

# Thyristor Module

$$V_{RRM} = 1200 \text{ V}$$

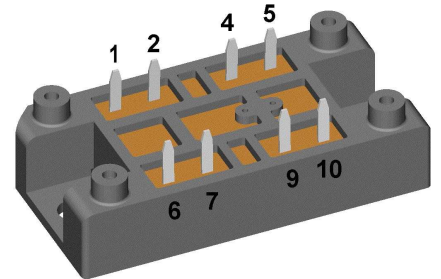
$$I_{TAV} = 27 \text{ A}$$

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


AC Controlling  
 2~ full-controlled

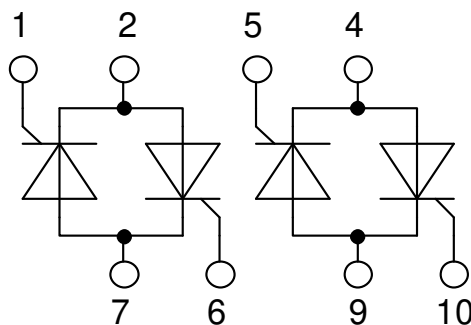
Part number

**VW2x60-12io1**



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: V1-A-Pack

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 17 mm
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

### 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	$T_{VJ} = 25^{\circ}\text{C}$			1300	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}\text{C}$			1200	V
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		100	$\mu\text{A}$
		$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		5	mA
$V_T$	forward voltage drop	$I_T = 40\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		1.25	V
		$I_T = 80\text{ A}$			1.65	V
		$I_T = 40\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$		1.28	V
		$I_T = 80\text{ A}$			1.75	V
$I_{TAV}$	average forward current	$T_C = 85^{\circ}\text{C}$	$T_{VJ} = 125^{\circ}\text{C}$		27	A
$I_{RMS}$	RMS forward current per phase	180° sine			60	A
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}\text{C}$		0.85	V
$r_T$	slope resistance				11	m $\Omega$
$R_{thJC}$	thermal resistance junction to case				0.92	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.3		K/W
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$		110	W
$I_{TSM}$	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		520	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		560	A
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$		440	A
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		475	A
$I^2t$	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		1.35	kA <sup>2</sup> s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		1.31	kA <sup>2</sup> s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$		970	A <sup>2</sup> s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		940	A <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400\text{ V } f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		64	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, $I_T = 45\text{ A}$			100	A/ $\mu\text{s}$
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ $I_G = 0.45\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 27\text{ A}$			500	A/ $\mu\text{s}$
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$ ; method 1 (linear voltage rise)	$T_{VJ} = 125^{\circ}\text{C}$		1000	V/ $\mu\text{s}$
$V_{GT}$	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	$\mu\text{s}$
		$I_G = 0.45\text{ A}; di_G/dt = 0.45\text{ A}/\mu\text{s}$				
$t_q$	turn-off time	$V_R = 100\text{ V}; I_T = 20\text{ A}; V = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s } dv/dt = 15\text{ V}/\mu\text{s } t_p = 200\text{ }\mu\text{s}$	$T_{VJ} = 100^{\circ}\text{C}$		150	$\mu\text{s}$



Package V1-A-Pack		Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			100	A
$T_{VJ}$	virtual junction temperature		-40		125	°C
$T_{op}$	operation temperature		-40		100	°C
$T_{stg}$	storage temperature		-40		125	°C
<b>Weight</b>				37		g
$M_D$	mounting torque		2		2.5	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	3600			V
		t = 1 minute	3000			V



Data Matrix: Typ (1-19), DC+Prod.Index (20-25), FKT# (26-31)  
leer (33), lld.# (33-36)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	VW2x60-12io1	VW2x60-12io1	Blister	24	519000

**Equivalent Circuits for Simulation**

\* on die level

$T_{VJ} = 125^{\circ}C$

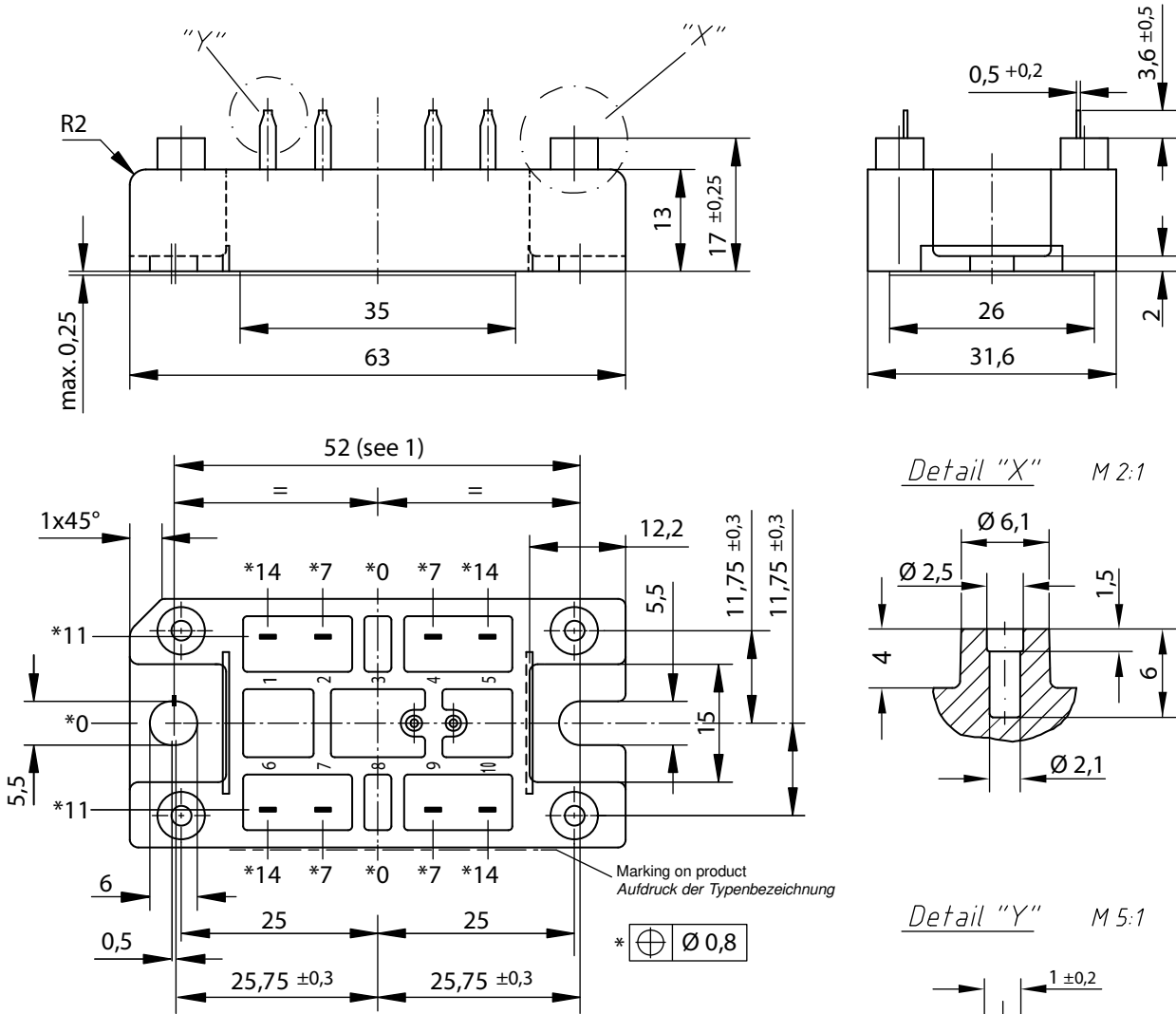


**Thyristor**

$V_{0\ max}$	threshold voltage	0.85	V
$R_{0\ max}$	slope resistance *	8.5	mΩ

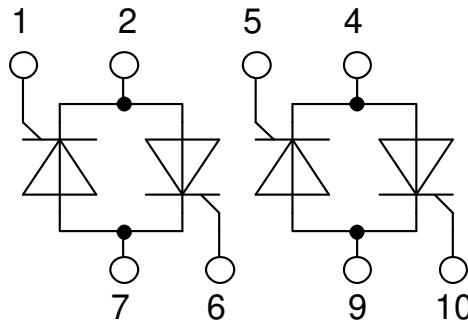


**Outlines V1-A-Pack**



**Remarks / Bemerkungen:**

1. Nominal distance mounting screws on heat sink: 52 mm / Nennabstand Befestigungsschrauben auf Kühlkörper: 52 mm
  2. General tolerance / Allgemeintoleranz: DIN ISO 2768 -T1-c
  3. Surface treatment of pins: tin plated (Sn) in hot dip / Oberflächenbehandlung der Pins: verzinkt (Sn) im Tauchbad
  4. Detail X:<sup>L</sup>  
EJOT PT® self-tapping screws (dimension K25) to be recommended for mounting on PCB<sup>L</sup>  
*selbstschneidende Schraube (Größe K25) empfohlen für die PCB-Montage*
- Take care on the maximum screw length according to board thickness and the maximum hole depth of 6 mm<sup>L</sup>  
Bei der Wahl der Schraubenlänge die PCB-Dicke und die maximale Lochtiefe von 6mm beachten
- Recommended mounting torque: 1.5 Nm / Empfohlenes Drehmoment: 1.5 Nm



