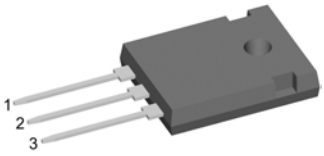
# High Efficiency Thyristor

$V_{RRM}$ = 1200 V
$I_{TAV}$ = 30 A
$V_T$ = 1,25 V

Three Quadrants operation: QI - QIII
1~ Triac

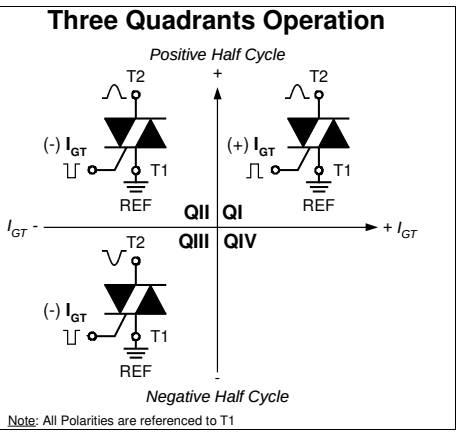
**Part number**

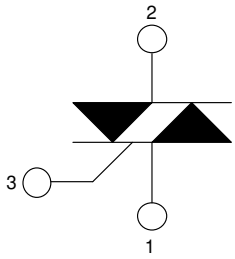
**CLA60MT1200NHR**




Backside: isolated

E72873




**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:** ISO247

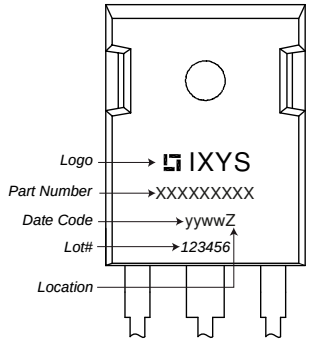
- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Backside: DCB ceramic
- Reduced weight
- Advanced power cycling

## Rectifier

| 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 | | | 10 | µA |
| | | $V_{R/D}$ = 1200 V | $T_{VJ}$ = 125°C | | | 2 | mA |
| $V_T$ | *forward voltage drop* | $I_T$ = 30 A | $T_{VJ}$ = 25°C | | | 1,28 | V |
| | | $I_T$ = 60 A | | | | 1,56 | V |
| | | $I_T$ = 30 A | $T_{VJ}$ = 125°C | | | 1,25 | V |
| | | $I_T$ = 60 A | | | | 1,61 | V |
| $I_{TAV}$ | *average forward current* | $T_C$ = 100°C | $T_{VJ}$ = 150°C | | | 30 | A |
| $I_{RMS}$ | *RMS forward current per phase* | 180° sine | | | | 66 | A |
| $V_{T0}$ | *threshold voltage* } *for power loss calculation only* | | $T_{VJ}$ = 150°C | | | 0,86 | V |
| $r_T$ | *slope resistance* } | | | | | 12,5 | mΩ |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0,9 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0,25 | | K/W |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 140 | W |
| $I_{TSM}$ | *max. forward surge current* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 380 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 410 | A |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 325 | A |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 350 | A |
| $I^2t$ | *value for fusing* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 720 | $A^2s$ |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 700 | $A^2s$ |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 150°C | | | 530 | $A^2s$ |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 510 | $A^2s$ |
| $C_J$ | *junction capacitance* | $V_R$ = 400V 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, | $I_T$ = 90 A | | | 150 | A/µs |
| | | $t_P$ = 200 µs; $di_G/dt$ = 0,3 A/µs; | | | | | |
| | | $I_G$ = 0,3A; $V_D$ = ⅔ $V_{DRM}$ non-repet., | $I_T$ = 30 A | | | 500 | A/µs |
| $(dv/dt)_{cr}$ | *critical rate of rise of voltage* | $V_D$ = ⅔ $V_{DRM}$ | $T_{VJ}$ = 150°C | | | 500 | V/µs |
| | | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | | | |
| $V_{GT}$ | *gate trigger voltage* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | 1,7 | V |
| | | | $T_{VJ}$ = -40°C | | | 1,9 | V |
| $I_{GT}$ | *gate trigger current* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | ± 60 | 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* | | | | | ± 1 | mA |
| $I_L$ | *latching current* | $t_p$ = 10 µs | $T_{VJ}$ = 25°C | | | 90 | mA |
| | | $I_G$ = 0,3A; $di_G/dt$ = 0,3 A/µs | | | | | |
| $I_H$ | *holding current* | $V_D$ = 6 V $R_{GK}$ = ∞ | $T_{VJ}$ = 25°C | | | 60 | mA |
| $t_{gd}$ | *gate controlled delay time* | $V_D$ = ½ $V_{DRM}$ | $T_{VJ}$ = 25°C | | | 2 | µs |
| | | $I_G$ = 0,3A; $di_G/dt$ = 0,3 A/µs | | | | | |
| $t_q$ | *turn-off time* | $V_R$ = 100 V; $I_T$ = 30A; $V_D$ = ⅔ $V_{DRM}$ | $T_{VJ}$ =125 °C | | 150 | | µs |
| | | di/dt = 10 A/µs; dv/dt = 20 V/µs; $t_p$ = 200 µs | | | | | |

