

## High Efficiency Thyristor

$$V_{RRM} = 1200V$$

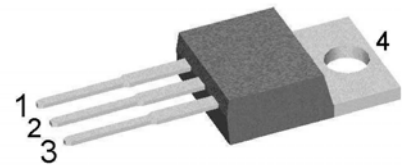
$$I_{TAV} = 20A$$

$$V_T = 1.31V$$

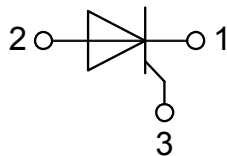
### Single Thyristor

Part number

CS19-12ho1



Backside: anode



#### Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability

#### Applications:

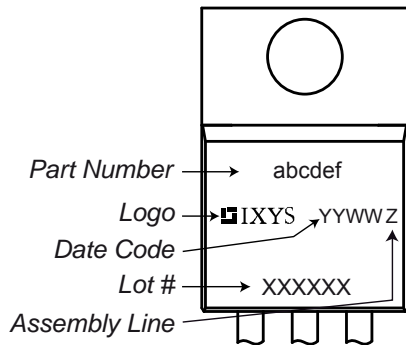
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

#### Package: TO-220

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

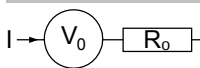
Thyristor			Ratings				
Symbol	Definition	Conditions	min.	typ.	max.	Unit	
$V_{RSM/DSM}$	max. non-repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1300	V	
$V_{RRM/DRM}$	max. repetitive reverse/forward blocking voltage	$T_{VJ} = 25^{\circ}C$			1200	V	
$I_{RD}$	reverse current, drain current	$V_{RD} = 1200 V$	$T_{VJ} = 25^{\circ}C$		50	$\mu A$	
		$V_{RD} = 1200 V$	$T_{VJ} = 125^{\circ}C$		1	mA	
$V_T$	forward voltage drop	$I_T = 20 A$	$T_{VJ} = 25^{\circ}C$		1.32	V	
					1.65	V	
		$I_T = 40 A$	$T_{VJ} = 125^{\circ}C$		1.31	V	
					1.73	V	
$I_{TAV}$	average forward current	$T_C = 110^{\circ}C$	$T_{VJ} = 125^{\circ}C$		20	A	
$I_{T(RMS)}$	RMS forward current	180° sine			31	A	
$V_{T0}$	threshold voltage	} for power loss calculation only	$T_{VJ} = 125^{\circ}C$		0.86	V	
$r_T$	slope resistance				22	m $\Omega$	
$R_{thJC}$	thermal resistance junction to case				0.7	K/W	
$R_{thCH}$	thermal resistance case to heatsink			0.50		K/W	
$P_{tot}$	total power dissipation		$T_C = 25^{\circ}C$		170	W	
$I_{TSM}$	max. forward surge current	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$	$V_R = 0 V$	180	A	
					t = 8,3 ms; (60 Hz), sine	195	A
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 125^{\circ}C$	$V_R = 0 V$	155	A	
					t = 8,3 ms; (60 Hz), sine	165	A
$I^2t$	value for fusing	t = 10 ms; (50 Hz), sine	$T_{VJ} = 45^{\circ}C$	$V_R = 0 V$	160	A <sup>2</sup> s	
					t = 8,3 ms; (60 Hz), sine	160	A <sup>2</sup> s
		t = 10 ms; (50 Hz), sine	$T_{VJ} = 125^{\circ}C$	$V_R = 0 V$	120	A <sup>2</sup> s	
					t = 8,3 ms; (60 Hz), sine	115	A <sup>2</sup> s
$C_J$	junction capacitance	$V_R = 230 V$ f = 1 MHz	$T_{VJ} = 25^{\circ}C$		9	pF	
$P_{GM}$	max. gate power dissipation	$t_p = 30 \mu s$	$T_C = 125^{\circ}C$		5	W	
		$t_p = 300 \mu s$			2.5	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 Hz	repetitive, $I_T = 60 A$		150	A/ $\mu s$	
				$t_p = 200 \mu s$ ; $di_G/dt = 0.15 A/\mu s$ ;			
$(dv/dt)_{cr}$	critical rate of rise of voltage	$V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 150^{\circ}C$	$I_G = 0.15 A$ ; $V_D = \frac{2}{3} V_{DRM}$	non-repet., $I_T = 20 A$	500	A/ $\mu s$
$V_{GT}$	gate trigger voltage	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		1.5	V	
			$T_{VJ} = -40^{\circ}C$		2.5	V	
$I_{GT}$	gate trigger current	$V_D = 6 V$	$T_{VJ} = 25^{\circ}C$		28	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				3	mA	
$I_L$	latching current	$t_p = 10 \mu s$	$T_{VJ} = 25^{\circ}C$	$I_G = 0.1 A$ ; $di_G/dt = 0.1 A/\mu s$		75	mA
$I_H$	holding current	$V_D = 6 V$ $R_{GK} = \infty$	$T_{VJ} = 25^{\circ}C$		50	mA	
$t_{gd}$	gate controlled delay time	$V_D = \frac{1}{2} V_{DRM}$	$T_{VJ} = 25^{\circ}C$	$I_G = 0.1 A$ ; $di_G/dt = 0.1 A/\mu s$		2	$\mu s$
$t_q$	turn-off time	$V_R = 100 V$ ; $I_T = 20 A$ ; $V_D = \frac{2}{3} V_{DRM}$	$T_{VJ} = 125^{\circ}C$		150	$\mu s$	
		$di/dt = 10 A/\mu s$ ; $dv/dt = 20 V/\mu s$ ; $t_p = 200 \mu s$					

Package TO-220			Ratings			
Symbol	Definition	Conditions	min.	typ.	max.	Unit
$I_{RMS}$	RMS current	per terminal			35	A
$T_{stg}$	storage temperature		-55		150	°C
$T_{vj}$	virtual junction temperature		-40		125	°C
<b>Weight</b>				2		g
$M_D$	mounting torque		0.4		0.6	Nm
$F_C$	mounting force with clip		20		60	N

**Product Marking**


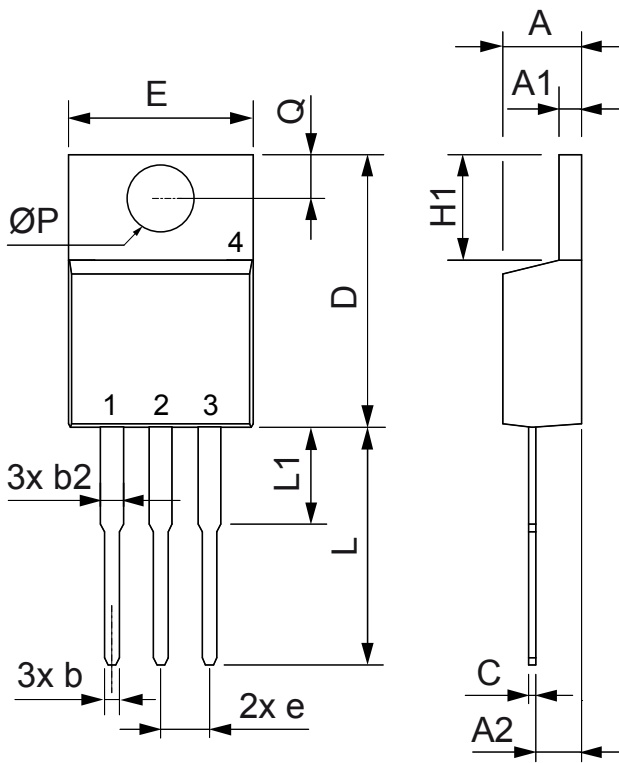
Ordering	Part Number	Marking on Product	Delivery Mode	Quantity	Code No.
Standard	CS19-12ho1	CS19-12ho1	Tube	50	473138

Similar Part	Package	Voltage class
CS19-12ho1S	TO-263AB (D2Pak) (2)	1200
CS19-08ho1	TO-220AB (3)	800
CS19-08ho1S	TO-263AB (D2Pak) (2)	800

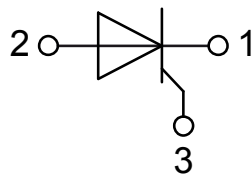
**Equivalent Circuits for Simulation**
*\* on die level*
 $T_{vj} = 125\text{ °C}$ 

**Thyristor**

$V_{0\ max}$	threshold voltage	0.86	V
$R_{0\ max}$	slope resistance *	19	mΩ

**Outlines TO-220**



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.32	4.82	0.170	0.190
A1	1.14	1.39	0.045	0.055
A2	2.29	2.79	0.090	0.110
b	0.64	1.01	0.025	0.040
b2	1.15	1.65	0.045	0.065
C	0.35	0.56	0.014	0.022
D	14.73	16.00	0.580	0.630
E	9.91	10.66	0.390	0.420
e	2.54	BSC	0.100	BSC
H1	5.85	6.85	0.230	0.270
L	12.70	13.97	0.500	0.550
L1	2.79	5.84	0.110	0.230
$\varnothing P$	3.54	4.08	0.139	0.161
Q	2.54	3.18	0.100	0.125



## Thyristor

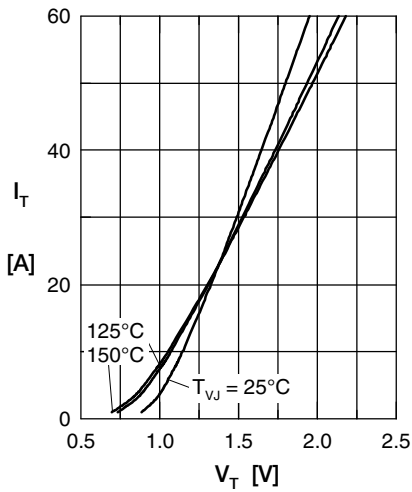


Fig. 1 Forward characteristics

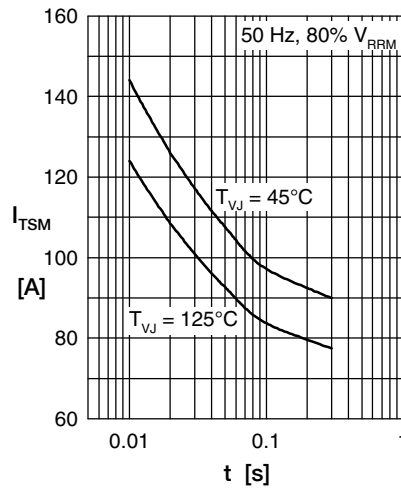


Fig. 2 Surge overload current

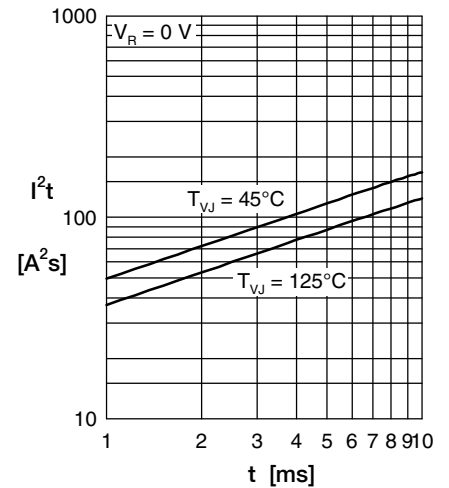


Fig. 3  $I^2t$  versus time (1-10 ms)

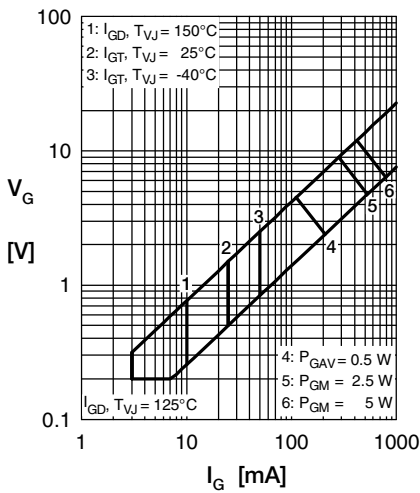


Fig. 4 Gate trigger characteristics

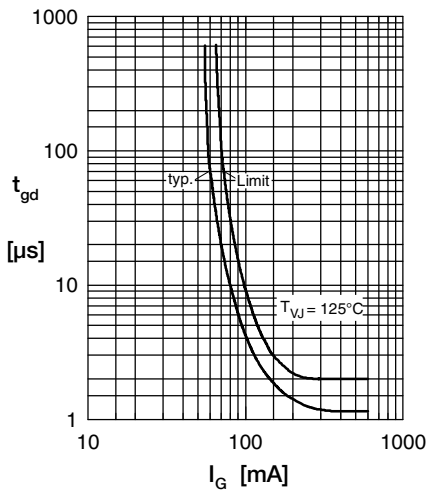


Fig. 5 Gate controlled delay time

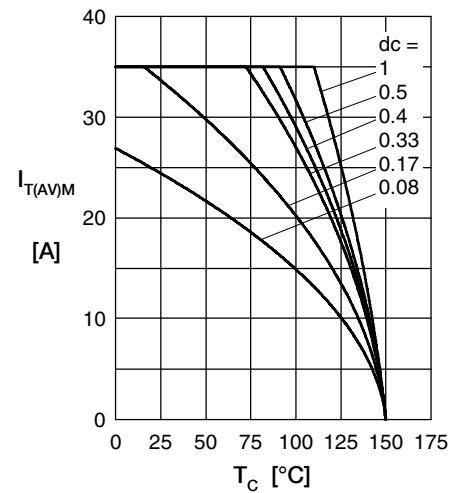


Fig. 6 Max. forward current at case temperature

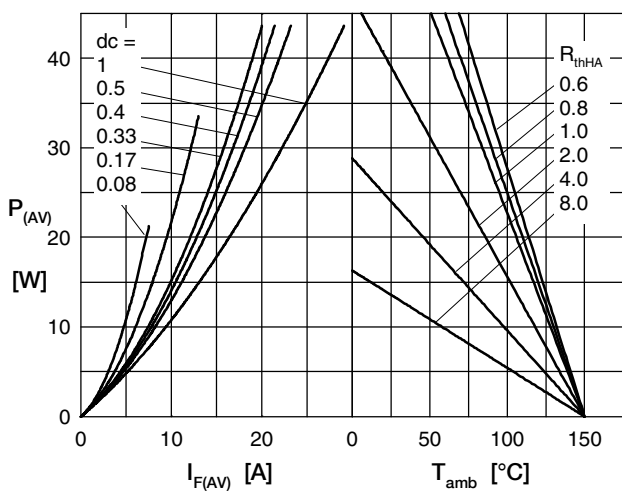


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

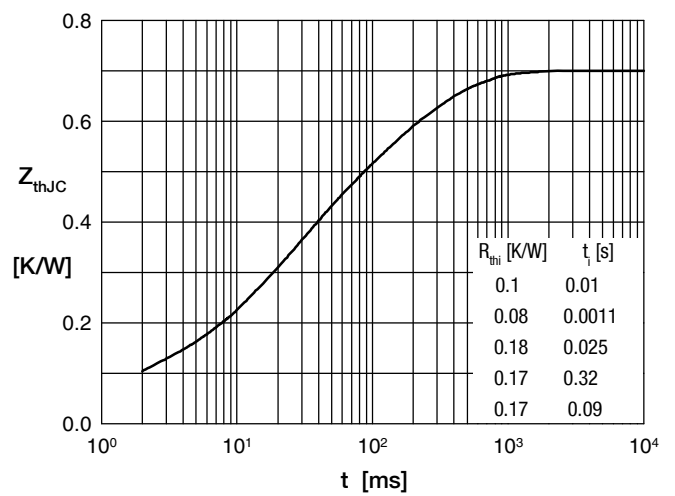


Fig. 8 Transient thermal impedance