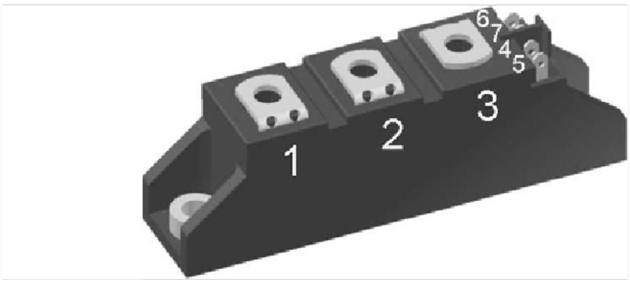
Thyristor Module

V_{RRM} = 2x 1600 V
I_{TAV} = 49 A
V_{T} = 1.34 V

Phase leg

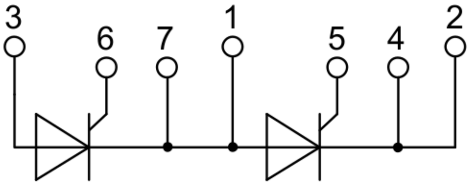
Part number

MCC44-16io1B



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: TO-240AA
- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

Data according to IEC 60747and per semiconductor unless otherwise specified

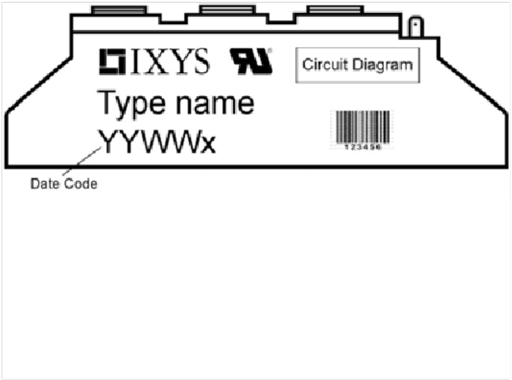
Thyristor

Symbol	Definition	Conditions		min.	typ.	max.	Unit
				Ratings			
$V_{RSM/DSM}$	*max. non-repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			1700	V
$V_{RRM/DRM}$	*max. repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			1600	V
$I_{R/D}$	*reverse current, drain current*	$V_{R/D}$ = 1600 V	T_{VJ} = 25°C			100	µA
		$V_{R/D}$ = 1600 V	T_{VJ} = 125°C			5	mA
V_T	*forward voltage drop*	I_T = 100 A	T_{VJ} = 25°C			1.34	V
		I_T = 200 A				1.75	V
		I_T = 100 A	T_{VJ} = 125°C			1.34	V
		I_T = 200 A				1.80	V
I_{TAV}	*average forward current*	T_C = 85°C	T_{VJ} = 125°C			49	A
$I_{T(RMS)}$	*RMS forward current*	180° sine				77	A
V_{T0}	*threshold voltage*	*for power loss calculation only*	T_{VJ} = 125°C			0.85	V
r_T	*slope resistance*					5.3	mΩ
R_{thJC}	*thermal resistance junction to case*					0.53	K/W
R_{thCH}	*thermal resistance case to heatsink*				0.20		K/W
P_{tot}	*total power dissipation*		T_C = 25°C			180	W
I_{TSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			1.15	kA
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			1.24	kA
		t = 10 ms; (50 Hz), sine	T_{VJ} = 125°C			980	A
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			1.06	kA
I^2t	*value for fusing*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			6.62	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			6.40	kA²s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 125°C			4.80	kA²s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			4.63	kA²s
C_J	*junction capacitance*	V_R = 400 V f = 1 MHz	T_{VJ} = 25°C		54		pF
P_{GM}	*max. gate power dissipation*	t_P = 30 µs	T_C = 125°C			10	W
		t_P = 300 µs				5	W
P_{GAV}	*average gate power dissipation*					0.5	W
$(di/dt)_{cr}$	*critical rate of rise of current*	T_{VJ} = 125°C; f = 50 Hz	repetitive, I_T = 150 A			150	A/µs
		t_P = 200 µs; di_G/dt = 0.45 A/µs;					
		I_G = 0.45A; V_D = ⅔ V_{DRM}	non-repet., I_T = 49 A			500	A/µs
$(dv/dt)_{cr}$	*critical rate of rise of voltage*	V_D = ⅔ V_{DRM}	T_{VJ} = 125°C			1000	V/µs
		R_{GK} = ∞; method 1 (linear voltage rise)					
V_{GT}	*gate trigger voltage*	V_D = 6 V	T_{VJ} = 25°C			1.5	V
			T_{VJ} = -40°C			1.6	V
I_{GT}	*gate trigger current*	V_D = 6 V	T_{VJ} = 25°C			100	mA
			T_{VJ} = -40°C			200	mA
V_{GD}	*gate non-trigger voltage*	V_D = ⅔ V_{DRM}	T_{VJ} = 125°C			0.2	V
I_{GD}	*gate non-trigger current*					10	mA
I_L	*latching current*	t_p = 10 µs	T_{VJ} = 25°C			450	mA
		I_G = 0.45A; di_G/dt = 0.45 A/µs					
I_H	*holding current*	V_D = 6 V R_{GK} = ∞	T_{VJ} = 25°C			200	mA
t_{gd}	*gate controlled delay time*	V_D = ½ V_{DRM}	T_{VJ} = 25°C			2	µs
		I_G = 0.45A; di_G/dt = 0.45 A/µs					
t_q	*turn-off time*	V_R = 100 V; I_T = 120 A; V_D = ⅔ V_{DRM}	T_{VJ} = 125°C		150		µs
		di/dt = 10 A/µs; dv/dt = 20 V/µs; t_p = 200 µs					

Data according to IEC 60747and per semiconductor unless otherwise specified

Package TO-240AA

Symbol	Definition	Conditions		min.	typ.	max.	Unit
				Ratings			
I_{RMS}	*RMS current*	per terminal				200	A
T_{VJ}	*virtual junction temperature*			-40		125	°C
T_{op}	*operation temperature*			-40		100	°C
T_{stg}	*storage temperature*			-40		125	°C
Weight					90		g
M_D	*mounting torque*			2.5		4	Nm
M_T	*terminal torque*			2.5		4	Nm
$d_{Spp/App}$	*creepage distance on surface | striking distance through air*	*terminal to terminal*	13.0	9.7			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} ≤ 1 mA		3600			V
		t = 1 minute		3000			V

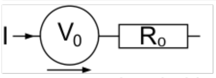


Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC44-16io1B	MCC44-16io1B	Box	6	452920

Similar Part	Package	Voltage class
MCMA50P1600TA	TO-240AA-1B	1600
MCMA65P1600TA	TO-240AA-1B	1600

Equivalent Circuits for Simulation

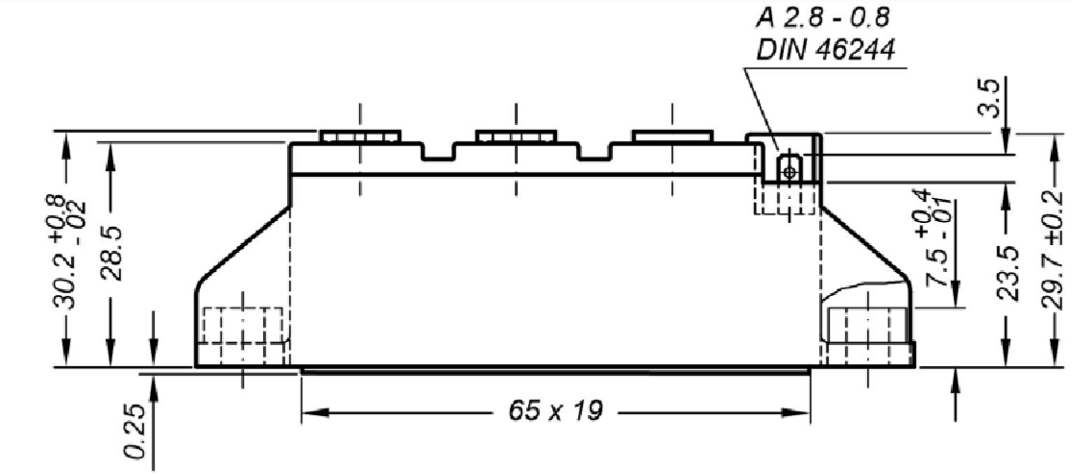
** on die level* T_{VJ} = 125 °C



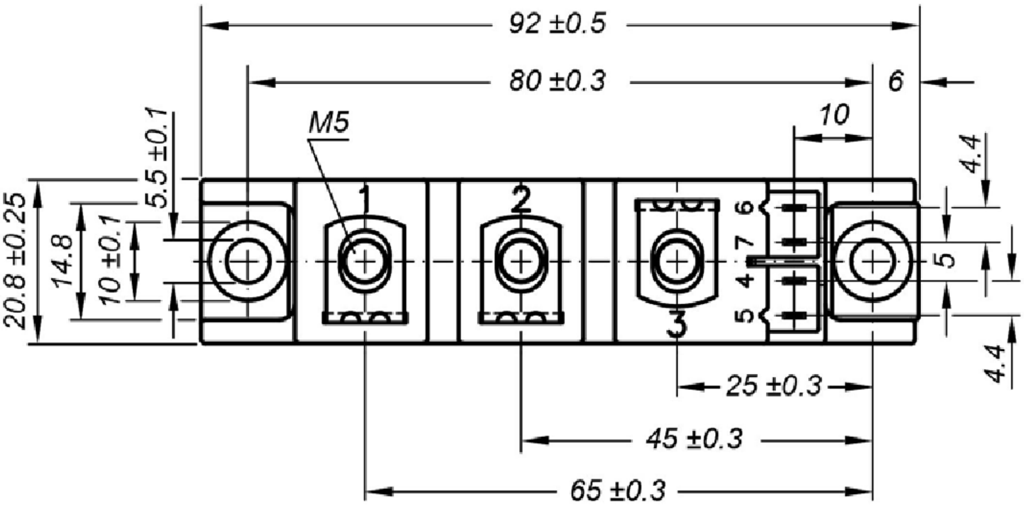
		Thyristor	
$V_{0\,max}$	*threshold voltage*	0.85	V
$R_{0\,max}$	*slope resistance **	4.1	mΩ

Data according to IEC 60747and per semiconductor unless otherwise specified

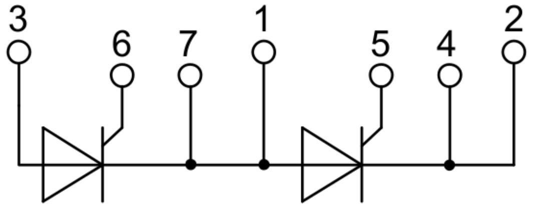
Outlines TO-240AA



General tolerance: DIN ISO 2768 class „c“



Optional accessories: Keyed gate/cathode twin plugs
Wire length: 350 mm, gate = white, cathode = red
UL 758, style 3751
*Type **ZY 200L** (L = Left for pin pair 4/5)*
*Type **ZY 200R** (R = Right for pin pair 6/7)*



Thyristor

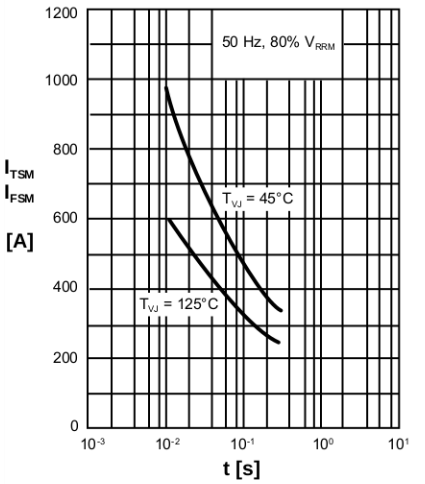


Fig. 1 Surge overload current
I_{TSM}, I_{FSM}: Crest value, t: duration

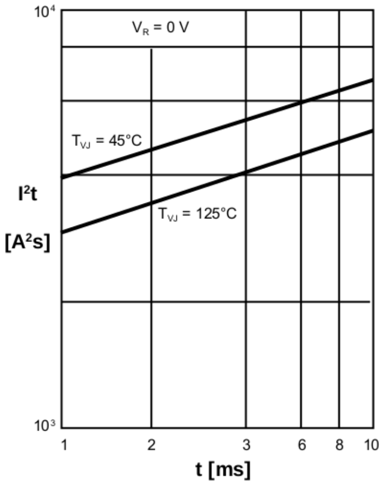


Fig. 2 I^2t versus time (1-10 ms)

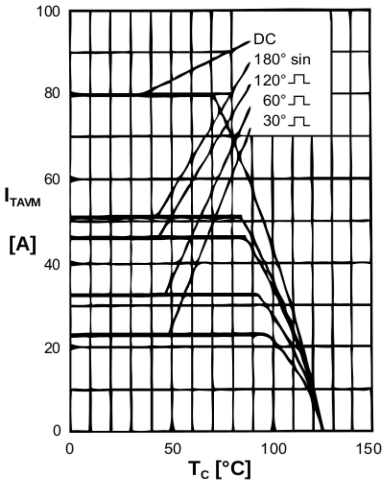


Fig. 3 Maximum forward current at case temperature

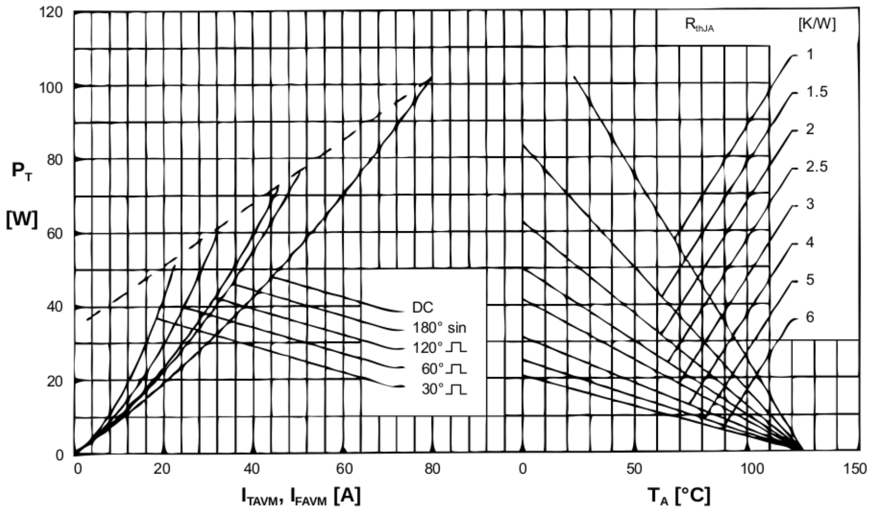


Fig. 4 Power dissipation vs. onstate current and ambient temperature (per thyristor/diode)

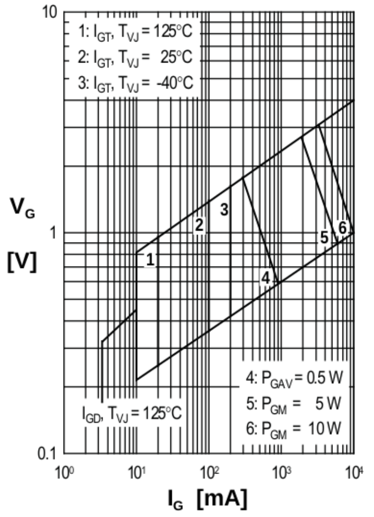


Fig. 5 Gate trigger characteristics

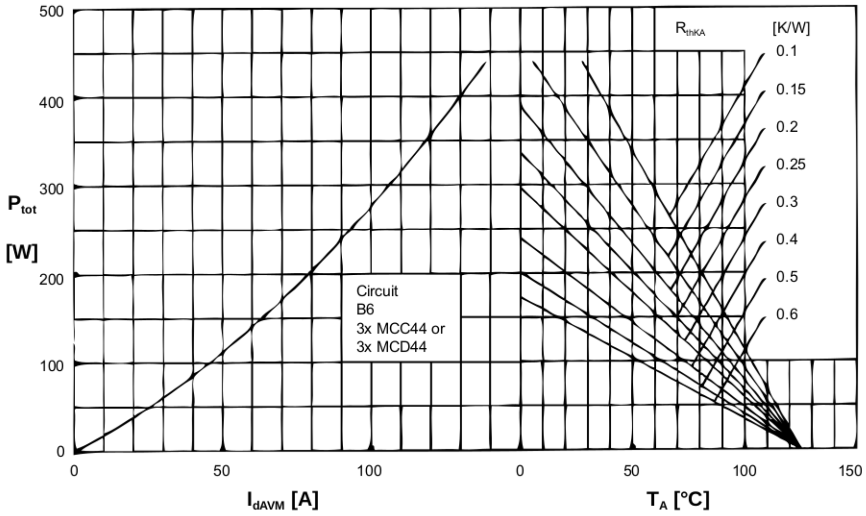


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

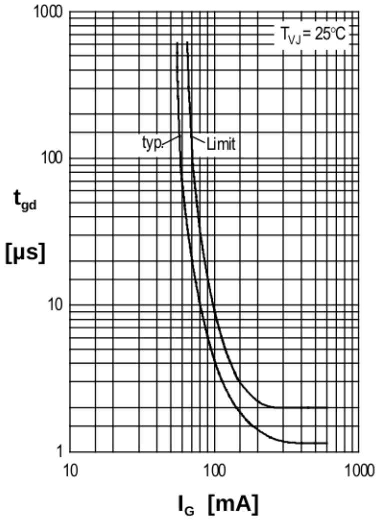


Fig. 7 Gate trigger delay time

Thyristor

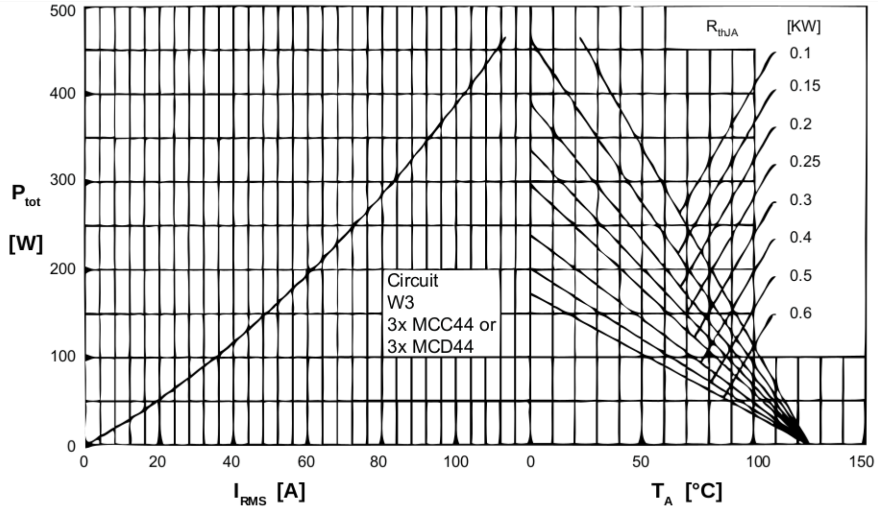


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

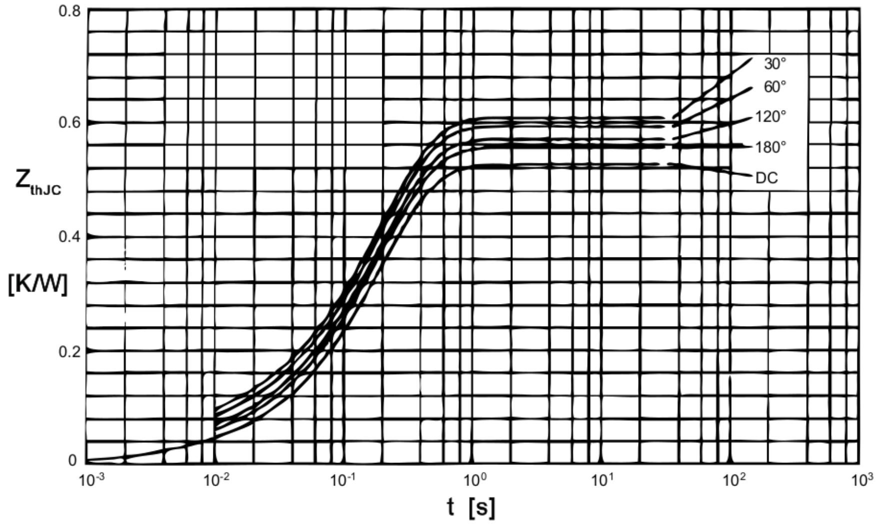


Fig. 9 Transient thermal impedance junction to case (per thyristor)

R_{thJC} for various conduction angles d:

d	R_{thJC} [K/W]
DC	0.53
180°	0.55
120°	0.58
60°	0.60
30°	0.62

Constants for Z_{thJC} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.015	0.0035
2	0.026	0.0200
3	0.489	0.1950

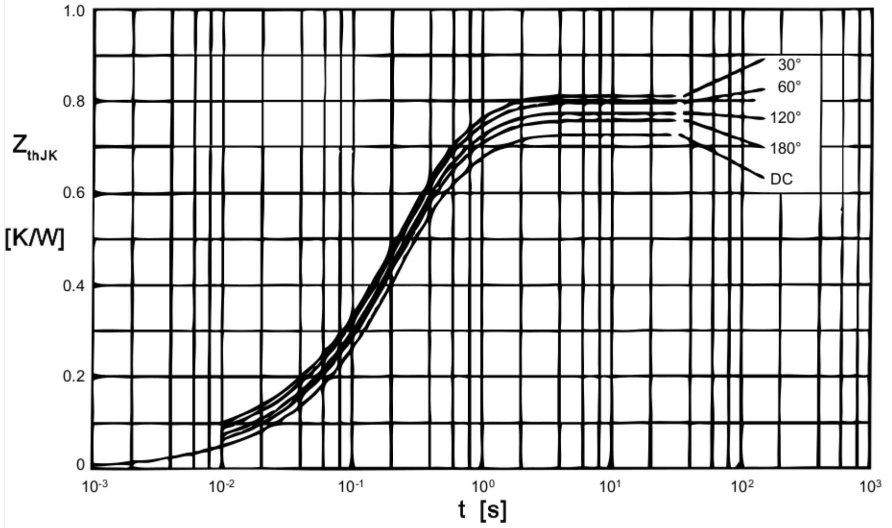


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor)

R_{thJK} for various conduction angles d:

d	R_{thJK} [K/W]
DC	0.73
180°	0.75
120°	0.78
60°	0.80
30°	0.82

Constants for Z_{thJK} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.015	0.0035
2	0.026	0.0200
3	0.489	0.0195
4	0.200	0.6800