

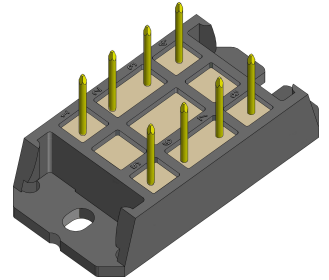
# Standard Rectifier Module

<b>3~ Rectifier</b>	
$V_{RRM}$	= 1600 V
$I_{DAV}$	= 60 A
$I_{FSM}$	= 350 A

## 3~ Rectifier Bridge + Softstart-Thyristor

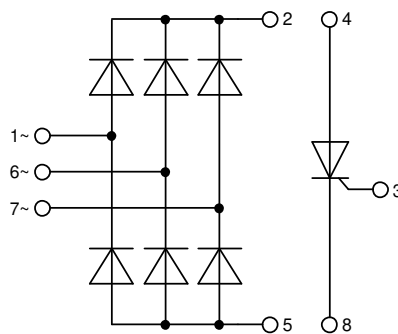
Part number

**MDMA60UC1600VC**



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: V1-B-Pack

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 10 mm
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

### Disclaimer Notice

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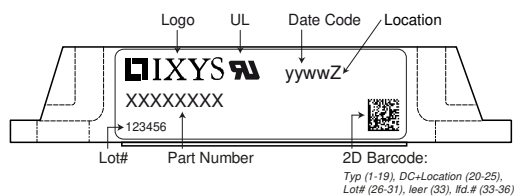
Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM}$	max. non-repetitive reverse blocking voltage					1700	V
$V_{RRM}$	max. repetitive reverse blocking voltage					1600	V
$I_R$	reverse current	$V_R = 1600$ V	$T_{VJ} = 25^\circ\text{C}$			40	$\mu\text{A}$
		$V_R = 1600$ V	$T_{VJ} = 150^\circ\text{C}$			1.5	mA
$V_F$	forward voltage drop	$I_F = 20$ A	$T_{VJ} = 25^\circ\text{C}$			1.13	V
		$I_F = 60$ A				1.44	V
		$I_F = 20$ A	$T_{VJ} = 125^\circ\text{C}$			1.07	V
		$I_F = 60$ A				1.50	V
$I_{DAV}$	bridge output current	$T_C = 110^\circ\text{C}$ rectangular	$T_{VJ} = 150^\circ\text{C}$			60	A
$V_{FO}$	threshold voltage	} for power loss calculation only				0.83	V
$r_F$	slope resistance					11.5	m $\Omega$
$R_{thJC}$	thermal resistance junction to case					1.3	K/W
$R_{thCH}$	thermal resistance case to heatsink				0.3		K/W
$P_{tot}$	total power dissipation			$T_C = 25^\circ\text{C}$		95	W
$I_{FSM}$	max. forward surge current	$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 45^\circ\text{C}$			350	A
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			380	A
		$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 150^\circ\text{C}$			300	A
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			320	A
$I^2t$	value for fusing	$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 45^\circ\text{C}$			615	A <sup>2</sup> s
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			600	A <sup>2</sup> s
		$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 150^\circ\text{C}$			450	A <sup>2</sup> s
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V			425	A <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	$T_{VJ} = 25^{\circ}\text{C}$			1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$			1600	V
$I_{RD}$	reverse current, drain current	$V_{RD} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		100	$\mu\text{A}$
		$V_{RD} = 1600\text{ V}$	$T_{VJ} = 140^{\circ}\text{C}$		6	mA
$V_T$	forward voltage drop	$I_T = 50\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		1.25	V
					1.48	V
		$I_T = 100\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$		1.17	V
					1.44	V
$I_{TAV}$	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 140^{\circ}\text{C}$		50	A
$I_{T(RMS)}$	RMS forward current	180° sine			79	A
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 140^{\circ}\text{C}$		0.89	V
$r_T$	slope resistance				5.3	m $\Omega$
$R_{thJC}$	thermal resistance junction to case				0.7	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.20		K/W
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$		160	W
$I_{TSM}$	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		800	A
			$V_R = 0\text{ V}$		865	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}\text{C}$		680	A
			$V_R = 0\text{ V}$		735	A
$I^2t$	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		3.20	kA <sup>2</sup> s
			$V_R = 0\text{ V}$		3.12	kA <sup>2</sup> s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}\text{C}$		2.31	kA <sup>2</sup> s
			$V_R = 0\text{ V}$		2.25	kA <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		32	pF
$P_{GM}$	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$ $t_p = 300\text{ }\mu\text{s}$	$T_C = 140^{\circ}\text{C}$		10	W
					5	W
$P_{GAV}$	average gate power dissipation				0.5	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 140^{\circ}\text{C}; f = 50\text{ Hz}$	repetitive, $I_T = 150\text{ A}$		150	A/ $\mu\text{s}$
			$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ $I_G = 0.45\text{ A}; V_D = \frac{2}{3} V_{DRM}$	non-repet., $I_T = 50\text{ A}$		500
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$ ; method 1 (linear voltage rise)	$T_{VJ} = 140^{\circ}\text{C}$		1000	V/ $\mu\text{s}$
$V_{GT}$	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		1.5	V
			$T_{VJ} = -40^{\circ}\text{C}$		1.6	V
$I_{GT}$	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		78	mA
			$T_{VJ} = -40^{\circ}\text{C}$		200	mA
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}\text{C}$		0.2	V
$I_{GD}$	gate non-trigger current				5	mA
$I_L$	latching current	$t_p = 10\text{ }\mu\text{s}$ $I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$		200	mA
$I_H$	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$		100	mA
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$ $I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$		2	$\mu\text{s}$
$t_q$	turn-off time	$V_R = 100\text{ V}; I_T = 50\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 20\text{ V}/\mu\text{s}; t_p = 200\text{ }\mu\text{s}$	$T_{VJ} = 140^{\circ}\text{C}$	150		$\mu\text{s}$



