

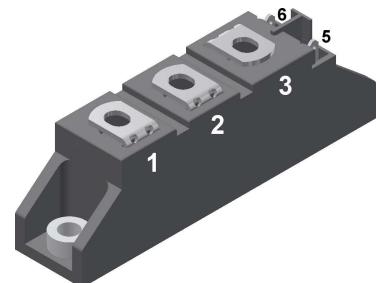
# Thyristor Module

$V_{RRM} = 2 \times 1200 \text{ V}$   
 $I_{TAV} = 60 \text{ A}$   
 $V_T = 1.24 \text{ V}$

## Phase leg

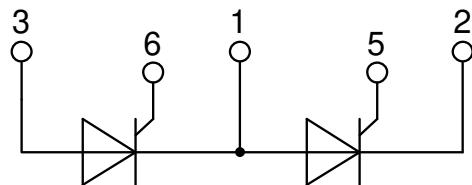
### Part number

**MCC56-12io8B**



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

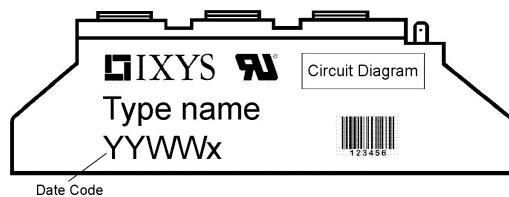
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**Thyristor**

Symbol	Definition	Conditions	Ratings			
			min.	typ.	max.	
$V_{RSM/DSM}$	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
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1200 V$ $V_{R/D} = 1200 V$	$T_{VJ} = 25^\circ C$ $T_{VJ} = 125^\circ C$		200 5	$\mu A$ mA
$V_T$	forward voltage drop	$I_T = 100 A$	$T_{VJ} = 25^\circ C$		1.26	V
		$I_T = 200 A$			1.57	V
		$I_T = 100 A$	$T_{VJ} = 125^\circ C$		1.24	V
		$I_T = 200 A$			1.62	V
$I_{TAV}$	average forward current	$T_C = 85^\circ C$	$T_{VJ} = 125^\circ C$		60	A
$I_{T(RMS)}$	RMS forward current	180° sine			94	A
$V_{T0}$	threshold voltage	$r_T$ slope resistance } for power loss calculation only	$T_{VJ} = 125^\circ C$		0.85	V
	slope resistance				3.7	$m\Omega$
$R_{thJC}$	thermal resistance junction to case				0.45	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.2		K/W
$P_{tot}$	total power dissipation		$T_C = 25^\circ C$		222	W
$I_{TSM}$	max. forward surge current	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$	$T_{VJ} = 45^\circ C$		1.50	kA
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$	$V_R = 0 V$		1.62	kA
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$	$T_{VJ} = 125^\circ C$		1.28	kA
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$	$V_R = 0 V$		1.38	kA
$I^2t$	value for fusing	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$	$T_{VJ} = 45^\circ C$		11.3	$kA^2s$
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$	$V_R = 0 V$		10.9	$kA^2s$
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$	$T_{VJ} = 125^\circ C$		8.13	$kA^2s$
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$	$V_R = 0 V$		7.87	$kA^2s$
$C_J$	junction capacitance	$V_R = 400 V$ $f = 1 \text{ MHz}$	$T_{VJ} = 25^\circ C$	74		pF
$P_{GM}$	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 125^\circ C$		10	W
		$t_p = 300 \mu s$			5	W
					0.5	W
$P_{GAV}$	average gate power dissipation					
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^\circ C; f = 50 \text{ Hz}$ repetitive, $I_T = 150 A$			150	$A/\mu s$
		$t_p = 200 \mu s; di_G/dt = 0.45 A/\mu s;$				
		$I_G = 0.45 A; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 60 A$			500	$A/\mu s$
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^\circ C$		1000	$V/\mu s$
		$R_{GK} = \infty$ ; method 1 (linear voltage rise)				
$V_{GT}$	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^\circ C$		1.5	V
			$T_{VJ} = -40^\circ C$		1.6	V
$I_{GT}$	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^\circ C$		100	mA
			$T_{VJ} = -40^\circ C$		200	mA
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^\circ C$		0.2	V
$I_{GD}$	gate non-trigger current				10	mA
$I_L$	latching current	$t_p = 10 \mu s$ $I_G = 0.45 A; di_G/dt = 0.45 A/\mu s$	$T_{VJ} = 25^\circ C$		450	mA
$I_H$	holding current	$V_D = 6 V$ $R_{GK} = \infty$	$T_{VJ} = 25^\circ C$		200	mA
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^\circ C$		2	$\mu s$
		$I_G = 0.45 A; di_G/dt = 0.45 A/\mu s$				
$t_q$	turn-off time	$V_R = 100 V; I_T = 150 A; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 100^\circ C$ $di/dt = 10 A/\mu s$ $dv/dt = 20 V/\mu s$ $t_p = 200 \mu s$		150		$\mu s$

