

# High Efficiency Thyristor

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

$$I_{TAV} = 15 \text{ A}$$

$$V_T = 1.35 \text{ V}$$

Three Quadrants operation: QI - QIII  
 1~ Triac

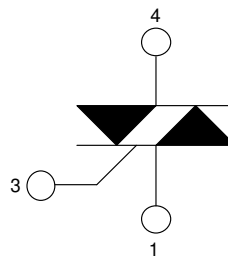
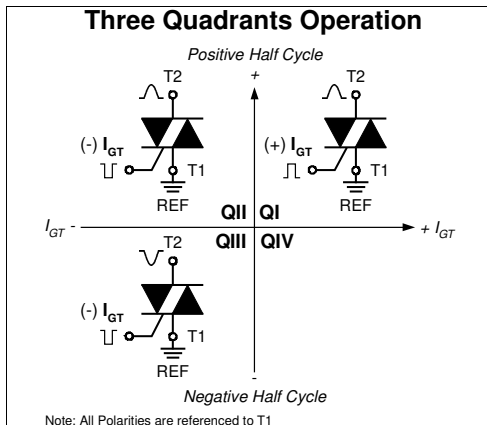
Part number

**CLA30MT1200NPZ**

Marking on Product: CLA30MT1200NPZ



Backside: anode/cathode



## Features / Advantages:

- Triac for line frequency
- Three Quadrants Operation - QI - QIII
- Planar passivated chip
- Long-term stability of blocking currents and voltages

## Applications:

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

## Package: TO-263 (D2Pak-HV)

- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- High creepage distance between terminals

