

Thyristor Module

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

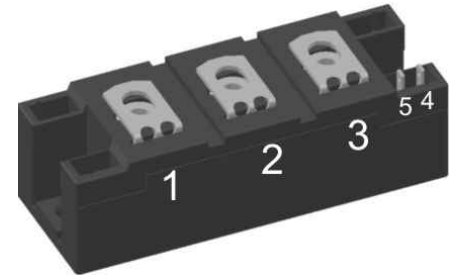
$$I_{TAV} = 181 \text{ A}$$

$$V_T = 1.03 \text{ V}$$


Phase leg

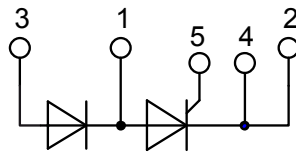
Part number

MCD162-16io1



Backside: isolated

 E72873



Features / Advantages:

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

Applications:

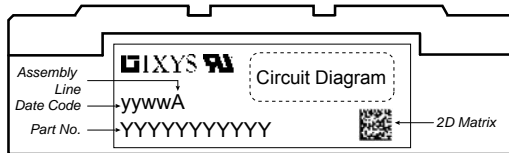
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

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

Rectifier				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	$V_{R/D} = 1600 V$	$T_{VJ} = 25^{\circ}C$		300	μA	
		$V_{R/D} = 1600 V$	$T_{VJ} = 125^{\circ}C$		10	mA	
V_T	forward voltage drop	$I_T = 150 A$	$T_{VJ} = 25^{\circ}C$		1.09	V	
					1.25	V	
		$I_T = 300 A$	$T_{VJ} = 125^{\circ}C$		1.03	V	
					1.25	V	
I_{TAV}	average forward current	$T_C = 85^{\circ}C$	$T_{VJ} = 125^{\circ}C$		181	A	
$I_{T(RMS)}$	RMS forward current	180° sine			300	A	
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}C$		0.88	V	
r_T	slope resistance				1.15	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		$T_C = 25^{\circ}C$		645	W	
I_{TSM}	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$		6.00	kA	
				$V_R = 0 V$		6.48	kA
		t = 8,3 ms; (60 Hz), sine	$T_{VJ} = 125^{\circ}C$			5.10	kA
				$V_R = 0 V$		5.51	kA
I^2t	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$		180.0	kA ² s	
				$V_R = 0 V$		174.7	kA ² s
		t = 8,3 ms; (60 Hz), sine	$T_{VJ} = 125^{\circ}C$			130.1	kA ² s
				$V_R = 0 V$		126.3	kA ² s
C_J	junction capacitance	$V_R = 400 V$ f = 1 MHz	$T_{VJ} = 25^{\circ}C$		273	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				8	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}C$; f = 50 Hz	repetitive, $I_T = 540 A$		150	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., $I_T = 180 A$		500	A/ μs
					$R_{GK} = \infty$; method 1 (linear voltage rise)		1000
V_{GT}	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		2.5	V	
			$T_{VJ} = -40^{\circ}C$		2.6	V	
I_{GT}	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		150	mA	
			$T_{VJ} = -40^{\circ}C$		200	mA	
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		0.2	V	
I_{GD}	gate non-trigger current				10	mA	
I_L	latching current	$t_p = 30 \mu s$	$T_{VJ} = 25^{\circ}C$		300	mA	
				$I_G = 0.5 A$; $di_G/dt = 0.5 A/\mu s$			
I_H	holding current	$V_D = 6 V$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		200	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	$V_R = 100 V$; $I_T = 300 A$; $V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		150	μs	
		$di/dt = 10 A/\mu s$; $dv/dt = 20 V/\mu s$; $t_p = 200 \mu s$					

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

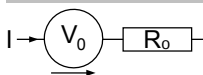


Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD162-16io1	MCD162-16io1	Box	6	429678