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
<b>Weight</b>				81		g
$M_D$	mounting torque		2.5		4	Nm
$M_T$	terminal torque		2.5		4	Nm
$d_{Spp/App}$	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 t = 1 minute 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA		4800		V
				4000		V



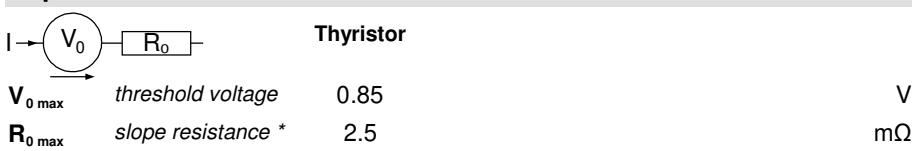
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC56-12io8B	MCC56-12io8B	Box	36	457574

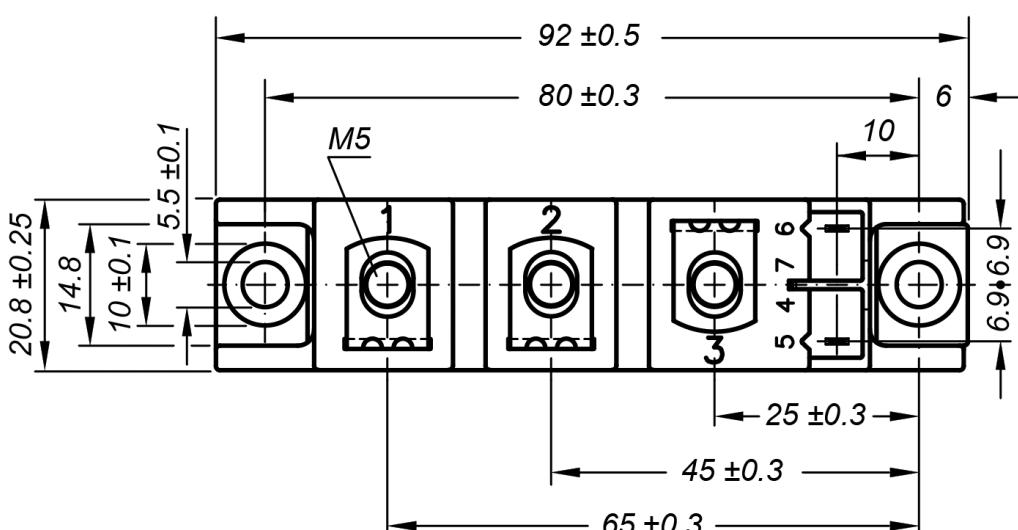
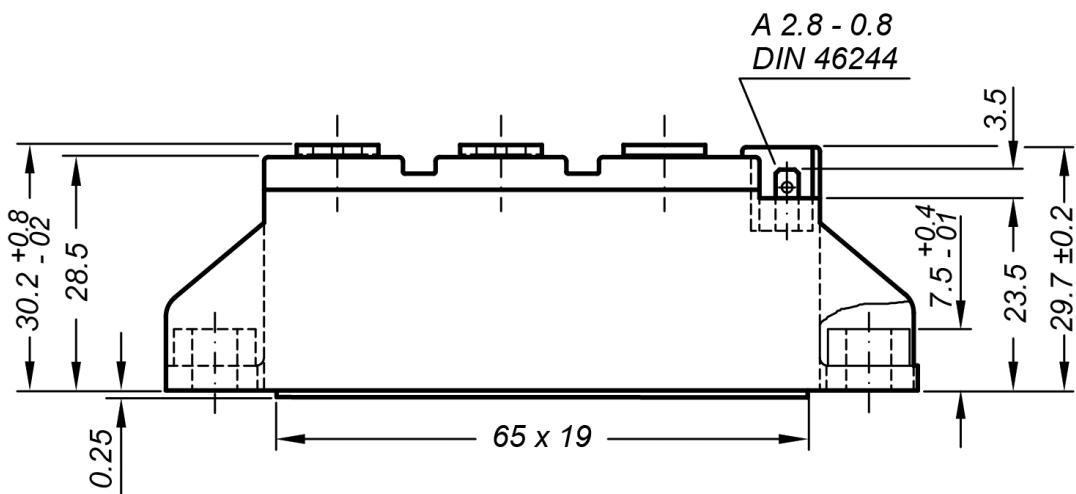
Similar Part	Package	Voltage class
MCMA65P1200TA	TO-240AA-1B	1200
MCMA85P1200TA	TO-240AA-1B	1200