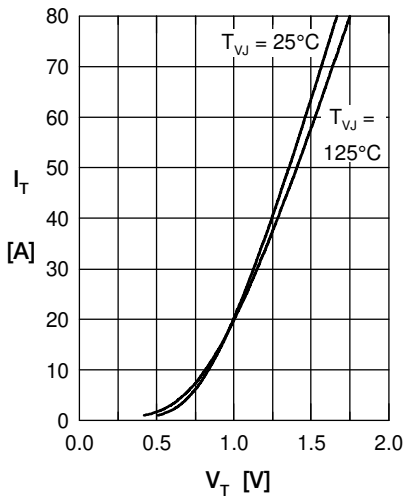
**Thyristor**


Fig. 1 Forward characteristics

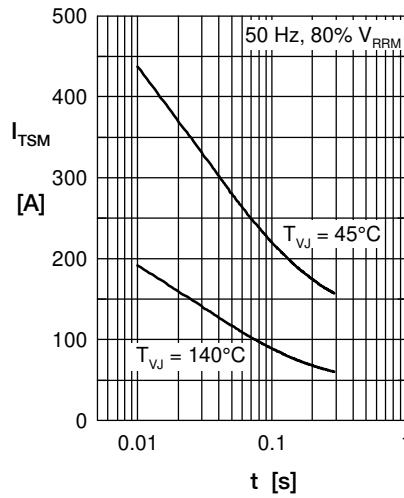
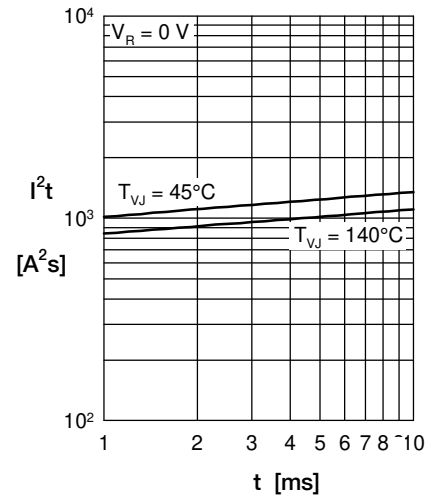
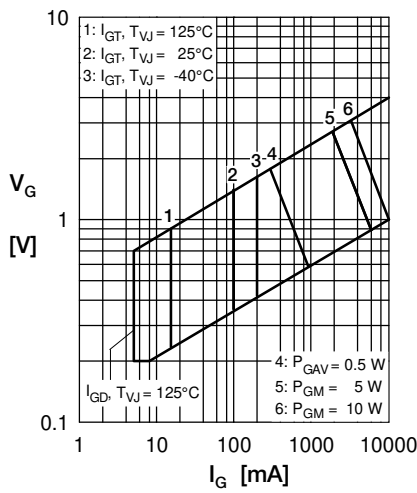

 Fig. 2 Surge overload current  $I_{TSM}$ ; crest value, t: duration

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


Fig. 4 Gate voltage &amp; gate current

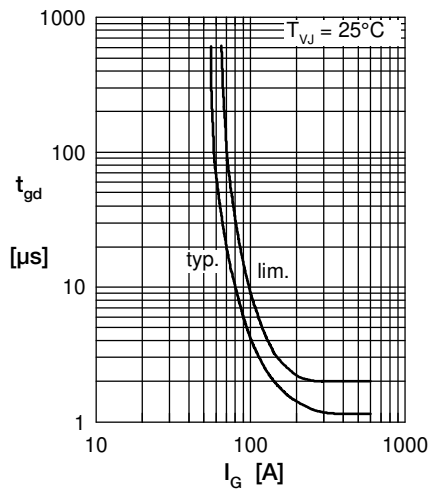
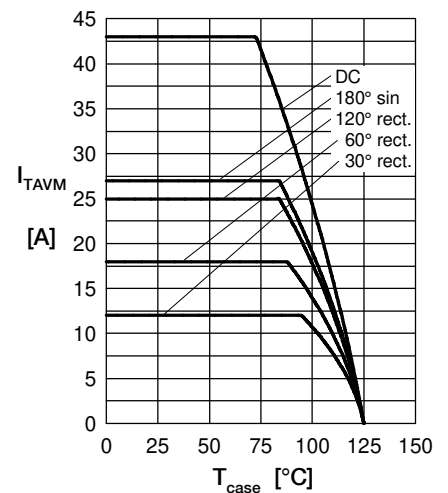

 Fig. 5 Gate controlled delay time  $t_{gd}$ 


Fig. 6 Max. forward current at case temperature

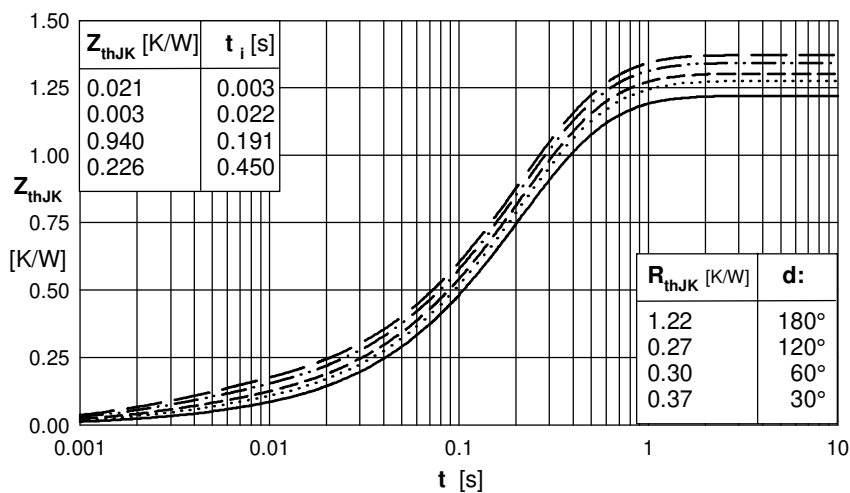


Fig. 7 Transient thermal impedance junction to heatsink (per thyristor)

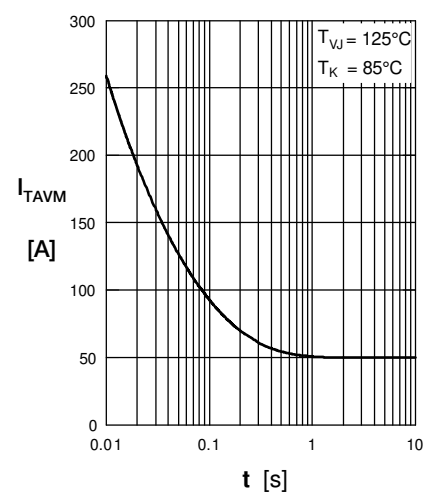


Fig. 8 Rated RMS current vs. time (360° conduction)



**Rectifier**

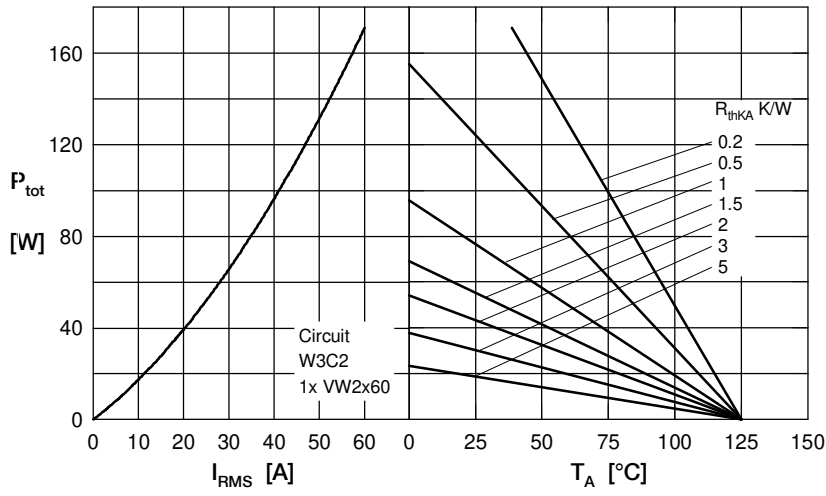


Fig. 9 Load current capability for two phase AC controller

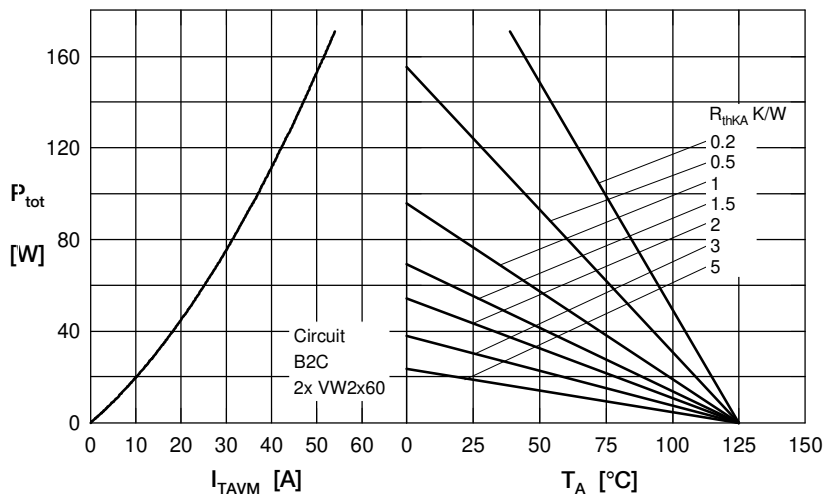


Fig. 10 Power dissipation vs. direct output current and ambient temperature cyclo converter, four quadrant operation