}$	average forward current	$T_C = 90^\circ$ C 180° sine			150	A	
$V_{TO}$	threshold voltage	} for power loss calculation only			0.84	V	
$r_T$	slope resistance				3.1	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				0.17	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.080		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^\circ$ C		735	W	
$I_{TSM}$	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^\circ$ C		2.40	kA	
		t = 8,3 ms; (60 Hz), sine	$V_R = 0$ V		2.59	kA	
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 150^\circ$ C			2.04	kA
		t = 8,3 ms; (60 Hz), sine	$V_R = 0$ V			2.21	kA
$I^2t$	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^\circ$ C		28.8	kA <sup>2</sup> s	
		t = 8,3 ms; (60 Hz), sine	$V_R = 0$ V		27.9	kA <sup>2</sup> s	
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 150^\circ$ C			20.8	kA <sup>2</sup> s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0$ V			20.2	kA <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400$ V f = 1 MHz	$T_{VJ} = 25^\circ$ C		119	pF	
$P_{GM}$	max. gate power dissipation	$t_p = 30$ $\mu$ s	$T_C = 150^\circ$ C		10	W	
		$t_p = 300$ $\mu$ s			5	W	
$P_{GAV}$	average gate power dissipation				0.5	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 150^\circ$ C; f = 50 Hz repetitive, $I_T = 450$ A			150	A/ $\mu$ s	
		$t_p = 200$ $\mu$ s; $di_G/dt = 0.45$ A/ $\mu$ s; $I_G = 0.45$ A; $V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 150$ A			500	A/ $\mu$ s	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$ method 1 (linear voltage rise)	$T_{VJ} = 150^\circ$ C		1000	V/ $\mu$ s	
$V_{GT}$	gate trigger voltage	$V_D = 6$ V	$T_{VJ} = 25^\circ$ C		1.5	V	
			$T_{VJ} = -40^\circ$ C		1.6	V	
$I_{GT}$	gate trigger current	$V_D = 6$ V	$T_{VJ} = 25^\circ$ C		150	mA	
			$T_{VJ} = -40^\circ$ C		200	mA	
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^\circ$ C		0.2	V	
$I_{GD}$	gate non-trigger current				10	mA	
$I_L$	latching current	$t_p = 10$ $\mu$ s	$T_{VJ} = 25^\circ$ C		200	mA	
		$I_G = 0.45$ A; $di_G/dt = 0.45$ A/ $\mu$ s					
$I_H$	holding current	$V_D = 6$ V $R_{GK} = \infty$	$T_{VJ} = 25^\circ$ C		200	mA	
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^\circ$ C		2	$\mu$ s	
		$I_G = 0.45$ A; $di_G/dt = 0.45$ A/ $\mu$ s					
$t_q$	turn-off time	$V_R = 100$ V; $I_T = 150$ A; $V = \frac{2}{3} V_{DRM}$ $di/dt = 10$ A/ $\mu$ s $dv/dt = 20$ V/ $\mu$ s $t_p = 200$ $\mu$ s	$T_{VJ} = 125^\circ$ C		185	$\mu$ s	



Package E2-Pack		Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			50	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>				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 t = 1 minute	4300			V
		50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	3600			V



**Part description**

- M = Module
- D = Diode
- M = Standard Rectifier
- A = (up to 1800V)
- 360 = Current Rating [A]
- UC = 3- Rectifier Bridge + Softstart-Thyristor
- 1600 = Reverse Voltage [V]
- T = Thermistor \ Temperature sensor
- ED = E2-Pack

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MDMA360UC1600TED	MDMA360UC1600TED	Box	6	524541

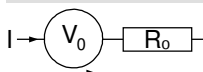
**Temperature Sensor NTC**

Symbol	Definition	Conditions	min.	typ.	max.	Unit
$R_{25}$	resistance	$T_{VJ} = 25^\circ$	4,85	5	5,15	k $\Omega$
$B_{25/50}$	temperature coefficient			3375		K

