

# High Efficiency Thyristor

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

$$I_{TAV} = 100\text{ A}$$

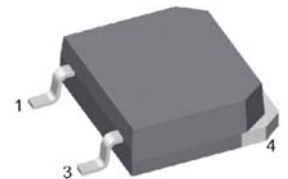
$$V_T = 1,34\text{ V}$$

## Single Thyristor

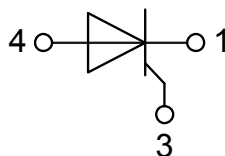
Part number

**CLA100E1200TZ**

Marking on Product: CLA100E1200TZ



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-268AA (D3Pak-HV)

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

### Disclaimer Notice

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| Thyristor      |                                                      |                                                                                                                                                                                                          |                                | Ratings |      |      |                   |
|----------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|------|------|-------------------|
| Symbol         | Definition                                           | Conditions                                                                                                                                                                                               |                                | min.    | typ. | max. | Unit              |
| $V_{RSM/DSM}$  | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                            |                                |         |      | 1300 | V                 |
| $V_{RRM/DRM}$  | max. repetitive reverse/forward blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                            |                                |         |      | 1200 | V                 |
| $I_{R/D}$      | reverse current, drain current                       | $V_{R/D} = 1200\text{ V}$                                                                                                                                                                                | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 10   | $\mu\text{A}$     |
|                |                                                      | $V_{R/D} = 1200\text{ V}$                                                                                                                                                                                | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 5    | mA                |
| $V_T$          | forward voltage drop                                 | $I_T = 100\text{ A}$                                                                                                                                                                                     | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1,37 | V                 |
|                |                                                      | $I_T = 200\text{ A}$                                                                                                                                                                                     |                                |         |      | 1,78 | V                 |
|                |                                                      | $I_T = 100\text{ A}$                                                                                                                                                                                     | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 1,34 | V                 |
|                |                                                      | $I_T = 200\text{ A}$                                                                                                                                                                                     |                                |         |      | 1,85 | V                 |
| $I_{TAV}$      | average forward current                              | $T_C = 105^{\circ}\text{C}$                                                                                                                                                                              | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 100  | A                 |
| $I_{T(RMS)}$   | RMS forward current                                  | 180° sine                                                                                                                                                                                                |                                |         |      | 160  | A                 |
| $V_{T0}$       | threshold voltage                                    | } for power loss calculation only                                                                                                                                                                        | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 0,82 | V                 |
| $r_T$          | slope resistance                                     |                                                                                                                                                                                                          |                                |         |      | 5,2  | m $\Omega$        |
| $R_{thJC}$     | thermal resistance junction to case                  |                                                                                                                                                                                                          |                                |         |      | 0,2  | K/W               |
| $R_{thCH}$     | thermal resistance case to heatsink                  |                                                                                                                                                                                                          |                                |         | 0,15 |      | K/W               |
| $P_{tot}$      | total power dissipation                              |                                                                                                                                                                                                          | $T_C = 25^{\circ}\text{C}$     |         |      | 625  | W                 |
| $I_{TSM}$      | max. forward surge current                           | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                         | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 1,10 | kA                |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                        | $V_R = 0\text{ V}$             |         |      | 1,19 | kA                |
|                |                                                      | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                         | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 935  | A                 |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                        | $V_R = 0\text{ V}$             |         |      | 1,01 | kA                |
| $I^2t$         | value for fusing                                     | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                         | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 6,05 | kA <sup>2</sup> s |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                        | $V_R = 0\text{ V}$             |         |      | 5,89 | kA <sup>2</sup> s |