Package V1-B-Pack		Ratings				
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>				28		g
$M_D$	mounting torque		2		2.5	Nm
$d_{Spp/App}$	creepage distance on surface / striking distance through air	terminal to terminal	7.0			mm
$d_{Spb/Apb}$		terminal to backside	10.0			mm
$V_{ISOL}$	isolation voltage	t = 1 second	3600			V
		t = 1 minute	3000			V



**Part description**

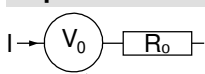
- M = Module
- D = Diode
- M = Standard Rectifier
- A = (up to 1800V)
- 60 = Current Rating [A]
- UC = 3- Rectifier Bridge + Softstart-Thyristor
- 1600 = Reverse Voltage [V]
- VC = V1-B-Pack

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MDMA60UC1600VC	MDMA60UC1600VC	Box	10	517265

**Equivalent Circuits for Simulation**

\* on die level

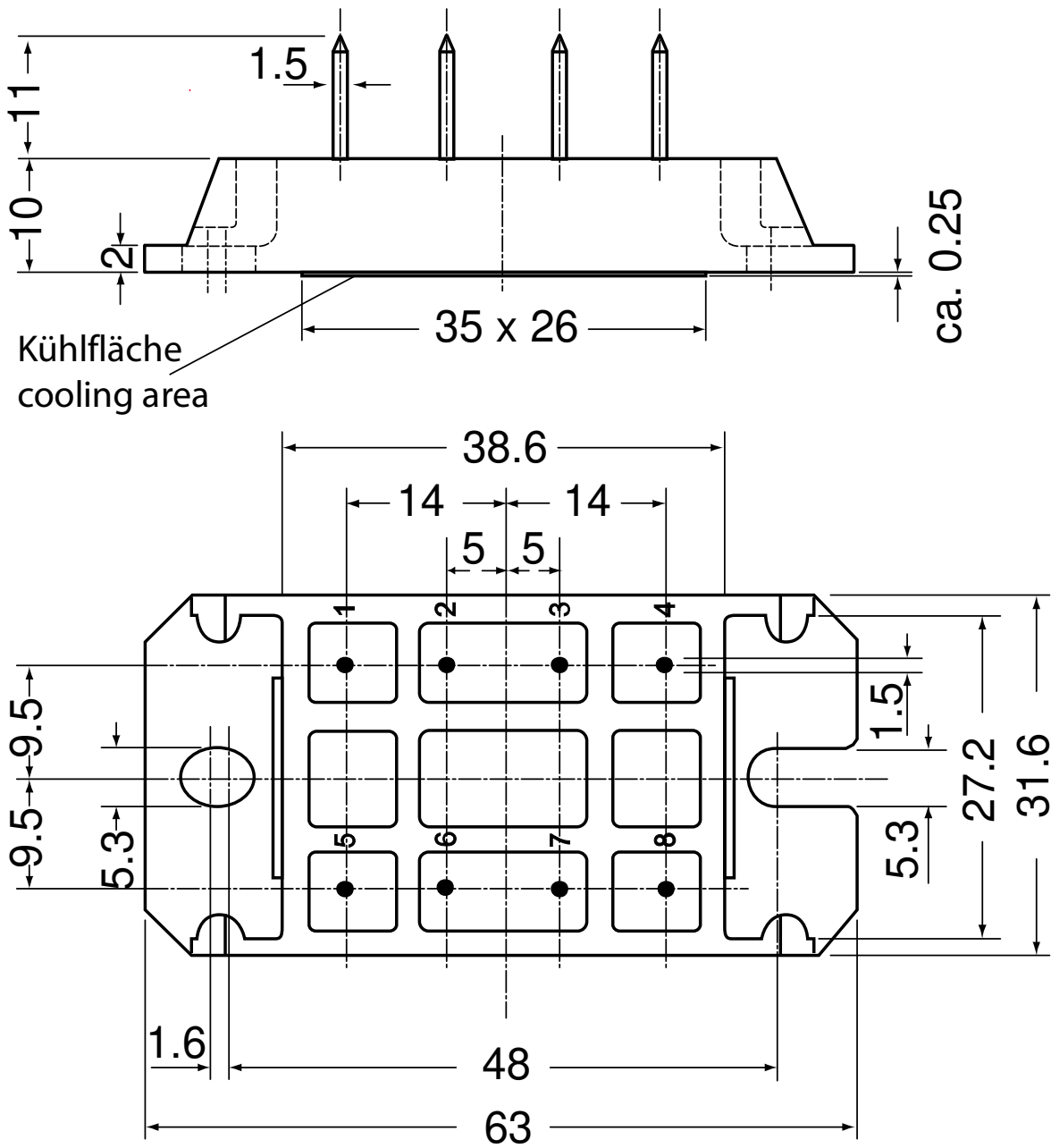
$T_{VJ} = 150^{\circ}C$



$V_{0\ max}$	threshold voltage	0.83	V
$R_{0\ max}$	slope resistance *	10.2	mΩ

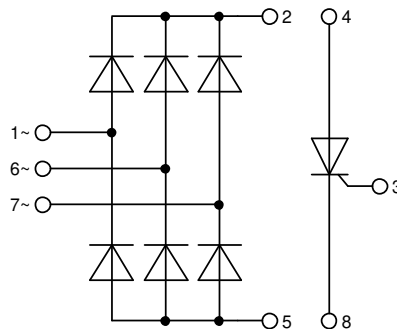


Outlines V1-B-Pack



Kühlfläche  
