

Thyristor \ Diode Module

$$V_{RRM} = 2 \times 1400 \text{ V}$$

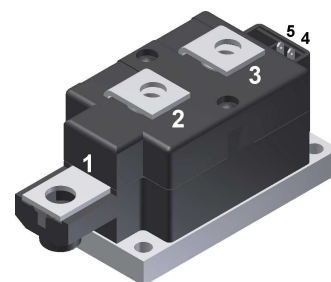
$$I_{TAV} = 220 \text{ A}$$

$$V_T = 0,97 \text{ V}$$

Phase leg

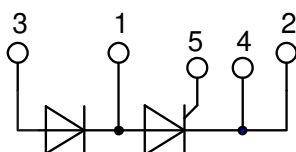
Part number

MCD225-14io1



Backside: isolated

 E72873



Features / Advantages:

- International standard package
- Direct copper bonded Al₂O₃-ceramic with copper base plate
- Planar passivated chip
- 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

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

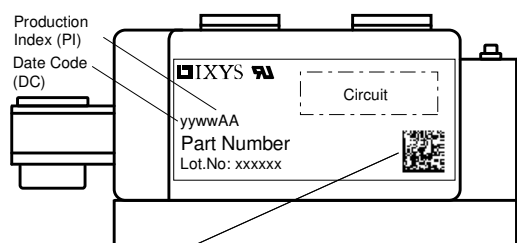
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Rectifier				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1500	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1400	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1400\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			1	mA
		$V_{R/D} = 1400\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			40	mA
V_T	forward voltage drop	$I_T = 200\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1,04	V
		$I_T = 400\text{ A}$				1,18	V
		$I_T = 200\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			0,97	V
		$I_T = 400\text{ A}$				1,14	V
I_{TAV}	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 140^{\circ}\text{C}$			220	A
$I_{T(RMS)}$	RMS forward current	180° sine				400	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 140^{\circ}\text{C}$			0,79	V
r_T	slope resistance					0,83	mΩ
R_{thJC}	thermal resistance junction to case					0,157	K/W
R_{thCH}	thermal resistance case to heatsink				0,04		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$			730	W
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			8,00	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			8,64	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}\text{C}$			6,80	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			7,35	kA
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			320,0	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			310,5	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 140^{\circ}\text{C}$			231,2	kA ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			224,4	kA ² s
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		366		pF
P_{GM}	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$	$T_C = 140^{\circ}\text{C}$			120	W
		$t_p = 500\text{ }\mu\text{s}$				60	W
P_{GAV}	average gate power dissipation					20	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 140^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 660\text{ A}$				100	A/ μs
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 1\text{ A}/\mu\text{s};$ $I_G = 1\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 220\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}\text{C}$			1000	V/ μs
		$R_{GK} = \infty$; method 1 (linear voltage rise)					
V_{GT}	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			2	V
			$T_{VJ} = -40^{\circ}\text{C}$			3	V
I_{GT}	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			150	mA
			$T_{VJ} = -40^{\circ}\text{C}$			220	mA
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}\text{C}$			0,25	V
I_{GD}	gate non-trigger current					10	mA
I_L	latching current	$t_p = 30\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			200	mA
		$I_G = 0,45\text{ A}; di_G/dt = 0,45\text{ A}/\mu\text{s}$					
I_H	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$			150	mA
t_{gd}	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$			2	μs
		$I_G = 1\text{ A}; di_G/dt = 1\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 220\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 50\text{ V}/\mu\text{s}; t_p = 200\text{ }\mu\text{s}$			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	4800			V
		t = 1 minute	4000			V



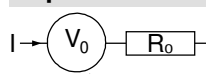
Data Matrix: part no. (1-19), DC + PI (20-25), lot.no.# (26-31), blank (32), serial no.# (33-36)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCD225-14io1	MCD225-14io1	Box	3	467901

Equivalent Circuits for Simulation

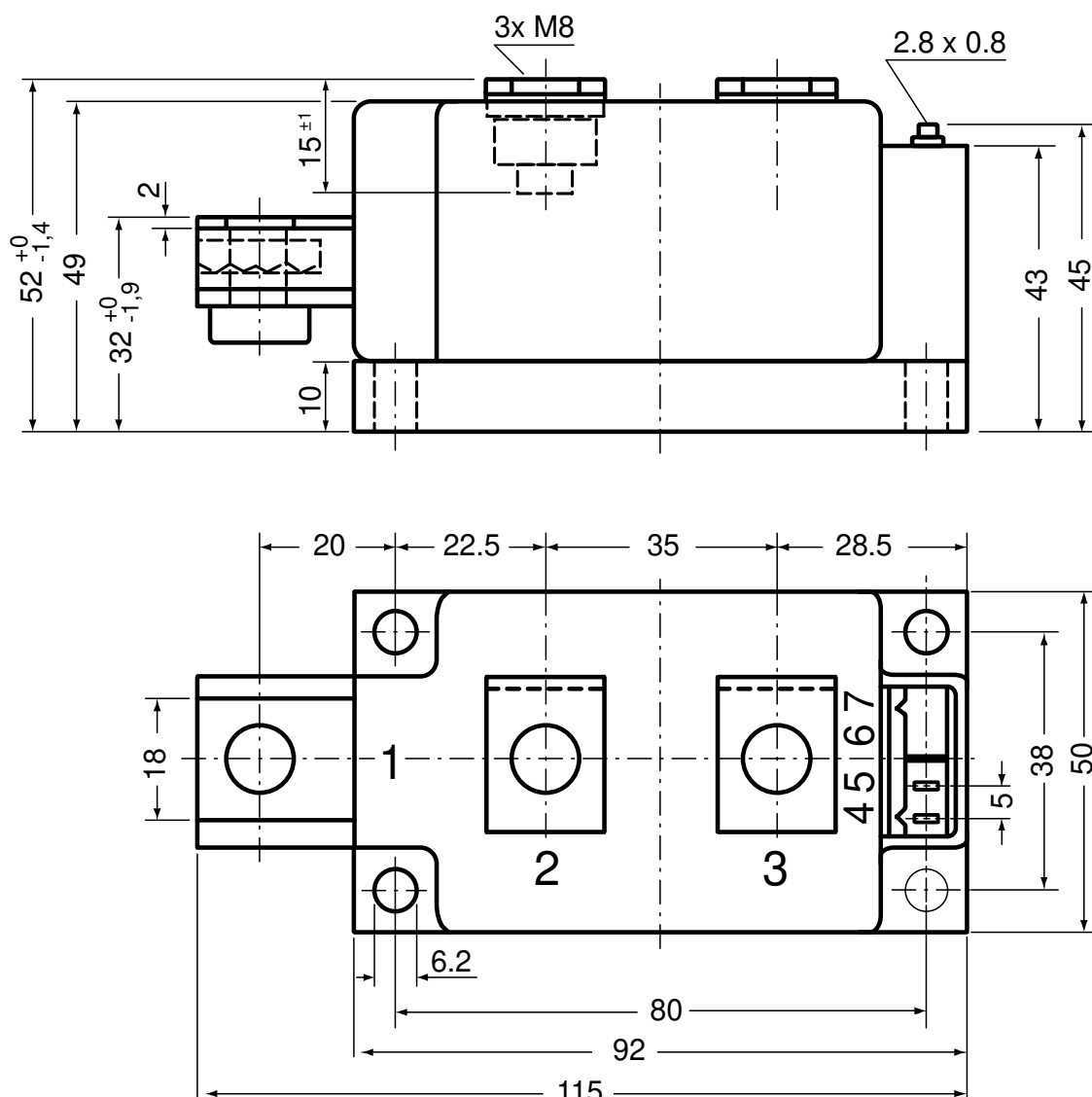
* on die level

$T_{VJ} = 140^{\circ}\text{C}$



Thyristor

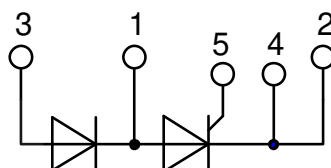
$V_{0 \max}$	threshold voltage	0,79	V
$R_{0 \max}$	slope resistance *	0,64	mΩ

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

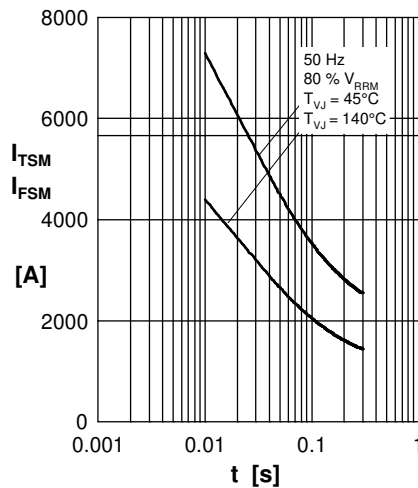


Fig. 1 Surge overload current
 $I_{TSM/FSM}$: Crest value, t : duration

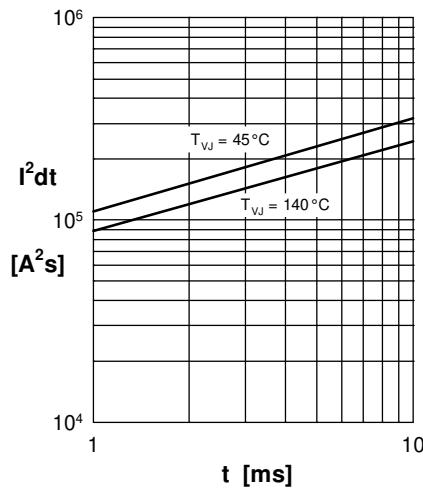


Fig. 2 I^2dt versus time

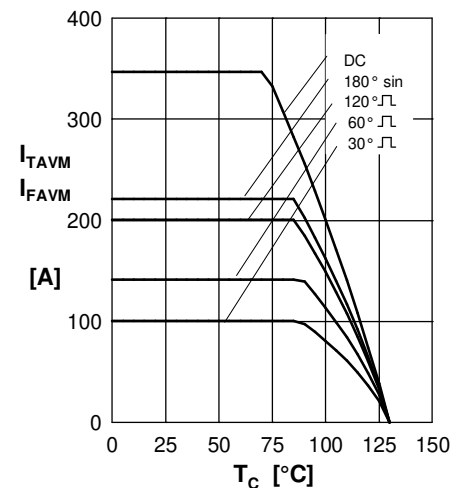


Fig. 3 Max. forward current at case temperature

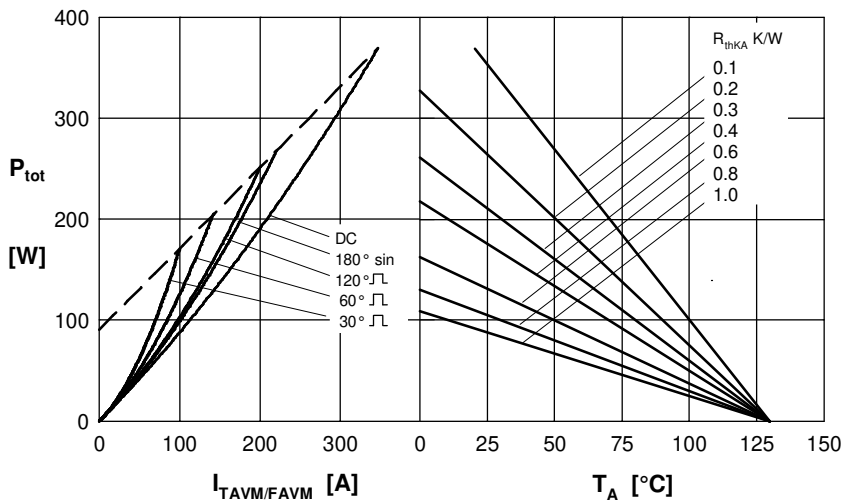


Fig. 4 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

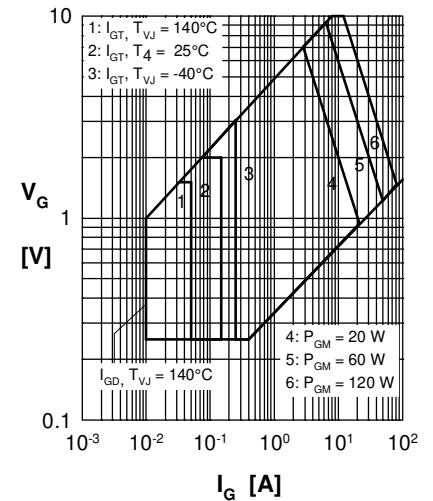


Fig. 5 Gate voltage and current

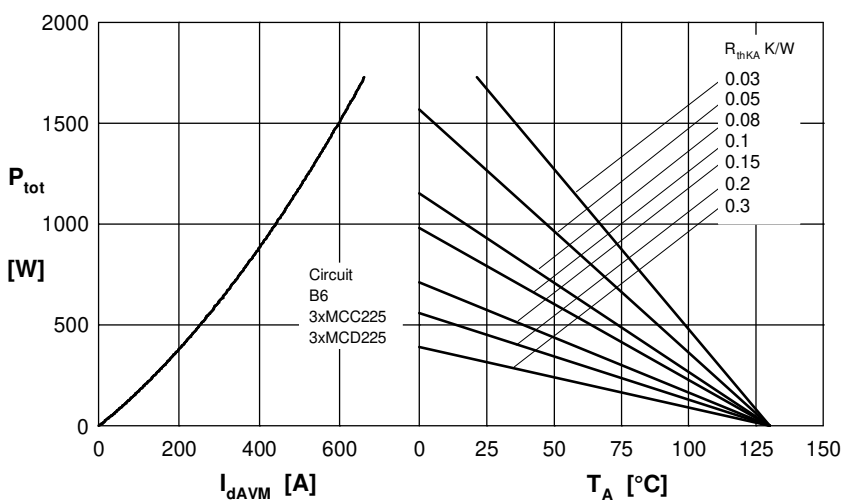


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

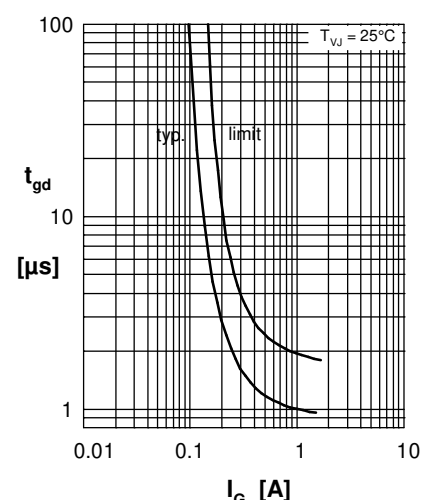


Fig. 7 Gate trigger characteristics

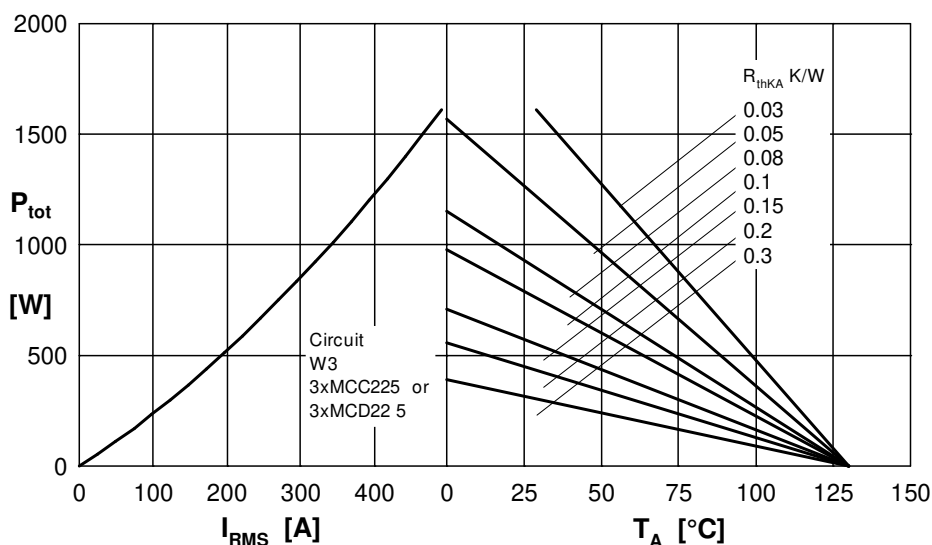
Rectifier


Fig. 8 Three phase AC-controller: Power dissipation versus R_{MS} output current and ambient temperature

