

# High Efficiency Thyristor

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

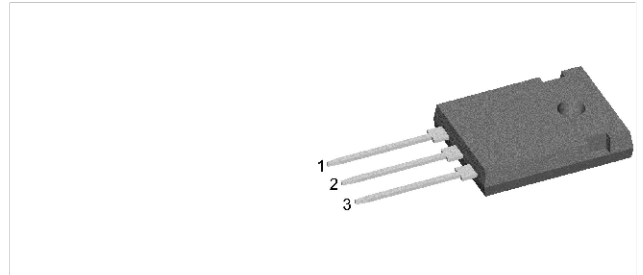
$$I_{TAV} = 30 \text{ A}$$

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

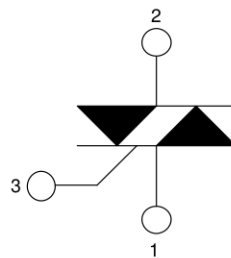
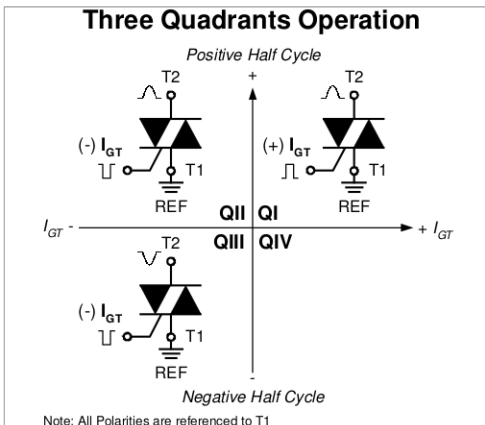
Three Quadrants operation: QI - QIII  
1~ Triac

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

### Terms Conditions of usage:

The data contained in this product data sheet is exclusively intended for technically trained staff. The user will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to his application. The specifications of our components may not be considered as an assurance of component characteristics. The information in the valid application- and assembly notes must be considered. Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of your product, please contact the sales office, which is responsible for you.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the product in aviation, in health or live endangering or life support applications, please notify. For any such application we urgently recommend

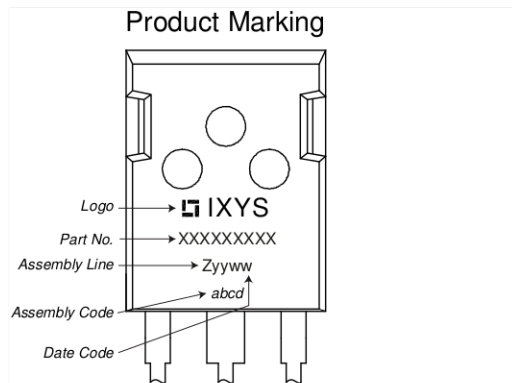
- to perform joint risk and quality assessments;

- the conclusion of quality agreements;

- to establish joint measures of an ongoing product survey, and that we may make delivery dependent on the realization of any such measures.

Rectifier				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage				1300	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage				1200	V	
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		10	$\mu\text{A}$	
		$V_{R/D} = 1200\text{ V}$	$T_{VJ} = 125^{\circ}\text{C}$		2	mA	
$V_T$	forward voltage drop	$I_T = 30\text{ A}$	$T_{VJ} = 25^{\circ}\text{C}$		1,28	V	
		$I_T = 60\text{ A}$			1,56	V	
		$I_T = 30\text{ A}$	$T_{VJ} = 125^{\circ}\text{C}$		1,25	V	
		$I_T = 60\text{ A}$			1,61	V	
$I_{TAV}$	average forward current	$T_C = 120^{\circ}\text{C}$	$T_{VJ} = 150^{\circ}\text{C}$		30	A	
$I_{RMS}$	RMS forward current per phase	180° sine			66	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}\text{C}$		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		$T_C = 25^{\circ}\text{C}$		230	W	
$I_{TSM}$	max. forward surge current	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		380	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		410	A	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$		325	A	
		$t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$	$V_R = 0\text{ V}$		350	A	
$I^2t$	value for fusing	$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}\text{C}$		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	
		$t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}\text{C}$		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	$V_R = 400\text{ V}$ $f = 1\text{ MHz}$	$T_{VJ} = 25^{\circ}\text{C}$	25		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, $I_T = 90\text{ A}$			150	A/ $\mu\text{s}$	
		$t_p = 200\text{ }\mu\text{s}; di_G/dt = 0,3\text{ A}/\mu\text{s};$ $I_G = 0,3\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 30\text{ A}$			500	A/ $\mu\text{s}$	
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}\text{C}$		500	V/ $\mu\text{s}$	
		$R_{GK} = \infty$ ; method 1 (linear voltage rise)					
$V_{GT}$	gate trigger voltage	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		1,7	V	
			$T_{VJ} = -40^{\circ}\text{C}$		1,9	V	
$I_{GT}$	gate trigger current	$V_D = 6\text{ V}$	$T_{VJ} = 25^{\circ}\text{C}$		$\pm 60$	mA	
			$T_{VJ} = -40^{\circ}\text{C}$		$\pm 80$	mA	
$V_{GD}$	gate non-trigger voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}\text{C}$		0,2	V	
$I_{GD}$	gate non-trigger current				$\pm 1$	mA	
$I_L$	latching current	$t_p = 10\text{ }\mu\text{s}$	$T_{VJ} = 25^{\circ}\text{C}$		90	mA	
		$I_G = 0,3\text{ A}; di_G/dt = 0,3\text{ A}/\mu\text{s}$					
$I_H$	holding current	$V_D = 6\text{ V}$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}\text{C}$		60	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	$V_R = 100\text{ V}; I_T = 30\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$		150		$\mu\text{s}$	

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



### 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)

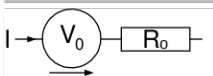
Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CLA60MT1200NHB	CLA60MT1200NHB	Tube	30	512073

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

### Equivalent Circuits for Simulation

\* on die level

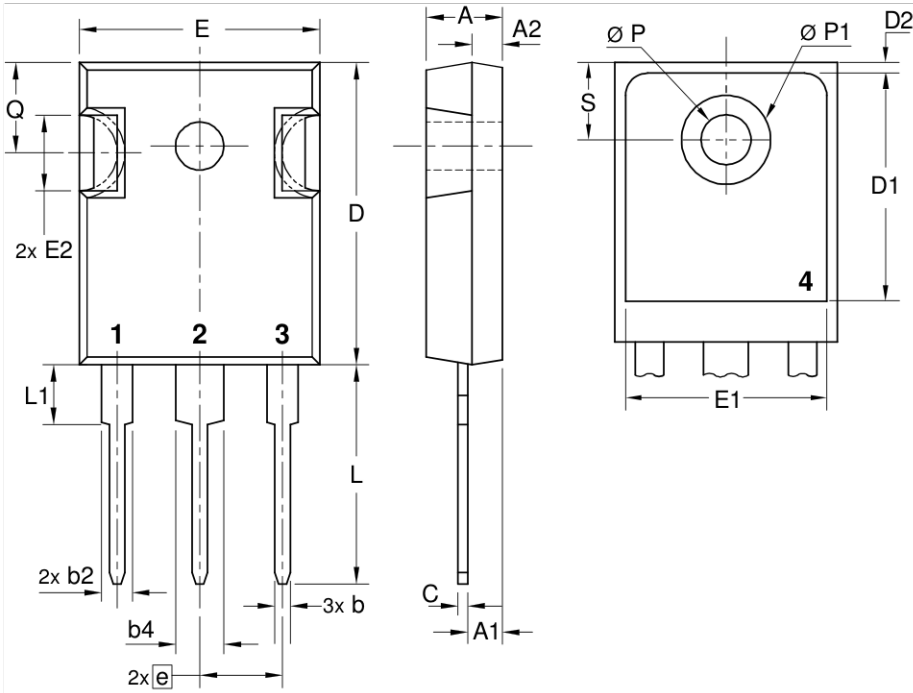
$T_{VJ} = 150\text{ °C}$



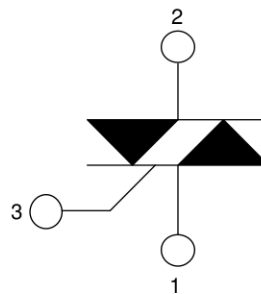
Thyristor

$V_{0\ max}$	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	0.244	5.38	6.19
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

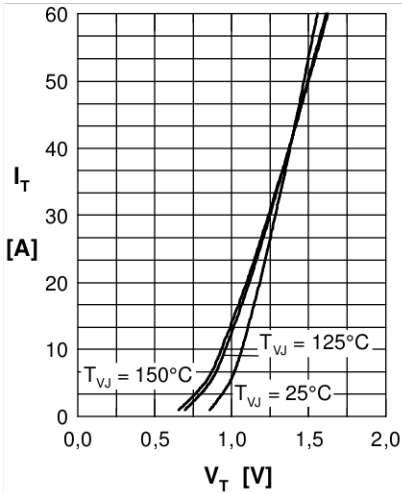


Fig. 1 Forward characteristics

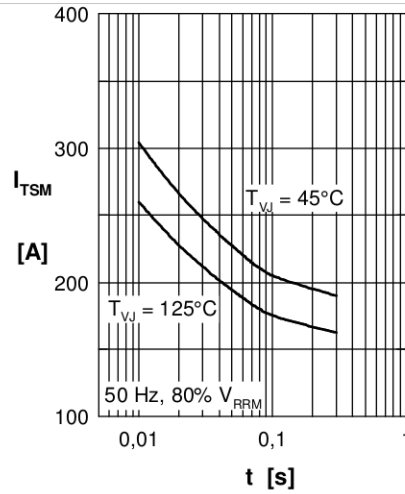


Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value, t: duration

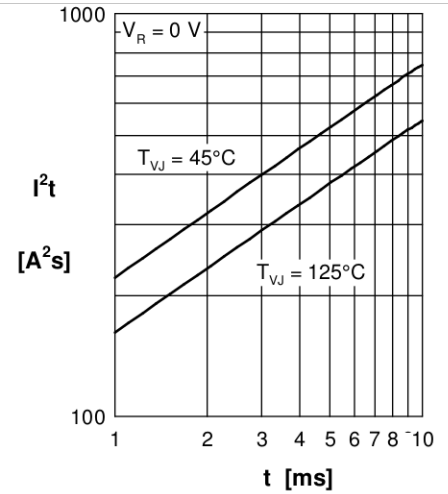


Fig. 3  $I^2t$  versus time (1-10 s)

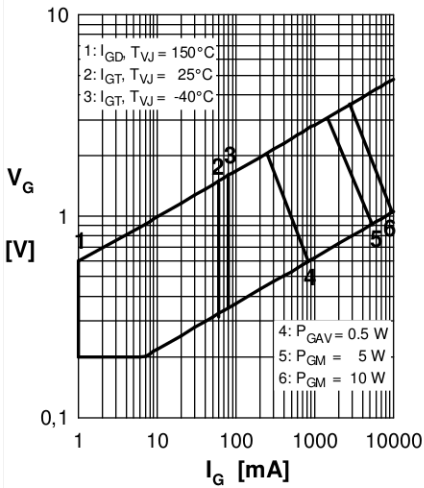


Fig. 4 Gate voltage & gate current

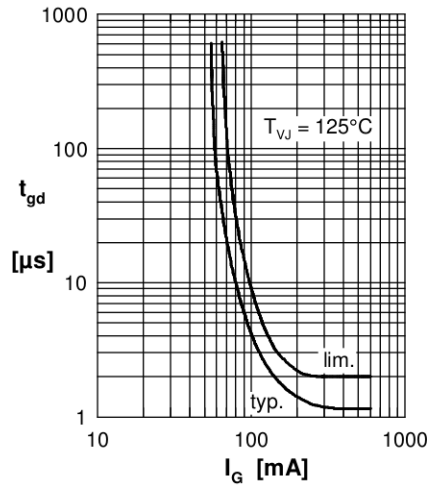


Fig. 5 Gate controlled delay time  $t_{gd}$

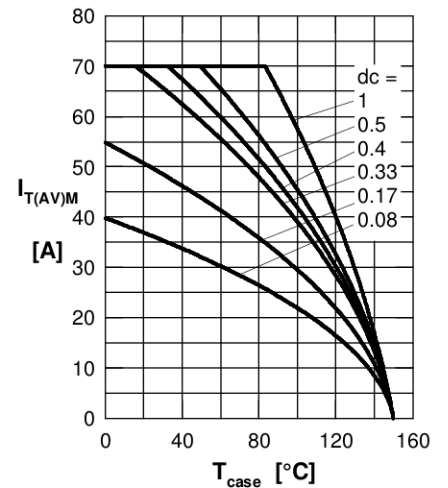


Fig. 6 Max. forward current at case temperature

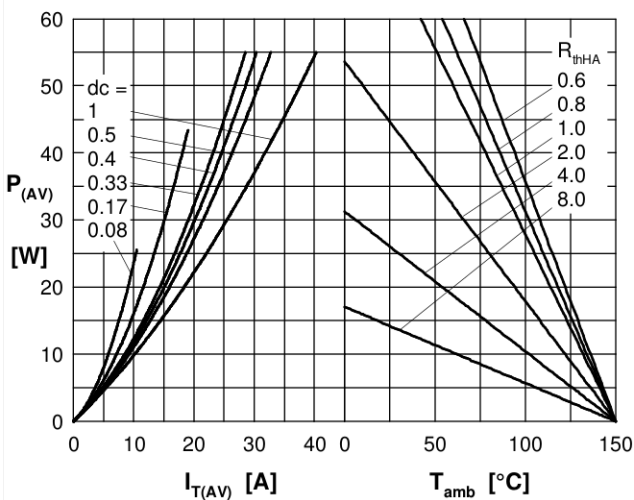


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

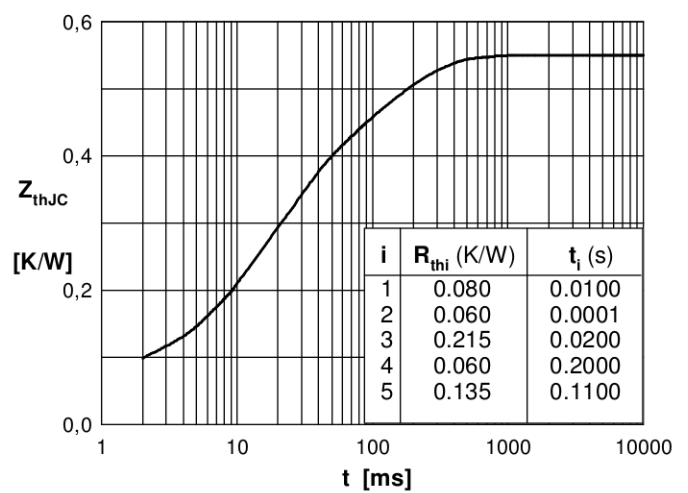


Fig. 7 Transient thermal impedance junction to case