

# High Efficiency Thyristor

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

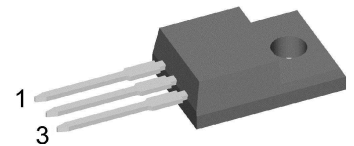
$$I_{TAV} = 10\text{ A}$$

$$V_T = 1.07\text{ V}$$


## Single Thyristor

Part number

**CLA16E1200PN**



Backside: isolated

 E72873



### 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-220FP

- Isolation Voltage: 2500 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Base plate: Plastic overmolded tab
- Reduced weight

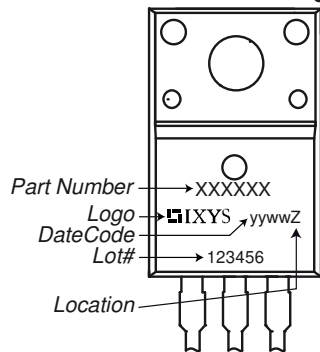
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Thyristor			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1300	V
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1200	V
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1200 V$	$T_{VJ} = 25^{\circ}C$		10	$\mu A$
		$V_{R/D} = 1200 V$	$T_{VJ} = 125^{\circ}C$		1	mA
$V_T$	forward voltage drop	$I_T = 10 A$	$T_{VJ} = 25^{\circ}C$		1.14	V
		$I_T = 20 A$			1.32	V
		$I_T = 10 A$	$T_{VJ} = 125^{\circ}C$		1.07	V
		$I_T = 20 A$			1.31	V
$I_{TAV}$	average forward current	$T_C = 90^{\circ}C$	$T_{VJ} = 150^{\circ}C$		10	A
$I_{T(RMS)}$	RMS forward current	180° sine			16	A
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0.81	V
$r_T$	slope resistance				24	m $\Omega$
$R_{thJC}$	thermal resistance junction to case				4	K/W
$R_{thCH}$	thermal resistance case to heatsink			0.5		K/W
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		31	W
$I_{TSM}$	max. forward surge current	$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$		180	A
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		195	A
		$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 150^{\circ}C$		155	A
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		165	A
$I^2t$	value for fusing	$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$		160	A <sup>2</sup> s
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		160	A <sup>2</sup> s
		$t = 10 ms$ ; (50 Hz), sine	$T_{VJ} = 150^{\circ}C$		120	A <sup>2</sup> s
		$t = 8,3 ms$ ; (60 Hz), sine	$V_R = 0 V$		115	A <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 400 V$ $f = 1 MHz$	$T_{VJ} = 25^{\circ}C$		7	pF
$P_{GM}$	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 150^{\circ}C$		5	W
		$t_p = 300 \mu s$			2.55	W
$P_{GAV}$	average gate power dissipation				0.5	W
$(di/dt)_{cr}$	critical rate of rise of current	$T_{VJ} = 125^{\circ}C$ ; $f = 50 Hz$ repetitive, $I_T = 60 A$			150	A/ $\mu s$
		$t_p = 200 \mu s$ ; $di_G/dt = 0.3 A/\mu s$ ; $I_G = 0.3 A$ ; $V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 20 A$			500	A/ $\mu s$
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		500	V/ $\mu s$
		$R_{GK} = \infty$ ; method 1 (linear voltage rise)				
$V_{GT}$	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		1.3	V
			$T_{VJ} = -40^{\circ}C$		1.6	V
$I_{GT}$	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		30	mA
			$T_{VJ} = -40^{\circ}C$		50	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				1	mA
$I_L$	latching current	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$		60	mA
		$I_G = 0.3 A$ ; $di_G/dt = 0.3 A/\mu s$				
$I_H$	holding current	$V_D = 6 V$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		60	mA
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$		2	$\mu s$
		$I_G = 0.3 A$ ; $di_G/dt = 0.3 A/\mu s$				
$t_q$	turn-off time	$V_R = 100 V$ ; $I_T = 20 A$ ; $V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}C$ $di/dt = 10 A/\mu s$ $dv/dt = 20 V/\mu s$ $t_p = 200 \mu s$		150		$\mu s$

Package TO-220FP		Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			35	A
$T_{VJ}$	virtual junction temperature		-55		150	°C
$T_{op}$	operation temperature		-55		125	°C
$T_{stg}$	storage temperature		-55		150	°C
<b>Weight</b>				2		g
$M_D$	mounting torque		0.4		0.6	Nm
$F_C$	mounting force with clip		20		60	N
$d_{Spp/App}$	creepage distance on surface   striking distance through air	terminal to terminal	1.6	1.0		mm
$d_{Spb/Apb}$		terminal to backside	2.5	2.5		mm
$V_{ISOL}$	isolation voltage	t = 1 second	2500			V
		t = 1 minute	2100			V
		50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA				

**Product Marking**

**Part description**

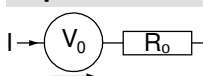
C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 16 = Current Rating [A]  
 E = Single Thyristor  
 1200 = Reverse Voltage [V]  
 PN = TO-220ABFP (3)

Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CLA16E1200PN	CLA16E1200PN	Tube	50	517734

Similar Part	Package	Voltage class
CLA16E800PN	TO-220ABFP (3)	800
CS22-12io1M	TO-220ABFP (3)	1200
CS22-08io1M	TO-220ABFP (3)	800
CMA30E1600PN	TO-220ABFP (3)	1600

**Equivalent Circuits for Simulation**

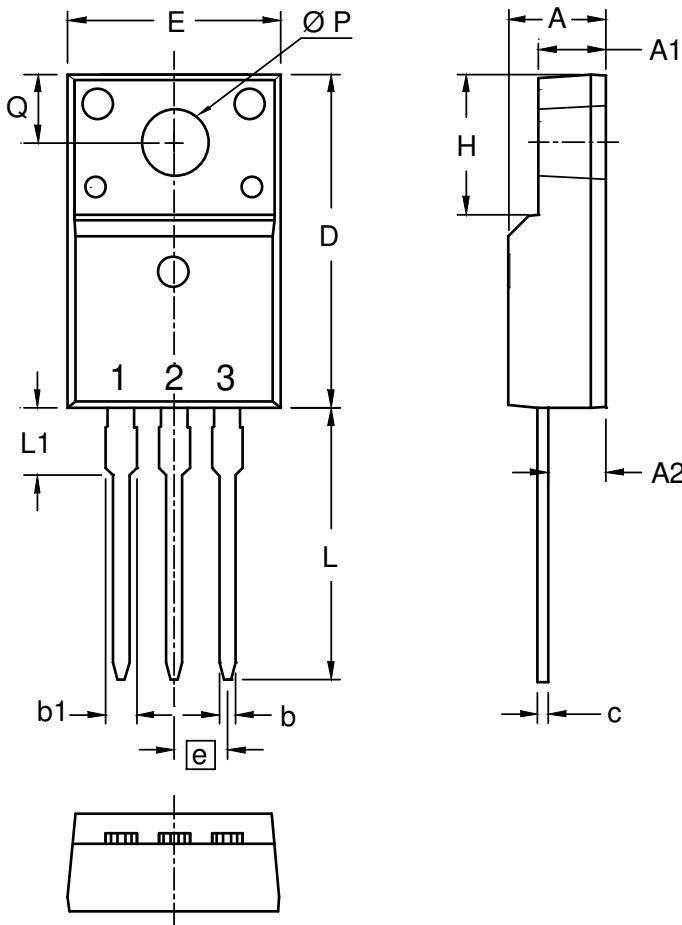
\* on die level

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

**Thyristor**

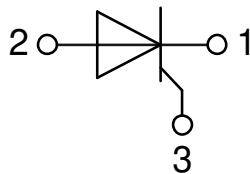
$V_{0\ max}$	threshold voltage	0.81	V
$R_{0\ max}$	slope resistance *	21	mΩ



**Outlines TO-220FP**



Dim.	Millimeters		Inches	
	min	max	min	max
A	4.50	4.90	0.177	0.193
A1	2.34	2.74	0.092	0.108
A2	2.56	2.96	0.101	0.117
b	0.70	0.90	0.028	0.035
c	0.45	0.60	0.018	0.024
D	15.67	16.07	0.617	0.633
E	9.96	10.36	0.392	0.408
e	2.54 BSC		0.100 BSC	
H	6.48	6.88	0.255	0.271
L	12.68	13.28	0.499	0.523
L1	3.03	3.43	0.119	0.135
ØP	3.08	3.28	0.121	0.129
Q	3.20	3.40	0.126	0.134



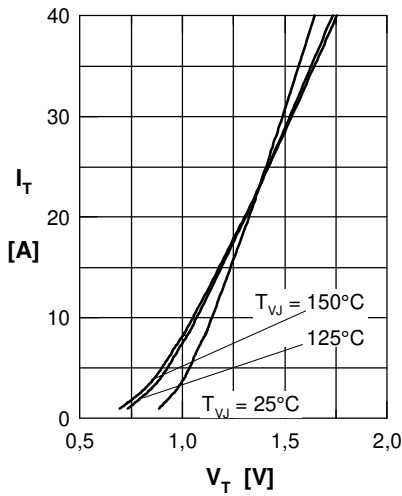
**Thyristor**


Fig. 1 Forward characteristics

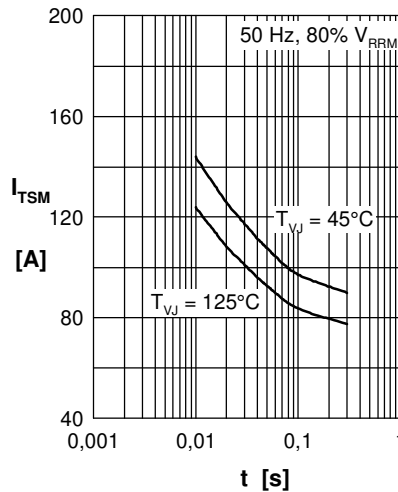
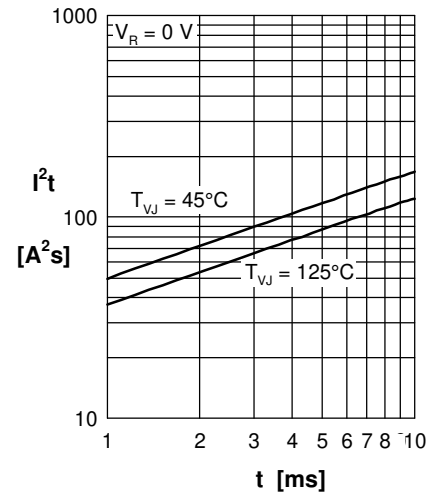
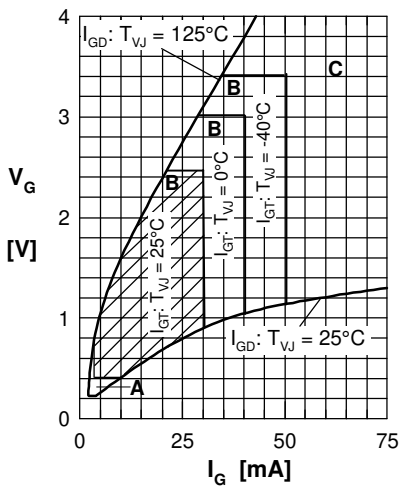
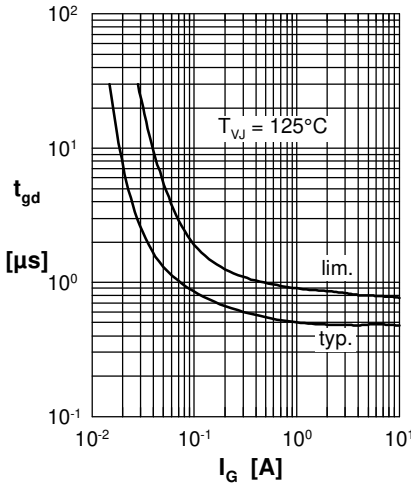
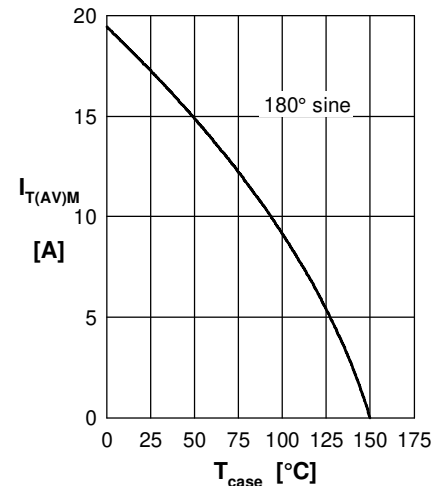

 Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

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

 Fig. 4 Gate voltage & gate current  
 Triggering: A = no; B = possible; C = safe

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


Fig. 6 Max. forward current at case temperature

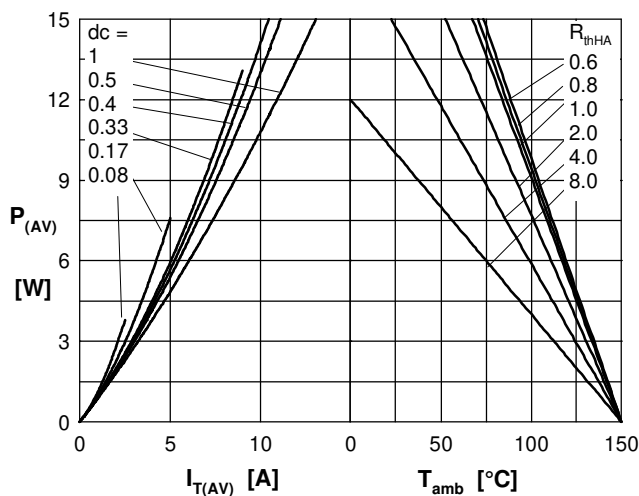
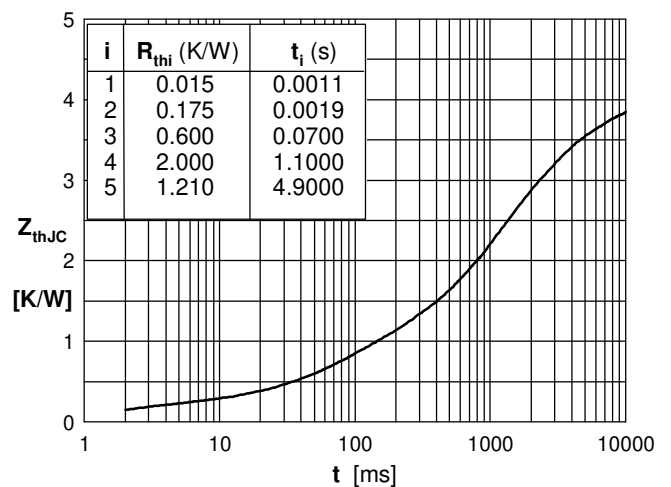

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case



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