**Equivalent Circuits for Simulation**

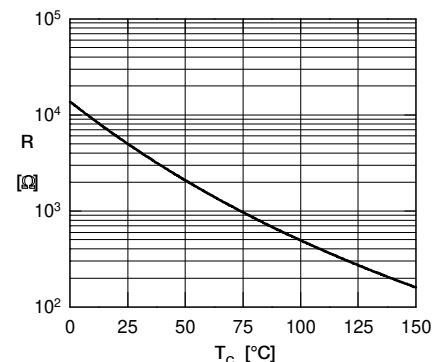
\* on die level

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



Rectifier

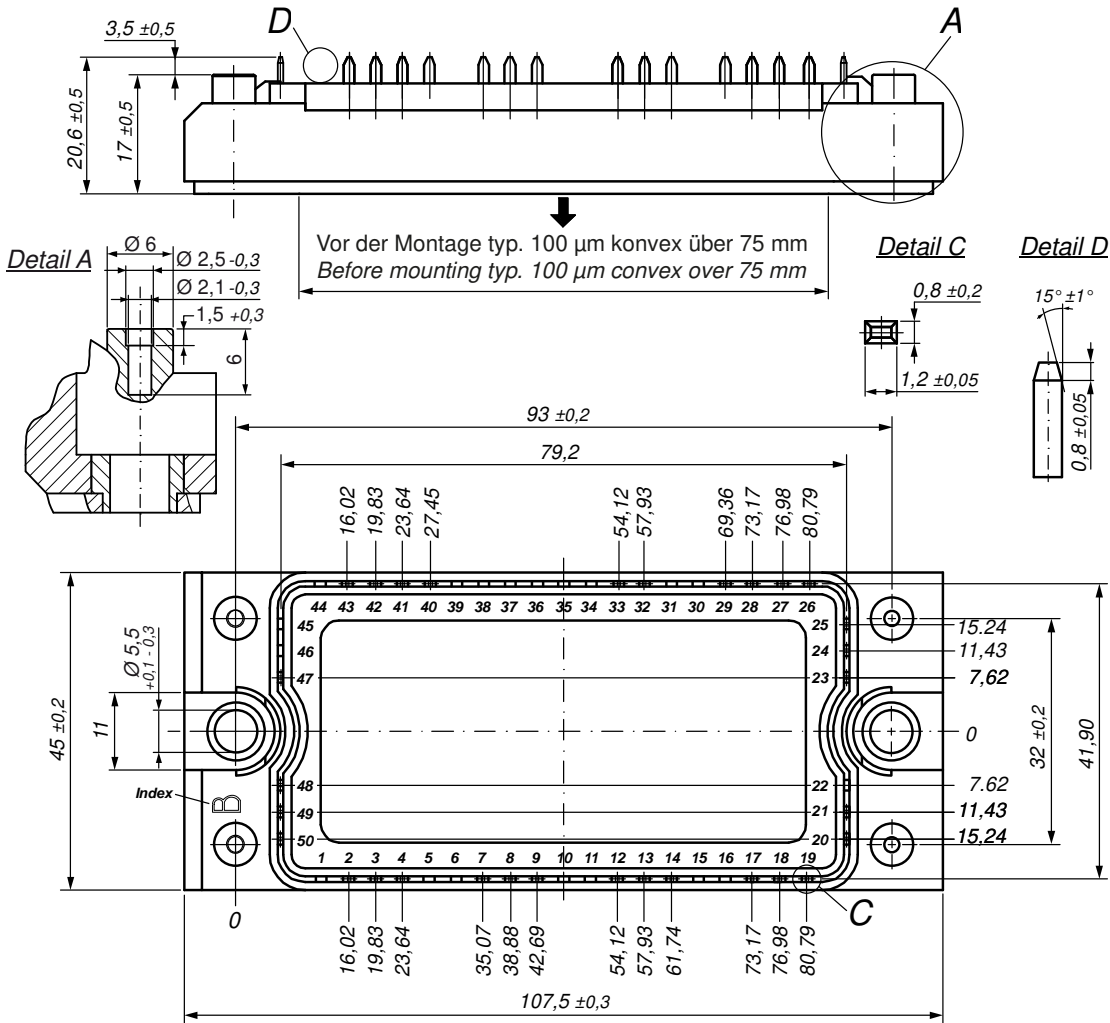
$V_{0 \max}$	threshold voltage	0,82				V
$R_{0 \max}$	slope resistance *	10,2				m $\Omega$



