

High Efficiency Thyristor

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

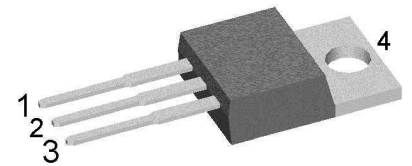
$$I_{TAV} = 20 \text{ A}$$

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

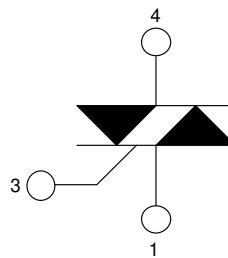
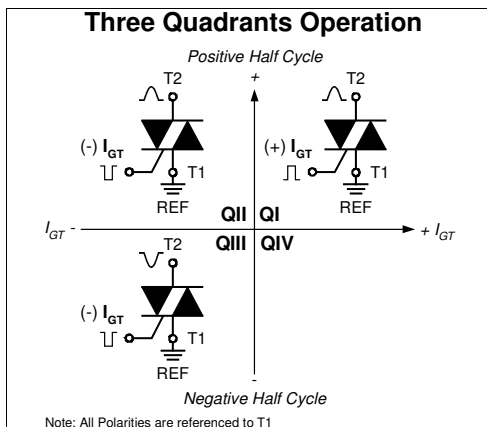
Three Quadrants operation: QI - QIII
 1~ Triac

Part number

CLA40MT1200NPB



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-220

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

Disclaimer Notice

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| Rectifier | | | Ratings | | | |
|----------------|--|---|--------------------------|------|----------|------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$ | | | 1300 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$ | | | 1200 | V |
| I_{RD} | reverse current, drain current | $V_{R/D} = 1200 V$ | $T_{VJ} = 25^{\circ}C$ | | 10 | μA |
| | | $V_{R/D} = 1200 V$ | $T_{VJ} = 125^{\circ}C$ | | 1.5 | mA |
| V_T | forward voltage drop | $I_T = 20 A$ | $T_{VJ} = 25^{\circ}C$ | | 1.37 | V |
| | | $I_T = 40 A$ | | | 1.71 | V |
| | | $I_T = 20 A$ | $T_{VJ} = 125^{\circ}C$ | | 1.37 | V |
| | | $I_T = 40 A$ | | | 1.83 | V |
| I_{TAV} | average forward current | $T_C = 115^{\circ}C$ | $T_{VJ} = 150^{\circ}C$ | | 20 | A |
| I_{RMS} | RMS forward current per phase | 180° sine | | | 44 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 150^{\circ}C$ | | 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 | | | 0.5 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}C$ | | 155 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 200 | A |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 215 | A |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^{\circ}C$ | | 170 | A |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 185 | A |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 200 | A ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 190 | A ² s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^{\circ}C$ | | 145 | A ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 140 | A ² s |
| C_J | junction capacitance | $V_R = 400 V \quad f = 1 \text{ MHz}$ | $T_{VJ} = 25^{\circ}C$ | | 12 | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30 \mu s$ | $T_C = 150^{\circ}C$ | | 5 | W |
| | | $t_p = 300 \mu s$ | | | 1 | W |
| P_{GAV} | average gate power dissipation | | | | 0.2 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 150^{\circ}C; f = 50 \text{ Hz}$ | repetitive, $I_T = 60 A$ | | 150 | A/ μs |
| | | $t_p = 200 \mu s; di_G/dt = 0.3 A/\mu s;$ $I_G = 0.3 A; V = \frac{2}{3} V_{DRM}$ | non-repet., $I_T = 20 A$ | | 500 | A/ μs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 150^{\circ}C$ | | 500 | V/ μs |
| | | $R_{GK} = \infty; \text{method 1 (linear voltage rise)}$ | | | | |
| V_{GT} | gate trigger voltage | $V_D = 6 V$ | $T_{VJ} = 25^{\circ}C$ | | 1.3 | V |
| | | | $T_{VJ} = -40^{\circ}C$ | | 1.6 | V |
| I_{GT} | gate trigger current | $V_D = 6 V$ | $T_{VJ} = 25^{\circ}C$ | | ± 40 | mA |
| | | | $T_{VJ} = -40^{\circ}C$ | | ± 60 | mA |
| V_{GD} | gate non-trigger voltage | $V_D = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 150^{\circ}C$ | | 0.2 | V |
| I_{GD} | gate non-trigger current | | | | ± 1 | mA |
| I_L | latching current | $t_p = 10 \mu s$ | $T_{VJ} = 25^{\circ}C$ | | 70 | mA |
| | | $I_G = 0.3 A; di_G/dt = 0.3 A/\mu s$ | | | | |
| I_H | holding current | $V_D = 6 V \quad R_{GK} = \infty$ | $T_{VJ} = 25^{\circ}C$ | | 50 | mA |
| t_{gd} | gate controlled delay time | $V_D = \frac{1}{2} V_{DRM}$ | $T_{VJ} = 25^{\circ}C$ | | 2 | μs |
| | | $I_G = 0.3 A; di_G/dt = 0.3 A/\mu s$ | | | | |
| t_q | turn-off time | $V_R = 100 V; I_T = 20 A; V = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s \quad dv/dt = 20 V/\mu s \quad t_p = 200 \mu s$ | $T_{VJ} = 125^{\circ}C$ | | 150 | μs |