## Disclaimer Notice

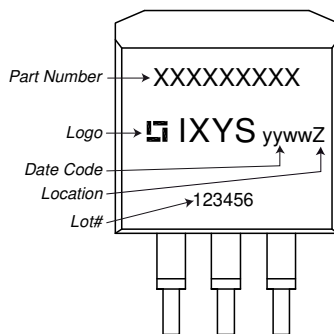
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| Rectifier      |  |   | Ratings                  |      |          |                  |
|----------------|--|---|--------------------------|------|----------|------------------|
| Symbol         | Definition   | Conditions  | min.                     | 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       | $\mu A$          |
|                |  | $V_{R/D} = 1200 V$  | $T_{VJ} = 125^{\circ}C$  |      | 1.5      | mA               |
| $V_T$          | forward voltage drop                                 | $I_T = 15 A$  | $T_{VJ} = 25^{\circ}C$   |      | 1.35     | V                |
|                |  | $I_T = 30 A$  |                          |      | 1.68     | V                |
|                |  | $I_T = 15 A$  | $T_{VJ} = 125^{\circ}C$  |      | 1.35     | V                |
|                |  | $I_T = 30 A$  |                          |      | 1.79     | V                |
| $I_{TAV}$      | average forward current                              | $T_C = 120^{\circ}C$  | $T_{VJ} = 150^{\circ}C$  |      | 15       | A                |
| $I_{RMS}$      | RMS forward current per phase                        | 180° sine   |                          |      | 33       | A                |
| $V_{T0}$       | threshold voltage                                    | } for power loss calculation only   | $T_{VJ} = 150^{\circ}C$  |      | 0.89     | V                |
| $r_T$          | slope resistance                                     |   |                          |      | 30       | m $\Omega$       |
| $R_{thJC}$     | thermal resistance junction to case                  |   |                          |      | 0.95     | K/W              |
| $R_{thCH}$     | thermal resistance case to heatsink                  |   |                          | 0.3  |          | K/W              |
| $P_{tot}$      | total power dissipation                              |   | $T_C = 25^{\circ}C$      |      | 130      | W                |
| $I_{TSM}$      | max. forward surge current                           | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$  | $T_{VJ} = 45^{\circ}C$   |      | 170      | A                |
|                |  | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$   | $V_R = 0 V$              |      | 185      | A                |
|                |  | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$  | $T_{VJ} = 150^{\circ}C$  |      | 145      | A                |
|                |  | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$   | $V_R = 0 V$              |      | 155      | A                |
| $I^2t$         | value for fusing                                     | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$  | $T_{VJ} = 45^{\circ}C$   |      | 145      | A <sup>2</sup> s |
|                |  | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$   | $V_R = 0 V$              |      | 140      | A <sup>2</sup> s |
|                |  | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$  | $T_{VJ} = 150^{\circ}C$  |      | 105      | A <sup>2</sup> s |
|                |  | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$   | $V_R = 0 V$              |      | 100      | A <sup>2</sup> s |
| $C_J$          | junction capacitance                                 | $V_R = 400 V \quad f = 1 \text{ MHz}$   | $T_{VJ} = 25^{\circ}C$   |      | 9        | pF               |
| $P_{GM}$       | max. gate power dissipation                          | $t_p = 30 \mu s$  | $T_C = 150^{\circ}C$     |      | 5        | W                |
|                |  | $t_p = 300 \mu s$   |                          |      | 1        | W                |
| $P_{GAV}$      | average gate power dissipation                       |   |                          |      | 0.2      | W                |
| $(di/dt)_{cr}$ | critical rate of rise of current                     | $T_{VJ} = 150^{\circ}C; f = 50 \text{ Hz}$  | repetitive, $I_T = 45 A$ |      | 150      | A/ $\mu s$       |
|                |  | $t_p = 200 \mu s; di_G/dt = 0.3 A/\mu s;$<br>$I_G = 0.3 A; V = \frac{2}{3} V_{DRM}$                                       | non-repet., $I_T = 15 A$ |      | 500      | A/ $\mu s$       |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage                     | $V = \frac{2}{3} V_{DRM}$   | $T_{VJ} = 150^{\circ}C$  |      | 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                                 | $V_D = 6 V$   | $T_{VJ} = 25^{\circ}C$   |      | $\pm 40$ | mA               |
|                |  |   | $T_{VJ} = -40^{\circ}C$  |      | $\pm 60$ | 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                             |   |                          |      | $\pm 1$  | mA               |
| $I_L$          | latching current                                     | $t_p = 10 \mu s$  | $T_{VJ} = 25^{\circ}C$   |      | 70       | mA               |
|                |  | $I_G = 0.3 A; di_G/dt = 0.3 A/\mu s$  |                          |      |          |                  |
| $I_H$          | holding current                                      | $V_D = 6 V \quad R_{GK} = \infty$   | $T_{VJ} = 25^{\circ}C$   |      | 50       | 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  | $V_R = 100 V; I_T = 15 A; V = \frac{2}{3} V_{DRM}$<br>$di/dt = 10 A/\mu s \quad dv/dt = 20 V/\mu s \quad t_p = 200 \mu s$ | $T_{VJ} = 125^{\circ}C$  |      | 150      | $\mu s$          |

| Package TO-263 (D2Pak-HV) |  | 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>             |  |                      |      | 1.5  |      | g    |
| $F_C$                     | mounting force with clip                                     |                      | 20   |      | 60   | N    |
| $d_{Spp/APP}$             | creepage distance on surface / striking distance through air | terminal to terminal | 4.2  |      |      | mm   |
| $d_{Spb/APb}$             |  | terminal to backside | 4.7  |      |      | mm   |

### Product Marking



### Part description

C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 30 = Current Rating [A]  
 MT = 1~ Triac  
 1200 = Reverse Voltage [V]  
 N = Three Quadrants operation: QI - QIII  
 PZ = TO-263AB (D2Pak) (2HV)

| Ordering    | Ordering Number    | Marking on Product | Delivery Mode | Quantity | Code No. |
|-------------|--------------------|--------------------|---------------|----------|----------|
| Standard    | CLA30MT1200NPZ-TRL | CLA30MT1200NPZ     | Tape & Reel   | 800      | 516960   |
| Alternative | CLA30MT1200NPZ-TUB | CLA30MT1200NPZ     | Tube          | 50       | 525255   |

| Similar Part   | Package      | Voltage class |
|----------------|--------------|---------------|
| CLA30MT1200NPB | TO-220AB (3) | 1200          |