Typ. NTC resistance vs. temperature



**Outlines E2-Pack**

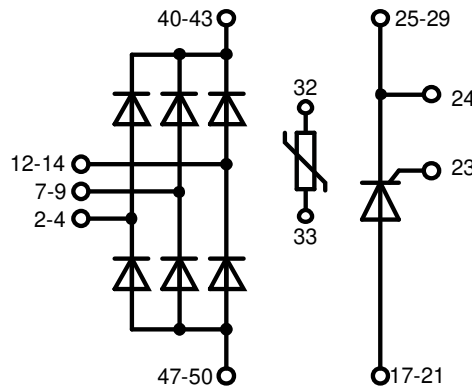


**Bemerkung / Note:**

- Nichttolerierete Maße nach / Measure without tolerances according DIN ISO 2768-T1-m
- PCB-Lochmuster / PCB hole pattern: **see pin position**
- Toleranz Pin-Position und PCB-Lochmuster / Tolerance of pin position and PCB hole pattern:  $\oplus 0.1$
- Montageanleitung / Mounting instruction: [www.ixys.com](http://www.ixys.com) **Application note IXAN0024**

**Detail A:** PCB-Montage / Mounting on PCB

- Empfohlene, selbstschneidende Schraube / Recommended, self-tapping screw: **EJOT PT®** (Größe / size: **K25**)
- Max. Schraubenlänge / Max. screw length: **PCB-Dicke / thickness + 6 mm** (max. Lochtiefe / hole depth)
- Empfohlenes Drehmoment / Recommended mounting torque: **1.5 Nm**



