

Thyristor Module

$$V_{RRM} = 2 \times 1600 \text{ V}$$

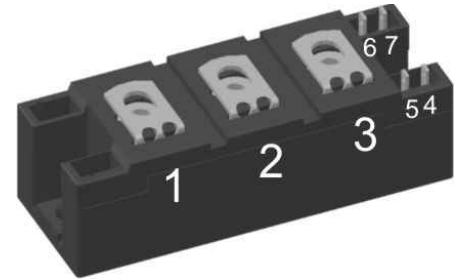
$$I_{TAV} = 216 \text{ A}$$

$$V_T = 1.1 \text{ V}$$


Phase leg

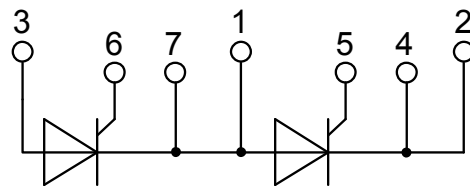
Part number

MCC200-16io1



Backside: isolated

 E72873



Features / Advantages:

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

Applications:

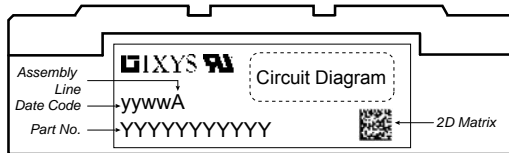
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

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	$T_{VJ} = 25^{\circ}C$			1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1600	V
I_{RD}	reverse current, drain current	$V_{R/D} = 1600 V$	$T_{VJ} = 25^{\circ}C$		400	μA
		$V_{R/D} = 1600 V$	$T_{VJ} = 125^{\circ}C$		15	mA
V_T	forward voltage drop	$I_T = 200 A$	$T_{VJ} = 25^{\circ}C$		1.20	V
					1.52	V
		$I_T = 400 A$	$T_{VJ} = 125^{\circ}C$		1.10	V
					1.50	V
I_{TAV}	average forward current	$T_C = 85^{\circ}C$	$T_{VJ} = 125^{\circ}C$		216	A
$I_{T(RMS)}$	RMS forward current	180° sine			340	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}C$		0.80	V
r_T	slope resistance				1.4	m Ω
R_{thJC}	thermal resistance junction to case				0.13	K/W
R_{thCH}	thermal resistance case to heatsink			0.05		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}C$		770	W
I_{TSM}	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$	$V_R = 0 V$	8.00	kA
					t = 8,3 ms; (60 Hz), sine	8.64
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 125^{\circ}C$	$V_R = 0 V$	6.80	kA
					t = 8,3 ms; (60 Hz), sine	7.35
I^2t	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$	$V_R = 0 V$	320.0	kA ² s
					t = 8,3 ms; (60 Hz), sine	310.5
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 125^{\circ}C$	$V_R = 0 V$	231.2	kA ² s
					t = 8,3 ms; (60 Hz), sine	224.4
C_J	junction capacitance	$V_R = 400 V$ f = 1 MHz	$T_{VJ} = 25^{\circ}C$		366	pF
P_{GM}	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 125^{\circ}C$		120	W
		$t_p = 500 \mu s$			60	W
P_{GAV}	average gate power dissipation				20	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}C$; f = 50 Hz	repetitive, $I_T = 600 A$		100	A/ μs
				$t_p = 200 \mu s$; $di_G/dt = 0.5 A/\mu s$;		
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$	non-repet., $I_T = 200 A$	500	A/ μs
					$R_{GK} = \infty$; method 1 (linear voltage rise)	
V_{GT}	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		2	V
			$T_{VJ} = -40^{\circ}C$		3	V
I_{GT}	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		150	mA
			$T_{VJ} = -40^{\circ}C$		220	mA
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		0.25	V
I_{GD}	gate non-trigger current				10	mA
I_L	latching current	$t_p = 30 \mu s$	$T_{VJ} = 25^{\circ}C$		200	mA
				$I_G = 0.5 A$; $di_G/dt = 0.5 A/\mu s$		
I_H	holding current	$V_D = 6 V$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		150	mA
t_{gd}	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	μs
				$I_G = 0.5 A$; $di_G/dt = 0.5 A/\mu s$		
t_q	turn-off time	$V_R = 100 V$; $I_T = 300 A$; $V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		200	μs
		$di/dt = 10 A/\mu s$; $dv/dt = 50 V/\mu s$; $t_p = 200 \mu s$				

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

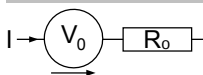


Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC200-16io1	MCC200-16io1	Box	6	497460

