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We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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# **Thyristor Module**

= 2x 1400 V

181 A

 $V_{\tau}$ 1.03 V

## Phase leg

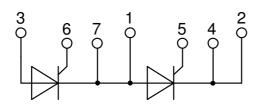
#### Part number

#### MCC162-14io1



Backside: isolated





#### 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: Y4

- 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.

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

Data according to IEC 60747 and per semiconductor unless otherwise specified

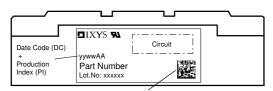
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Thyristo				<b>'</b> 	Ratings	1	1
Symbol	Definition	Conditions		min.	typ.	max.	Un
V <sub>RSM/DSM</sub>	max. non-repetitive reverse/forwa	rd blocking voltage	$T_{VJ} = 25^{\circ}C$			1500	ļ
V <sub>RRM/DRM</sub>	max. repetitive reverse/forward bl	<u> </u>	$T_{VJ} = 25^{\circ}C$			1400	<u> </u>
R/D	reverse current, drain current	$V_{R/D} = 1400 \text{ V}$	$T_{VJ} = 25^{\circ}C$			300	μ
		$V_{R/D} = 1400 \text{ V}$	$T_{VJ} = 125^{\circ}C$			10	m.
V <sub>T</sub>	forward voltage drop	$I_T = 150 \text{ A}$	$T_{VJ} = 25^{\circ}C$			1.09	
		$I_T = 300 A$				1.25	
		I <sub>T</sub> = 150 A	T <sub>VJ</sub> = 125°C			1.03	
		$I_T = 300 \text{ A}$				1.25	
I <sub>TAV</sub>	average forward current	T <sub>C</sub> = 85°C	T <sub>vJ</sub> = 125°C			181	
T(RMS)	RMS forward current	180° sine				300	
V <sub>T0</sub>	threshold voltage		T <sub>vJ</sub> = 125°C			0.88	
r <sub>T</sub>	slope resistance	oss calculation only				1.15	m!
R <sub>thJC</sub>	thermal resistance junction to cas	e				0.155	K/V
R <sub>thCH</sub>	thermal resistance case to heatsi				0.070		K/V
P <sub>tot</sub>	total power dissipation		T <sub>C</sub> = 25°C			645	٧
I <sub>TSM</sub>	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{V,I} = 45^{\circ}C$			6.00	!
•ISM		t = 8.3  ms; (60  Hz),  sine	$V_{R} = 0 V$			6.48	k
		t = 0.0  ms; (50  Hz),  sine t = 10  ms; (50  Hz),  sine	T <sub>vJ</sub> = 125°C			5.10	<u> </u>
		t = 8.3  ms; (60 Hz), sine	$V_{R} = 0 V$			5.51	k
l²t	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$			180.0	kA <sup>2</sup>
-t	value for fusing	. , , , , , , , , , , , , , , , , , , ,	$V_{N} = 45 \text{ C}$ $V_{R} = 0 \text{ V}$			174.7	1
		t = 8,3  ms; (60 Hz), sine t = 10  ms; (50 Hz), sine					1
		. , , , , , , , , , , , , , , , , , , ,	$T_{VJ} = 125$ °C			130.1	kA <sup>2</sup>
	i un ation a sur a litera a	t = 8,3 ms; (60 Hz), sine	$V_R = 0 V$		070	126.3	
C,	junction capacitance	V <sub>R</sub> = 400 V f = 1 MHz	$T_{VJ} = 25^{\circ}C$		273	400	р
$P_{GM}$	max. gate power dissipation	$t_P = 30 \mu s$	$T_{c} = 125^{\circ}C$			120	۷
		t <sub>P</sub> = 500 μs				60	٧
P <sub>GAV</sub>	average gate power dissipation					8	۷
(di/dt) <sub>cr</sub>	critical rate of rise of current		epetitive, $I_T = 540 \text{ A}$			150	A/μ
		$t_P = 200 \mu s; di_G/dt = 0.5 A/\mu s; -$					
		$I_G = 0.5 A; V = \frac{2}{3} V_{DRM}$ no	on-repet., $I_T = 180 A$			500	A/μ
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125$ °C			1000	V/µ
		R <sub>GK</sub> = ∞; method 1 (linear volta	ge rise)				į
<b>V</b> <sub>GT</sub>	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$			2.5	,
			$T_{VJ} = -40$ °C			2.6	١
I <sub>GT</sub>	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$			150	m
			$T_{VJ} = -40$ °C			200	m
V <sub>GD</sub>	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	T <sub>vJ</sub> = 125°C			0.2	١
I <sub>GD</sub>	gate non-trigger current					10	m
<u>.                                    </u>	latching current	t <sub>p</sub> = 30 μs	$T_{VJ} = 25$ °C			300	m
_	-	$I_{G} = 0.5 \text{ A}; \text{ di}_{G}/\text{dt} = 0.5 \text{ A}/\mu\text{s}$					
I <sub>H</sub>	holding current	$V_D = 6 \text{ V } R_{GK} = \infty$	T <sub>vJ</sub> = 25°C			200	m
тн t <sub>gd</sub>	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$			2	μ
<b>•</b> gd	gato controlled delay line	$I_{G} = 0.5 \text{ A}; \text{ di}_{G}/\text{dt} = 0.5 \text{ A}/\mu\text{s}$				_	μ
	turn-off time				150		
t <sub>q</sub>	tanron time	$V_R = 100 \text{ V}; I_T = 300 \text{ A}; V = \frac{2}{3}$			150		μ
		$di/dt = 10 A/\mu s dv/dt = 20 V_s$	$/\mu s t_p = 200 \mu s$				i I



