

Thyristor Module

$$V_{RRM} = 2 \times 1200 \text{ V}$$

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

$$V_T = 1,06 \text{ V}$$


Phase leg

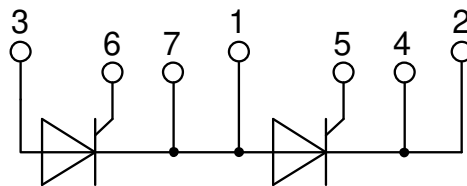
Part number

MCC312-12io1



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: 4800 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: Copper internally DCB isolated
- Advanced power cycling

Disclaimer Notice

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at www.littelfuse.com/disclaimer-electronics.

Thyristor				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1300	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1200	V	
I_{RD}	reverse current, drain current	$V_{R/D} = 1200 V$	$T_{VJ} = 25^{\circ}C$		1	mA	
		$V_{R/D} = 1200 V$	$T_{VJ} = 140^{\circ}C$		40	mA	
V_T	forward voltage drop	$I_T = 300 A$	$T_{VJ} = 25^{\circ}C$		1,12	V	
		$I_T = 600 A$			1,32	V	
		$I_T = 300 A$	$T_{VJ} = 125^{\circ}C$		1,06	V	
		$I_T = 600 A$			1,29	V	
I_{TAV}	average forward current	$T_C = 85^{\circ}C$	$T_{VJ} = 140^{\circ}C$		320	A	
$I_{T(RMS)}$	RMS forward current	180° sine			520	A	
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 140^{\circ}C$		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		$T_C = 25^{\circ}C$		960	W	
I_{TSM}	max. forward surge current	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		9,60	kA	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		10,4	kA	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}C$		8,16	kA	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		8,82	kA	
I^2t	value for fusing	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		460,8	kA ² s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		447,4	kA ² s	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}C$		332,9	kA ² s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		323,3	kA ² s	
C_J	junction capacitance	$V_R = 400V \quad f = 1 \text{ MHz}$	$T_{VJ} = 25^{\circ}C$	438		pF	
P_{GM}	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 140^{\circ}C$		120	W	
		$t_p = 500 \mu s$			60	W	
P_{GAV}	average gate power dissipation				20	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 140^{\circ}C; f = 50 \text{ Hz}$ repetitive, $I_T = 960 A$			100	A/μs	
		$t_p = 200 \mu s; di_G/dt = 1 A/\mu s;$ $I_G = 1 A; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 320 A$			500	A/μs	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise)	$T_{VJ} = 140^{\circ}C$		1000	V/μs	
V_{GT}	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		2	V	
			$T_{VJ} = -40^{\circ}C$		3	V	
I_{GT}	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		150	mA	
			$T_{VJ} = -40^{\circ}C$		220	mA	
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}C$		0,25	V	
I_{GD}	gate non-trigger current				10	mA	
I_L	latching current	$t_p = 30 \mu s$	$T_{VJ} = 25^{\circ}C$		200	mA	
		$I_G = 0,45 A; di_G/dt = 0,45 A/\mu s$					
I_H	holding current	$V_D = 6 V \quad R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		150	mA	
t_{gd}	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	μs	
		$I_G = 1 A; di_G/dt = 1 A/\mu s$					
t_q	turn-off time	$V_R = 100 V; I_T = 300 A; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s; dv/dt = 50 V/\mu s; t_p = 200 \mu s$	$T_{VJ} = 125^{\circ}C$	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	4800			V
		t = 1 minute	4000			V



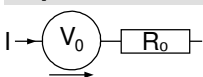
Data Matrix: part no. (1-19), DC + PI (20-25), lot.no.# (26-31), blank (32), serial no.# (33-36)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC312-12io1	MCC312-12io1	Box	3	461784

Equivalent Circuits for Simulation

* on die level

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

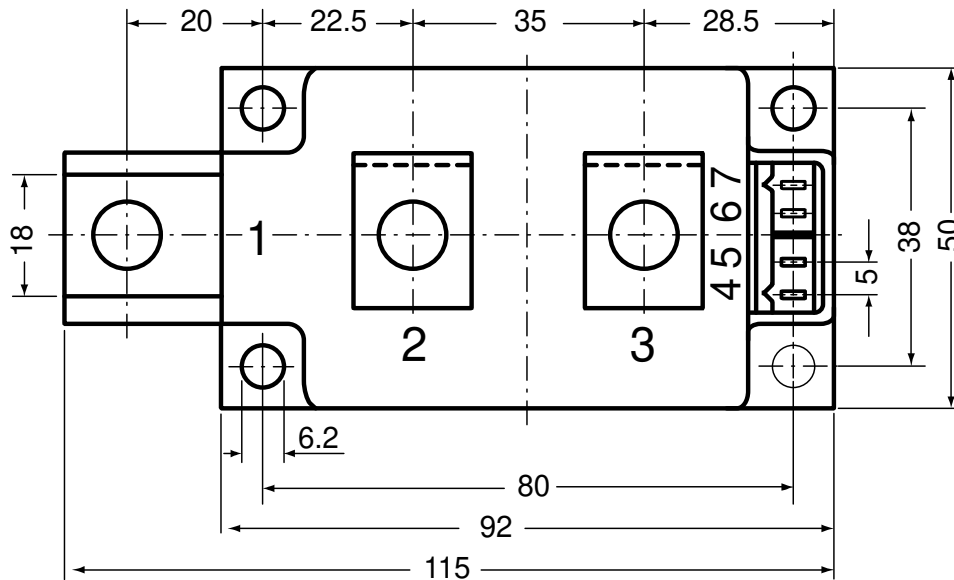
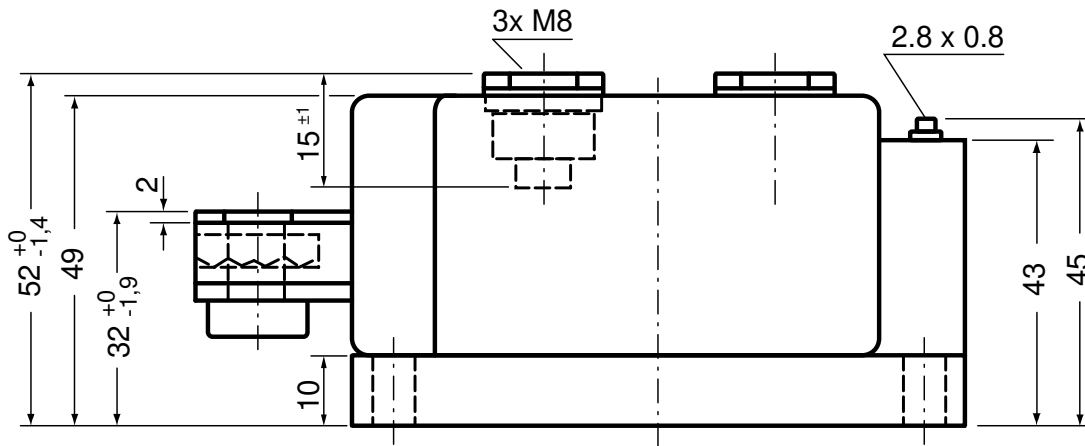


Thyristor

$V_{0\ max}$	threshold voltage	0,8	V
$R_{0\ max}$	slope resistance *	0,5	mΩ



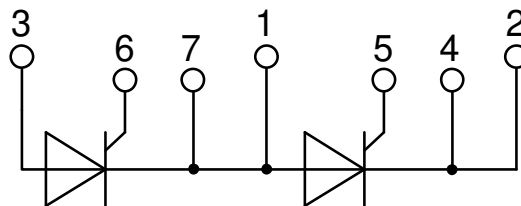
Outlines Y1



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)
 Type ZY 180R (R = Right for pin pair 6/7) } UL 758, style 3751



