

# Thyristor Module

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

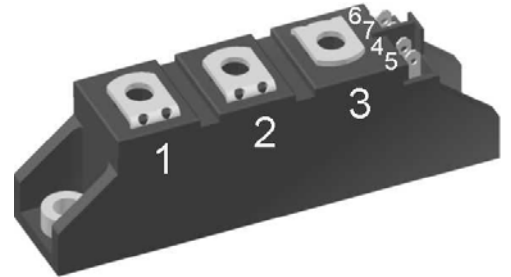
$$I_{TAV} = 110A$$

$$V_T = 1.21V$$

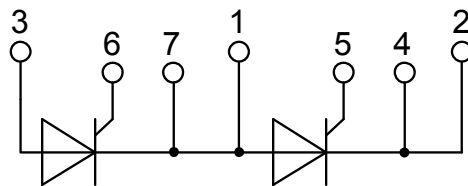
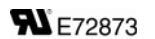
Phase leg

Part number

**MCMA110P1600TA**



Backside: isolated



**Features / Advantages:**

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al<sub>2</sub>O<sub>3</sub>-ceramic

**Applications:**

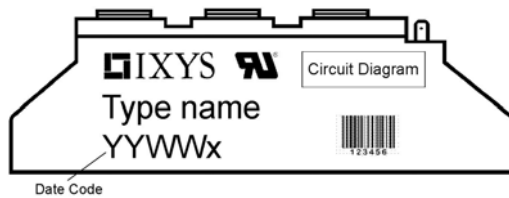
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

**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

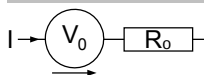
Thyristor				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1700	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1600	V	
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1600 V$	$T_{VJ} = 25^{\circ}C$		100	$\mu A$	
		$V_{R/D} = 1600 V$	$T_{VJ} = 140^{\circ}C$		10	mA	
$V_T$	forward voltage drop	$I_T = 110 A$	$T_{VJ} = 25^{\circ}C$		1.24	V	
		$I_T = 220 A$			1.52	V	
		$I_T = 110 A$	$T_{VJ} = 125^{\circ}C$		1.21	V	
		$I_T = 220 A$			1.57	V	
$I_{TAV}$	average forward current	$T_C = 85^{\circ}C$	$T_{VJ} = 140^{\circ}C$		110	A	
$I_{T(RMS)}$	RMS forward current	180° sine			170	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 140^{\circ}C$		0.85	V	
$r_T$	slope resistance				3.3	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				0.3	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.20		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		380	W	
$I_{TSM}$	max. forward surge current	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		1.90	kA	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		2.05	kA	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}C$		1.62	kA	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		1.75	kA	
$I^2t$	value for fusing	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		18.1	kA <sup>2</sup> s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		17.5	kA <sup>2</sup> s	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}C$		13.0	kA <sup>2</sup> s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		12.7	kA <sup>2</sup> s	
$C_J$	junction capacitance	$V_R = 400 V \quad f = 1 \text{ MHz}$	$T_{VJ} = 25^{\circ}C$		95	pF	
$P_{GM}$	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 140^{\circ}C$		10	W	
		$t_p = 300 \mu s$			5	W	
$P_{GAV}$	average gate power dissipation				0.5	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 140^{\circ}C; f = 50 \text{ Hz}$	repetitive, $I_T = 330 A$		150	A/ $\mu s$	
		$t_p = 200 \mu s; di_G/dt = 0.45 A/\mu s;$ $I_G = 0.45 A; V_D = \frac{2}{3} V_{DRM}$	non-repet., $I_T = 110 A$		500	A/ $\mu s$	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty; \text{ method 1 (linear voltage rise)}$	$T_{VJ} = 140^{\circ}C$		1000	V/ $\mu s$	
$V_{GT}$	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	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		150	mA	
			$T_{VJ} = -40^{\circ}C$		200	mA	
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}C$		0.2	V	
$I_{GD}$	gate non-trigger current				10	mA	
$I_L$	latching current	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$		200	mA	
		$I_G = 0.45 A; di_G/dt = 0.45 A/\mu s$					
$I_H$	holding current	$V_D = 6 V \quad R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		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	$V_R = 100 V; I_T = 110 A; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s; dv/dt = 20 V/\mu s; t_p = 200 \mu s$	$T_{VJ} = 140^{\circ}C$		185	$\mu s$	

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		140	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage temperature		-40		125	°C
<b>Weight</b>					90	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	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA		4800	V
		t = 1 minute			4000	V


**Part number**

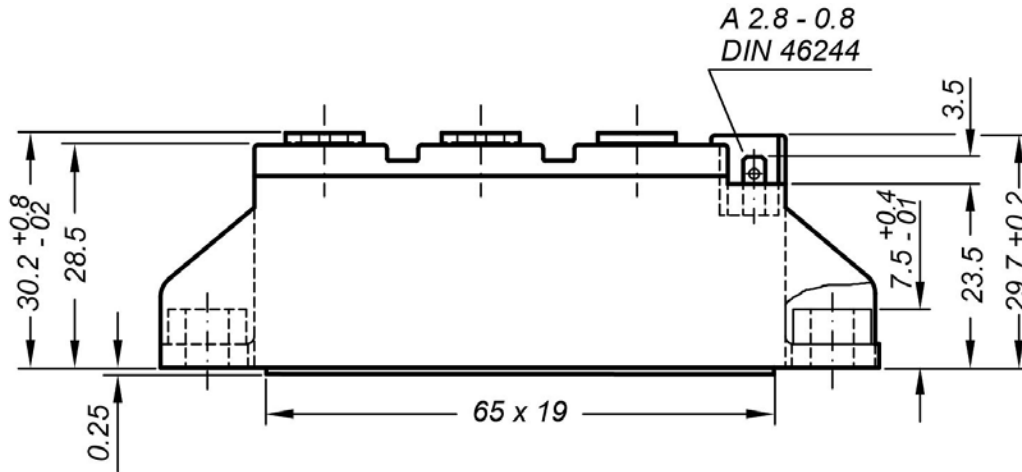
- M = Module
- C = Thyristor (SCR)
- M = Thyristor
- A = (up to 1800V)
- 110 = Current Rating [A]
- P = Phase leg
- 1600 = Reverse Voltage [V]
- TA = TO-240AA-1B

Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCMA110P1600TA	MCMA110P1600TA	Box	6	513383

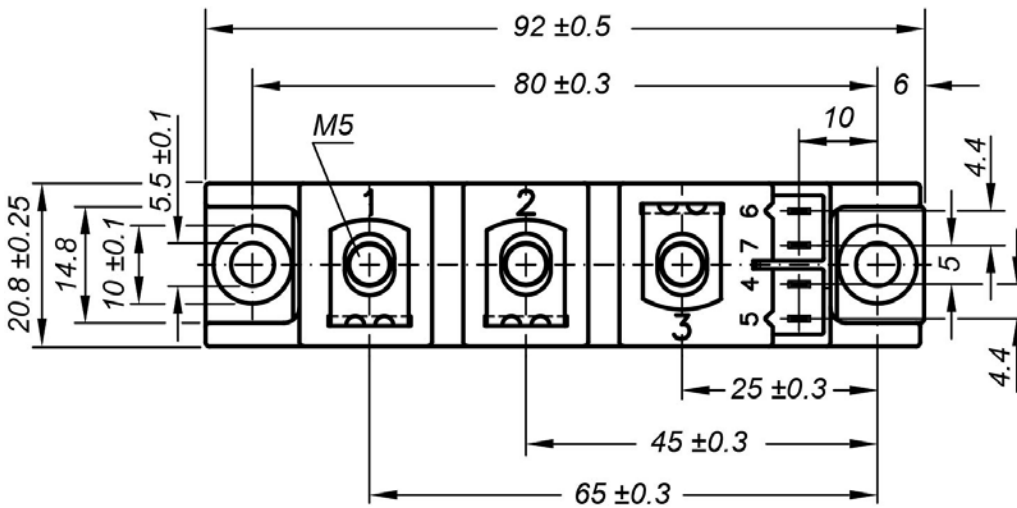
**Equivalent Circuits for Simulation**
*\* on die level*
 $T_{VJ} = 140\text{ °C}$ 

