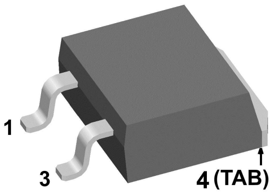
# High Efficiency Thyristor

$V_{RRM}$ = 1200 V
$I_{TAV}$ = 15 A
$V_T$ = 1.35 V

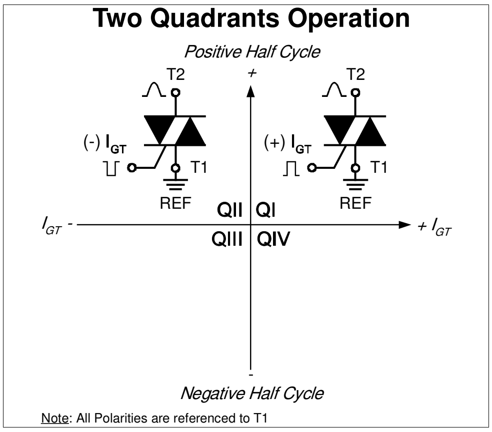
Two Quadrants Operation QI & QII
Single Thyristor with two gate polarities

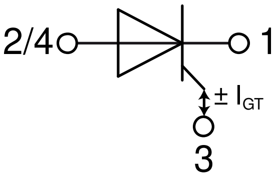
**Part number**

**CLA15E1200NPZ**



Backside: anode





**Features / Advantages:**

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Two gate current polarities usable
  - positive -> quadrant I
  - negative -> quadrant II

**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

**Disclaimer Notice**

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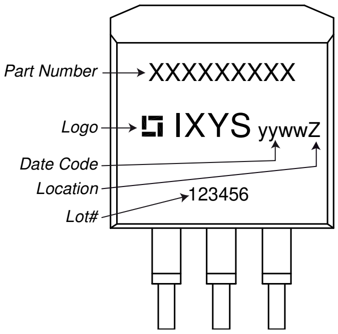
| **Thyristor** | | | | | **Ratings** | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | **Definition** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| $\mathbf{V_{RSM/DSM}}$ | *max. non-repetitive reverse/forward blocking voltage* | | $T_{VJ}$ = 25°C | | | 1300 | V |
| $\mathbf{V_{RRM/DRM}}$ | *max. repetitive reverse/forward blocking voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $\mathbf{I_{R/D}}$ | *reverse current, drain current* | $V_{R/D}$ = 1200 V | $T_{VJ}$ = 25°C | | | 10 | µA |
| | | $V_{R/D}$ = 1200 V | $T_{VJ}$ = 125°C | | | 1.5 | mA |
| $\mathbf{V_T}$ | *forward voltage drop* | $I_T$ = 15 A | $T_{VJ}$ = 25°C | | | 1.35 | V |
| | | $I_T$ = 30 A | | | | 1.68 | V |
| | | $I_T$ = 15 A | $T_{VJ}$ = 125°C | | | 1.35 | V |
| | | $I_T$ = 30 A | | | | 1.79 | V |
| $\mathbf{I_{TAV}}$ | *average forward current* | $T_C$ = 120°C | $T_{VJ}$ = 150°C | | | 15 | A |
| $\mathbf{I_{T(RMS)}}$ | *RMS forward current* | 180° sine | | | | 23 | A |
| $\mathbf{V_{T0}}$ | *threshold voltage* } *for power loss calculation only* | | $T_{VJ}$ = 150°C | | | 0.89 | V |
| $\mathbf{r_T}$ | *slope resistance* | | | | | 30 | mΩ |
| $\mathbf{R_{thJC}}$ | *thermal resistance junction to case* | | | | | 0.95 | K/W |
| $\mathbf{R_{thCH}}$ | *thermal resistance case to heatsink* | | | | 0.3 | | K/W |
| $\mathbf{P_{tot}}$ | *total power dissipation* | | $T_C$ = 25°C | | | 130 | W |
