

# High Efficiency Thyristor

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

$$I_{TAV} = 30\text{ A}$$

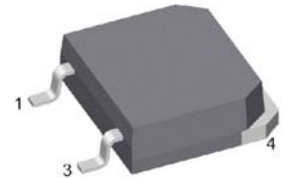
$$V_T = 1,25\text{ V}$$

Three Quadrants operation: QI - QIII  
 1~ Triac

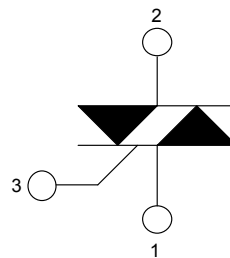
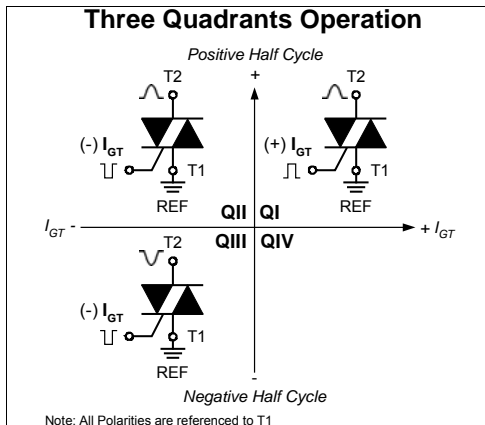
Part number

**CLA60MT1200NTZ**

Marking on Product: CLA60MT1200NTZ



Backside: anode/cathode



### Features / Advantages:

- Triac for line frequency
- Three Quadrants Operation
  - QI - QIII
- Planar passivated chip
- Long-term stability of blocking currents and voltages

### 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

### Disclaimer Notice

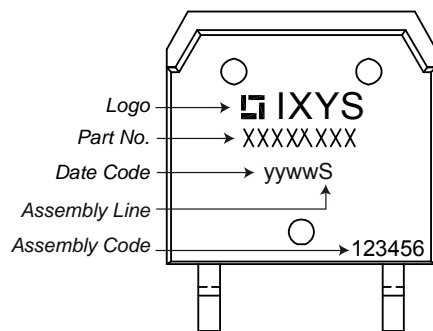
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Rectifier				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1300	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1200	V	
$I_{RD}$	reverse current, drain current	$V_{RD} = 1200 V$	$T_{VJ} = 25^{\circ}C$		10	$\mu A$	
		$V_{RD} = 1200 V$	$T_{VJ} = 125^{\circ}C$		2	mA	
$V_T$	forward voltage drop	$I_T = 30 A$	$T_{VJ} = 25^{\circ}C$		1,28	V	
		$I_T = 60 A$			1,56	V	
		$I_T = 30 A$	$T_{VJ} = 125^{\circ}C$		1,25	V	
		$I_T = 60 A$			1,61	V	
$I_{TAV}$	average forward current	$T_C = 120^{\circ}C$	$T_{VJ} = 150^{\circ}C$		30	A	
$I_{RMS}$	RMS forward current per phase	180° sine			66	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0,86	V	
$r_T$	slope resistance				12,5	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				0,55	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0,15		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		230	W	
$I_{TSM}$	max. forward surge current	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		380	A	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		410	A	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		325	A	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		350	A	
$I^2t$	value for fusing	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		720	A <sup>2</sup> s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		700	A <sup>2</sup> s	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		530	A <sup>2</sup> s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		510	A <sup>2</sup> s	
$C_J$	junction capacitance	$V_R = 400 V \quad f = 1 \text{ MHz}$	$T_{VJ} = 25^{\circ}C$		25	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	$T_{VJ} = 150^{\circ}C; f = 50 \text{ Hz}$	repetitive, $I_T = 90 A$		150	A/ $\mu s$	
		$t_p = 200 \mu s; di_G/dt = 0,3 A/\mu s;$	non-repet., $I_T = 30 A$		500	A/ $\mu s$	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}C$		500	V/ $\mu s$	
		$R_{GK} = \infty; \text{method 1 (linear voltage rise)}$					
$V_{GT}$	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		1,7	V	
			$T_{VJ} = -40^{\circ}C$		1,9	V	
$I_{GT}$	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		$\pm 60$	mA	
			$T_{VJ} = -40^{\circ}C$		$\pm 80$	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				$\pm 1$	mA	
$I_L$	latching current	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$		90	mA	
		$I_G = 0,3 A; di_G/dt = 0,3 A/\mu s$					
$I_H$	holding current	$V_D = 6 V \quad R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		60	mA	
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	$\mu s$	
		$I_G = 0,3 A; di_G/dt = 0,3 A/\mu s$					
$t_q$	turn-off time	$V_R = 100 V; I_T = 30 A; V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		150	$\mu s$	
		$di/dt = 10 A/\mu s \quad dv/dt = 20 V/\mu s \quad t_p = 200 \mu s$					

Package TO-268AA (D3Pak-HV)			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			70	A
$T_{VJ}$	virtual junction temperature		-40		150	°C
$T_{op}$	operation temperature		-40		125	°C
$T_{stg}$	storage 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 description

C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 60 = Current Rating [A]  
 MT = 1~ Triac  
 1200 = Reverse Voltage [V]  
 N = Three Quadrants operation: QI - QIII  
 TZ = TO-268AA (D3Pak) (2HV)

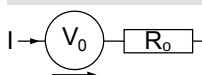
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CLA60MT1200NTZ-TUB	CLA60MT1200NTZ	Tube	30	512767
Alternative	CLA60MT1200NTZ-TRL	CLA60MT1200NTZ	Tape & Reel	400	525122

Similar Part	Package	Voltage class
CLA60MT1200NHB	TO-247AD (3)	1200
CLA60MT1200NHR	ISO247 (3)	1200

### Equivalent Circuits for Simulation

\* on die level

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

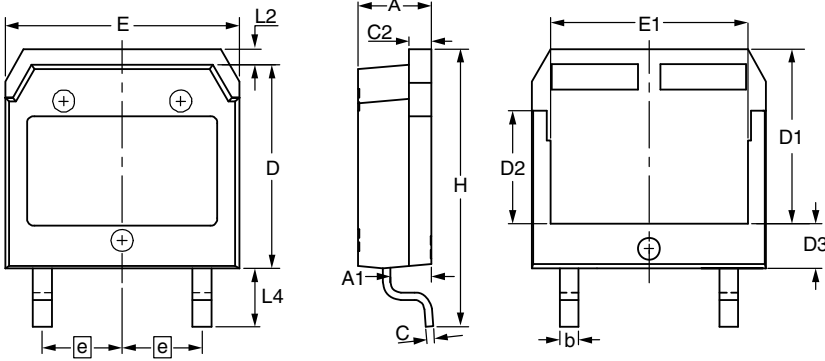


Thyristor

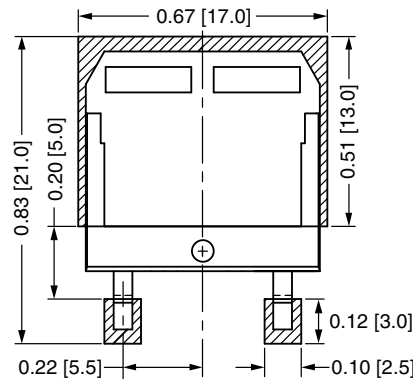
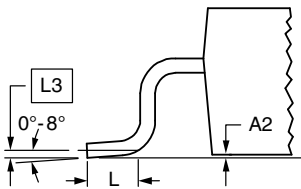
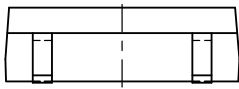
$V_{0\ max}$	threshold voltage	0,86	V
$R_{0\ max}$	slope resistance *	10	mΩ



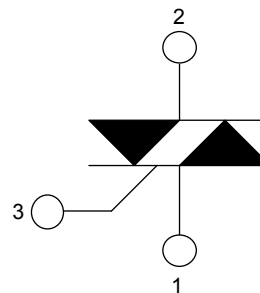
**Outlines TO-268AA (D3Pak-HV)**



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**



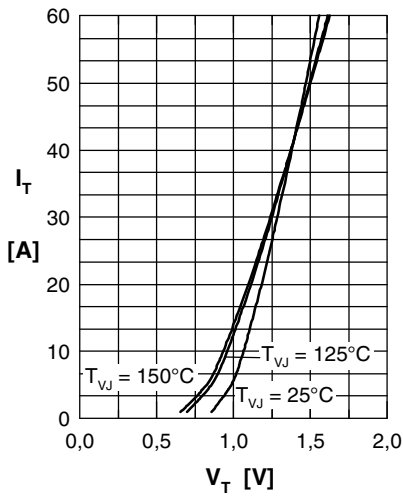
**Thyristor**


Fig. 1 Forward characteristics

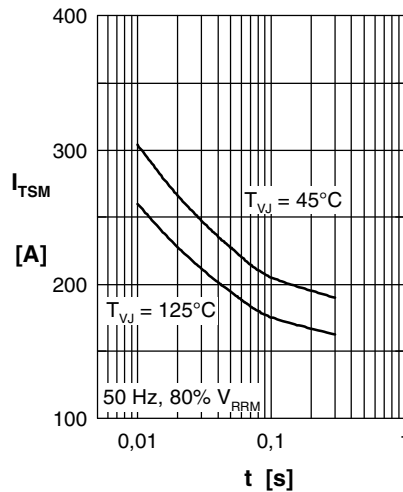
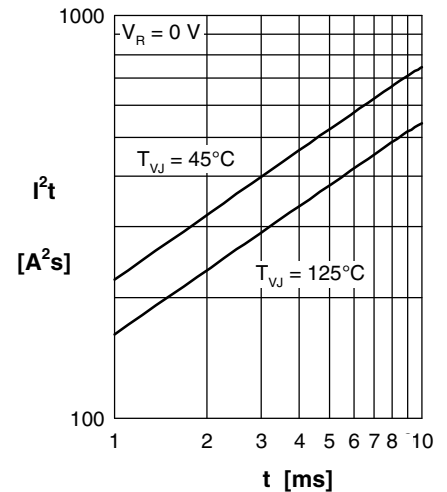
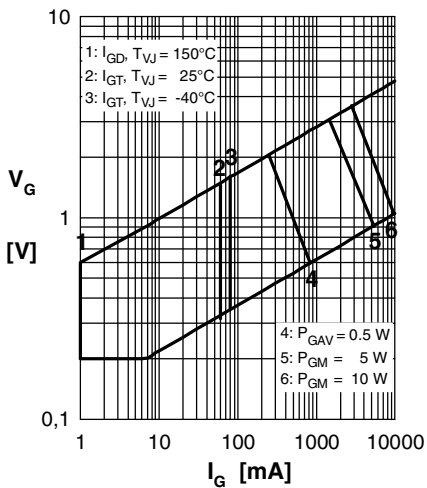

 Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

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


Fig. 4 Gate voltage &amp; gate current

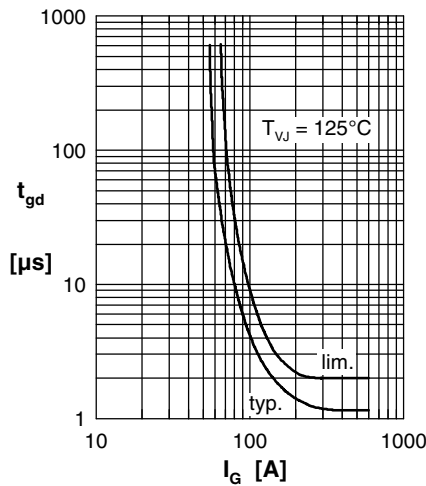
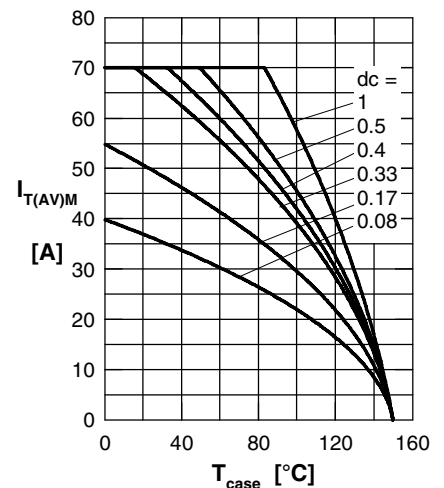

 Fig. 5 Gate controlled delay time  $t_{gd}$ 


Fig. 6 Max. forward current at case temperature

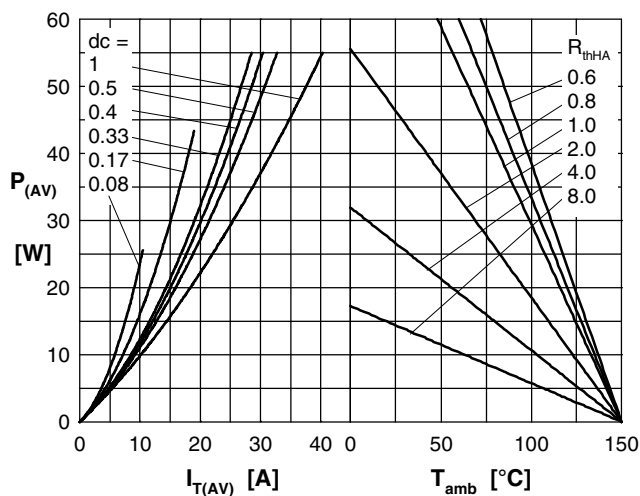
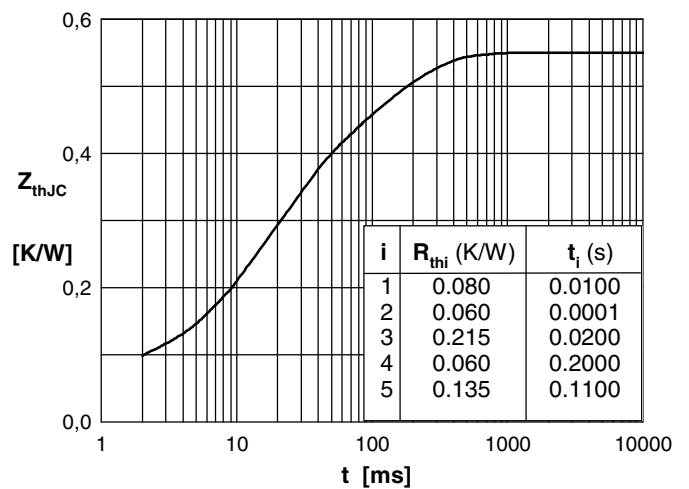

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 7 Transient thermal impedance junction to case