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 *	0.7	mΩ

Thyristor

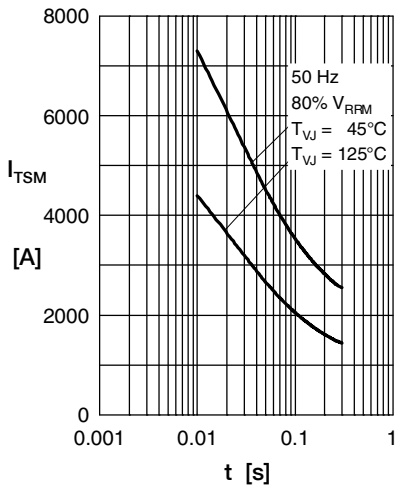


Fig. 1 Surge overload current I_{TSM} ,
 I_{FSM} : Crest value, t : duration

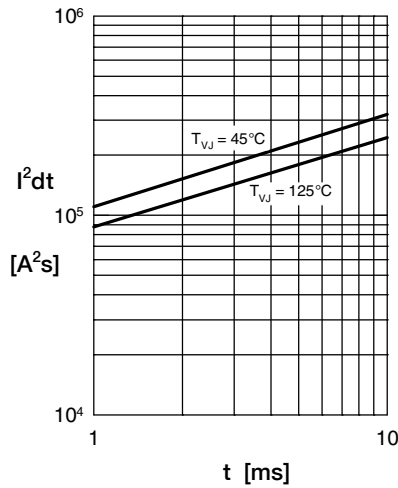


Fig. 2 I^2t versus time (1-10 ms)

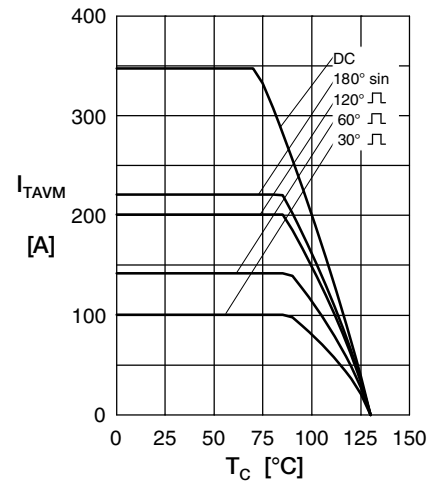


Fig. 3 Max. forward current at case temperature

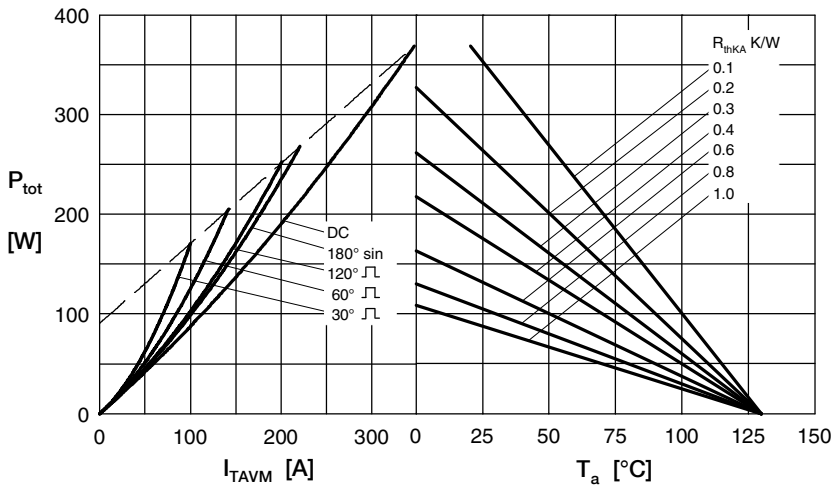


Fig. 4 Power dissipation vs. on-state current & ambient temperature (per thyristor or diode)