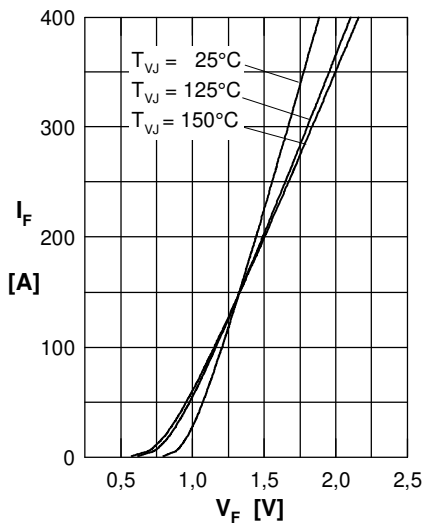
**Rectifier**


Fig. 1 Forward current versus voltage drop per diode

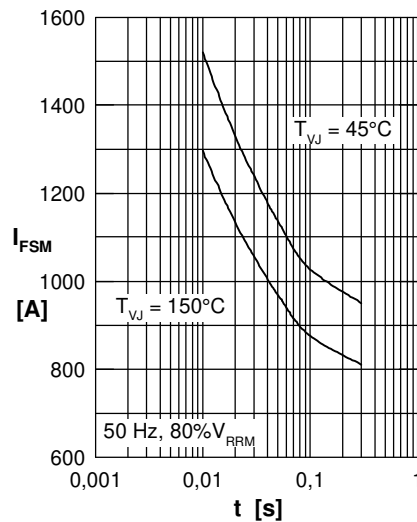


Fig. 2 Surge overload current vs. time per diode

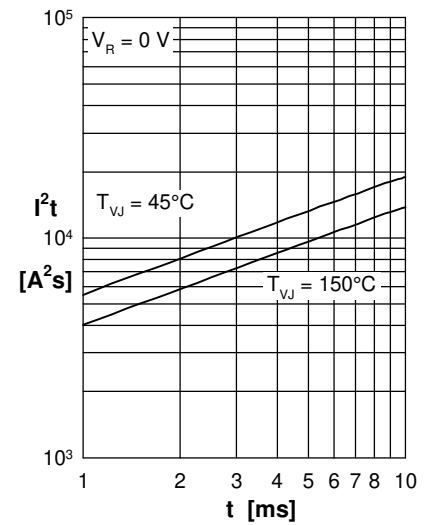
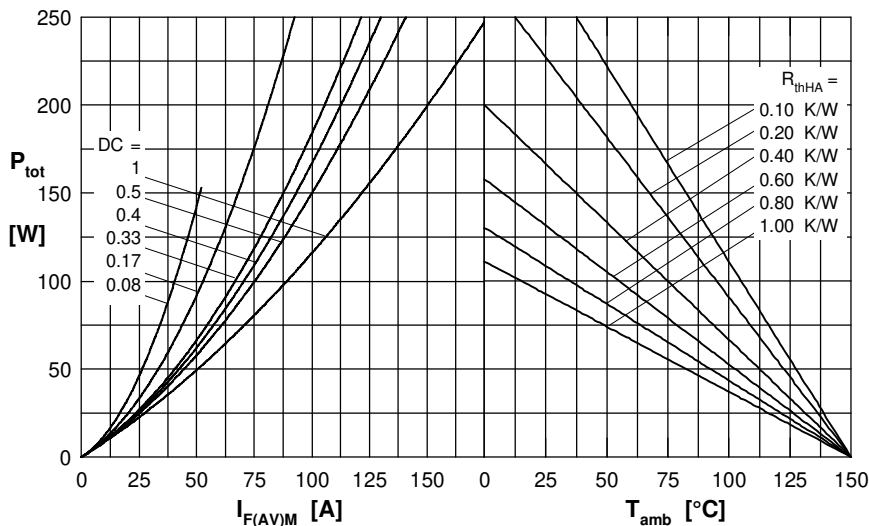

 Fig. 3  $I^2t$  versus time per diode


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

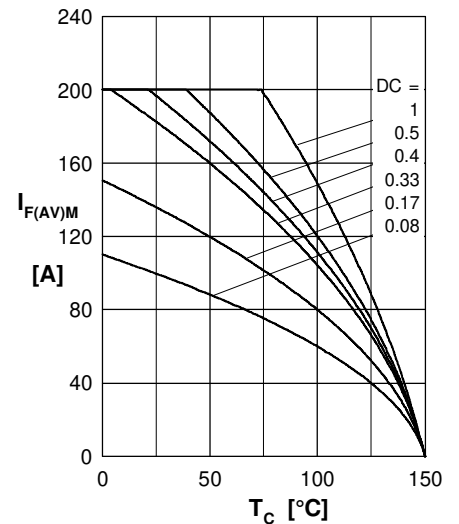


Fig. 5 Max. forward current vs. case temperature per diode

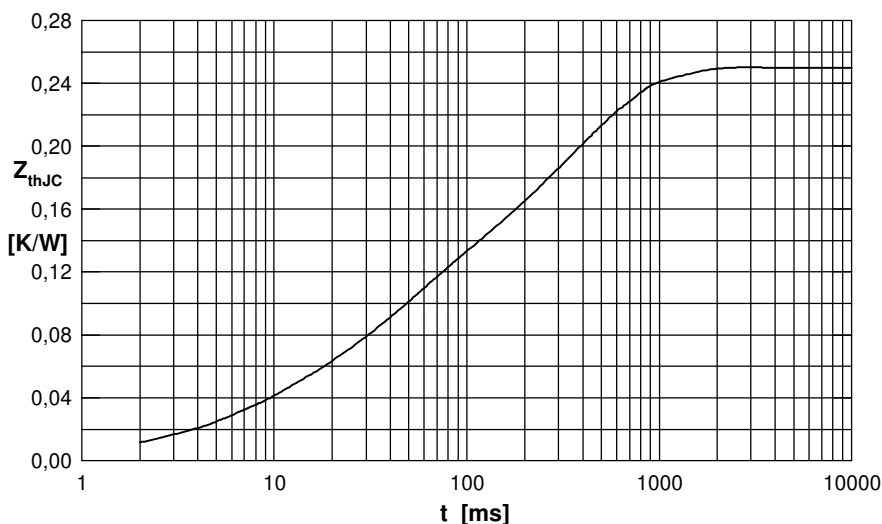


Fig. 6 Transient thermal impedance junction to case vs. time per diode

 Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.020	0.006
2	0.003	0.007
3	0.080	0.037
4	0.147	0.360

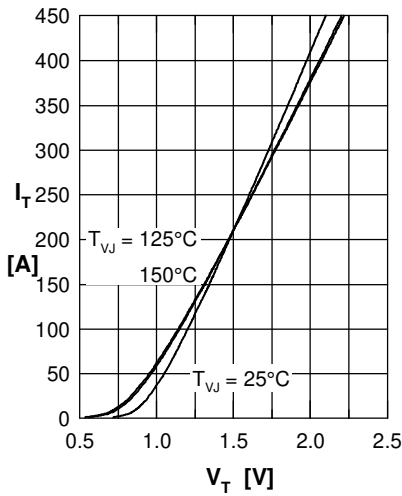
**Softstart Thyristor**


Fig. 1 Forward characteristics

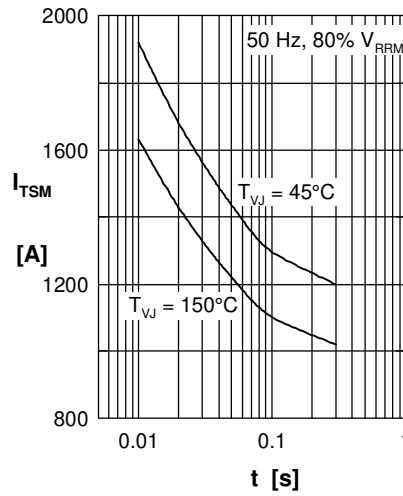
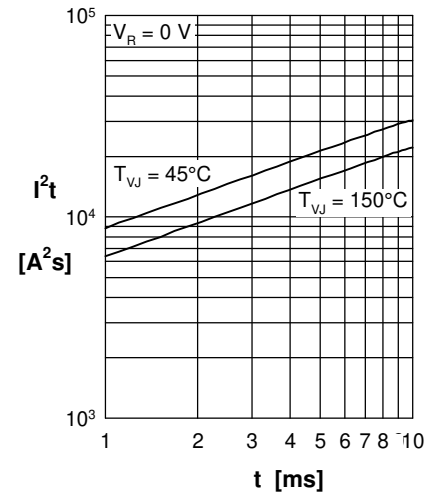
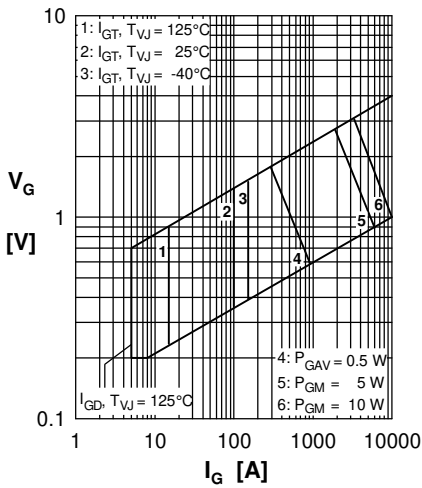

 Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

 Fig. 3  $I^2t$  versus time (1-10 s)


Fig. 4 Gate voltage &amp; gate current

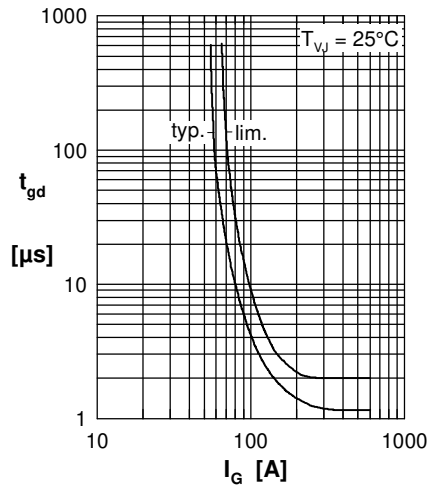
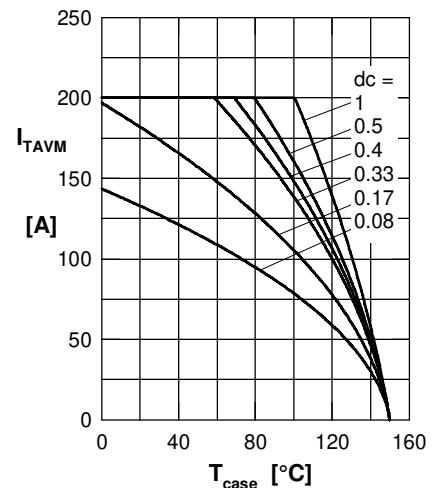

 Fig. 5 Gate controlled delay time  $t_{gd}$ 


Fig. 6 Max. forward current at case temperature

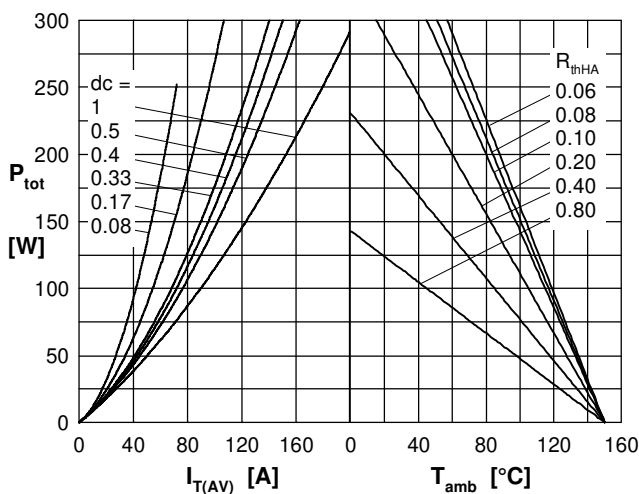
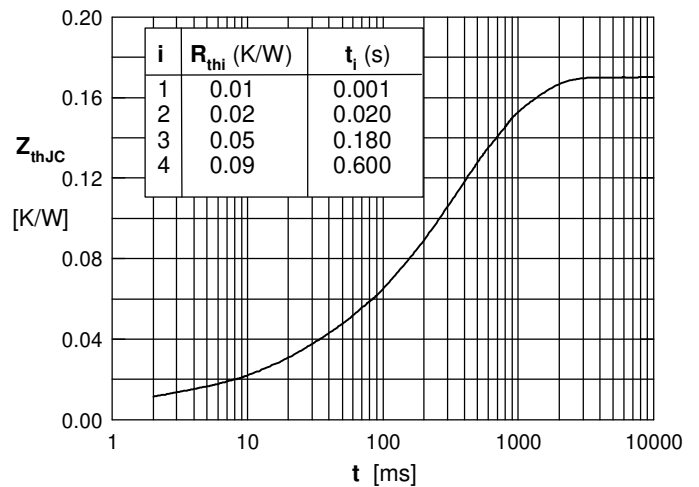

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case