

High Efficiency Thyristor

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

$$I_{TAV} = 20\text{ A}$$

$$V_T = 1.37\text{ V}$$

Three Quadrants operation: QI - QIII
 1~ Triac

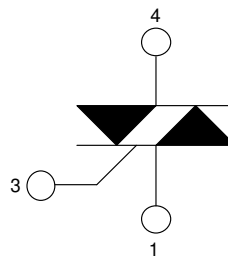
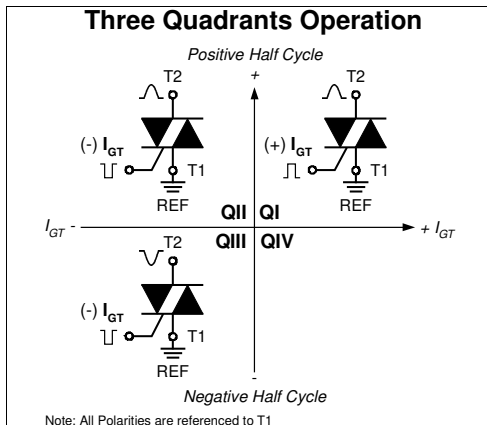
Part number

CLA40MT1200NPZ

Marking on Product: CLA40MT1200NPZ



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

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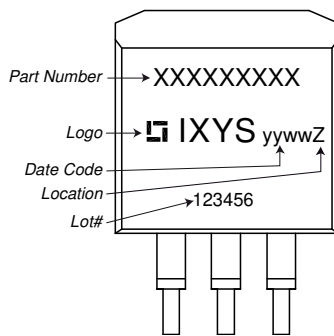


| Rectifier | | | Ratings | | | |
|----------------|--|---|--------------------------------|------|----------|------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$ | | | 1300 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$ | | | 1200 | V |
| I_{RD} | reverse current, drain current | $V_{R/D} = 1200\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 10 | μA |
| | | $V_{R/D} = 1200\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 1.5 | mA |
| V_T | forward voltage drop | $I_T = 20\text{ A}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 1.37 | V |
| | | $I_T = 40\text{ A}$ | | | 1.71 | V |
| | | $I_T = 20\text{ A}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 1.37 | V |
| | | $I_T = 40\text{ A}$ | | | 1.83 | V |
| I_{TAV} | average forward current | $T_C = 115^{\circ}\text{C}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 20 | A |
| I_{RMS} | RMS forward current per phase | 180° sine | | | 44 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 150^{\circ}\text{C}$ | | 0.89 | V |
| r_T | slope resistance | | | | 24 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | 0.8 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.3 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}\text{C}$ | | 155 | W |
| I_{TSM} | max. forward surge current | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}\text{C}$ | | 200 | A |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 215 | A |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 170 | A |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 185 | A |
| I^2t | value for fusing | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}\text{C}$ | | 200 | A ² s |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 190 | A ² s |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 145 | A ² s |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 140 | A ² s |
| C_J | junction capacitance | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 12 | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30\text{ }\mu\text{s}$ | $T_C = 150^{\circ}\text{C}$ | | 5 | W |
| | | $t_p = 300\text{ }\mu\text{s}$ | | | 1 | W |
| P_{GAV} | average gate power dissipation | | | | 0.2 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 150^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 60\text{ A}$ | | | 150 | A/ μs |
| | | $t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.3\text{ A}/\mu\text{s};$ $I_G = 0.3\text{ A}; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 20\text{ A}$ | | | 500 | A/ μs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 500 | V/ μs |
| | | $R_{GK} = \infty$; method 1 (linear voltage rise) | | | | |
| V_{GT} | gate trigger voltage | $V_D = 6\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 1.3 | 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 |
| | | | $T_{VJ} = -40^{\circ}\text{C}$ | | ± 60 | 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 | | | | ± 1 | mA |
| I_L | latching current | $t_p = 10\text{ }\mu\text{s}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 70 | mA |
| | | $I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$ | | | | |
| I_H | holding current | $V_D = 6\text{ V}$ $R_{GK} = \infty$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 50 | mA |
| t_{gd} | gate controlled delay time | $V_D = \frac{1}{2} V_{DRM}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 2 | μs |
| | | $I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$ | | | | |
| t_q | turn-off time | $V_R = 100\text{ V}; I_T = 20\text{ A}; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 125^{\circ}\text{C}$ $di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 200\text{ }\mu\text{s}$ | | | 150 | μs |



| 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 |
| 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)
- 40 = 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 | CLA40MT1200NPZ-TRL | CLA40MT1200NPZ | Tape & Reel | 800 | 515974 |
| Alternative | CLA40MT1200NPZ-TUB | CLA40MT1200NPZ | Tube | 50 | 525269 |

| Similar Part | Package | Voltage class |
|----------------|--------------|---------------|
| CLA40MT1200NPB | TO-220AB (3) | 1200 |

Equivalent Circuits for Simulation

* on die level

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



Thyristor

| | | | |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage | 0.89 | V |
| $R_{0\ max}$ | slope resistance * | 21 | mΩ |

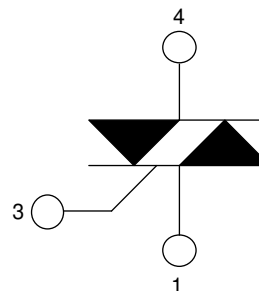


Outlines TO-263 (D2Pak-HV)



| 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.