cooling area

ca. 0.25





**Rectifier**

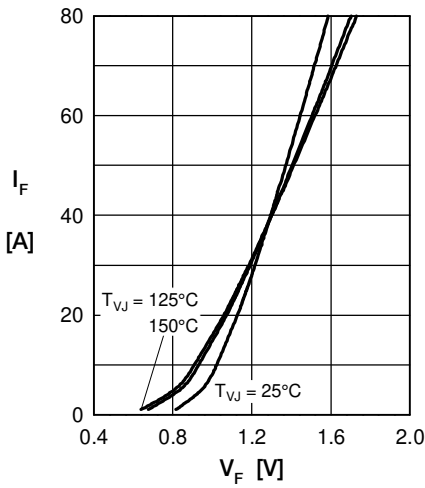


Fig. 1 Forward current vs. voltage drop per diode

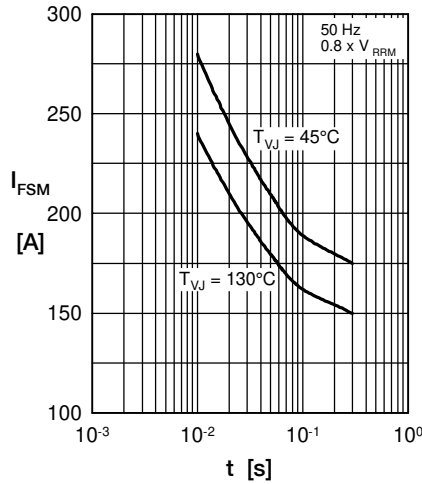


Fig. 2 Surge overload current vs. time per diode

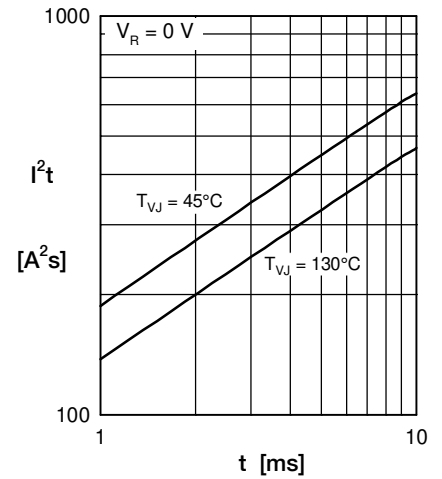


Fig. 3  $I^2t$  vs. time per diode

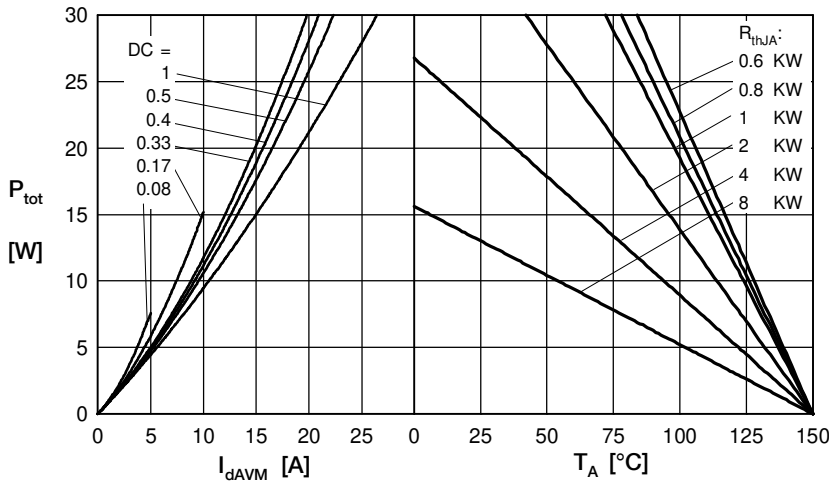


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

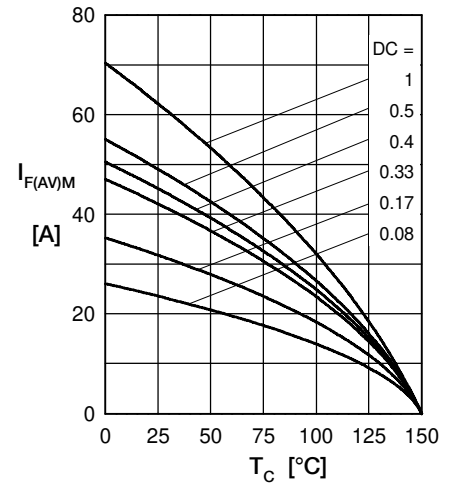


Fig. 5 Max. forward current vs. case temperature per diode

