

# Thyristor

$$V_{RRM} = 1600\text{ V}$$

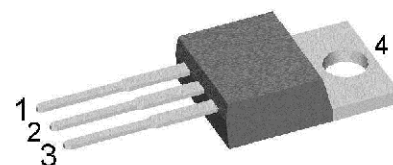
$$I_{TAV} = 30\text{ A}$$

$$V_T = 1.42\text{ V}$$

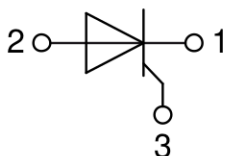
Single Thyristor

Part number

**CMA30E1600PB**



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

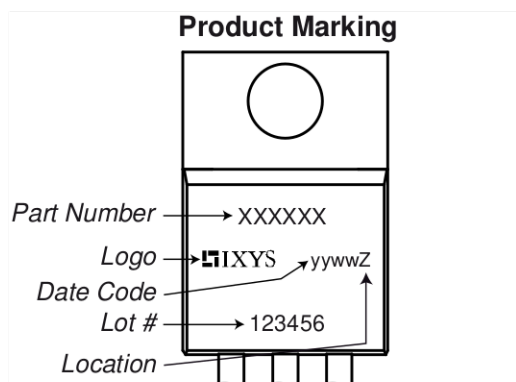
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0

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| Thyristor      |                                                      |                                                                                                                                                                                                       |                                | Ratings |      |      |                  |
|----------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|------|------|------------------|
| Symbol         | Definition                                           | Conditions                                                                                                                                                                                            |                                | min.    | typ. | max. | Unit             |
| $V_{RSM/DSM}$  | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                         |                                |         |      | 1700 | V                |
| $V_{RRM/DRM}$  | max. repetitive reverse/forward blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                         |                                |         |      | 1600 | V                |
| $I_{R/D}$      | reverse current, drain current                       | $V_{R/D} = 1600\text{ V}$                                                                                                                                                                             | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 10   | $\mu\text{A}$    |
|                |                                                      | $V_{R/D} = 1600\text{ V}$                                                                                                                                                                             | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 2    | mA               |
| $V_T$          | forward voltage drop                                 | $I_T = 30\text{ A}$                                                                                                                                                                                   | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1.42 | V                |
|                |                                                      | $I_T = 60\text{ A}$                                                                                                                                                                                   |                                |         |      | 1.80 | V                |
|                |                                                      | $I_T = 30\text{ A}$                                                                                                                                                                                   | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 1.42 | V                |
|                |                                                      | $I_T = 60\text{ A}$                                                                                                                                                                                   |                                |         |      | 1.92 | V                |
| $I_{TAV}$      | average forward current                              | $T_C = 115^{\circ}\text{C}$                                                                                                                                                                           | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 30   | A                |
| $I_{T(RMS)}$   | RMS forward current                                  | 180° sine                                                                                                                                                                                             |                                |         |      | 47   | A                |
| $V_{T0}$       | threshold voltage                                    | for power loss calculation only                                                                                                                                                                       | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 0.90 | V                |
| $r_T$          | slope resistance                                     |                                                                                                                                                                                                       |                                |         |      | 17   | m $\Omega$       |
| $R_{thJC}$     | thermal resistance junction to case                  |                                                                                                                                                                                                       |                                |         |      | 0.5  | K/W              |
| $R_{thCH}$     | thermal resistance case to heatsink                  |                                                                                                                                                                                                       |                                |         | 0.5  |      | K/W              |
| $P_{tot}$      | total power dissipation                              |                                                                                                                                                                                                       | $T_C = 25^{\circ}\text{C}$     |         |      | 250  | W                |
| $I_{TSM}$      | max. forward surge current                           | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                      | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 260  | A                |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                     | $V_R = 0\text{ V}$             |         |      | 280  | A                |
|                |                                                      | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                      | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 220  | A                |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                     | $V_R = 0\text{ V}$             |         |      | 240  | A                |
| $I^2t$         | value for fusing                                     | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                      | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 340  | A <sup>2</sup> s |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                     | $V_R = 0\text{ V}$             |         |      | 325  | A <sup>2</sup> s |
|                |                                                      | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                      | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 240  | A <sup>2</sup> s |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                     | $V_R = 0\text{ V}$             |         |      | 240  | A <sup>2</sup> s |
| $C_J$          | junction capacitance                                 | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$                                                                                                                                                               | $T_{VJ} = 25^{\circ}\text{C}$  |         | 13   |      | 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                     | $T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 90\text{ A}$                                                                                                                      |                                |         |      | 150  | A/ $\mu\text{s}$ |
|                |                                                      | $t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.2\text{ A}/\mu\text{s};$<br>$I_G = 0.2\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 30\text{ A}$                                                  |                                |         |      | 500  | A/ $\mu\text{s}$ |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage                     | $V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$                                                                                                                                              |                                |         |      | 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                                 | $V_D = 6\text{ V}$                                                                                                                                                                                    | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 28   | mA               |
|                |                                                      |                                                                                                                                                                                                       | $T_{VJ} = -40^{\circ}\text{C}$ |         |      | 50   | 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                                     | $t_p = 10\text{ }\mu\text{s}$                                                                                                                                                                         | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 90   | mA               |
|                |                                                      | $I_G = 0.2\text{ A}; di_G/dt = 0.2\text{ A}/\mu\text{s}$                                                                                                                                              |                                |         |      |      |                  |
| $I_H$          | 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    | $\mu\text{s}$    |
|                |                                                      | $I_G = 0.5\text{ A}; di_G/dt = 0.5\text{ A}/\mu\text{s}$                                                                                                                                              |                                |         |      |      |                  |
| $t_q$          | turn-off time                                        | $V_R = 100\text{ V}; I_T = 30\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$<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   |
| Weight         |                              |              |         | 2    |      | g    |
| $M_D$          | mounting torque              |              | 0.4     |      | 0.6  | Nm   |
| $F_C$          | mounting force with clip     |              | 20      |      | 60   | N    |

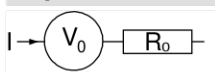

**Part description**

C = Thyristor (SCR)  
 M = Thyristor  
 A = (up to 1800V)  
 30 = Current Rating [A]  
 E = Single Thyristor  
 1600 = Reverse Voltage [V]  
 PB = TO-220AB (3)

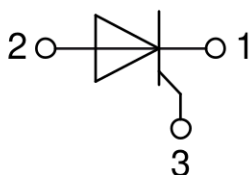
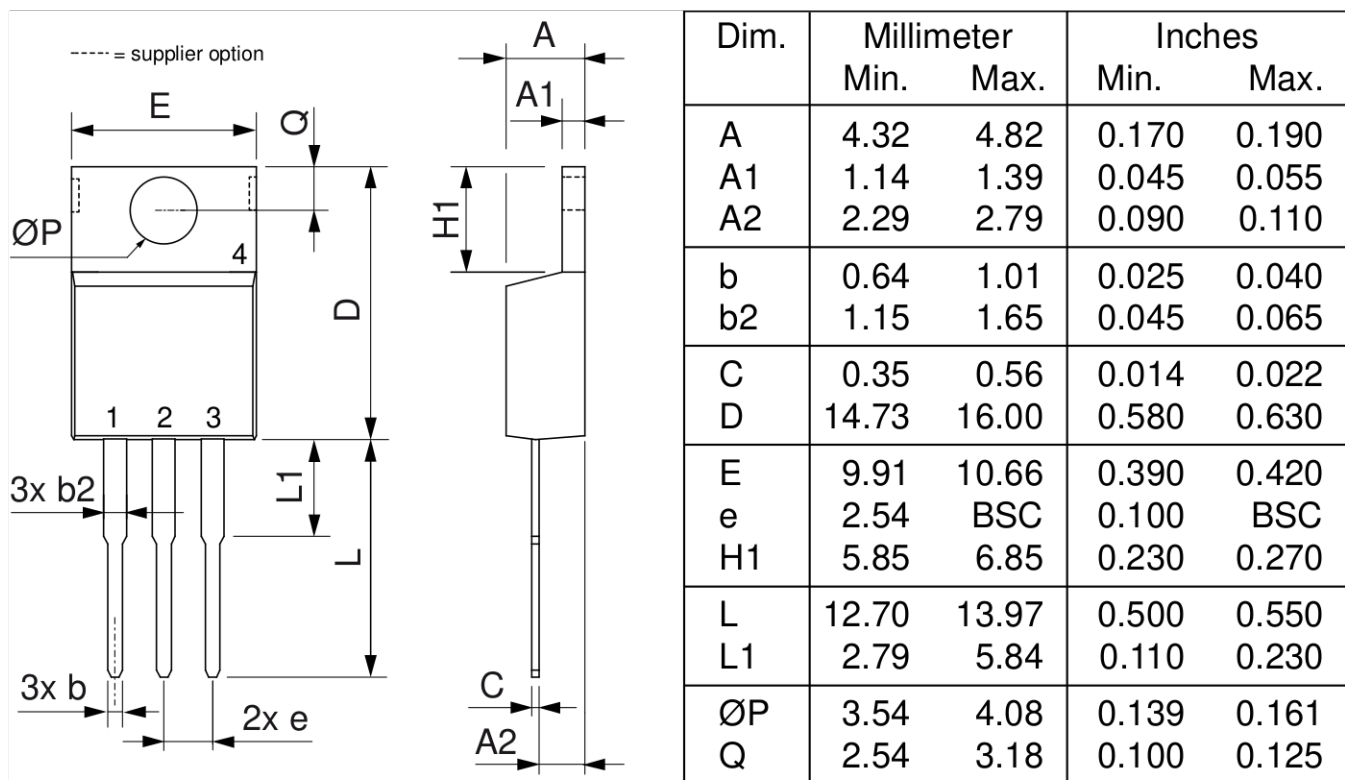
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | CMA30E1600PB    | CMA30E1600PB       | Tube          | 50       | 503348   |

