

# Thyristor

$$V_{RRM} = 1600V$$

$$I_{TAV} = 50A$$

$$V_T = 1.31V$$

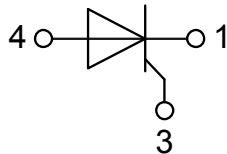
## Single Thyristor

Part number

CMA50E1600TZ



Backside: anode



### Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability

### Applications:

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

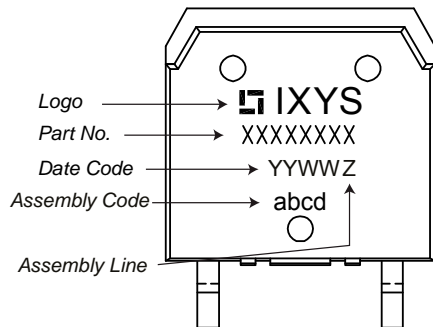
### Package: TO-268AA (D3Pak-HV)

- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- High creepage distance between terminals

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	
$I_{RD}$	reverse current, drain current	$V_{RD} = 1600\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		50	$\mu\text{A}$	
		$V_{RD} = 1600\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		5	mA	
$V_T$	forward voltage drop	$I_T = 50\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		1.30	V	
		$I_T = 100\text{ A}$			1.66	V	
		$I_T = 50\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$		1.31	V	
		$I_T = 100\text{ A}$			1.77	V	
$I_{TAV}$	average forward current	$T_C = 110^{\circ}\text{C}$	$T_{VJ} = 150^{\circ}\text{C}$		50	A	
$I_{T(RMS)}$	RMS forward current	180° sine			79	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}\text{C}$		0.83	V	
$r_T$	slope resistance				9.6	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				0.4	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.15		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}\text{C}$		310	W	
$I_{TSM}$	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		550	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		595	A	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$		470	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		505	A	
$I^2t$	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		1.52	kA <sup>2</sup> s	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		1.48	kA <sup>2</sup> s	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$		1.11	kA <sup>2</sup> s	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		1.06	kA <sup>2</sup> s	
$C_J$	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$		26	pF	
$P_{GM}$	max. gate power dissipation	$t_p = 30\text{ }\mu\text{s}$	$T_C = 150^{\circ}\text{C}$		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	$T_{VJ} = 150^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 150\text{ A}$			150	A/ $\mu\text{s}$	
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.3\text{ A}/\mu\text{s};$ $I_G = 0.3\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 50\text{ A}$			500	A/ $\mu\text{s}$	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$ ; method 1 (linear voltage rise)	$T_{VJ} = 150^{\circ}\text{C}$		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	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		50	mA	
			$T_{VJ} = -40^{\circ}\text{C}$		80	mA	
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 140^{\circ}\text{C}$		0.2	V	
$I_{GD}$	gate non-trigger current				5	mA	
$I_L$	latching current	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$		125	mA	
		$I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$					
$I_H$	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$		100	mA	
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}\text{C}$		2	$\mu\text{s}$	
		$I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$					
$t_q$	turn-off time	$V_R = 100\text{ V}; I_T = 50\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s}; dv/dt = 20\text{ V}/\mu\text{s}; t_p = 200\text{ }\mu\text{s}$	$T_{VJ} = 150^{\circ}\text{C}$		150	$\mu\text{s}$	

Package TO-268AA (D3Pak-HV)			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			70	A
$T_{stg}$	storage temperature		-55		150	°C
$T_{vj}$	virtual junction temperature		-40		150	°C
<b>Weight</b>				4		g
$F_C$	mounting force with clip		20		120	N
$d_{Spp/App}$	creepage distance on surface   striking distance through air	terminal to terminal	9.4			mm
$d_{Spb/Apb}$		terminal to backside	5.6			mm

### Product Marking



### Part number

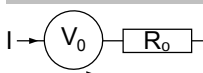
- C = Thyristor (SCR)
- M = Thyristor
- A = (up to 1800V)
- 50 = Current Rating [A]
- E = Single Thyristor
- 1600 = Reverse Voltage [V]
- TZ = TO-268AA (D3Pak) (2HV)

Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CMA50E1600TZ	CMA50E1600TZ	Tube	30	513202

