

# Thyristor Modules

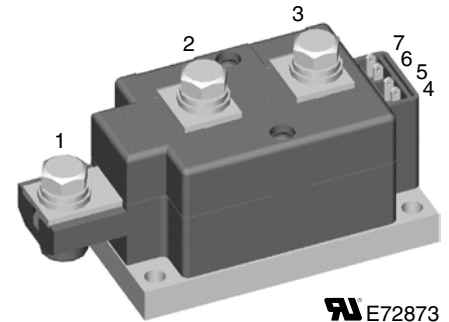
## Thyristor/Diode Modules

$$I_{TRMS} = 2x\ 400\ A$$

$$I_{TAVM} = 2x\ 221\ A$$

$$V_{RRM} = 1200-1800\ V$$

$V_{RSM}$ $V_{DSM}$ V	$V_{RRM}$ $V_{DRM}$ V	Type	
1300	1200	MCC 225-12io1	MCD 225-12io1
1500	1400	MCC 225-14io1	MCD 225-14io1
1700	1600	MCC 225-16io1	MCD 225-16io1
1900	1800	MCC 225-18io1	MCD 225-18io1



Symbol	Conditions	Maximum Ratings		
$I_{TRMS}, I_{FRMS}$ $I_{TAVM}, I_{FAVM}$	$T_{VJ} = T_{VJM}$ $T_C = 85^\circ C; 180^\circ$ sine	400 221	A A	
$I_{TSM}, I_{FSM}$	$T_{VJ} = 45^\circ C; V_R = 0$ $t = 10\ ms\ (50\ Hz)$ $t = 8.3\ ms\ (60\ Hz)$	8000 8500	A A	
$I^2t$	$T_{VJ} = 45^\circ C; V_R = 0$ $t = 10\ ms\ (50\ Hz)$ $t = 8.3\ ms\ (60\ Hz)$	320 000 300 000	$A^2s$ $A^2s$	
	$T_{VJ} = T_{VJM}; V_R = 0$ $t = 10\ ms\ (50\ Hz)$ $t = 8.3\ ms\ (60\ Hz)$	245 000 246 000	$A^2s$ $A^2s$	
$(di/dt)_{cr}$	$T_{VJ} = T_{VJM}; f = 50\ Hz; t_p = 200\ \mu s;$ $V_D = \frac{2}{3} V_{DRM}; I_G = 1\ A;$ $di_G/dt = 1\ A/\mu s$	repetitive, $I_T = 750\ A$  non repetitive, $I_T = I_{TAVM}$	100 500	$A/\mu s$ $A/\mu s$
$(dv/dt)_{cr}$	$T_{VJ} = T_{VJM}; V_D = \frac{2}{3} V_{DRM}; R_{GK} = \infty;$ method 1 (linear voltage rise)		1000	$V/\mu s$
$P_{GM}$	$T_{VJ} = T_{VJM}; t_p = 30\ \mu s$ $I_T = I_{T(AV)M}; t_p = 500\ \mu s$	120 60	W W	
$P_{GAV}$		20	W	
$V_{RGM}$		10	V	
$T_{VJ}$		-40...+130	$^\circ C$	
$T_{VJM}$		130	$^\circ C$	
$T_{stg}$		-40...+125	$^\circ C$	
$V_{ISOL}$	50/60 Hz, RMS $I_{ISOL} \leq 1\ mA$	$t = 1\ min$ $t = 1\ s$	3000 3600	$V\sim$ $V\sim$
$M_d$	Mounting torque (M6) Terminal connection torque (M8)	4.5 - 7 11 - 13	Nm Nm	
<b>Weight</b>	Typical including screws	750	g	

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



### Features

- International standard package
- **D**irect **C**opper **B**onded  $Al_2O_3$ -ceramic with copper 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

Symbol	Conditions	Characteristic Values	
		typ.	max.
$I_{RRM}, I_{DRM}$	$V_R / V_D = V_{RRM} / V_{DRM}$	$T_{VJ} = T_{VJM}$	40 mA
$V_T, V_F$	$I_T, I_F = 600$ 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		0.157 K/W 0.079 K/W
$R_{thJK}$	per thyristor; DC current per module		0.197 K/W 0.099 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>