| Similar Part | Package                | Voltage class |
|--------------|------------------------|---------------|
| CMA30E1600PN | TO-220ABFP (3)         | 1600          |
| CMA30E1600PZ | TO-263AB (D2Pak) (2HV) | 1600          |
| CLA30E1200PB | TO-220AB (3)           | 1200          |
| CS22-12io1M  | TO-220ABFP (3)         | 1200          |

|              |                      |      |
|--------------|----------------------|------|
| CLA30E1200PC | TO-263AB (D2Pak) (2) | 1200 |
| CLA30E1200HB | TO-247AD (3)         | 1200 |
| CS22-08io1M  | TO-220ABFP (3)       | 800  |

**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 * | 14  | mΩ |

**Outlines TO-220**


## Thyristor

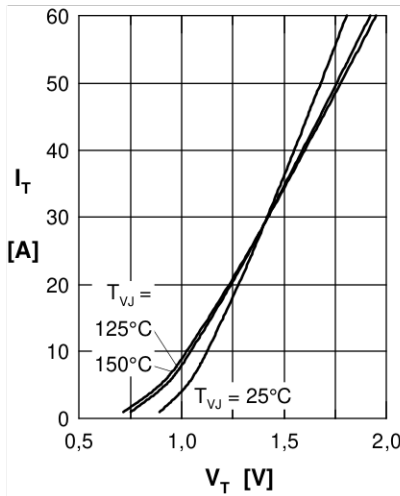


Fig. 1 Forward characteristics

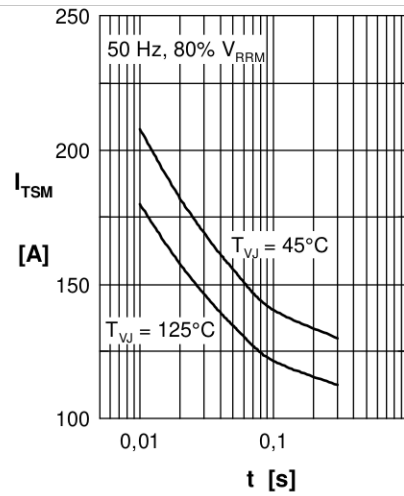


Fig. 2 Surge overload current  
 $I_{TSM}$ : crest value,  $t$ : duration

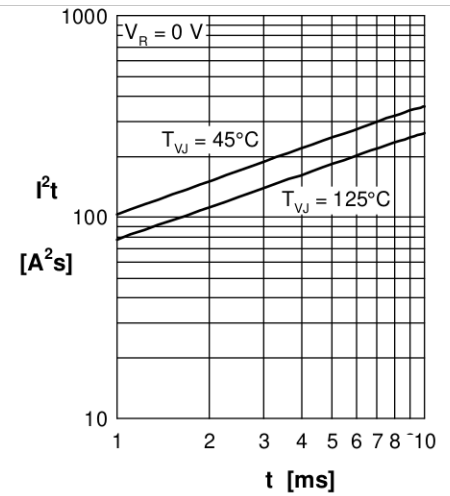


Fig. 3  $I^2t$  versus time (1-10 s)

