

# High Efficiency Thyristor

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

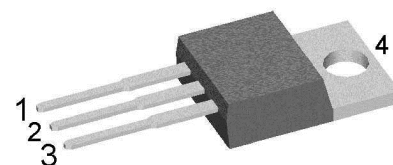
$$I_{\text{TAV}} = 20 \text{ A}$$

$$V_{\text{T}} = 1.4 \text{ V}$$

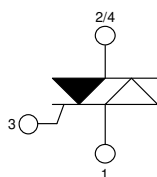
Triode  
Single Reverse Conducting Thyristor

Part number

**CLA20EF1200PB**



Backside: anode



## Features / Advantages:

- Thyristor for fast turn-on switching
- Integrated free wheeling diode
- Planar passivated chip
- Long-term stability

## Applications:

- Ignition for HD lamps
- Capacity discharge

## Package: TO-220

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

## Disclaimer Notice

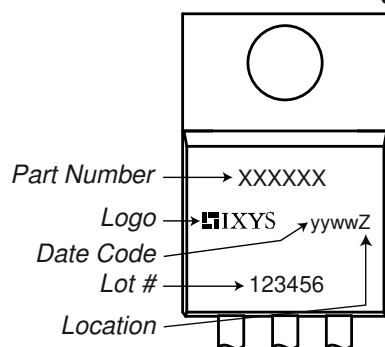
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| Thyristor      |                                                                             |                                                                                                                                                                                                     |                                | Ratings |      |      |                  |
|----------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|------|------|------------------|
| Symbol         | Definition                                                                  | Conditions                                                                                                                                                                                          |                                | min.    | typ. | max. | Unit             |
| $V_{DSM}$      | max. non-repetitive forward blocking voltage                                | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                       |                                |         |      | 1300 | V                |
| $V_{DRM}$      | max. repetitive forward blocking voltage                                    | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                       |                                |         |      | 1200 | V                |
| $I_D$          | drain current                                                               | $V_D = 1200\text{ V}$                                                                                                                                                                               | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 10   | $\mu\text{A}$    |
|                |                                                                             | $V_D = 1200\text{ V}$                                                                                                                                                                               | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 1    | mA               |
| $V_T$          | forward voltage drop<br>Note:<br>reverse voltage drop $\sim 1.2 \times V_T$ | $I_T = 20\text{ A}$                                                                                                                                                                                 | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1.40 | V                |
|                |                                                                             | $I_T = 40\text{ A}$                                                                                                                                                                                 |                                |         |      | 1.60 | V                |
|                |                                                                             | $I_T = 20\text{ A}$                                                                                                                                                                                 | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 1.40 | V                |
|                |                                                                             | $I_T = 40\text{ A}$                                                                                                                                                                                 |                                |         |      | 1.60 | V                |
| $I_{TAV}$      | average forward current                                                     | $T_C = 115^{\circ}\text{C}$<br>DC                                                                                                                                                                   | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 20   | A                |
| $V_{T0}$       | threshold voltage                                                           | } for power loss calculation only                                                                                                                                                                   | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 0.90 | V                |
| $r_T$          | slope resistance                                                            |                                                                                                                                                                                                     |                                |         |      | 25   | m $\Omega$       |
| $R_{thJC}$     | thermal resistance junction to case                                         |                                                                                                                                                                                                     |                                |         |      | 0.65 | K/W              |
| $R_{thCH}$     | thermal resistance case to heatsink                                         |                                                                                                                                                                                                     |                                |         | 0.5  |      | K/W              |
| $P_{tot}$      | total power dissipation                                                     |                                                                                                                                                                                                     | $T_C = 25^{\circ}\text{C}$     |         |      | 190  | W                |
| $I_{TSM}$      | max. forward surge current                                                  | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                    | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 120  | A                |
|                |                                                                             | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                   | $V_R = 0\text{ V}$             |         |      | 130  | A                |
|                |                                                                             | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                    | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 100  | A                |
|                |                                                                             | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                   | $V_R = 0\text{ V}$             |         |      | 110  | A                |
| $I^2t$         | value for fusing                                                            | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                    | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 72   | A <sup>2</sup> s |
|                |                                                                             | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                   | $V_R = 0\text{ V}$             |         |      | 70   | A <sup>2</sup> s |
|                |                                                                             | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                    | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 50   | A <sup>2</sup> s |
|                |                                                                             | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                   | $V_R = 0\text{ V}$             |         |      | 50   | A <sup>2</sup> s |
| $C_J$          | junction capacitance                                                        | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$                                                                                                                                                             | $T_{VJ} = 25^{\circ}\text{C}$  |         | 6    |      | 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, $I_T = 60\text{ A}$<br>$t_p = 1\text{ }\mu\text{s}; di_G/dt = 0.5\text{ A}/\mu\text{s}; I_{TSA} = 600\text{ A}$                        |                                |         |      | 500  | A/ $\mu\text{s}$ |
|                |                                                                             | $I_G = 0.07\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 20\text{ A}$                                                                                                                      |                                |         |      | 1500 | 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                                                        | $V_D = 6\text{ V}$                                                                                                                                                                                  | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1.3  | V                |
|                |                                                                             |                                                                                                                                                                                                     | $T_{VJ} = -40^{\circ}\text{C}$ |         |      | 1.6  | V                |
| $I_{GT}$       | gate trigger current                                                        | $V_D = 6\text{ V}$                                                                                                                                                                                  | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 20   | mA               |
|                |                                                                             |                                                                                                                                                                                                     | $T_{VJ} = -40^{\circ}\text{C}$ |         |      | 35   | 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                                                    |                                                                                                                                                                                                     |                                |         |      | 1    | mA               |
| $I_L$          | latching current                                                            | $t_p = 10\text{ }\mu\text{s}$                                                                                                                                                                       | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 30   | mA               |
|                |                                                                             | $I_G = 0.07\text{ A}; di_G/dt = 0.5\text{ A}/\mu\text{s}$                                                                                                                                           |                                |         |      |      |                  |
| $I_H$          | holding current                                                             | $V_D = 6\text{ V}$ $R_{GK} = \infty$                                                                                                                                                                | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 25   | mA               |
| $t_{gd}$       | gate controlled delay time                                                  | $V_D = \frac{1}{2} V_{DRM}$                                                                                                                                                                         | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 2    | $\mu\text{s}$    |
|                |                                                                             | $I_G = 0.07\text{ A}; di_G/dt = 0.5\text{ A}/\mu\text{s}$                                                                                                                                           |                                |         |      |      |                  |
| $t_q$          | turn-off time                                                               | $V_R = 0\text{ V}; I_T = 20\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$<br>$di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$ |                                |         | 150  |      | $\mu\text{s}$    |

| Package TO-220 |                              |              | Ratings |      |      |      |
|----------------|------------------------------|--------------|---------|------|------|------|
| Symbol         | Definition                   | Conditions   | min.    | typ. | max. | Unit |
| $I_{RMS}$      | RMS current                  | per terminal |         |      | 35   | 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>  |                              |              |         | 2    |      | g    |
| $M_D$          | mounting torque              |              | 0.4     |      | 0.6  | Nm   |
| $F_C$          | mounting force with clip     |              | 20      |      | 60   | N    |

### Product Marking



### Part description

C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 20 = Current Rating [A]  
 EF = Single Reverse Conducting Thyristor  
 1200 = Reverse Voltage [V]  
 PB = TO-220AB (3)

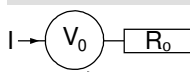
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | CLA20EF1200PB   | CLA20EF1200PB      | Tube          | 50       | 516273   |

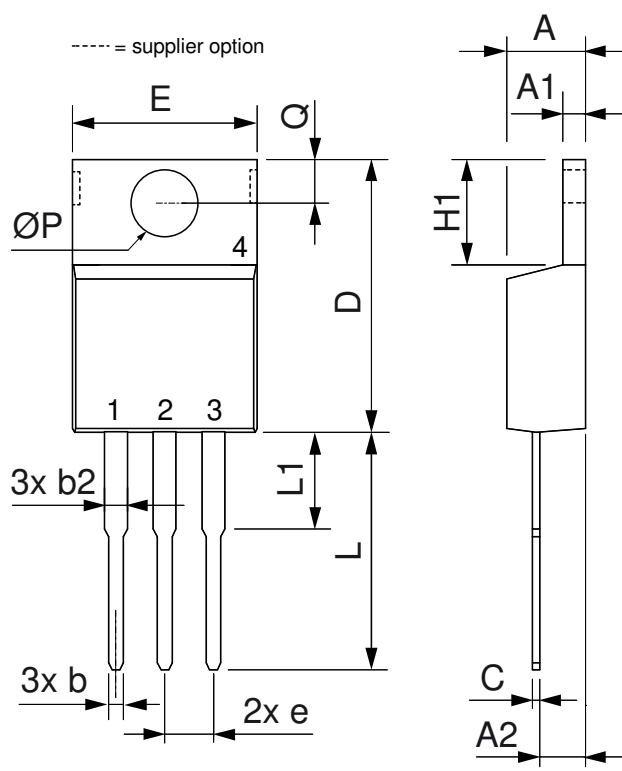
| Similar Part  | Package                | Voltage class |
|---------------|------------------------|---------------|
| CLA20EF1200PZ | TO-263AB (D2Pak) (2HV) | 1200          |

### Equivalent Circuits for Simulation

\* on die level

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

|                                                                                     |                    |           |    |
|-------------------------------------------------------------------------------------|--------------------|-----------|----|
|  |                    | Thyristor |    |
| $V_{0\max}$                                                                         | threshold voltage  | 0.9       | V  |
| $R_{0\max}$                                                                         | slope resistance * | 22        | 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 |
| ØP   | 3.54       | 4.08  | 0.139  | 0.161 |
| Q    | 2.54       | 3.18  | 0.100  | 0.125 |