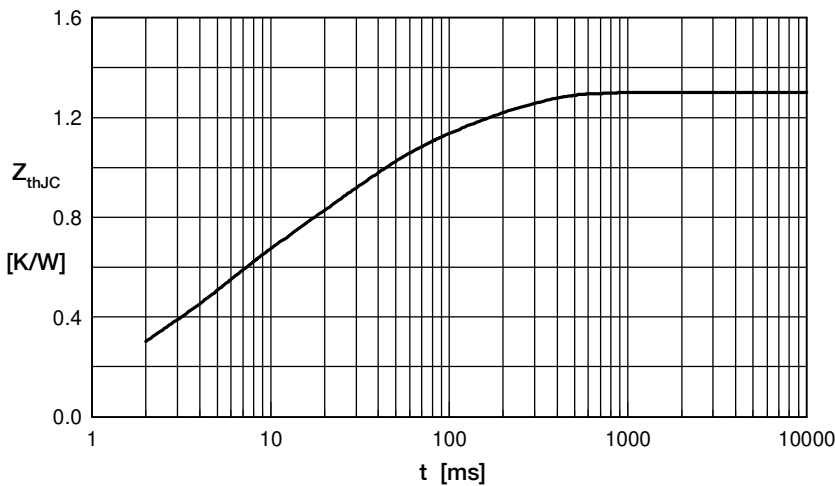


Fig. 6 Transient thermal impedance junction to case vs. time per diode

Constants for  $Z_{thJC}$  calculation:

i	$R_{th}$ (K/W)	$t_i$ (s)
1	0.06070	0.008
2	0.173	0.05
3	0.3005	0.06
4	0.463	0.3
5	0.3028	0.15

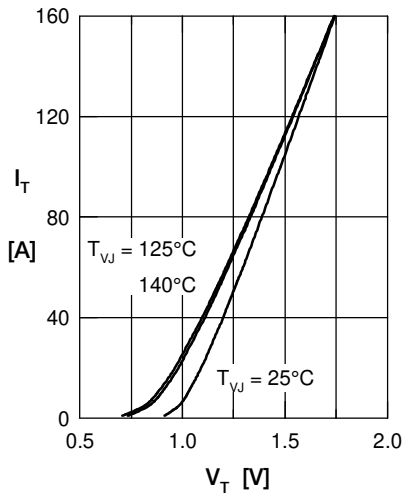
**Softstart Thyristor**


Fig. 1 Forward characteristics

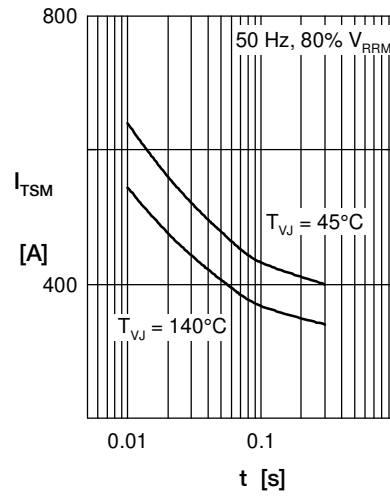
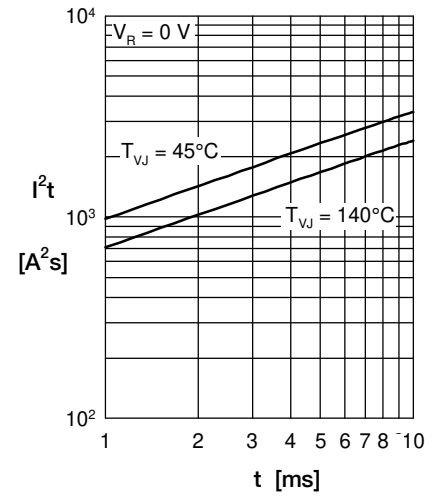
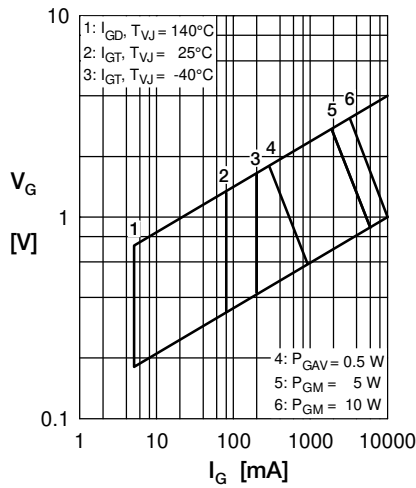

 Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

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


Fig. 4 Gate voltage &amp; gate current

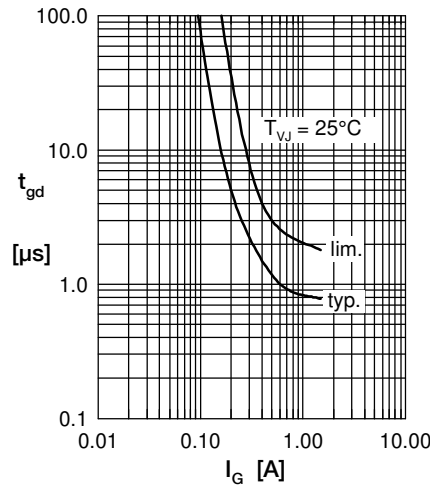
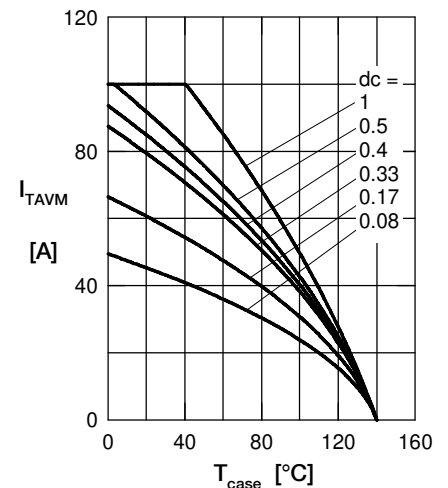

 Fig. 5 Gate controlled delay time  $t_{gd}$ 


Fig. 6 Max. forward current at case temperature

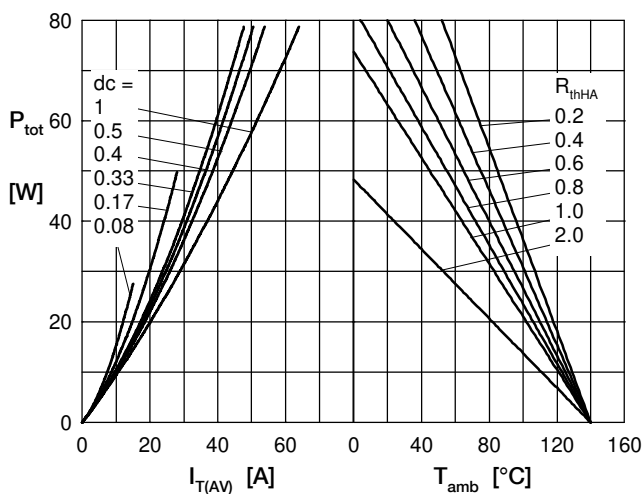
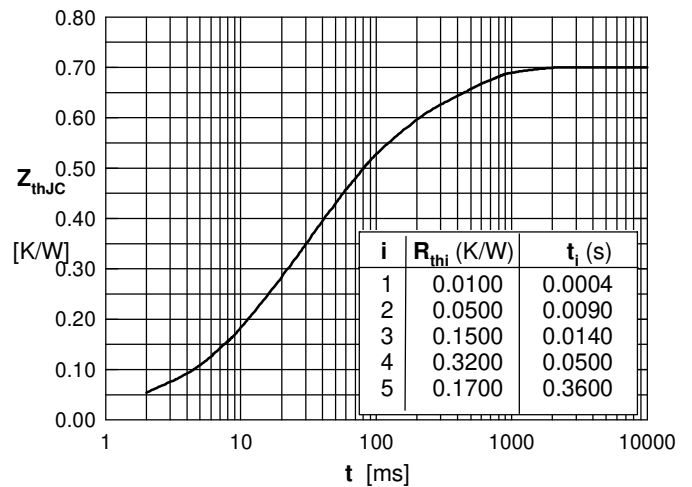

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case