

Thyristor Module

$$V_{RRM} = 2 \times 1600 \text{ V}$$

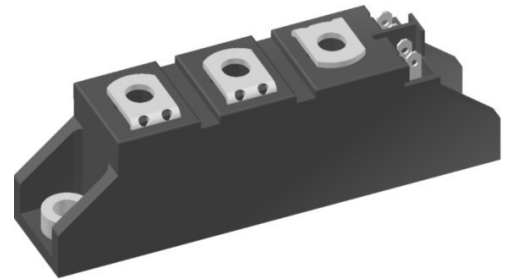
$$I_{TAV} = 18 \text{ A}$$

$$V_T = 1.57 \text{ V}$$

Phase leg

Part number

MCC19-16io1B



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

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.

Thyristor				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$				1600	V
$I_{R/D}$	reverse current, drain current	$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			3	mA
V_T	forward voltage drop	$I_T = 40\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$			1.56	V
		$I_T = 80\text{ A}$				2.05	V
		$I_T = 40\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$			1.57	V
		$I_T = 80\text{ A}$				2.29	V
I_{TAV}	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 125^{\circ}\text{C}$			18	A
$I_{T(RMS)}$	RMS forward current	180° sine				28	A
V_{T0}	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}\text{C}$			0.85	V
r_T	slope resistance					18	m Ω
R_{thJC}	thermal resistance junction to case					1.3	K/W
R_{thCH}	thermal resistance case to heatsink				0.20		K/W
P_{tot}	total power dissipation		$T_C = 25^{\circ}\text{C}$			77	W
I_{TSM}	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			400	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			430	A
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			340	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			365	A
I^2t	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$			800	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			770	A ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			580	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			555	A ² s
C_J	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		22		pF
P_{GM}	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$	$T_C = 125^{\circ}\text{C}$			10	W
		$t_p = 300\text{ }\mu\text{s}$				5	W
P_{GAV}	average gate power dissipation					0.5	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 75\text{ A}$				150	A/ μs
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ $I_G = 0.45\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 18\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$			1000	V/ μs
		$R_{GK} = \infty$; method 1 (linear voltage rise)					
V_{GT}	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			1.5	V
			$T_{VJ} = -40^{\circ}\text{C}$			1.6	V
I_{GT}	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	mA
			$T_{VJ} = -40^{\circ}\text{C}$			200	mA
V_{GD}	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}\text{C}$			0.2	V
I_{GD}	gate non-trigger current					5	mA
I_L	latching current	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$			450	mA
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
I_H	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$			200	mA
t_{gd}	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$			2	μs
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$					
t_q	turn-off time	$V_R = 100\text{ V}; I_T = 20\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 100^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$			150		μs

Package TO-240AA				Ratings			
Symbol	Definition	Conditions		min.	typ.	max.	Unit
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					81		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; $I_{ISOL} \leq 1$ mA	3600			V
		t = 1 minute		3000			V



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCC19-16io1B	MCC19-16io1B	Box	36	452874

Similar Part	Package	Voltage class
MCMA25P1600TA	TO-240AA-1B	1600
MCMA35P1600TA	TO-240AA-1B	1600

Equivalent Circuits for Simulation			* on die level	$T_{VJ} = 125^\circ\text{C}$
		Thyristor		
$V_{0\max}$	threshold voltage	0.85		V
$R_{0\max}$	slope resistance *	16.8		mΩ

Technical drawing of a multi-pin connector assembly. The drawing shows a side view of the component with various dimensions and part numbers indicated.

- Dimensions:**
 - Total length: 92 ± 0.5
 - Distance from left face to center of pin 1: 80 ± 0.3
 - Pin diameter: $\varnothing 6$
 - Distance between pins 1 and 2: 10
 - Distance between pins 2 and 3: 10
 - Distance between pins 3 and 4: 10
 - Distance between pins 4 and 5: 10
 - Distance between pins 5 and 6: 10
 - Distance between pins 6 and 7: 10
 - Distance between pins 7 and 8: 10
 - Distance between pins 8 and 9: 10
 - Distance between pins 9 and 10: 10
 - Distance between pins 10 and 11: 10
 - Distance between pins 11 and 12: 10
 - Distance between pins 12 and 13: 10
 - Distance between pins 13 and 14: 10
 - Distance between pins 14 and 15: 10
 - Distance between pins 15 and 16: 10
 - Distance between pins 16 and 17: 10
 - Distance between pins 17 and 18: 10
 - Distance between pins 18 and 19: 10
 - Distance between pins 19 and 20: 10
 - Distance between pins 20 and 21: 10
 - Distance between pins 21 and 22: 10
 - Distance between pins 22 and 23: 10
 - Distance between pins 23 and 24: 10
 - Distance between pins 24 and 25: 10
 - Distance between pins 25 and 26: 10
 - Distance between pins 26 and 27: 10
 - Distance between pins 27 and 28: 10
 - Distance between pins 28 and 29: 10
 - Distance between pins 29 and 30: 10
 - Distance between pins 30 and 31: 10
 - Distance between pins 31 and 32: 10
 - Distance between pins 32 and 33: 10
 - Distance between pins 33 and 34: 10
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 - Distance between pins 35 and 36: 10
 - Distance between pins 36 and 37: 10
 - Distance between pins 37 and 38: 10
 - Distance between pins 38 and 39: 10
 - Distance between pins 39 and 40: 10
 - Distance between pins 40 and 41: 10
 - Distance between pins 41 and 42: 10
 - Distance between pins 42 and 43: 10
 - Distance between pins 43 and 44: 10
 - Distance between pins 44 and 45: 10
 - Distance between pins 45 and 46: 10
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 - Distance between pins 47 and 48: 10
 - Distance between pins 48 and 49: 10
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 - Distance between pins 69 and 70: 10
 - Distance between pins 70 and 71: 10
 - Distance between pins 71 and 72: 10
 - Distance between pins 72 and 73: 10
 - Distance between pins 73 and 74: 10
 - Distance between pins 74 and 75: 10
 - Distance between pins 75 and 76: 10
 - Distance between pins 76 and 77: 10
 - Distance between pins 77 and 78: 10
 - Distance between pins 78 and 79: 10
 - Distance between pins 79 and 80: 10
 - Distance between pins 80 and 81: 10
 - Distance between pins 81 and 82: 10
 - Distance between pins 82 and 83: 10
 - Distance between pins 83 and 84: 10
 - Distance between pins 84 and 85: 10
 - Distance between pins 85 and 86: 10
 - Distance between pins 86 and 87: 10
 - Distance between pins 87 and 88: 10
 - Distance between pins 88 and 89: 10
 - Distance between pins 89 and 90: 10
 - Distance between pins 90 and 91: 10
 - Distance between pins 91 and 92: 10
 - Distance between pins 92 and 93: 10
 - Distance between pins 93 and 94: 10
 - Distance between pins 94 and 95: 10
 - Distance between pins 95 and 96: 10
 - Distance between pins 96 and 97: 10
 - Distance between pins 97 and 98: 10
 - Distance between pins 98 and 99: 10
 - Distance between pins 99 and 100: 10
 - Distance between pins 100 and 101: 10
 - Distance between pins 101 and 102: 10
 - Distance between pins 102 and 103: 10
 - Distance between pins 103 and 104: 10
 - Distance between pins 104 and 105: 10
 - Distance between pins 105 and 106: 10
 - Distance between pins 106 and 107: 10
 - Distance between pins 107 and 108: 10
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 - Distance between pins 109 and 110: 10
 - Distance between pins 110 and 111: 10
 - Distance between pins 111 and 112: 10
 - Distance between pins 112 and 113: 10
 - Distance between pins 113 and 114: 10
 - Distance between pins 114 and 115: 10
 - Distance between pins 115 and 116: 10
 - Distance between pins 116 and 117: 10
 - Distance between pins 117 and 118: 10
 - Distance between pins 118 and 119: 10
 - Distance between pins 119 and 120: 10
 - Distance between pins 120 and 121: 10
 - Distance between pins 121 and 122: 10
 - Distance between pins 122 and 123: 10
 - Distance between pins 123 and 124: 10
 - Distance between pins 124 and 125: 10
 - Distance between pins 125 and 126: 10
 - Distance between pins 126 and 127: 10
 - Distance between pins 127 and 128: 10
 - Distance between pins 128 and 129: 10
 - Distance between pins 129 and 130: 10
 - Distance between pins 130 and 131: 10
 - Distance between pins 131 and 132: 10
 - Distance between pins 132 and 133: 10
 - Distance between pins 133 and 134: 10
 - Distance between pins 134 and 135: 10
 - Distance between pins 135 and 136: 10
 - Distance between pins 136 and 137: 10
 - Distance between pins 137 and 138: 10
 - Distance between pins 138 and 139: 10
 - Distance between pins 139 and 140: 10
 - Distance between pins 140 and 141: 10
 - Distance between pins 141 and 142: 10
 - Distance between pins 142 and 143: 10
 - Distance between pins 143 and 144: 10
 - Distance between pins 144 and 145: 10
 - Distance between pins 145 and 146: 10
 - Distance between pins 146 and 147: 10
 - Distance between pins 147 and 148: 10
 - Distance between pins 148 and 149: 10
 - Distance between pins 149 and 150: 10
 - Distance between pins 150 and 151: 10
 - Distance between pins 151 and 152: 10
 - Distance between pins 152 and 153: 10
 - Distance between pins 153 and 154: 10
 - Distance between pins 154 and 155: 10
 - Distance between pins 155 and 156: 10
 - Distance between pins 156 and 157: 10
 - Distance between pins 157 and 158: 10
 - Distance between pins 158 and 159: 10
 - Distance between pins 159 and 160: 10
 - Distance between pins 160 and 161: 10
 - Distance between pins 161 and 162: <

The diagram shows a logic circuit with two inverters. The input signal is labeled 3. The first inverter has its input connected to 3 and its output connected to 6. The second inverter has its input connected to 6 and its output connected to 2. There are also labels 7, 1, 5, and 4 along the signal path between the two inverters.

Thyristor

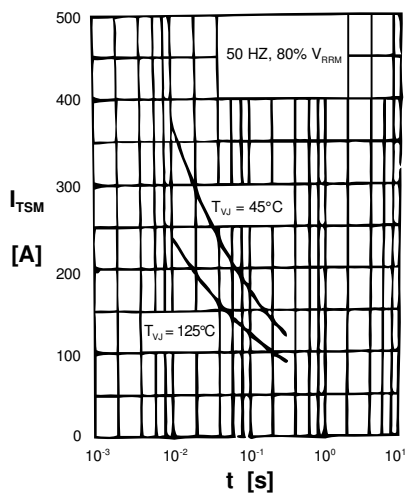


Fig. 1 Surge overload current
 I_{TSM} : Crest value, t : duration

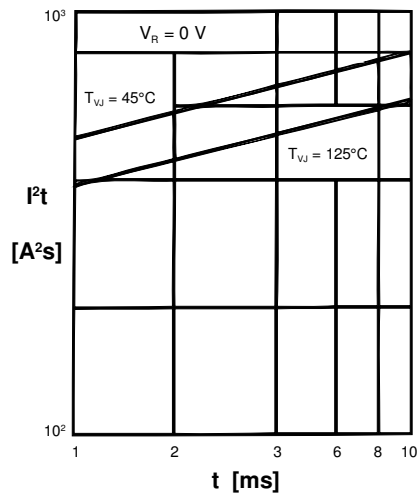


Fig. 2 I^2t versus time (1-10 ms)

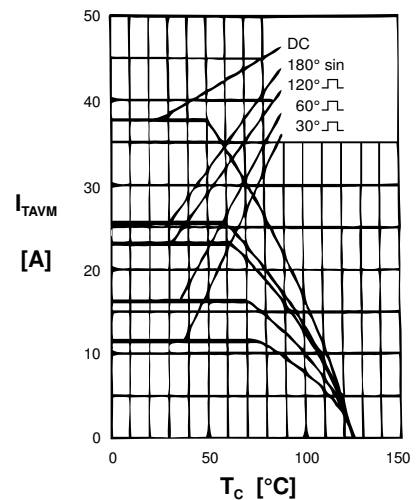


Fig. 3 Max. forward current
at case temperature

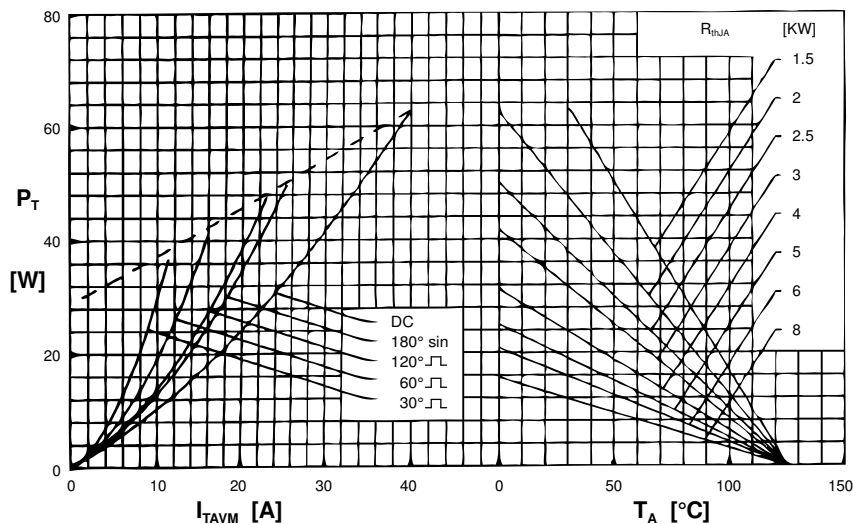


Fig. 4 Power dissipation versus onstate current & ambient temp. (per thyristor)

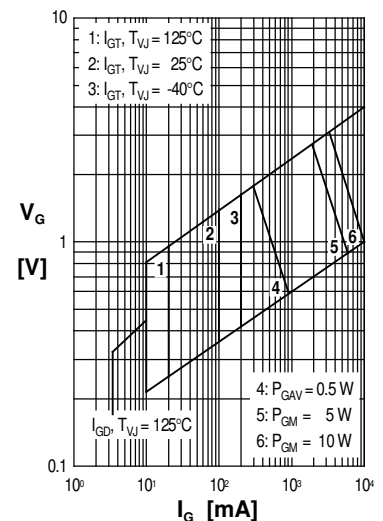


Fig. 5 Gate trigger charact.

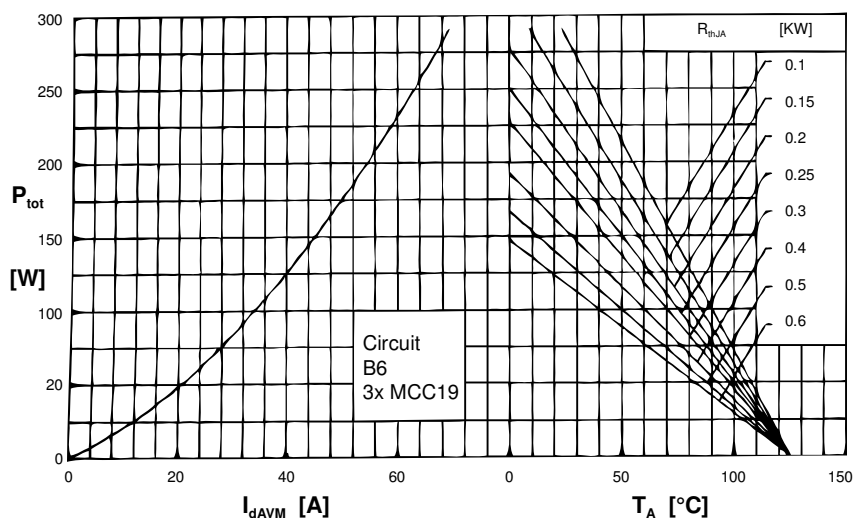


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct
output current and ambient temperature

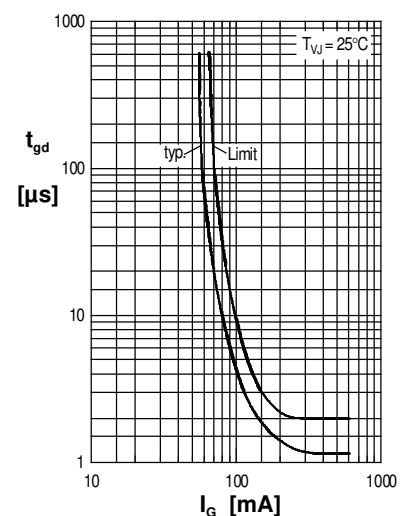


Fig. 7 Gate trigger delay time

Thyristor

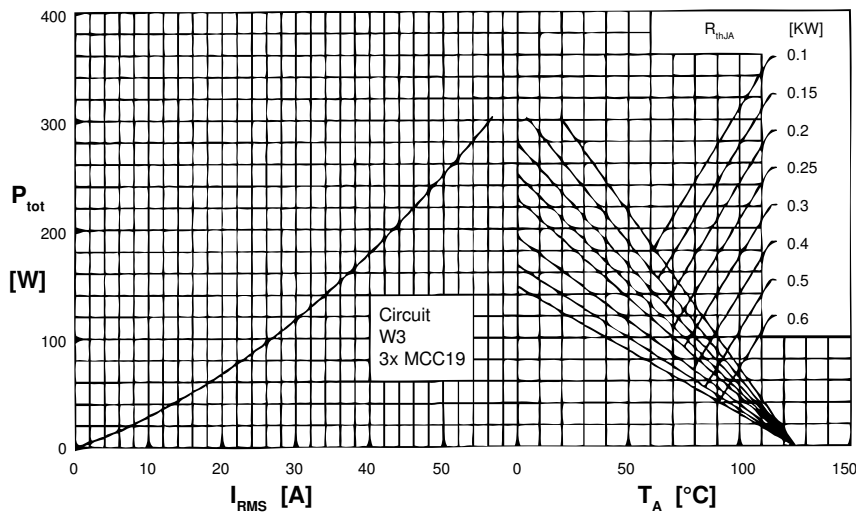


Fig. 8 Three phase AC-controller: Power dissipation vs. RMS output current and ambient temperature

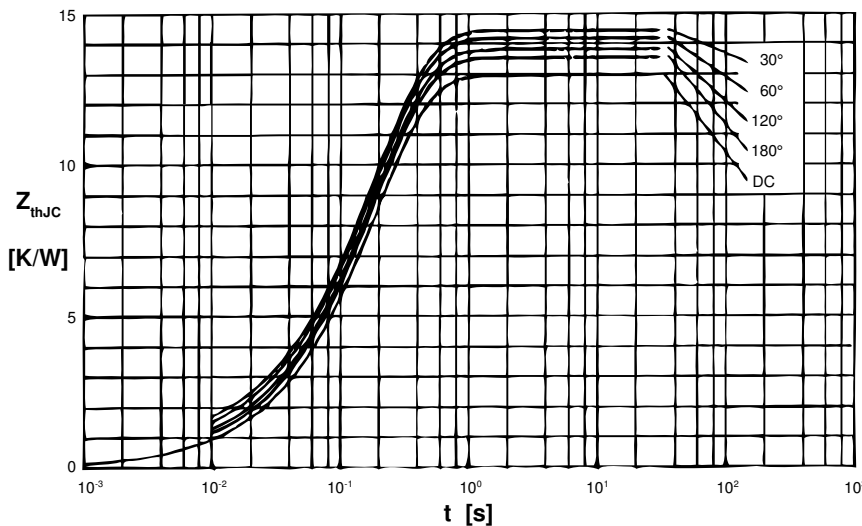


Fig. 9 Transient thermal impedance junction to case (per thyristor)

R_{thJC} for various conduction angles d :

d	R_{thJC} [K/W]
DC	1.30
180°	1.35
120°	1.39
60°	1.42
30°	1.45

Constants for Z_{thJC} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.018	0.0033
2	0.041	0.0216
3	1.241	0.1910

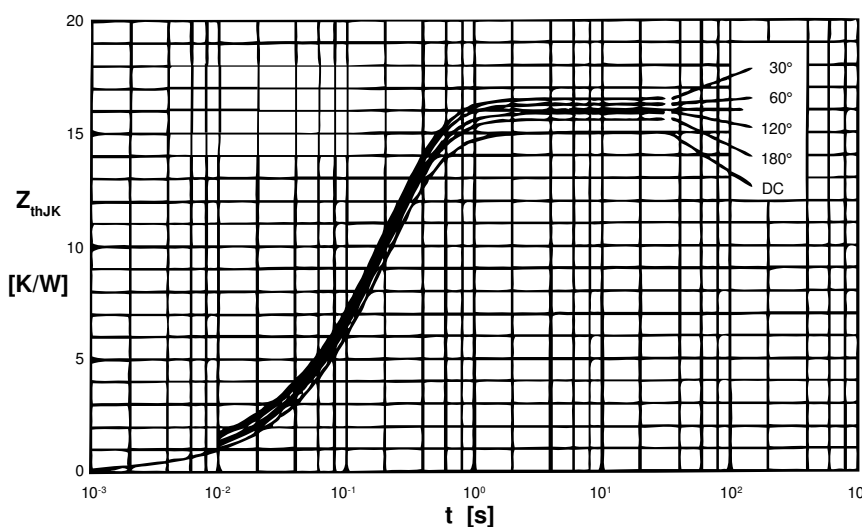


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor)

R_{thJK} for various conduction angles d :

d	R_{thJK} [K/W]
DC	1.50
180°	1.55
120°	1.59
60°	1.62
30°	1.65

Constants for Z_{thJK} calculation:

i	R_{thi} [K/W]	t_i [s]
1	0.018	0.0033
2	0.041	0.0216
3	1.241	0.1910
4	0.200	0.4600