

# Thyristor \ Diode Module

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

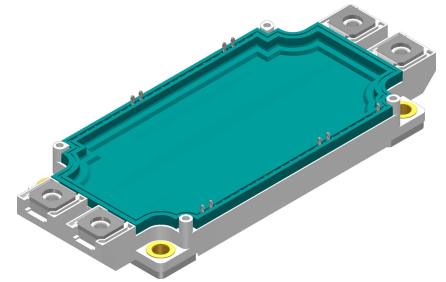
$$I_{TAV} = 400 \text{ A}$$

$$V_T = 1.28 \text{ V}$$

Phase leg + NTC

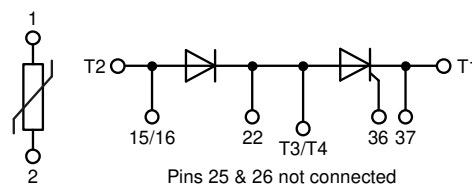
Part number

**MCMA400PD1600PTSF**



Backside: isolated

 E72873



### Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al<sub>2</sub>O<sub>3</sub>-ceramic

### Applications:

- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

### Package: SimBus F

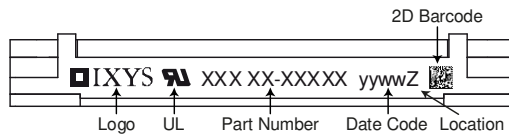
- Isolation Voltage: 4300 V~
- Industry standard outline
- RoHS compliant
- PressFit-Pins for PCB mounting
- Height: 17 mm
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

### 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			$T_{VJ} = 25^{\circ}\text{C}$		1700	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage			$T_{VJ} = 25^{\circ}\text{C}$		1600	V
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1600\text{ V}$		$T_{VJ} = 25^{\circ}\text{C}$		300	$\mu\text{A}$
		$V_{R/D} = 1600\text{ V}$		$T_{VJ} = 140^{\circ}\text{C}$		20	mA
$V_T$	forward voltage drop	$I_T = 400\text{ A}$		$T_{VJ} = 25^{\circ}\text{C}$		1.31	V
		$I_T = 800\text{ A}$				1.70	V
		$I_T = 400\text{ A}$		$T_{VJ} = 125^{\circ}\text{C}$		1.28	V
		$I_T = 800\text{ A}$				1.74	V
$I_{TAV}$	average forward current	$T_C = 85^{\circ}\text{C}$		$T_{VJ} = 140^{\circ}\text{C}$		400	A
$I_{T(RMS)}$	RMS forward current	sine $180^{\circ}$	$d = 0.5$			630	A
$V_{T0}$	threshold voltage	} for power loss calculation only		$T_{VJ} = 140^{\circ}\text{C}$		0.82	V
$r_T$	slope resistance					1.14	$\text{m}\Omega$
$R_{thJC}$	thermal resistance junction to case					0.07	K/W
$R_{thCH}$	thermal resistance case to heatsink				0.04		K/W
$P_{tot}$	total power dissipation			$T_C = 25^{\circ}\text{C}$		1640	W
$I_{TSM}$	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$		$T_{VJ} = 45^{\circ}\text{C}$		10.0	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$		$V_R = 0\text{ V}$		10.8	kA
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$		$T_{VJ} = 140^{\circ}\text{C}$		8.50	kA
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$		$V_R = 0\text{ V}$		9.18	kA
$I^2t$	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$		$T_{VJ} = 45^{\circ}\text{C}$		500.0	$\text{kA}^2\text{s}$
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$		$V_R = 0\text{ V}$		485.2	$\text{kA}^2\text{s}$
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$		$T_{VJ} = 140^{\circ}\text{C}$		361.3	$\text{kA}^2\text{s}$
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$		$V_R = 0\text{ V}$		350.6	$\text{kA}^2\text{s}$
$C_J$	junction capacitance	$V_R = 400\text{ V } f = 1\text{ MHz}$		$T_{VJ} = 25^{\circ}\text{C}$	482		pF
$P_{GM}$	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$		$T_C = 140^{\circ}\text{C}$		120	W
		$t_p = 300\text{ }\mu\text{s}$				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, $I_T = 1200\text{ A}$		100	$\text{A}/\mu\text{s}$
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$		non-repet., $I_T = 400\text{ A}$		500	$\text{A}/\mu\text{s}$
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$		$T_{VJ} = 140^{\circ}\text{C}$		1000	$\text{V}/\mu\text{s}$
		$R_{GK} = \infty$ ; 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	$\mu\text{s}$
		$I_G = 0.5\text{ A}; di_G/dt = 0.5\text{ A}/\mu\text{s}$					
$t_q$	turn-off time	$V_R = 100\text{ V}; I_T = 400\text{ A}; V = \frac{2}{3} V_{DRM}$		$T_{VJ} = 125^{\circ}\text{C}$	350		$\mu\text{s}$
		$di/dt = 10\text{ A}/\mu\text{s } dv/dt = 50\text{ V}/\mu\text{s } t_p = 200\text{ }\mu\text{s}$					

Package SimBus F		Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			tdb	A
$T_{VJ}$	virtual junction temperature		-40		140	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage temperature		-40		125	°C
<b>Weight</b>				350		g
$M_D$	mounting torque		3		6	Nm
$M_T$	terminal torque		3		6	Nm
$d_{Spp/App}$	creepage distance on surface   striking distance through air	terminal to terminal	13.3	10.0		mm
$d_{Spb/Apb}$		terminal to backside	10.2	10.2		mm
$V_{ISOL}$	isolation voltage	t = 1 second	4300			V
		t = 1 minute	3600			V


**Part description**

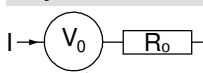
M = Module  
 C = Thyristor (SCR)  
 M = Thyristor  
 A = (up to 1800V)  
 400 = Current Rating [A]  
 PD = Phase leg  
 1600 = Reverse Voltage [V]  
 PT = PressFit-Pin, Thermistor  
 SF = SimBus F  
 - = Hyphen  
 PC = Phase Change Material

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	MCMA400PD1600PTSF	MCMA400PD1600PTSF	Blister	24	522726
Alternative	MCMA400PD1600PTSF-PC	MCMA400PD1600PTSF	Blister	24	522719

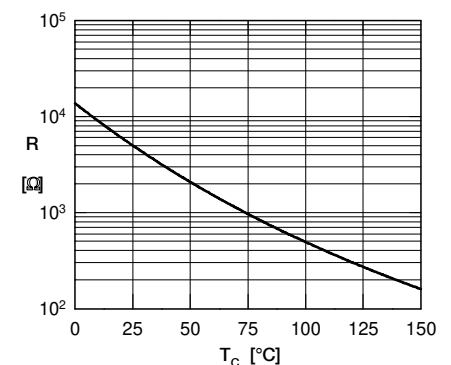
Similar Part	Package	Voltage class
MCMA280PD1600PTSF	SimBus F	1600
MCMA550PD1600PTSF	SimBus F	1600

**Temperature Sensor NTC**

Symbol	Definition	Conditions	min.	typ.	max.	Unit
$R_{25}$	resistance	$T_{VJ} = 25^\circ$	4.85	5	5.15	k $\Omega$
$B_{25/50}$	temperature coefficient			3375		K

**Equivalent Circuits for Simulation**
*\* on die level*
 $T_{VJ} = 140^\circ\text{C}$ 

**Thyristor**

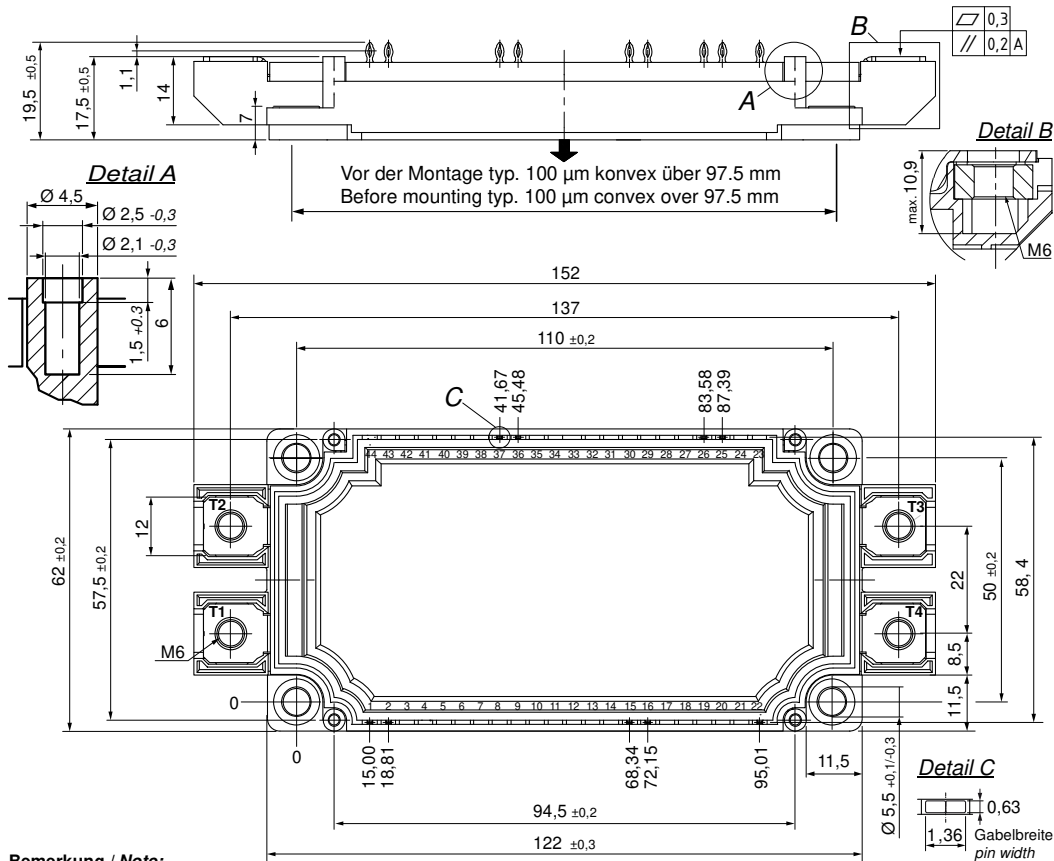
$V_{0\max}$	threshold voltage	0.82				V
$R_{0\max}$	slope resistance *	0.43				m $\Omega$



Typ. NTC resistance vs. temperature



**Outlines SimBus F**

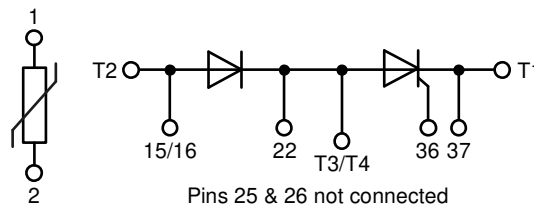


**Bemerkung / Note:**

- Nichttolerierete Maße nach / Measure w/o tolerances acc. 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:  $\oplus 0.1$
- Bohrlochdurchmesser / Diameter of drill:  $\varnothing 1.16$  mm
- Endlochdurchmesser / Diameter of plated holes:  $\varnothing 1.00 - 1.10$  mm (Cu thickness in via typ. 50  $\mu\text{m}$ )
- Beschichtung / Plating: chem. Sn max. 15  $\mu\text{m}$
- Einpresskraft / Insert Force: per terminal with a typ. insert speed of 1 mm/s: typ. 90 N
- Weitere Angaben / Further information: [www.ixys.com](http://www.ixys.com) Application note IXAN0077
- Montageanleitung / Mounting instruction: [www.ixys.com](http://www.ixys.com) Application note IXAN0024

**Detail A: PCB-Montage / Mounting on PCB<sup>L</sup>**

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



## Thyristor

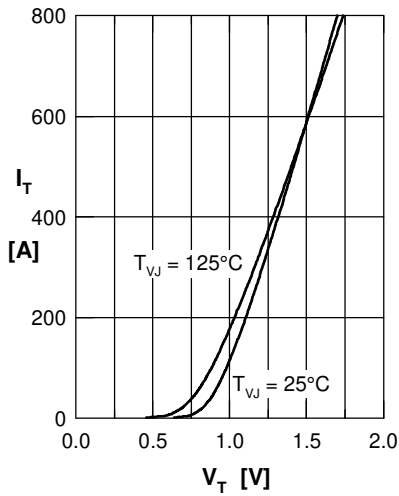


Fig. 1 Forward characteristics

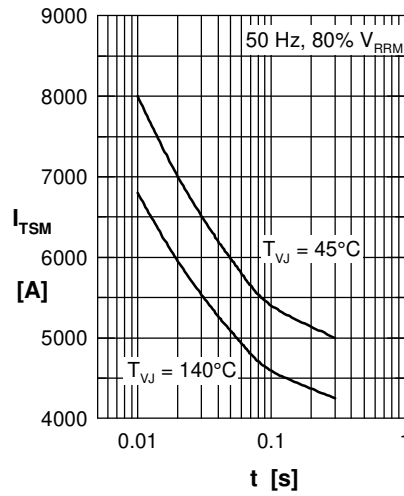


Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

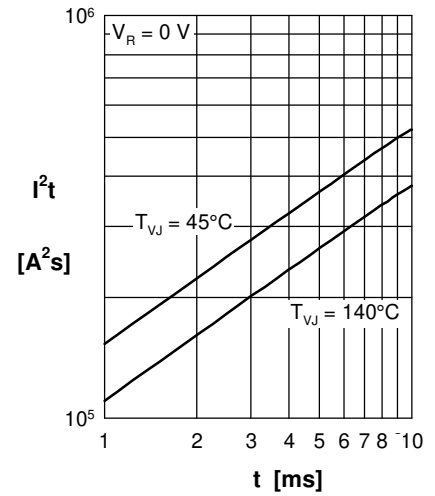


Fig. 3  $I^2t$  versus time (1-10 s)

