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With the principle of "Quality Parts, Customers Priority, Honest Operation, and Considerate Service", our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip, ALPS, ROHM, Xilinx, Pulse, ON, Everlight and Freescale. Main products comprise IC, Modules, Potentiometer, IC Socket, Relay, Connector. Our parts cover such applications as commercial, industrial, and automotives areas.

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# MCD220-14io1

Phase out

= 2x 1400 V

250 A

 $V_{\tau}$ 1.14 V

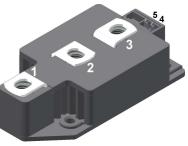
# **Thyristor \ Diode Module**

# PHASE OUT

Phase leg

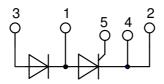
Part number

MCD220-14io1



Backside: isolated

**F1** 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: Y2

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

# Recommended replacement: MCD310-14io1

#### 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.

IXYS reserves the right to change limits, conditions and dimensions.

Data according to IEC 60747 and per semiconductor unless otherwise specified

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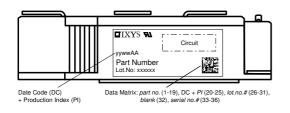


Rectifier					Ratings	3	ı.
Symbol	Definition	Conditions		min.	typ.	max.	Unit
V <sub>RSM/DSM</sub>	max. non-repetitive reverse/forwa	rd blocking voltage	$T_{VJ} = 25^{\circ}C$			1500	٧
V <sub>RRM/DRM</sub>	max. repetitive reverse/forward bl	ocking voltage	$T_{VJ} = 25^{\circ}C$			1400	V
R/D	reverse current, drain current	V <sub>R/D</sub> = 1400 V	$T_{VJ} = 25^{\circ}C$			1	mA
		$V_{R/D} = 1400 \text{ V}$	$T_{VJ} = 140$ °C			40	mΑ
V <sub>T</sub>	forward voltage drop	I <sub>T</sub> = 200 A	$T_{VJ} = 25^{\circ}C$			1.24	٧
		$I_T = 400 \text{ A}$				1.39	٧
		$I_{T} = 200 \text{ A}$	T <sub>VJ</sub> = 125°C			1.14	٧
		$I_T = 400 A$				1.33	٧
I <sub>TAV</sub>	average forward current	T <sub>C</sub> = 85°C	T <sub>VJ</sub> = 140°C			250	Α
I <sub>T(RMS)</sub>	RMS forward current	180° sine				400	Α
V <sub>T0</sub>	threshold voltage		T <sub>vJ</sub> = 140°C			0.90	٧
r <sub>T</sub>	slope resistance } for power lo	oss calculation only				1	mΩ
R <sub>thJC</sub>	thermal resistance junction to cas	e				0.14	K/W
R <sub>thCH</sub>	thermal resistance case to heatsi	nk			0.040		K/W
P <sub>tot</sub>	total power dissipation		$T_{C} = 25^{\circ}C$			820	W
I <sub>TSM</sub>	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$			8.50	kA
		t = 8,3 ms; (60 Hz), sine	$V_R = 0 V$			9.18	kA
		t = 10  ms; (50  Hz),  sine	T <sub>v,j</sub> = 140°C			7.23	kA
		t = 8,3 ms; (60 Hz), sine	$V_R = 0 V$			7.81	kA
2t value for fusing	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$	77	17	361.3	kA2s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0 V$			350.6	kA2s
		t = 10 ms; (50 Hz), sine	T <sub>VJ</sub> = 140°C			261.0	kA2s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0 V$			253.4	į
<b>C</b> <sub>J</sub>	junction capacitance	$V_B = 400 V$ f = 1 MHz	T <sub>VJ</sub> = 25°C		438		pF
P <sub>GM</sub>	max. gate power dissipation	t <sub>P</sub> = 30 μs	T <sub>C</sub> = 140°C			120	W
<b></b>	, ,	t <sub>P</sub> = 500 μs	•			60	W
$P_{GAV}$	average gate power dissipation					20	W
(di/dt) <sub>cr</sub>	critical rate of rise of current	T <sub>v.l</sub> = 140°C; f = 50 Hz re	epetitive, $I_T = 750 \text{ A}$			100	A/μs
701		$t_P = 200 \mu s; di_G/dt = 1 A/\mu s; -$	•				<u> </u>
		· · · · ·			500	A/μs	
(dv/dt) <sub>cr</sub>	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	on-repet., $I_T = 250 \text{ A}$ $T_{VI} = 140 ^{\circ}\text{C}$				V/μs
(	ŭ	R <sub>GK</sub> = ∞; method 1 (linear volta	••				
V <sub>GT</sub>	gate trigger voltage	$V_D = 6 \text{ V}$	$T_{VJ} = 25^{\circ}C$			2	V
* GI	3-11-1-33-1	. b	$T_{VJ} = -40$ °C			3	V
<b>I</b> <sub>GT</sub>	gate trigger current	$V_D = 6 \text{ V}$	$T_{VJ} = 25^{\circ}C$			150	mA
•GI	gate trigger carrent	<b>v</b> <sub>D</sub> − <b>3 v</b>	$T_{VJ} = -40$ °C			200	mA
V <sub>GD</sub>	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}C$			0.25	V
I <sub>GD</sub>	gate non-trigger current	P / J PHM	1 1/3 = 1 10 0			10	mA
I <sub>L</sub>	latching current	t <sub>p</sub> = 30 μs	T <sub>vJ</sub> = 25°C			200	mA
IL.	ratering current	$I_p = 30  \mu s$ $I_G = 0.45  A;  di_G/dt = 0.45  A/\mu s$				200	ША
1	holding current	$V_D = 6 \text{ V } R_{GK} = \infty$	$T_{VJ} = 25$ °C			150	mA
I <sub>H</sub>							1
t <sub>gd</sub>	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25$ °C			2	μs
	turn off tim-	$I_{G} = 1 \text{ A}; \text{ di}_{G}/\text{dt} = 1 \text{ A}/\mu \text{s}$			000		<u> </u>
t <sub>q</sub>	turn-off time	$V_R = 100 \text{ V}; I_T = 250 \text{ A}; V = \frac{2}{7}$			200		μs
		$di/dt = 10 A/\mu s dv/dt = 50 V$	//μs t <sub>p</sub> = 200 μs				į





