

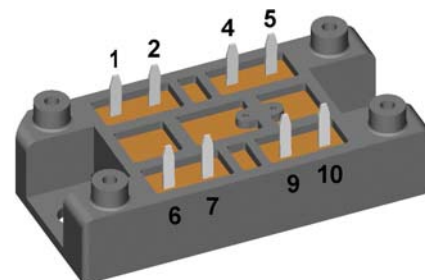
Thyristor Module

$$\begin{aligned} V_{RRM} &= 1600V \\ I_{TAV} &= 27A \\ V_T &= 1.28V \end{aligned}$$

2~ full-controlled

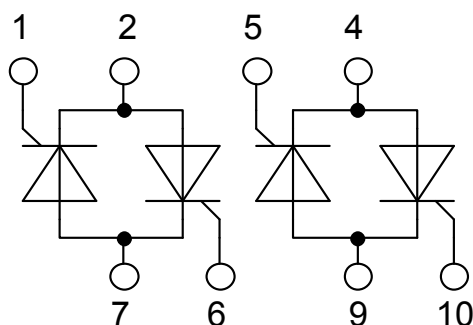
Part number

VW2x60-16io1



Backside: isolated

 E72873



Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al₂O₃-ceramic

Applications:

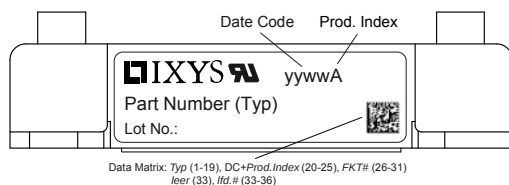
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

Package: 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

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	$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$			100	μA
		$V_{R/D} = 1600\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$			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 Ω
R_{thJC}	thermal resistance junction to case					0.92	K/W
R_{thCH}	thermal resistance case to heatsink				0.30		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 ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			1.31	kA ² s
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 125^{\circ}\text{C}$			970	A ² s
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$			940	A ² 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/ μs
		$t_P = 200\text{ }\mu\text{s}; di_G/dt = 0.45\text{ A}/\mu\text{s};$ $I_G = 0.45\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 27\text{ A}$				500	A/ μs
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$ $R_{GK} = \infty$; method 1 (linear voltage rise)				1000	V/ μs
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	$V_R = 100\text{ V}; I_T = 20\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 15\text{ V}/\mu\text{s}; t_P = 200\text{ }\mu\text{s}$			150		μs

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
Weight					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	50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA	3600			V
		t = 1 minute		3000			V

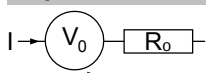


Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	VW2x60-16io1	VW2x60-16io1	Box	10	471410

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 *	8.5	mΩ

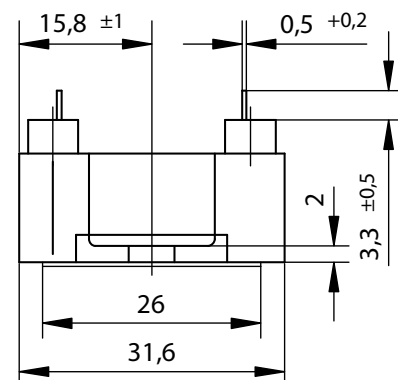
Technical drawing of a mechanical part, showing three views: front view (top), top view (bottom), and side view (right).

Front View (Top):

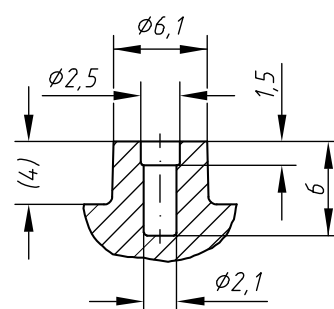
- Overall width: 63
- Overall height: 17 $\pm 0,25$
- Height of the main body: 13
- Radius of the top edge: R2
- Two circular features are highlighted with dashed circles and labeled "Y" and "X".
- Dimension 35 indicates the distance between the centers of the two circular features.
- Dimension 0,25 indicates the thickness of the part.

Top View (Bottom):

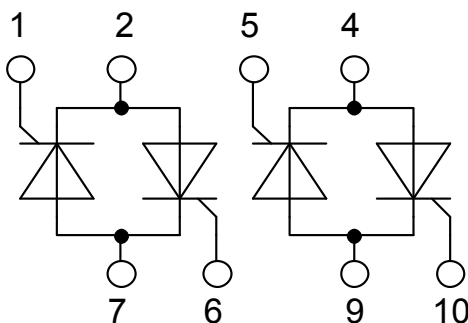
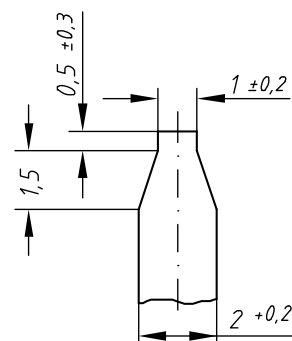
- Overall width: 51,5 $\pm 0,3$
- Overall height: 23,5 $\pm 0,1$
- Radius of the top edge: R1
- Radius of the bottom edge: R
- Four corner chamfers are indicated: 4x45°
- Dimensions for the central rectangular area:
 - Width: 38,6
 - Height: 14 $\pm 0,3$
 - Distance between centers of the four circular features: 7 $\pm 0,3$
- Dimensions for the side features:
 - Distance from the left edge to the center of the left circular feature: 11 $\pm 0,3$
 - Distance from the right edge to the center of the right circular feature: 11 $\pm 0,3$
 - Distance from the top edge to the center of the top circular feature: 11 $\pm 0,3$
 - Distance from the bottom edge to the center of the bottom circular feature: 11 $\pm 0,3$
 - Distance from the left edge to the center of the left circular feature: 5,5
 - Distance from the right edge to the center of the right circular feature: 5,5
 - Distance from the top edge to the center of the top circular feature: 5,5
 - Distance from the bottom edge to the center of the bottom circular feature: 5,5
- Dimensions for the central rectangular area:
 - Width: 25,75 $\pm 0,15$
 - Height: 15



Detail "X" M 2:1



Detail "Y" M 5:1



Thyristor

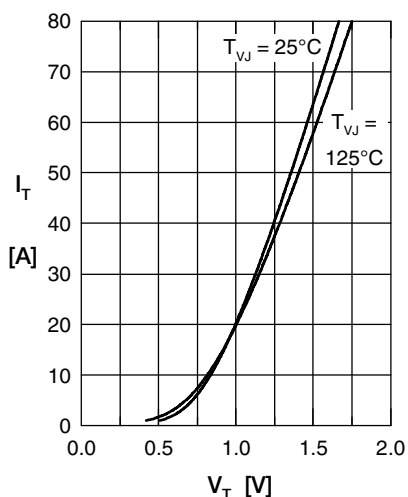


Fig. 1 Forward characteristics

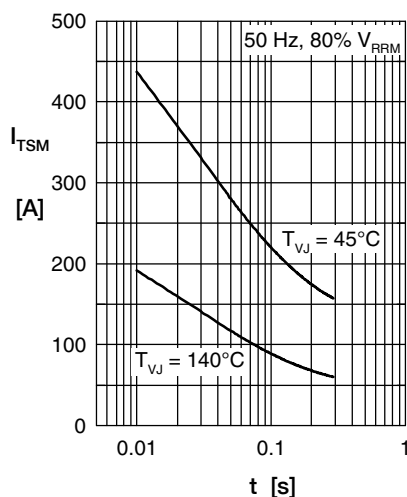


Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

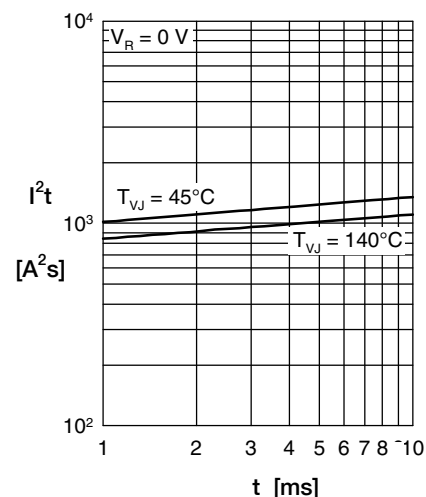


Fig. 3 I^2t versus time (1-10 s)

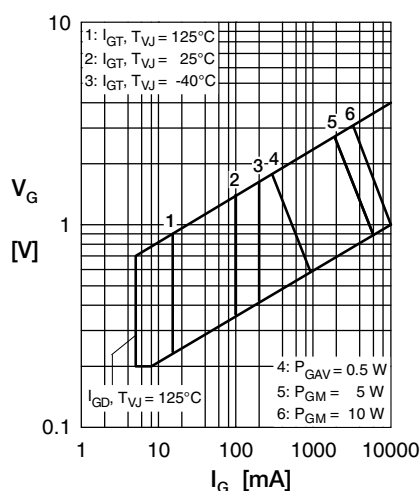


Fig. 4 Gate voltage & gate current

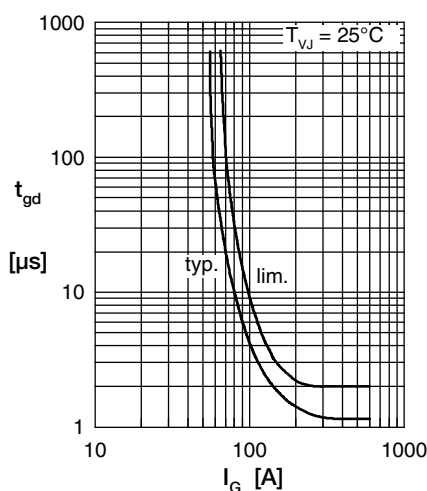


Fig. 5 Gate controlled delay time t_{gd}

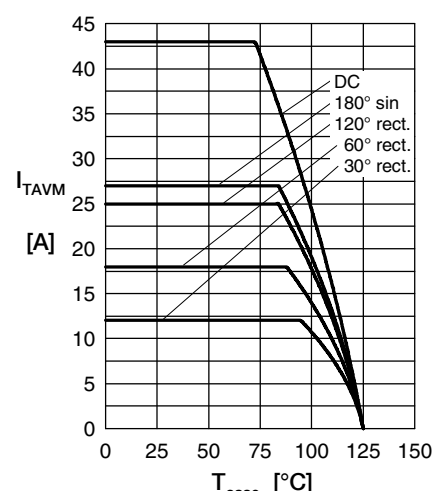


Fig. 6 Max. forward current at case temperature

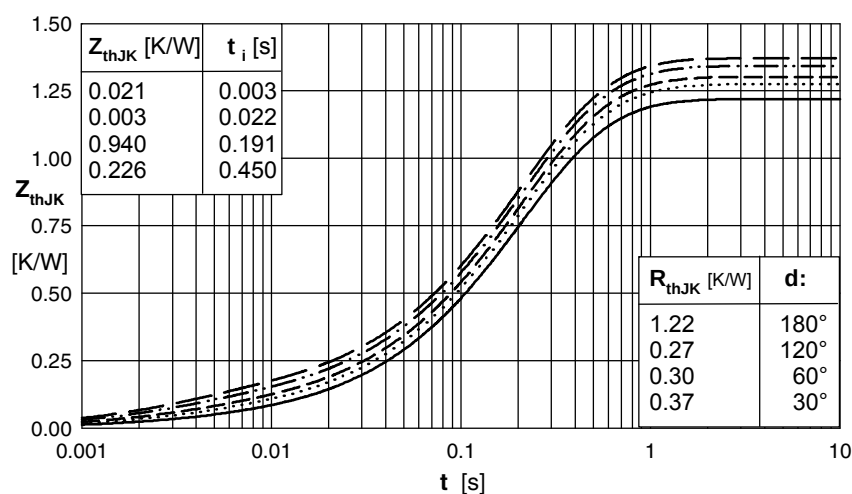


Fig. 7 Transient thermal impedance junction to heatsink (per thyristor)