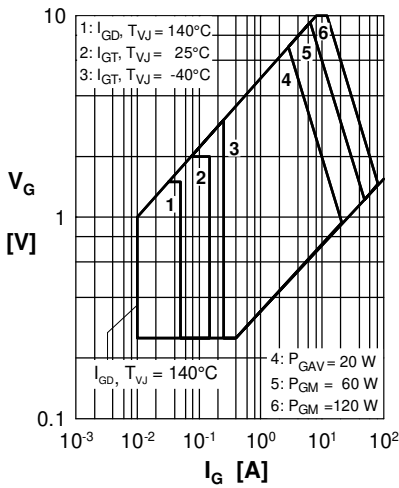


Fig. 4 Gate voltage & gate current

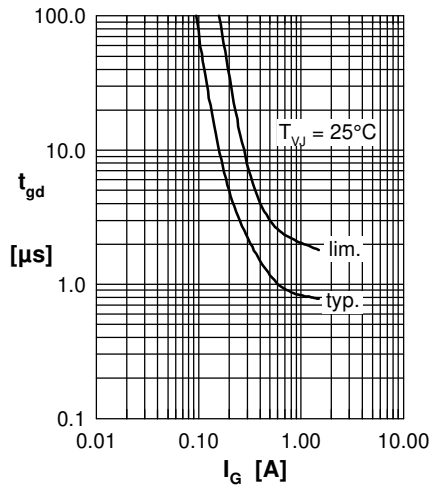


Fig. 5 Gate controlled delay time  $t_{gd}$

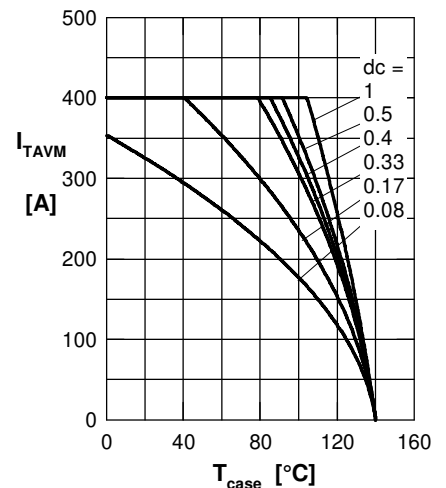


Fig. 6 Max. forward current at case temperature

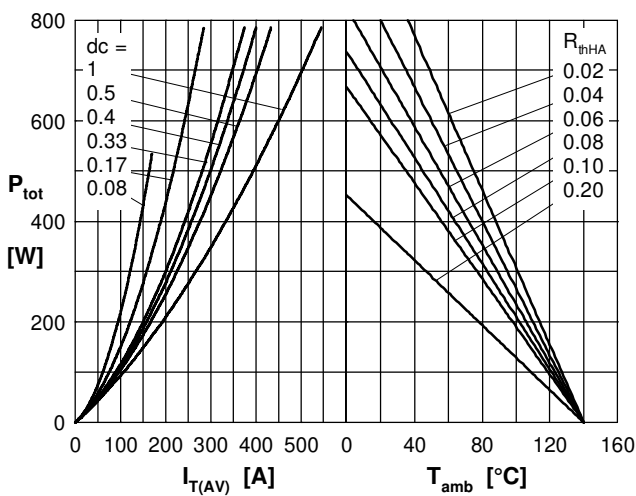


Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature

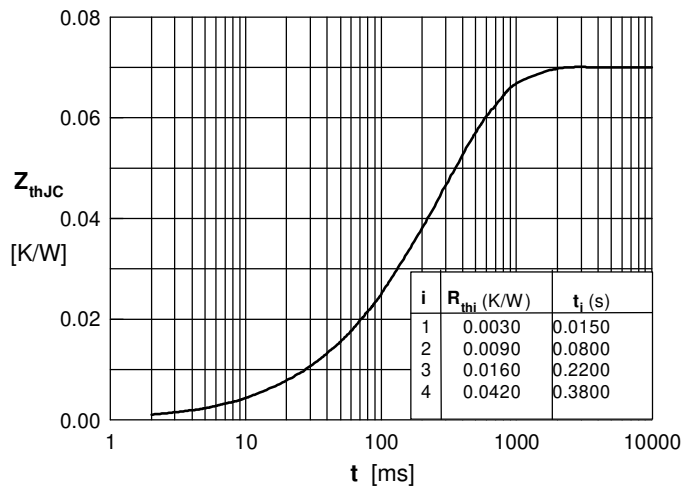


Fig. 8 Transient thermal impedance junction to case