

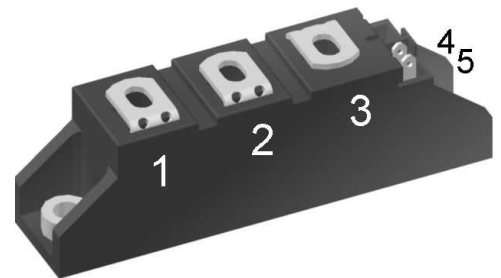
Thyristor \ Diode Module

$$\begin{aligned} V_{RRM} &= 2 \times 1400 \text{ V} \\ I_{TAV} &= 116 \text{ A} \\ V_T &= 1.28 \text{ V} \end{aligned}$$

Phase leg

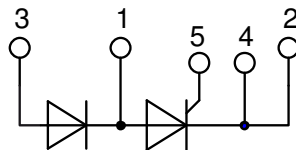
Part number

MCD95-14io1B



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

Terms .Conditions of usage:

The data contained in this product data sheet is exclusively intended for technically trained staff. The user will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to his application. The specifications of our components may not be considered as an assurance of component characteristics. The information in the valid application- and assembly notes must be considered. Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of your product, please contact your local sales office.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact your local sales office.

Should you intend to use the product in aviation, in health or life endangering or life support applications, please notify. For any such application we urgently recommend

- to perform joint risk and quality assessments;

- the conclusion of quality agreements;

- to establish joint measures of an ongoing product survey, and that we may make delivery dependent on the realization of any such measures.

Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1500	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1400	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1400\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			200	μA
		$V_{R/D} = 1400\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			5	mA
V_T	forward voltage drop	$I_T = 150\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.29	V
		$I_T = 300\text{ A}$				1.50	V
		$I_T = 150\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.28	V
		$I_T = 300\text{ A}$				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				182	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 Ω
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	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			2.25	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			2.43	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			1.92	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			2.07	kA
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			25.3	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			24.6	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			18.3	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			17.7	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		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	$T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 250\text{ A}$				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., $I_T = 116\text{ A}$				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	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			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	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			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	$V_R = 100\text{ V}; I_T = 150\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 100^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$			185		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/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} ≤ 1 mA		3600		V
		t = 1 minute			3000		V



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD95-14io1B	MCD95-14io1B	Box	36	464864

Similar Part	Package	Voltage class
MCMA110PD1600TB	TO-240AA-1B	1600
MCMA140PD1600TB	TO-240AA-1B	1600

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 *	1.2		mΩ

Technical drawing of a 5-pin DIN connector. The drawing shows the front and side views with the following dimensions:

- Overall length: 92 ± 0.5
- Length from first pin to last pin: 80 ± 0.3
- Pin pitch (center-to-center): 10
- Pin diameter: 4
- Pin length: 5.5 ± 0.1
- Pin 1 diameter: 10 ± 0.1
- Pin 2 diameter: 14.8
- Pin 3 diameter: 20.8 ± 0.25
- Pin 4 diameter: 25 ± 0.3
- Pin 5 diameter: 45 ± 0.3
- Pin 6 diameter: 65 ± 0.3
- Pin 7 diameter: 4.4
- Pin 8 diameter: 2.5
- Pin 9 diameter: 1.5
- Pin 10 diameter: 1.5
- Pin 11 diameter: 1.5
- Pin 12 diameter: 1.5
- Pin 13 diameter: 1.5
- Pin 14 diameter: 1.5
- Pin 15 diameter: 1.5
- Pin 16 diameter: 1.5
- Pin 17 diameter: 1.5
- Pin 18 diameter: 1.5
- Pin 19 diameter: 1.5
- Pin 20 diameter: 1.5
- Pin 21 diameter: 1.5
- Pin 22 diameter: 1.5
- Pin 23 diameter: 1.5
- Pin 24 diameter: 1.5
- Pin 25 diameter: 1.5
- Pin 26 diameter: 1.5
- Pin 27 diameter: 1.5
- Pin 28 diameter: 1.5
- Pin 29 diameter: 1.5
- Pin 30 diameter: 1.5
- Pin 31 diameter: 1.5
- Pin 32 diameter: 1.5
- Pin 33 diameter: 1.5
- Pin 34 diameter: 1.5
- Pin 35 diameter: 1.5
- Pin 36 diameter: 1.5
- Pin 37 diameter: 1.5
- Pin 38 diameter: 1.5
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- Pin 41 diameter: 1.5
- Pin 42 diameter: 1.5
- Pin 43 diameter: 1.5
- Pin 44 diameter: 1.5
- Pin 45 diameter: 1.5
- Pin 46 diameter: 1.5
- Pin 47 diameter: 1.5
- Pin 48 diameter: 1.5
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- Pin 50 diameter: 1.5
- Pin 51 diameter: 1.5
- Pin 52 diameter: 1.5
- Pin 53 diameter: 1.5
- Pin 54 diameter: 1.5
- Pin 55 diameter: 1.5
- Pin 56 diameter: 1.5
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- Pin 62 diameter: 1.5
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- Pin 70 diameter: 1.5
- Pin 71 diameter: 1.5
- Pin 72 diameter: 1.5
- Pin 73 diameter: 1.5
- Pin 74 diameter: 1.5
- Pin 75 diameter: 1.5
- Pin 76 diameter: 1.5
- Pin 77 diameter: 1.5
- Pin 78 diameter: 1.5
- Pin 79 diameter: 1.5
- Pin 80 diameter: 1.5
- Pin 81 diameter: 1.5
- Pin 82 diameter: 1.5
- Pin 83 diameter: 1.5
- Pin 84 diameter: 1.5
- Pin 85 diameter: 1.5
- Pin 86 diameter: 1.5
- Pin 87 diameter: 1.5
- Pin 88 diameter: 1.5
- Pin 89 diameter: 1.5
- Pin 90 diameter: 1.5
- Pin 91 diameter: 1.5
- Pin 92 diameter: 1.5
- Pin 93 diameter: 1.5
- Pin 94 diameter: 1.5
- Pin 95 diameter: 1.5
- Pin 96 diameter: 1.5
- Pin 97 diameter: 1.5
- Pin 98 diameter: 1.5
- Pin 99 diameter: 1.5
- Pin 100 diameter: 1.5

Thyristor

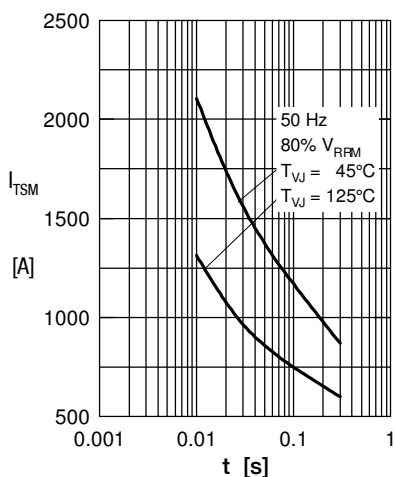


Fig. 1 Surge overload current I_{TSM} ,
 I_{FSM} : Crest value, t : duration

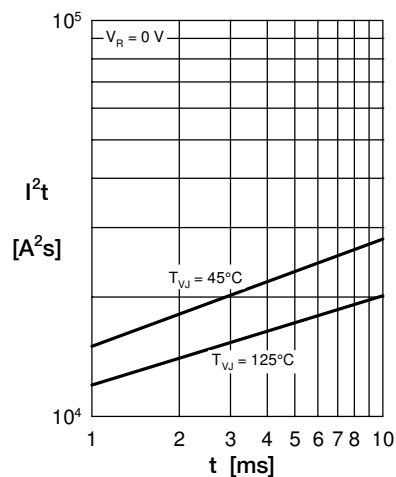


Fig. 2 I^2t versus time (1-10 ms)

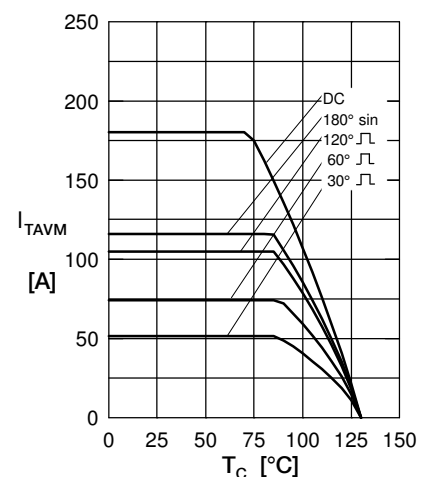


Fig. 3 Max. forward current
at case temperature

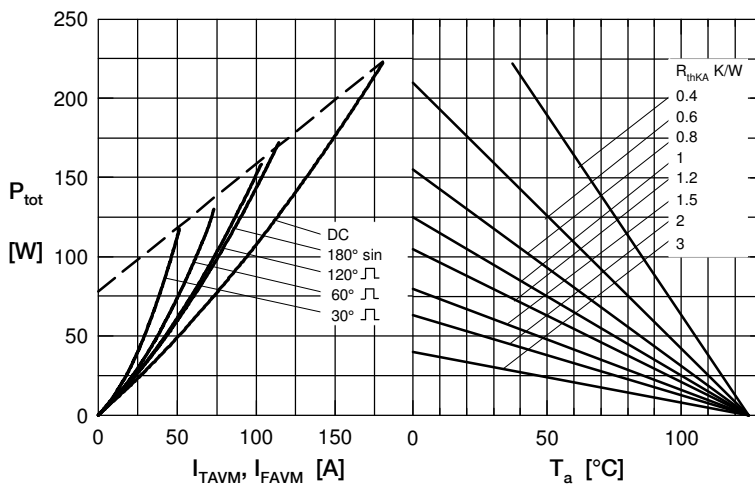


Fig. 4 Power dissipation vs. on-state current & ambient temperature
(per thyristor or diode)

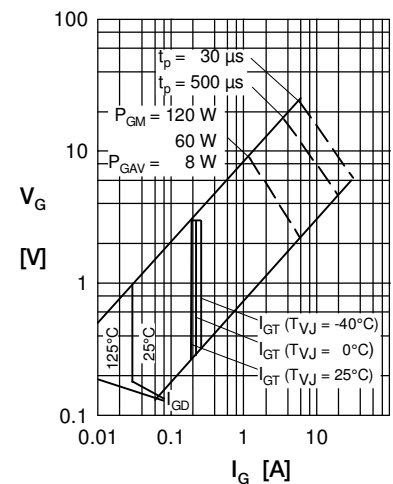


Fig. 5 Gate trigger characteristics

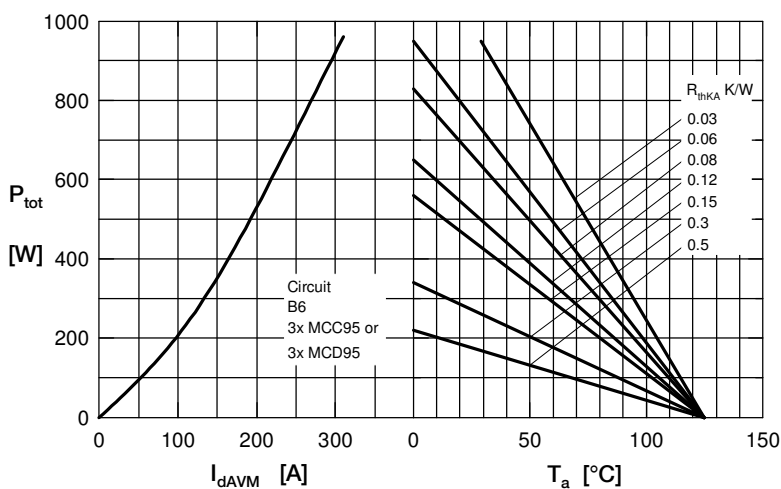


Fig. 6 Three phase rectifier bridge: Power dissipation vs. direct
output current and ambient temperature

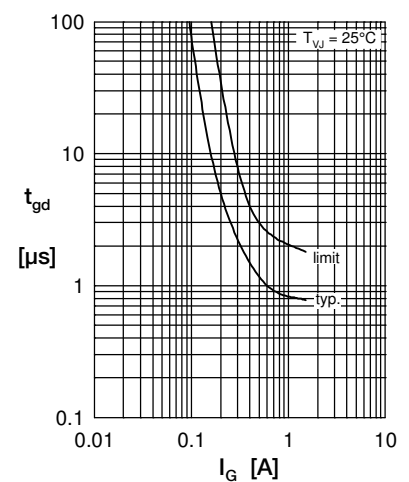


Fig. 7 Gate trigger delay time

Rectifier

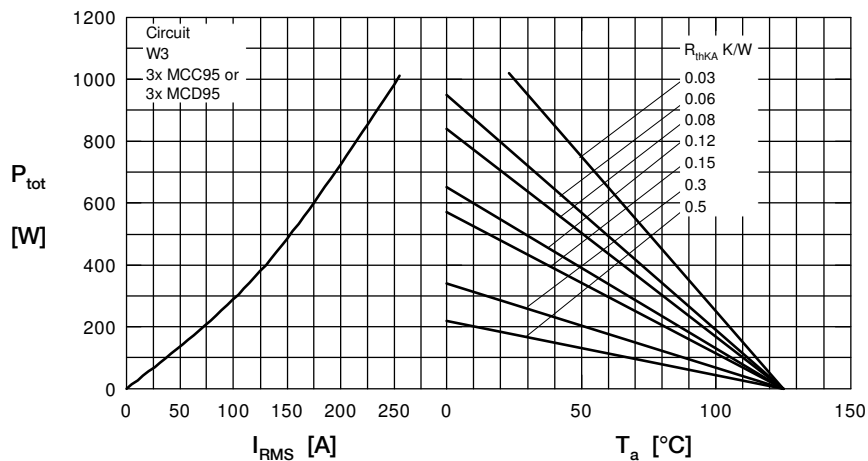


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

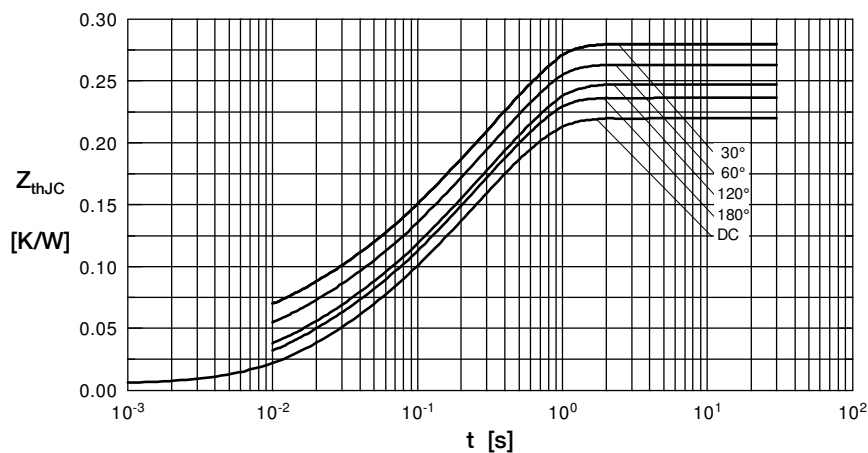


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

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

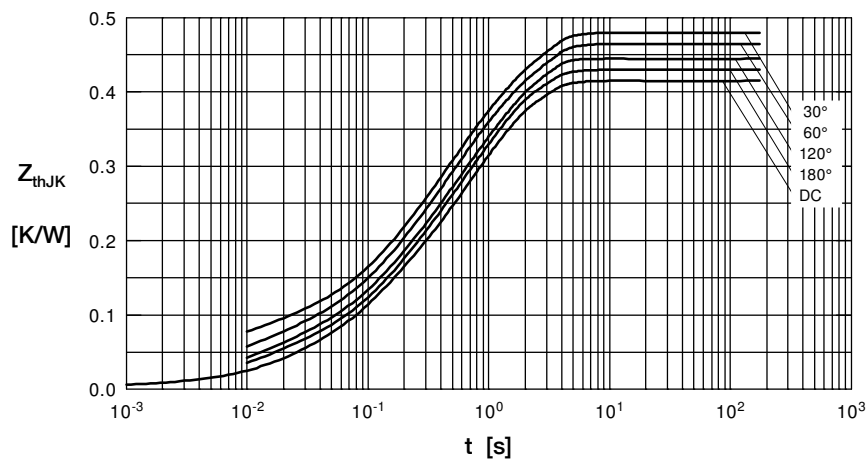


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

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