

# High Efficiency Thyristor

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

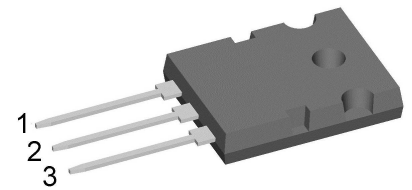
$$I_{TAV} = 100\text{ A}$$

$$V_T = 1.34\text{ V}$$

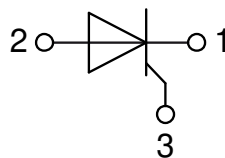
## Single Thyristor

Part number

**CLA100E1200KB**



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-264

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

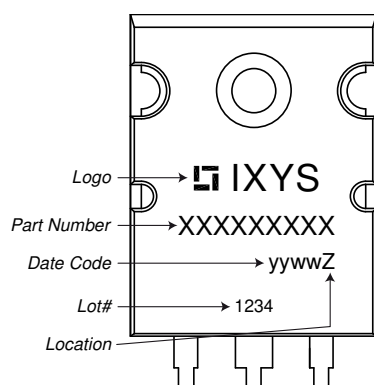
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| Thyristor      |                                                      |                                                                                                                                                                                                        |                                | Ratings |      |      |                   |
|----------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------|------|------|-------------------|
| Symbol         | Definition                                           | Conditions                                                                                                                                                                                             |                                | min.    | typ. | max. | Unit              |
| $V_{RSM/DSM}$  | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                                                          |                                |         |      | 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                       | $V_{R/D} = 1200\text{ V}$                                                                                                                                                                              | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 50   | $\mu\text{A}$     |
|                |                                                      | $V_{R/D} = 1200\text{ V}$                                                                                                                                                                              | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 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                              |                                                                                                                                                                                                        | $T_C = 25^{\circ}\text{C}$     |         |      | 220  | 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                                 | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$                                                                                                                                                                | $T_{VJ} = 25^{\circ}\text{C}$  |         | 86   |      | 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>$I_G = 0.45\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 100\text{ A}$                                                |                                |         |      | 500  | A/ $\mu\text{s}$  |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage                     | $V = \frac{2}{3} V_{DRM}$                                                                                                                                                                              | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 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                                        | $V_R = 100\text{ V}; I_T = 100\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$<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-264 |                              |              | 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   |
| Weight         |                              |              |         | 10   |      | g    |
| $M_D$          | mounting torque              |              | 0.8     |      | 1.2  | Nm   |
| $F_C$          | mounting force with clip     |              | 20      |      | 120  | N    |



### Part description

C = Thyristor (SCR)  
 L = High Efficiency Thyristor  
 A = (up to 1200V)  
 100 = Current Rating [A]  
 E = Single Thyristor  
 1200 = Reverse Voltage [V]  
 KB = TO-264 (3)

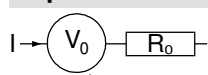
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | CLA100E1200KB   | CLA100E1200KB      | Tube          | 25       | 514750   |

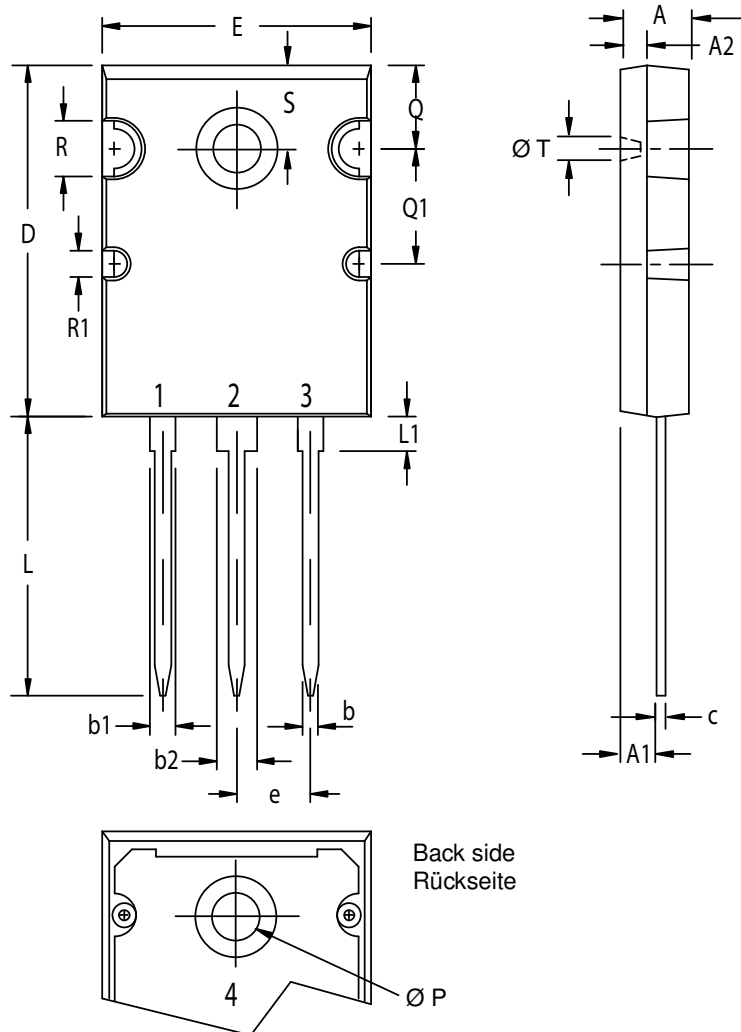
| Similar Part  | Package      | Voltage class |
|---------------|--------------|---------------|
| CLA100E1200HB | TO-247AD (3) | 1200          |

### Equivalent Circuits for Simulation

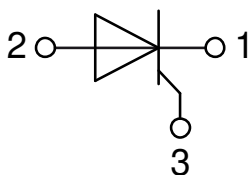
\* on die level

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

|                                                                                     |                    |           |    |
|-------------------------------------------------------------------------------------|--------------------|-----------|----|
|  |                    | Thyristor |    |
| $V_{0\max}$                                                                         | threshold voltage  | 0.82      | V  |
| $R_{0\max}$                                                                         | slope resistance * | 2.7       | mΩ |

**Outlines TO-264**


| SYM | INCHES   |       | MILLIMETERS |       |
|-----|----------|-------|-------------|-------|
|     | MIN      | MAX   | MIN         | MAX   |
| A   | 0.190    | 0.202 | 4.82        | 5.13  |
| A1  | 0.100    | 0.114 | 2.54        | 2.89  |
| A2  | 0.079    | 0.083 | 2.00        | 2.10  |
| b   | 0.044    | 0.056 | 1.12        | 1.42  |
| b1  | 0.094    | 0.106 | 2.39        | 2.69  |
| b2  | 0.114    | 0.122 | 2.90        | 3.09  |
| c   | 0.021    | 0.033 | 0.53        | 0.83  |
| D   | 1.020    | 1.030 | 25.91       | 26.16 |
| E   | 0.780    | 0.786 | 19.81       | 19.96 |
| e   | 5.46 BSC |       | .215 BSC    |       |
| J   | 0.000    | 0.010 | 0.00        | 0.25  |
| K   | 0.000    | 0.010 | 0.00        | 0.25  |
| L   | 0.800    | 0.820 | 20.32       | 20.83 |
| L1  | 0.090    | 0.102 | 2.29        | 2.59  |
| P   | 0.125    | 0.144 | 3.17        | 3.66  |
| Q   | 0.239    | 0.247 | 6.07        | 6.27  |
| Q1  | 0.330    | 0.342 | 8.38        | 8.69  |
| R   | 0.150    | 0.170 | 3.81        | 4.32  |
| R1  | 0.070    | 0.090 | 1.78        | 2.29  |
| S   | 0.238    | 0.248 | 6.04        | 6.30  |
| T   | 0.062    | 0.072 | 1.57        | 1.83  |



## Thyristor

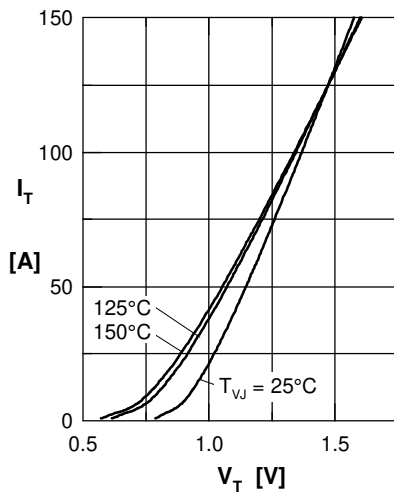


Fig. 1 Forward characteristics

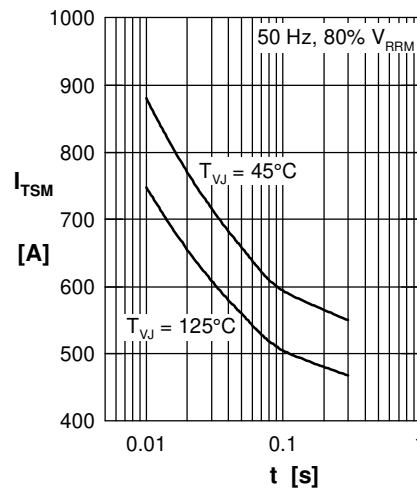


Fig. 2 Surge overload current

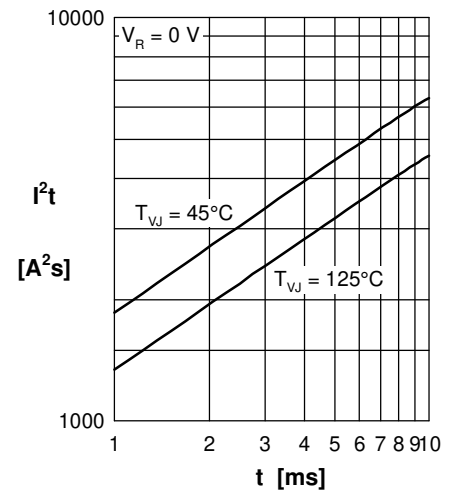


Fig. 3  $I^2t$  versus time (1-10 ms)

