

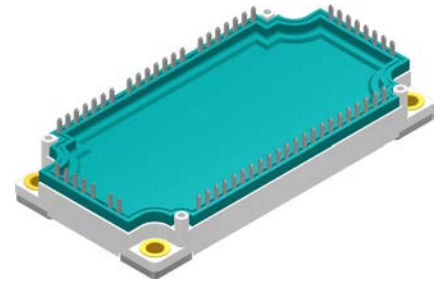
# Thyristor Module

<b>3~ Rectifier</b>
$V_{RRM} = 1600\text{ V}$
$I_{DAV} = 450\text{ A}$
$I_{FSM} = 2400\text{ A}$

3~ Rectifier Bridge, half-controlled (high-side) + NTC

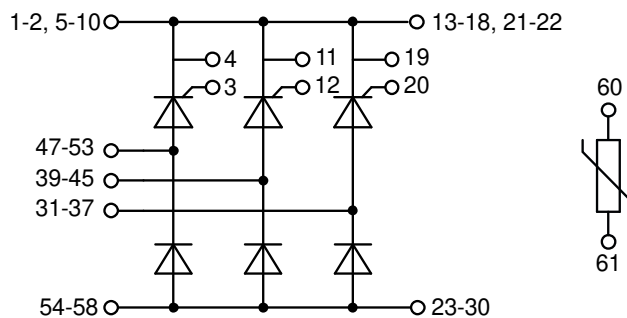
Part number

**MCMA450UH1600TEH**



Backside: isolated

 E72873



### Features / Advantages:

- Package with DCB ceramic
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current

### Applications:

- 3~ half-controlled Rectifier for drive inverters

### Package: E3-Pack

- Isolation Voltage: 4300 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

### Disclaimer Notice

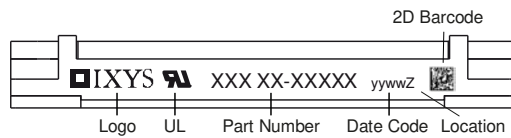
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Rectifier				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1700	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1600	V	
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1600 V$	$T_{VJ} = 25^{\circ}C$		100	$\mu A$	
		$V_{R/D} = 1600 V$	$T_{VJ} = 150^{\circ}C$		15	mA	
$V_T$	forward voltage drop	$I_T = 150 A$	$T_{VJ} = 25^{\circ}C$		1,34	V	
		$I_T = 450 A$			2,10	V	
		$I_T = 150 A$	$T_{VJ} = 125^{\circ}C$		1,31	V	
		$I_T = 450 A$			2,20	V	
$I_{DAV}$	bridge output current	$T_C = 90^{\circ}C$ rectangular $d = 120^{\circ}$	$T_{VJ} = 150^{\circ}C$		450	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0,84	V	
$r_T$	slope resistance				3,1	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				0,17	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0,08		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		735	W	
$I_{TSM}$	max. forward surge current	$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$		2,40	kA	
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		2,59	kA	
		$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 150^{\circ}C$		2,04	kA	
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		2,21	kA	
$I^2t$	value for fusing	$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$		28,8	kA <sup>2</sup> s	
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		27,9	kA <sup>2</sup> s	
		$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 150^{\circ}C$		20,8	kA <sup>2</sup> s	
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		20,2	kA <sup>2</sup> s	
$C_J$	junction capacitance	$V_R = 400V$ $f = 1 MHz$	$T_{VJ} = 25^{\circ}C$		119	pF	
$P_{GM}$	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 150^{\circ}C$		10	W	
		$t_p = 300 \mu s$			5	W	
$P_{GAV}$	average gate power dissipation				0,5	W	
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 150^{\circ}C$ ; $f = 50 Hz$ repetitive, $I_T = 450 A$			150	A/ $\mu s$	
		$t_p = 200 \mu s$ ; $di_G/dt = 0,45 A/\mu s$ ; $I_G = 0,45A$ ; $V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 150 A$			500	A/ $\mu s$	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$ ; method 1 (linear voltage rise)	$T_{VJ} = 150^{\circ}C$		1000	V/ $\mu s$	
$V_{GT}$	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		1,5	V	
			$T_{VJ} = -40^{\circ}C$		1,6	V	
$I_{GT}$	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		150	mA	
			$T_{VJ} = -40^{\circ}C$		200	mA	
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}C$		0,2	V	
$I_{GD}$	gate non-trigger current				10	mA	
$I_L$	latching current	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$		200	mA	
		$I_G = 0,45A$ ; $di_G/dt = 0,45 A/\mu s$					
$I_H$	holding current	$V_D = 6 V$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		200	mA	
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$ $I_G = 0,45A$ ; $di_G/dt = 0,45 A/\mu s$	$T_{VJ} = 25^{\circ}C$		2	$\mu s$	
$t_q$	turn-off time	$V_R = 100 V$ ; $I_T = 150A$ ; $V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s$ ; $dv/dt = 20 V/\mu s$ ; $t_p = 200 \mu s$	$T_{VJ} = 125^{\circ}C$		185	$\mu s$	



Package E3-Pack		Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			50	A
$T_{VJ}$	virtual junction temperature		-40		150	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage temperature		-40		125	°C
<b>Weight</b>				270		g
$M_D$	mounting torque		3		6	Nm
$d_{Spp/App}$	creepage distance on surface   striking distance through air	terminal to terminal	6,0			mm
$d_{Spb/Apb}$		terminal to backside	12,0			mm
$V_{ISOL}$	isolation voltage	t = 1 second t = 1 minute	4300			V
		50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	3600			V



**Part description**

- M = Module
- C = Thyristor (SCR)
- M = Thyristor
- A = (up to 1800V)
- 450 = Current Rating [A]
- UH = 3- Rectifier Bridge, half-controlled (high-side)
- 1600 = Reverse Voltage [V]
- T = Thermistor \ Temperature sensor
- EH = E3-Pack

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCMA450UH1600TEH	MCMA450UH1600TEH	Box	5	521901

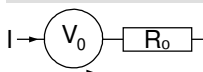
**Temperature Sensor NTC**

Symbol	Definition	Conditions	min.	typ.	max.	Unit
$R_{25}$	resistance	$T_{VJ} = 25^\circ$	4,85	5	5,15	kΩ
$B_{25/50}$	temperature coefficient			3375		K

**Equivalent Circuits for Simulation**

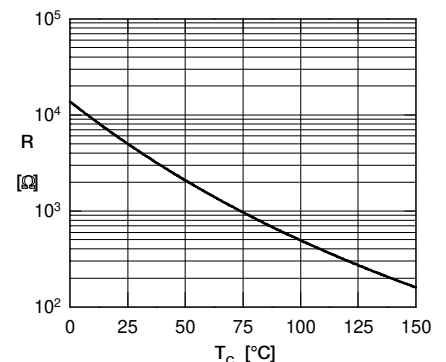
\* on die level

$T_{VJ} = 150^\circ\text{C}$



Thyristor

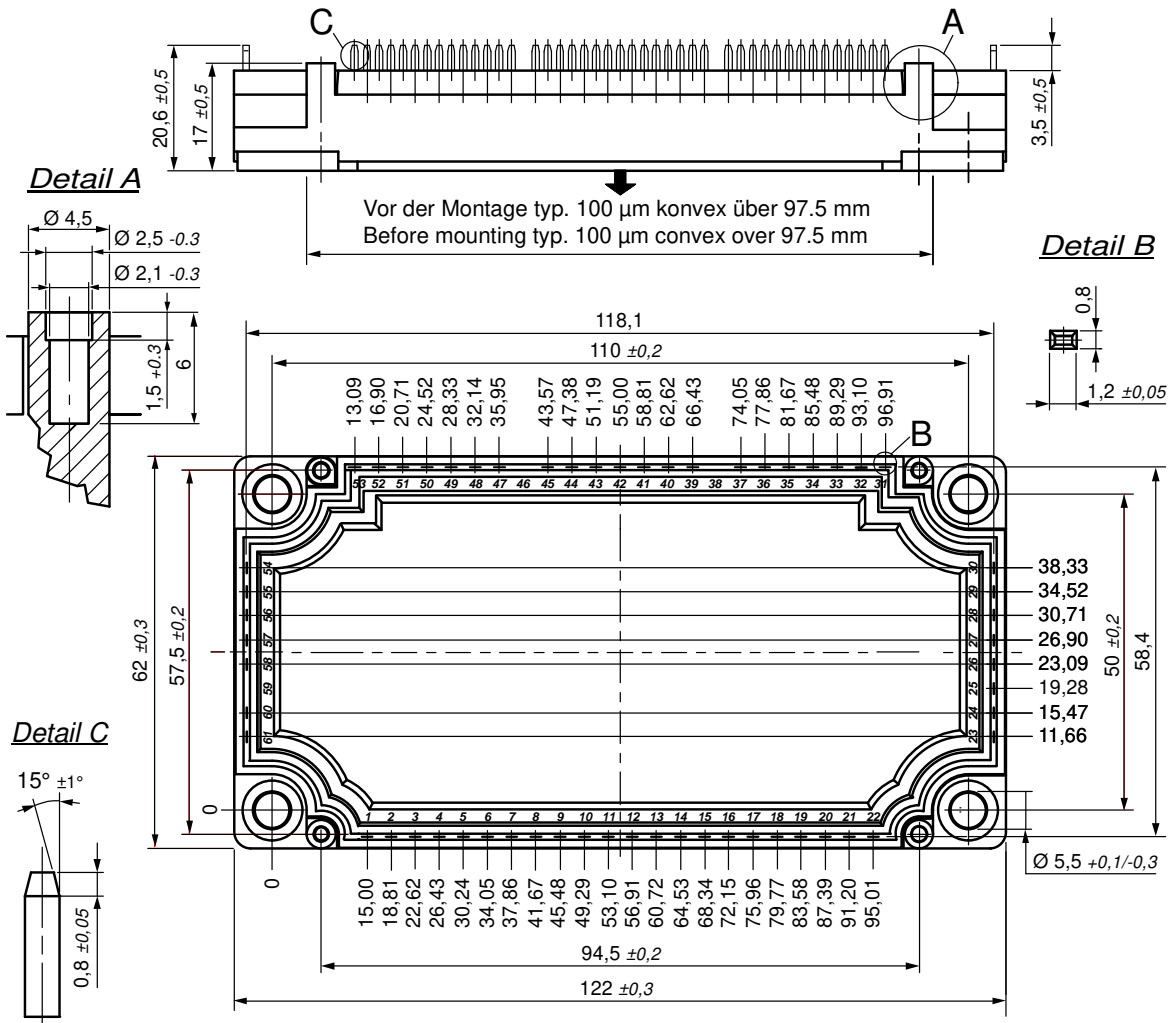
$V_{0\ max}$	threshold voltage	0,84				V
$R_{0\ max}$	slope resistance *	1,65				mΩ



Typ. NTC resistance vs. temperature



**Outlines E3-Pack**

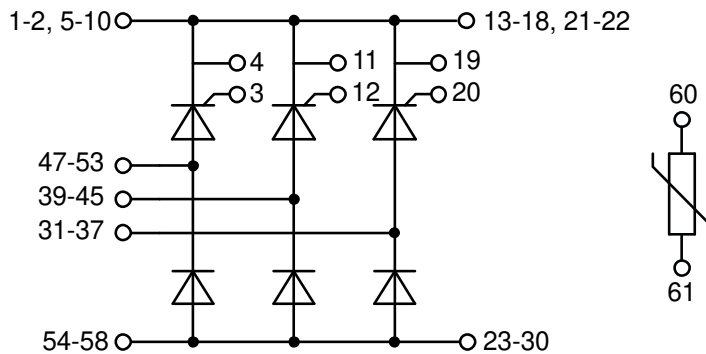


**Bemerkung / Note:**

- Nichttolerierete Maße nach / Measure without tolerances according DIN ISO 2768-T1-m
- PCB-Lochmuster / PCB hole pattern: **see pin position**
- Toleranz Pin-Position und PCB-Lochmuster / Tolerance of pin position and PCB hole pattern:  $\pm 0.1$
- Montageanleitung / Mounting instruction: [www.ixys.com](http://www.ixys.com) **Application note IXAN0024**

**Detail A:** PCB-Montage / Mounting on PCB

- Empfohlene, selbstschneidende Schraube / Recommended, self-tapping screw: **EJOT PT®** (Größe / size: **K25**)
- Max. Schraubenlänge / Max. screw length: **PCB-Dicke / thickness + 6 mm** (max. Lochtiefe / hole depth)
- Empfohlenes Drehmoment / Recommended mounting torque: **1.5 Nm**



## Thyristor

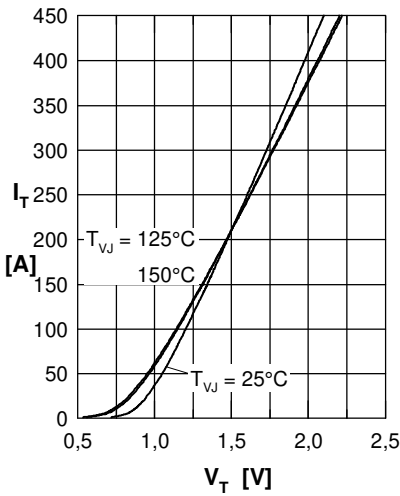


Fig. 1 Forward characteristics

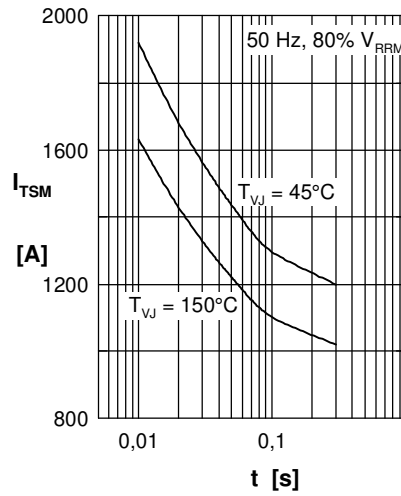


Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value, t: duration

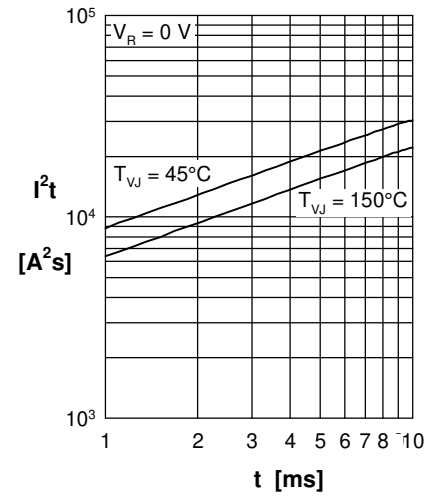


Fig. 3  $I^2t$  versus time (1-10 s)

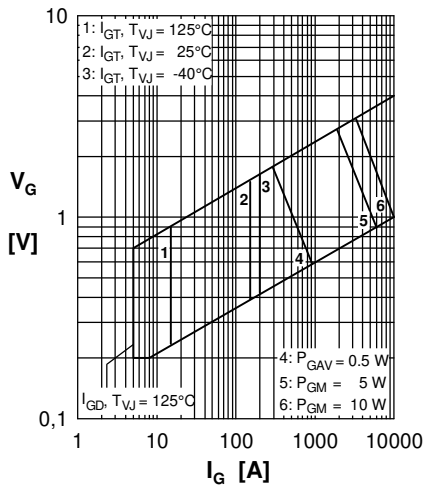


Fig. 4 Gate voltage & gate current

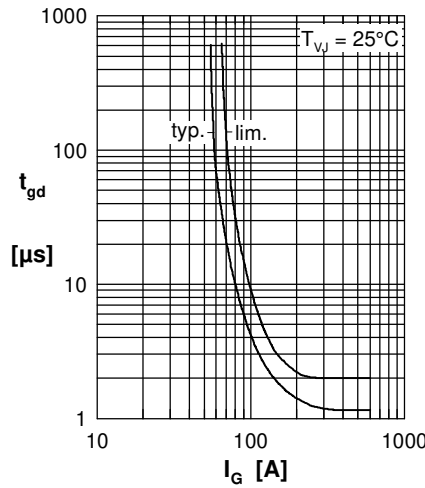


Fig. 5 Gate controlled delay time  $t_{gd}$

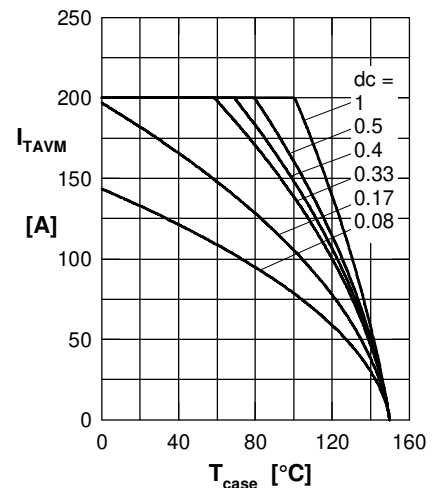


Fig. 6 Max. forward current at case temperature

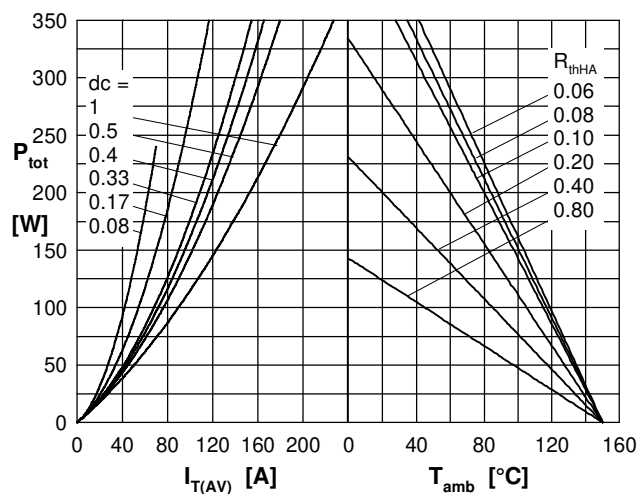


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

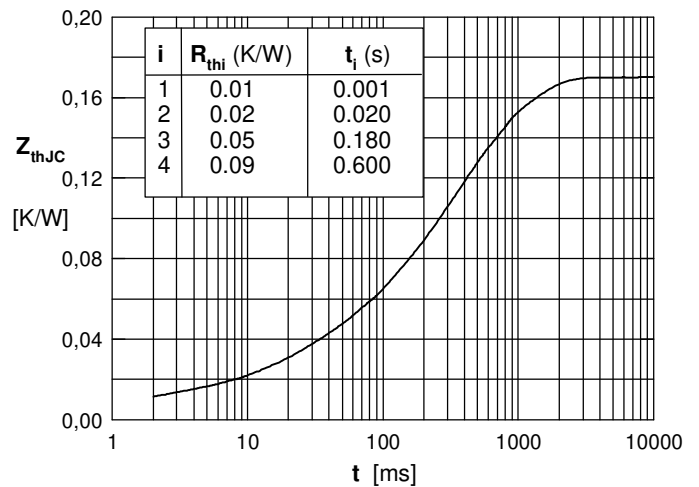


Fig. 8 Transient thermal impedance junction to case