

# High Efficiency Thyristor

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

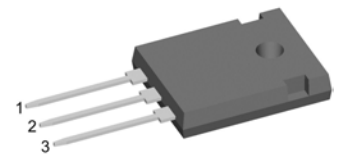
$$I_{TAV} = 30\text{ A}$$

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

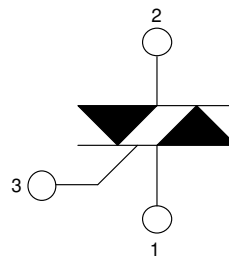
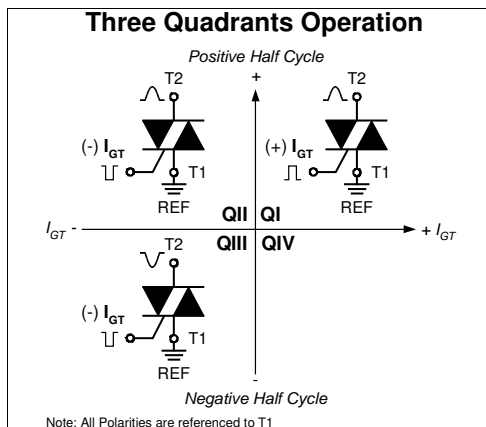
Three Quadrants operation: QI - QIII  
 1~ Triac

Part number

**CLA60MT1200NHB**



Backside: Terminal 2



### 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-247

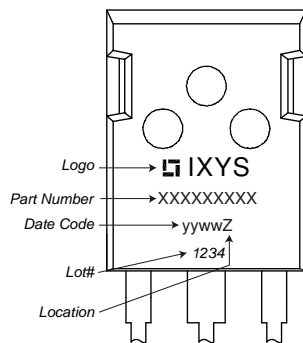
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0

### 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	$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 25^{\circ}C$		10	$\mu A$	
		$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 125^{\circ}C$		2	mA	
$V_T$	forward voltage drop	$I_T = 30\text{ A}$	$T_{VJ} = 25^{\circ}C$		1,28	V	
		$I_T = 60\text{ A}$			1,56	V	
		$I_T = 30\text{ A}$	$T_{VJ} = 125^{\circ}C$		1,25	V	
		$I_T = 60\text{ A}$			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			0,25		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	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		410	A	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		325	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		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	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		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	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		510	A <sup>2</sup> s	
$C_J$	junction capacitance	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}C$		25	pF	
$P_{GM}$	max. gate power dissipation	$t_p = 30\text{ }\mu s$	$T_C = 150^{\circ}C$		10	W	
		$t_p = 300\text{ }\mu s$			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, $I_T = 90\text{ A}$			150	A/ $\mu s$	
		$t_p = 200\text{ }\mu s; di_G/dt = 0,3\text{ A}/\mu s;$ $I_G = 0,3\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 30\text{ A}$			500	A/ $\mu s$	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$ ; method 1 (linear voltage rise)	$T_{VJ} = 150^{\circ}C$		500	V/ $\mu s$	
$V_{GT}$	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}C$		1,7	V	
			$T_{VJ} = -40^{\circ}C$		1,9	V	
$I_{GT}$	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}C$		$\pm 60$	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	$t_p = 10\text{ }\mu s$	$T_{VJ} = 25^{\circ}C$		90	mA	
		$I_G = 0,3\text{ A}; di_G/dt = 0,3\text{ A}/\mu s$					
$I_H$	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		60	mA	
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	$\mu s$	
		$I_G = 0,3\text{ A}; di_G/dt = 0,3\text{ A}/\mu s$					
$t_q$	turn-off time	$V_R = 100\text{ V}; I_T = 30\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu s; dv/dt = 20\text{ V}/\mu s; t_p = 200\text{ }\mu s$	$T_{VJ} = 125^{\circ}C$		150	$\mu s$	

Package TO-247			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>				6		g
$M_D$	mounting torque		0,8		1,2	Nm
$F_C$	mounting force with clip		20		120	N

**Product Marking**

**Part description**

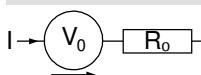
C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 60 = Current Rating [A]  
 MT = 1~ Triac  
 1200 = Reverse Voltage [V]  
 N = Three Quadrants operation: QI - QIII  
 HB = TO-247AD (3)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CLA60MT1200NHB	CLA60MT1200NHB	Tube	30	512073

Similar Part	Package	Voltage class
CLA60MT1200NHR	ISO247 (3)	1200
CLA60MT1200NTZ	TO-268AA (D3Pak) (2HV)	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-247**



Sym.	Inches		Millimeter	
	min.	max.	min.	max.
A	0.185	0.209	4.70	5.30
A1	0.087	0.102	2.21	2.59
A2	0.059	0.098	1.50	2.49
D	0.819	0.845	20.79	21.45
E	0.610	0.640	15.48	16.24
E2	0.170	0.216	4.31	5.48
e	0.215 BSC		5.46 BSC	
L	0.780	0.800	19.80	20.30
L1	-	0.177	-	4.49
Ø P	0.140	0.144	3.55	3.65
Q	0.212		5.38	
S	0.242 BSC		6.14 BSC	
b	0.039	0.055	0.99	1.40
b2	0.065	0.094	1.65	2.39
b4	0.102	0.135	2.59	3.43
c	0.015	0.035	0.38	0.89
D1	0.515	-	13.07	-
D2	0.020	0.053	0.51	1.35
E1	0.530	-	13.45	-
Ø P1	-	0.29	-	7.39



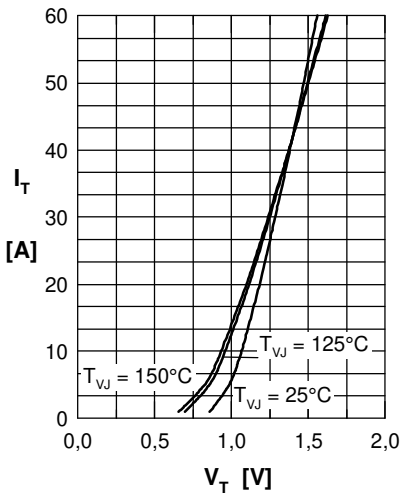
**Thyristor**


Fig. 1 Forward characteristics

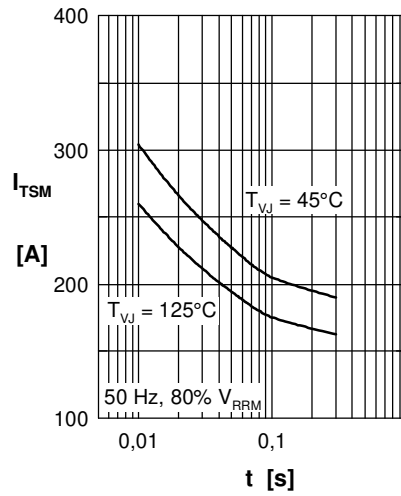
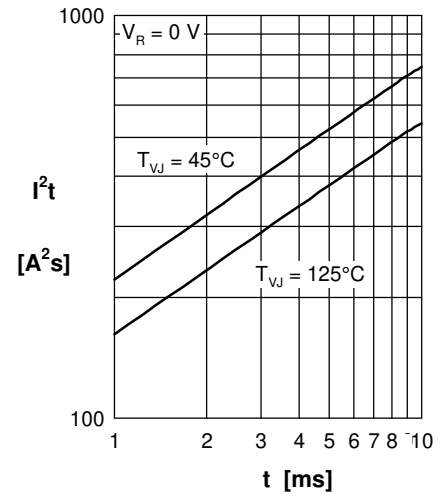
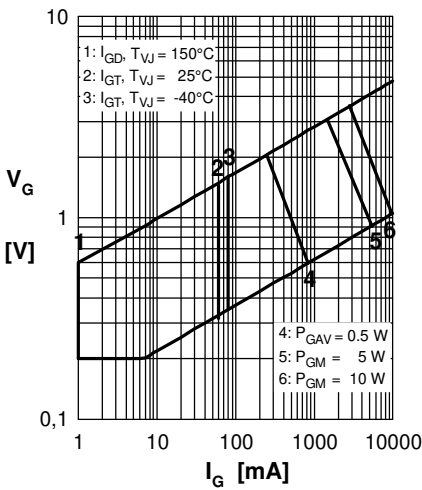

 Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

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


Fig. 4 Gate voltage &amp; gate current

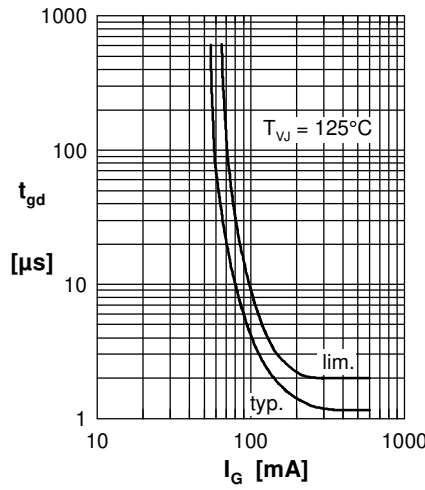
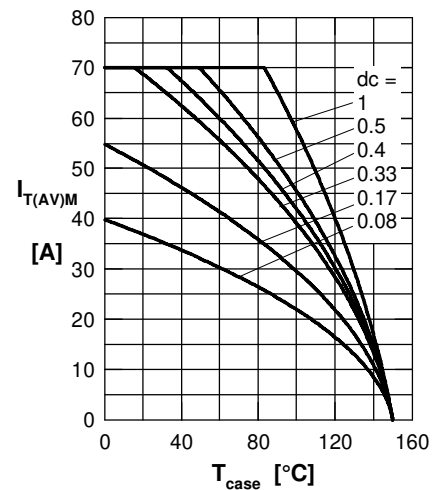

 Fig. 5 Gate controlled delay time  $t_{gd}$ 


Fig. 6 Max. forward current at case temperature

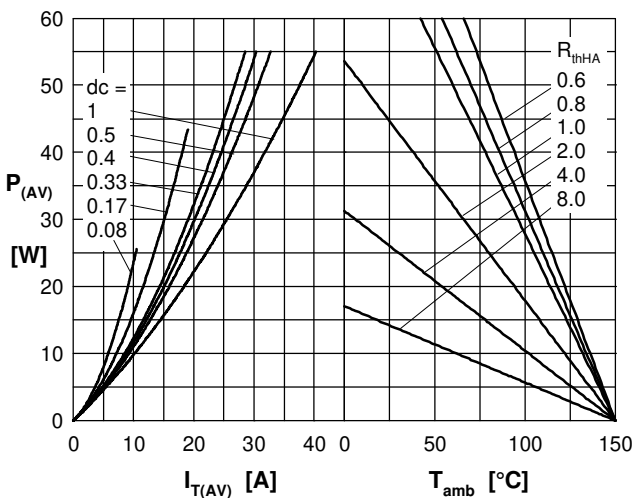
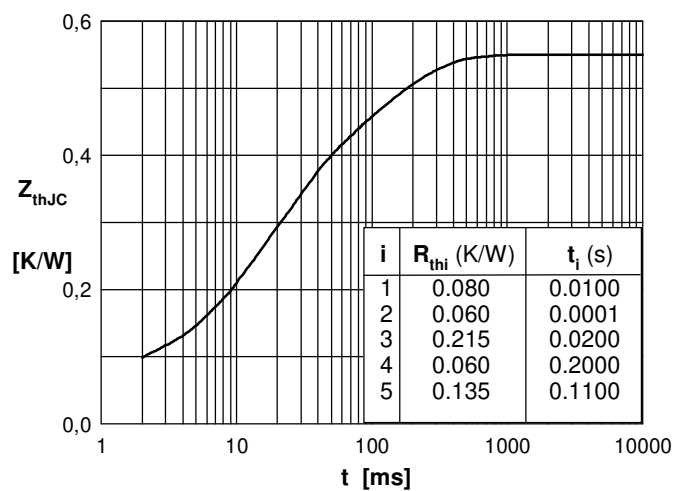

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 7 Transient thermal impedance junction to case