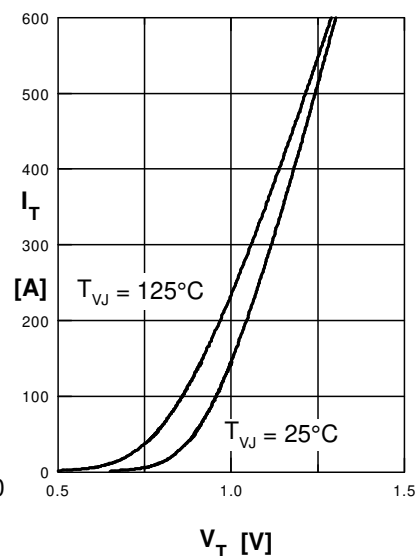


Fig. 9 Forward characteristics

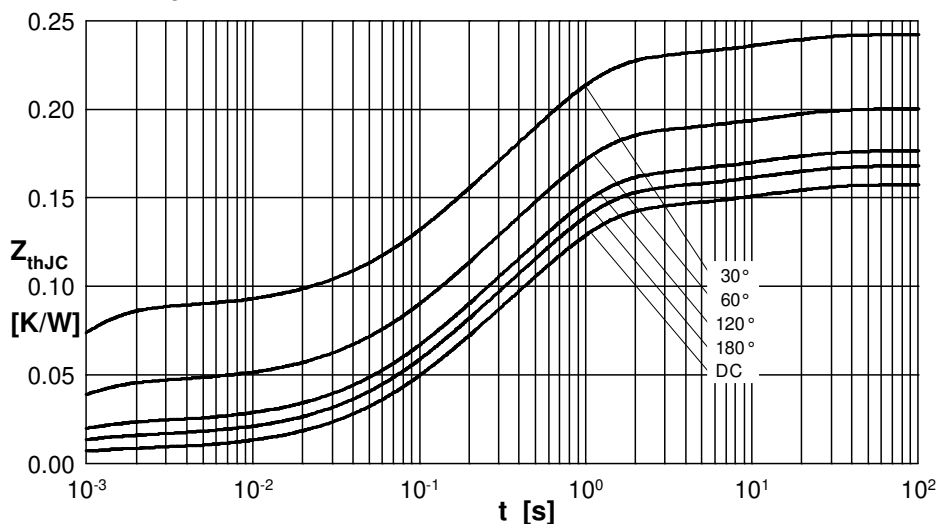


Fig. 10 Transient thermal impedance junction to case (per thyristor/diode)

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 (s)
1	0.0076	0.00054
2	0.0406	0.09800
3	0.0944	0.54000
4	0.0147	12.0000

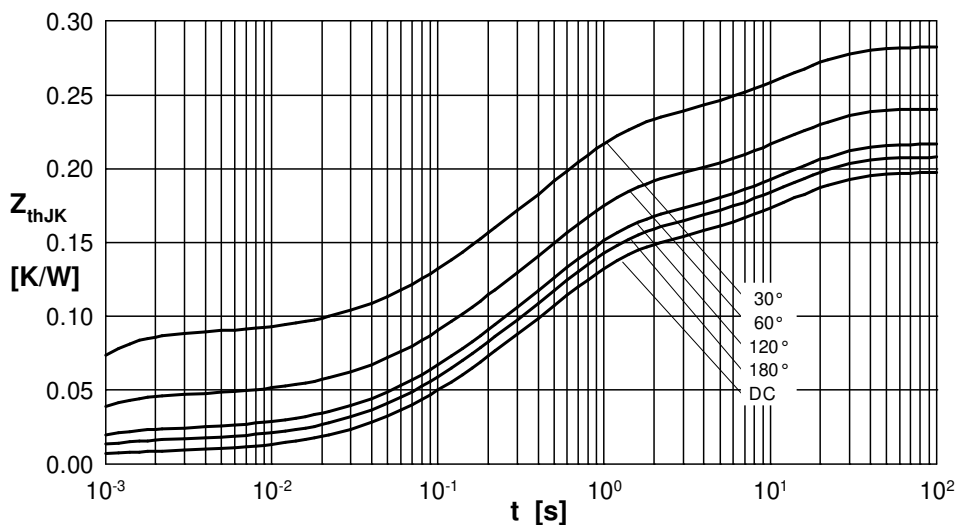


Fig. 11 Transient thermal impedance junction to heatsink (per thyristor/diode)

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 (s)
1	0.0076	0.00054
2	0.0406	0.09800
3	0.0944	0.54000
4	0.0147	12.0000
5	0.0400	12.0000