

Thyristor Module

$$V_{RRM} = 2 \times 1800 \text{ V}$$

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

$$V_T = 1.34 \text{ V}$$

Phase leg

Part number

MCC44-18io1B



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.

Thyristor				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1900	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1800	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1800\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_{R/D} = 1800\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			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
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ $I_G = 0.45\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 49\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$			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	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			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	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$			2	μs
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 120\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 100^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$			150		μs

Package TO-240AA				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
I_{RMS}	RMS current	per terminal				200	A
T_{VJ}	virtual junction temperature			-40		125	°C
T_{op}	operation temperature			-40		100	°C
T_{stg}	storage temperature			-40		125	°C
Weight					81		g
M_D	mounting torque			2.5		4	Nm
M_T	terminal torque			2.5		4	Nm
$d_{Spp/Apb}$	creepage distance on surface striking distance through air	terminal to terminal	13.0	9.7			mm
$d_{Spb/Apb}$		terminal to backside	16.0	16.0			mm
V_{ISOL}	isolation voltage	t = 1 second	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	4800			V
		t = 1 minute		4000			V



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC44-18io1B	MCC44-18io1B	Box	36	454524

Equivalent Circuits for Simulation

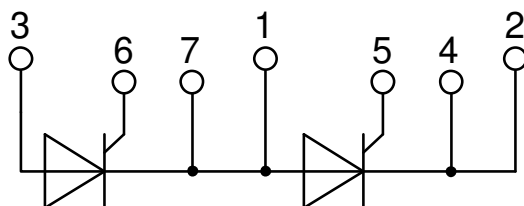
* on die level

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

		Thyristor	
$V_{0\max}$	threshold voltage	0.85	V
$R_{0\max}$	slope resistance *	4.1	mΩ

Technical drawing of a 5-hole metal plate. The drawing shows a side view with dimensions and labels. The overall width is 92 ± 0.5 . The distance between the first and last hole is 80 ± 0.3 . The overall height is 20.8 ± 0.25 . The distance from the top edge to the center of the first hole is 14.8 . The distance between the centers of the first and second holes is 10 ± 0.1 . The distance from the bottom edge to the center of the first hole is 5.5 ± 0.1 . The first hole is labeled *M5*. The second hole is labeled 1. The third hole is labeled 2. The fourth hole is labeled 3. The fifth hole is labeled 4. The distance between the center of the third hole and the center of the fourth hole is 25 ± 0.3 . The distance between the center of the fourth hole and the center of the fifth hole is 45 ± 0.3 . The distance between the center of the second hole and the center of the fifth hole is 65 ± 0.3 . The distance from the right edge to the center of the fifth hole is 6 . The distance from the right edge to the center of the fourth hole is 10 . The distance from the right edge to the center of the third hole is 4.4 . The distance from the right edge to the center of the second hole is 5 . The distance from the right edge to the center of the first hole is 4.4 .

Type ZY 200L (L = Left for pin pair 4/5)
Type ZY 200R (R = Right for pin pair 6/7) } UL 758, style 3751



Thyristor



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

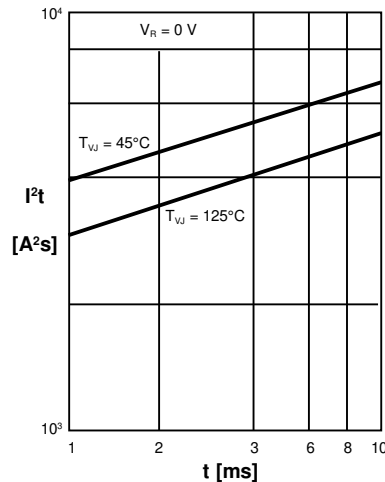


Fig. 2 I^2t versus time (1-10 ms)



Fig. 3 Maximum forward current at case temperature



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

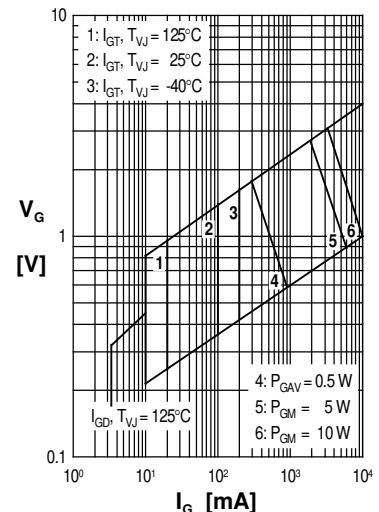


Fig. 5 Gate trigger characteristics



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



Fig. 7 Gate trigger delay time

Thyristor



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