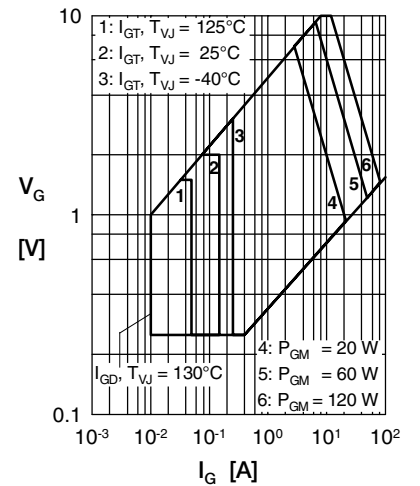


Fig. 5 Gate trigger characteristics

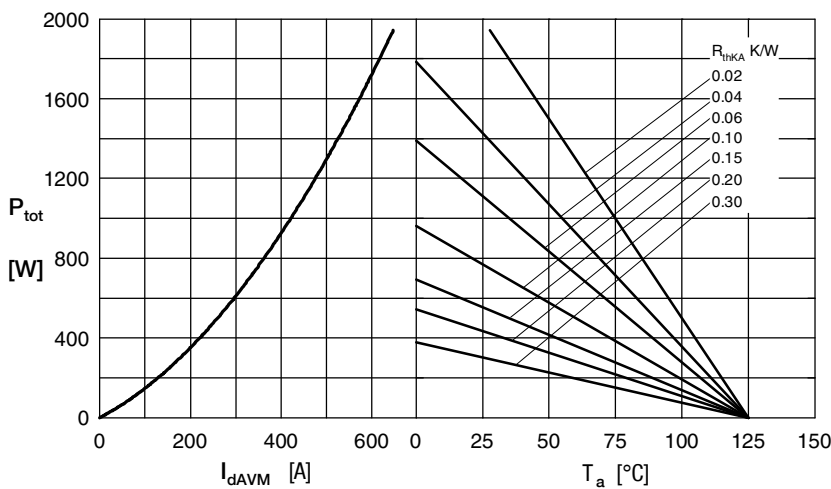


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

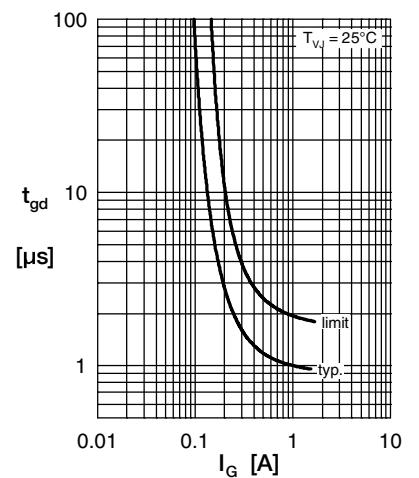


Fig. 7 Gate trigger delay time

Thyristor

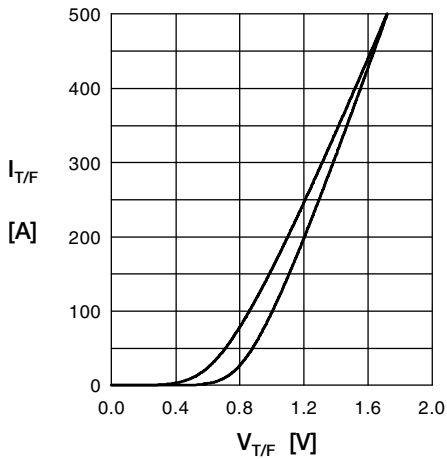
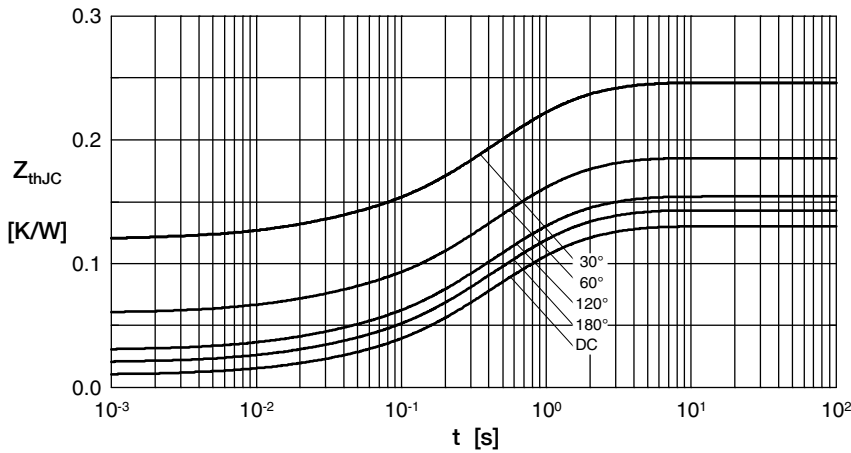


Fig. 8 Forward current versus voltage drop



Constants for Z_{thJC} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.0100	0.00014
2	0.0065	0.019
3	0.0250	0.180
4	0.0615	0.520
5	0.0270	1.600

Fig. 9 Transient thermal impedance junction to case at various conduction angles

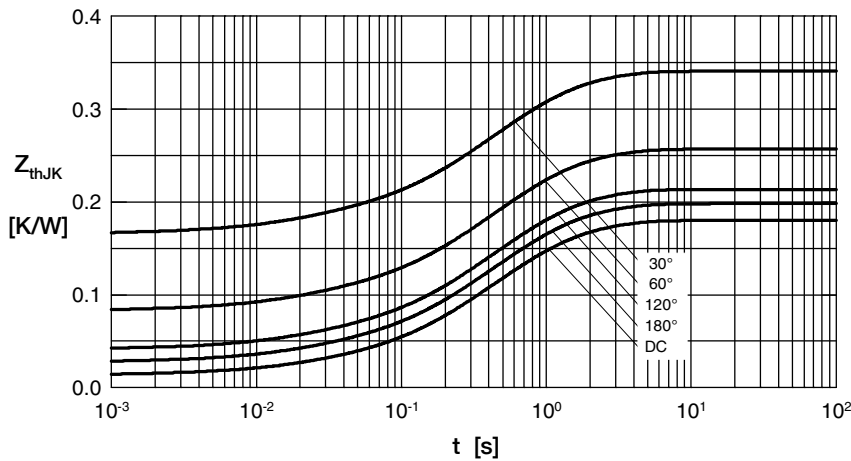


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)