### Equivalent Circuits for Simulation

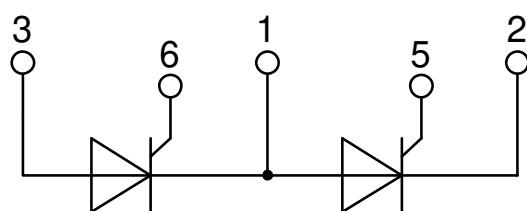
\* on die level

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



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



## Thyristor

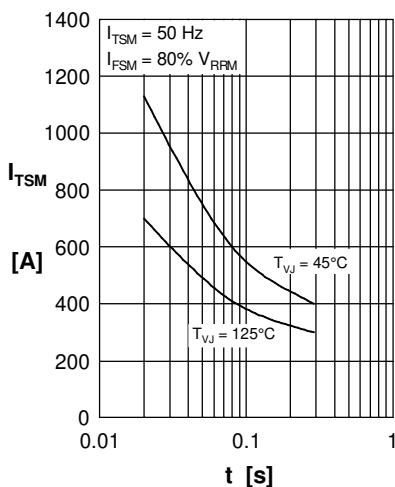


Fig. 1 Surge overload current  $I_{TSM}$ ,  
 $I_{FSM}$ : Crest value, t: duration

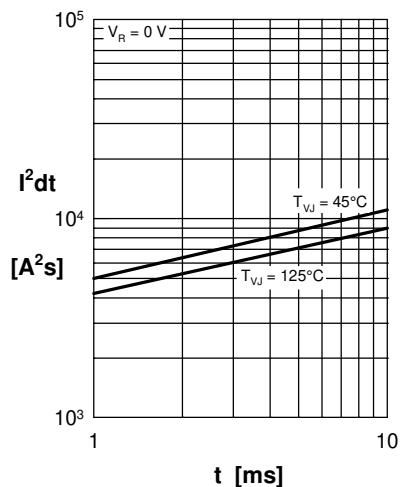


Fig. 2  $I^2t$  versus time (1-10 ms)

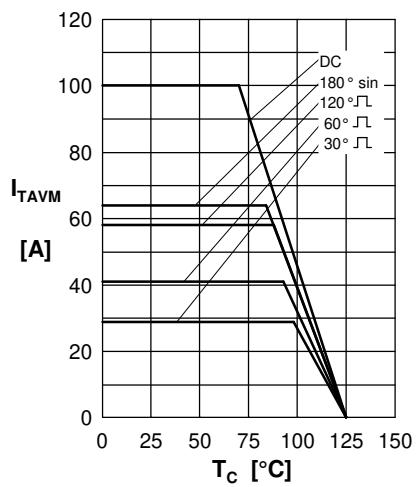


Fig. 3 Max. forward current  
at case temperature

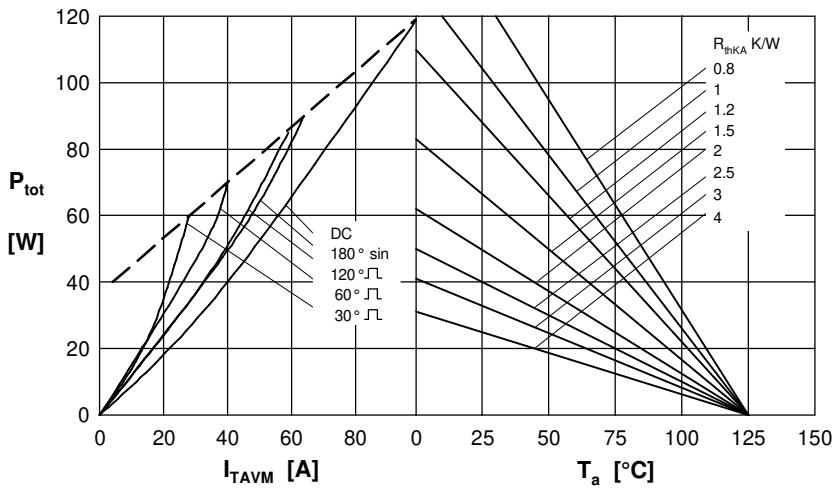


Fig. 4 Power dissipation vs. on-state current & ambient temperature  
(per thyristor or diode)