### Equivalent Circuits for Simulation

\* on die level

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

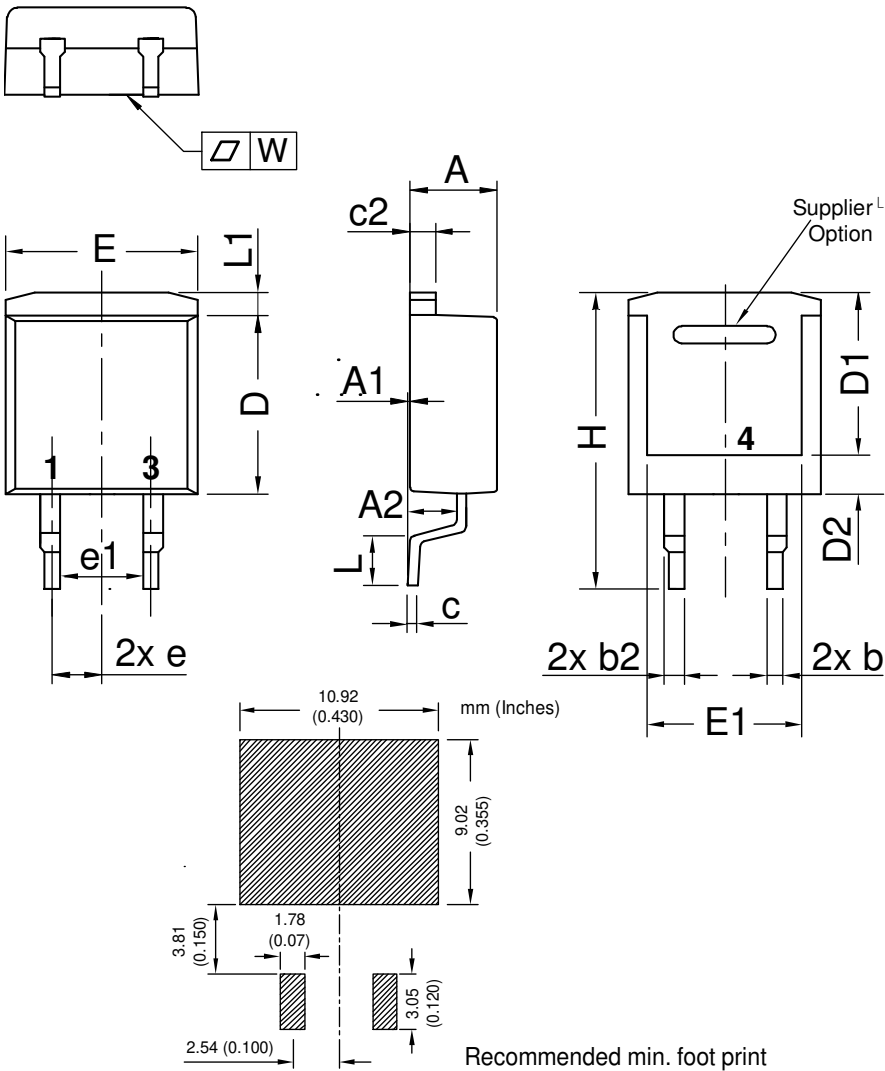


Thyristor

|              |                    |      |    |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage  | 0.89 | V  |
| $R_{0\ max}$ | slope resistance * | 27   | mΩ |

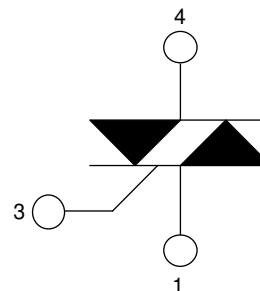


**Outlines TO-263 (D2Pak-HV)**



| Dim. | Millimeter |       | Inches      |       |
|------|------------|-------|-------------|-------|
|      | min        | max   | min         | max   |
| A    | 4.06       | 4.83  | 0.160       | 0.190 |
| A1   | typ. 0.10  |       | typ. 0.004  |       |
| A2   | 2.41       |       | 0.095       |       |
| b    | 0.51       | 0.99  | 0.020       | 0.039 |
| b2   | 1.14       | 1.40  | 0.045       | 0.055 |
| c    | 0.40       | 0.74  | 0.016       | 0.029 |
| c2   | 1.14       | 1.40  | 0.045       | 0.055 |
| D    | 8.38       | 9.40  | 0.330       | 0.370 |
| D1   | 8.00       | 8.89  | 0.315       | 0.350 |
| D2   | 2.3        |       | 0.091       |       |
| E    | 9.65       | 10.41 | 0.380       | 0.410 |
| E1   | 6.22       | 8.50  | 0.245       | 0.335 |
| e    | 2,54 BSC   |       | 0,100 BSC   |       |
| e1   | 4.28       |       | 0.169       |       |
| H    | 14.61      | 15.88 | 0.575       | 0.625 |
| L    | 1.78       | 2.79  | 0.070       | 0.110 |
| L1   | 1.02       | 1.68  | 0.040       | 0.066 |
| W    | typ. 0.02  | 0.040 | typ. 0.0008 | 0.002 |