| $\mathbf{I_{TSM}}$ | *max. forward surge current* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 170 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 185 | A |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 145 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 155 | A |
| $\mathbf{I^2t}$ | *value for fusing* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 145 | $A^2s$ |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 140 | $A^2s$ |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 105 | $A^2s$ |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 100 | $A^2s$ |
| $\mathbf{C_J}$ | *junction capacitance* | $V_R$ = 400 V f = 1 MHz | $T_{VJ}$ = 25°C | | 4 | | pF |
| $\mathbf{P_{GM}}$ | *max. gate power dissipation* | $t_P$ = 30 µs | $T_C$ = 150°C | | | 5 | W |
| | | $t_P$ = 300 µs | | | | 1 | W |
| $\mathbf{P_{GAV}}$ | *average gate power dissipation* | | | | | 0.2 | W |
| $\mathbf{(di/dt)_{cr}}$ | *critical rate of rise of current* | $T_{VJ}$ = 150°C; f = 50 Hz<br>$t_P$ = 200 µs; $di_G/dt$ = 0.3 A/µs; | repetitive, $I_T$ = 45 A | | | 150 | A/µs |
| | | $I_G$ = 0.3 A; V = ⅔ $V_{DRM}$ | non-repet., $I_T$ = 15 A | | | 500 | A/µs |
| $\mathbf{(dv/dt)_{cr}}$ | *critical rate of rise of voltage* | V = ⅔ $V_{DRM}$<br>$R_{GK}$ = ∞; method 1 (linear voltage rise) | $T_{VJ}$ = 150°C | | | 500 | V/µs |
| $\mathbf{V_{GT}}$ | *gate trigger voltage* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | 1.3 | V |
| | | | $T_{VJ}$ = -40°C | | | 1.6 | V |
| $\mathbf{I_{GT}}$ | *gate trigger current* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | ± 20 | mA |
| | | | $T_{VJ}$ = -40°C | | | ± 40 | mA |
| $\mathbf{V_{GD}}$ | *gate non-trigger voltage* | $V_D$ = ⅔ $V_{DRM}$ | $T_{VJ}$ = 150°C | | | 0.2 | V |
| $\mathbf{I_{GD}}$ | *gate non-trigger current* | | | | | ± 1 | mA |
| $\mathbf{I_L}$ | *latching current* | $t_p$ = 10 µs<br>$I_G$ = 0.3 A; $di_G/dt$ = 0.3 A/µs | $T_{VJ}$ = 25°C | | | 70 | mA |
| $\mathbf{I_H}$ | *holding current* | $V_D$ = 6 V $R_{GK}$ = ∞ | $T_{VJ}$ = 25°C | | | 70 | mA |
| $\mathbf{t_{gd}}$ | *gate controlled delay time* | $V_D$ = ½ $V_{DRM}$<br>$I_G$ = 0.3 A; $di_G/dt$ = 0.3 A/µs | $T_{VJ}$ = 25°C | | | 2 | µs |
| $\mathbf{t_q}$ | *turn-off time* | $V_R$ = 100 V; $I_T$ = 15A; V = ⅔ $V_{DRM}$<br>di/dt = 10 A/µs dv/dt = 20 V/µs | $T_{VJ}$ = 125 °C<br>$t_p$ = 200 µs | | 150 | | µs |

## Package TO-263 (D2Pak-HV)

| Symbol | Definition | Conditions | Ratings 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** | | | | 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

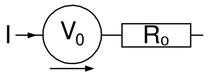
C = Thyristor (SCR)
L = High Efficiency Thyristor
A = (up to 1200V)
15 = Current Rating [A]
E = Single Thyristor with two gate polarities
1200 = Reverse Voltage [V]
N = Three Quadrants operation: QI - QIII
PZ = TO-263AB (D2Pak) (2HV)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | CLA15E1200NPZ-TRL | CLA15E1200NPZ-TRL | Tape & Reel | 800 | 517595 |
| Alternative | CLA15E1200NPZ-TUB | CLA15E1200NPZ | Tube | 50 | 523755 |

| Similar Part | Package | Voltage class |
|---|---|---|
| CLA15E1200NPB | TO-220AB (3) | 1200 |

## Equivalent Circuits for Simulation

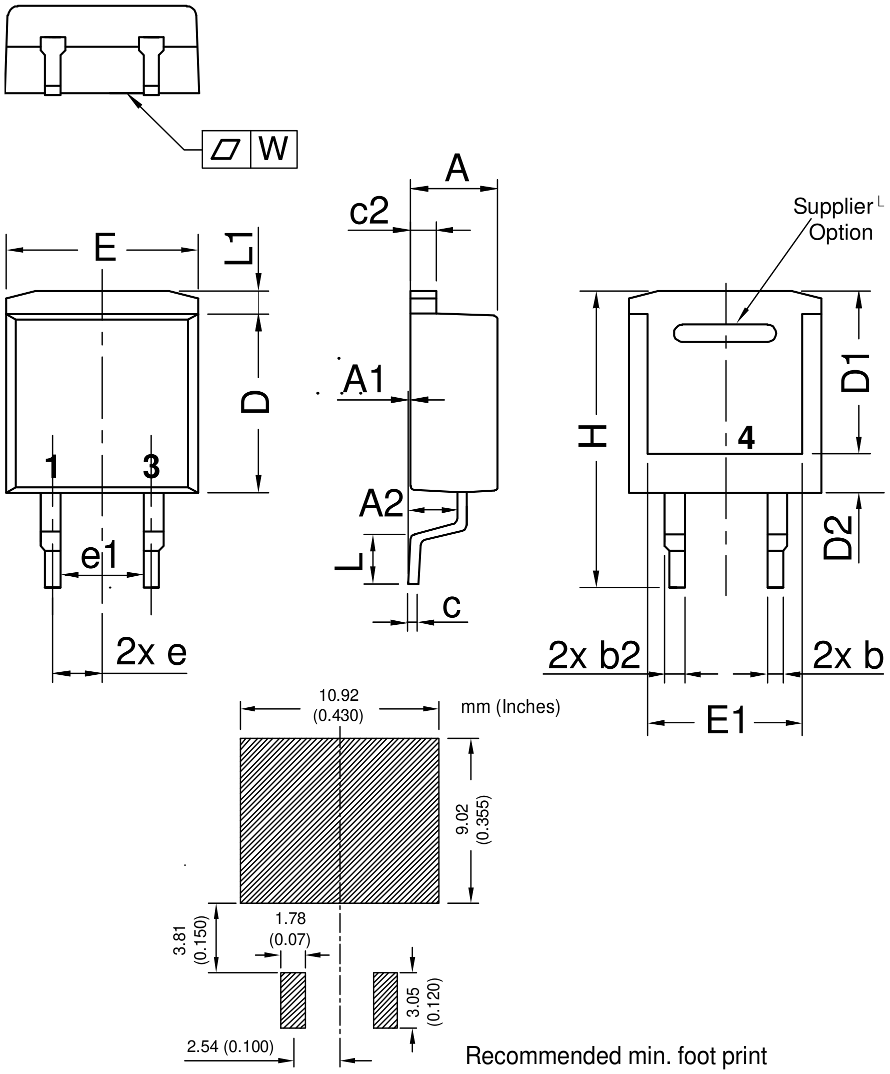
** on die level* $T_{VJ} = 150°C$



**Thyristor**

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

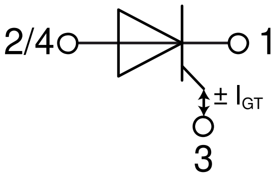
## Outlines TO-263 (D2Pak-HV)



Recommended min. foot print

| 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

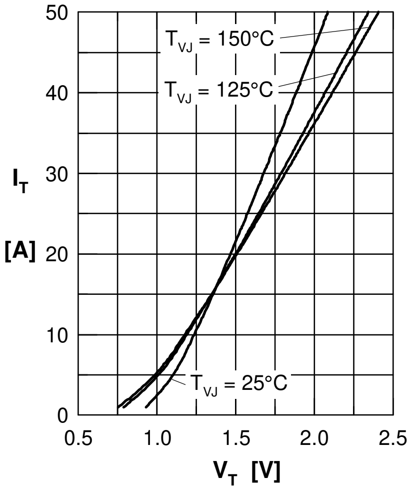


Fig. 1 Forward characteristics

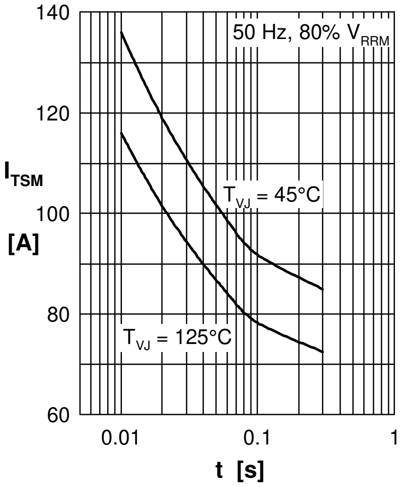


Fig. 2 Surge overload current

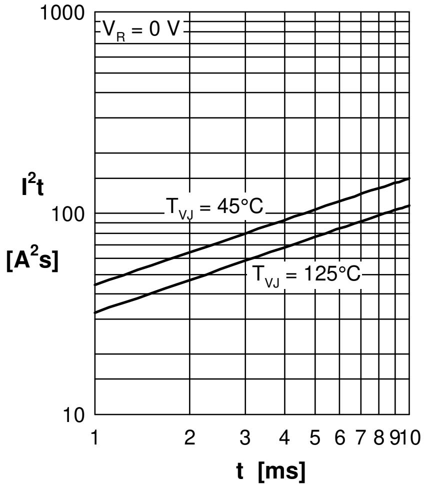


Fig. 3 I$^2$t versus time (1-10 ms)

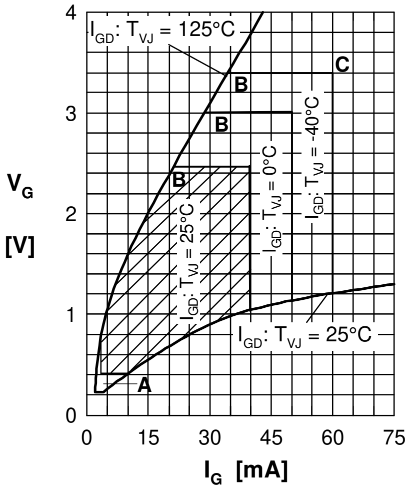


Fig. 4 Gate trigger characteristics

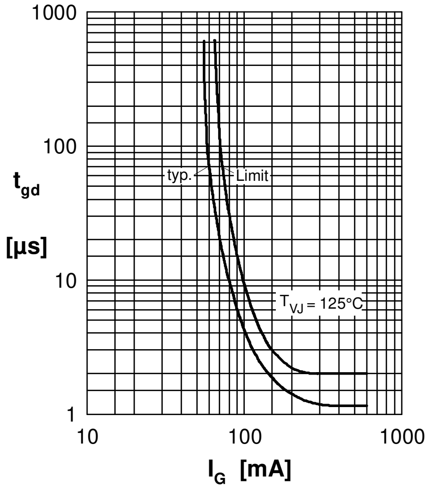


Fig. 5 Gate controlled delay time

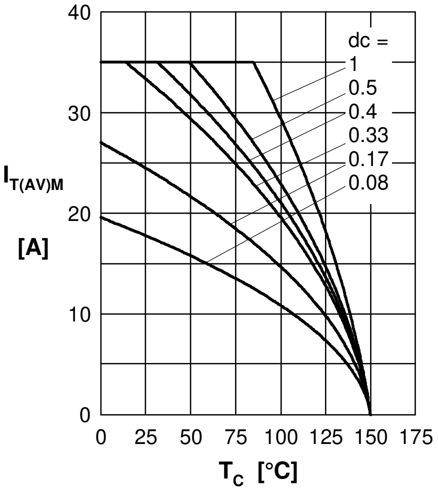


Fig. 6 Max. forward current at case temperature

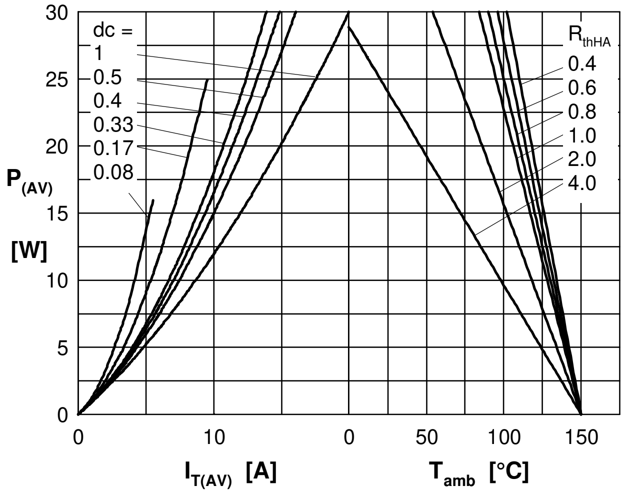
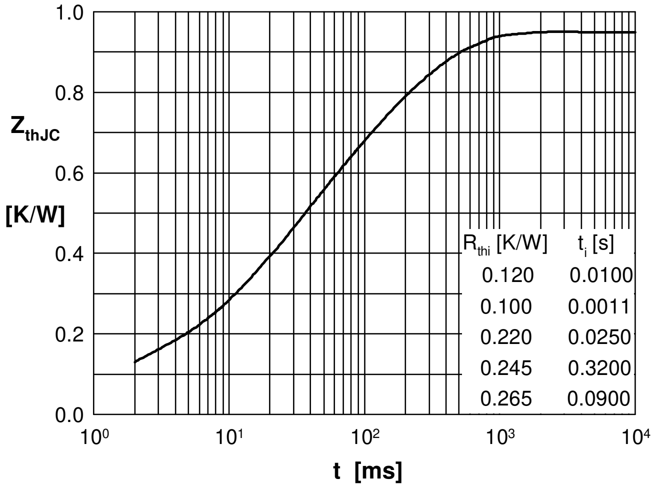


Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature



| R$_{thi}$ [K/W] | t$_i$ [s] |
|---|---|
| 0.120 | 0.0100 |
| 0.100 | 0.0011 |
| 0.220 | 0.0250 |
| 0.245 | 0.3200 |
| 0.265 | 0.0900 |

Fig. 8 Transient thermal impedance