| 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



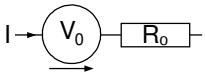

**Part description**

C = Thyristor (SCR)
L = High Efficiency Thyristor
A = (up to 1200V)
60 = Current Rating [A]
MT = 1~ Triac
1200 = Reverse Voltage [V]
N = Three Quadrants operation: QI - QIII
HR = ISO247 (3)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | CLA60MT1200NHR | CLA60MT1200NHR | Tube | 30 | 513282 |

| Similar Part | Package | Voltage class |
|---|---|---|
| CLA40MT1200NHR | ISO247 (3) | 1200 |
| CLA80MT1200NHR | ISO247 (3) | 1200 |
| CLA60MT1200NHB | TO-247AD (3) | 1200 |
| CLA60MT1200NTZ | TO-268AA (D3Pak) (2HV) | 1200 |

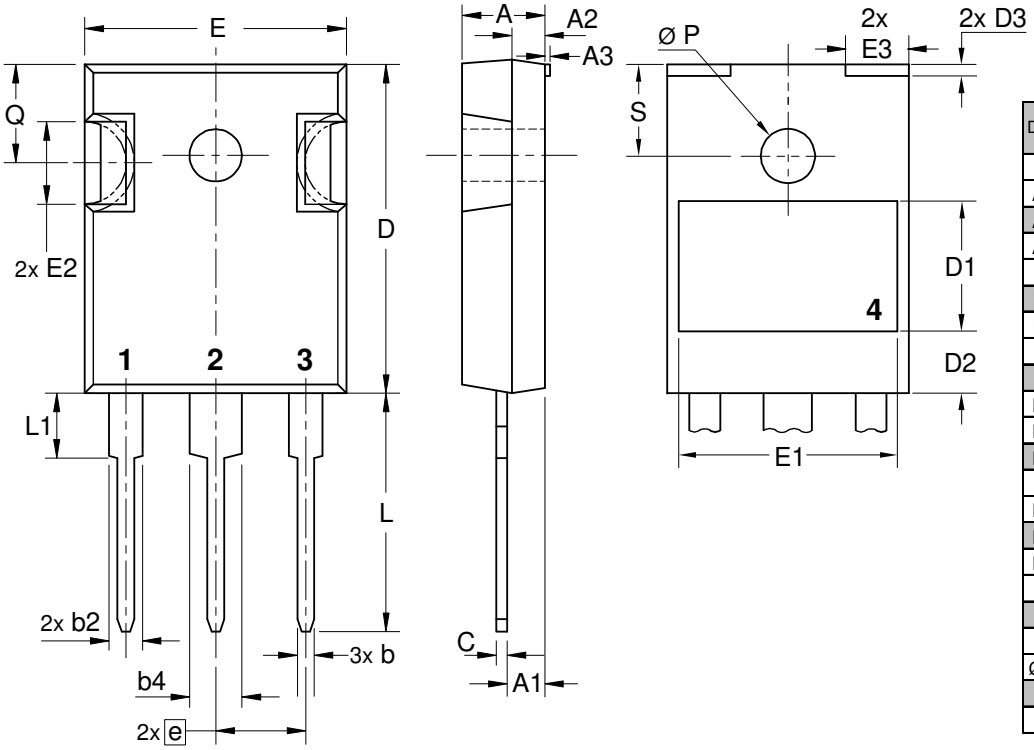
**Equivalent Circuits for Simulation** ** on die level* $T_{VJ}$ = 150°C



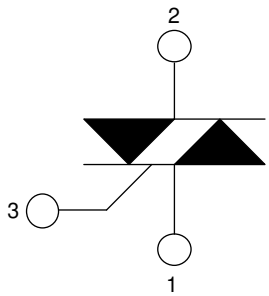

**Thyristor**

| | | | |
|---|---|---|---|
| $V_{0\ max}$ | *threshold voltage* | 0,86 | V |
| $R_{0\ max}$ | *slope resistance ** | 10 | mΩ |

## 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 | |



## Thyristor

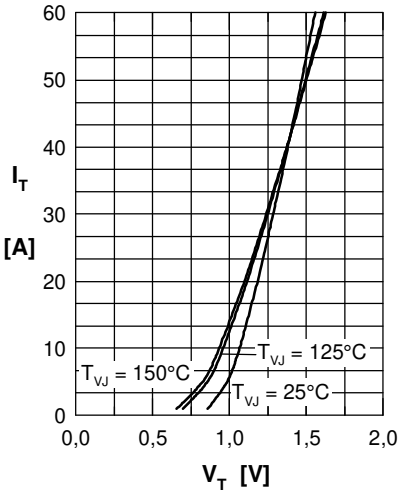



Fig. 1 Forward characteristics

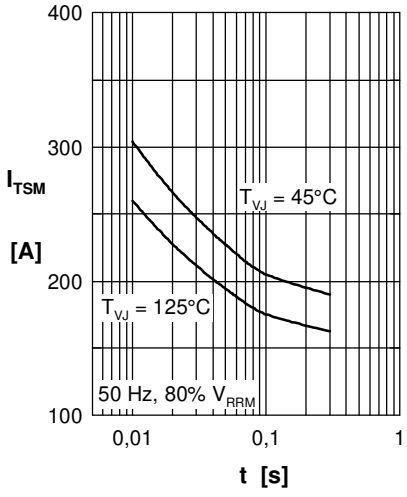



Fig. 2 Surge overload current
$I_{TSM}$: crest value, t: duration

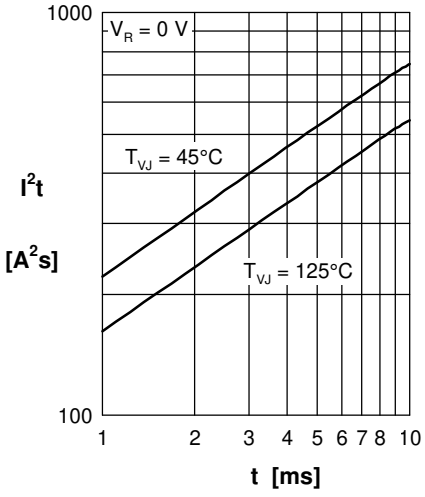



Fig. 3 $I^2t$ versus time (1-10 s)

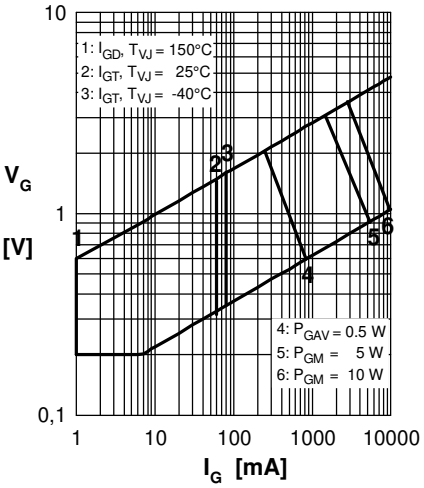



Fig. 4 Gate voltage & gate current

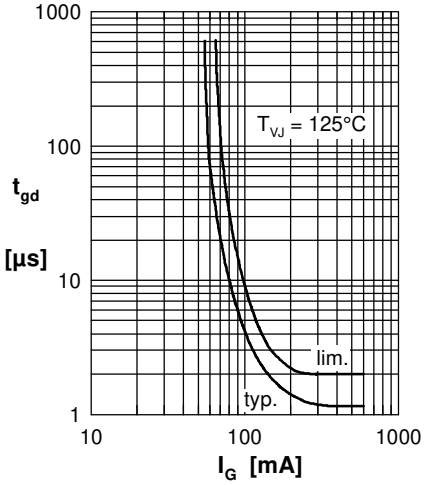



Fig. 5 Gate controlled delay time $t_{gd}$

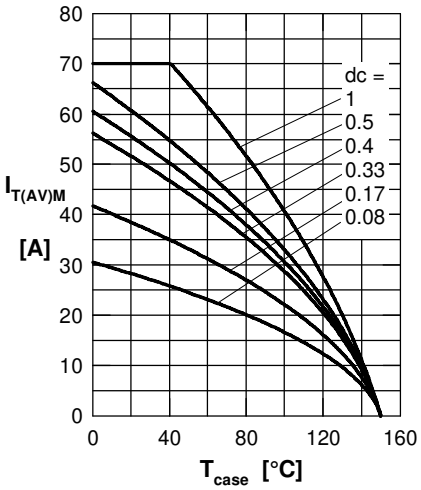



Fig. 6 Max. forward current at case temperature

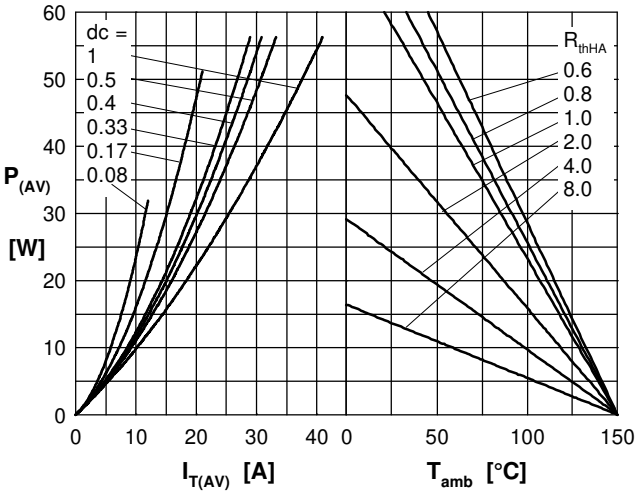
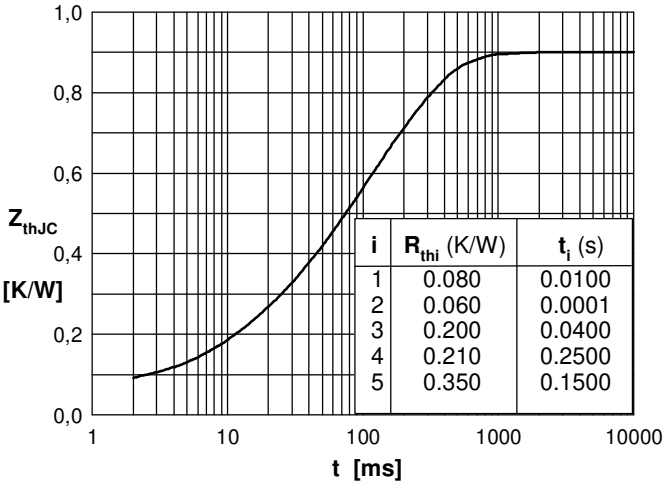



Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature




| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.080 | 0.0100 |
| 2 | 0.060 | 0.0001 |
| 3 | 0.200 | 0.0400 |
| 4 | 0.210 | 0.2500 |
| 5 | 0.350 | 0.1500 |

Fig. 7 Transient thermal impedance junction to case