|                |                                                      | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                                                                         | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 4,37 | kA <sup>2</sup> s |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                                                                        | $V_R = 0\text{ V}$             |         |      | 4,25 | kA <sup>2</sup> s |
| $C_J$          | junction capacitance                                 | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$                                                                                                                                                                  | $T_{VJ} = 25^{\circ}\text{C}$  |         | 43   |      | pF                |
| $P_{GM}$       | max. gate power dissipation                          | $t_p = 30\text{ }\mu\text{s}$                                                                                                                                                                            | $T_C = 150^{\circ}\text{C}$    |         |      | 10   | W                 |
|                |                                                      | $t_p = 300\text{ }\mu\text{s}$                                                                                                                                                                           |                                |         |      | 1    | 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, $I_T = 300\text{ A}$                                                                                                                        |                                |         |      | 150  | A/ $\mu\text{s}$  |
|                |                                                      | $t_p = 200\text{ }\mu\text{s}; di_G/dt = 0,45\text{ A}/\mu\text{s};$<br>$I_G = 0,45\text{ A}; V_D = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 100\text{ A}$                                                |                                |         |      | 500  | A/ $\mu\text{s}$  |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage                     | $V_D = \frac{2}{3} V_{DRM}$                                                                                                                                                                              | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 1000 | V/ $\mu\text{s}$  |
|                |                                                      | $R_{GK} = \infty$ ; method 1 (linear voltage rise)                                                                                                                                                       |                                |         |      |      |                   |
| $V_{GT}$       | gate trigger voltage                                 | $V_D = 6\text{ V}$                                                                                                                                                                                       | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1,5  | V                 |
|                |                                                      |                                                                                                                                                                                                          | $T_{VJ} = -40^{\circ}\text{C}$ |         |      | 1,6  | V                 |
| $I_{GT}$       | gate trigger current                                 | $V_D = 6\text{ V}$                                                                                                                                                                                       | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 40   | mA                |
|                |                                                      |                                                                                                                                                                                                          | $T_{VJ} = -40^{\circ}\text{C}$ |         |      | 80   | 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                             |                                                                                                                                                                                                          |                                |         |      | 5    | mA                |
| $I_L$          | latching current                                     | $t_p = 10\text{ }\mu\text{s}$                                                                                                                                                                            | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 150  | mA                |
|                |                                                      | $I_G = 0,45\text{ A}; di_G/dt = 0,45\text{ A}/\mu\text{s}$                                                                                                                                               |                                |         |      |      |                   |
| $I_H$          | holding current                                      | $V_D = 6\text{ V}$ $R_{GK} = \infty$                                                                                                                                                                     | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 100  | 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                                        | $V_R = 100\text{ V}; I_T = 100\text{ A}; V_D = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$<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-268AA (D3Pak-HV) |                                                              |                      | Ratings |      |      |      |
|-----------------------------|--------------------------------------------------------------|----------------------|---------|------|------|------|
| Symbol                      | Definition                                                   | Conditions           | min.    | typ. | max. | Unit |
| $I_{RMS}$                   | RMS current                                                  | per terminal         |         |      | 70   | 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>               |                                                              |                      |         | 4    |      | g    |
| $F_c$                       | mounting force with clip                                     |                      | 20      |      | 120  | N    |
| $d_{Spp/App}$               | creepage distance on surface   striking distance through air | terminal to terminal | 9,4     |      |      | mm   |
| $d_{Spb/Apb}$               |                                                              | terminal to backside | 5,6     |      |      | mm   |