Equivalent Circuits for Simulation

* on die level

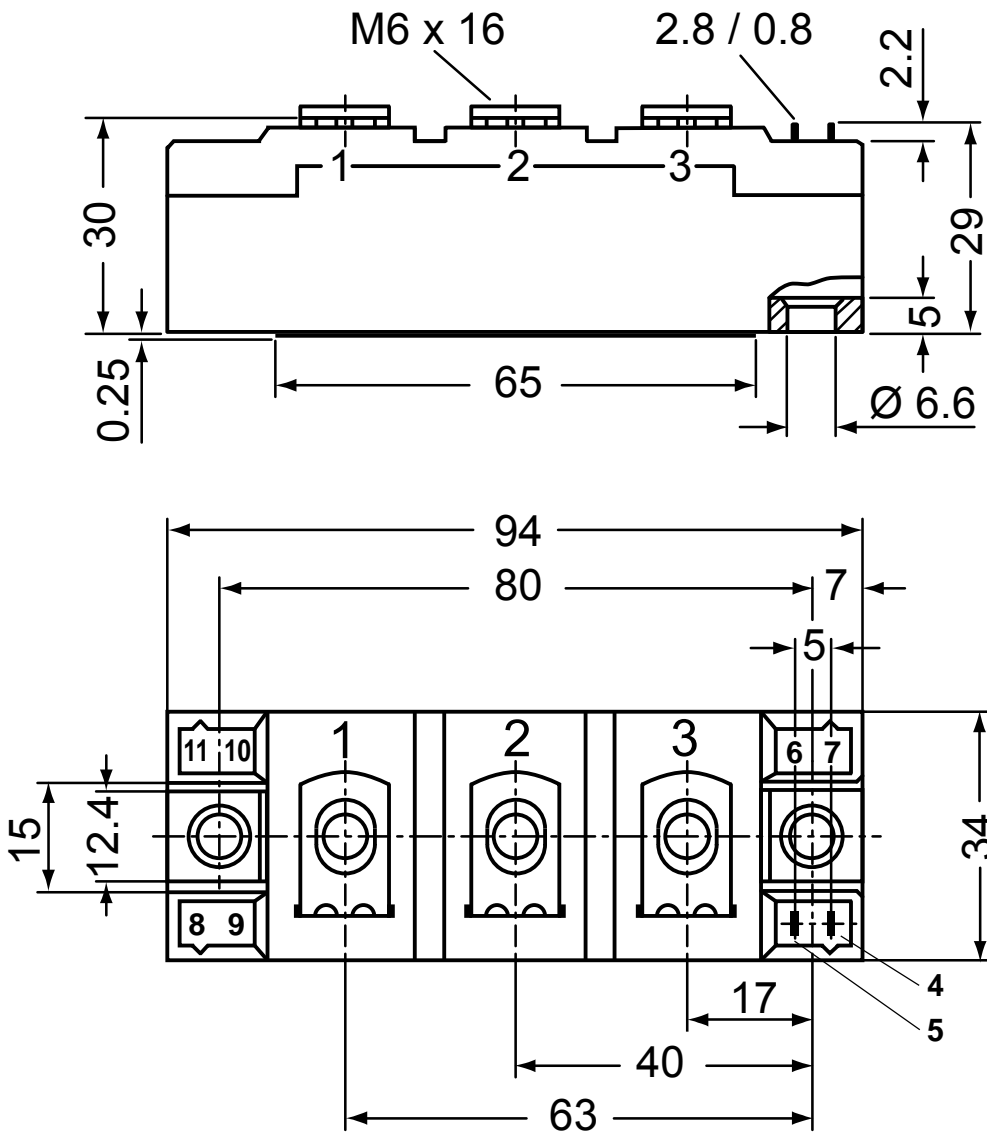
$T_{VJ} = 125^\circ\text{C}$



Thyristor

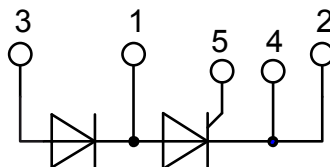
$V_{0\max}$	threshold voltage	0.88	V
$R_{0\max}$	slope resistance *	0.8	mΩ

Outlines Y4



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

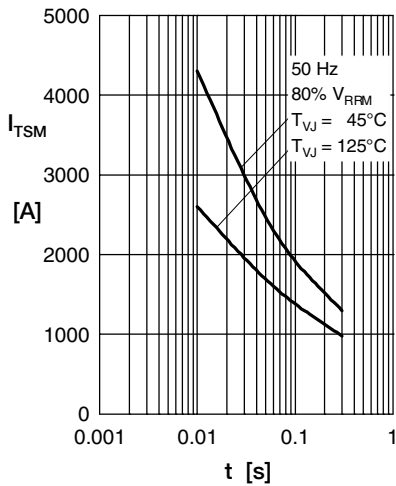


Fig. 1 Surge overload current I_{TSM} , I_{FSM} : Crest value, t : duration

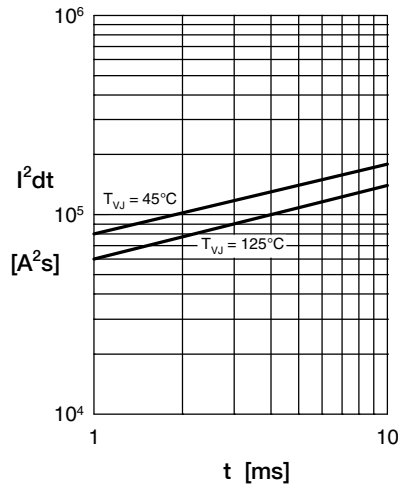


Fig. 2 I^2dt versus time (1-10 ms)