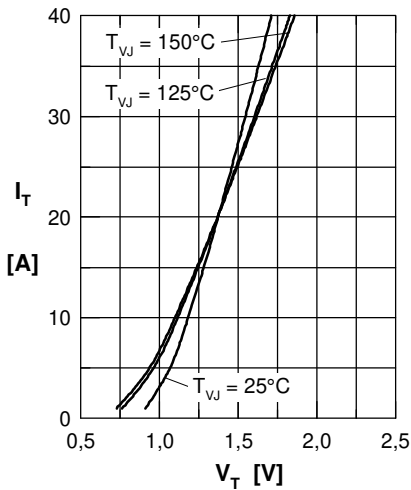
Thyristor


Fig. 1 Forward characteristics

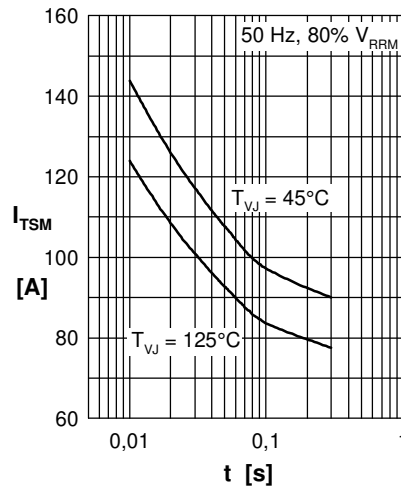


Fig. 2 Surge overload current

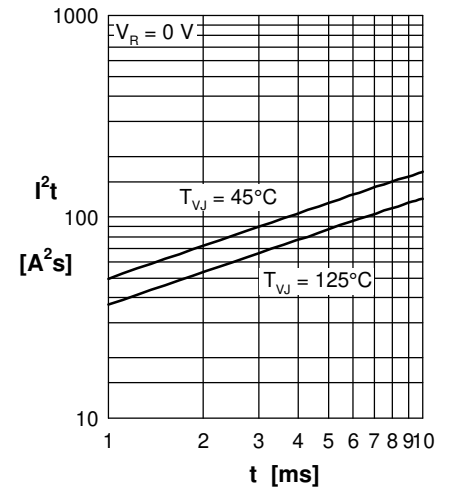
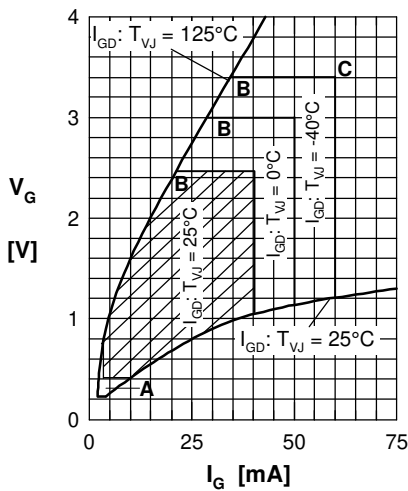

 Fig. 3 I^2t versus time (1-10 ms)


Fig. 4 Gate trigger characteristics

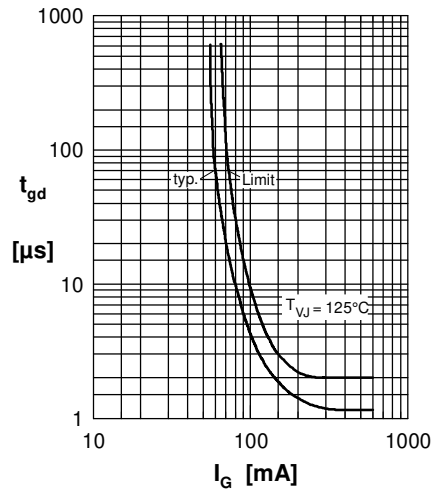


Fig. 5 Gate controlled delay time

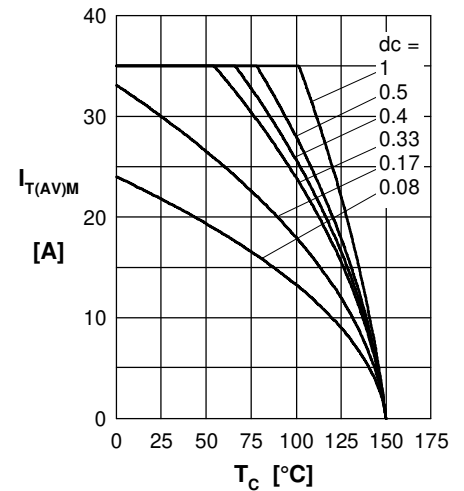


Fig. 6 Max. forward current at case temperature

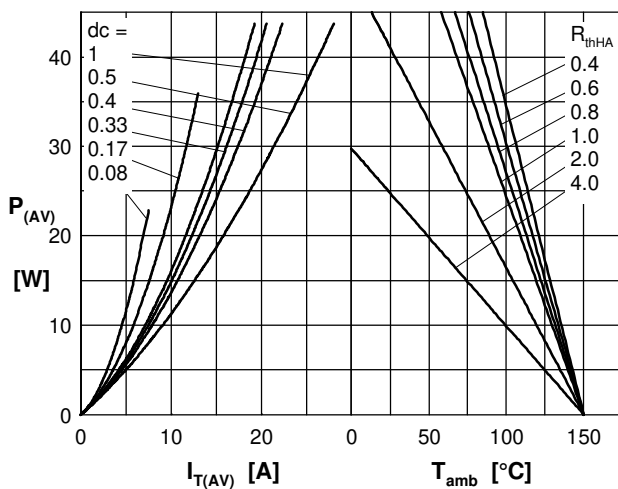

 Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance