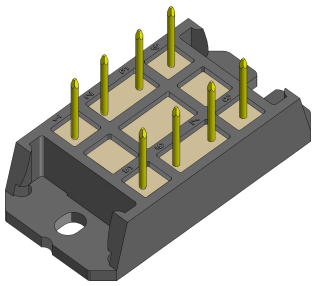
Standard Rectifier Module

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

3~ Rectifier Bridge + Softstart-Thyristor

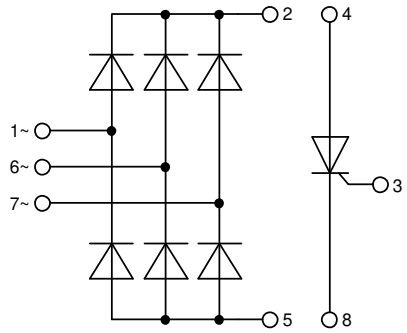
Part number

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

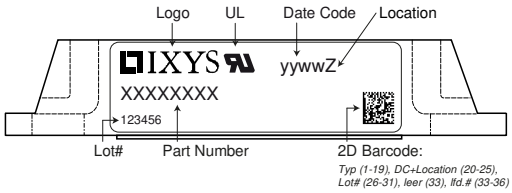
Rectifier

Symbol	Definition	Conditions		Ratings min.	typ.	max.	Unit
V_{RSM}	*max. non-repetitive reverse blocking voltage*		T_{VJ} = 25°C			1700	V
V_{RRM}	*max. repetitive reverse blocking voltage*		T_{VJ} = 25°C			1600	V
I_R	*reverse current*	V_R = 1600 V	T_{VJ} = 25°C			40	µA
		V_R = 1600 V	T_{VJ} = 150°C			1.5	mA
V_F	*forward voltage drop*	I_F = 20 A	T_{VJ} = 25°C			1.13	V
		I_F = 60 A				1.44	V
		I_F = 20 A	T_{VJ} = 125°C			1.07	V
		I_F = 60 A				1.50	V
I_{DAV}	*bridge output current*	T_C = 110°C	T_{VJ} = 150°C			60	A
		rectangular d = ⅓					
V_{F0}	*threshold voltage* } *for power loss calculation only*		T_{VJ} = 150°C			0.83	V
r_F	*slope resistance* }					11.5	mΩ
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°C			95	W
I_{FSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°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°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°C			615	A²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			600	A²s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 150°C			450	A²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			425	A²s
C_J	*junction capacitance*	V_R = 400 V; f = 1 MHz	T_{VJ} = 25°C		10		pF

Softstart-Thyristor

Symbol	Definition	Conditions		Ratings min.	typ.	max.	Unit
$V_{RSM/DSM}$	*max. non-repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			1700	V
$V_{RRM/DRM}$	*max. repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			1600	V
$I_{R/D}$	*reverse current, drain current*	$V_{R/D}$ = 1600 V	T_{VJ} = 25°C			100	µA
		$V_{R/D}$ = 1600 V	T_{VJ} = 140°C			6	mA
V_T	*forward voltage drop*	I_T = 50 A	T_{VJ} = 25°C			1.25	V
		I_T = 100 A				1.48	V
		I_T = 50 A	T_{VJ} = 125°C			1.17	V
		I_T = 100 A				1.44	V
I_{TAV}	*average forward current*	T_C = 85°C	T_{VJ} = 140°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°C			0.89	V
r_T	*slope resistance* }					5.3	mΩ
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°C			160	W
I_{TSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			800	A
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			865	A
		t = 10 ms; (50 Hz), sine	T_{VJ} = 140°C			680	A
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			735	A
I^2t	*value for fusing*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			3.20	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			3.12	kA²s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 140°C			2.31	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			2.25	kA²s
C_J	*junction capacitance*	V_R = 400 V f = 1 MHz	T_{VJ} = 25°C		32		pF
P_{GM}	*max. gate power dissipation*	t_P = 30 µs	T_C = 140°C			10	W
		t_P = 300 µs				5	W
P_{GAV}	*average gate power dissipation*					0.5	W
$(di/dt)_{cr}$	*critical rate of rise of current*	T_{VJ} = 140°C; f = 50 Hz	repetitive, I_T = 150 A			150	A/µs
		t_P = 200 µs; di_G/dt = 0.45 A/µs;					
		I_G = 0.45 A; V_D = ⅔ V_{DRM}	non-repet., I_T = 50 A			500	A/µs
$(dv/dt)_{cr}$	*critical rate of rise of voltage*	V_D = ⅔ V_{DRM}	T_{VJ} = 140°C			1000	V/µs
		R_{GK} = ∞; method 1 (linear voltage rise)					
V_{GT}	*gate trigger voltage*	V_D = 6 V	T_{VJ} = 25°C			1.5	V
			T_{VJ} = -40°C			1.6	V
I_{GT}	*gate trigger current*	V_D = 6 V	T_{VJ} = 25°C			78	mA
			T_{VJ} = -40°C			200	mA
V_{GD}	*gate non-trigger voltage*	V_D = ⅔ V_{DRM}	T_{VJ} = 140°C			0.2	V
I_{GD}	*gate non-trigger current*					5	mA
I_L	*latching current*	t_p = 10 µs	T_{VJ} = 25°C			200	mA
		I_G = 0.45 A; di_G/dt = 0.45 A/µs					
I_H	*holding current*	V_D = 6 V R_{GK} = ∞	T_{VJ} = 25°C			100	mA
t_{gd}	*gate controlled delay time*	V_D = ½ V_{DRM}	T_{VJ} = 25°C			2	µs
		I_G = 0.45 A; di_G/dt = 0.45 A/µs					
t_q	*turn-off time*	V_R = 100 V; I_T = 50 A; V_D = ⅔ V_{DRM}	T_{VJ} = 140°C		150		µs
		di/dt = 10 A/µs; dv/dt = 20 V/µs; t_p = 200 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} ≤ 1 mA	3600			V
		t = 1 minute		3000			V

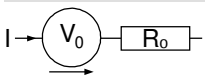


Part description

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

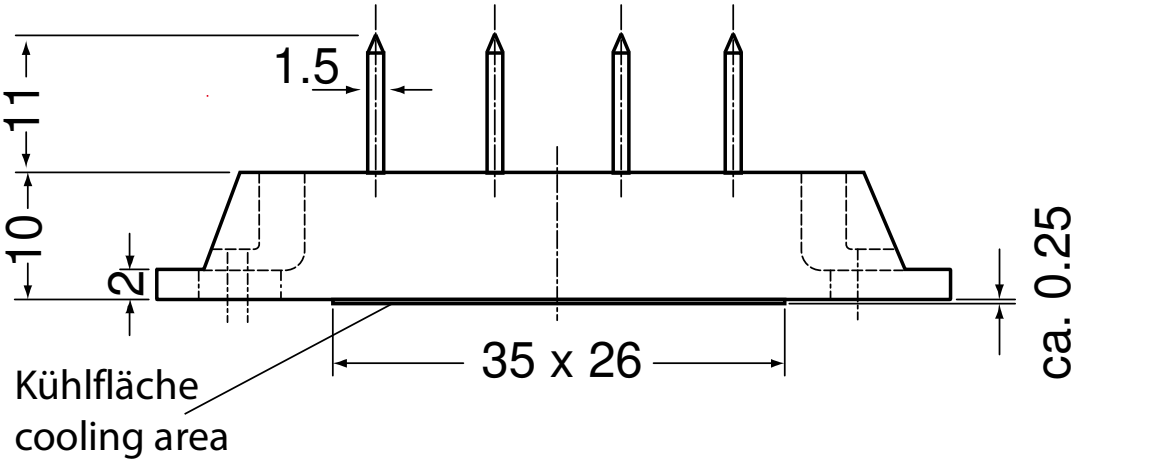
Equivalent Circuits for Simulation * *on die level* T_{VJ} = 150°C

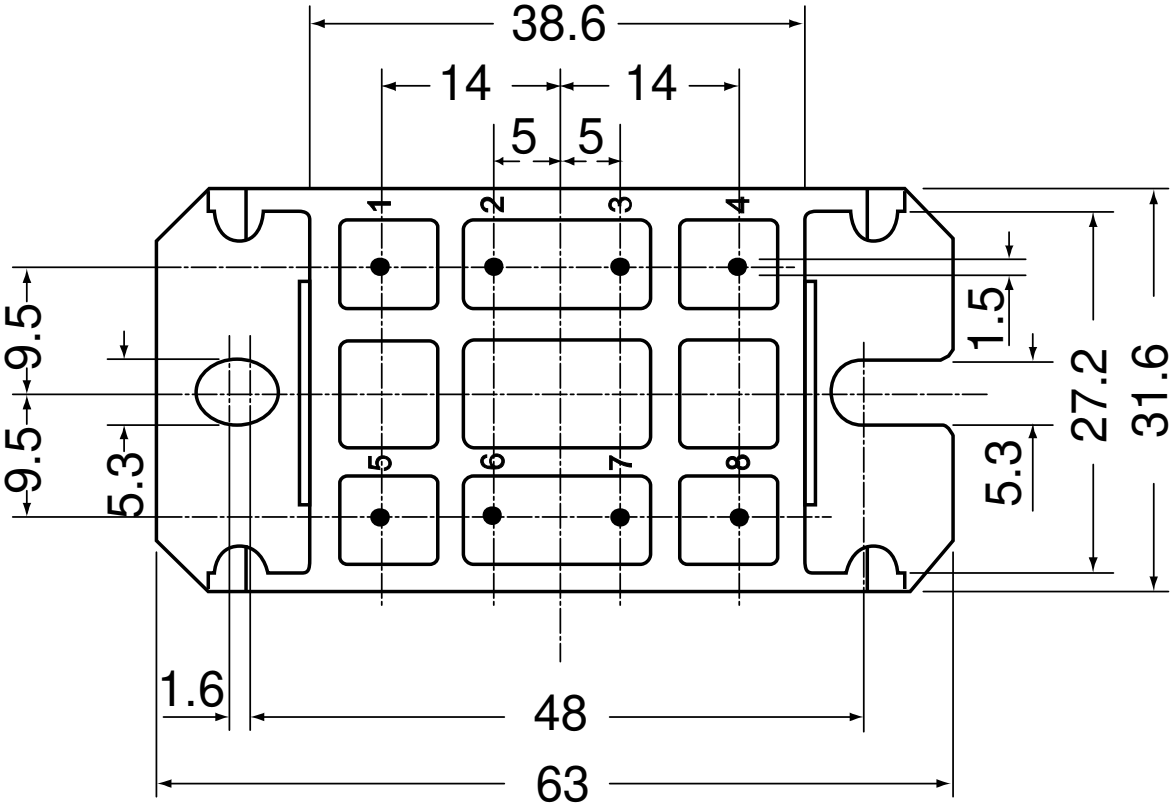


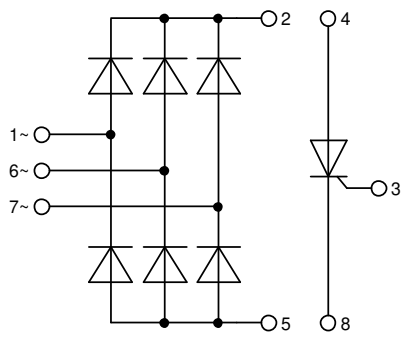
Rectifier

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

Outlines V1-B-Pack







Rectifier

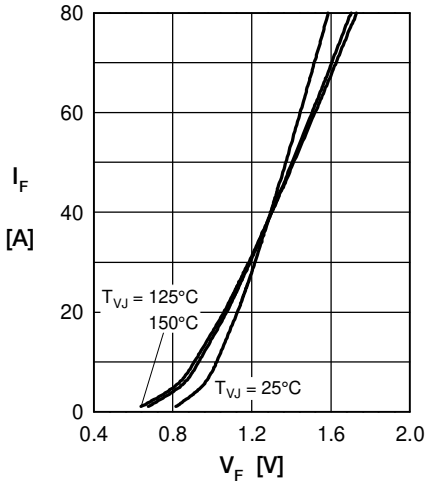


Fig. 1 Forward current vs. voltage drop per diode

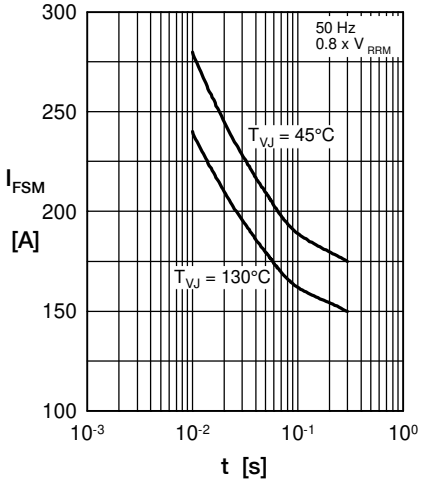


Fig. 2 Surge overload current vs. time per diode

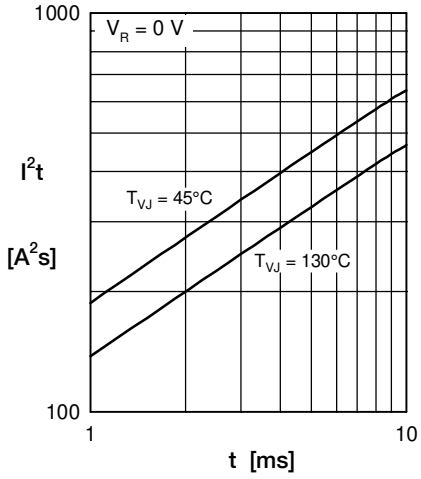


Fig. 3 I^2t vs. time per diode

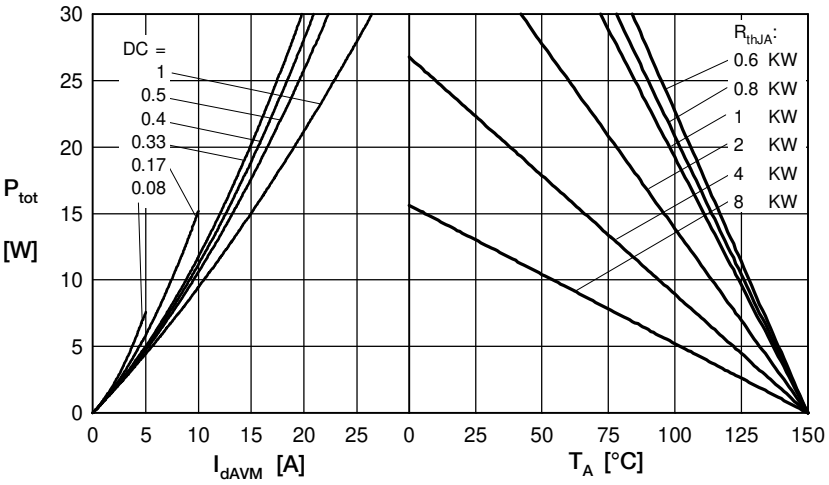


Fig. 4 Power dissipation vs. forward current and ambient temperature per diode

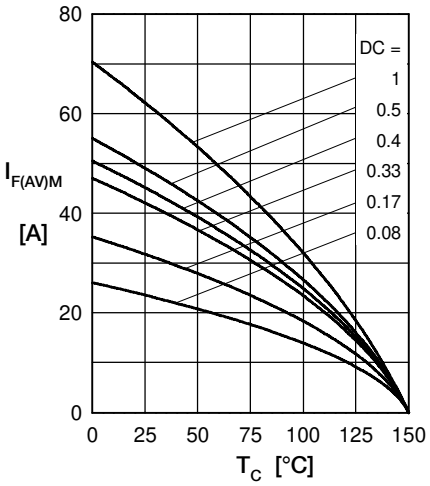


Fig. 5 Max. forward current vs. case temperature per diode

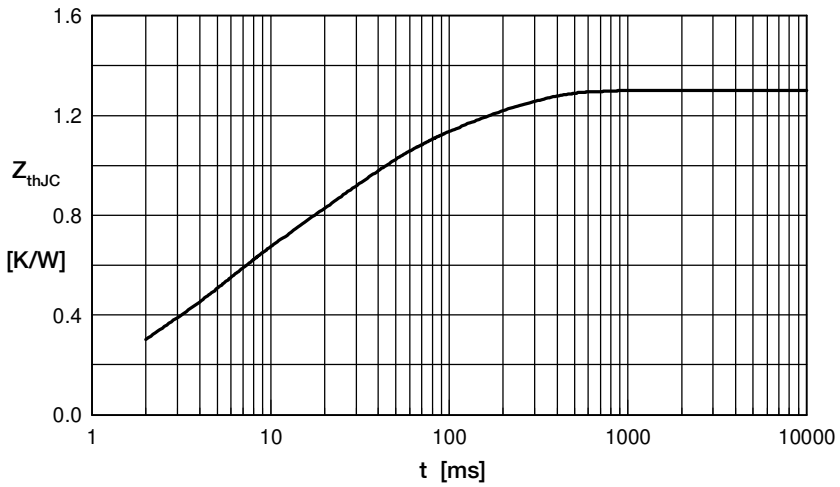


Fig. 6 Transient thermal impedance junction to case vs. time per diode

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

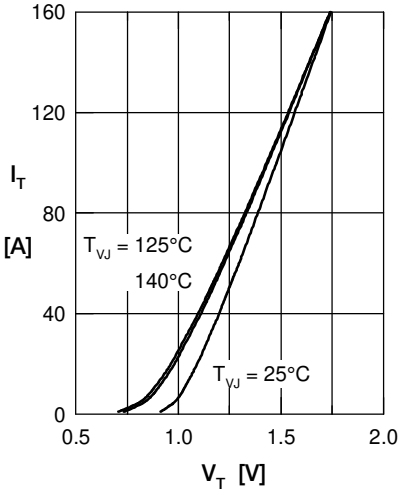


Fig. 1 Forward characteristics

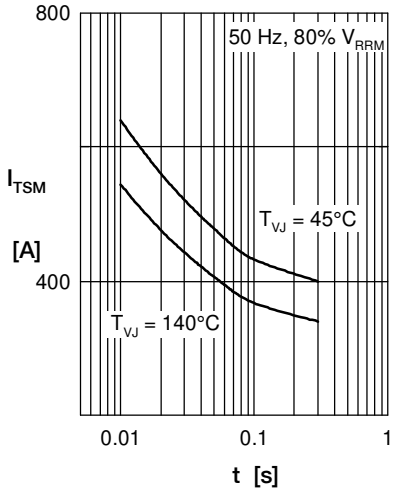


Fig. 2 Surge overload current
I_{TSM}: crest value, t: duration

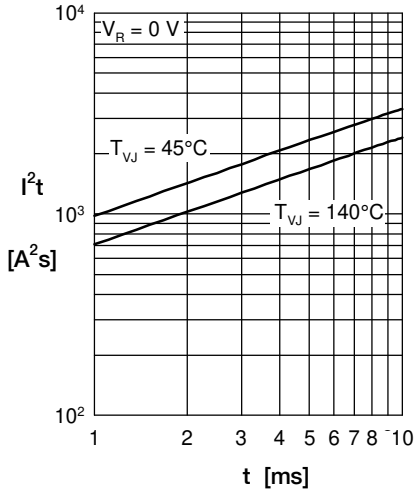


Fig. 3 I^2t versus time (1-10 s)

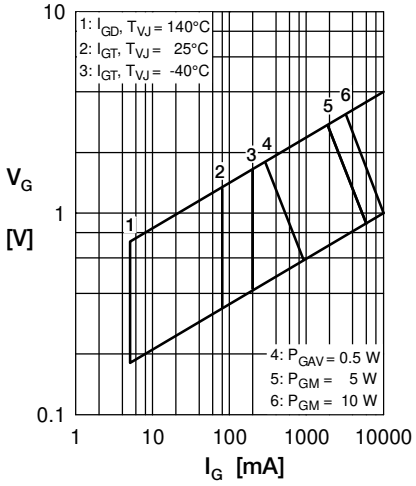


Fig. 4 Gate voltage & gate current

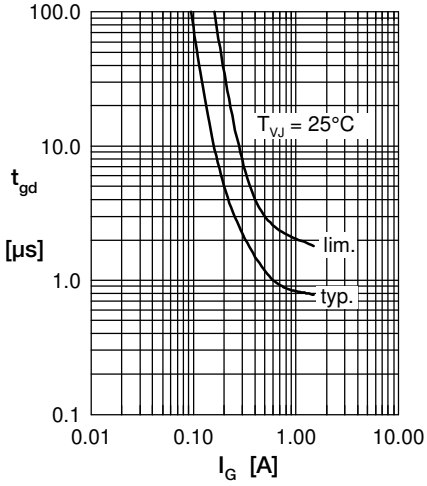


Fig. 5 Gate controlled delay time t_{gd}

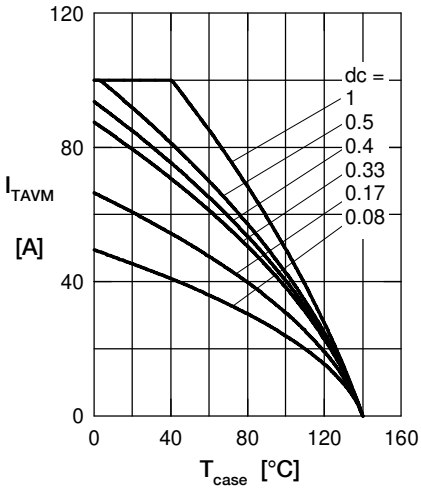


Fig. 6 Max. forward current at case temperature

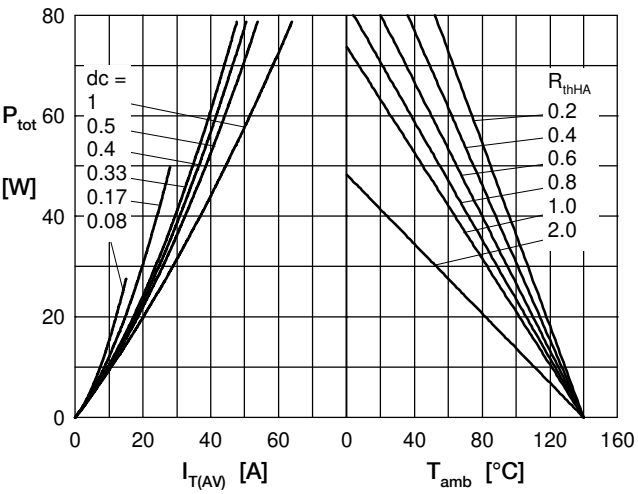
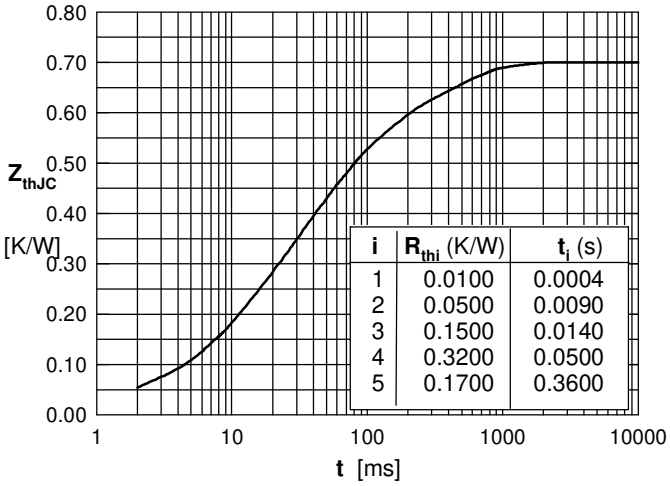


Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature



i	R_{thi} (K/W)	t_i (s)
1	0.0100	0.0004
2	0.0500	0.0090
3	0.1500	0.0140
4	0.3200	0.0500
5	0.1700	0.3600

Fig. 8 Transient thermal impedance junction to case