

High Voltage Thyristor Module

$$V_{RRM} = 2 \times 2200 \text{ V}$$

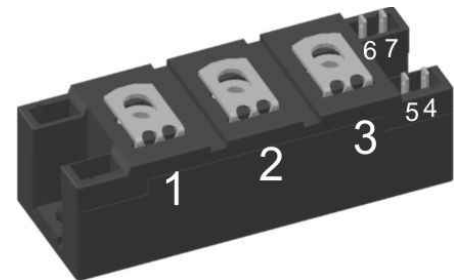
$$I_{TAV} = 165 \text{ A}$$

$$V_T = 1.08 \text{ V}$$

Phase leg

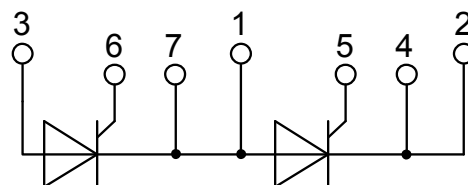
Part number

MCC161-22io1



Backside: isolated

 E72873



Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al₂O₃-ceramic

Applications:

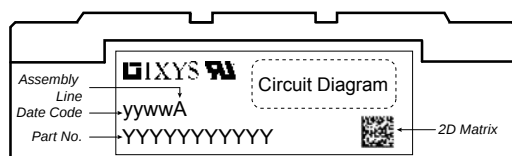
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

Package: Y4

- Isolation Voltage: 3600 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	$T_{VJ} = 25^{\circ}\text{C}$				2300	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				2200	V
I_{RD}	reverse current, drain current	$V_{RD} = 2200\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			400	μA
		$V_{RD} = 2200\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			40	mA
V_T	forward voltage drop	$I_T = 150\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.14	V
		$I_T = 300\text{ A}$				1.36	V
		$I_T = 150\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.08	V
		$I_T = 300\text{ A}$				1.36	V
I_{TAV}	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 125^{\circ}\text{C}$			165	A
$I_{T(RMS)}$	RMS forward current	180° sine				300	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}\text{C}$			0.80	V
r_T	slope resistance					1.6	m Ω
R_{thJC}	thermal resistance junction to case					0.155	K/W
R_{thCH}	thermal resistance case to heatsink				0.07		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$			645	W
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			6.00	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			6.48	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			5.10	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			5.51	kA
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			180.0	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			174.7	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			130.1	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			126.3	kA ² s
C_J	junction capacitance	$V_R = 700\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		195		pF
P_{GM}	max. gate power dissipation	$t_P = 30\text{ }\mu\text{s}$	$T_C = 125^{\circ}\text{C}$			120	W
		$t_P = 500\text{ }\mu\text{s}$				60	W
P_{GAV}	average gate power dissipation					8	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 500\text{ A}$				150	A/ μs
		$t_P = 200\text{ }\mu\text{s}; di_G/dt = 0.5\text{ A}/\mu\text{s};$ $I_G = 0.5\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 160\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise)	$T_{VJ} = 125^{\circ}\text{C}$			1000	V/ μs
V_{GT}	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			2	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	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$			0.25	V
I_{GD}	gate non-trigger current					10	mA
I_L	latching current	$t_P = 30\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			200	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
		$I_G = 0.5\text{ A}; di_G/dt = 0.5\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 160\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 20\text{ V}/\mu\text{s}; t_P = 200\text{ }\mu\text{s}$	$T_{VJ} = 125^{\circ}\text{C}$		150		μs

Package Y4				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
I_{RMS}	RMS current	per terminal				300	A
T_{VJ}	virtual junction temperature			-40		125	°C
T_{op}	operation temperature			-40		100	°C
T_{stg}	storage temperature			-40		125	°C
Weight					150		g
M_D	mounting torque			2.25		2.75	Nm
M_T	terminal torque			4.5		5.5	Nm
$d_{Spp/App}$	creepage distance on surface striking distance through air	terminal to terminal	14.0	10.0			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	3600			V
		t = 1 minute		3000			V



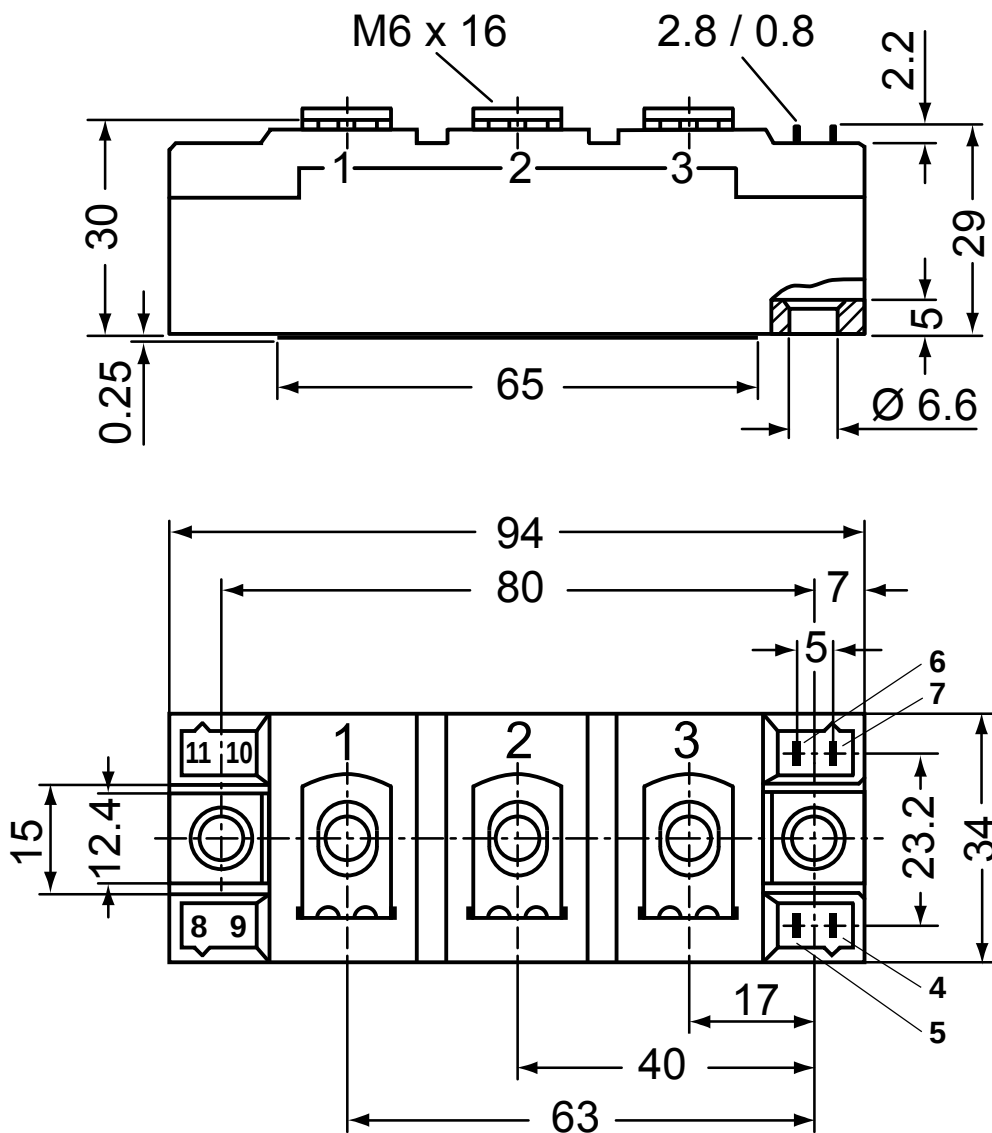
Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC161-22io1	MCC161-22io1	Box	6	463515

Equivalent Circuits for Simulation

* on die level

 $T_{VJ} = 125^\circ\text{C}$

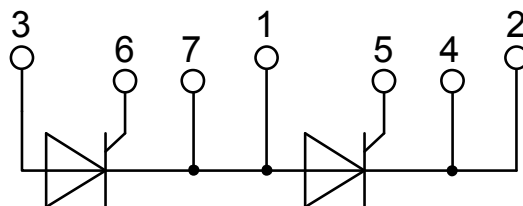
		Thyristor	
$V_{0\max}$	threshold voltage	0.8	V
$R_{0\max}$	slope resistance *	0.9	mΩ



Optional accessories for modules

Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red

Type ZY 180L (L = Left for pin pair 4/5) } UL 758, style 3751
Type ZY 180R (R = Right for pin pair 6/7) }



Thyristor

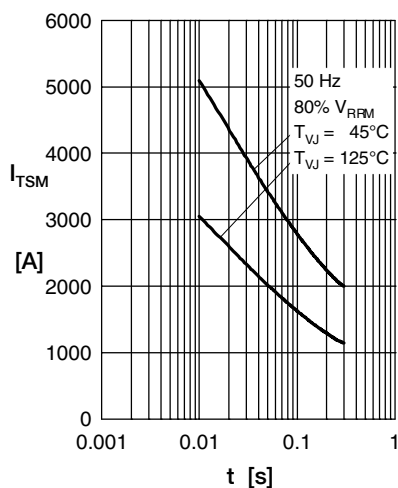


Fig. 1 Surge overload current I_{TSM} ,
 I_{FSM} : Crest value, t : duration

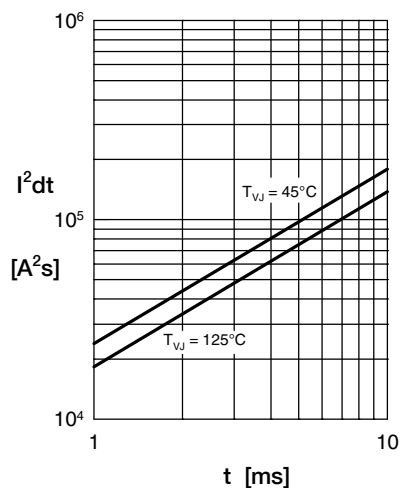


Fig. 2 I^2t versus time (1-10 ms)

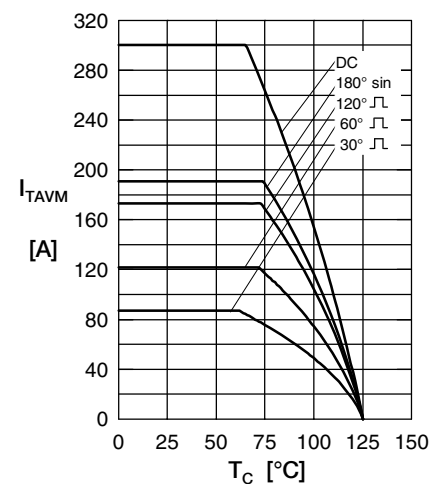


Fig. 3 Max. forward current
at case temperature

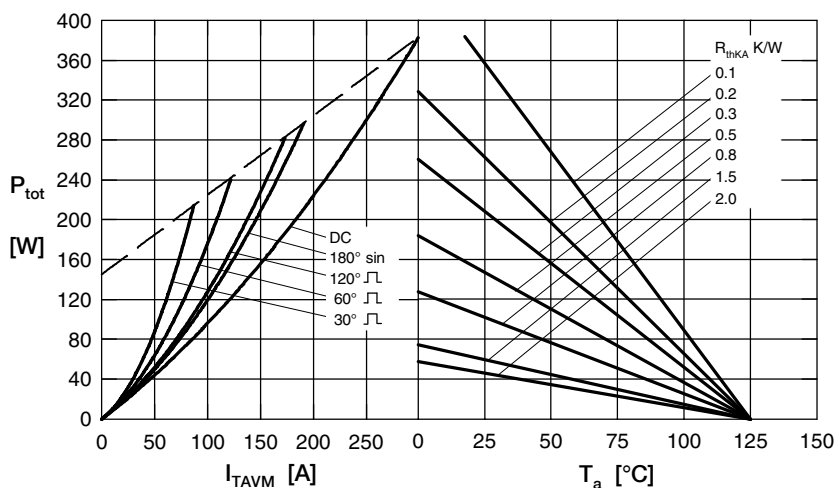


Fig. 4 Power dissipation vs. on-state current & ambient temperature
(per thyristor or diode)

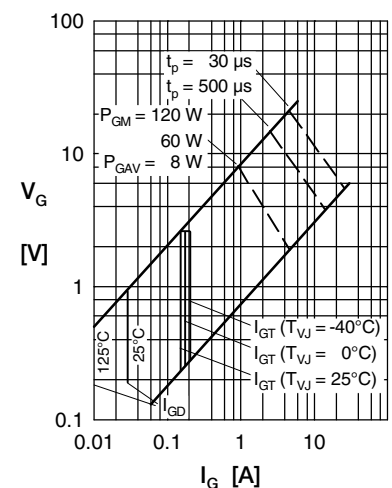


Fig. 5 Gate trigger characteristics

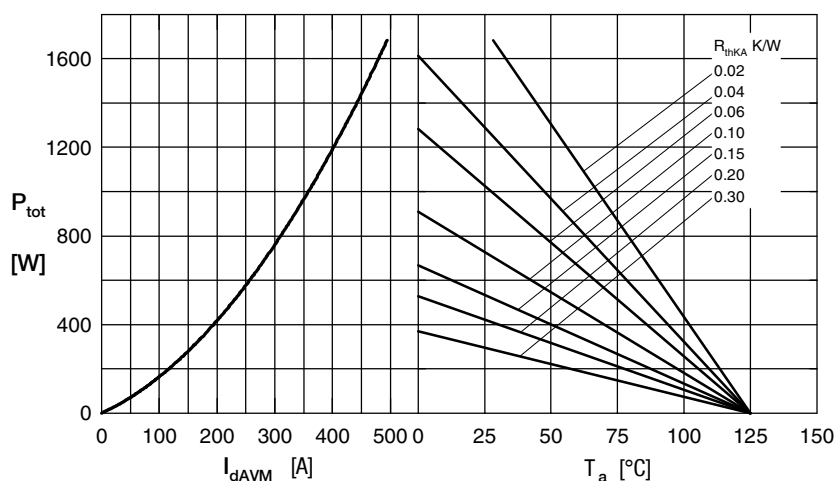


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct
output current and ambient temperature

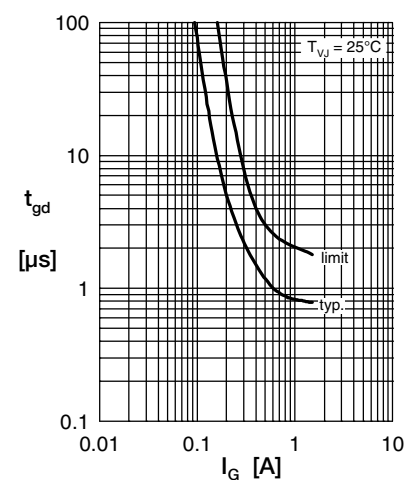


Fig. 7 Gate trigger delay time

Thyristor

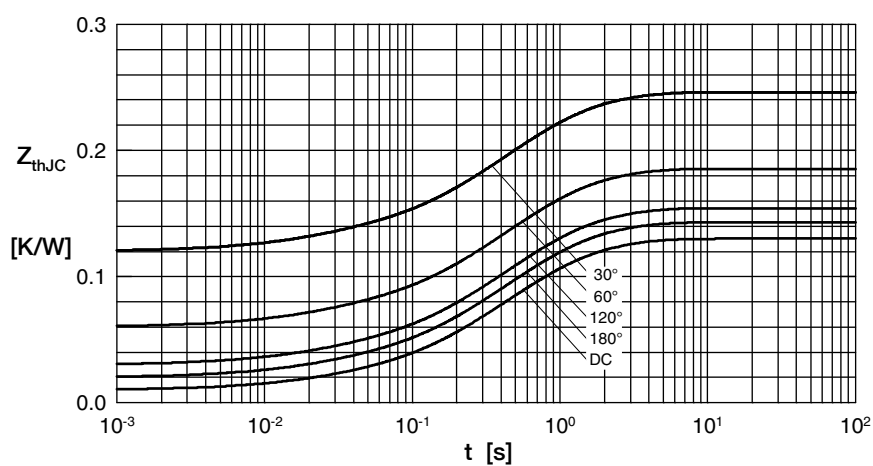


Fig. 8 Transient thermal impedance junction to case at various conduction angles

R_{thJC} for various conduction angles d:

d	R_{thJC} [K/W]
DC	0.155
180°	0.171
120°	0.184
60°	0.222
30°	0.294

Constants for Z_{thJC} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.012	0.00014
2	0.008	0.019
3	0.030	0.180
4	0.073	0.520
5	0.032	1.600

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