| Package TO-220 | | | 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 | | | | 2 | | g |
| M_D | mounting torque | | 0.4 | | 0.6 | Nm |
| F_C | mounting force with clip | | 20 | | 60 | N |

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
- PB = TO-220AB (3)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | CLA40MT1200NPB | CLA40MT1200NPB | Tube | 50 | 517038 |

| Similar Part | Package | Voltage class |
|----------------|------------------------|---------------|
| CLA40MT1200NPZ | TO-263AB (D2Pak) (2HV) | 1200 |

Equivalent Circuits for Simulation

* on die level

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



Thyristor

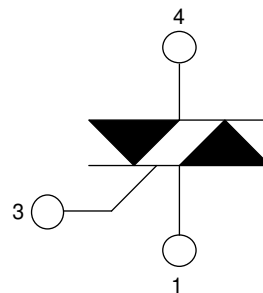
| | | | |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage | 0.89 | V |
| $R_{0\ max}$ | slope resistance * | 21 | mΩ |



Outlines TO-220



| Dim. | Millimeter | | Inches | |
|------|------------|-------|--------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.32 | 4.82 | 0.170 | 0.190 |
| A1 | 1.14 | 1.39 | 0.045 | 0.055 |
| A2 | 2.29 | 2.79 | 0.090 | 0.110 |
| b | 0.64 | 1.01 | 0.025 | 0.040 |
| b2 | 1.15 | 1.65 | 0.045 | 0.065 |
| C | 0.35 | 0.56 | 0.014 | 0.022 |
| D | 14.73 | 16.00 | 0.580 | 0.630 |
| E | 9.91 | 10.66 | 0.390 | 0.420 |
| e | 2.54 | BSC | 0.100 | BSC |
| H1 | 5.85 | 6.85 | 0.230 | 0.270 |
| L | 12.70 | 13.97 | 0.500 | 0.550 |
| L1 | 2.79 | 5.84 | 0.110 | 0.230 |
| ØP | 3.54 | 4.08 | 0.139 | 0.161 |
| Q | 2.54 | 3.18 | 0.100 | 0.125 |



