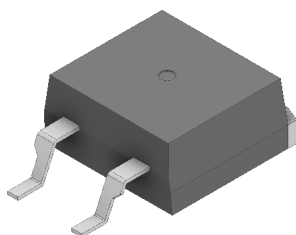


# CLA30MT1200NPZ

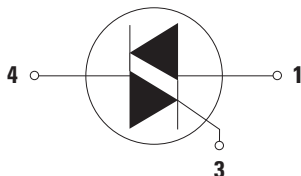
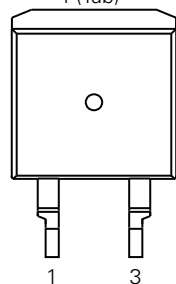
## 1200 V, 15 A High Efficiency Thyristor

### Three Quadrants Operation: QI–QIII, 1 ~ TRIAC

RoHS



### Pinout Diagram TO-263 (D²PAK-HV)

Backside: anode/cathode  
4 (Tab)

1: T1; 3: Gate; 4: T2

### Features:

- TRIAC for line frequency
- Three quadrants operation: QI–QIII
- Planar passivated chip
- Long-term stability of blocking currents and voltages

### Applications:

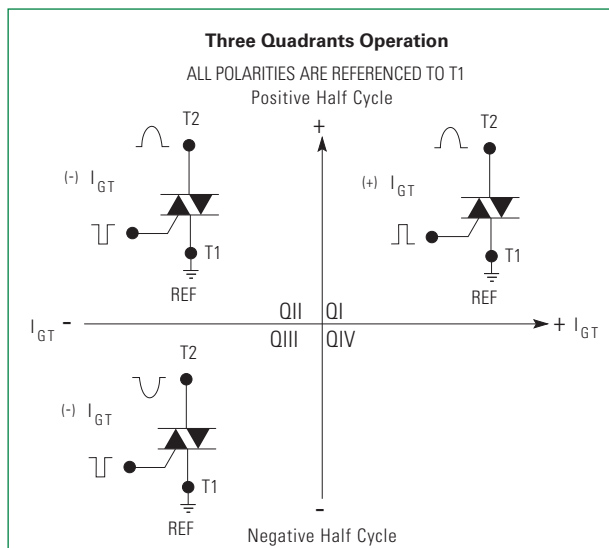
- Line rectifying 50/60 Hz
- Soft start AC motor control
- Lighting and temperature control
- DC motor control
- Power converter
- AC power control

### Package:

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

### Product Summary

| Characteristic | Value | Unit |
|----------------|-------|------|
| $V_{RRM}$      | 1200  | V    |
| $I_{TAV}$      | 15    | A    |
| $V_T$          | 1.35  | V    |



Maximum Ratings

| Symbol            | Characteristics                                         | Conditions                                                                                                                                                                 |                                            | Value      | Units                  |
|-------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------|------------------------|
| $I_{T(RMS)}$      | RMS Forward Current per Phase                           | 180° Sine; $T_C = 120\text{ }^{\circ}\text{C}$ ; $T_{vj} = 150\text{ }^{\circ}\text{C}$                                                                                    |                                            | 33         | A                      |
| $I_{TAV}$         | Average Forward Current                                 |                                                                                                                                                                            |                                            | 15         |                        |
| $I_{R/D}$         | Reverse Current, Drain Current                          | $T_{vj} = 25\text{ }^{\circ}\text{C}$ ; $V_{R/D} = 1200\text{ V}$                                                                                                          |                                            | 10         | $\mu\text{A}$          |
|                   |                                                         | $T_{vj} = 125\text{ }^{\circ}\text{C}$ ; $V_{R/D} = 1200\text{ V}$                                                                                                         |                                            | 1.5        | mA                     |
| $I_{TSM}$         | Maximum Forward Surge Current                           | $T_{vj} = 45\text{ }^{\circ}\text{C}$                                                                                                                                      | t = 10 ms, 50 Hz sine, $V_R = 0\text{ V}$  | 170        | A                      |
|                   |                                                         |                                                                                                                                                                            | t = 8.3 ms, 60 Hz sine, $V_R = 0\text{ V}$ | 185        |                        |
|                   |                                                         | $T_{vj} = 150\text{ }^{\circ}\text{C}$                                                                                                                                     | t = 10 ms, 50 Hz sine, $V_R = 0\text{ V}$  | 145        |                        |
|                   |                                                         |                                                                                                                                                                            | t = 8.3 ms, 60 Hz sine, $V_R = 0\text{ V}$ | 155        |                        |
| $I^2t$            | $I^2t$ Value for Fusing                                 | $T_{vj} = 45\text{ }^{\circ}\text{C}$                                                                                                                                      | t = 10 ms, 50 Hz sine, $V_R = 0\text{ V}$  | 145        | $\text{A}^2\text{s}$   |
|                   |                                                         |                                                                                                                                                                            | t = 8.3 ms, 60 Hz sine, $V_R = 0\text{ V}$ | 140        |                        |
|                   |                                                         | $T_{vj} = 150\text{ }^{\circ}\text{C}$                                                                                                                                     | t = 10 ms, 50 Hz sine, $V_R = 0\text{ V}$  | 105        |                        |
|                   |                                                         |                                                                                                                                                                            | t = 8.3 ms, 60 Hz sine, $V_R = 0\text{ V}$ | 100        |                        |
| $V_{RSM}/V_{DSM}$ | Maximum Non-repetitive Reverse/Forward Blocking Voltage | $T_{vj} = 25\text{ }^{\circ}\text{C}$                                                                                                                                      |                                            | 1300       | V                      |
| $V_{RRM}/V_{DRM}$ | Maximum Repetitive Reverse/Forward Blocking Voltage     | $T_{vj} = 25\text{ }^{\circ}\text{C}$                                                                                                                                      |                                            | 1200       | V                      |
| $di/dt_{cr}$      | Critical Rate of Rise of On-state Current               | $t_p = 200\text{ }\mu\text{s}$ ; f = 50 Hz;<br>$di_G/dt = 0.3\text{ A}/\mu\text{s}$ ; $I_G = 0.3\text{ A}$ ;<br>$T_{vj} = 150\text{ }^{\circ}\text{C}$ ; $V = 2/3 V_{DRM}$ | Repetitive, $I_T = 45\text{ A}$            | 150        | $\text{A}/\mu\text{s}$ |
|                   |                                                         |                                                                                                                                                                            | Non-repetitive, $I_T = 15\text{ A}$        | 500        |                        |
| $dv/dt_{cr}$      | Critical Rate of Rise of Voltage                        | $V = 2/3 V_{DRM}$ , $R_{GK} = \infty$ ,<br>method 1 (linear voltage rise), $T_{vj} = 150\text{ }^{\circ}\text{C}$                                                          |                                            | 500        | $\text{V}/\mu\text{s}$ |
| $P_{GM}$          | Maximum Gate Power Dissipation                          | $T_C = 150\text{ }^{\circ}\text{C}$                                                                                                                                        | $t_p = 30\text{ }\mu\text{s}$              | 5          | W                      |
|                   |                                                         |                                                                                                                                                                            | $t_p = 300\text{ }\mu\text{s}$             | 1          |                        |
| $P_{GAV}$         | Average Gate Power Dissipation                          | $T_C = 150\text{ }^{\circ}\text{C}$                                                                                                                                        |                                            | 0.2        | W                      |
| $P_{tot}$         | Total Power Dissipation                                 | $T_C = 25\text{ }^{\circ}\text{C}$                                                                                                                                         |                                            | 130        | W                      |
| $T_{stg}$         | Storage Temperature Range                               | –                                                                                                                                                                          |                                            | –40 to 150 | $^{\circ}\text{C}$     |
| $T_{op}$          | Operating Temperature Range                             | –                                                                                                                                                                          |                                            | –40 to 125 | $^{\circ}\text{C}$     |
| $T_{vj}$          | Virtual Junction Temperature Range                      | –                                                                                                                                                                          |                                            | –40 to 150 | $^{\circ}\text{C}$     |

Thermal Characteristics

| Symbol     | Characteristics                      | Value |      |      | Units               |
|------------|--------------------------------------|-------|------|------|---------------------|
|            |                                      | Min.  | Typ. | Max. |                     |
| $R_{thJC}$ | Thermal Resistance, Junction to Case | –     | –    | 0.95 | $\text{K}/\text{W}$ |
| $R_{thCH}$ | Thermal Resistance, Case to Heatsink | –     | 0.3  | –    | $\text{K}/\text{W}$ |

Electrical Characteristics

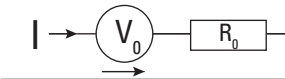
| Symbol          | Characteristics                | Conditions                                                                                                                                                       |                       | Value |      |      | Units |
|-----------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------|------|------|-------|
|                 |                                |                                                                                                                                                                  |                       | Min.  | Typ. | Max. |       |
| I <sub>GT</sub> | Gate Trigger Current           | T <sub>vj</sub> = 25 °C                                                                                                                                          | V <sub>D</sub> = 6 V  | –     | –    | ±48  | mA    |
|                 |                                | T <sub>vj</sub> = –40 °C                                                                                                                                         |                       | –     | –    | ±60  |       |
| V <sub>GT</sub> | Gate Trigger Voltage           | T <sub>vj</sub> = 25 °C                                                                                                                                          | V <sub>D</sub> = 6 V  | –     | –    | 1.5  | V     |
|                 |                                | T <sub>vj</sub> = –40 °C                                                                                                                                         |                       | –     | –    | 1.6  |       |
| I <sub>GD</sub> | Gate Non-trigger Current       | V <sub>D</sub> = 2/3 V <sub>DRM</sub> , T <sub>vj</sub> = 150 °C                                                                                                 |                       | –     | –    | ±1   | mA    |
| V <sub>GD</sub> | Gate Non-trigger Voltage       | V <sub>D</sub> = 2/3 V <sub>DRM</sub> , T <sub>vj</sub> = 150 °C                                                                                                 |                       | –     | –    | 0.2  | V     |
| V <sub>T</sub>  | Forward Voltage Drop           | T <sub>vj</sub> = 25 °C                                                                                                                                          | I <sub>T</sub> = 15 A | –     | –    | 1.35 | V     |
|                 |                                |                                                                                                                                                                  | I <sub>T</sub> = 30 A | –     | –    | 1.68 |       |
|                 |                                | T <sub>vj</sub> = 125 °C                                                                                                                                         | I <sub>T</sub> = 15 A | –     | –    | 1.35 |       |
|                 |                                |                                                                                                                                                                  | I <sub>T</sub> = 30 A | –     | –    | 1.79 |       |
| I <sub>L</sub>  | Latching Current               | t <sub>p</sub> = 10 µs; I <sub>G</sub> = 0.3 A; di <sub>G</sub> /dt = 0.3 A/µs; T <sub>vj</sub> = 25 °C                                                          |                       | –     | –    | 70   | mA    |
| I <sub>H</sub>  | Holding Current                | V <sub>D</sub> = 6 V; R <sub>GK</sub> = ∞; T <sub>vj</sub> = 25 °C                                                                                               |                       | –     | –    | 50   | mA    |
| V <sub>T0</sub> | Threshold Voltage <sup>1</sup> | T <sub>vj</sub> = 150 °C                                                                                                                                         |                       | –     | –    | 0.89 | V     |
| r <sub>T</sub>  | Slope Resistance <sup>1</sup>  | T <sub>vj</sub> = 150 °C                                                                                                                                         |                       | –     | –    | 30   | mΩ    |
| C <sub>J</sub>  | Junction Capacitance           | V <sub>R</sub> = 400 V, f = 1 MHz, T <sub>vj</sub> = 25 °C                                                                                                       |                       | –     | 9    | –    | pF    |
| t <sub>gd</sub> | Gate Controlled Delay Time     | V <sub>D</sub> = 1/2 V <sub>DRM</sub> ; I <sub>G</sub> = 0.3 A ; di <sub>G</sub> /dt = 0.3 A/µs; T <sub>vj</sub> = 25 °C                                         |                       | –     | –    | 2    | µs    |
| t <sub>q</sub>  | Turn-off Time                  | V <sub>R</sub> = 100 V; I <sub>T</sub> = 15 A; V = 2/3 V <sub>DRM</sub> ; di/dt = 10 A/µs;<br>dv/dt = 20 V/µs; t <sub>p</sub> = 200 µs; T <sub>vj</sub> = 125 °C |                       | –     | 150  | –    | µs    |

Note 1: For power loss calculation only

Package

| Symbol                | Characteristics                                              | Conditions           | Value |      |      | Units |
|-----------------------|--------------------------------------------------------------|----------------------|-------|------|------|-------|
|                       |                                                              |                      | Min.  | Typ. | Max. |       |
| I <sub>RMS</sub>      | RMS Current                                                  | per terminal         | –     | –    | 35   | A     |
| F <sub>C</sub>        | Mounting force with clip                                     | –                    | 20    | –    | 60   | N     |
| G                     | Weight                                                       | –                    | –     | 1.5  | –    | g     |
| d <sub>Spp/App</sub>  | creepage distance on surface / striking distance through air | terminal to terminal | 4.2   | –    | –    | mm    |
| d <sub>Sptb/Apb</sub> |                                                              | terminal to backside | 4.7   | –    | –    |       |

Equivalent Circuits for Simulation (T<sub>vj</sub> = 150 °C)



| Symbol             | Characteristics               | Value | Units |
|--------------------|-------------------------------|-------|-------|
| V <sub>0 max</sub> | Threshold Voltage             | 0.89  | V     |
| R <sub>0 max</sub> | Slope Resistance <sup>1</sup> | 27    | mΩ    |

Note 1: On die level

## Characteristic Curves

Figure 1. Forward Characteristics

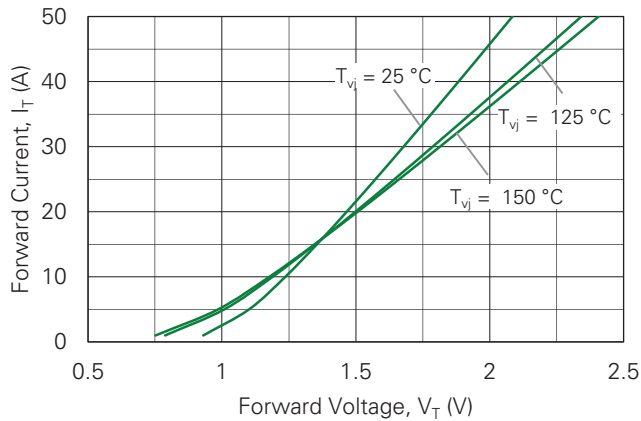
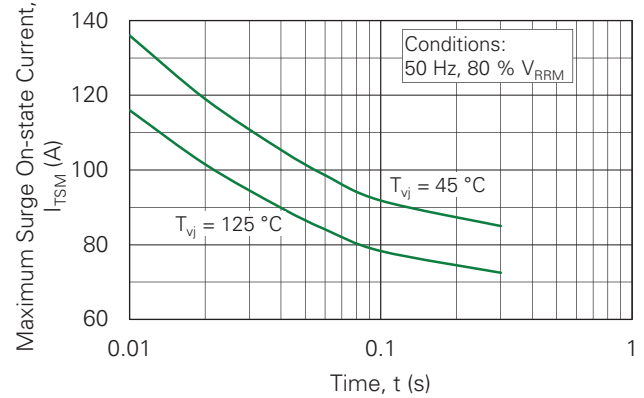
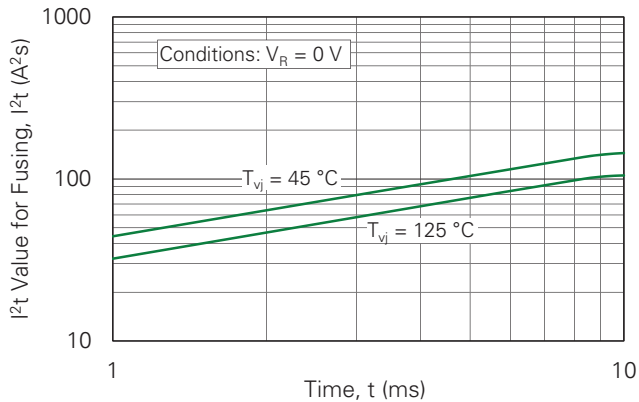
Figure 2. Surge Overload Current  
 $I_{TSM}$ : Crest Value, t: durationFigure 3.  $I^2t$  vs. Time (1-10 s)

