

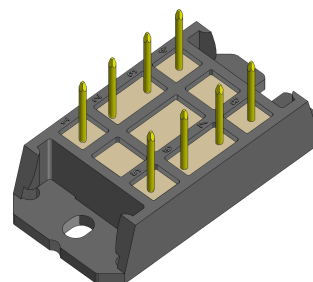
Standard Rectifier Module

3~ Rectifier	
V_{RRM}	= 1600 V
I_{DAV}	= 60 A
I_{FSM}	= 350 A

3~ Rectifier Bridge + Softstart-Thyristor

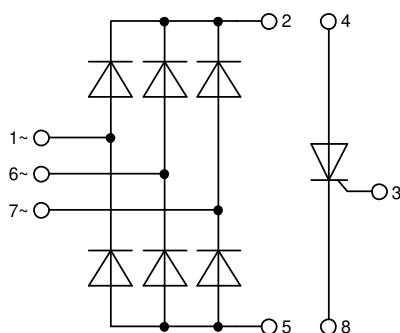
Part number

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

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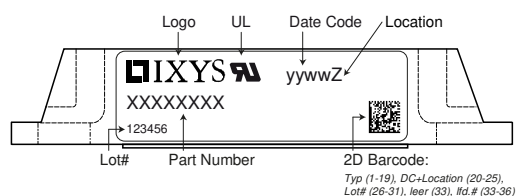
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Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
V_{RSM}	max. non-repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1700	V
V_{RRM}	max. repetitive reverse blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1600	V
I_R	reverse current	$V_R = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			40	μA
		$V_R = 1600\text{ V}$	$T_{VJ} = 150^{\circ}\text{C}$			1.5	mA
V_F	forward voltage drop	$I_F = 20\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.13	V
		$I_F = 60\text{ A}$				1.44	V
		$I_F = 20\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.07	V
		$I_F = 60\text{ A}$				1.50	V
I_{DAV}	bridge output current	$T_C = 110^{\circ}\text{C}$ rectangular	$T_{VJ} = 150^{\circ}\text{C}$ $d = \frac{1}{3}$			60	A
V_{F0}	threshold voltage	} for power loss calculation only		$T_{VJ} = 150^{\circ}\text{C}$		0.83	V
r_F	slope resistance					11.5	m Ω
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	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			350	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			380	A
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			300	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			320	A
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			615	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			600	A ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$			450	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			425	A ² s
C_J	junction capacitance	$V_R = 400\text{ V}; f = 1\text{ MHz}$			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	$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 140^{\circ}\text{C}$			6	mA
V_T	forward voltage drop	$I_T = 50\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.25	V
		$I_T = 100\text{ A}$				1.48	V
		$I_T = 50\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.17	V
		$I_T = 100\text{ A}$				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	mΩ
$R_{\theta JC}$	thermal resistance junction to case					0.7	K/W
$R_{\theta CH}$	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 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}\text{C}$			800	A
		t = 8,3 ms; (60 Hz), sine	$V_R = 0\text{ V}$			865	A
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 140^{\circ}\text{C}$			680	A
		t = 8,3 ms; (60 Hz), sine	$V_R = 0\text{ V}$			735	A
I^2t	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}\text{C}$			3.20	kA²s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0\text{ V}$			3.12	kA²s
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 140^{\circ}\text{C}$			2.31	kA²s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0\text{ V}$			2.25	kA²s
C_J	junction capacitance	$V_R = 400\text{ V}$ f = 1 MHz	$T_{VJ} = 25^{\circ}\text{C}$		32		pF
P_{GM}	max. gate power dissipation	$t_P = 30\text{ }\mu\text{s}$	$T_C = 140^{\circ}\text{C}$			10	W
		$t_P = 300\text{ }\mu\text{s}$				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/ μs
		$t_P = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ — non-repet., $I_T = 50\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}\text{C}$			1000	V/ μs
		$R_{GK} = \infty$; method 1 (linear voltage rise)					
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	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			200	mA
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
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	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$			2	μs
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 50\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $T_{VJ} = 140^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 20\text{ V}/\mu\text{s}; t_p = 200\text{ }\mu\text{s}$		150			μs

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
Weight					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	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	3600			V
		t = 1 minute		3000			V



Part description

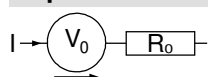
M = Module
 D = Diode
 M = Standard Rectifier
 A = (up to 1800V)
 60 = Current Rating [A]
 UC = 3~ Rectifier Bridge + Softstart-Thyristor
 1600 = Reverse Voltage [V]
 VC = V1-B-Pack

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

Equivalent Circuits for Simulation

* on die level

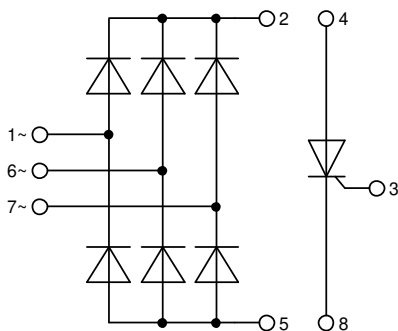
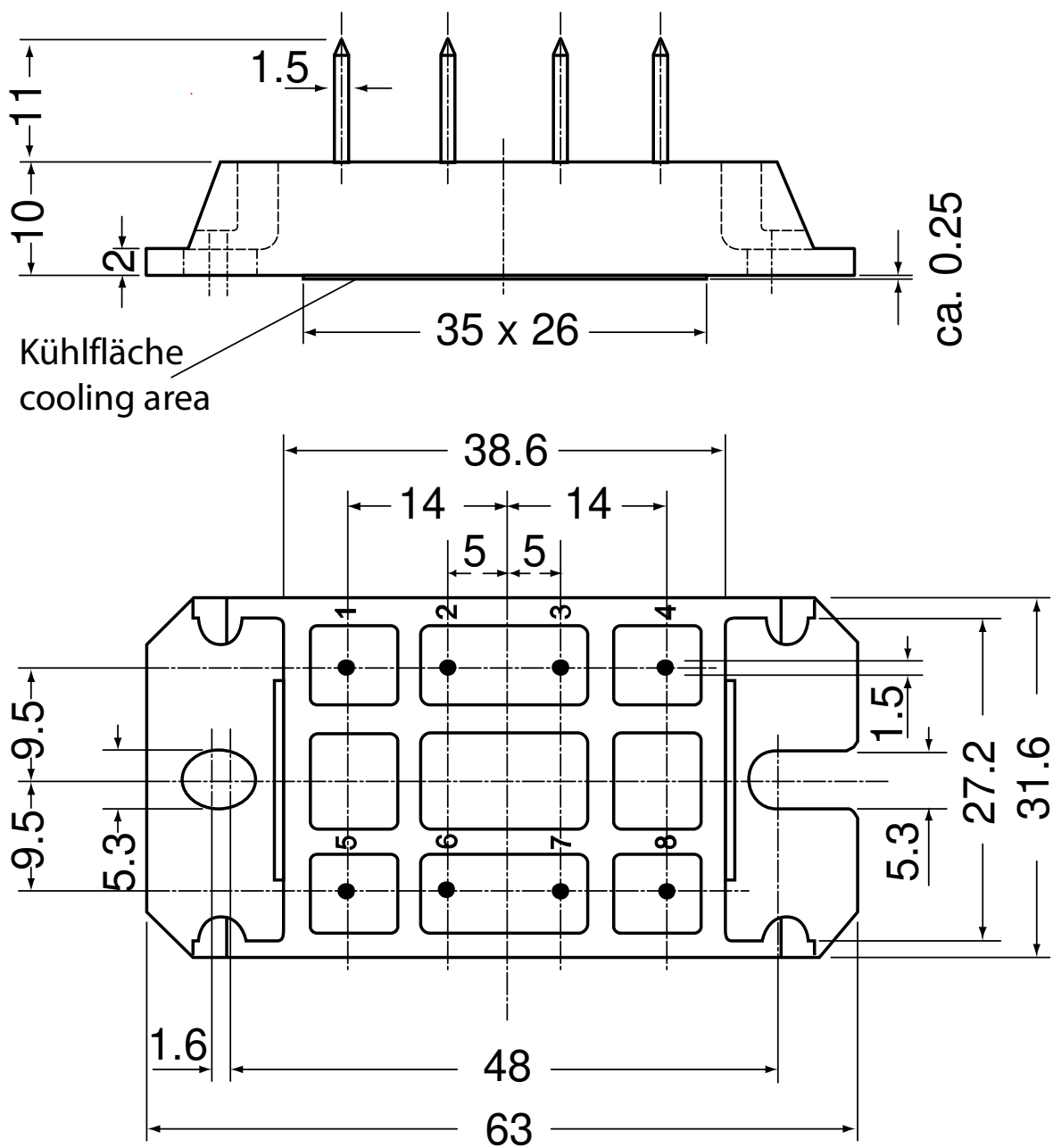
$T_{VJ} = 150^{\circ}\text{C}$



Rectifier

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

Outlines V1-B-Pack



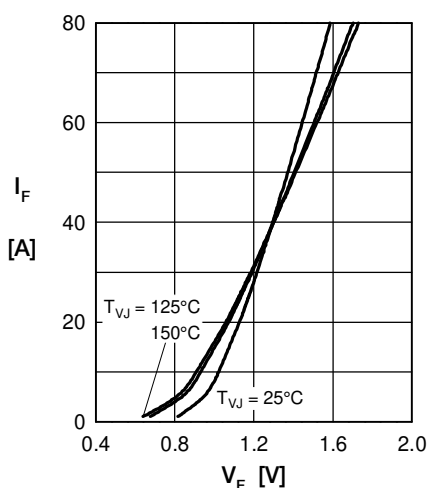
Rectifier


Fig. 1 Forward current vs. voltage drop per diode

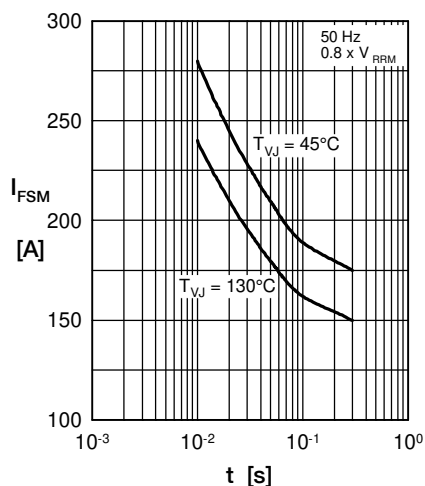


Fig. 2 Surge overload current vs. time per diode

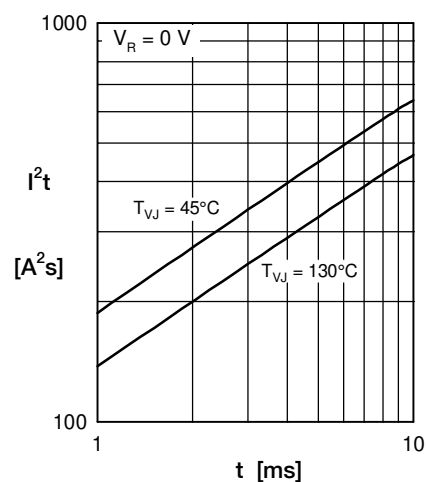


Fig. 3 I^2t vs. time per diode

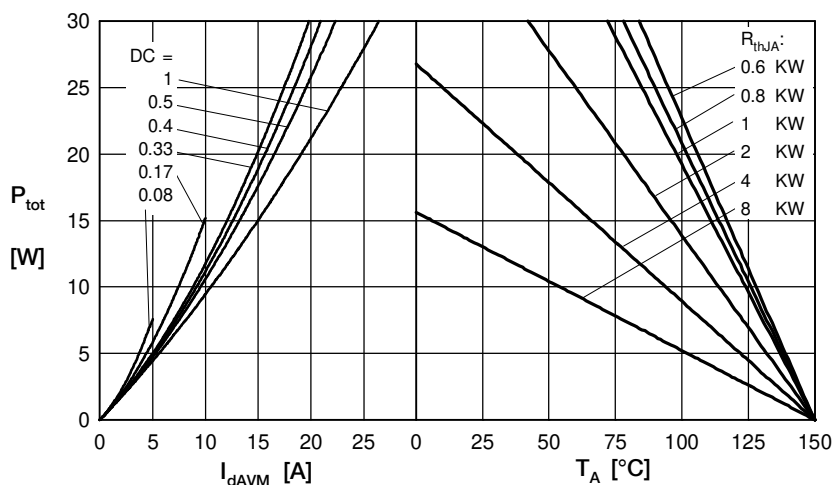


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

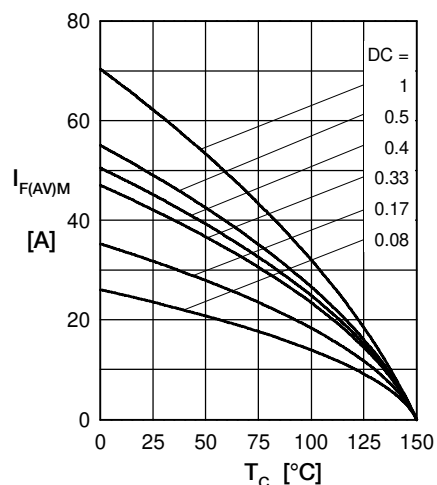


Fig. 5 Max. forward current vs. case temperature per diode

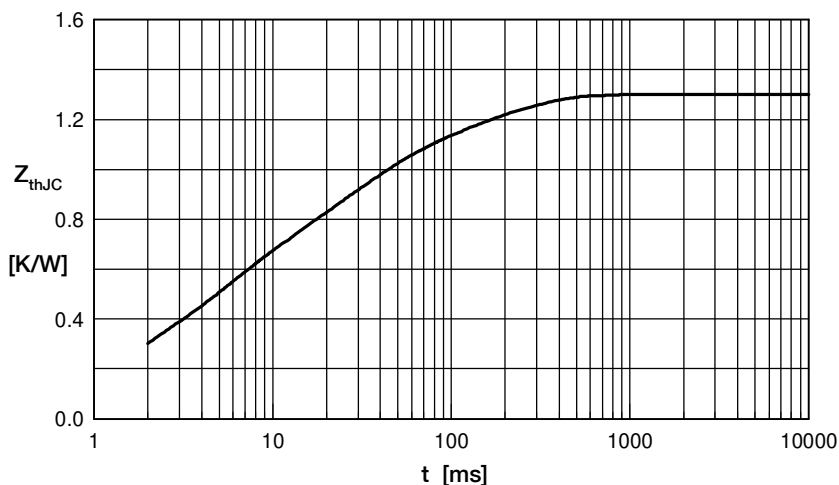


Fig. 6 Transient thermal impedance junction to case vs. time per diode

Constants for Z_{thJC} calculation:

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

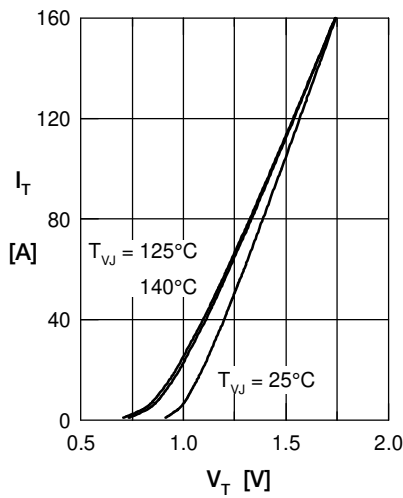
Softstart Thyristor


Fig. 1 Forward characteristics

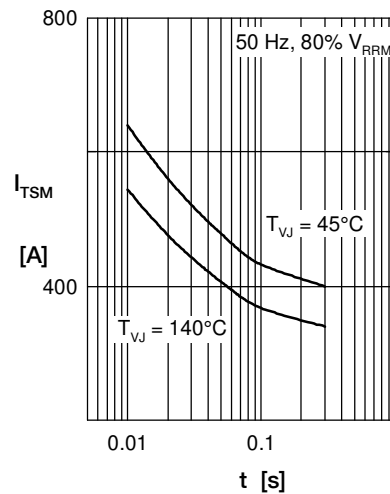
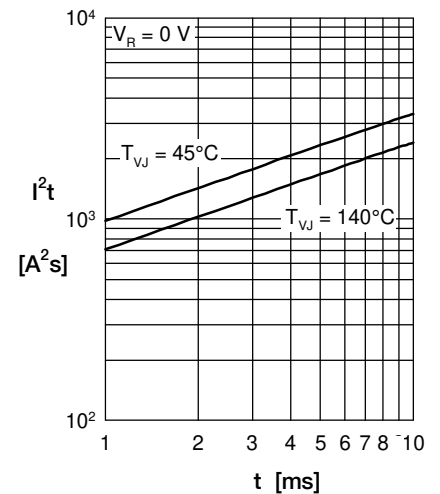
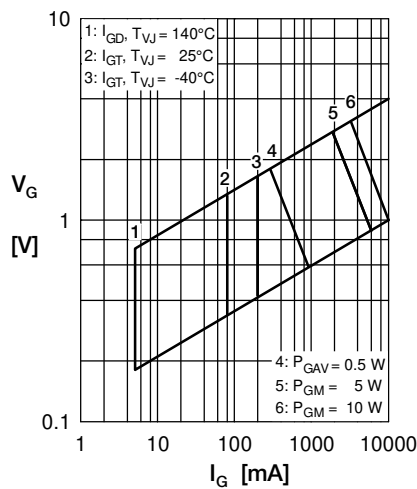

 Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

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


Fig. 4 Gate voltage & gate current

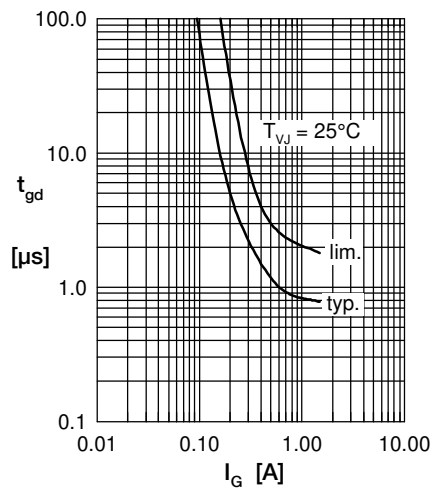
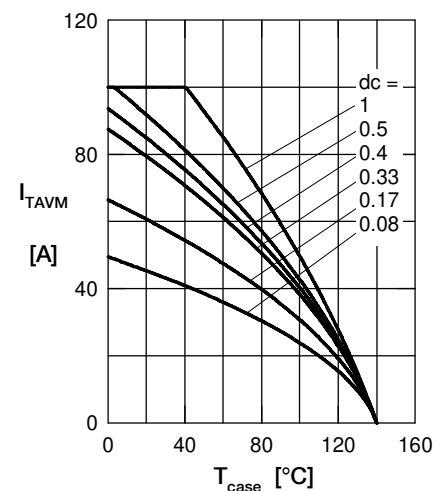

 Fig. 5 Gate controlled delay time t_{gd}


Fig. 6 Max. forward current at case temperature

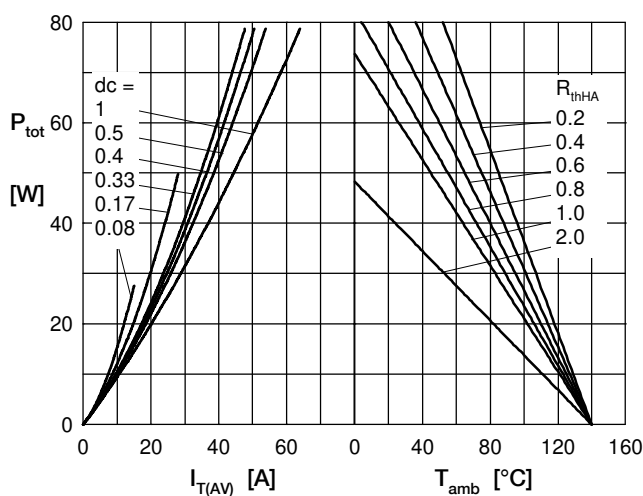
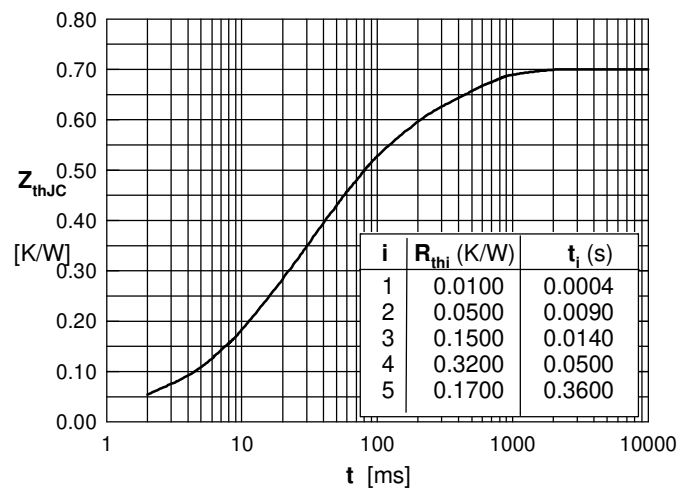

 Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case