## Product Marking



## Part description

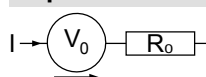
C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 100 = Current Rating [A]  
 E = Single Thyristor  
 1200 = Reverse Voltage [V]  
 TZ = TO-268AA (D3Pak) (2HV)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard |                 | CLA100E1200TZ      |               |          |          |

## Equivalent Circuits for Simulation

\* on die level

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



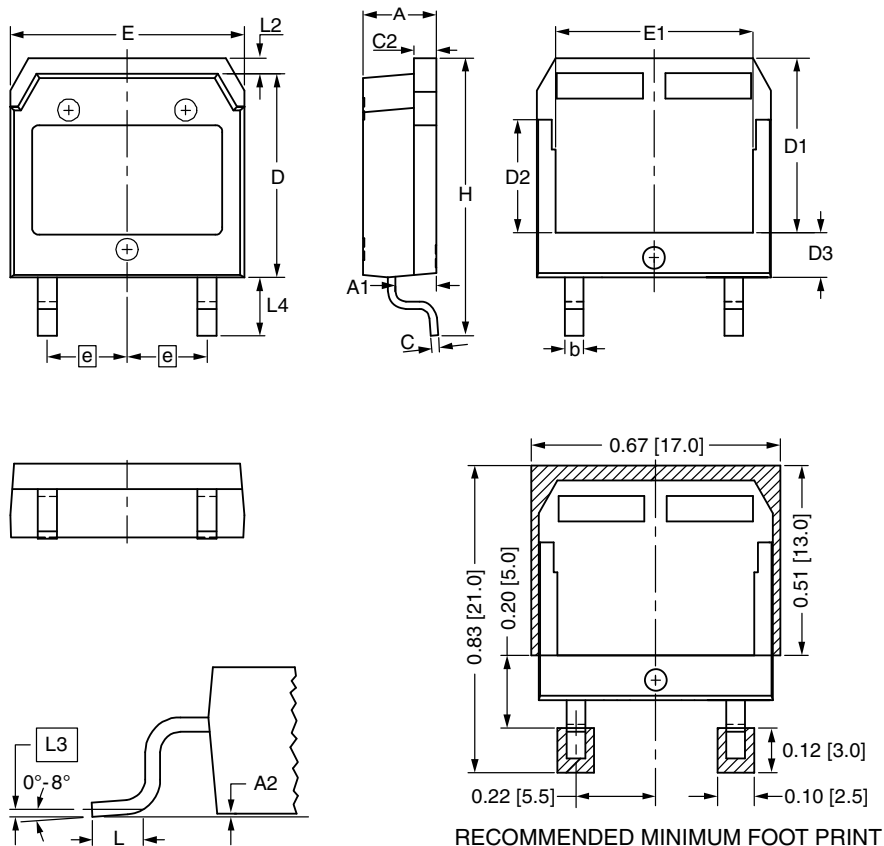
Thyristor

$V_{0\max}$  threshold voltage 0,82

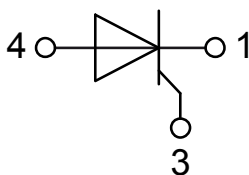
$R_{0\max}$  slope resistance \* 2,7

V

mΩ

**Outlines TO-268AA (D3Pak-HV)**


| Dim. | Millimeter |       | Inches    |       |
|------|------------|-------|-----------|-------|
|      | min        | max   | min       | max   |
| A    | 4.90       | 5.10  | 0.193     | 0.201 |
| A1   | 2.70       | 2.90  | 0.106     | 0.114 |
| A2   | 0.02       | 0.25  | 0.001     | 0.010 |
| b    | 1.15       | 1.45  | 0.045     | 0.057 |
| C    | 0.40       | 0.65  | 0.016     | 0.026 |
| C2   | 1.45       | 1.60  | 0.057     | 0.063 |
| D    | 13.80      | 14.00 | 0.543     | 0.551 |
| D1   | 11.80      | 12.10 | 0.465     | 0.476 |
| D2   | 7.50       | 7.80  | 0.295     | 0.307 |
| D3   | 2.90       | 3.20  | 0.114     | 0.126 |
| E    | 15.85      | 16.05 | 0.624     | 0.632 |
| E1   | 13.30      | 13.60 | 0.524     | 0.535 |
| e    | 5.450 BSC  |       | 0.215 BSC |       |
| H    | 18.70      | 19.10 | 0.736     | 0.752 |
| L    | 1.70       | 2.00  | 0.067     | 0.079 |
| L2   | 1.00       | 1.15  | 0.039     | 0.045 |
| L3   | 0.250 BSC  |       | 0.010 BSC |       |
| L4   | 3.80       | 4.10  | 0.150     | 0.161 |



## Thyristor

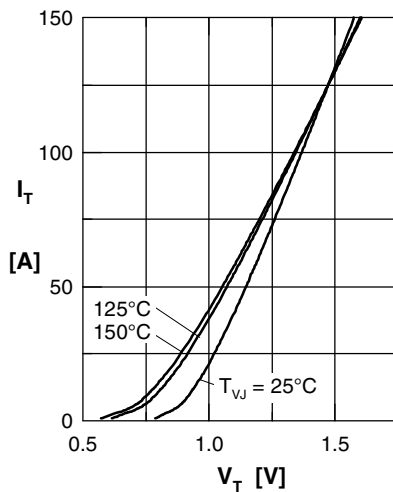


Fig. 1 Forward characteristics

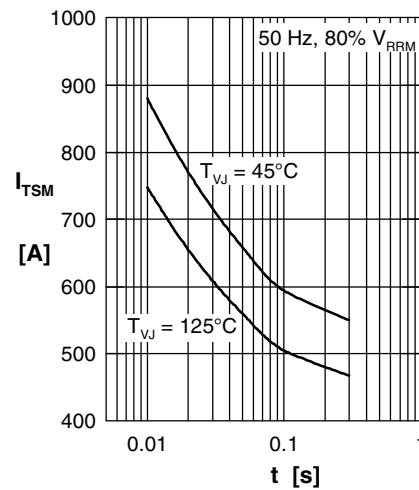


Fig. 2 Surge overload current

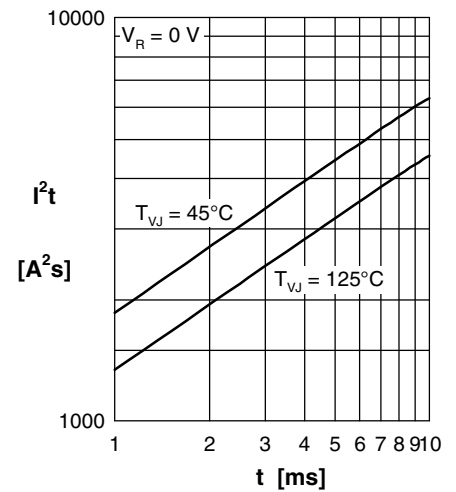


Fig. 3  $I^2t$  versus time (1-10 ms)

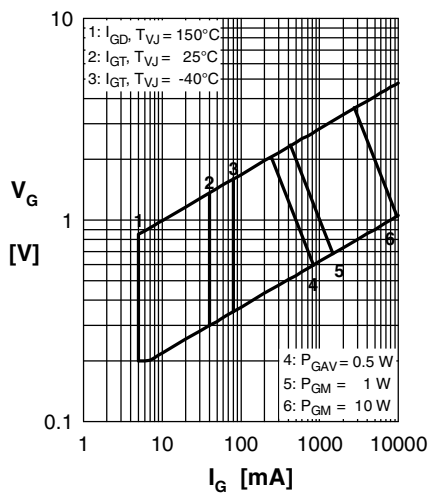


Fig. 4 Gate trigger characteristics

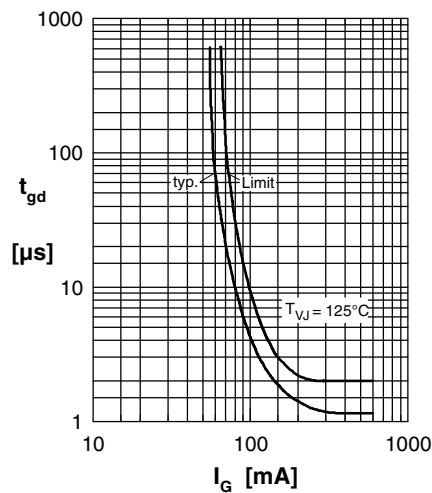


Fig. 5 Gate controlled delay time

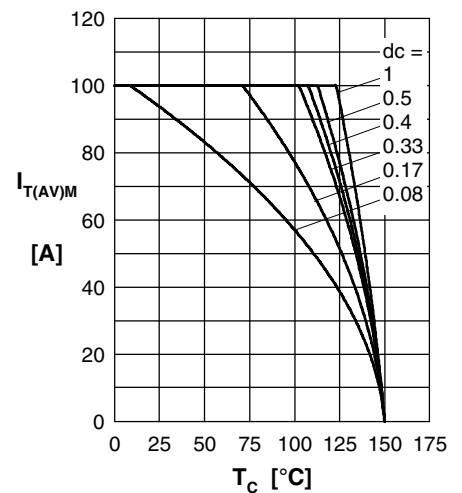


Fig. 6 Max. forward current at case temperature

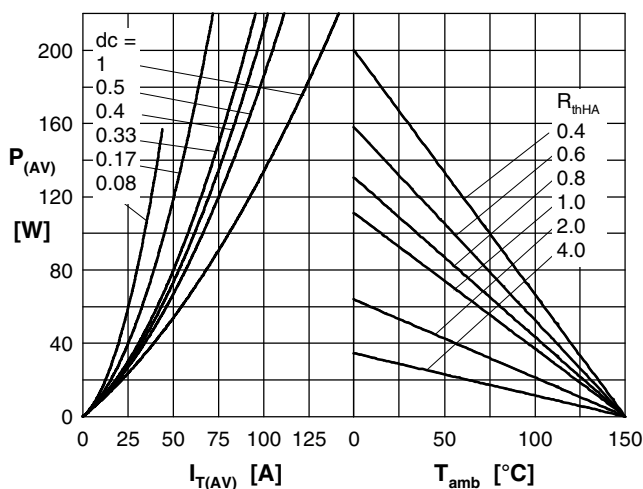


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

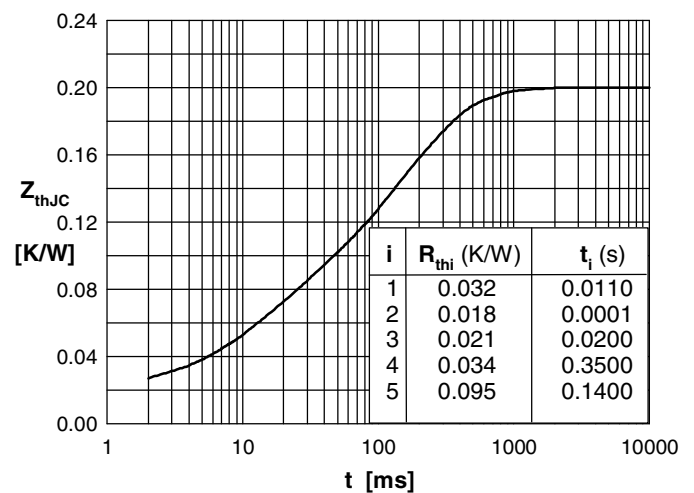


Fig. 8 Transient thermal impedance