



# High Efficiency Thyristor

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

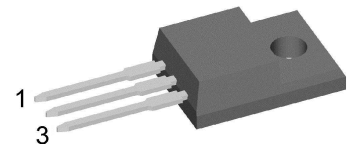
$$I_{TAV} = 16\text{ A}$$

$$V_T = 1.27\text{ V}$$

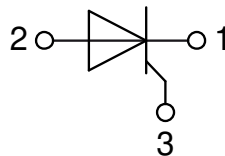
## Single Thyristor

Part number

**CS22-12io1M**



Backside: isolated



### 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

### Disclaimer Notice

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [www.littelfuse.com/disclaimer-electronics](http://www.littelfuse.com/disclaimer-electronics).

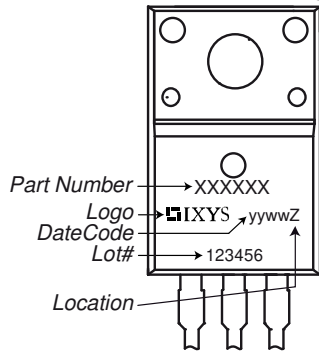


Thyristor				Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1300	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1200	V	
$I_{RD}$	reverse current, drain current	$V_{R/D} = 1200 V$	$T_{VJ} = 25^{\circ}C$		10	$\mu A$	
		$V_{R/D} = 1200 V$	$T_{VJ} = 125^{\circ}C$		2	mA	
$V_T$	forward voltage drop	$I_T = 30 A$	$T_{VJ} = 25^{\circ}C$		1.30	V	
		$I_T = 60 A$			1.59	V	
		$I_T = 30 A$	$T_{VJ} = 125^{\circ}C$		1.27	V	
		$I_T = 60 A$			1.65	V	
$I_{TAV}$	average forward current	$T_C = 90^{\circ}C$	$T_{VJ} = 150^{\circ}C$		16	A	
$I_{T(RMS)}$	RMS forward current	180° sine			25	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 150^{\circ}C$		0.86	V	
$r_T$	slope resistance				13.2	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				2.5	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.5		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		50	W	
$I_{TSM}$	max. forward surge current	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		300	A	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		325	A	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		255	A	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		275	A	
$I^2t$	value for fusing	$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 45^{\circ}C$		450	A <sup>2</sup> s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		440	A <sup>2</sup> s	
		$t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$	$T_{VJ} = 150^{\circ}C$		325	A <sup>2</sup> s	
		$t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$	$V_R = 0 V$		315	A <sup>2</sup> s	
$C_J$	junction capacitance	$V_R = 400 V \quad f = 1 \text{ MHz}$	$T_{VJ} = 25^{\circ}C$		13	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	$T_{VJ} = 125^{\circ}C; f = 50 \text{ Hz}$ repetitive, $I_T = 90 A$			150	A/ $\mu s$	
		$t_p = 200 \mu s; di_G/dt = 0.3 A/\mu s;$ $I_G = 0.3 A; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 30 A$			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	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$		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	$V_R = 100 V; I_T = 30 A; V = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s \quad dv/dt = 20 V/\mu s \quad t_p = 200 \mu s$	$T_{VJ} = 125^{\circ}C$		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

**Product Marking**



Ordering	Ordering Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CS22-12io1M	CS22-12io1M	Tube	50	500226

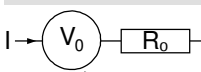
Similar Part	Package	Voltage class
CS22-08io1M	TO-220ABFP (3)	800
CLA16E1200PN	TO-220ABFP (3)	800
CMA30E1600PN	TO-220ABFP (3)	1600
CLA30E1200PB	TO-220AB (3)	1200

CLA30E1200PC	TO-263AB (D2Pak) (2)	1200
CLA30E1200HB	TO-247AD (3)	1200
CMA30E1600PB	TO-220AB (3)	1600
CMA30E1600PZ	TO-263AB (D2Pak) (2HV)	1600

**Equivalent Circuits for Simulation**

\* on die level

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

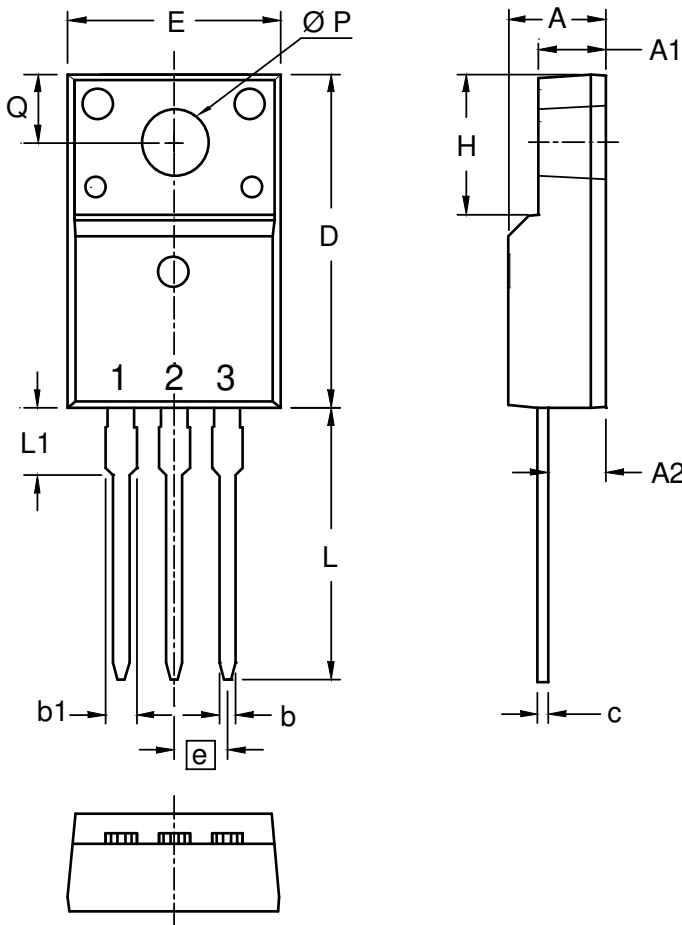


**Thyristor**

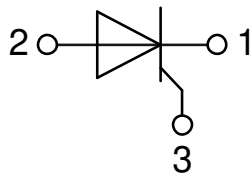
$V_{0\ max}$	threshold voltage	0.86	V
$R_{0\ max}$	slope resistance *	10.1	mΩ



**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



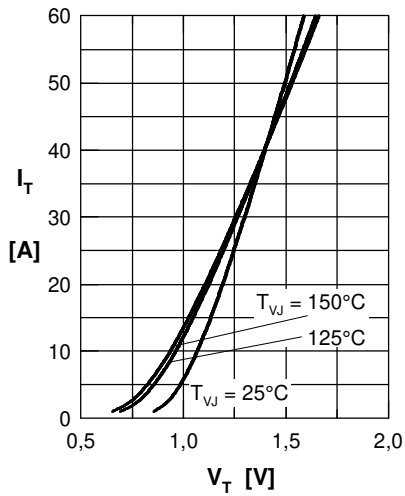
**Thyristor**


Fig. 1 Forward characteristics

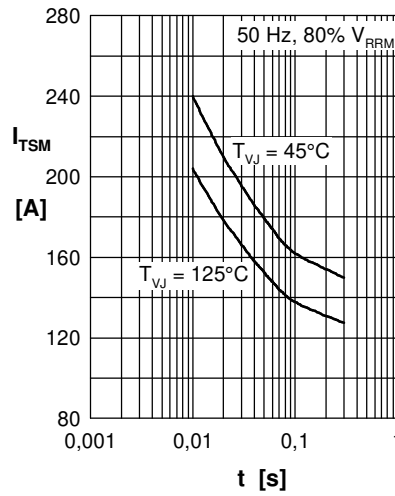
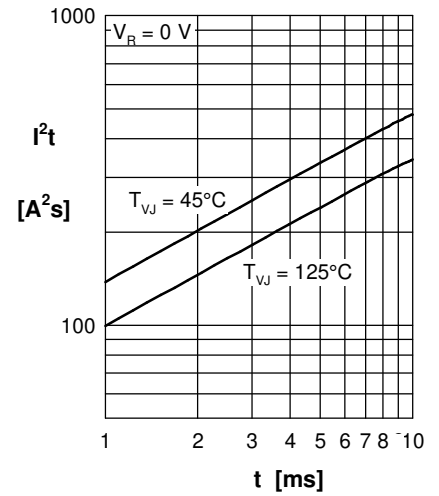
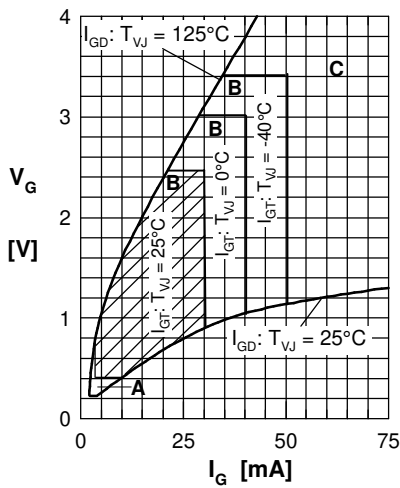
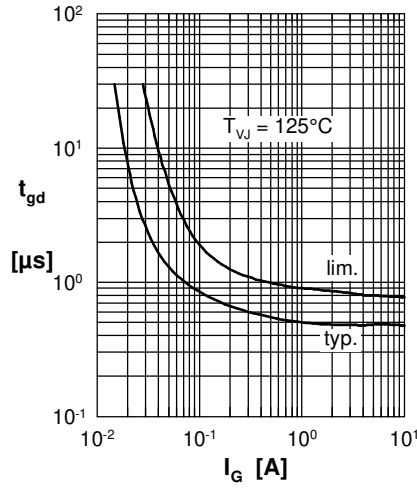
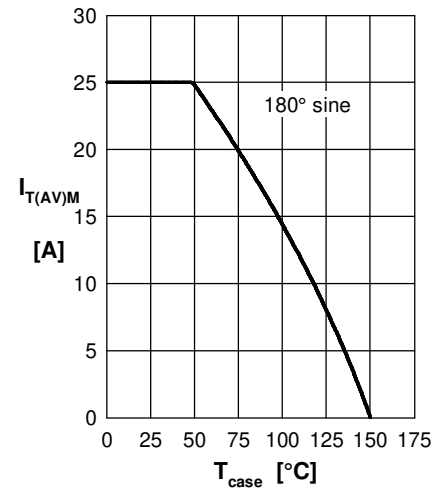

 Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

 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

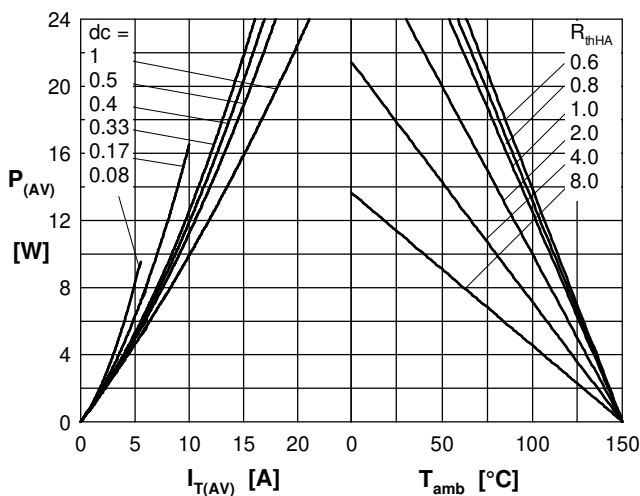
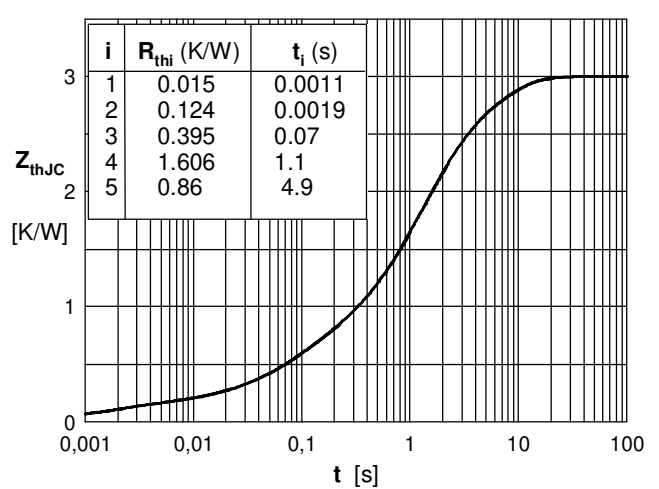

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case