*All dimensions conform with and/or within JEDEC standard.*



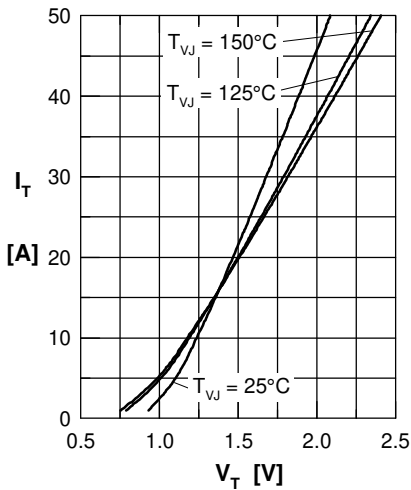
**Thyristor**


Fig. 1 Forward characteristics

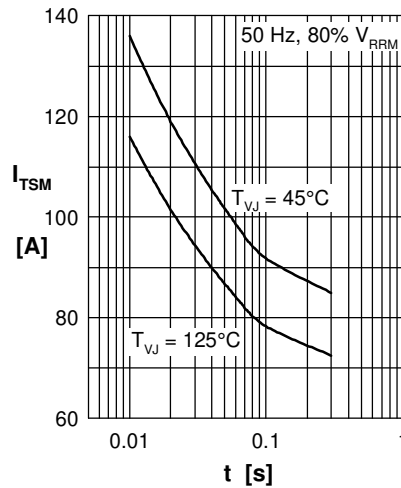


Fig. 2 Surge overload current

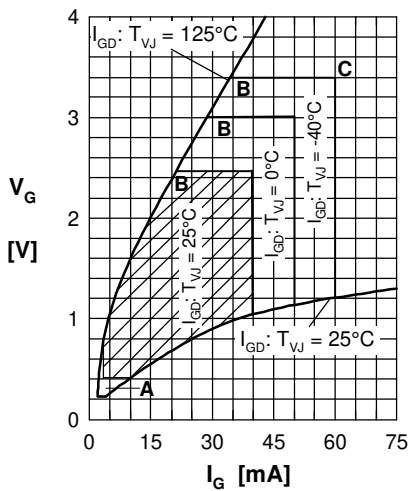

 Fig. 3  $I^2t$  versus time (1-10 ms)


Fig. 4 Gate trigger characteristics



Fig. 5 Gate controlled delay time



Fig. 6 Max. forward current at case temperature

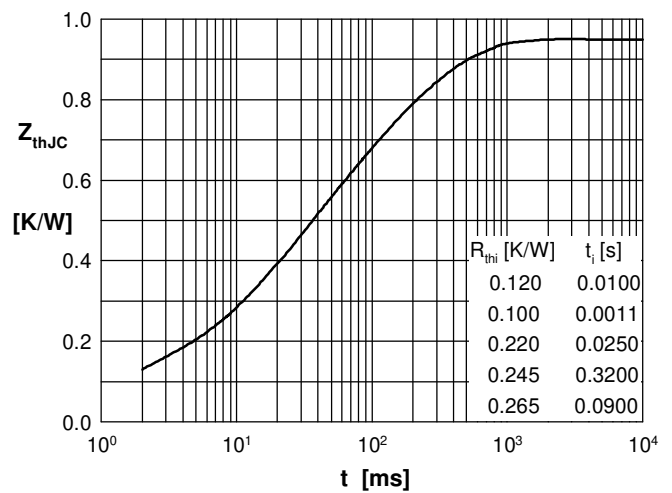

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance