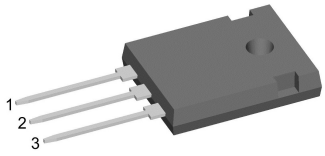
# High Efficiency Thyristor

| | | |
|---|---|---|
| $V_{RRM}$ | = | 1200 V |
| $I_{TAV}$ | = | 40 A |
| $V_T$ | = | 1.19 V |

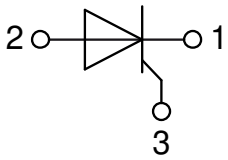
Single Thyristor

**Part number**

**CLA40E1200HR**




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:** ISO247

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Backside: DCB ceramic
- Reduced weight
- Advanced power cycling

**Disclaimer Notice**

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at www.littelfuse.com/disclaimer-electronics.



© 2019 IXYS all rights reserved

## Thyristor

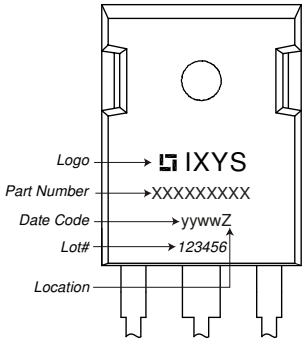
| Symbol | Definition | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RSM/DSM}$ | *max. non-repetitive reverse/forward blocking voltage* | | $T_{VJ}$ = 25°C | | | 1300 | V |
| $V_{RRM/DRM}$ | *max. repetitive reverse/forward blocking voltage* | | $T_{VJ}$ = 25°C | | | 1200 | V |
| $I_{R/D}$ | *reverse current, drain current* | $V_{R/D}$ = 1200 V | $T_{VJ}$ = 25°C | | | 50 | µA |
| | | $V_{R/D}$ = 1200 V | $T_{VJ}$ = 125°C | | | 4 | mA |
| $V_T$ | *forward voltage drop* | $I_T$ = 40 A | $T_{VJ}$ = 25°C | | | 1.25 | V |
| | | $I_T$ = 80 A | | | | 1.49 | V |
| | | $I_T$ = 40 A | $T_{VJ}$ = 125°C | | | 1.19 | V |
| | | $I_T$ = 80 A | | | | 1.50 | V |
| $I_{TAV}$ | *average forward current* | $T_C$ = 95°C | $T_{VJ}$ = 150°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°C | | | 0.86 | V |
| $r_T$ | *slope resistance* } | | | | | 7.9 | mΩ |
| $R_{thJC}$ | *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°C | | | 155 | W |
| $I_{TSM}$ | *max. forward surge current* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 650 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 700 | A |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 555 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 595 | A |
| $I^2t$ | *value for fusing* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 2.12 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 2.04 | kA²s |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 1.54 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 1.48 | kA²s |
| $C_J$ | *junction capacitance* | $V_R$ = 400 V f = 1 MHz | $T_{VJ}$ = 25°C | | 25 | | pF |
| $P_{GM}$ | *max. gate power dissipation* | $t_P$ = 30 µs | $T_C$ = 150°C | | | 10 | W |
| | | $t_P$ = 300 µs | | | | 5 | W |
| $P_{GAV}$ | *average gate power dissipation* | | | | | 0.5 | W |
| $(di/dt)_{cr}$ | *critical rate of rise of current* | $T_{VJ}$ = 150°C; f = 50 Hz | repetitive, $I_T$ = 120 A | | | 150 | A/µs |
| | | $t_P$ = 200 µs; $di_G/dt$ = 0.3 A/µs; | | | | | |
| | | $I_G$ = 0.3 A; V = ⅔ $V_{DRM}$ | non-repet., $I_T$ = 40 A | | | 500 | A/µs |
| $(dv/dt)_{cr}$ | *critical rate of rise of voltage* | V = ⅔ $V_{DRM}$ | $T_{VJ}$ = 150°C | | | 1000 | V/µs |
| | | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | | | |
| $V_{GT}$ | *gate trigger voltage* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | 1.5 | V |
| | | | $T_{VJ}$ = -40°C | | | 1.6 | V |
| $I_{GT}$ | *gate trigger current* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | 50 | mA |
| | | | $T_{VJ}$ = -40°C | | | 80 | mA |
| $V_{GD}$ | *gate non-trigger voltage* | $V_D$ = ⅔ $V_{DRM}$ | $T_{VJ}$ = 150°C | | | 0.2 | V |
| $I_{GD}$ | *gate non-trigger current* | | | | | 3 | mA |
| $I_L$ | *latching current* | $t_p$ = 10 µs | $T_{VJ}$ = 25°C | | | 125 | mA |
| | | $I_G$ = 0.3 A; $di_G/dt$ = 0.3 A/µs | | | | | |
| $I_H$ | *holding current* | $V_D$ = 6 V $R_{GK}$ = ∞ | $T_{VJ}$ = 25°C | | | 100 | mA |
| $t_{gd}$ | *gate controlled delay time* | $V_D$ = ½ $V_{DRM}$ | $T_{VJ}$ = 25°C | | | 2 | µs |
| | | $I_G$ = 0.3 A; $di_G/dt$ = 0.3 A/µs | | | | | |
| $t_q$ | *turn-off time* | $V_R$ = 100 V; $I_T$ = 40A; V = ⅔ $V_{DRM}$ | $T_{VJ}$ = 125 °C | | 200 | | µs |
| | | di/dt = 10 A/µs dv/dt = 20 V/µs $t_p$ = 200 µs | | | | | |



© 2019 IXYS all rights reserved

| Package ISO247 | | | | Ratings | | | |
|---|---|---|---|---|---|---|---|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| $I_{RMS}$ | *RMS current* | per terminal | | | | 70 | A |
| $T_{VJ}$ | *virtual junction temperature* | | | -55 | | 150 | °C |
| $T_{op}$ | *operation temperature* | | | -55 | | 125 | °C |
| $T_{stg}$ | *storage temperature* | | | -55 | | 150 | °C |
| **Weight** | | | | | 6 | | g |
| $M_D$ | *mounting torque* | | | 0.8 | | 1.2 | Nm |
| $F_C$ | *mounting force with clip* | | | 20 | | 120 | N |
| $d_{Spp/App}$ | *creepage distance on surface \| striking distance through air* | | *terminal to terminal* | 2.7 | | | mm |
| $d_{Spb/Apb}$ | | | *terminal to backside* | 4.1 | | | mm |
| $V_{ISOL}$ | *isolation voltage* | t = 1 second | 50/60 Hz, RMS; $I_{ISOL}$ ≤ 1 mA | 3600 | | | V |
| | | t = 1 minute | | 3000 | | | V |

Product Marking




**Part description**

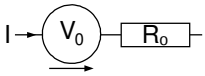
C = Thyristor (SCR)
L = High Efficiency Thyristor
A = (up to 1200V)
40 = Current Rating [A]
E = Single Thyristor
1200 = Reverse Voltage [V]
HR = ISO247 (3)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | CLA40E1200HR | CLA40E1200HR | Tube | 30 | 515428 |

| Similar Part | Package | Voltage class |
|---|---|---|
| CMA40E1600HR | ISO247 (3) | 1600 |

## Equivalent Circuits for Simulation

** on die level* $T_{VJ}$ = 150°C



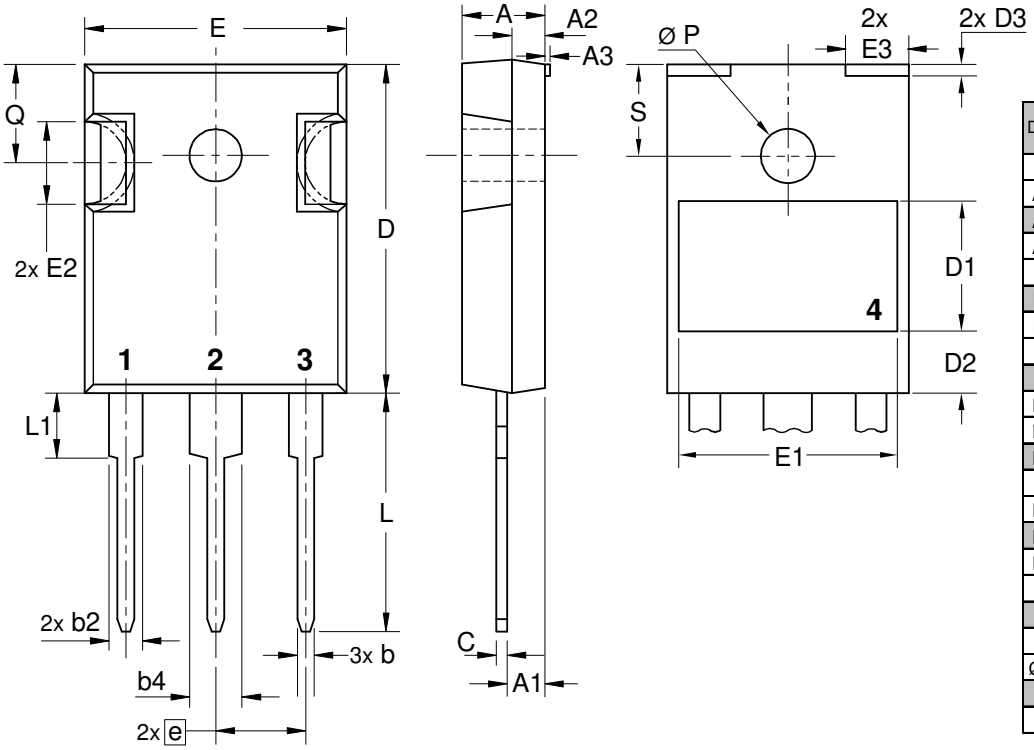

**Thyristor**

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

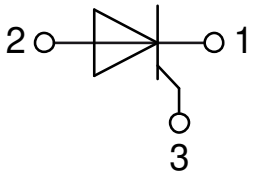


© 2019 IXYS all rights reserved

## Outlines ISO247




| Dim. | Millimeter | | Inches | |
|---|---|---|---|---|
| | min | max | min | max |
| A | 4.70 | 5.30 | 0.185 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| A3 | typ. 0.05 | | typ. 0.002 | |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 |
| c | 0.38 | 0.89 | 0.015 | 0.035 |
| D | 20.79 | 21.45 | 0.819 | 0.844 |
| D1 | typ. 8.90 | | typ. 0.350 | |
| D2 | typ. 2.90 | | typ. 0.114 | |
| D3 | typ. 1.00 | | typ. 0.039 | |
| E | 15.49 | 16.24 | 0.610 | 0.639 |
| E1 | typ. 13.45 | | typ. 0.530 | |
| E2 | 4.31 | 5.48 | 0.170 | 0.216 |
| E3 | typ. 4.00 | | typ. 0.157 | |
| e | 5.46 BSC | | 0.215 BSC | |
| L | 19.80 | 20.30 | 0.780 | 0.799 |
| L1 | - | 4.49 | - | 0.177 |
| Ø P | 3.55 | 3.65 | 0.140 | 0.144 |
| Q | 5.38 | 6.19 | 0.212 | 0.244 |
| S | 6.14 BSC | | 0.242 BSC | |






© 2019 IXYS all rights reserved

## Thyristor

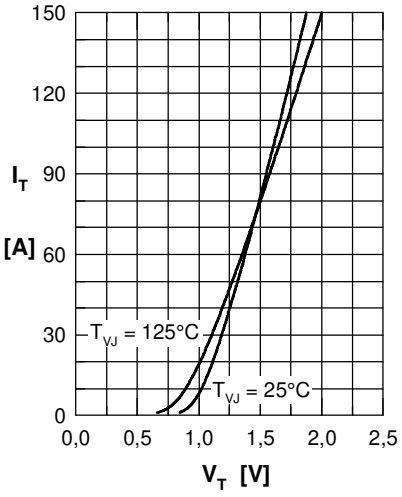



Fig. 1 Forward characteristics

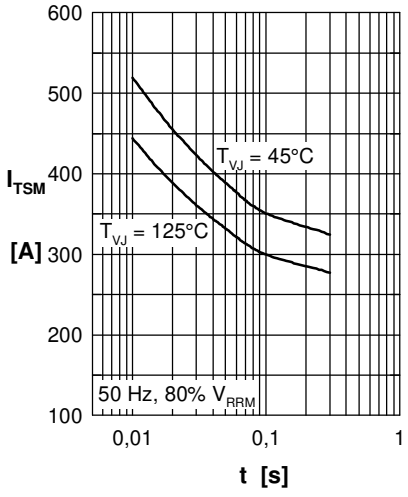



Fig. 2 Surge overload current
$I_{TSM}$: crest value, t: duration

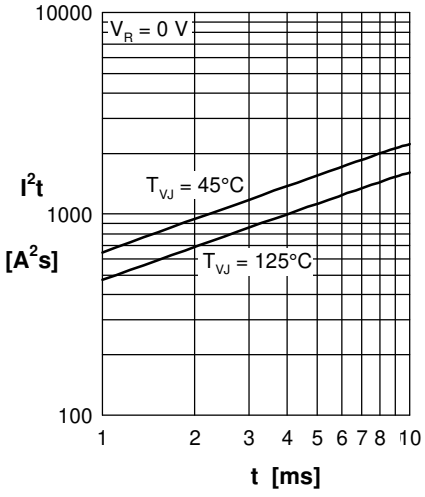



Fig. 3 $I^2t$ versus time (1-10 s)

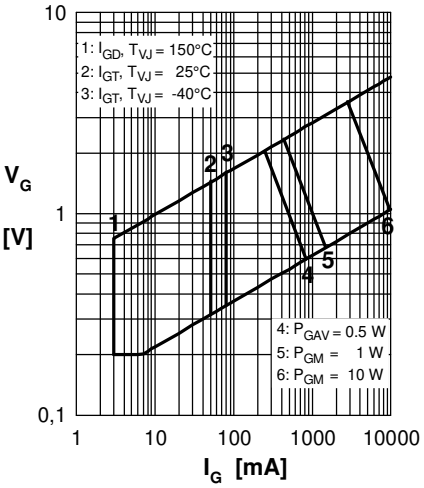



Fig. 4 Gate voltage & gate current

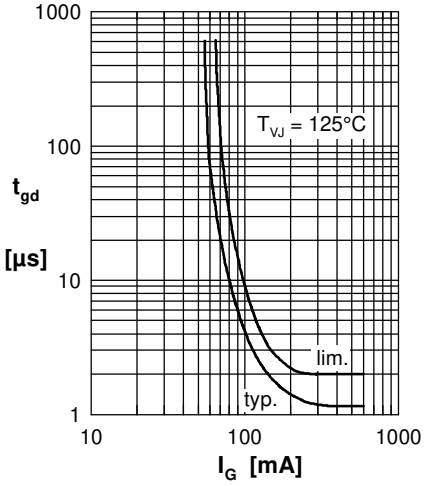



Fig. 5 Gate controlled delay time $t_{gd}$

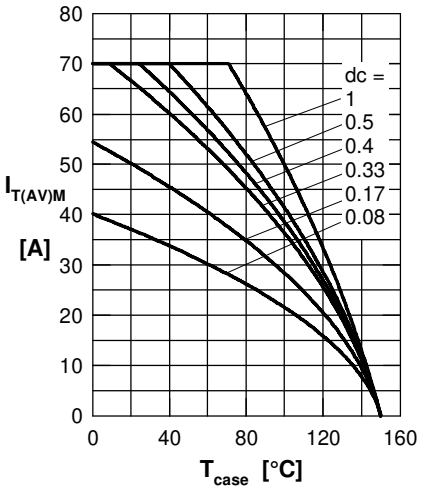



Fig. 6 Max. forward current at case temperature

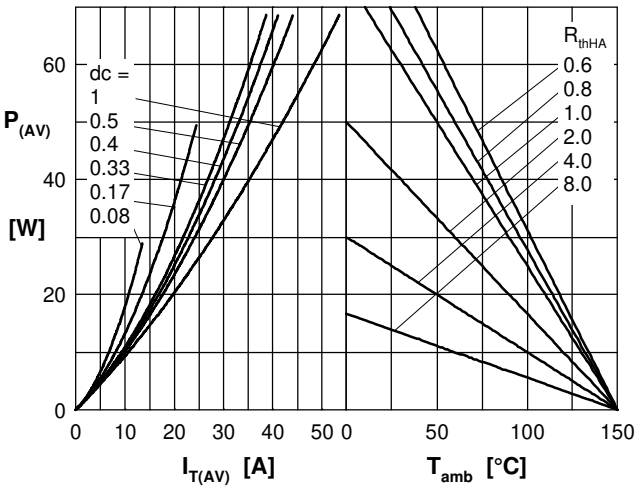
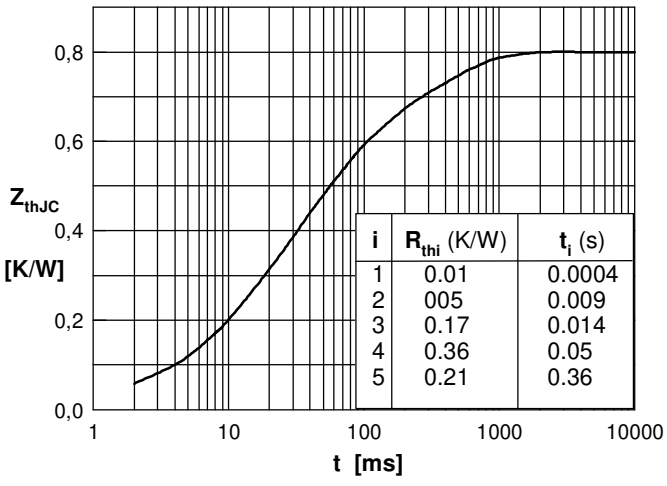



Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature




| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.01 | 0.0004 |
| 2 | 005 | 0.009 |
| 3 | 0.17 | 0.014 |
| 4 | 0.36 | 0.05 |
| 5 | 0.21 | 0.36 |

Fig. 7 Transient thermal impedance junction to case



© 2019 IXYS all rights reserved