**Thyristor**

$V_{0\max}$	threshold voltage	0.85	V
$R_{0\max}$	slope resistance *	2.1	mΩ

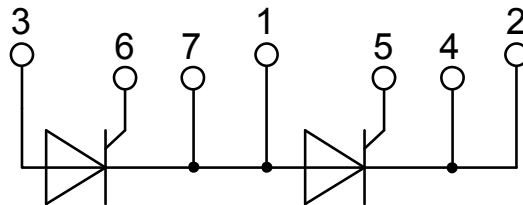
Outlines TO-240AA



General tolerance: DIN ISO 2768 class „c“



Optional accessories: Keyed gate/cathode twin plugs  
 Wire length: 350 mm, gate = white, cathode = red  
 UL 758, style 3751  
 Type ZY 200L (L = Left for pin pair 4/5)  
 Type ZY 200R (R = Right for pin pair 6/7)



## Thyristor

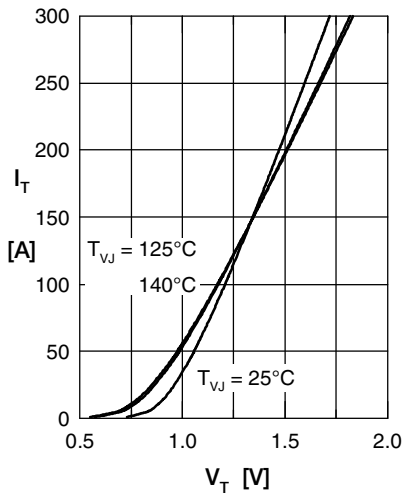


Fig. 1 Forward characteristics

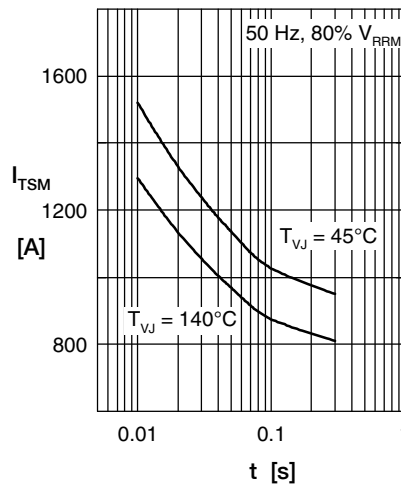


Fig. 2 Surge overload current  $I_{TSM}$ : crest value, t: duration

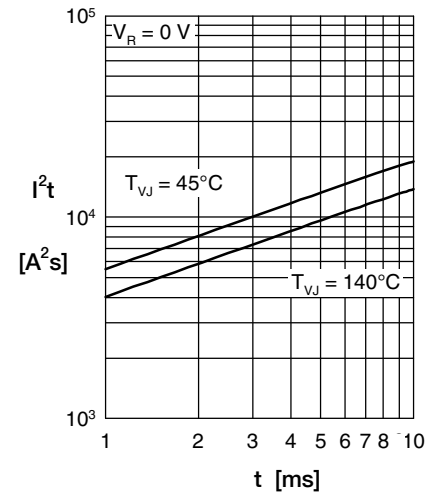


Fig. 3  $I^2t$  versus time (1-10 s)

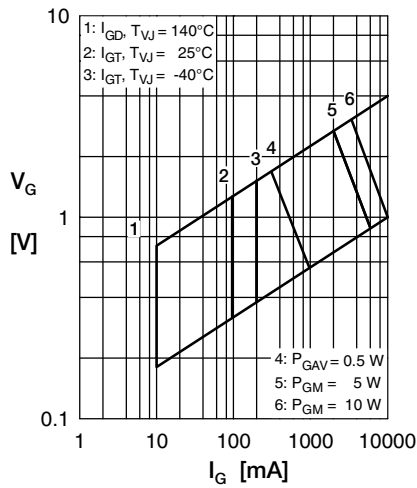


Fig. 4 Gate voltage & gate current

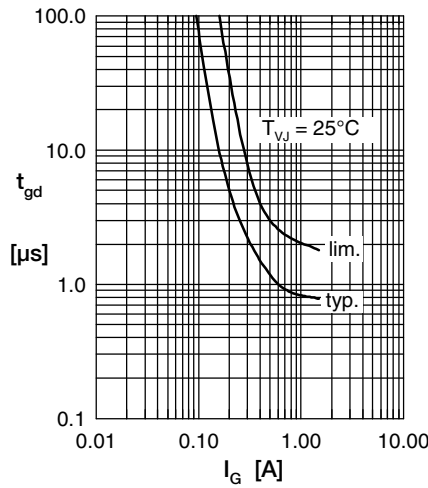


Fig. 5 Gate controlled delay time  $t_{gd}$

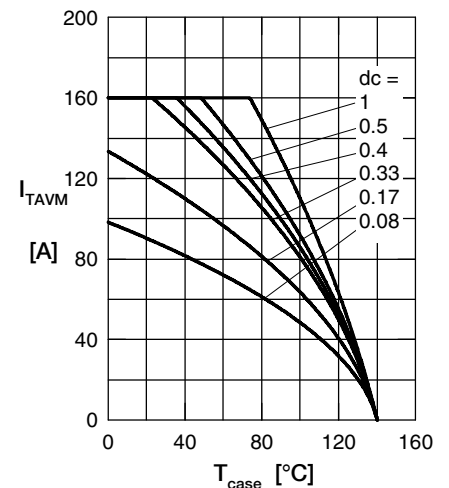


Fig. 6 Max. forward current at case temperature

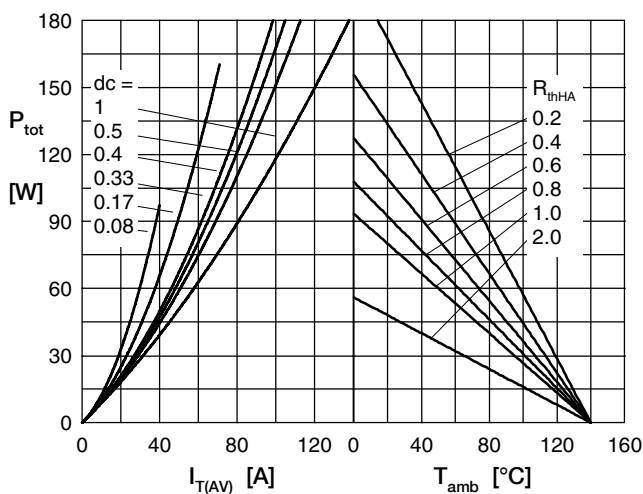


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

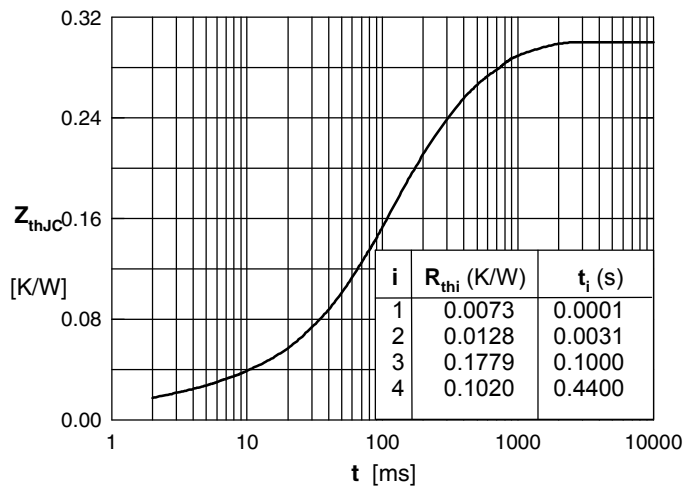


Fig. 8 Transient thermal impedance junction to case