Thyristor

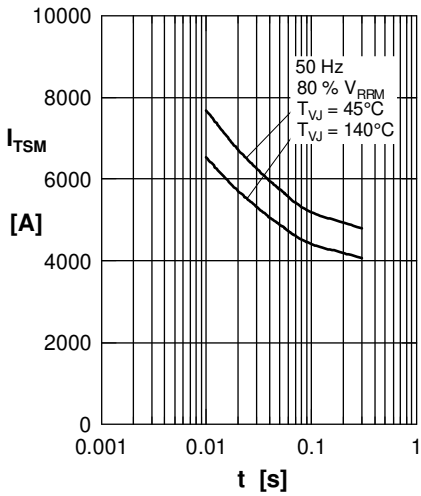


Fig. 1 Surge overload current
 I_{TSM} : Crest value, t : duration

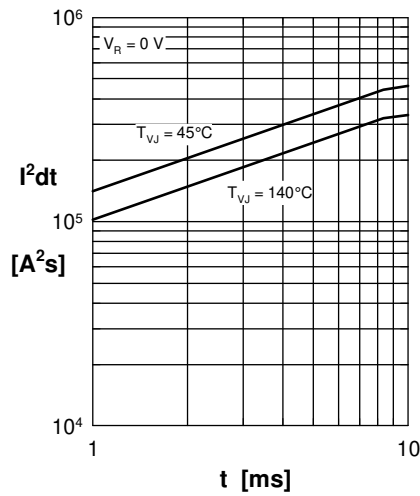


Fig. 2 I^2dt versus time

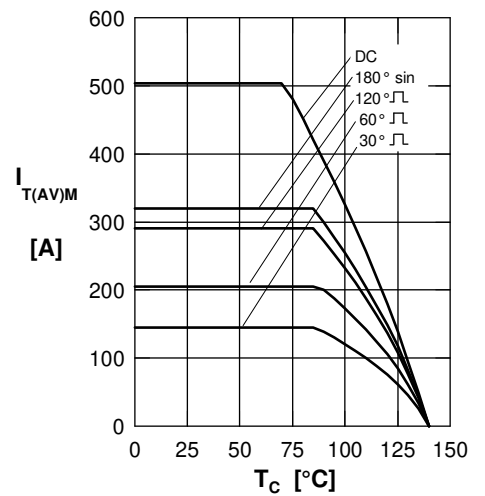


Fig. 3 Max. forward current at case temperature

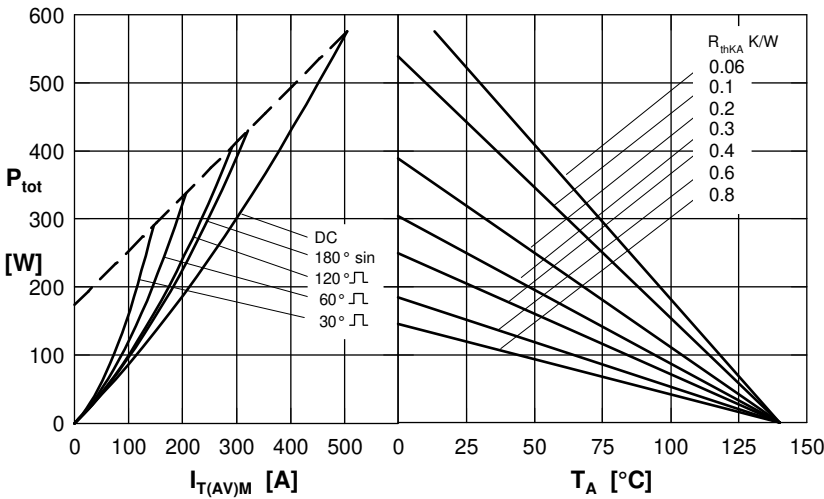


Fig. 4 Power dissipation versus on-state current and ambient temperature (per thyristor)

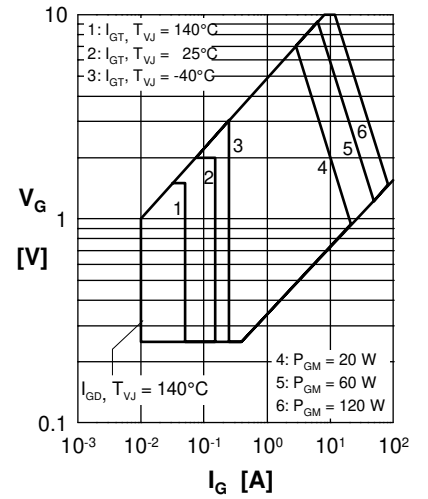


Fig. 5 Gate voltage & gate current

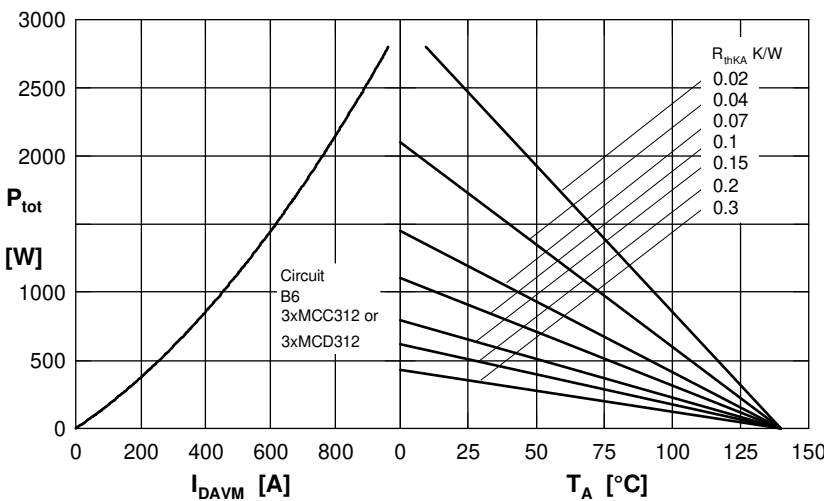


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

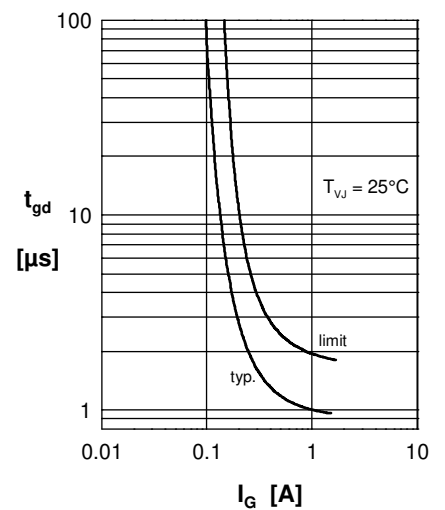


Fig. 7 Gate controlled delay time t_{gd}



Thyristor

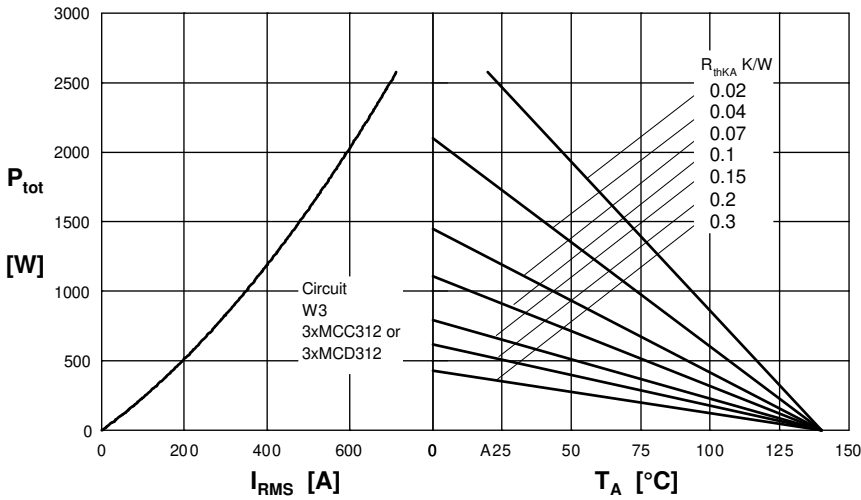


Fig. 8 Three phase AC-controller: Power dissipation versus R_{MS} output current and ambient temperature

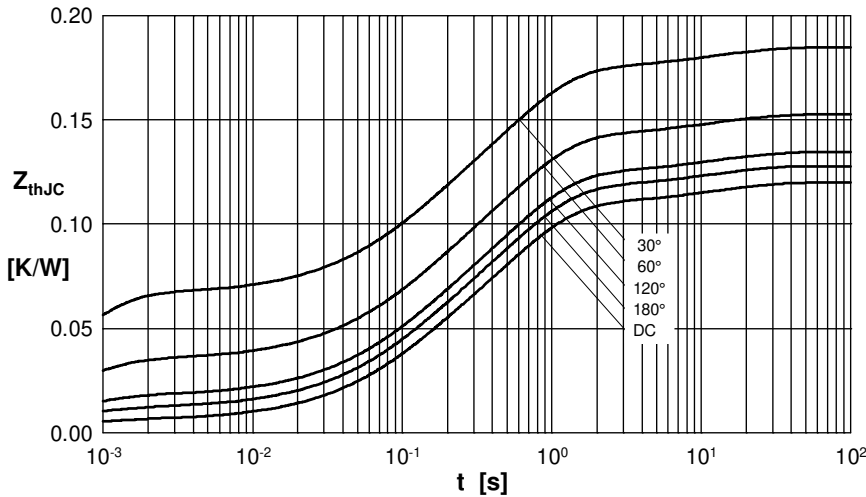


Fig. 9 Transient thermal impedance junction to case (per thyristor)

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

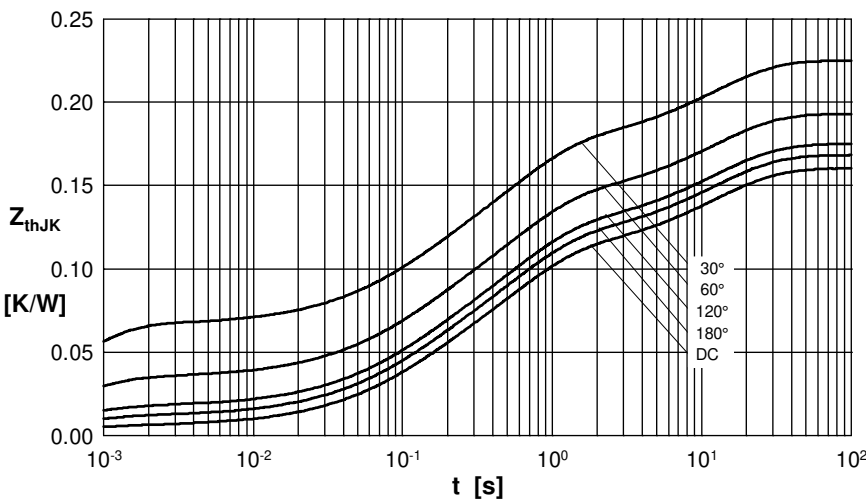


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor)

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