High Voltage Thyristor Module

$V_{RRM} = 2 \times 2200\,V$

$I_{TAV} = 250\,A$

$V_T = 1.03\,V$

Phase leg

Part number

MCC224-22io1
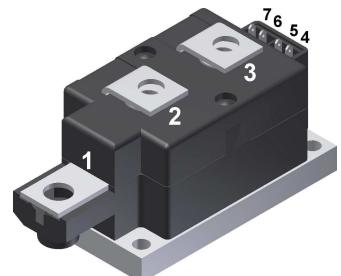
Backside: isolated

E72873
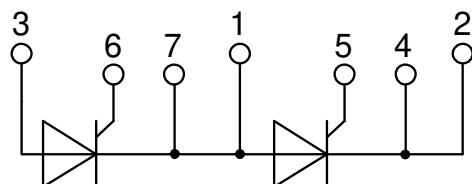
Features / Advantages:
- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al2O3-ceramic

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: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: Copper internally DCB isolated
- Advanced power cycling

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Thyristor

Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	*max. non-repetitive reverse/forward blocking voltage*	$T_{VJ} = 25°C$				2300	V
$V_{RRM/DRM}$	*max. repetitive reverse/forward blocking voltage*	$T_{VJ} = 25°C$				2200	V
$I_{R/D}$	*reverse current, drain current*	$V_{R/D} = 2200$ V	$T_{VJ} = 25°C$			1	mA
		$V_{R/D} = 2200$ 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	kA²s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0$ V			310.5	kA²s
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 140°C$			231.2	kA²s
		t = 8,3 ms; (60 Hz), sine	$V_R = 0$ V			224.4	kA²s
C_J	*junction capacitance*	$V_R = 700$ V 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 = ⅔ V_{DRM} non-repet., $I_T = 250$ A				500	A/µs
$(dv/dt)_{cr}$	*critical rate of rise of voltage*	V = 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
		$I_G = 0.45$ A; $di_G/dt = 0.45$ 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
		$I_G = 0.5$ A; $di_G/dt = 0.5$ A/µs					
t_q	*turn-off time*	$V_R = 100$ V; $I_T = 250$A; V = 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

Symbol	Definition	Conditions		min.	typ.	max.	Unit
Ratings							
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$_{ISOL}$ ≤ 1 mA	3600			V
		t = 1 minute		3000			V

Production Index (PI)
Date Code (DC)

IXYS Ꝛ

Circuit

yywwAA
Part Number
Lot.No: xxxxxx
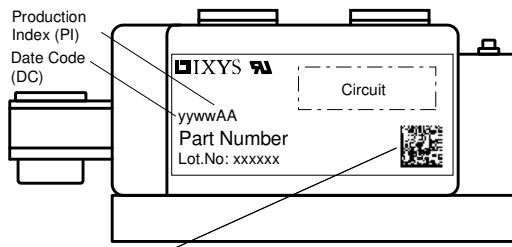
Data Matrix: *part no.* (1-19), DC + *PI* (20-25), *lot.no.#* (26-31),
blank (32), *serial no.#* (33-36)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC224-22io1	MCC224-22io1	Box	3	463531

Equivalent Circuits for Simulation   ** on die level*   T$_{VJ}$ = 140°C

I → (V$_0$) — [R$_0$] —   **Thyristor**
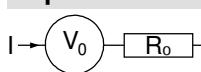
V$_{0\ max}$	threshold voltage	0.72	V
R$_{0\ max}$	slope resistance *	1.01	mΩ

IXYS reserves the right to change limits, conditions and dimensions.   Data according to IEC 60747and per semiconductor unless otherwise specified   20191210i