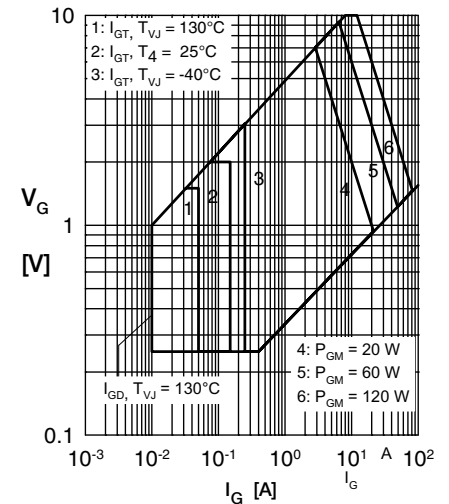


Fig. 1 Forward characteristics

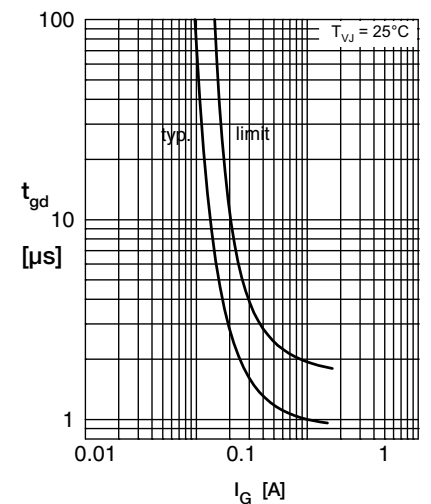


Fig. 2 Gate trigger characteristics

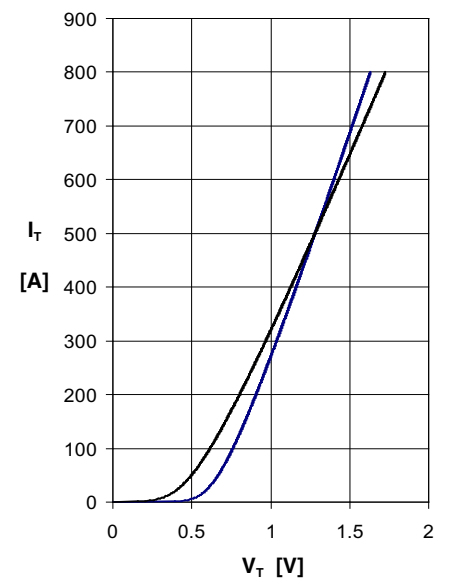
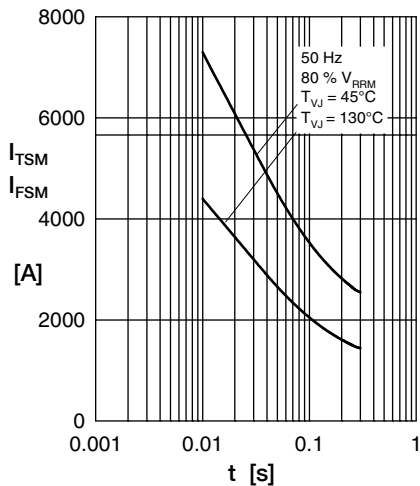
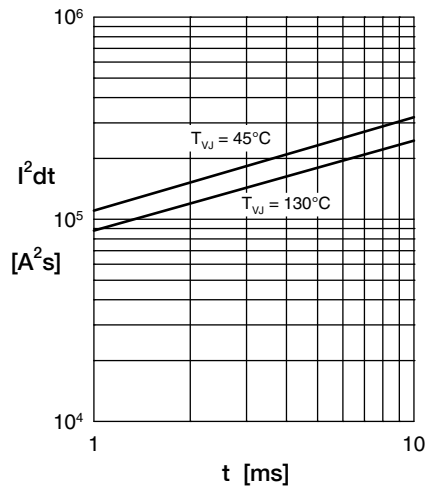


Fig. 2a Forward voltage drop

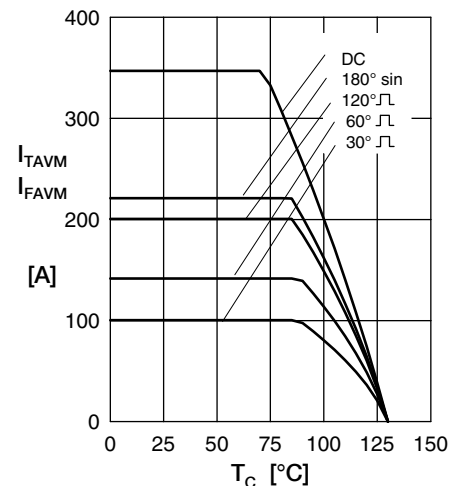




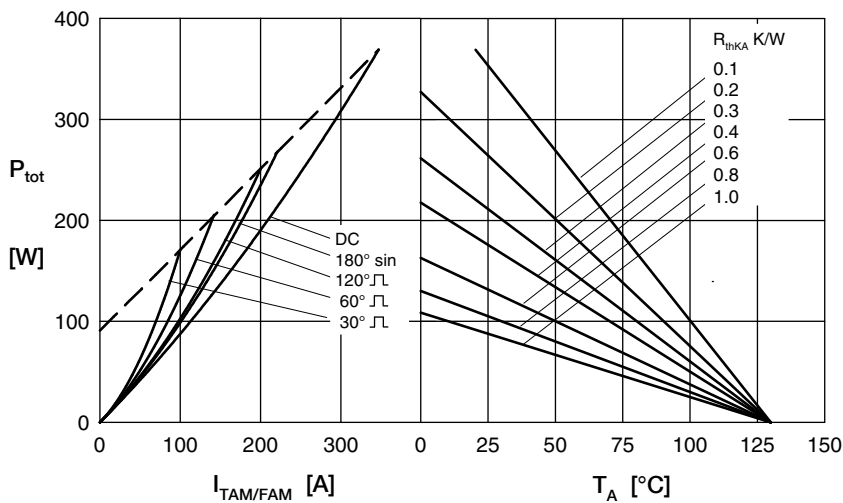
**Fig. 3 Surge overload current**  
 $I_{TSM/FSM}$ : Crest value, t: duration



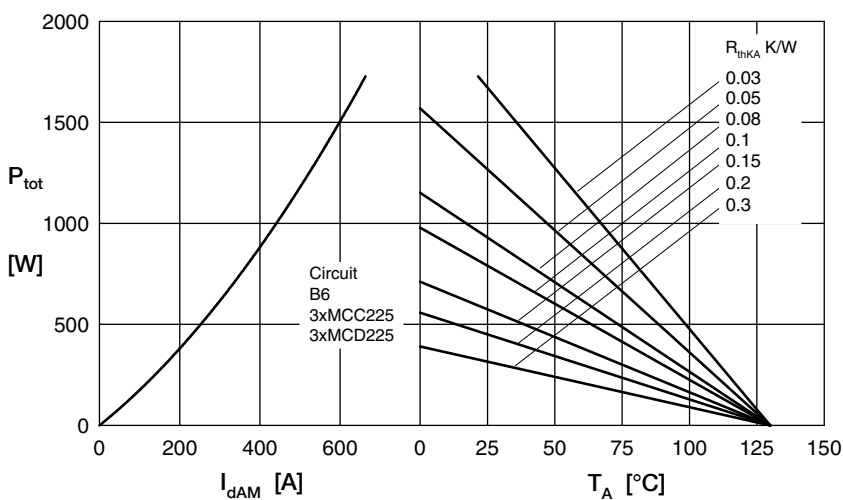
**Fig. 4  $I^2dt$  versus time**



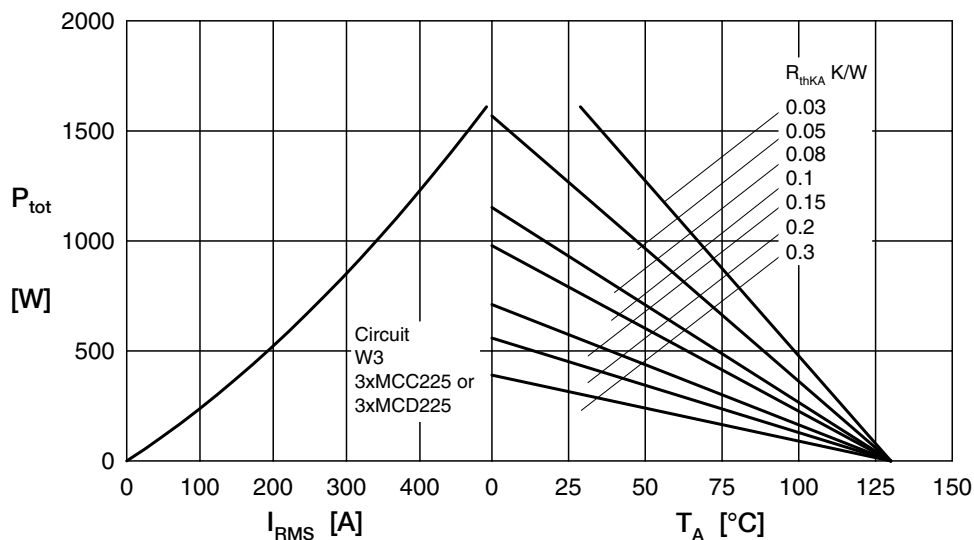
**Fig. 4a Max. forward current at case temperature**



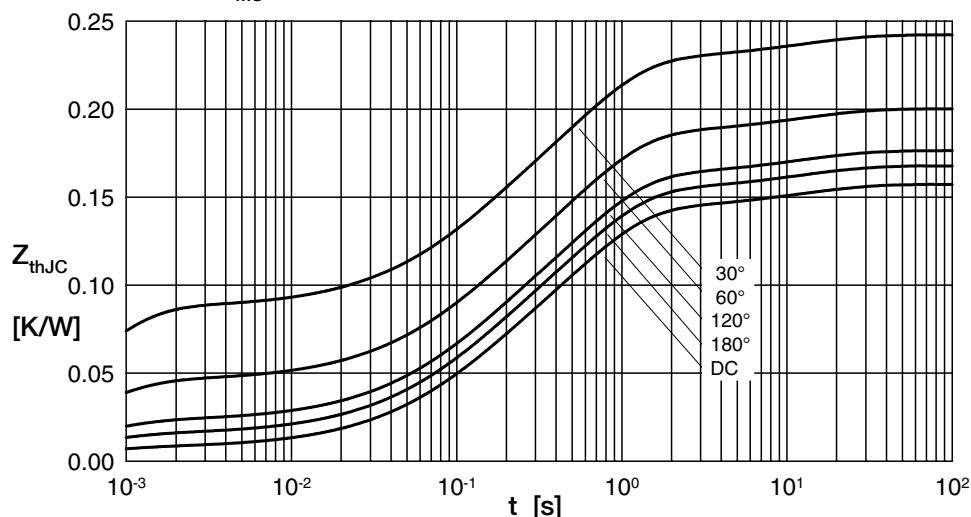
**Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)**



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



**Fig. 7 Three phase AC-controller: Power dissipation versus  $R_{MS}$  output current and ambient temperature**



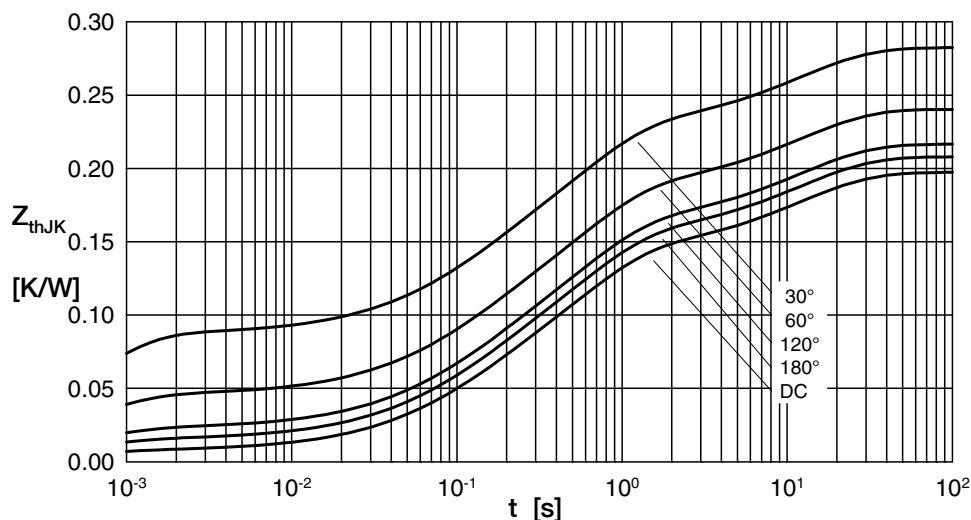
**Fig. 8 Transient thermal impedance junction to case (per thyristor/diode)**

$R_{thJC}$  for various conduct. angles d:

d	$R_{thJC}$ (K/W)
DC	0.157
180°	0.168
120°	0.177
60°	0.200
30°	0.243

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0076	0.00054
2	0.0406	0.098
3	0.0944	0.54
4	0.0147	12



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

$R_{thJK}$  for various conduct. angles d:

d	$R_{thJK}$ (K/W)
DC	0.197
180°	0.208
120°	0.217
60°	0.240
30°	0.283

Constants for  $Z_{thJK}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.0076	0.00054
2	0.0406	0.098
3	0.0944	0.54
4	0.0147	12
5	0.04	12