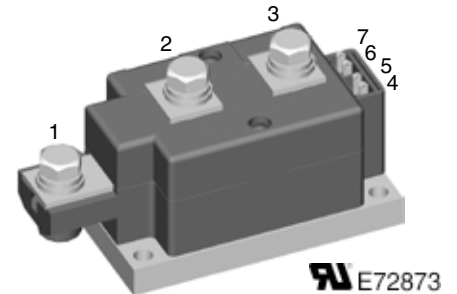
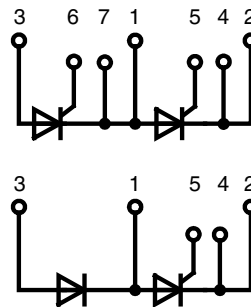


# Thyristor Modules

## Thyristor/Diode Modules

 $I_{TRMS} = 2x 400 A$   
 $I_{TAVM} = 2x 240 A$   
 $V_{RRM} = 2000/2200 V$ 

$V_{RSM}$	$V_{RRM}$	Type
$V_{DSM}$	$V_{DRM}$	
V	V	
2100	2000	MCC 224-20io1 MCD 224-20io1
2300	2200	MCC 224-22io1 MCD 224-22io1



Symbol	Conditions	Maximum Ratings
$I_{TRMS}$	$T_{VJ} = T_{VJM}$	400 A
$I_{TAVM}$	$T_C = 85^\circ C$ ; 180° sine	240 A
$I_{TSM}$	$T_{VJ} = 45^\circ C$ ; $t = 10$ ms (50 Hz)	8000 A
	$V_R = 0$ ; $t = 8.3$ ms (60 Hz)	8500 A
	$T_{VJ} = T_{VJM}$ ; $t = 10$ ms (50 Hz)	7000 A
	$V_R = 0$ ; $t = 8.3$ ms (60 Hz)	7500 A
$I^2t$	$T_{VJ} = 45^\circ C$ ; $t = 10$ ms (50 Hz)	320 000 A <sup>2</sup> s
	$V_R = 0$ ; $t = 8.3$ ms (60 Hz)	303 000 A <sup>2</sup> s
	$T_{VJ} = T_{VJM}$ ; $t = 10$ ms (50 Hz)	245 000 A <sup>2</sup> s
	$V_R = 0$ ; $t = 8.3$ ms (60 Hz)	240 000 A <sup>2</sup> s
$(di/dt)_{cr}$	$T_{VJ} = T_{VJM}$ ; repetitive, $I_T = 750$ A	100 A/ $\mu$ s
	$f = 50$ Hz; $t_p = 200$ $\mu$ s; $V_D = \frac{2}{3} V_{DRM}$ ; $I_G = 1$ A; $di_G/dt = 1$ A/ $\mu$ s	500 A/ $\mu$ s
$(dv/dt)_{cr}$	$T_{VJ} = T_{VJM}$ ; $V_D = \frac{2}{3} V_{DRM}$ ; $R_{GK} = \infty$ ; method 1 (linear voltage rise)	1000 V/ $\mu$ s
$P_{GM}$	$T_{VJ} = T_{VJM}$ ; $t_p = 30$ $\mu$ s	120 W
	$I_T = I_{T(AV)M}$ ; $t_p = 500$ $\mu$ s	60 W
$P_{GAV}$		20 W
$V_{RGM}$		10 V
$T_{VJ}$		-40...+130 °C
$T_{VJM}$		130 °C
$T_{stg}$		-40...+125 °C
$V_{ISOL}$	50/60 Hz, RMS $t = 1$ min	3000 V~
	$I_{ISOL} \leq 1$ mA $t = 1$ s	3600 V~
$M_d$	Mounting torque (M6)	4.5 - 7 Nm
	Terminal connection torque (M6)	11 - 13 Nm
<b>Weight</b>	Typical including screws	750 g

### Features

- International standard package
- **Direct Copper Bonded** Al<sub>2</sub>O<sub>3</sub>-ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

### Applications

- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

### Advantages

- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 and refer to a single diode unless otherwise stated.

Symbol	Conditions	Characteristic Values	
		typ.	max.
$I_{RRM}, I_{DRM}$	$V_R / V_D = V_{RRM} / V_{DRM}$	$T_{VJ} = T_{VJM}$	40 mA
$V_T$	$I_T = 600$ A	$T_{VJ} = 25^\circ\text{C}$	1.4 V
$V_{T0}$	For power-loss calculations only		0.8 V
$r_t$		$T_{VJ} = T_{VJM}$	0.76 mΩ
$V_{GT}$	$V_D = 6$ V	$T_{VJ} = 25^\circ\text{C}$	2 V
		$T_{VJ} = -40^\circ\text{C}$	3 V
$I_{GT}$	$V_D = 6$ V	$T_{VJ} = 25^\circ\text{C}$	150 mA
		$T_{VJ} = -40^\circ\text{C}$	220 mA
$V_{GD}$	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = T_{VJM}$	0.25 V
$I_{GD}$			10 mA
$I_L$	$t_p = 30 \mu\text{s}; V_D = 6$ V $I_G = 0.45$ A; $di_G/dt = 0.45$ A/ $\mu\text{s}$	$T_{VJ} = 25^\circ\text{C}$	200 mA
$I_H$	$V_D = 6$ V; $R_{GK} = \infty$ ;	$T_{VJ} = 25^\circ\text{C}$	150 mA
$t_{gd}$	$V_D = \frac{1}{2} V_{DRM}$ $I_G = 1$ A; $di_G/dt = 1$ A/ $\mu\text{s}$	$T_{VJ} = 25^\circ\text{C}$	2 $\mu\text{s}$
$t_q$	$V_D = \frac{2}{3} V_{DRM}$ $dv/dt = 50$ V/ $\mu\text{s}$ ; $-di/dt = 10$ A/ $\mu\text{s}$ $I_T = 300$ A; $V_R = 100$ V; $t_p = 200 \mu\text{s}$	$T_{VJ} = T_{VJM}$	200 $\mu\text{s}$
$Q_S$	$I_T = 300$ A; $-di/dt = 50$ A/ $\mu\text{s}$	$T_{VJ} = T_{VJM}$	760 $\mu\text{C}$
$I_{RM}$			275 A
$R_{thJC}$	per thyristor; DC current per module		0.139 K/W 0.069 K/W
$R_{thJK}$	per thyristor; DC current per module		0.179 K/W 0.089 K/W
$d_s$	Creeping distance on surface		12.7 mm
$d_A$	Creepage distance in air		9.6 mm
$a$	Maximum allowable acceleration		50 m/s <sup>2</sup>

Optional accessories for modules

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

Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,  
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

Dimensions in mm (1 mm = 0.0394")

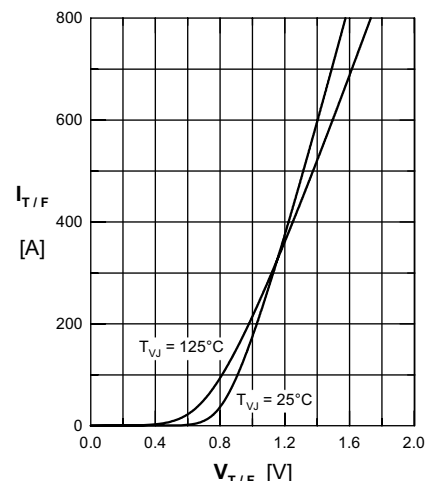
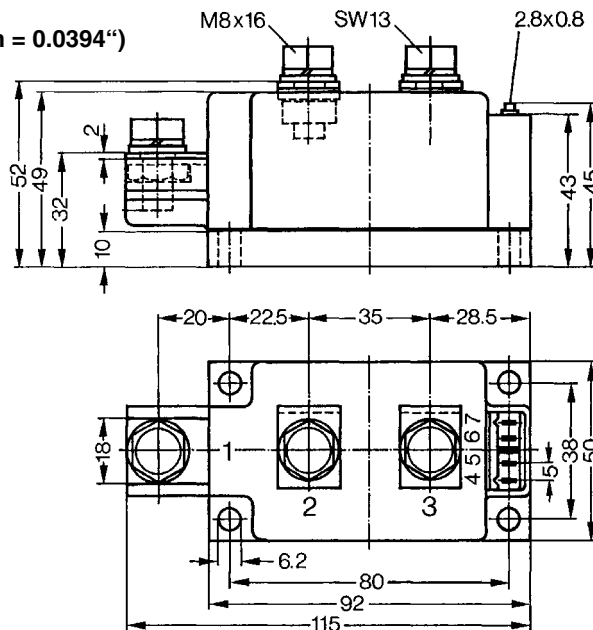


Fig. 1 Forward characteristics

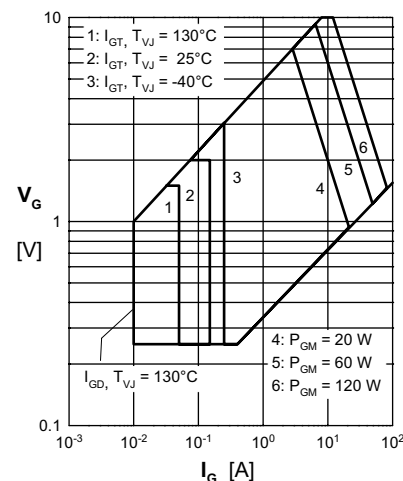


Fig. 2 Gate trigger characteristics

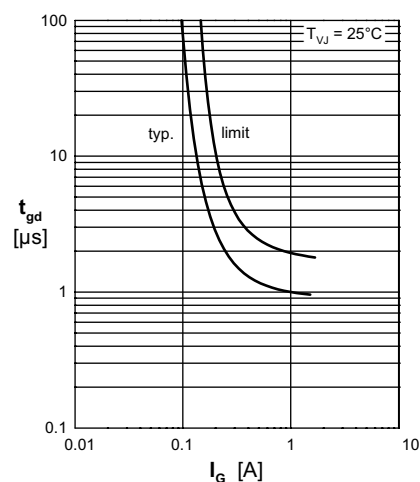


Fig. 3 Gate trigger delay time

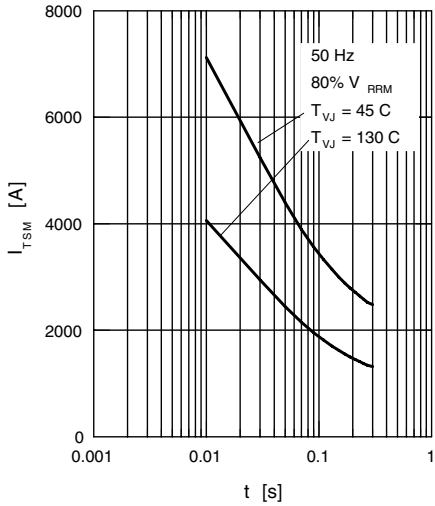


Fig. 4 Surge overload current  
I<sub>TSM</sub>: Crest value, t: duration

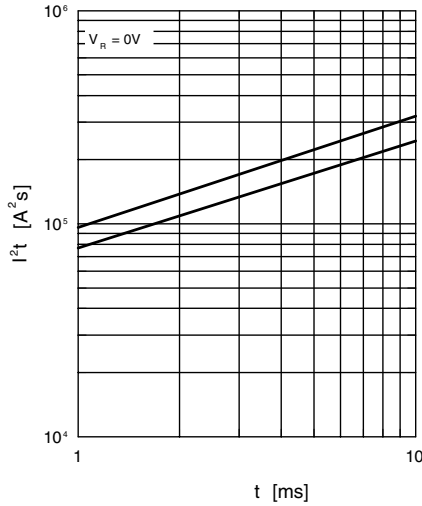


Fig. 5 i<sup>2</sup>t versus time (1-10 ms)

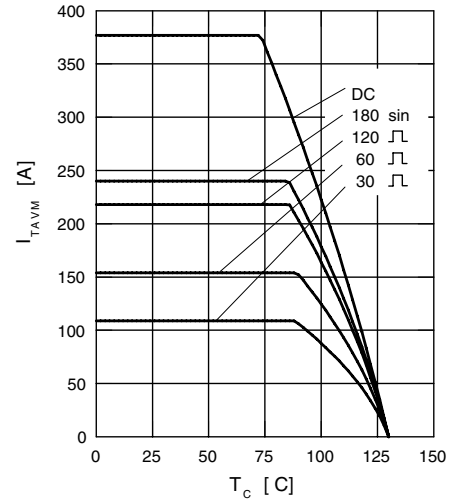


Fig. 5a Maximum forward current at case temperature

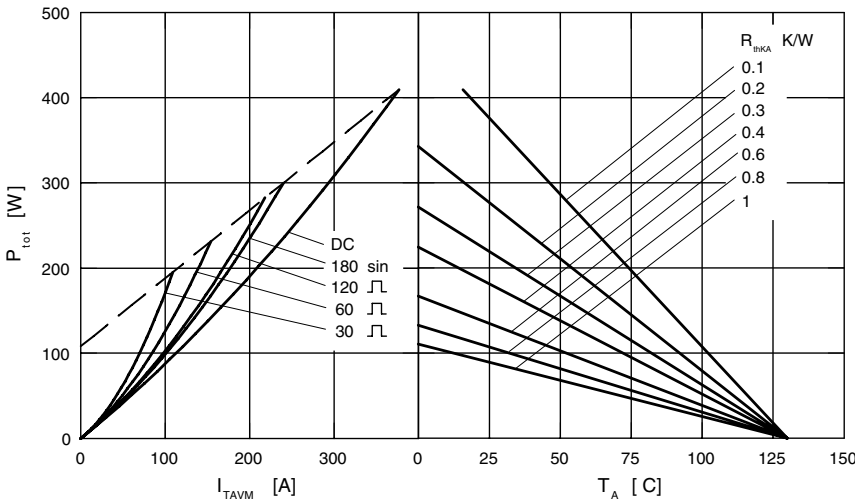


Fig. 6 Power dissipation vs. on-state current and ambient temperature

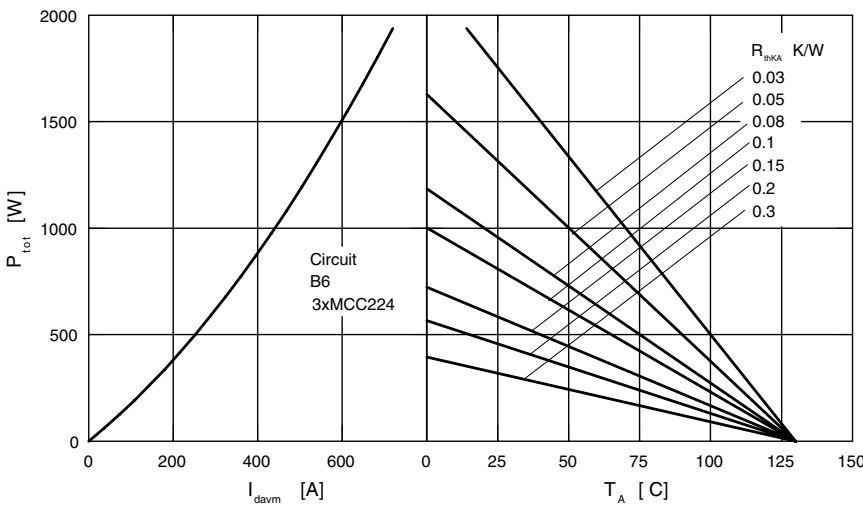


Fig. 7 Three phase rectifier bridge:  
Power dissipation vs. direct output current and ambient temperature

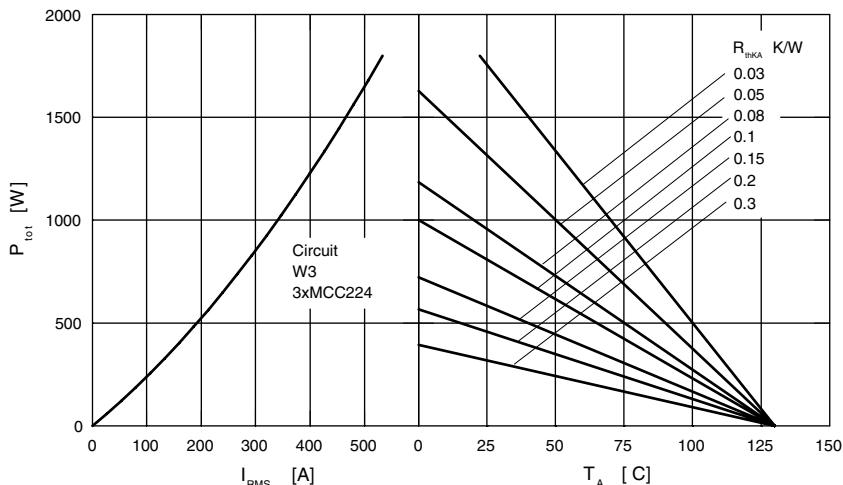


Fig. 8 3~ AC-controller: Power dissipation vs. RMS output current & ambient temperature

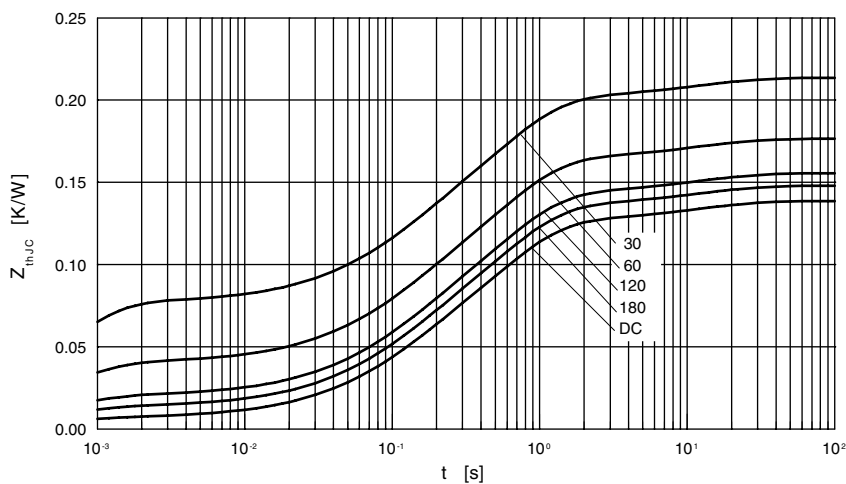


Fig. 9 Transient thermal impedance junction to case

$R_{thJC}$  for various conduction angles d:

d	$R_{thJC}$ (K/W)
DC	0.139
180°	0.148
120°	0.156
60°	0.176
30°	0.214

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0067	0.00054
2	0.0358	0.098
3	0.0832	0.54
4	0.0129	12

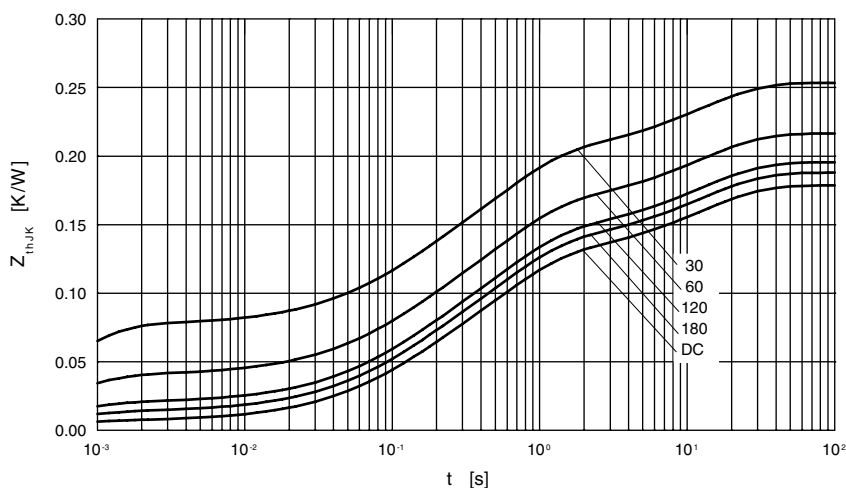


Fig. 10 Transient thermal impedance junction to heatsink

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

d	$R_{thJK}$ (K/W)
DC	0.179
180°	0.188
120°	0.196
60°	0.216
30°	0.256

Constants for  $Z_{thJK}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0067	0.001
2	0.0358	0.08
3	0.0832	0.20
4	0.0129	1.0
5	0.04	