Outlines   Y1

3x M8

2.8 x 0.8

15 ±1

2

52 $^{+0}_{-1,4}$

49

32 $^{+0}_{-1,9}$

10

43

45

20

22.5

35

28.5

18

1

2

3

4 5 6 7

38

50

5

6.2

80

92

115
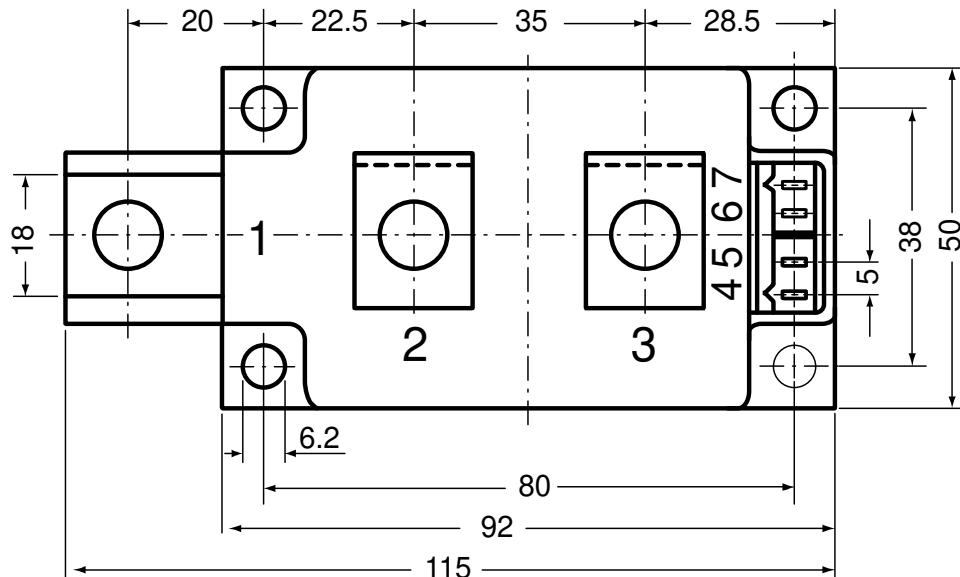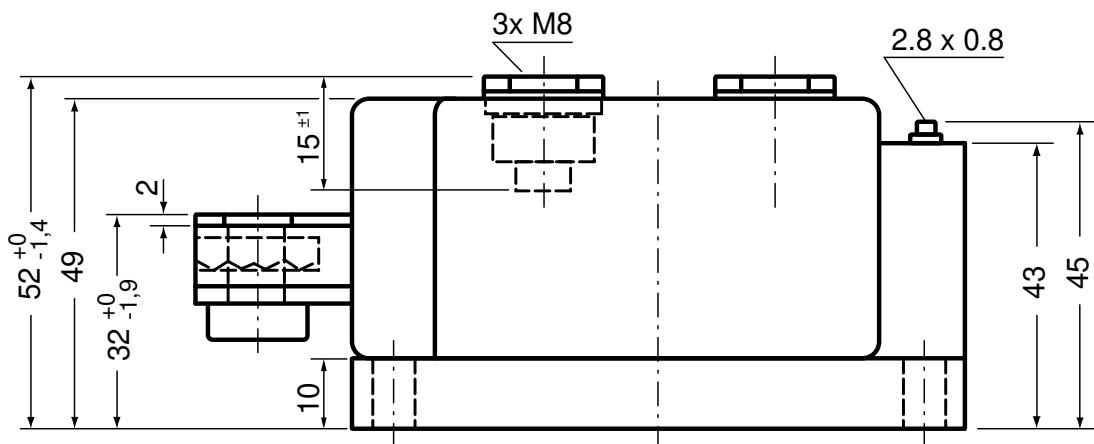
Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red
Type ZY 180L (L = Left for pin pair 4/5)
Type ZY 180R (R = Right for pin pair 6/7) } UL 758, style 3751

3   6   7   1   5   4   2
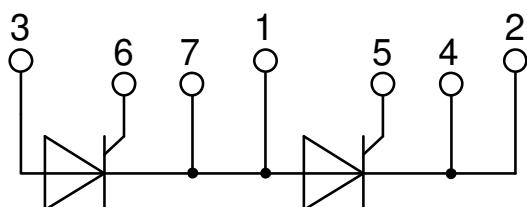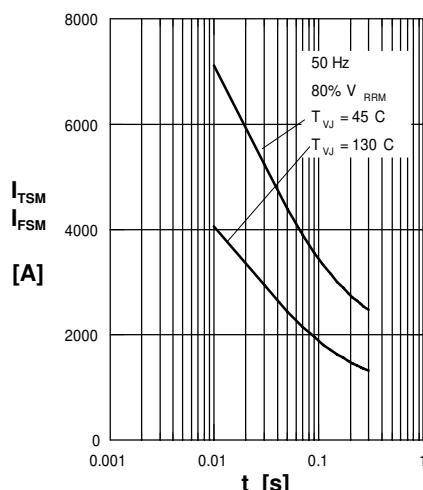
Thyristor

Fig. 1 Surge overload current
$I_{T(F)SM}$: crest value, t: duration
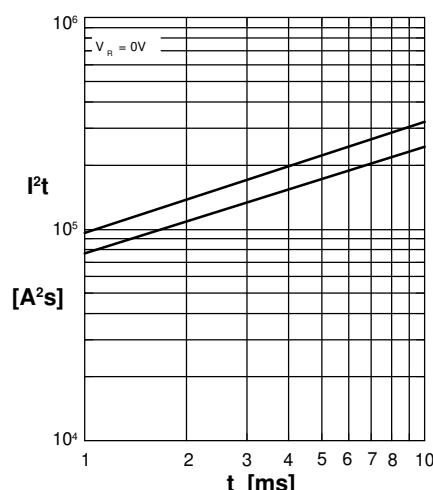
Fig. 2 I²t versus time (1-10 ms)
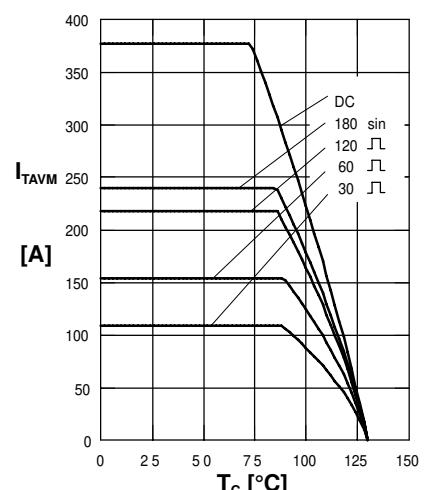
Fig. 3 Max. forward current
at case temperature
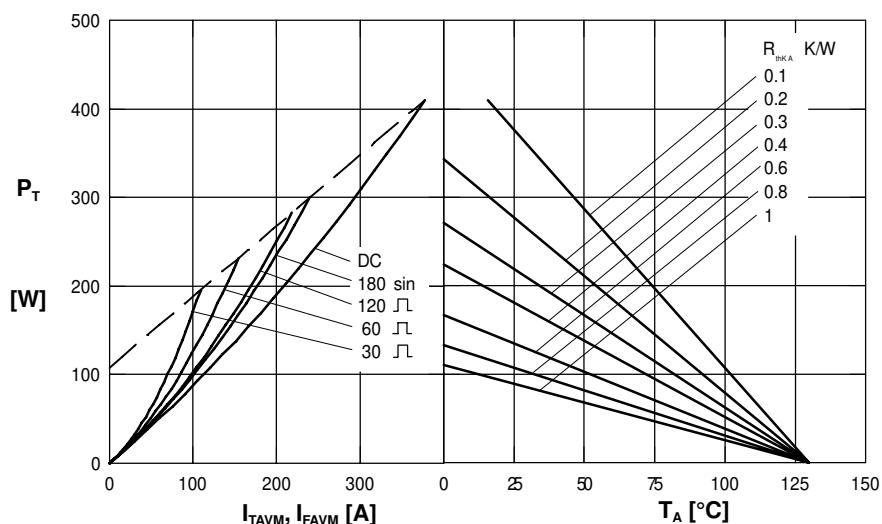
Fig. 4 Power dissipation versus onstate current and•
ambient temperature (per thyristor/diode)
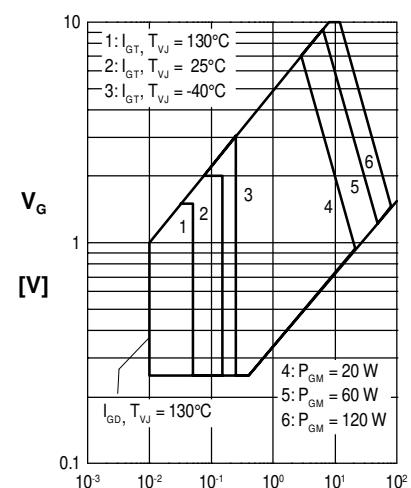

Fig. 5 Gate trigger characteristics
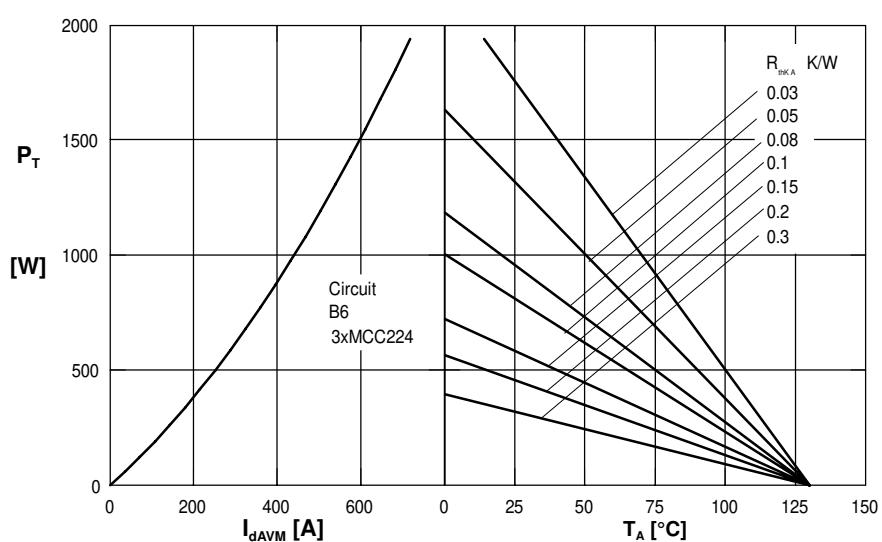
Fig. 6 Three phase rectifier bridge: Power dissipation versus
direct output current and ambient temperature
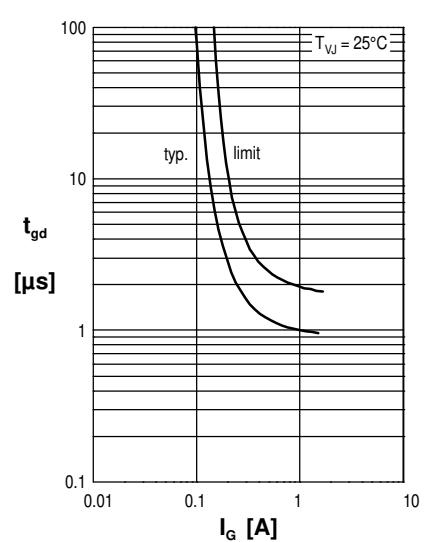

Fig. 7 Gate trigger delay time

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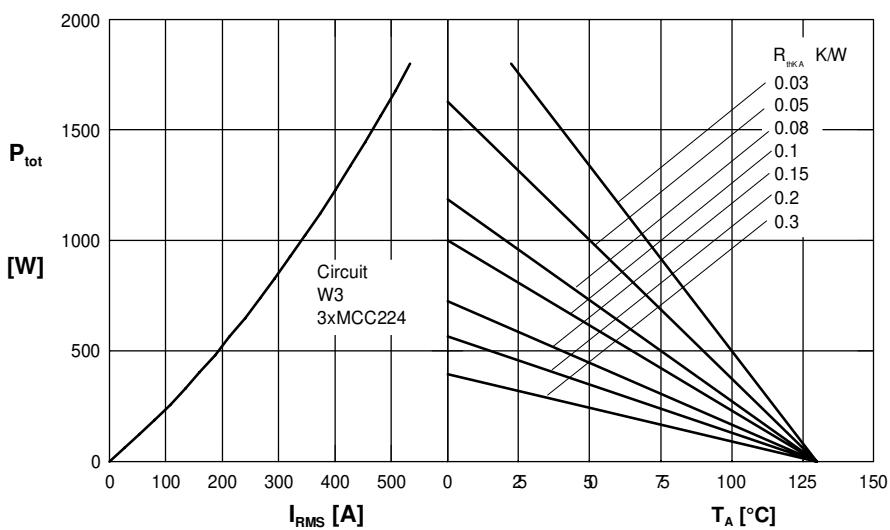
Fig. 7   Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature
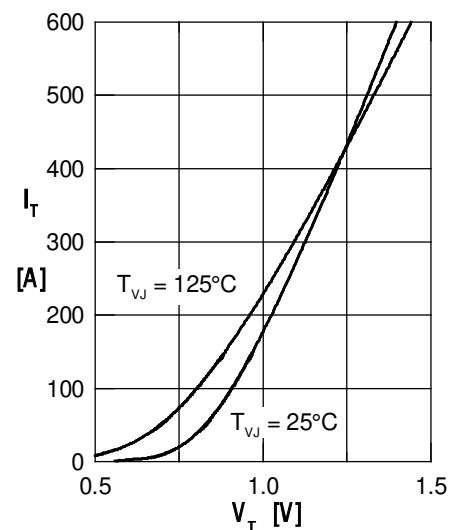

Fig. 10   Forward characteristics
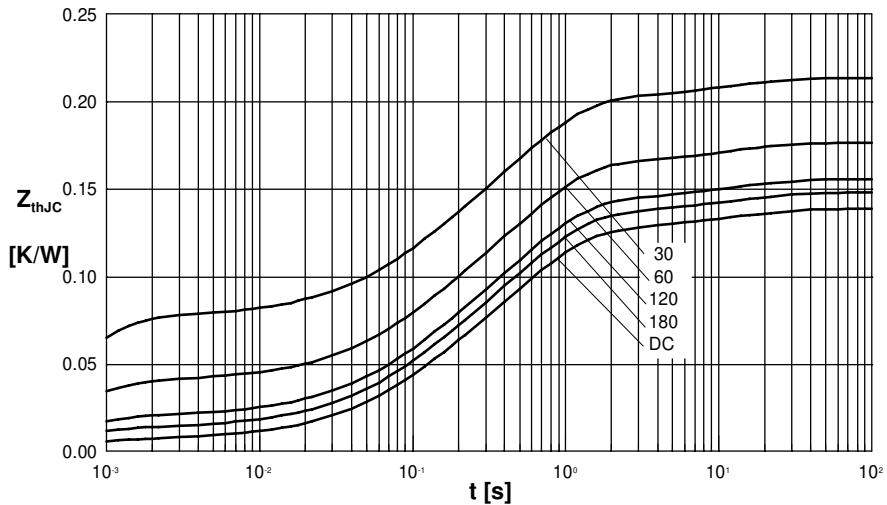
Fig. 8   Transient thermal impedance junction to case (per thyristor/diode)

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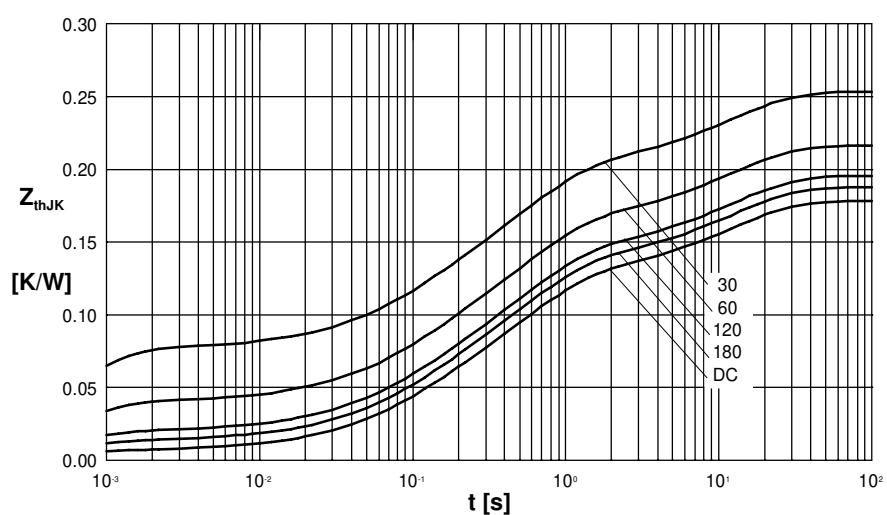
Fig. 9   Transient thermal impedance junction to heatsink (per thyristor/diode)

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

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