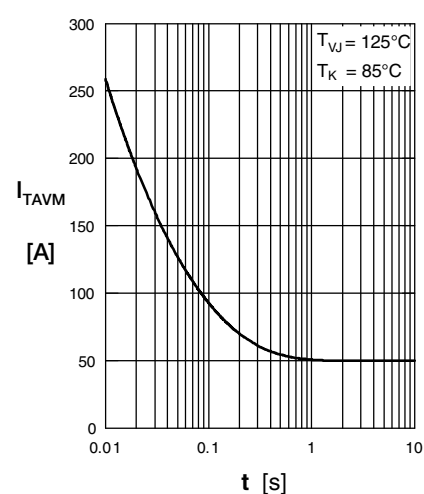


Fig. 8 Rated RMS current vs. time
(360° conduction)

Rectifier

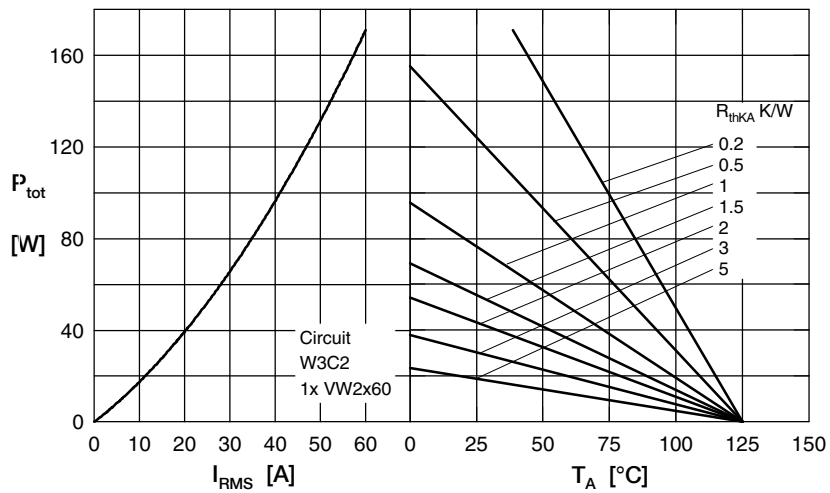


Fig. 9 Load current capability for two phase AC controller

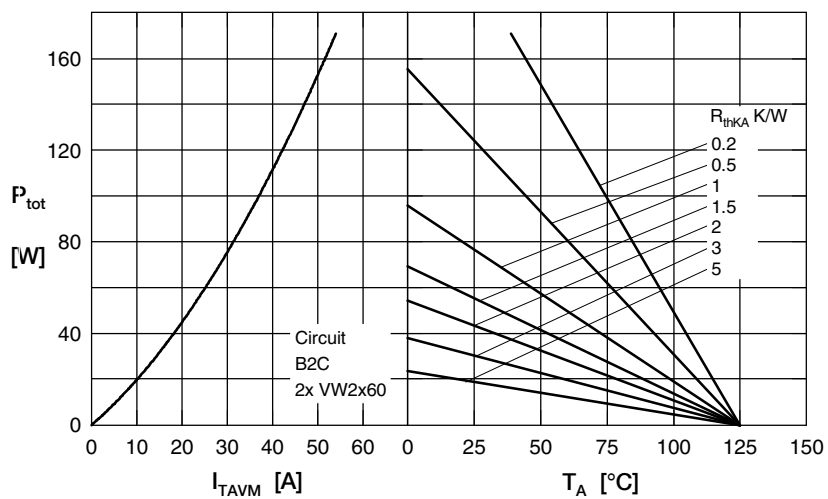


Fig. 10 Power dissipation vs. direct output current and ambient temperature cyclo converter, four quadrant operation