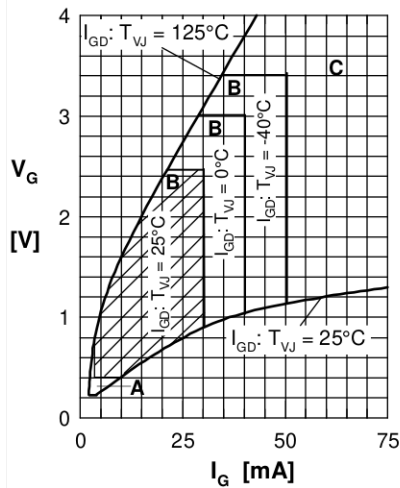


Fig. 4 Gate voltage & gate current  
 Triggering: A = no; B = possible; C = safe

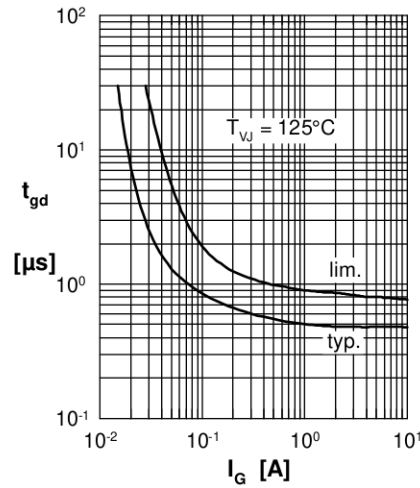


Fig. 5 Gate controlled delay time  $t_{gd}$

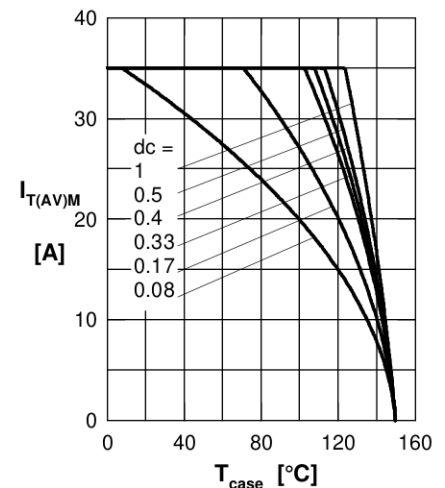


Fig. 6 Max. forward current at case temperature

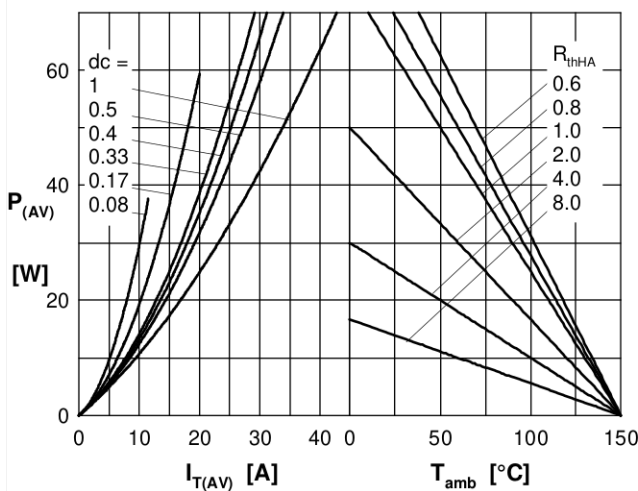


Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature

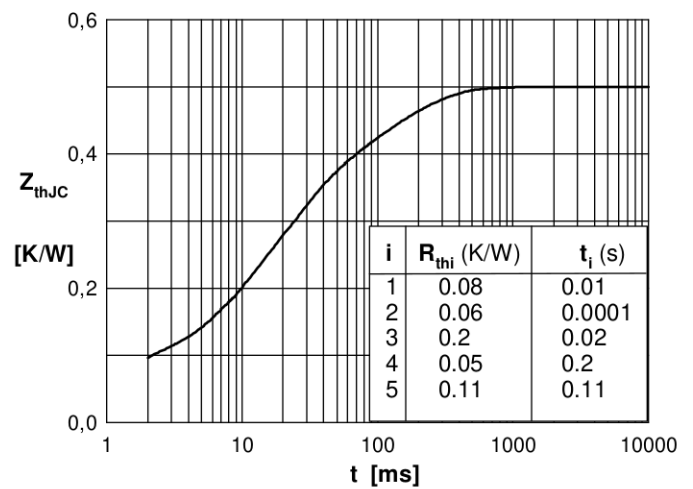


Fig. 7 Transient thermal impedance junction to case