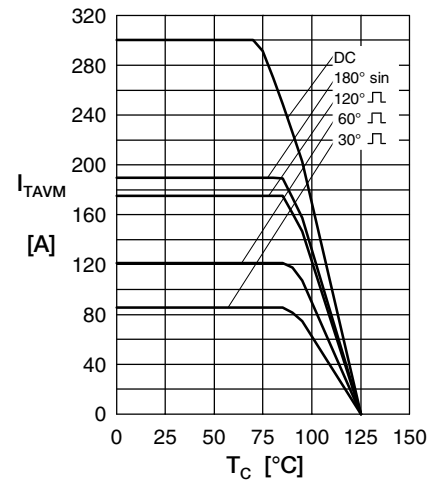


Fig. 3 Max. forward current at case temperature

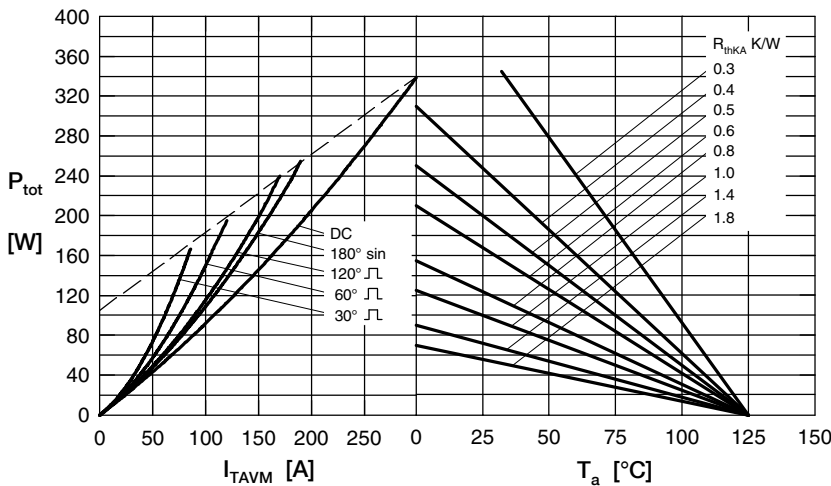


Fig. 4 Power dissipation vs. on-state current & ambient temperature (per thyristor or diode)

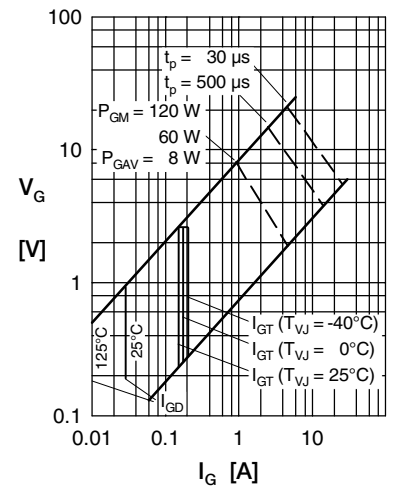


Fig. 5 Gate trigger characteristics

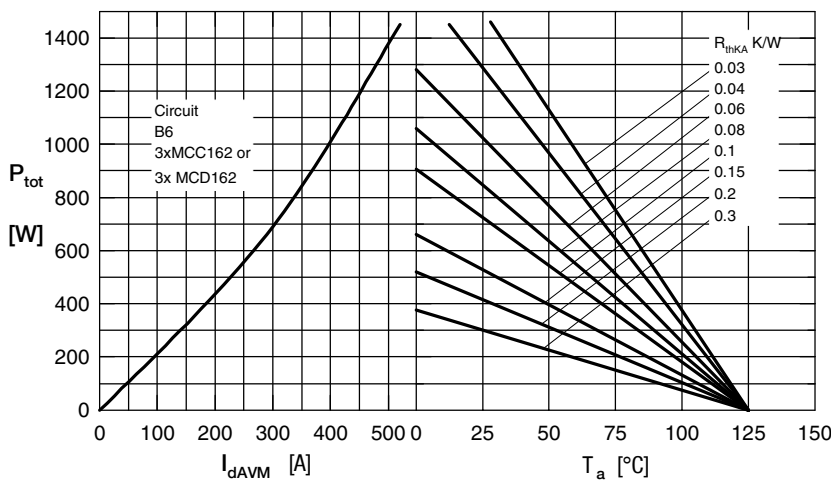


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

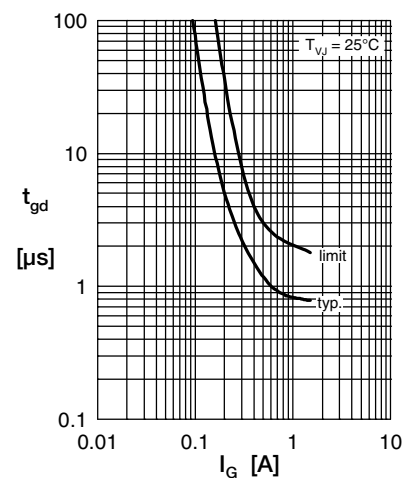


Fig. 7 Gate trigger delay time

Rectifier

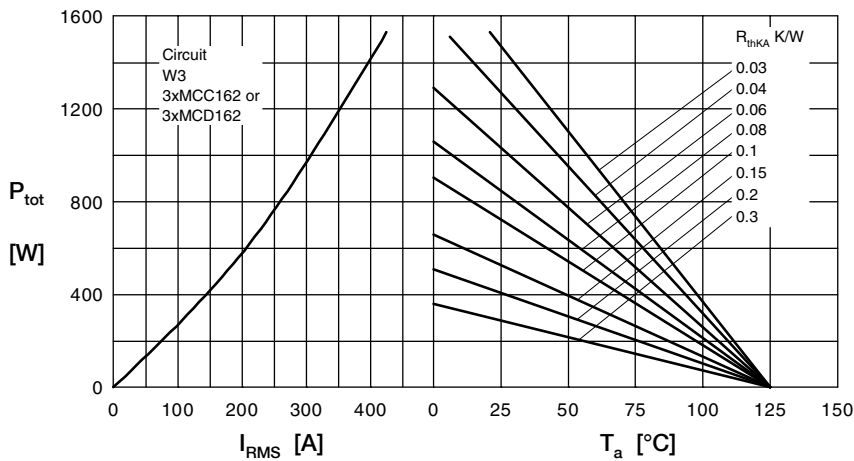


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

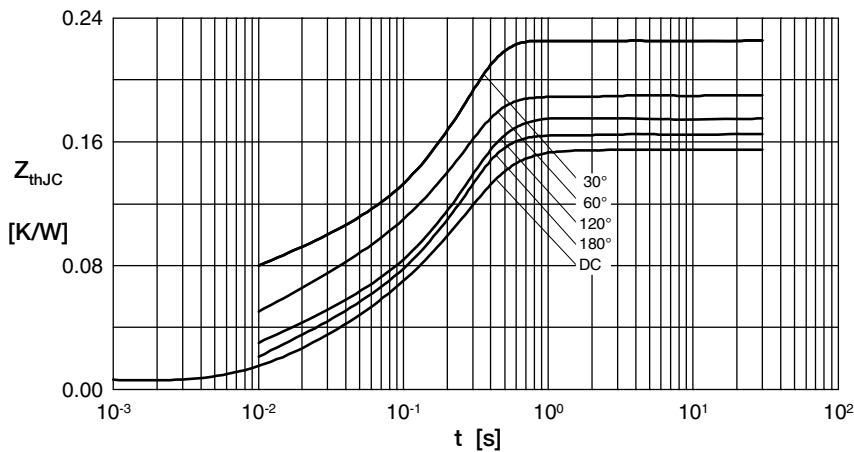


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

R_{thJC} for various conduction angles d:

d	R_{thJC} [K/W]
DC	0.155
180°	0.167
120°	0.176
60°	0.197
30°	0.227

Constants for Z_{thJC} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.0072	0.001
2	0.0188	0.080
3	0.1290	0.200

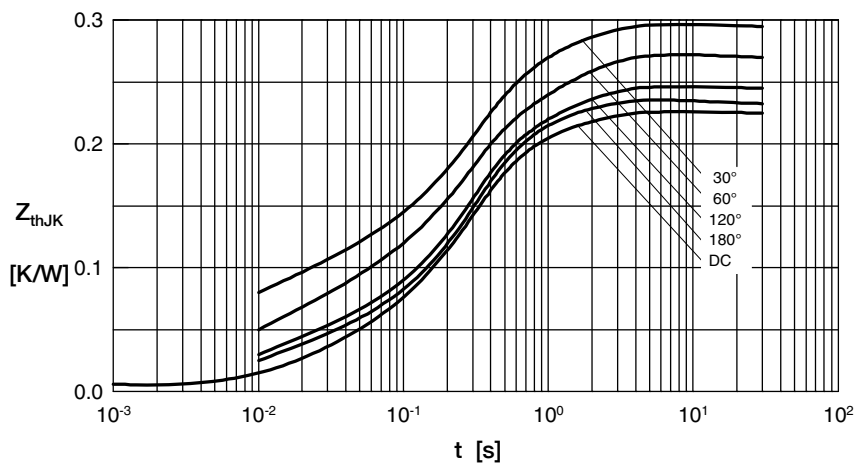


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

R_{thJK} for various conduction angles d:

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

Constants for Z_{thJK} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.0072	0.001
2	0.0188	0.080
3	0.1290	0.200
4	0.0700	1.000