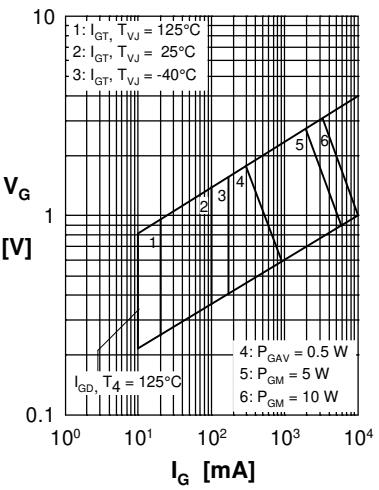


Fig. 5 Gate trigger characteristics

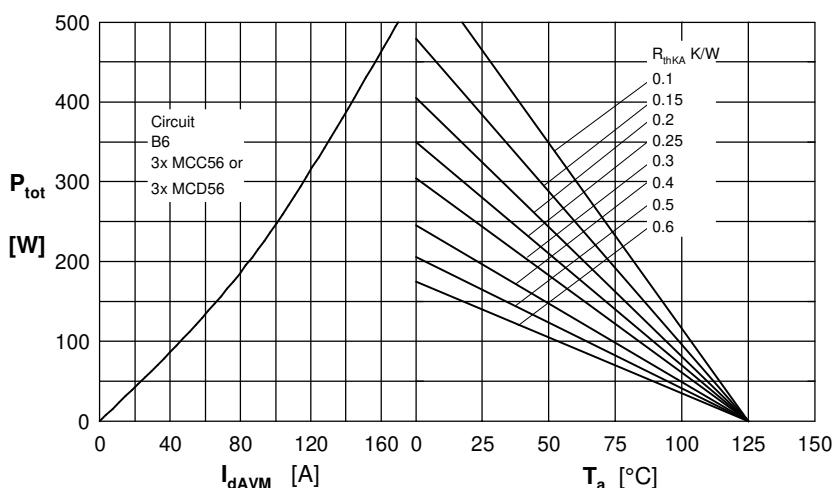


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

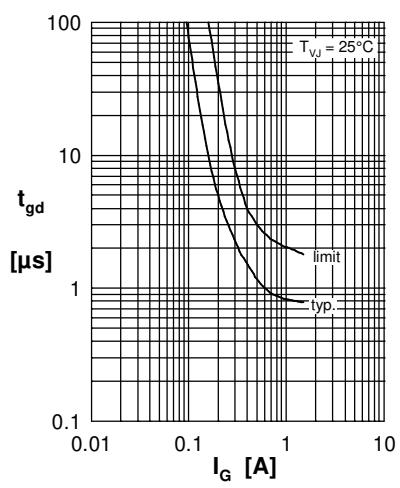


Fig. 7 Gate trigger delay time

## Thyristor

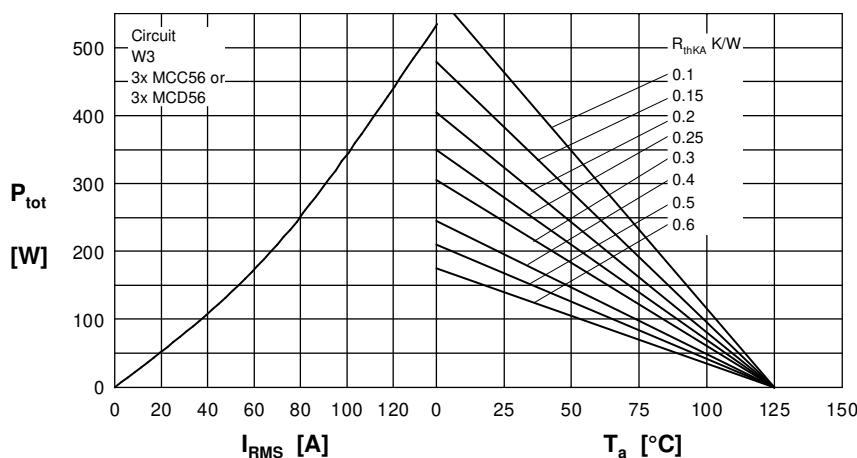


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

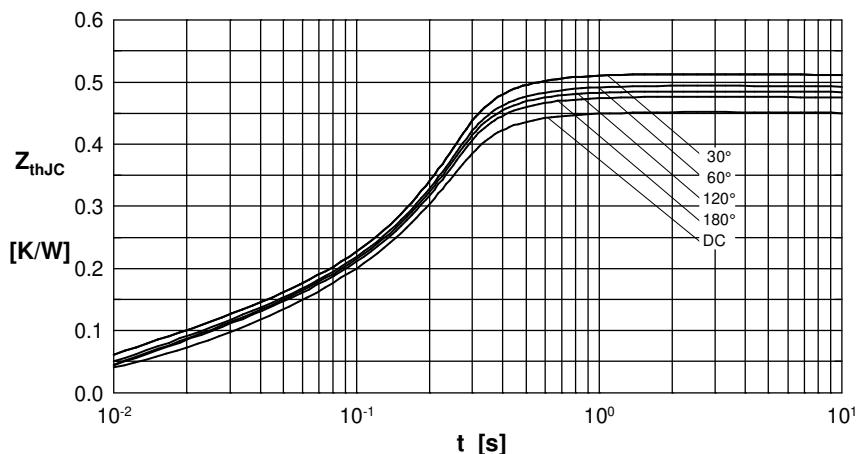


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

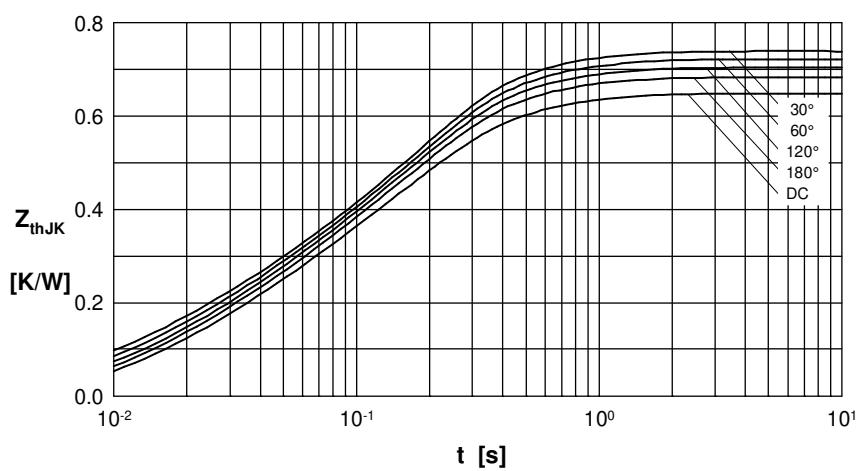


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

$R_{thJC}$  for various conduction angles d:

d	$R_{thJC}$ [K/W]
DC	0.450
180°	0.470
120°	0.490
60°	0.505
30°	0.520

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ [K/W]	$t_i$ [s]
1	0.014	0.0150
2	0.026	0.0095
3	0.410	0.1750

$R_{thJK}$  for various conduction angles d:

d	$R_{thJK}$ [K/W]
DC	0.650
180°	0.670
120°	0.690
60°	0.705
30°	0.720

Constants for  $Z_{thJK}$  calculation:

i	$R_{thi}$ [K/W]	$t_i$ [s]
1	0.014	0.0150
2	0.026	0.0095
3	0.410	0.1750
4	0.200	0.6700

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