

## Thyristor Module

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

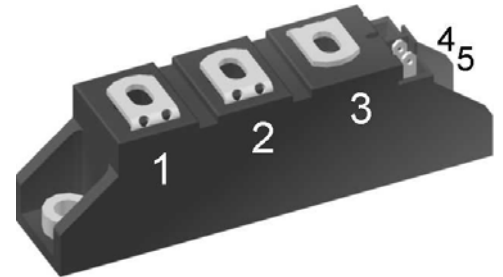
$$I_{TAV} = 116A$$

$$V_T = 1.28V$$


Phase leg

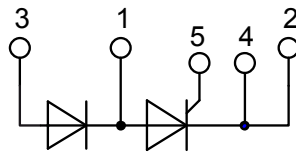
Part number

MCD95-12io1B



Backside: isolated

 E72873



### 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:

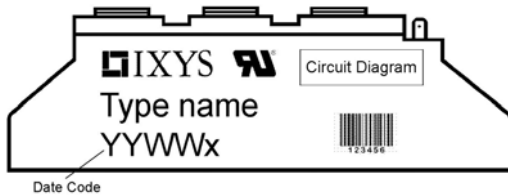
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

### Package: TO-240AA

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

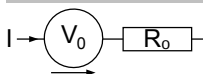
Rectifier			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$			1300	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		200	$\mu\text{A}$
		$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		5	mA
$V_T$	forward voltage drop	$I_T = 150\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		1.29	V
					1.50	V
		$I_T = 300\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$		1.28	V
					1.70	V
$I_{TAV}$	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 125^{\circ}\text{C}$		116	A
$I_{T(RMS)}$	RMS forward current	180° sine			180	A
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}\text{C}$		0.85	V
$r_T$	slope resistance				2.4	m $\Omega$
$R_{thJC}$	thermal resistance junction to case				0.22	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.20		K/W
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$		455	W
$I_{TSM}$	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}\text{C}$	$V_R = 0\text{ V}$	2.25	kA
					t = 8,3 ms; (60 Hz), sine	2.43
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 125^{\circ}\text{C}$	$V_R = 0\text{ V}$	1.92	kA
					t = 8,3 ms; (60 Hz), sine	2.07
$I^2t$	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}\text{C}$	$V_R = 0\text{ V}$	25.3	kA <sup>2</sup> s
					t = 8,3 ms; (60 Hz), sine	24.6
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 125^{\circ}\text{C}$	$V_R = 0\text{ V}$	18.3	kA <sup>2</sup> s
					t = 8,3 ms; (60 Hz), sine	17.7
$C_J$	junction capacitance	$V_R = 400\text{ V}$ f = 1 MHz	$T_{VJ} = 25^{\circ}\text{C}$		119	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 Hz	repetitive, $I_T = 250\text{ A}$		150	A/ $\mu\text{s}$
				$t_p = 200\text{ }\mu\text{s}$ ; $di_G/dt = 0.45\text{ A}/\mu\text{s}$ ;		
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$	$R_{GK} = \infty$ ; method 1 (linear voltage rise)	500	A/ $\mu\text{s}$
$V_{GT}$	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		2.5	V
			$T_{VJ} = -40^{\circ}\text{C}$		2.6	V
$I_{GT}$	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		150	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	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$	$I_G = 0.45\text{ A}$ ; $di_G/dt = 0.45\text{ A}/\mu\text{s}$	450	mA
$I_H$	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$		200	mA
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$	$I_G = 0.45\text{ A}$ ; $di_G/dt = 0.45\text{ A}/\mu\text{s}$	2	$\mu\text{s}$
$t_q$	turn-off time	$V_R = 100\text{ V}$ ; $I_T = 150\text{ A}$ ; $V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$		185	$\mu\text{s}$
		$di/dt = 10\text{ A}/\mu\text{s}$ ; $dv/dt = 20\text{ V}/\mu\text{s}$ ; $t_p = 200\text{ }\mu\text{s}$				

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>					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			3600	V
		t = 1 minute	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA		3000	V



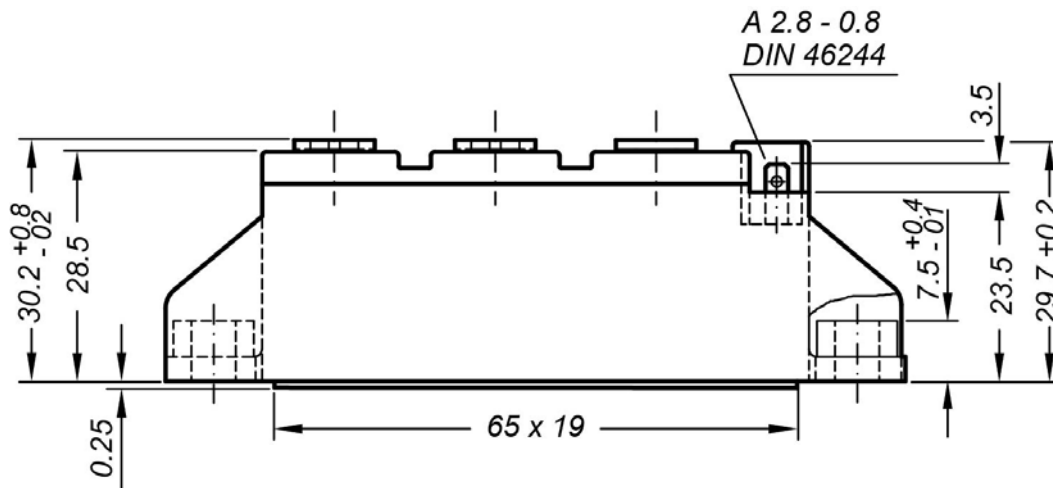
Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD95-12io1B	MCD95-12io1B	Box	6	469467

Similar Part	Package	Voltage class
MCMA110PD1200TB	TO-240AA-1B	1200
MCMA140PD1200TB	TO-240AA-1B	1200

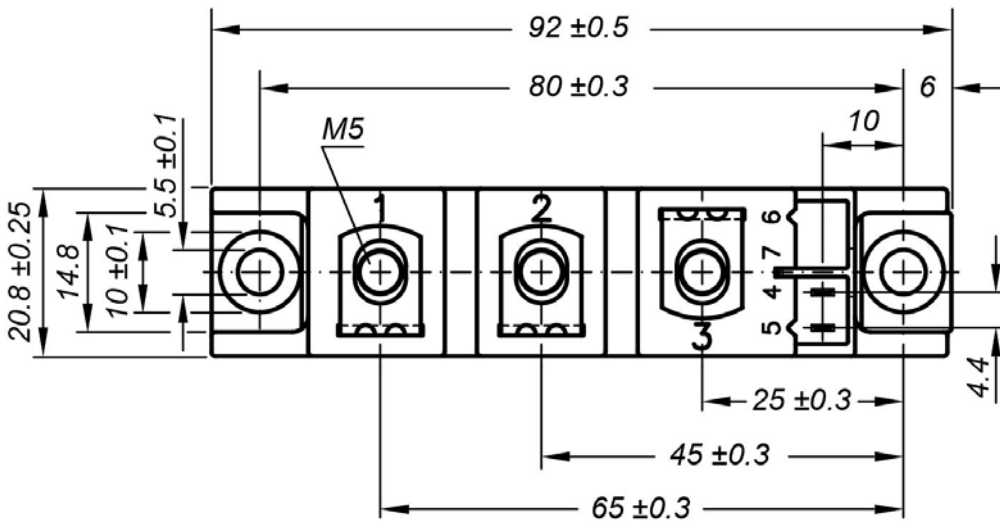
**Equivalent Circuits for Simulation**
*\* on die level*
 $T_{VJ} = 125\text{ °C}$ 

**Thyristor**

$V_{0\ max}$	threshold voltage	0.85	V
$R_{0\ max}$	slope resistance *	1.2	mΩ

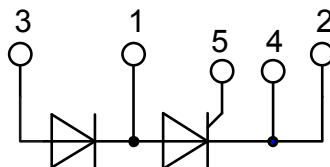
**Outlines TO-240AA**



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)



**Thyristor**

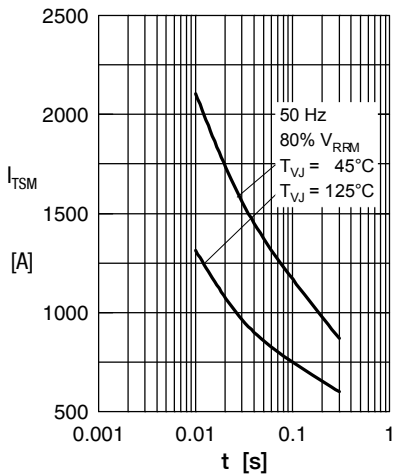


Fig. 1 Surge overload current  $I_{TSM}$ ,  $I_{FSM}$ : Crest value,  $t$ : duration

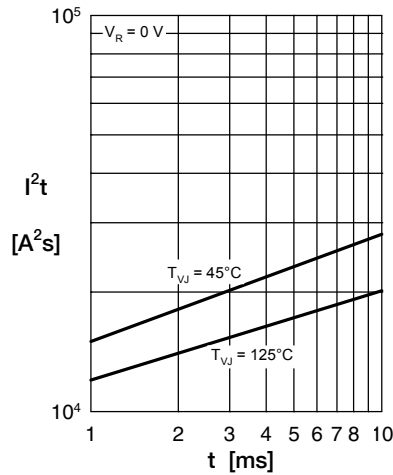


Fig. 2  $I^2t$  versus time (1-10 ms)

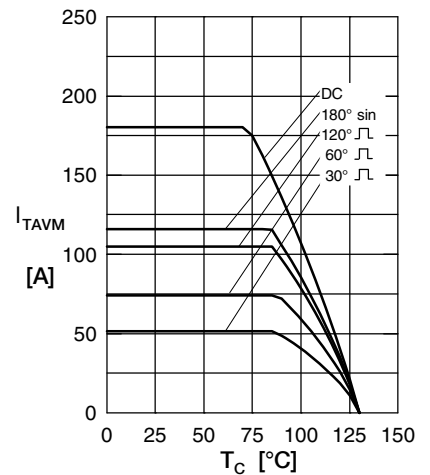


Fig. 3 Max. forward current at case temperature

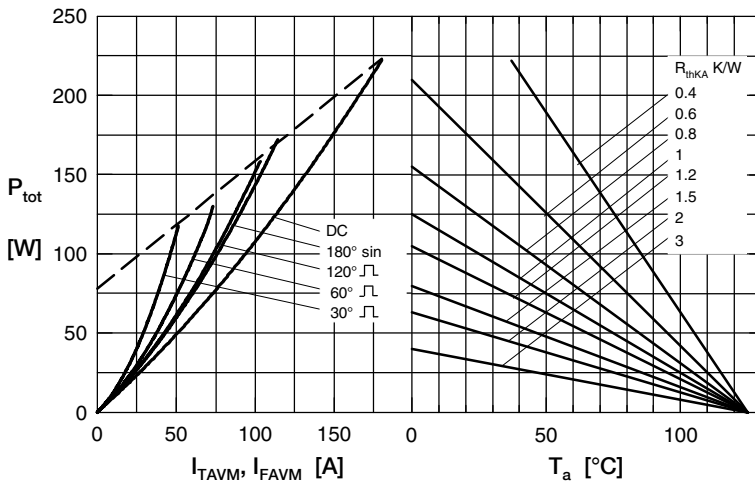


Fig. 4 Power dissipation vs. on-state current & ambient temperature (per thyristor or diode)

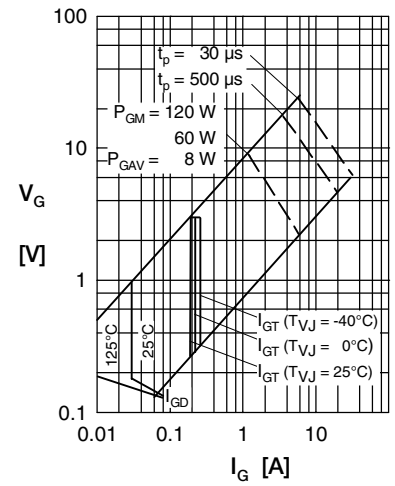


Fig. 5 Gate trigger characteristics

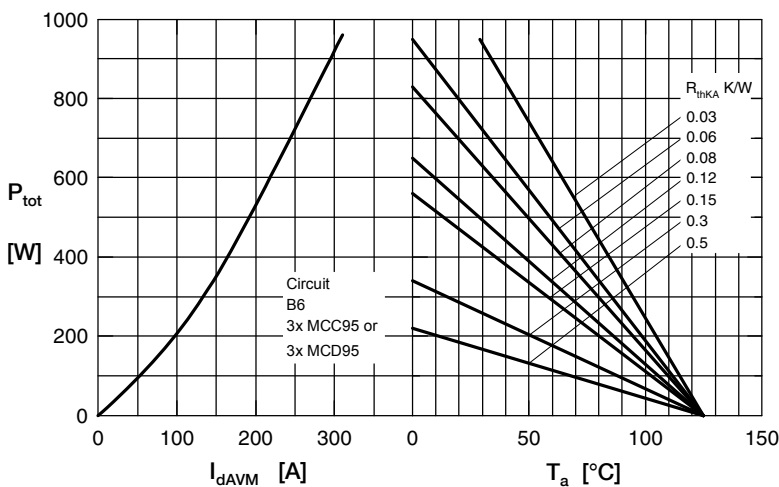


Fig. 6 Three phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature

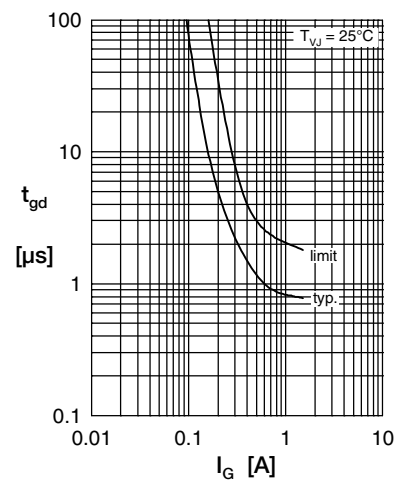


Fig. 7 Gate trigger delay time

**Rectifier**

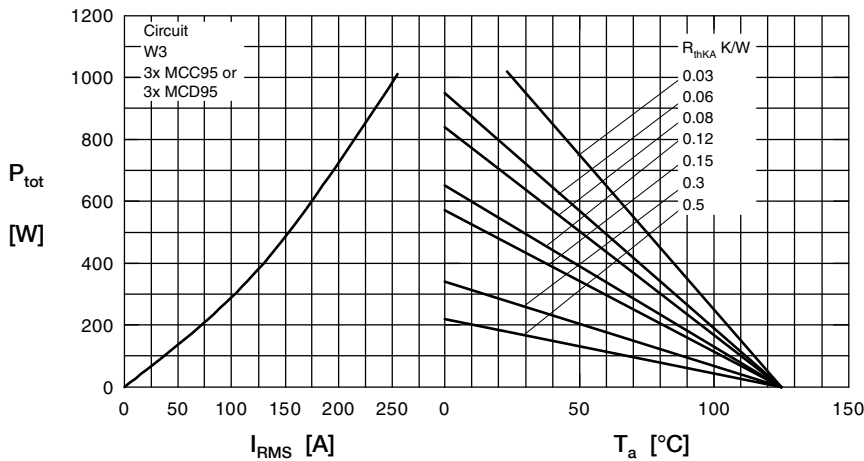
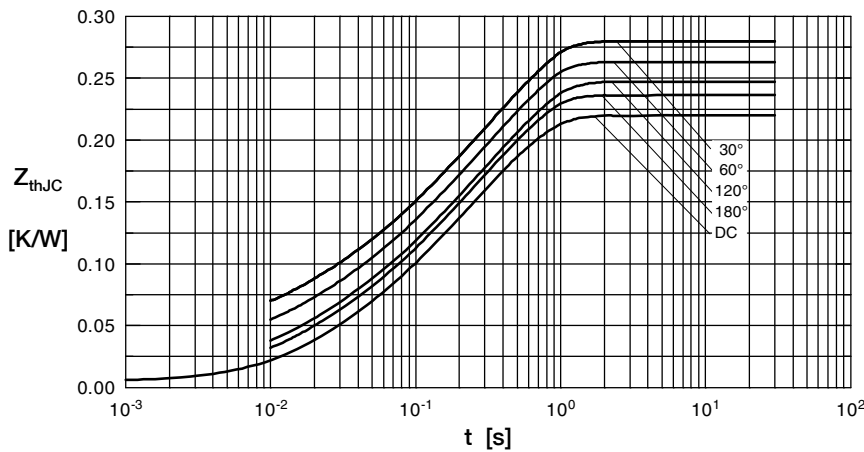


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature



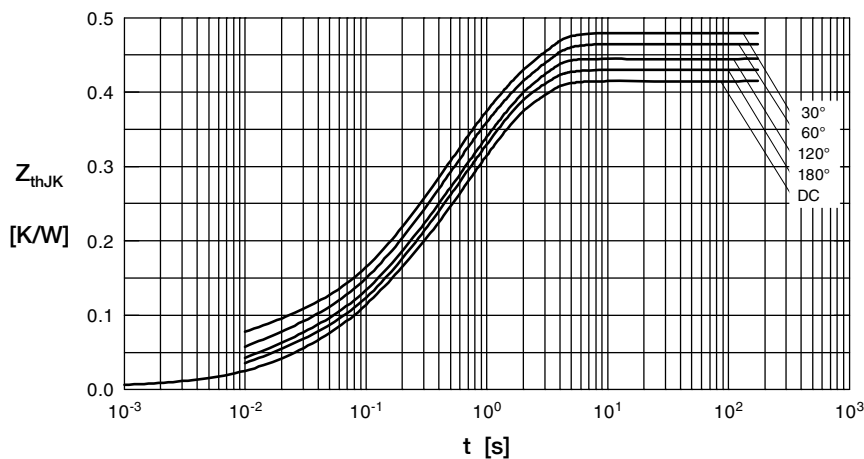
$R_{thJC}$  for various conduction angles d:

d	$R_{thJC}$ [K/W]
DC	0.22
180°	0.23
120°	0.25
60°	0.27
30°	0.28

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ [K/W]	$t_i$ [s]
1	0.0066	0.0019
2	0.0678	0.0477
3	0.1456	0.3440

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



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

d	$R_{thJK}$ [K/W]
DC	0.42
180°	0.43
120°	0.45
60°	0.47
30°	0.48

Constants for  $Z_{thJK}$  calculation:

i	$R_{thi}$ [K/W]	$t_i$ [s]
1	0.0066	0.0019
2	0.0678	0.0477
3	0.1456	0.3440
4	0.2000	1.3200

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