### Equivalent Circuits for Simulation

\* on die level

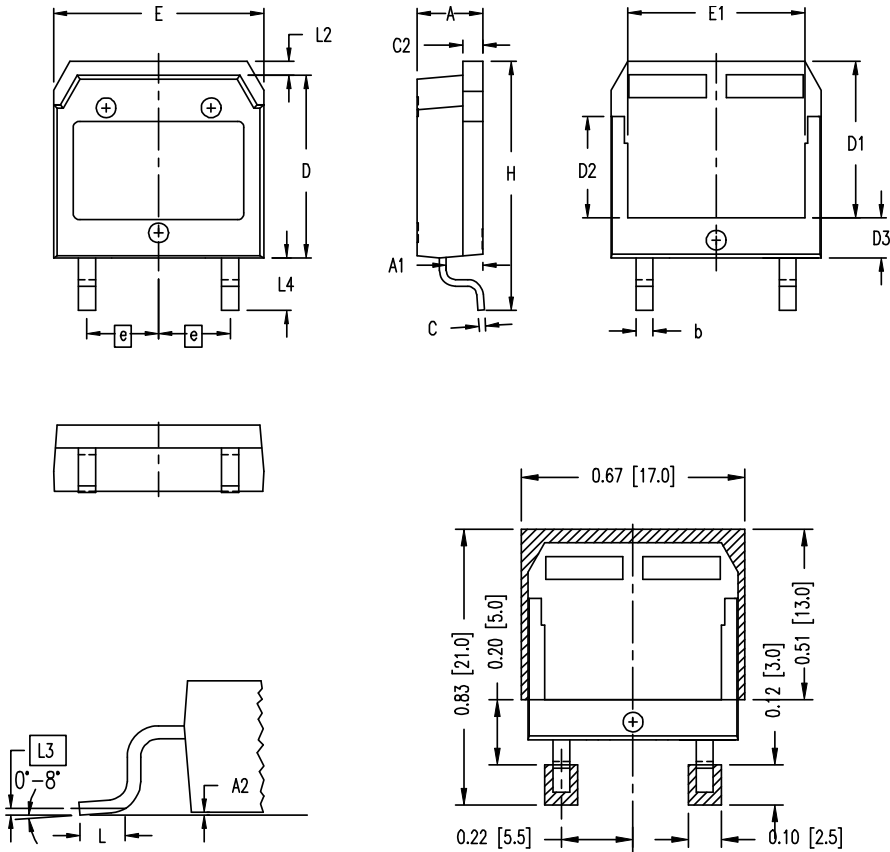
$T_{vj} = 150\text{ °C}$



Thyristor

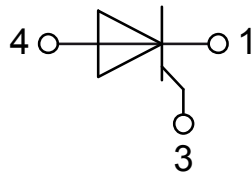
$V_{0\max}$	threshold voltage	0.83	V
$R_{0\max}$	slope resistance *	7	mΩ

## Outlines TO-268AA (D3Pak-HV)



Dim.	Millimeter		Inches	
	min	max	min	max
A	4.90	5.10	0.193	0.201
A1	2.70	2.90	0.106	0.114
A2	0.02	0.25	0.001	0.010
b	1.15	1.45	0.045	0.057
C	0.40	0.65	0.016	0.026
C2	1.45	1.60	0.057	0.063
D	13.80	14.00	0.543	0.551
D1	11.80	12.10	0.465	0.476
D2	7.50	7.80	0.295	0.307
D3	2.90	3.20	0.114	0.126
E	15.85	16.05	0.624	0.632
E1	13.30	13.60	0.524	0.535
e	5.450 BSC		0.215 BSC	
H	18.70	19.10	0.736	0.752
L	1.70	2.00	0.067	0.079
L2	1.00	1.15	0.039	0.045
L3	0.250 BSC		0.010 BSC	
L4	3.80	4.10	0.150	0.161

RECOMMENDED MINIMUM FOOT PRINT



## Thyristor

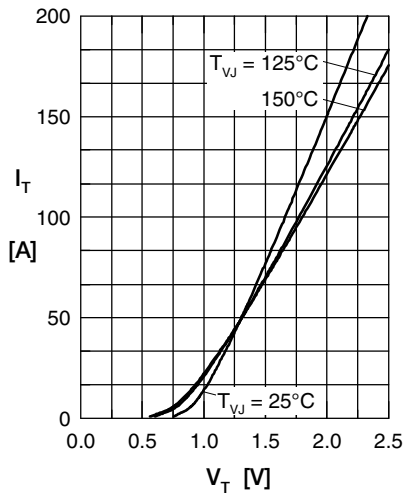


Fig. 1 Forward characteristics

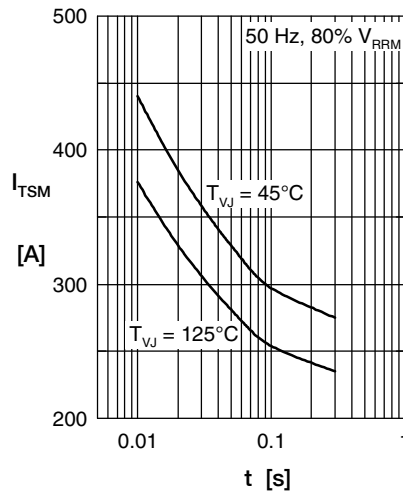


Fig. 2 Surge overload current  $I_{TSM}$ : crest value, t: duration

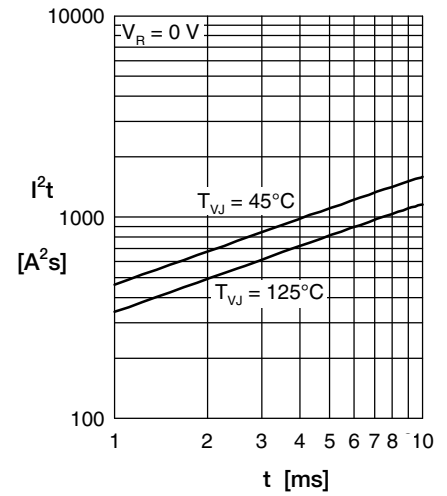


Fig. 3  $I^2t$  versus time (1-10 s)

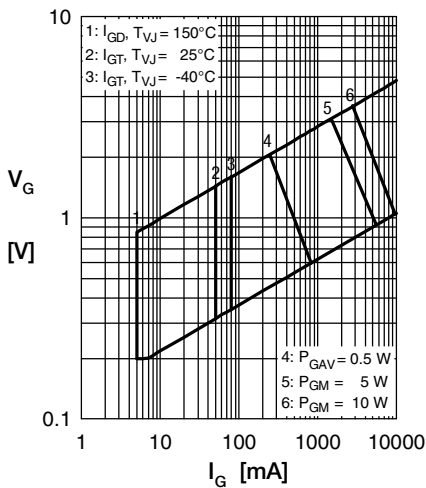


Fig. 4 Gate voltage & gate current

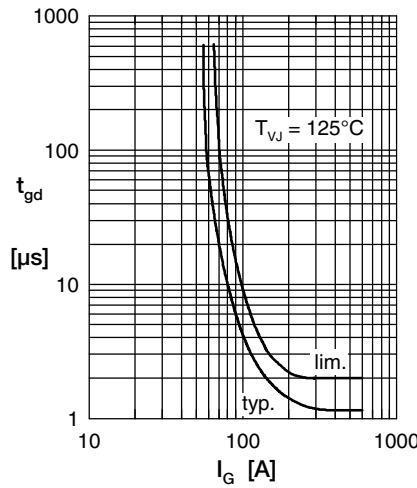


Fig. 5 Gate controlled delay time  $t_{gd}$

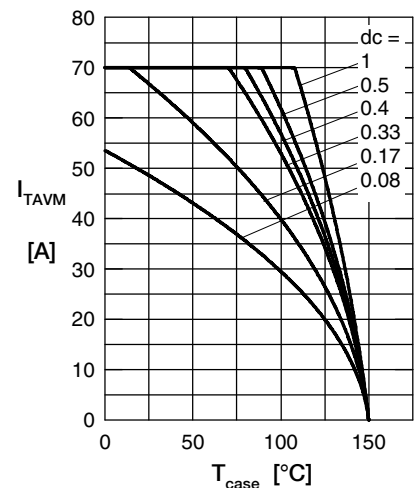


Fig. 6 Max. forward current at case temperature

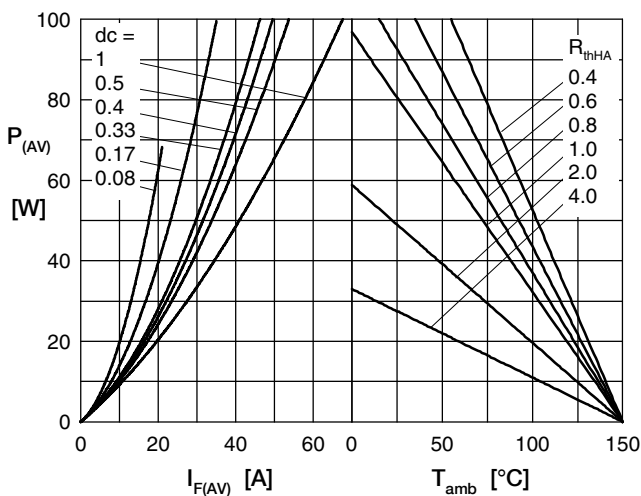


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

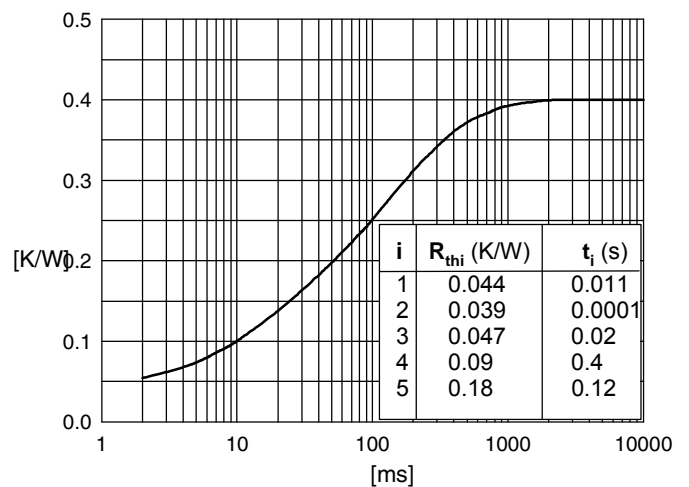


Fig. 7 Transient thermal impedance junction to case