Package	Y2		Ratings						
Symbol	Definition	Conditions		min.	typ.	max.	Unit		
I <sub>RMS</sub>	RMS current	per terminal				600	Α		
T <sub>VJ</sub>	virtual junction temperature			-40		140	°C		
Top	operation temperature			-40		125	°C		
T <sub>stg</sub>	storage temperature			-40		125	°C		
Weight					255		g		
M <sub>D</sub>	mounting torque			2.5		5	Nm		
$\mathbf{M}_{_{T}}$	terminal torque			12		15	Nm		
d <sub>Spp/App</sub>	oroonago distance on surface	e   striking distance through air	terminal to terminal	13.0			mm		
$d_{Spb/Apb}$	creepage distance on surface	e   Striking distance through an	terminal to backside	13.0			mm		
V <sub>ISOL</sub>	isolation voltage	t = 1 second	50/00 II DMO I 44 A	3600			٧		
IJUL	t = 1 minute		50/60 Hz, RMS; IsoL ≤ 1 mA	3000			٧		

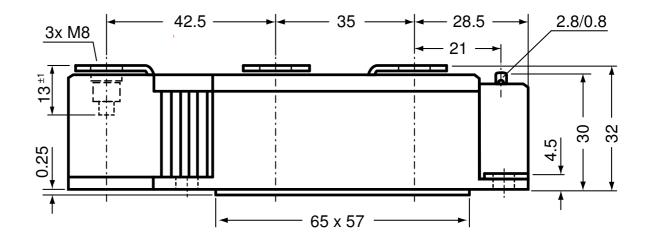


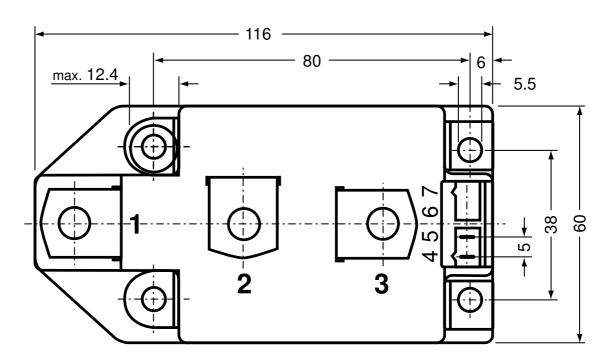
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD220-14io1	MCD220-14io1	Box	2	419281

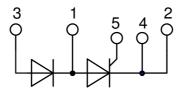
Equiva	alent Circuits for	Simulation	* on die level	$T_{VJ} = 140 ^{\circ}\text{C}$
$I \rightarrow V_0$	R <sub>o</sub>	Thyristor		
V <sub>0 max</sub>	threshold voltage	0.9		V
$R_{0 \text{ max}}$	slope resistance *	0.5		$m\Omega$



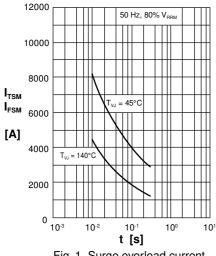
# Outlines Y2







## **Thyristor**



 $V_{R} = 0 V$   $V_{R} = 0 V$   $V_{R} = 0 V$   $V_{N} = 45^{\circ}C$   $V_{V,J} = 45^{\circ}C$   $V_{V,J} = 140^{\circ}C$   $V_{N} = 140^{\circ}C$ 

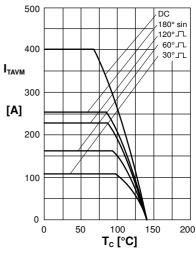
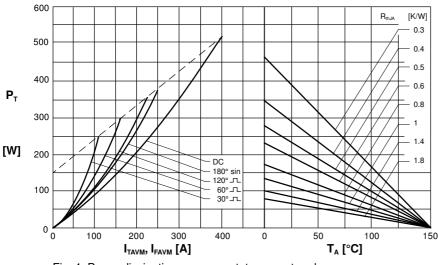


Fig. 1 Surge overload current  $I_{T(F)SM}$ : crest value, t: duration

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

Fig. 3 Max. forward current at case temperature



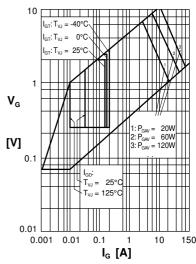
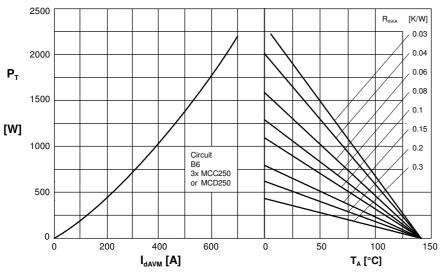


Fig. 4 Power dissipation versus onstate current and ambient temperature (per thyristor/diode)

Fig. 5 Gate trigger characteristics



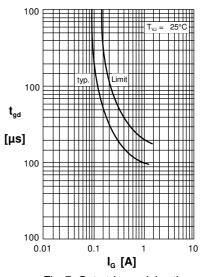


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

Fig. 7 Gate trigger delay time

### Rectifier

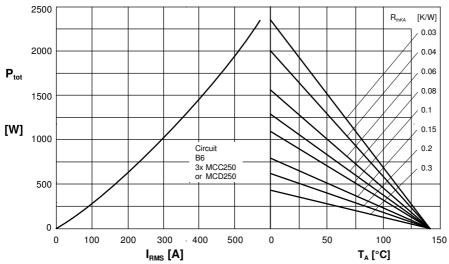


Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

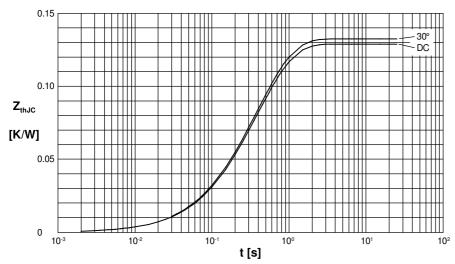


Fig. 8 Transient thermal impedance junction to case (per thyristor/diode)



d	$R_{thJC}$ [K/W]
DC	0.139
180°C	0.141
120°C	0.142
60°C	0.142
30°C	0.143

# Constants for $Z_{\text{thJC}}$ calculation:

i	$R_{thi}$ [K/W]	t, [s]
1	0.0037	0.0099
2	0.0177	0.168
3	0 1175	0.456

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

d	$R_{thJK}$ [K/W]
DC	0.179
180°C	0.181
120°C	0.182
60°C	0.183
30°C	0.183

#### Constants for $Z_{thJK}$ calculation:

i	$R_{thi}$ [K/W]	t <sub>i</sub> [s]
1	0.0033	0.0099
2	0.0159	0.168
3	0.1053	0.456
1	0.04	1 36

0.20	T	T	П	П	П			П	Т	П	П		Π	П	П	П	П		Т	Τ	П	П			П	П	П	П
		$\top$	Ħ	Ħ	Ħ			Н	$^{+}$	Ħ	Ħ			Н	Ħ	Ħ	Ħ		7	$^{\dagger}$	Ш	#			$\sqcap$	Ħ	Ħ	Ħ
	$\dashv$	$^{+}$	Ħ	Ħ	Ħ			H	$^{+}$	Ħ	Ħ			Н	Ħ	Ħ	#		7	$^{+}$	Ш	Ш			C'	30	o't	Ħ
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0.15	$\dashv$	+	H	Ħ	₩			Н	+	H	H			Н	+	Н	$^{+}$	-	$\dashv$	+	Н	₩			$\vdash$	Н	$^{+}$	Н
	$\dashv$	+	H	₩	₩			Н	+	Н	Н			Н	+	Н	Н	//	$\dashv$	+	Н	₩			$\vdash$	+	$^{+}$	Н
$\mathbf{Z}_{thJK}$	$\dashv$	+	H	₩	₩			Н	+	Н	Н			Н	+	Н	Я	1	$\dashv$	+	Н	₩			$\vdash$	+	$^{+}$	Н
—thJK	$\dashv$	+	Н	₩	₩			Н	+	Н	Н			Н	Н	И	4		$\dashv$	+	Н	₩			$\vdash$	Н	+	Н
	$\dashv$	+	Н	₩	₩			Н	+	Н	Н			Н	1	H	₩		$\dashv$	+	Н	₩			$\vdash$	Н	+	Н
0.10	$\rightarrow$	+	Н	₩	₩			Н	+	Н	₩			Н	#	$\mathbb{H}$	₩		+	+	Н	₩			$\vdash$	Н	+	Н
		+	Н	₩	₩			Н	+	Н	Н				7	Н	₩		$\dashv$	+	Н	₩			$\vdash$	Н	+	Н
F12 /\A/1	$\rightarrow$	+	₩	₩	₩			Н	+	Н	Н		<u> </u>	Z	$\dashv$	Н	#		$\dashv$	+	Ш	#			$\vdash$	Н	+	Н
[K/W]	-	+	$^{++}$	₩	Н-			Н	+	Н	Н			Н	Н	Н	#		-	+	Ш	#			$\vdash$	Н	+	Н
	-	+	Н	#	╙			Н	+	Н	Щ		/	Н	Н	Н	Н		_	+	Ш	4			$\vdash$	Н	+	Н
0.05	_	+	Н	#	Щ.			Ш	+	Н	Щ		1	Ш	Н	Н	#		_	$\perp$	Ш	44			Н	Ш	4	Щ
	_	4	Н	Щ	Ш			Ш	4	Щ	Щ			Ш	Ц	Щ	Щ		_	$\perp$	Ш	Щ			Н	Ш	Ш	Щ
	_	+	Н	4	Щ.			Н	+	Н	И			Ш	Ц	Щ	4		_	+	Ш	4			Н	Ш	Ш	Щ
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	_	4	Ш	Щ	Ш		_	4	1	Ц	Щ			Ш	Ц	Щ	Щ		4	$\perp$	Ш	Щ			Ш	Ш	Щ	Ш
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Fig. 9 Transient thermal impedance junction to heatsink (per thyristor/diode)