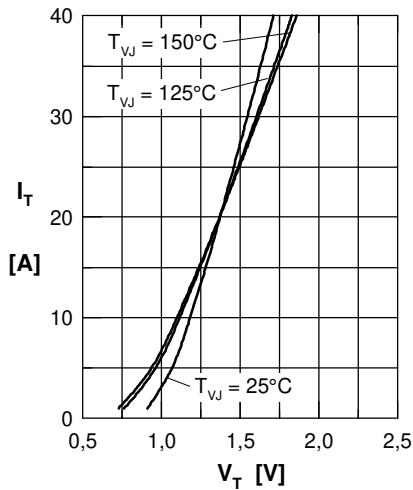
Thyristor


Fig. 1 Forward characteristics

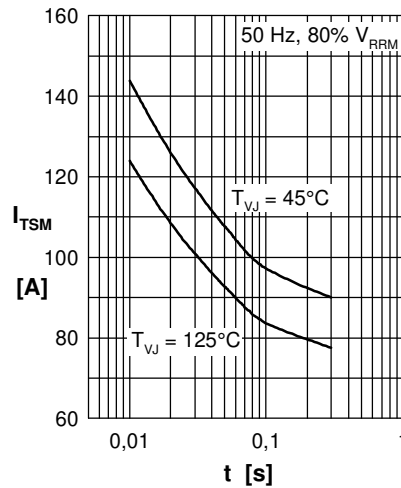


Fig. 2 Surge overload current

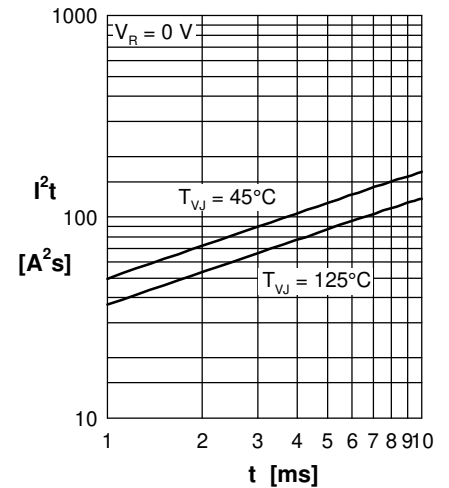
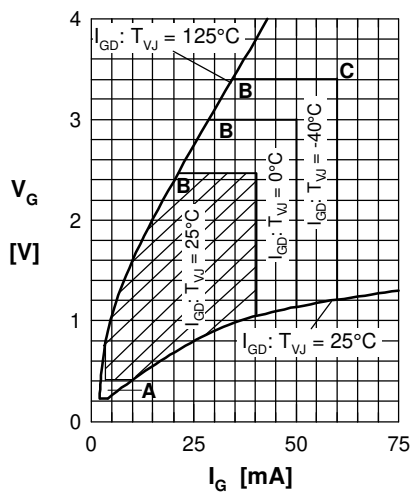

 Fig. 3 I^2t versus time (1-10 ms)


Fig. 4 Gate trigger characteristics



Fig. 5 Gate controlled delay time

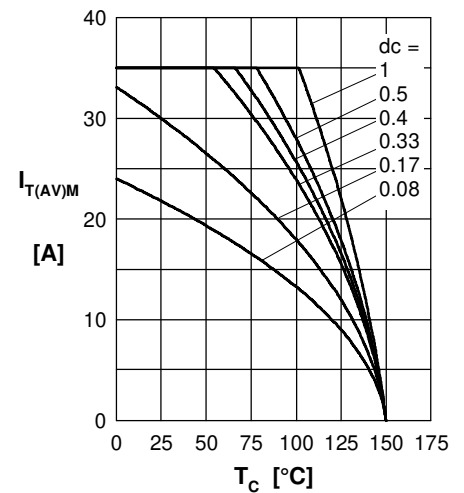


Fig. 6 Max. forward current at case temperature

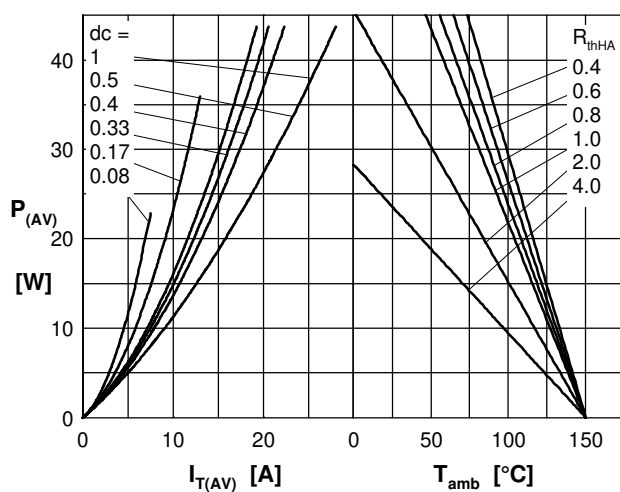
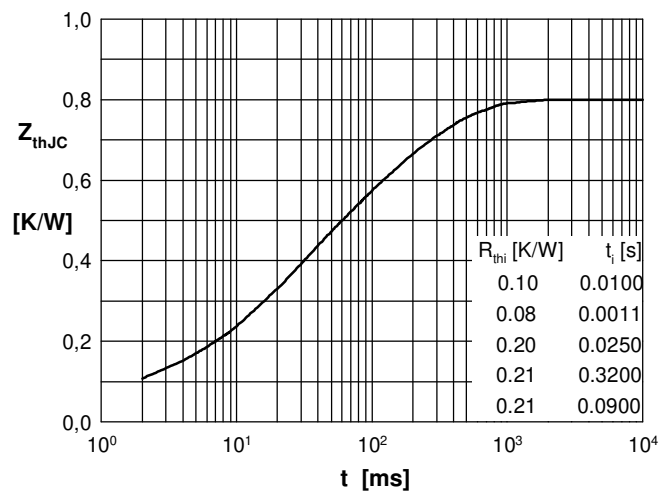

 Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance