

High Efficiency Thyristor

$$V_{RRM} = 2 \times 1200 \text{ V}$$

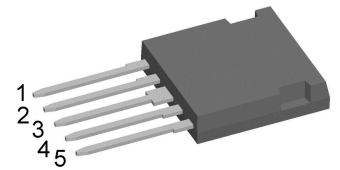
$$I_{TAV} = 40 \text{ A}$$

$$V_T = 1.19 \text{ V}$$

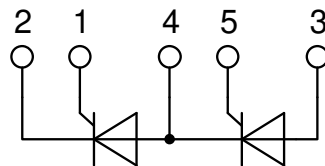
Phase leg

Part number

CLA40P1200FC



Backside: isolated



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: i4-Pac

- Isolation Voltage: 3000 V~
- Industry convenient outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Backside: DCB ceramic
- Reduced weight
- Advanced power cycling

Disclaimer Notice

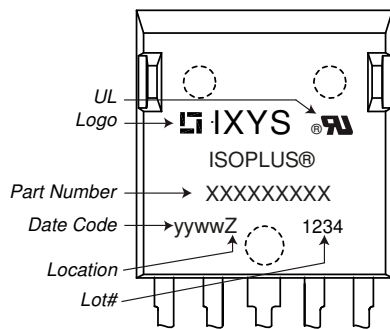
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| Thyristor | | | Ratings | | | |
|----------------|--|--|--------------------------------|------|------|-------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking 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_{RD} | reverse current, drain current | $V_{R/D} = 1200\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 50 | μA |
| | | $V_{R/D} = 1200\text{ V}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 4 | mA |
| V_T | forward voltage drop | $I_T = 40\text{ A}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 1.25 | V |
| | | $I_T = 80\text{ A}$ | | | 1.49 | V |
| | | $I_T = 40\text{ A}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 1.19 | V |
| | | $I_T = 80\text{ A}$ | | | 1.50 | V |
| I_{TAV} | average forward current | $T_C = 95^{\circ}\text{C}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 40 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 63 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 150^{\circ}\text{C}$ | | 0.86 | V |
| r_T | slope resistance | | | | 7.9 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | 0.8 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.2 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}\text{C}$ | | 150 | W |
| I_{TSM} | max. forward surge current | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}\text{C}$ | | 650 | A |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 700 | A |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 555 | A |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 595 | A |
| I^2t | value for fusing | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}\text{C}$ | | 2.12 | kA ² s |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 2.04 | kA ² s |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^{\circ}\text{C}$ | | 1.54 | kA ² s |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 1.48 | kA ² s |
| C_J | junction capacitance | $V_R = 400\text{ V } f = 1\text{ MHz}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 25 | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30\text{ }\mu\text{s}$ | $T_C = 150^{\circ}\text{C}$ | | 10 | W |
| | | $t_p = 300\text{ }\mu\text{s}$ | | | 5 | 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, $I_T = 120\text{ A}$ | | | 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., $I_T = 40\text{ A}$ | | | 500 | A/ μs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty$; method 1 (linear voltage rise) | $T_{VJ} = 150^{\circ}\text{C}$ | | 1000 | V/ μs |
| 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 | $V_D = 6\text{ V}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 50 | 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 | | | | 3 | mA |
| I_L | latching current | $t_p = 10\text{ }\mu\text{s}$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 125 | mA |
| | | $I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$ | | | | |
| I_H | holding current | $V_D = 6\text{ V } R_{GK} = \infty$ | $T_{VJ} = 25^{\circ}\text{C}$ | | 100 | 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 | $V_R = 100\text{ V}; I_T = 40\text{ A}; V = \frac{2}{3} V_{DRM}$ $di/dt = 10\text{ A}/\mu\text{s } dv/dt = 20\text{ V}/\mu\text{s } t_p = 200\text{ }\mu\text{s}$ | $T_{VJ} = 125^{\circ}\text{C}$ | | 200 | μs |



| Package i4-Pac | | 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 | | | | 6 | | g |
| F_C | mounting force with clip | | 20 | | 120 | N |
| $d_{Spp/ App}$ | creepage distance on surface / striking distance through air | terminal to terminal | 1.7 | | | mm |
| $d_{Spb/ Apb}$ | | terminal to backside | 5.1 | | | mm |
| V_{ISOL} | isolation voltage | t = 1 second t = 1 minute | 3000 2500 | | | V V |
| | | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | | | | |

Product Marking



Part description

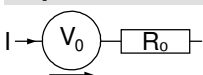
- C = Thyristor (SCR)
- L = High Efficiency Thyristor
- A = (up to 1200V)
- 40 = Current Rating [A]
- P = Phase leg
- 1200 = Reverse Voltage [V]
- FC = i4-Pac (5)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | CLA40P1200FC | CLA40P1200FC | Tube | 25 | 510210 |

Equivalent Circuits for Simulation

* on die level

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

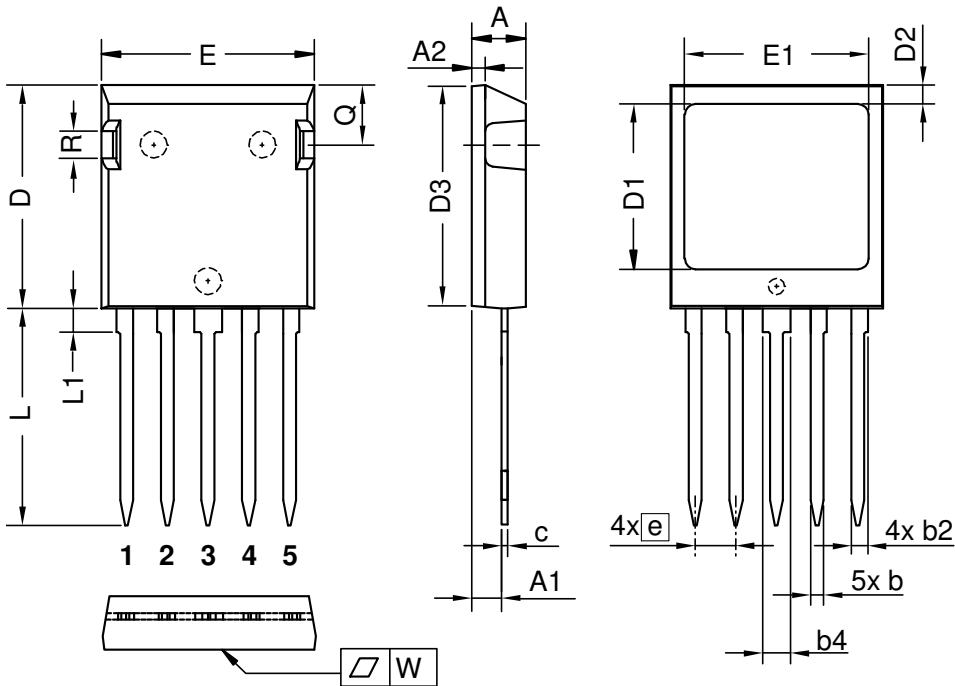


Thyristor

| | | | |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage | 0.86 | V |
| $R_{0\ max}$ | slope resistance * | 5.4 | mΩ |

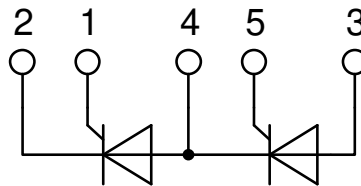


Outlines i4-Pac



| Dim. | Millimeter | | Inches | |
|------|------------|-------|-----------|-------|
| | min | max | min | max |
| A | 4.83 | 5.21 | 0.190 | 0.205 |
| A1 | 2.59 | 3.00 | 0.102 | 0.118 |
| A2 | 1.17 | 2.16 | 0.046 | 0.085 |
| b | 1.14 | 1.40 | 0.045 | 0.055 |
| b2 | 1.47 | 1.73 | 0.058 | 0.068 |
| b4 | 2.54 | 2.79 | 0.100 | 0.110 |
| c | 0.51 | 0.74 | 0.020 | 0.029 |
| D | 20.80 | 21.34 | 0.819 | 0.840 |
| D1 | 14.99 | 15.75 | 0.590 | 0.620 |
| D2 | 1.65 | 2.03 | 0.065 | 0.080 |
| D3 | 20.30 | 20.70 | 0.799 | 0.815 |
| E | 19.56 | 20.29 | 0.770 | 0.799 |
| E1 | 16.76 | 17.53 | 0.660 | 0.690 |
| e | 3.81 BSC | | 0.150 BSC | |
| L | 19.81 | 21.34 | 0.780 | 0.840 |
| L1 | 2.11 | 2.59 | 0.083 | 0.102 |
| Q | 5.33 | 6.20 | 0.210 | 0.244 |
| R | 2.54 | 4.57 | 0.100 | 0.180 |
| W | - | 0.10 | - | 0.004 |

Die konvexe Form des Substrates ist typ. < 0.05 mm über der Kunststoffoberfläche der Bauteilunterseite
The convexbow of substrate is typ. < 0.05 mm over plastic surface level of device bottom side



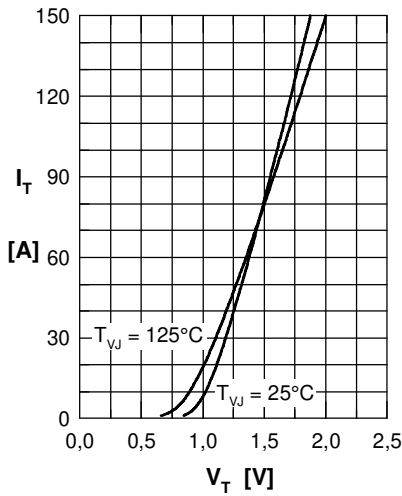
Thyristor


Fig. 1 Forward characteristics

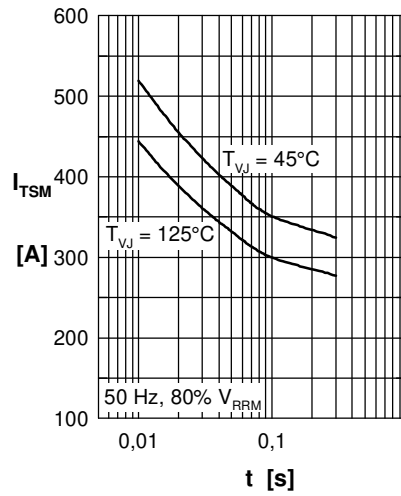
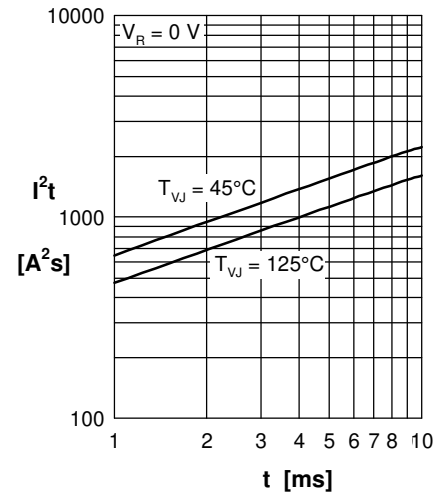
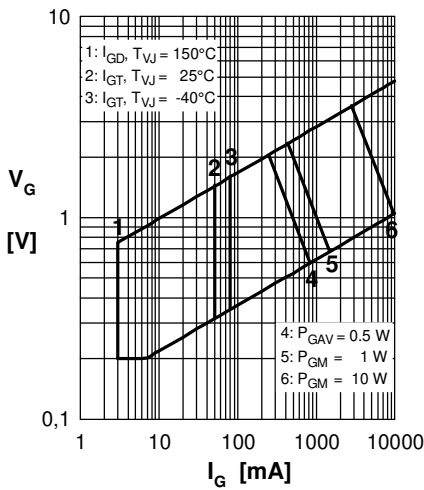

 Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

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


Fig. 4 Gate voltage & gate current

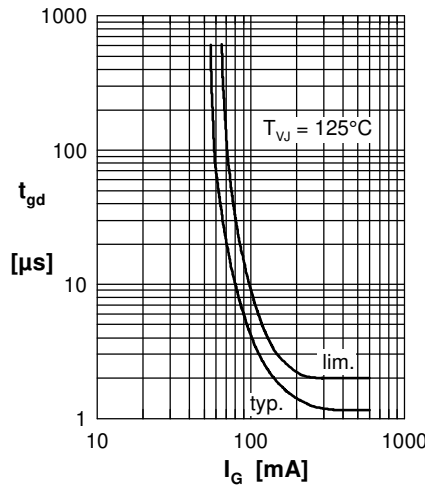
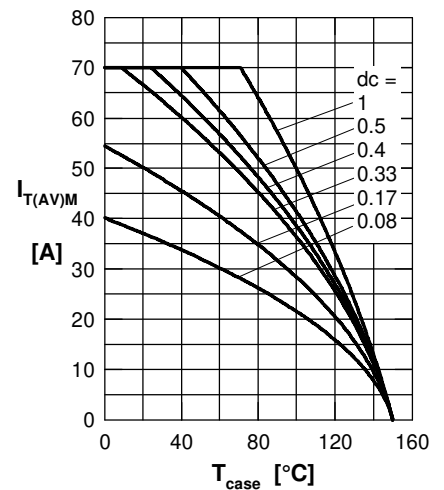

 Fig. 5 Gate controlled delay time t_{gd}


Fig. 6 Max. forward current at case temperature

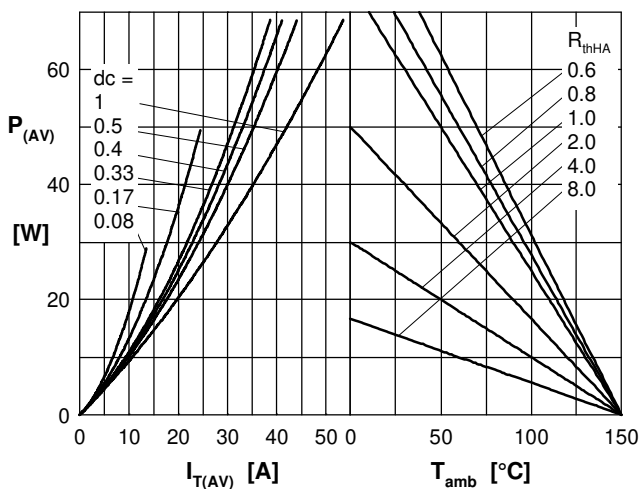
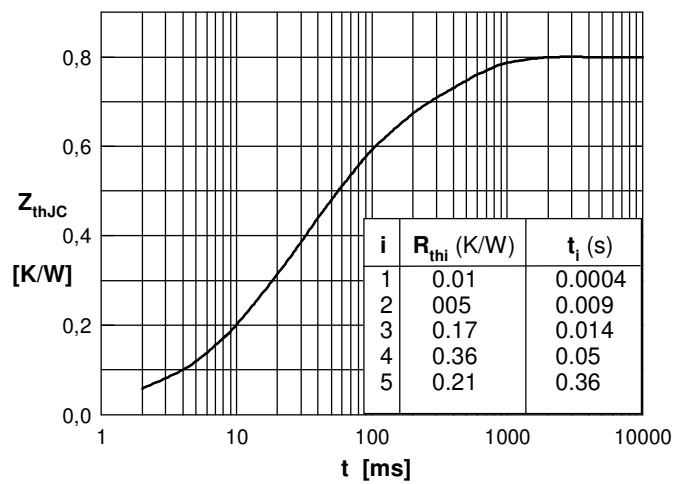

 Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature


Fig. 7 Transient thermal impedance junction to case