Figure 4. Gate Voltage and Gate Current

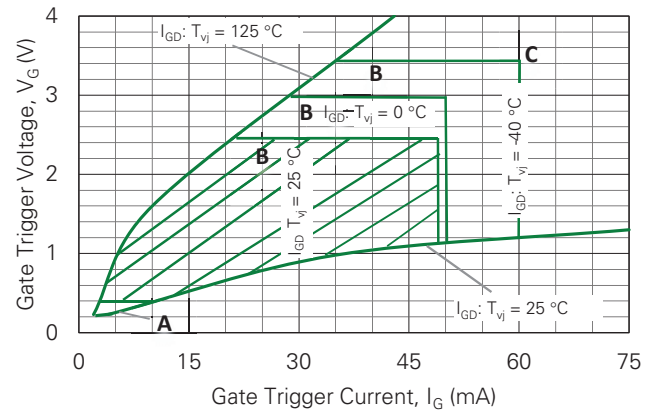


Figure 5. Gate Controlled Delay Time

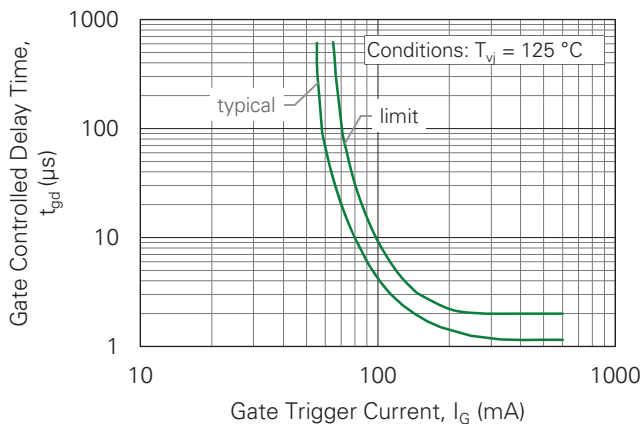


Figure 6. Max. Forward Current at Case Temperature

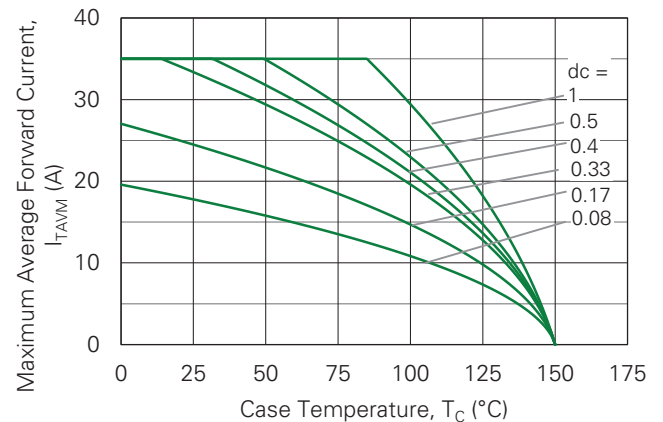


Figure 7a. Power Dissipation vs. Direct Output Current

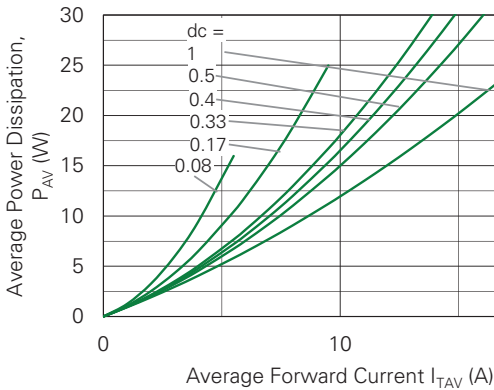


Figure 7b. Power Dissipation vs. Ambient Temperature

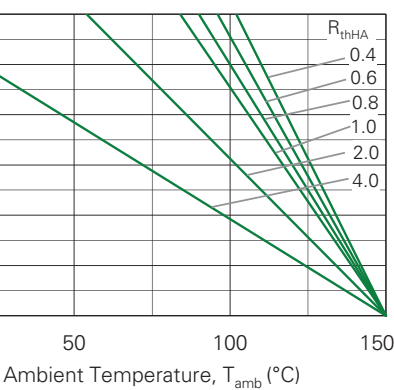
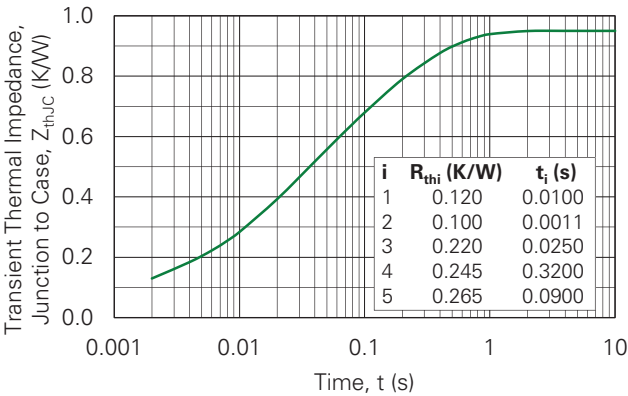
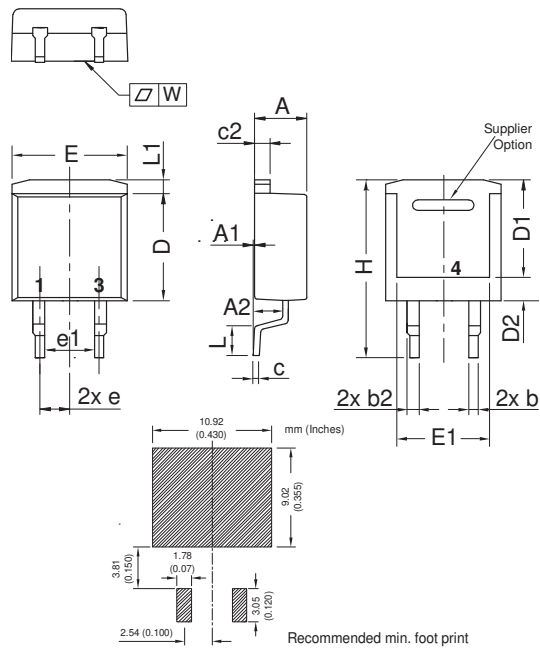


Figure 8. Transient Thermal Impedance, Junction to Case



Part Outline Drawing (TO-263-2L) (D<sup>2</sup>PAK-HV)



| Symbol | Millimeters |       | 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 |

Note: All dimensions conform with and/or within JEDEC standard.

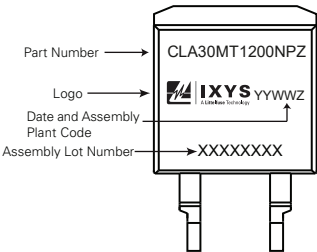
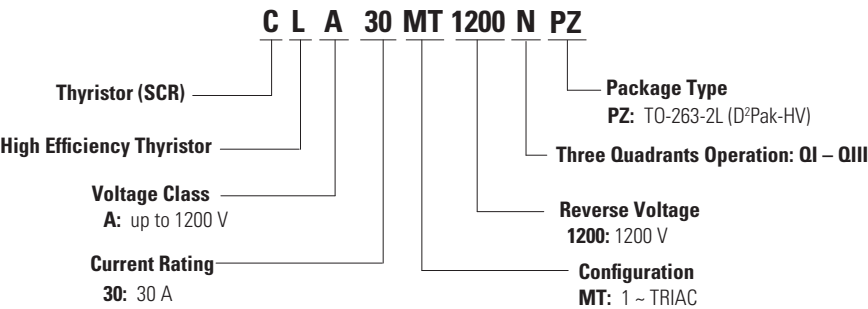
Product Selector

| Part Number    | Voltage Class | Package                           |
|----------------|---------------|-----------------------------------|
| CLA30MT1200NPZ | 1200 V        | TO-263-2L (D <sup>2</sup> PAK-HV) |
| CLA30MT1200NPB | 1200 V        | TO-220AB-3L                       |

Packing Options

| Part Number        | Marking        | Packing Mode | Quantity |
|--------------------|----------------|--------------|----------|
| CLA30MT1200NPZ-TRL | CLA30MT1200NPZ | Tape & Reel  | 800      |
| CLA30MT1200NPZ-TUB | CLA30MT1200NPZ | Tube         | 50       |

Part Numbering and Marking



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Part of:

