High Voltage Thyristor \ Diode Module

V_{RRM} = 2x 2000 V
I_{TAV} = 250 A
V_T = 1,03 V

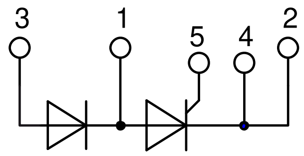
Phase leg

Part number

MCD224-20io1

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: Y1

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: Copper internally DCB isolated
- Advanced power cycling

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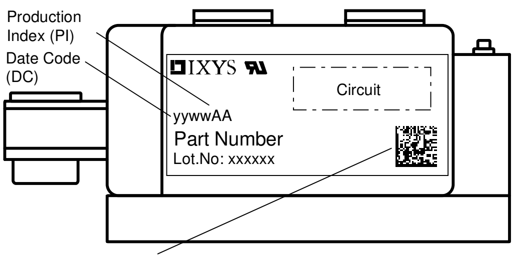
Rectifier

Symbol	Definition	Conditions		Ratings min.	typ.	max.	Unit
$V_{RSM/DSM}$	*max. non-repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			2100	V
$V_{RRM/DRM}$	*max. repetitive reverse/forward blocking voltage*		T_{VJ} = 25°C			2000	V
$I_{R/D}$	*reverse current, drain current*	$V_{R/D}$ = 2000 V	T_{VJ} = 25°C			1	mA
		$V_{R/D}$ = 2000 V	T_{VJ} = 140°C			40	mA
V_T	*forward voltage drop*	I_T = 250 A	T_{VJ} = 25°C			1,08	V
		I_T = 500 A				1,31	V
		I_T = 250 A	T_{VJ} = 125°C			1,03	V
		I_T = 500 A				1,33	V
I_{TAV}	*average forward current*	T_C = 85°C	T_{VJ} = 140°C			250	A
$I_{T(RMS)}$	*RMS forward current*	180° sine				390	A
V_{T0}	*threshold voltage*	*for power loss calculation only*	T_{VJ} = 140°C			0,72	V
r_T	*slope resistance*					1,2	mΩ
R_{thJC}	*thermal resistance junction to case*					0,139	K/W
R_{thCH}	*thermal resistance case to heatsink*				0,04		K/W
P_{tot}	*total power dissipation*		T_C = 25°C			820	W
I_{TSM}	*max. forward surge current*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			8,00	kA
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			8,64	kA
		t = 10 ms; (50 Hz), sine	T_{VJ} = 140°C			6,80	kA
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			7,35	kA
I^2t	*value for fusing*	t = 10 ms; (50 Hz), sine	T_{VJ} = 45°C			320,0	kA^2s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			310,5	kA^2s
		t = 10 ms; (50 Hz), sine	T_{VJ} = 140°C			231,2	kA^2s
		t = 8,3 ms; (60 Hz), sine	V_R = 0 V			224,4	kA^2s
C_J	*junction capacitance*	V_R = 700V f = 1 MHz	T_{VJ} = 25°C		235		pF
P_{GM}	*max. gate power dissipation*	t_P = 30 µs	T_C = 140°C			120	W
		t_P = 500 µs				60	W
P_{GAV}	*average gate power dissipation*					20	W
$(di/dt)_{cr}$	*critical rate of rise of current*	T_{VJ} = 125°C; f = 50 Hz	repetitive, I_T = 750 A			100	A/µs
		t_P = 200 µs; di_G/dt = 1 A/µs;					
		I_G = 1 A; V_D = ⅔ V_{DRM}	non-repet., I_T = 250 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			2	V
			T_{VJ} = -40°C			3	V
I_{GT}	*gate trigger current*	V_D = 6 V	T_{VJ} = 25°C			150	mA
			T_{VJ} = -40°C			220	mA
V_{GD}	*gate non-trigger voltage*	V_D = ⅔ V_{DRM}	T_{VJ} = 140°C			0,25	V
I_{GD}	*gate non-trigger current*					10	mA
I_L	*latching current*	t_p = 30 µs	T_{VJ} = 25°C			200	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			150	mA
t_{gd}	*gate controlled delay time*	V_D = ½ V_{DRM}	T_{VJ} = 25°C			2	µs
		I_G = 0,5A; di_G/dt = 0,5 A/µs					
t_q	*turn-off time*	V_R = 100 V; I_T = 250A; V_D = ⅔ V_{DRM}	T_{VJ} =125 °C		350		µs
		di/dt = 10 A/µs; dv/dt = 50 V/µs; t_p = 200 µs					

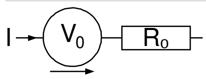
Package Y1			Ratings			
Symbol	**Definition**	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
I_{RMS}	*RMS current*	per terminal			600	A
T_{VJ}	*virtual junction temperature*		-40		140	°C
T_{op}	*operation temperature*		-40		125	°C
T_{stg}	*storage temperature*		-40		125	°C
Weight				680		g
M_D	*mounting torque*		4,5		7	Nm
M_T	*terminal torque*		11		13	Nm
$d_{Spp/App}$	*creepage distance on surface | striking distance through air*	*terminal to terminal*	16,0			mm
$d_{Spb/Apb}$		*terminal to backside*	16,0			mm
V_{ISOL}	*isolation voltage*	t = 1 second; 50/60 Hz, RMS; $I_{ISOL} \le 1$ mA	4800			V
		t = 1 minute	4000			V



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD224-20io1	MCD224-20io1	Box	3	481238

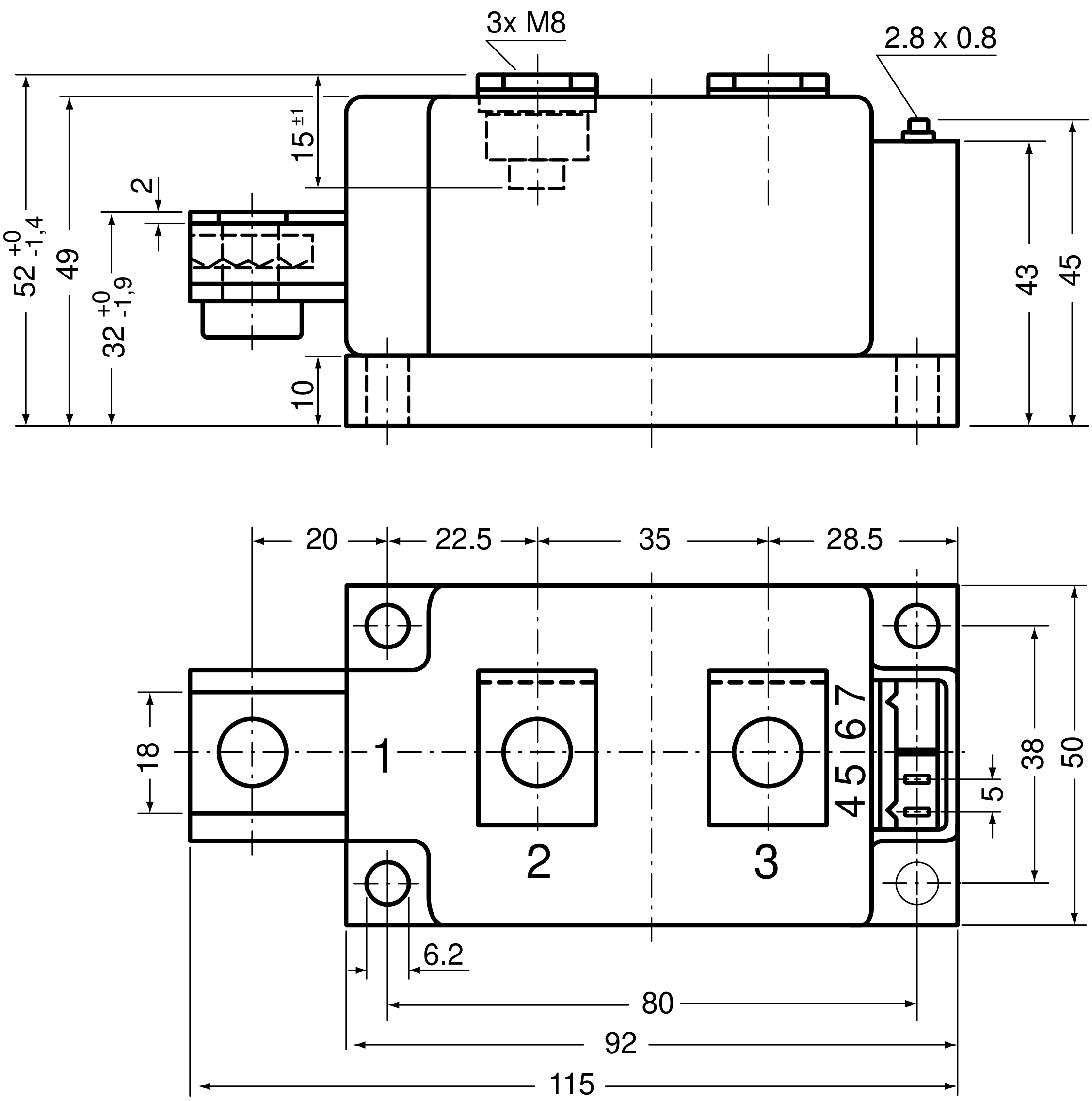
Equivalent Circuits for Simulation

* *on die level* $T_{VJ} = 140°C$

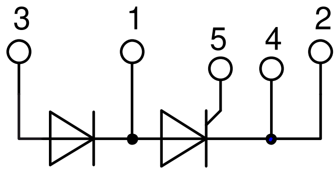


		Thyristor	
$V_{0\,max}$	*threshold voltage*	0,72	V
$R_{0\,max}$	*slope resistance **	1,01	mΩ

Outlines Y1



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



Thyristor

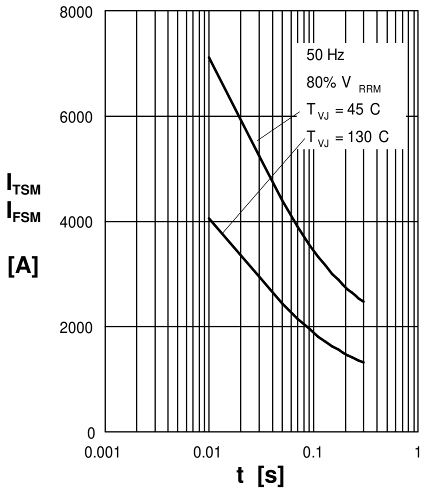


Fig. 1 Surge overload current
$I_{T(F)SM}$: crest value, t: duration

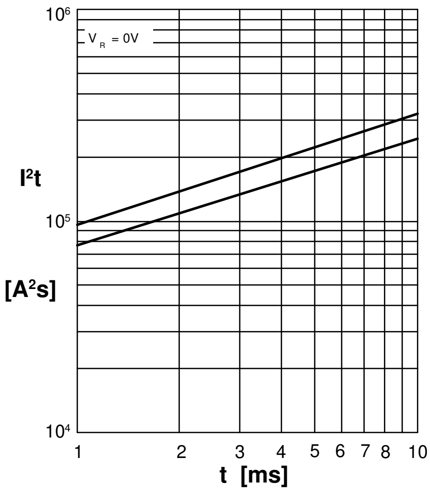


Fig. 2 I^2t versus time (1-10 ms)

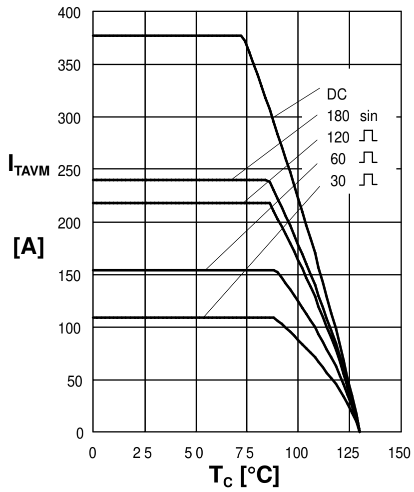


Fig. 3 Max. forward current
at case temperature

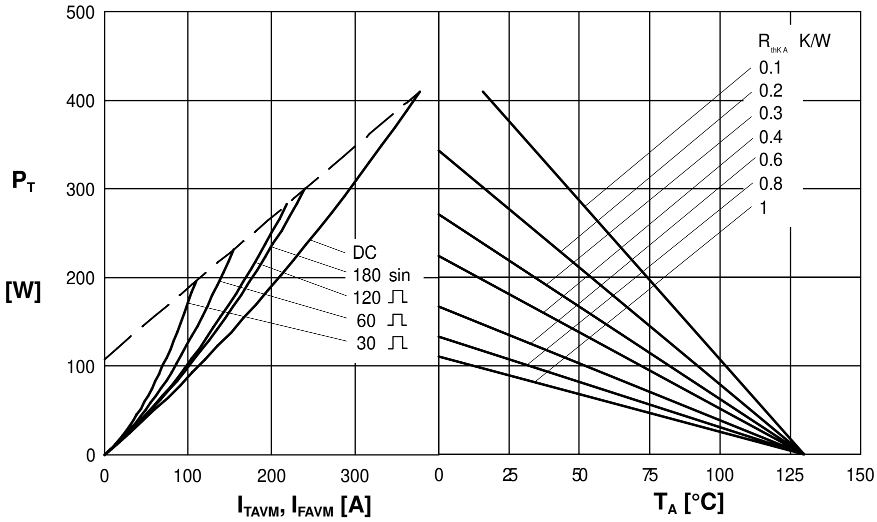


Fig. 4 Power dissipation versus onstate current and•
ambient temperature (per thyristor/diode)

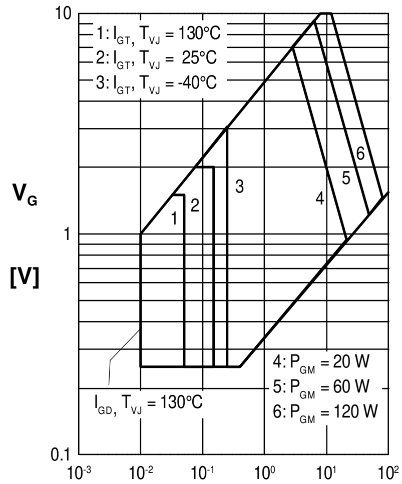


Fig. 5 Gate trigger characteristics

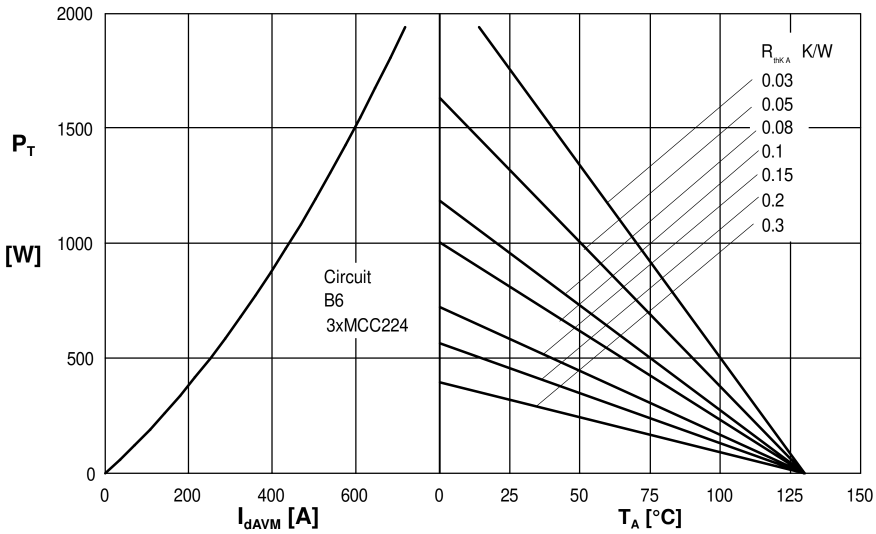


Fig. 6 Three phase rectifier bridge: Power dissipation versus
direct output current and ambient temperature

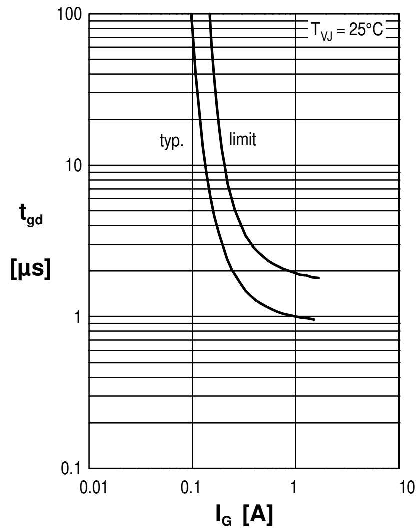


Fig. 7 Gate trigger delay time

Rectifier

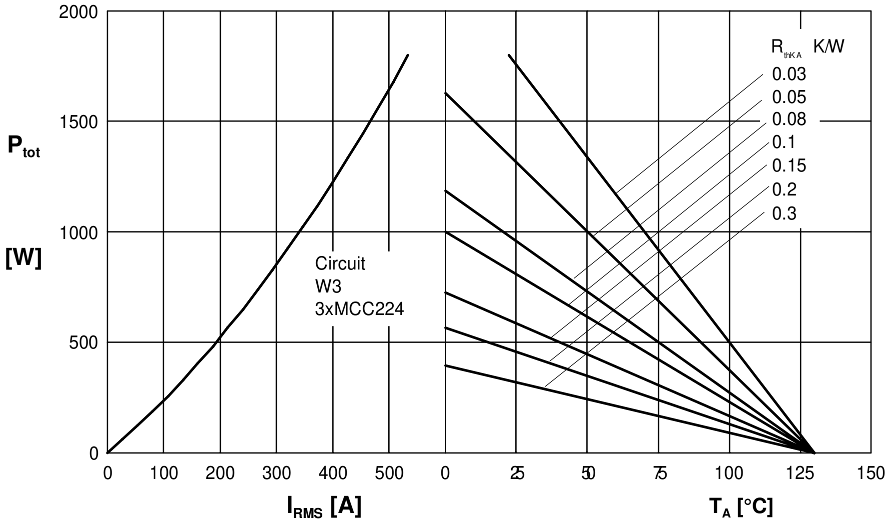


Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

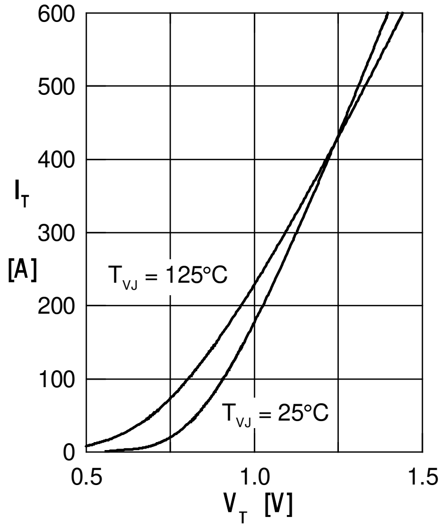


Fig. 10 Forward characteristics

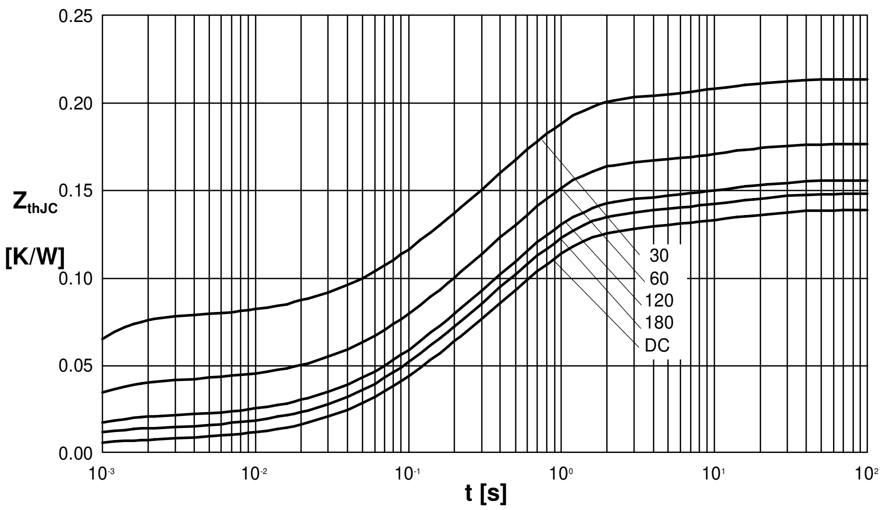


Fig. 8 Transient thermal impedance junction to case (per thyristor/diode)

R_{thJC} for various conduction angles d:

d	R_{thJC} [K/W]
DC	0.139
180°C	0.148
120°C	0.156
60°C	0.176
30°C	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	0.540
4	0.0129	12.00

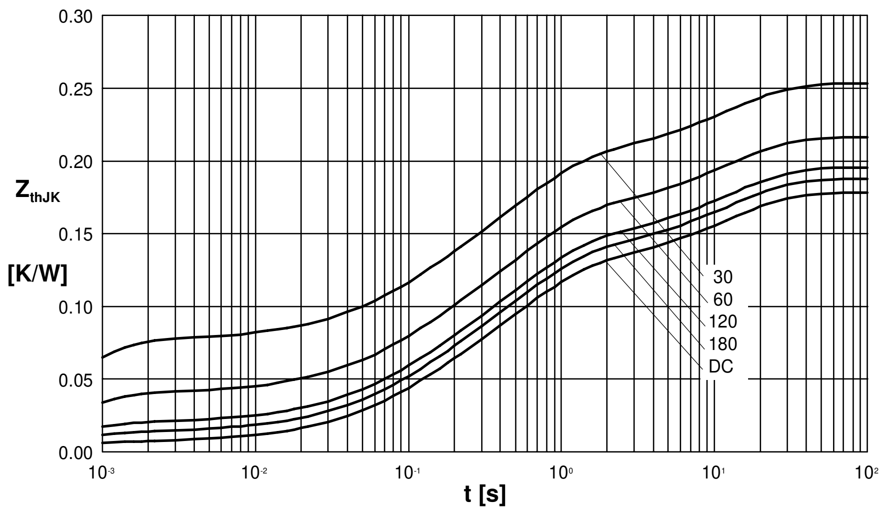


Fig. 9 Transient thermal impedance junction to heatsink (per thyristor/diode)

R_{thJK} for various conduction angles d:

d	R_{thJK} [K/W]
DC	0.179
180°C	0.188
120°C	0.196
60°C	0.216
30°C	0.256

Constants for Z_{thJK} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.0067	0.001
2	0.0358	0.080
3	0.0832	0.200
4	0.0129	1.000