



Thyristor \ Diode Module

$V_{RRM} = 2 \times 1600 \text{ V}$

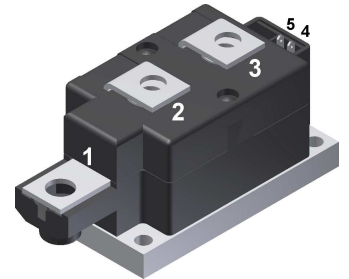
$I_{TAV} = 320 \text{ A}$

$V_T = 1.06 \text{ V}$

Phase leg

Part number

MCD312-16io1



Backside: isolated

E72873



Features / Advantages:

- International standard package
- Direct copper bonded Al₂O₃-ceramic with copper base plate
- Planar passivated chip
- Keyed gate/cathode twin pins

Applications:

- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

Package: Y1

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: Copper internally DCB isolated
- Advanced power cycling

Disclaimer Notice

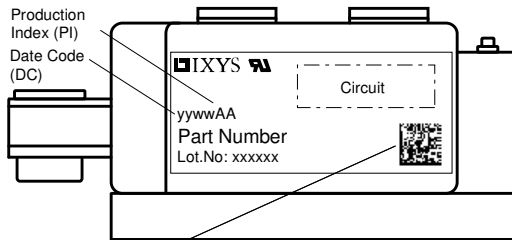
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Rectifier			Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage				1700	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage				1600	V	
I_{RD}	reverse current, drain current	$V_{R/D} = 1600$ V			1	mA	
		$V_{R/D} = 1600$ V			40	mA	
V_T	forward voltage drop	$I_T = 300$ A			1.12	V	
		$I_T = 600$ A			1.32	V	
		$I_T = 300$ A	$T_{VJ} = 125^\circ\text{C}$			1.06	V
		$I_T = 600$ A				1.29	V
I_{TAV}	average forward current	$T_C = 85^\circ\text{C}$			320	A	
$I_{T(RMS)}$	RMS forward current	180° sine			520	A	
V_{T0}	threshold voltage	} for power loss calculation only			0.80	V	
r_T	slope resistance				0.68	mΩ	
R_{thJC}	thermal resistance junction to case				0.12	K/W	
R_{thCH}	thermal resistance case to heatsink			0.04		K/W	
P_{tot}	total power dissipation		$T_C = 25^\circ\text{C}$		960	W	
I_{TSM}	max. forward surge current	$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 45^\circ\text{C}$		9.60	kA	
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V		10.4	kA	
		$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 140^\circ\text{C}$		8.16	kA	
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V		8.82	kA	
I^2t	value for fusing	$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 45^\circ\text{C}$		460.8	kA ² s	
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V		447.4	kA ² s	
		$t = 10$ ms; (50 Hz), sine	$T_{VJ} = 140^\circ\text{C}$		332.9	kA ² s	
		$t = 8,3$ ms; (60 Hz), sine	$V_R = 0$ V		323.3	kA ² s	
C_J	junction capacitance	$V_R = 400$ V $f = 1$ MHz	$T_{VJ} = 25^\circ\text{C}$		438	pF	
P_{GM}	max. gate power dissipation	$t_p = 30$ μs	$T_C = 140^\circ\text{C}$		120	W	
		$t_p = 500$ μs			60	W	
P_{GAV}	average gate power dissipation				20	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 140^\circ\text{C}; f = 50$ Hz	repetitive, $I_T = 960$ A		100	A/μs	
		$t_p = 200$ μs; $di_G/dt = 1$ A/μs; $I_G = 1$ A; $V = 2/3 V_{DRM}$	non-repet., $I_T = 320$ A		500	A/μs	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = 2/3 V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise)	$T_{VJ} = 140^\circ\text{C}$		1000	V/μs	
V_{GT}	gate trigger voltage	$V_D = 6$ V	$T_{VJ} = 25^\circ\text{C}$		2	V	
			$T_{VJ} = -40^\circ\text{C}$		3	V	
I_{GT}	gate trigger current	$V_D = 6$ V	$T_{VJ} = 25^\circ\text{C}$		150	mA	
			$T_{VJ} = -40^\circ\text{C}$		220	mA	
V_{GD}	gate non-trigger voltage	$V_D = 2/3 V_{DRM}$	$T_{VJ} = 140^\circ\text{C}$		0.25	V	
I_{GD}	gate non-trigger current				10	mA	
I_L	latching current	$t_p = 30$ μs	$T_{VJ} = 25^\circ\text{C}$		200	mA	
		$I_G = 0.45$ A; $di_G/dt = 0.45$ A/μs					
I_H	holding current	$V_D = 6$ V $R_{GK} = \infty$	$T_{VJ} = 25^\circ\text{C}$		150	mA	
t_{gd}	gate controlled delay time	$V_D = 1/2 V_{DRM}$	$T_{VJ} = 25^\circ\text{C}$		2	μs	
		$I_G = 1$ A; $di_G/dt = 1$ A/μs					
t_q	turn-off time	$V_R = 100$ V; $I_T = 300$ A; $V = 2/3 V_{DRM}$ $di/dt = 10$ A/μs $dv/dt = 50$ V/μs $t_p = 200$ μs	$T_{VJ} = 125^\circ\text{C}$		200	μs	



Package Y1			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
I_{RMS}	RMS current	per terminal			600	A
T_{VJ}	virtual junction temperature		-40		140	°C
T_{op}	operation temperature		-40		125	°C
T_{stg}	storage temperature		-40		125	°C
Weight				680		g
M_D	mounting torque		4.5		7	Nm
M_T	terminal torque		11		13	Nm
$d_{Spp/App}$	creepage distance on surface striking distance through air	terminal to terminal	16.0			mm
$d_{Spb/Apb}$		terminal to backside	16.0			mm
V_{ISOL}	isolation voltage	t = 1 second	3600			V
		t = 1 minute	3000			V



Data Matrix: part no. (1-19), DC + PI (20-25), lot.no.# (26-31), blank (32), serial no.# (33-36)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD312-16io1	MCD312-16io1	Box	3	461857

Equivalent Circuits for Simulation

* on die level

$T_{VJ} = 140^{\circ}C$

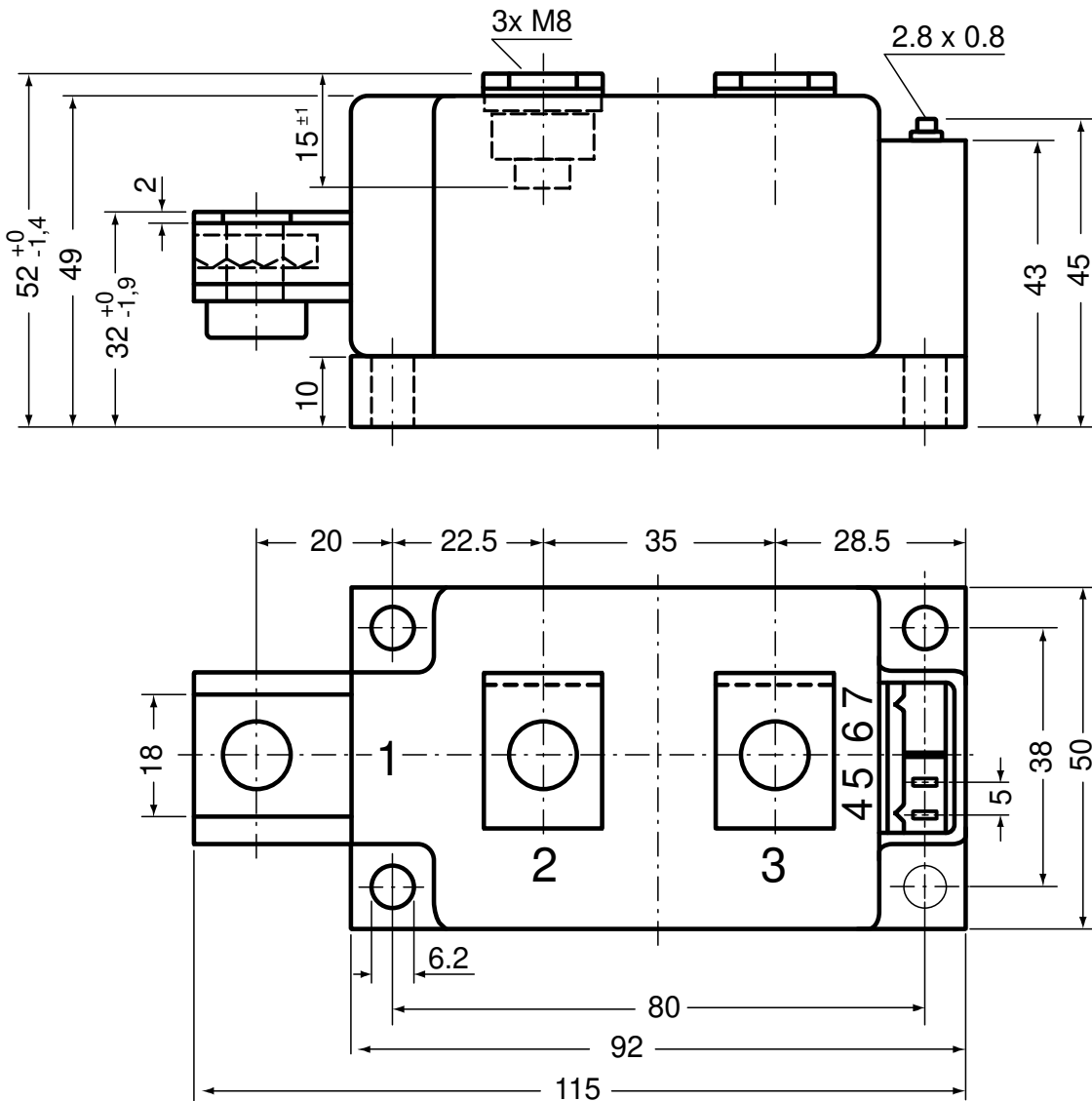


Thyristor

$V_{0\ max}$	threshold voltage	0.8	V
$R_{0\ max}$	slope resistance *	0.5	mΩ

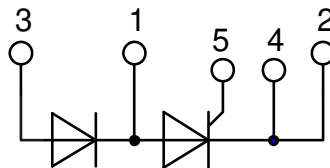


Outlines Y1



Optional accessories for modules

Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red
Type ZY 180L (L = Left for pin pair 4/5) UL 758, style 3751



Thyristor

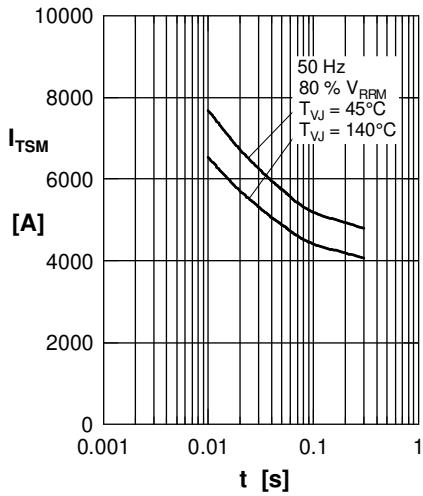


Fig. 1 Surge overload current
 I_{TSM} : Crest value, t : duration

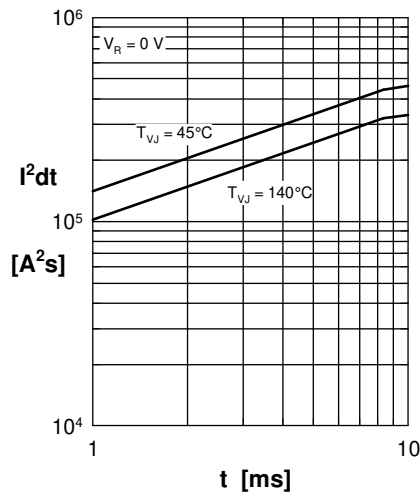


Fig. 2 I^2dt versus time

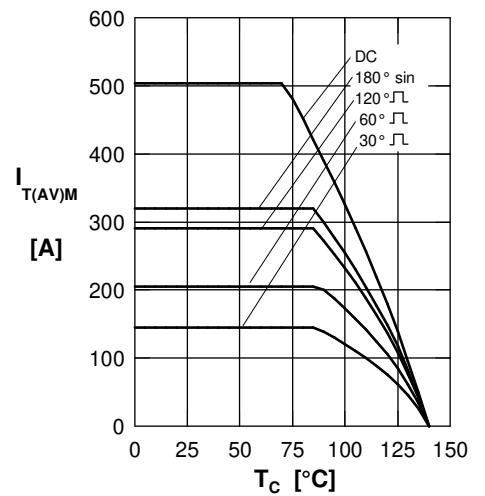


Fig. 3 Max. forward current at case temperature

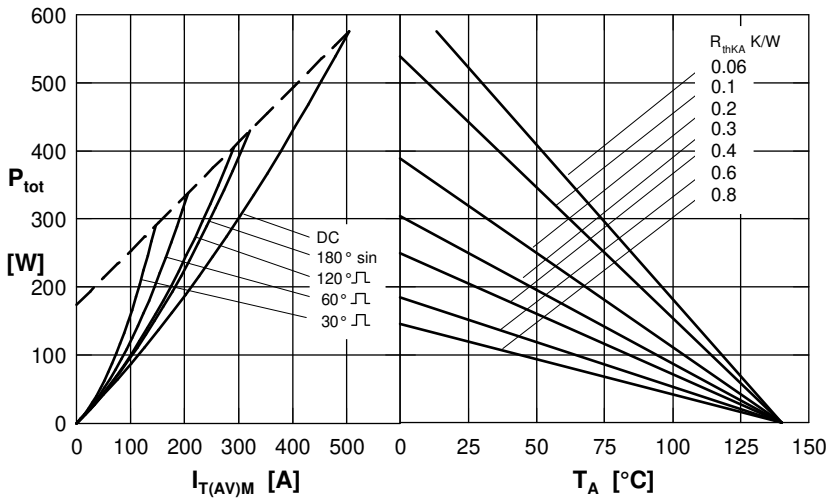


Fig. 4 Power dissipation versus on-state current and ambient temperature (per thyristor)

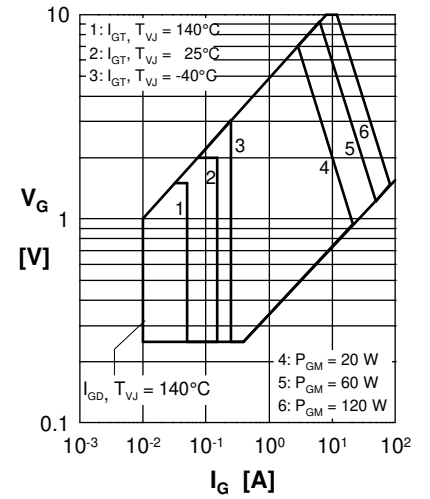


Fig. 5 Gate voltage & gate current

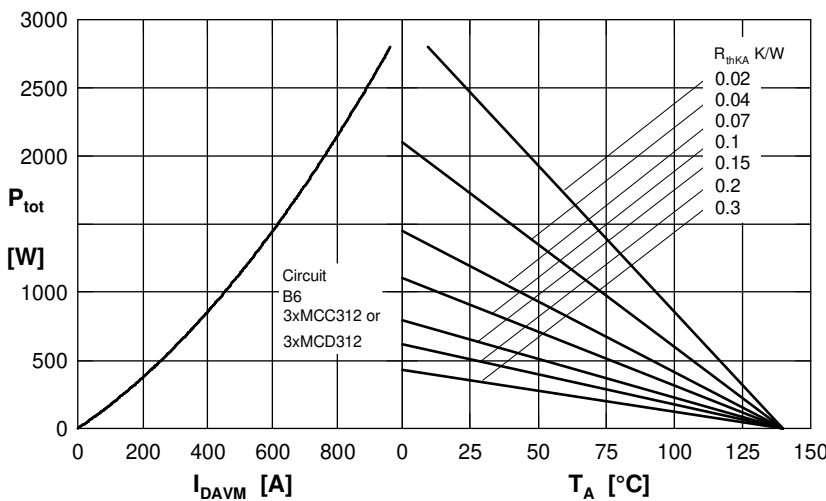


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

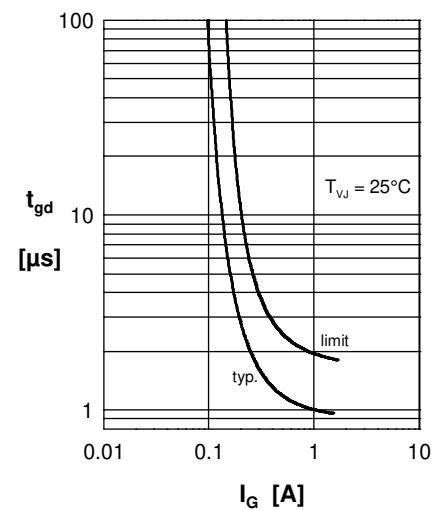


Fig. 7 Gate controlled delay time t_{gd}



Rectifier

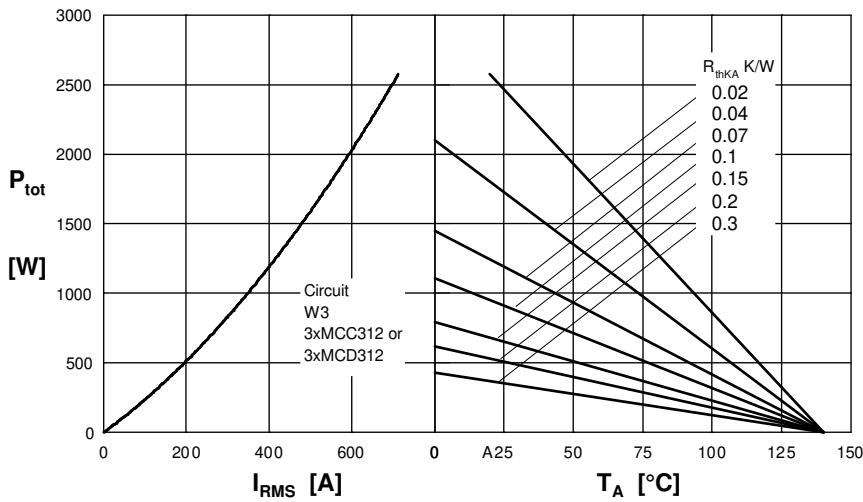


Fig. 8 Three phase AC-controller: Power dissipation versus R_{MS} output current and ambient temperature

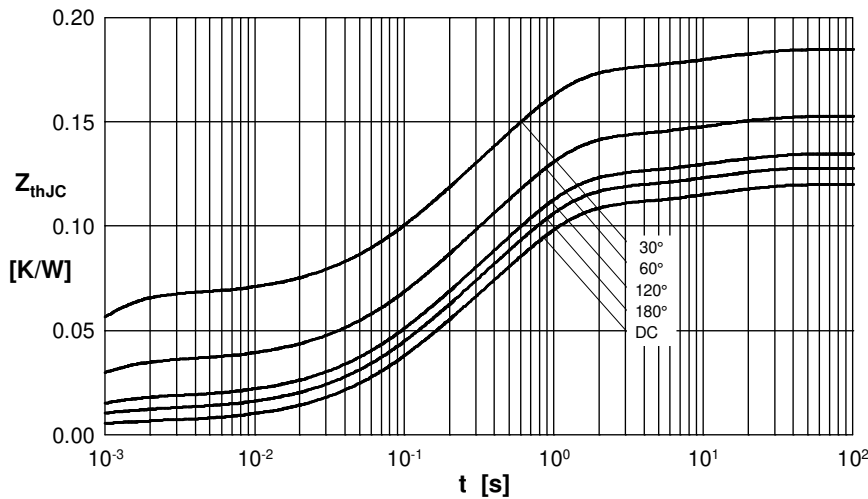


Fig. 9 Transient thermal impedance junction to case (per thyristor)

R_{thJC} for various conduct. angles d:

d	R_{thJC} [K/W]
DC	0.120
180°	0.128
120°	0.135
60°	0.153
30°	0.185

Constants for Z_{thJC} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.0058	0.00054
2	0.0310	0.098
3	0.0720	0.54
4	0.0112	12

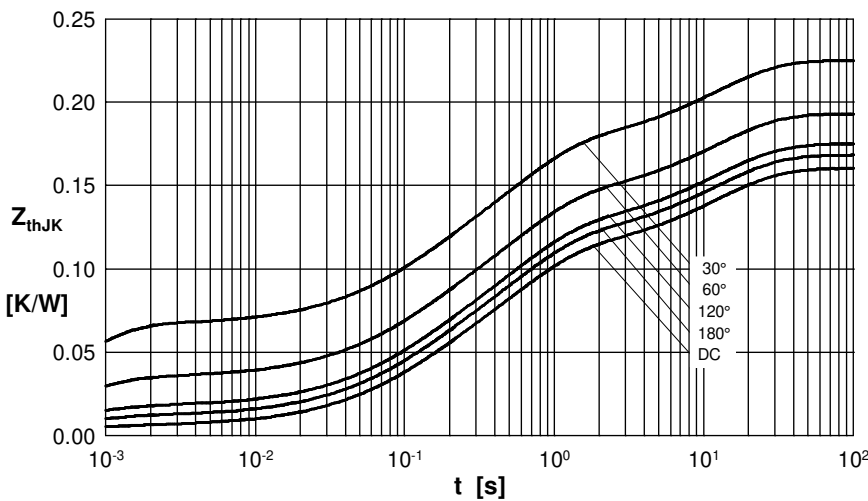


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor)

R_{thJK} for various conduct. angles d:

d	R_{thJK} [K/W]
DC	0.160
180°	0.168
120°	0.175
60°	0.193
30°	0.225

Constants for Z_{thJK} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.0058	0.00054
2	0.0310	0.098
3	0.0720	0.54
4	0.0114	12
5	0.0400	12