High Voltage Thyristor \ Diode Module

V_{RRM}	$=$	$2 \times 2000\,V$
I_{TAV}	$=$	$250\,A$
V_T	$=$	$1.03\,V$

Phase leg

Part number

MCD224-20io1
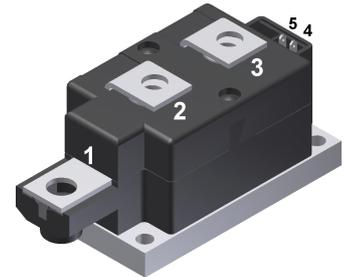
Backside: isolated

E72873

| 3 | 1 | 5 | 4 | 2 |
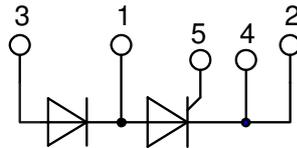
Features / Advantages:

- 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

Terms _Conditions of usage:

The data contained in this product data sheet is exclusively intended for technically trained staff. The user will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to his application. The specifications of our components may not be considered as an assurance of component characteristics. The information in the valid application- and assembly notes must be considered. Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of your product, please contact your local sales office.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact your local sales office.

Should you intend to use the product in aviation, in health or life endangering or life support applications, please notify. For any such application we urgently recommend
- to perform joint risk and quality assessments;
- the conclusion of quality agreements;
- to establish joint measures of an ongoing product survey, and that we may make delivery dependent on the realization of any such measures.

IXYS reserves the right to change limits, conditions and dimensions.   Data according to IEC 60747and per semiconductor unless otherwise specified   20170116h

Rectifier | | | | Ratings | | |

Symbol	Definition	Conditions		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				0.040		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
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	3600			V
		t = 1 minute		3000			V

Ratings

Production Index (PI)
Date Code (DC)

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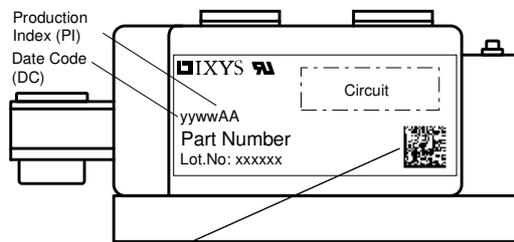
Data Matrix: *part no.* (1-19), DC + *PI* (20-25), *lot.no.#* (26-31), *blank* (32), *serial no.#* (33-36)

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

Equivalent Circuits for Simulation   ** on die level* $T_{VJ} = 140\,°C$
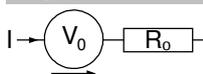
I → V_0 → R_o **Thyristor**

$V_{0\ max}$	threshold voltage	0.72		V
$R_{0\ max}$	slope resistance *	1.01		mΩ

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Outlines   Y1

3x M8

15 ±1

2

2.8 x 0.8

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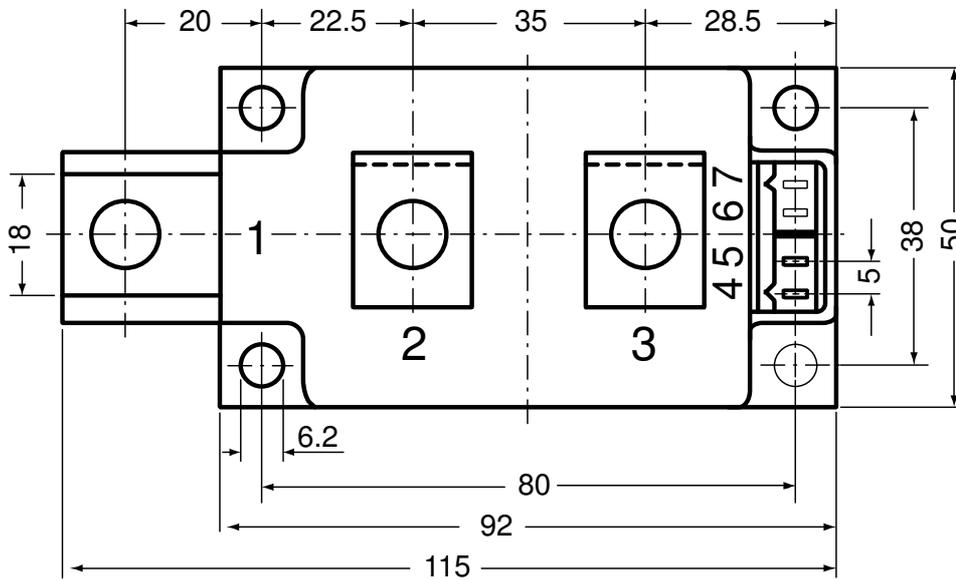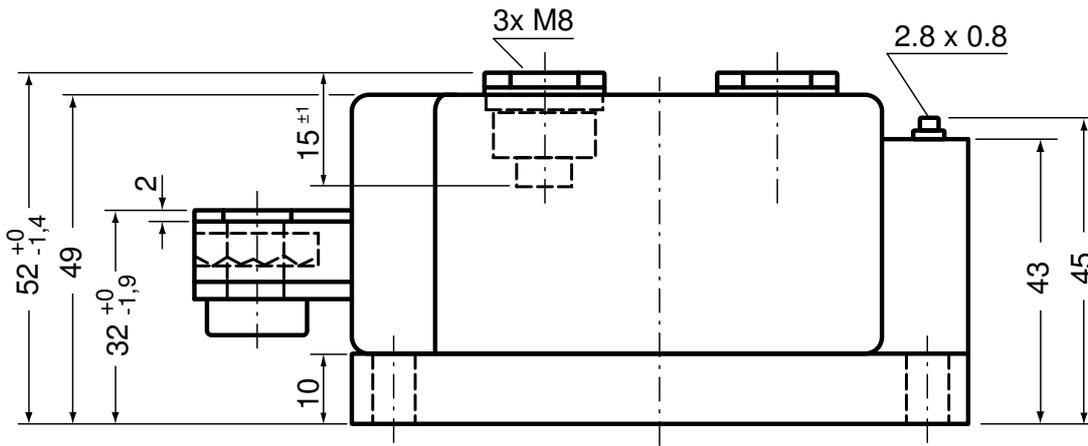
Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red
Type ZY 180L (L = Left for pin pair 4/5) } UL 758, style 3751
Type ZY 180R (R = Right for pin pair 6/7) }

3   1   5   4   2

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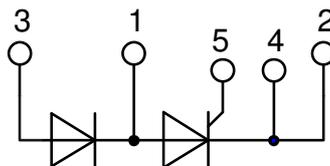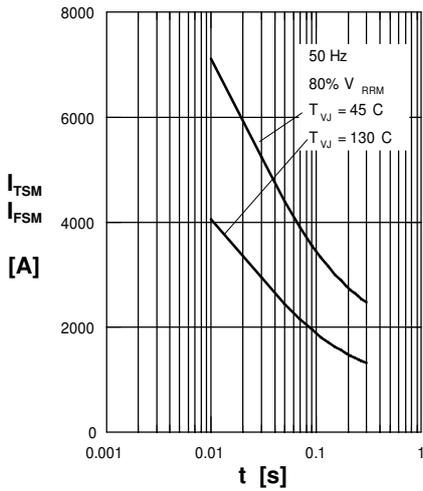
Thyristor

Fig. 1 Surge overload current
$I_{T(F)SM}$: crest value, t: duration
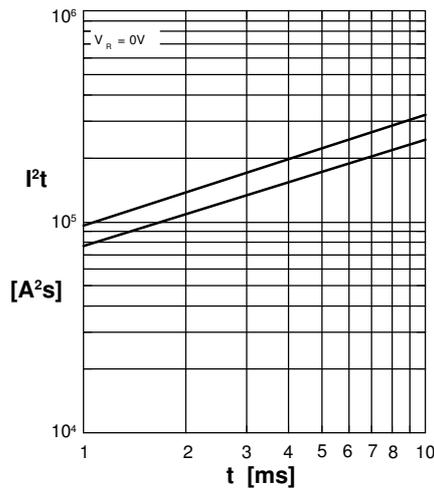
Fig. 2 I²t versus time (1-10 ms)
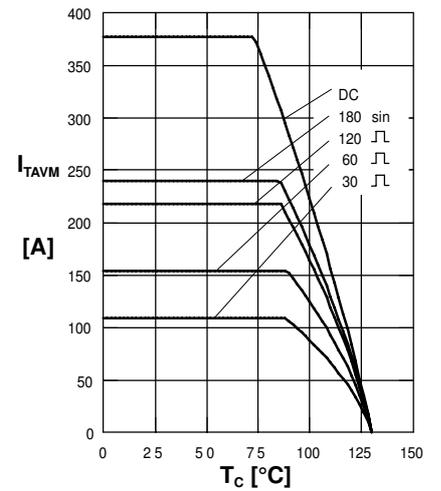
Fig. 3 Max. forward current
at case temperature
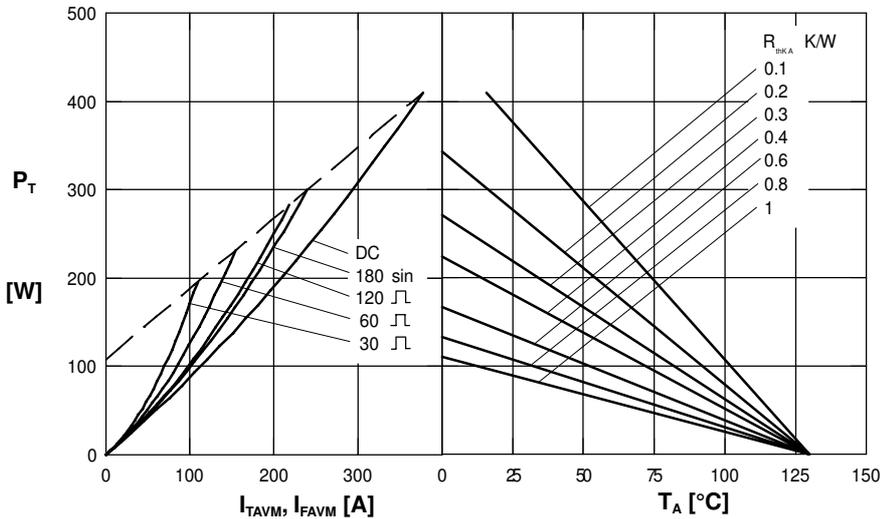
Fig. 4 Power dissipation versus onstate current and•
ambient temperature (per thyristor/diode)
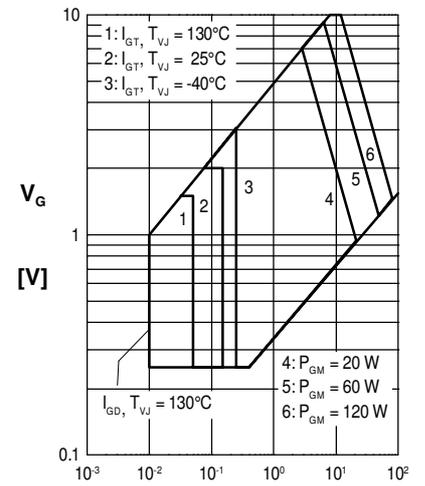
Fig. 5 Gate trigger characteristics
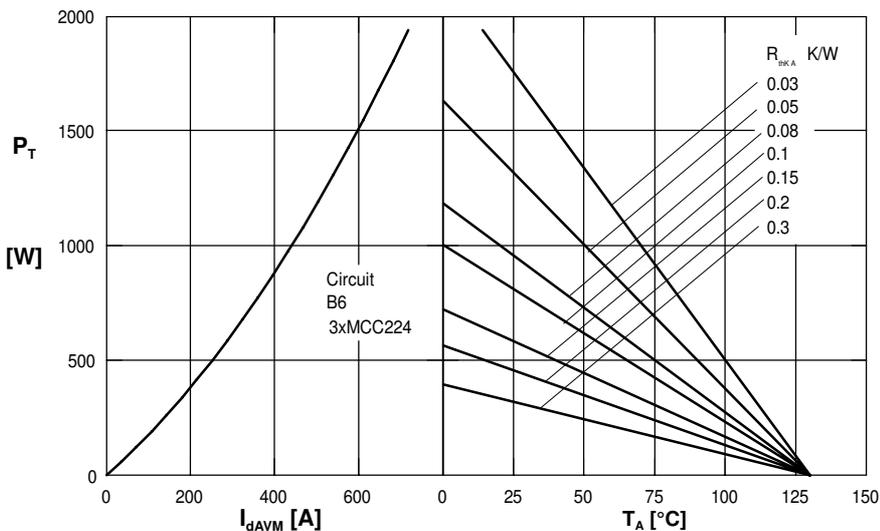
Fig. 6 Three phase rectifier bridge: Power dissipation versus
direct output current and ambient temperature
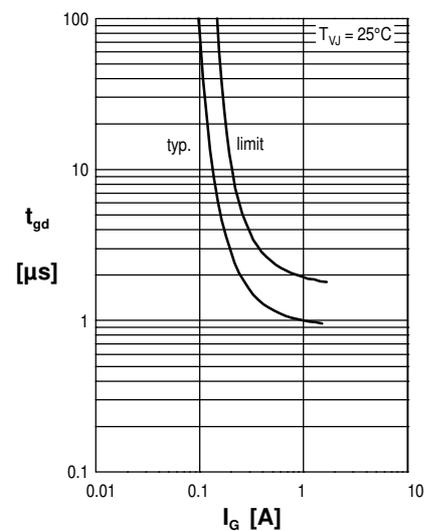
Fig. 7 Gate trigger delay time

Data according to IEC 60747and per semiconductor unless otherwise specified   20170116h

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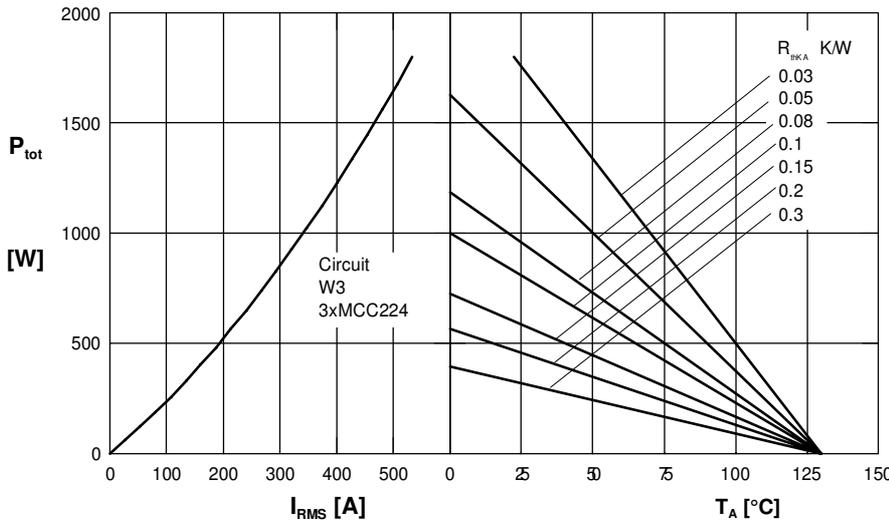
Fig. 7   Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature
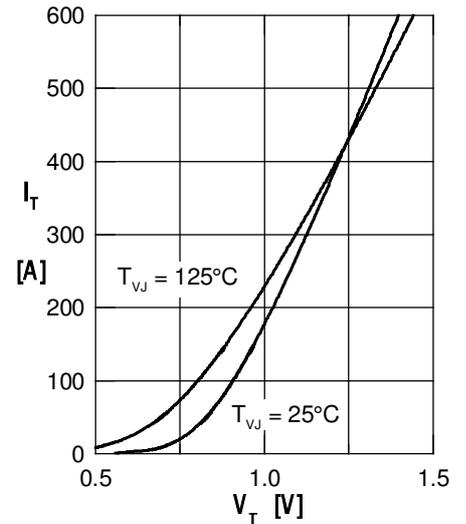

Fig. 10   Forward characteristics

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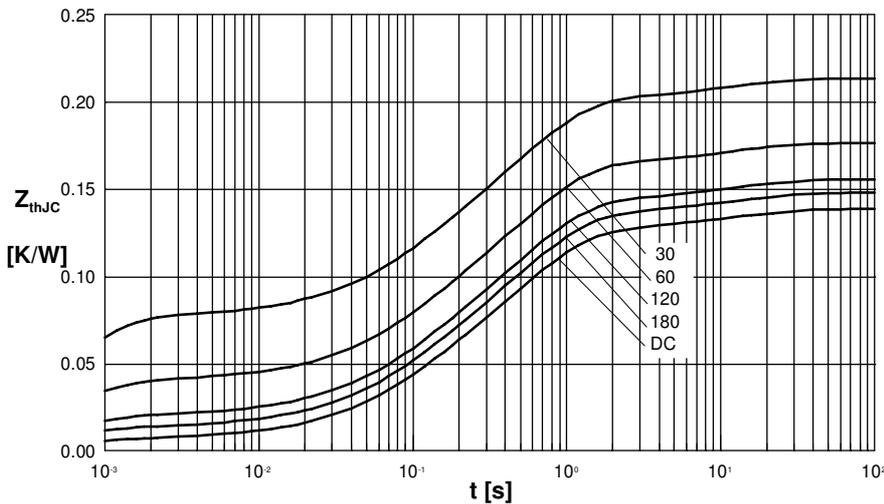
Fig. 8   Transient thermal impedance junction to case (per thyristor/diode)

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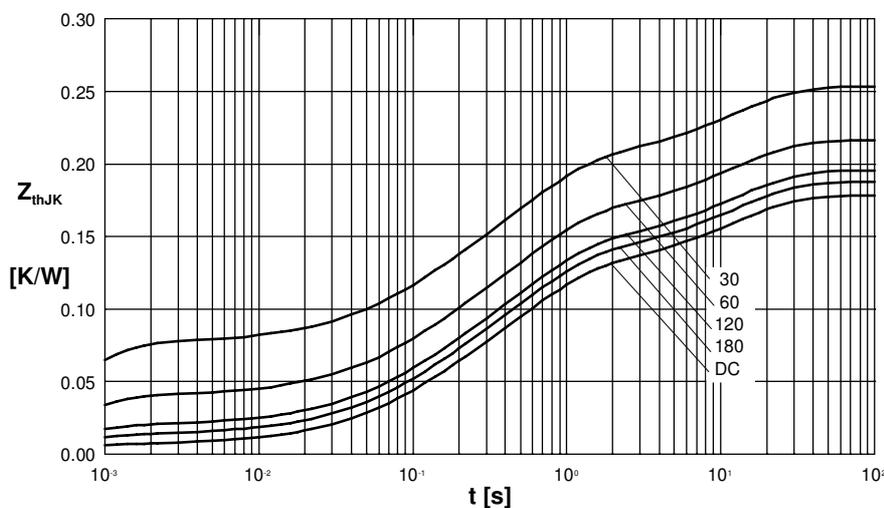
Fig. 9   Transient thermal impedance junction to heatsink (per thyristor/diode)