Package	Y4				ı	Ratings	5	
Symbol	Definition	Conditions			min.	typ.	max.	Unit
RMS	RMS current	per terminal					300	Α
T <sub>VJ</sub>	virtual junction temperature				-40		125	°C
T <sub>op</sub>	operation temperature				-40		100	°C
T <sub>stg</sub>	storage temperature				-40		125	°C
Weight						150		g
M <sub>D</sub>	mounting torque				2.25		2.75	Nm
$\mathbf{M}_{_{T}}$	terminal torque				4.5		5.5	Nm
d <sub>Spp/App</sub>	creepage distance on surface	Latriking diatanga through air	terminal to terminal	14.0	10.0			mm
d <sub>Spb/Apb</sub>	creepage distance on surface	Striking distance through an	terminal to backside 16.0		16.0			mm
V <sub>ISOL</sub>	isolation voltage	t = 1 second	50/60 Hz. RMS: IIsoL ≤ 1 mA		3600			٧
.002		t = 1 minute			3000			٧



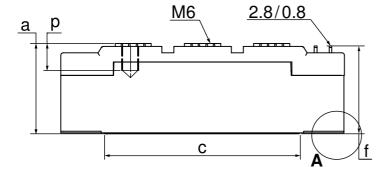
Data Matrix: part no. (1-19), DC + Pl (20-25), lot.no.# (26-31), blank (32), serial no.# (33-36)

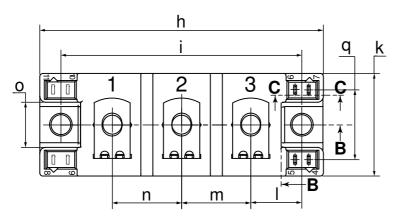
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC162-14io1	MCC162-14io1	Box	6	429600

<b>Equivalent Circuits for Simulation</b>			* on die level	$T_{VJ} = 125 ^{\circ}\text{C}$
$I \rightarrow V_0$	$R_0$	Thyristor		
V <sub>0 max</sub>	threshold voltage	0.88		V
$R_{0 \text{ max}}$	slope resistance *	0.8		$m\Omega$

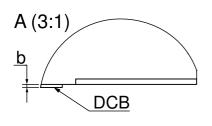


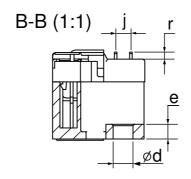
### Outlines Y4



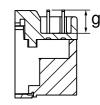


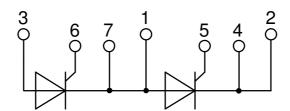
Dies	MIN	MAX	MIN	MAX
Dim.	[mm]	[mm]	[inch]	[inch]
а	30.0	30.6	1.181	1.205
b	typ.	0.25	typ. (	0.010
С	64.0	65.0	2.520	2.559
d	6.5	7.0	0.256	0.275
е	4.9	5.1	0.193	0.201
f	28.6	29.2	1.126	1.150
g	7.3	7.7	0.287	0.303
h	93.5	94.5	3.681	3.720
i	79.5	80.5	3.130	3.169
j	4.8	5.2	0.189	0.205
k	33.4	34.0	1.315	1.339
ı	16.7	17.3	0.657	0.681
m	22.7	23.3	0.894	0.917
n	22.7	23.3	0.894	0.917
0	14.0	15.0	0.551	0.591
р	typ. 10.5 typ. 0.41		0.413	
q	22.8	23.3	0.898	0.917
r	1.8	2.4	0.071	0.041













#### **Thyristor**

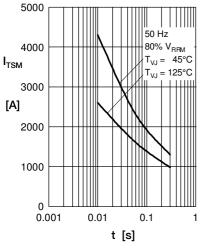


Fig. 1 Surge overload current  $I_{TSM}$ ,  $I_{ESM}$ : Crest value, t: duration

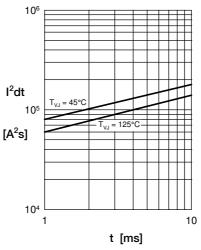


Fig. 2 I<sup>2</sup>t versus time (1-10 ms)

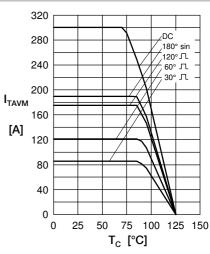


Fig. 3 Max. forward current at case temperature

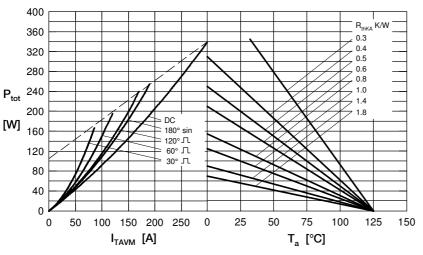


Fig. 4 Power dissipation vs. on-state current & ambient temperature (per thyristor or diode)

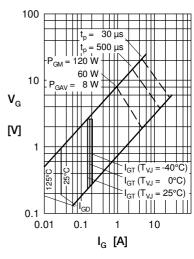


Fig. 5 Gate trigger characteristics

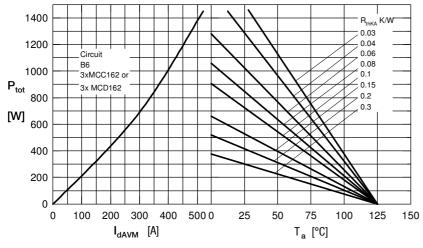


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

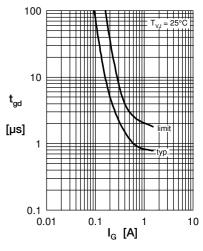


Fig. 7 Gate trigger delay time



#### **Thyristor**

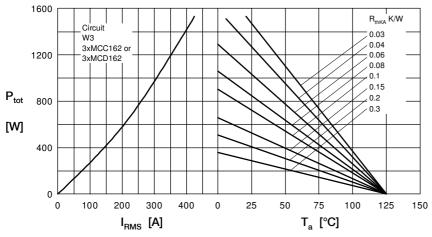


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

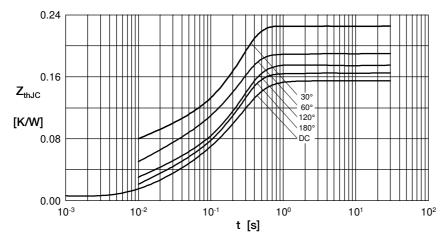


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

 $\mathbf{R}_{\text{thJC}}$  for various conduction angles d:

d	R <sub>thJC</sub> [K/W]
DC	0.155
180°	0.167
120°	0.176
60°	0.197
30°	0.227

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

i	$R_{thi}$ [K/W]	t <sub>i</sub> [s]
1	0.0072	0.00
2	0.0188	0.080
3	0.1290	0.200

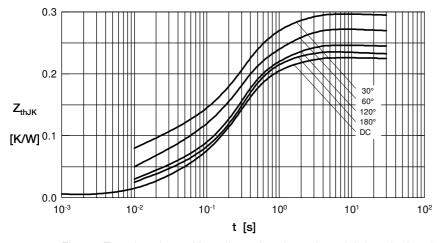


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

 $\boldsymbol{R}_{\text{thJK}}$  for various conduction angles d:

d	$R_{thJK}$ [K/W]
DC	0.225
180°	0.237
120°	0.246
60°	0.267
30°	0.297

#### Constants for $\mathbf{Z}_{\text{thJK}}$ calculation:

i	$R_{thi}$ [K/W]	t <sub>i</sub> [s]
1	0.0072	0.001
2	0.0188	0.080
3	0.1290	0.200
4	0.0700	1.000