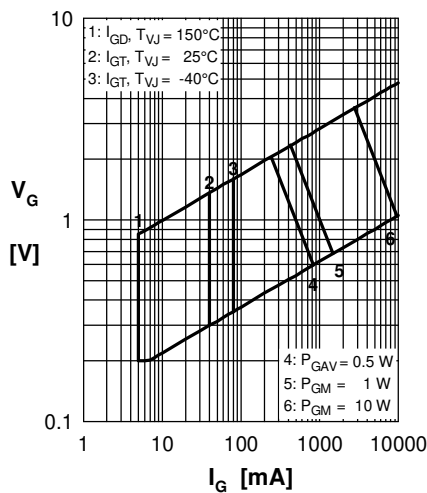


Fig. 4 Gate trigger characteristics

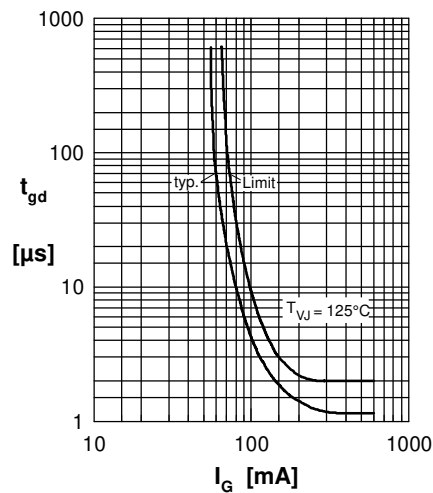


Fig. 5 Gate controlled delay time

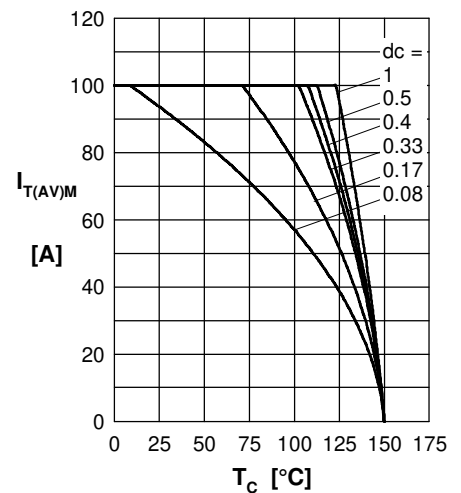


Fig. 6 Max. forward current at case temperature

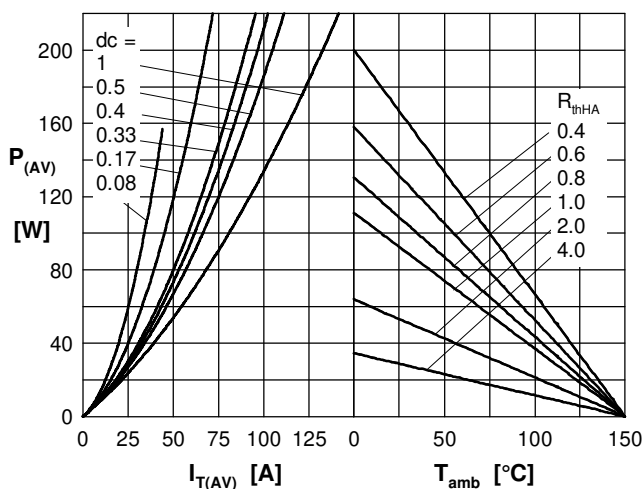


Fig. 7a Power dissipation versus direct output current  
Fig. 7b and ambient temperature

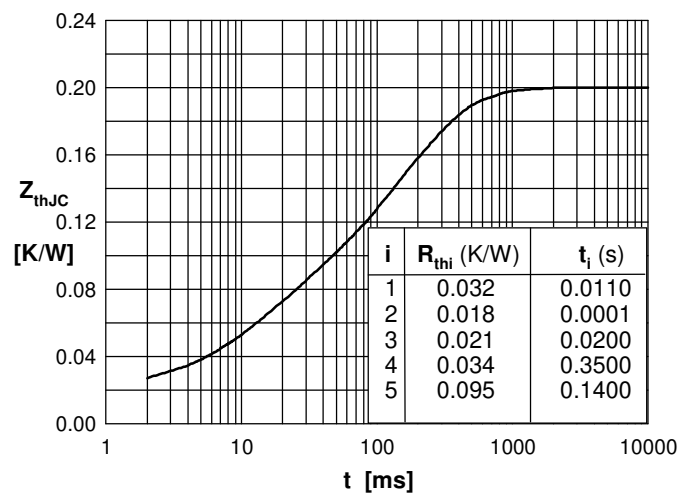


Fig. 8 Transient thermal impedance