

Thyristor \ Diode Module

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

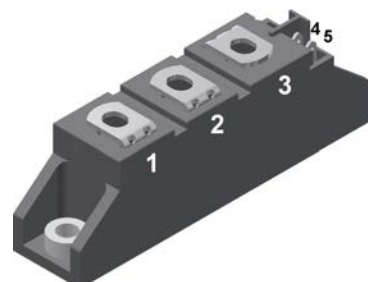
$$I_{TAV} = 49 \text{ A}$$

$$V_T = 1,34 \text{ V}$$

Phase leg

Part number

MCD44-12io1B



Backside: isolated

 E72873



Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al₂O₃-ceramic

Applications:

- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

Package: TO-240AA

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- 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.



Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1300	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1200	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			5	mA
V_T	forward voltage drop	$I_T = 100\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1,34	V
		$I_T = 200\text{ A}$				1,75	V
		$I_T = 100\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1,34	V
		$I_T = 200\text{ A}$				1,80	V
I_{TAV}	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 125^{\circ}\text{C}$			49	A
$I_{T(RMS)}$	RMS forward current	180° sine				77	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}\text{C}$			0,85	V
r_T	slope resistance					5,3	m Ω
R_{thJC}	thermal resistance junction to case					0,53	K/W
R_{thCH}	thermal resistance case to heatsink				0,2		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$			180	W
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			1,15	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1,24	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			980	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1,06	kA
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			6,62	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			6,40	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			4,80	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			4,63	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		54		pF
P_{GM}	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$	$T_C = 125^{\circ}\text{C}$			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	$T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 150\text{ A}$				150	A/ μs
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0,45\text{ A}/\mu\text{s};$ $I_G = 0,45\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 49\text{ A}$				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)	$T_{VJ} = 125^{\circ}\text{C}$			1000	V/ μs
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	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	mA
			$T_{VJ} = -40^{\circ}\text{C}$			200	mA
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$			0,2	V
I_{GD}	gate non-trigger current					10	mA
I_L	latching current	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			450	mA
		$I_G = 0,45\text{ A}; di_G/dt = 0,45\text{ A}/\mu\text{s}$					
I_H	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$			200	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	μs
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 120\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 20\text{ V}/\mu\text{s}; t_p = 200\text{ }\mu\text{s}$	$T_{VJ} = 100^{\circ}\text{C}$		150		μs

Package TO-240AA				Ratings				
Symbol	Definition	Conditions		min.	typ.	max.	Unit	
I _{RMS}	<i>RMS current</i>	per terminal				200	A	
T _{VJ}	<i>virtual junction temperature</i>			-40		125	°C	
T _{op}	<i>operation temperature</i>			-40		100	°C	
T _{stg}	<i>storage temperature</i>			-40		125	°C	
Weight					81		g	
M _D	<i>mounting torque</i>			2,5		4	Nm	
M _T	<i>terminal torque</i>			2,5		4	Nm	
d _{Spp/App}	<i>creepage distance on surface striking distance through air</i>	<i>terminal to terminal</i>	13,0	9,7			mm	
d _{Spb/Apb}		<i>terminal to backside</i>	16,0	16,0			mm	
V _{ISOL}	<i>isolation voltage</i>	t = 1 second	50/60 Hz, RMS; I _{ISOL} ≤ 1 mA		4800			V
		t = 1 minute			4000			V



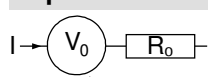
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD44-12io1B	MCD44-12io1B	Box	36	500626

Similar Part	Package	Voltage class
MCMA50PD1200TB	TO-240AA-1B	1200
MCMA65PD1200TB	TO-240AA-1B	1200

Equivalent Circuits for Simulation

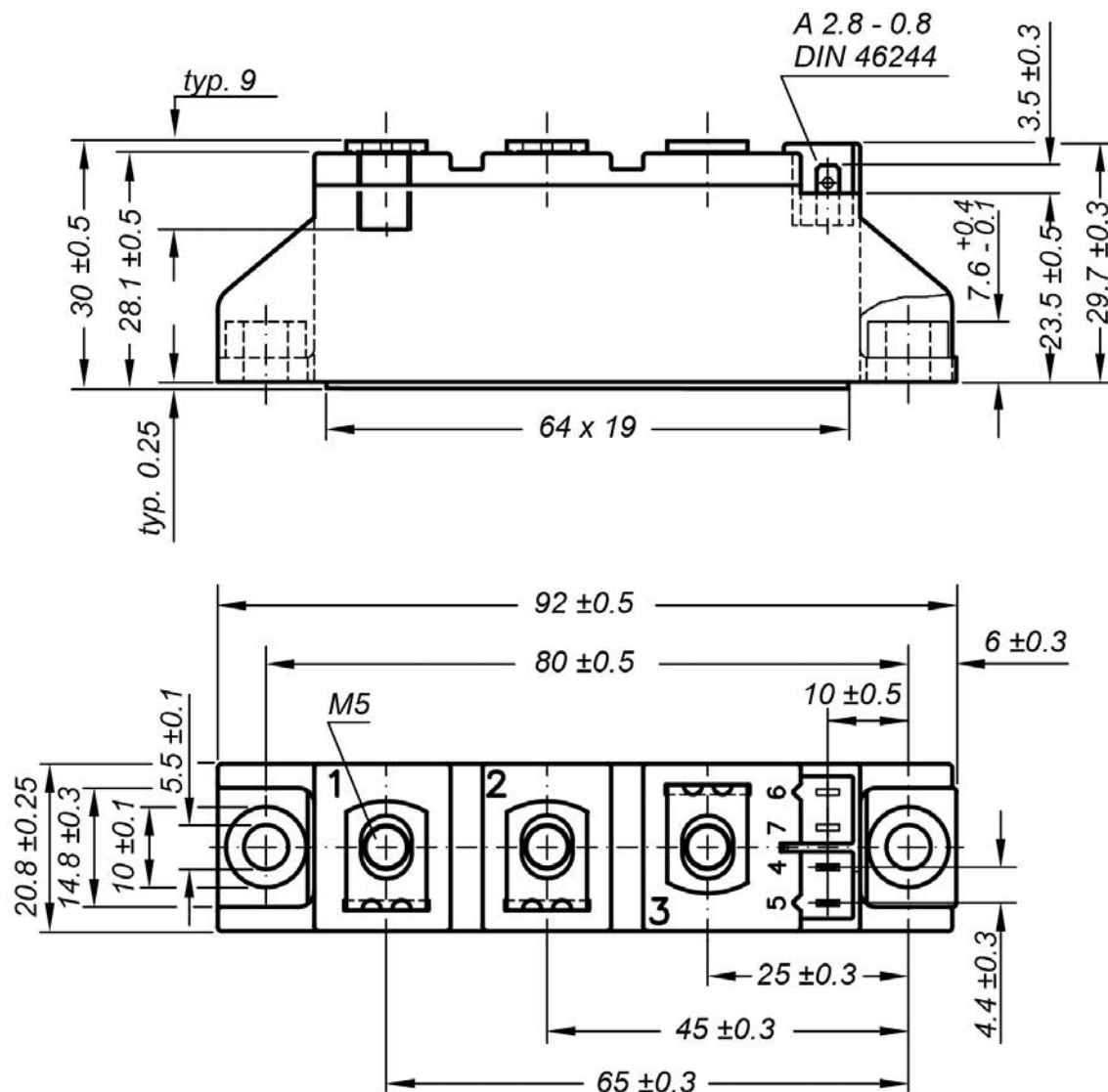
* on die level

$T_{VJ} = 125^{\circ}\text{C}$

		Thyristor	
$V_{0\ max}$	<i>threshold voltage</i>	0,85	V
$R_{0\ max}$	<i>slope resistance *</i>	4,1	mΩ

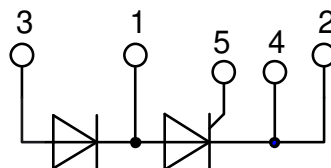


Outlines TO-240AA



Optional accessories for modules

Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red
Type ZY 200L (L = Left for pin pair 4/5) UL 758, style 3751



Thyristor

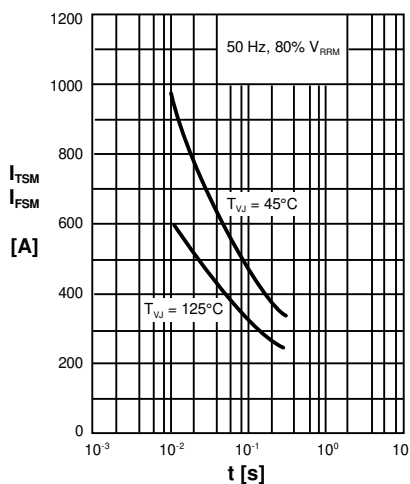


Fig. 1 Surge overload current
 I_{TSM} , I_{FSM} : Crest value, t : duration

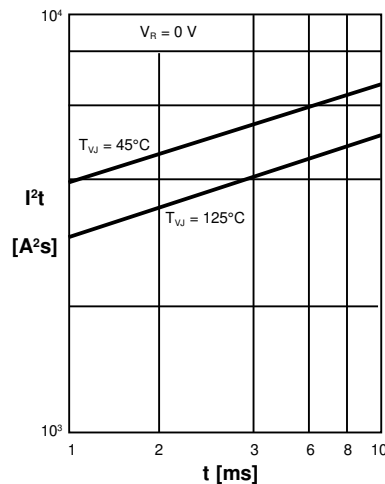


Fig. 2 I^2t versus time (1-10 ms)

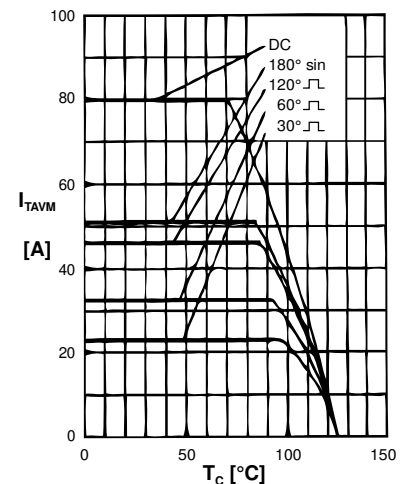


Fig. 3 Maximum forward current at case temperature



Fig. 4 Power dissipation vs. onstate current and ambient temperature (per thyristor/diode)



Fig. 5 Gate trigger characteristics



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



Fig. 7 Gate trigger delay time

Rectifier

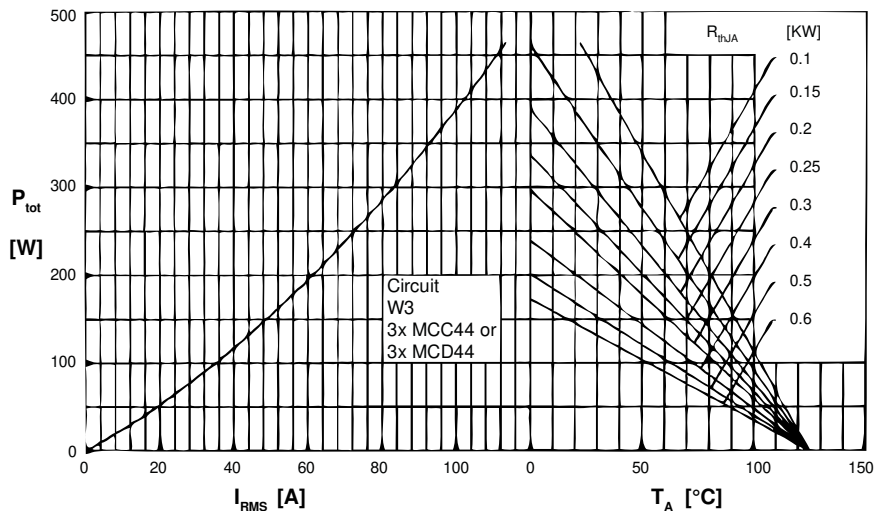


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature



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

R_{thJC} for various conduction angles d:

d	R_{thJC} [KW]
DC	0.53
180°	0.55
120°	0.58
60°	0.60
30°	0.62

Constants for Z_{thJC} calculation:

i	R_{thi} [KW]	t_i [s]
1	0.015	0.0035
2	0.026	0.0200
3	0.489	0.1950



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

R_{thJK} for various conduction angles d:

d	R_{thJK} [KW]
DC	0.73
180°	0.75
120°	0.78
60°	0.80
30°	0.82

Constants for Z_{thJK} calculation:

i	R_{thi} [KW]	t_i [s]
1	0.015	0.0035
2	0.026	0.0200
3	0.489	0.0195
4	0.200	0.6800