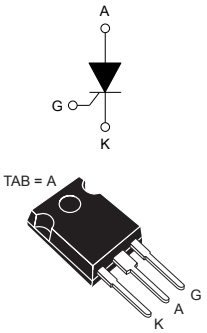
# TN5050H-12WY

Datasheet

## 50 A 1200 V automotive grade thyristor (SCR)




**TO-247 uninsulated**

| Product status |
|---|
| TN5050H-12WY |

| Product summary | |
|---|---|
| $I_{T(RMS)}$ | 50 A |
| $V_{DRM}/V_{RRM}$ | 1200 V |
| $V_{DSM}/V_{RSM}$ | 1500 V |
| $I_{GT}$ | 50 mA |
| $T_j$ | 150 °C |

## Features

- AEC-Q101 qualified
- Blocking voltage: +/- 1200 V
- On-state current: 50 $A_{RMS}$
- High static and dynamic commutation:
  - dI/dt = 200 A/µs
  - dV/dt = 1000 V/µs
- $I_{GT}$ = 50 mA
- ECOPACK2 compliant component

## Application

- Automotive applications: on board and off board battery charger
- Renewable energy inverters
- Solid state relay
- Overvoltage crowbar protection
- UPS (uninterruptible power supply)
- Bypass SSR / hybrid relay
- Inrush current limiter in battery charger
- AC-DC voltage controlled rectifier
- Industrial welding systems

## Description

Available in TO-247 high power package, the TN5050H-12WY autograde is suitable in applications such as automotive / stationary battery charger, renewable energy generator, interruptible power supply, solid state relay, welding equipment and, motor drive applications.

Its power switching, voltage robustness and power dissipation performances are the key features for functions such as a 80 A AC switch, an AC phasing inverter and an AC-DC controlled rectifier bridge.

The TN5050H-12WY is an automotive grade product and offers a superior performance in surge current handling, thermal cooling capabilities and overvoltage robustness.

# 1 Characteristics

**Table 1. Absolute ratings (limiting values)**

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (180 ° conduction angle) | | $T_C$ = 137 °C | 50 | A |
| $I_{T(AV)}$ | Average on-state current (180 ° conduction angle) | | | 32 | |
| $I_{T(RMS)}$ | RMS on-state current (180 ° conduction angle) | | $T_C$ = 125 °C | 80 | A |
| $I_{T(AV)}$ | Average on-state current (180 ° conduction angle) | | | 51 | |
| $I_{TSM}$ (1) | Non repetitive surge peak on-state current, $V_R$ = 0 V | $t_p$ = 8.3 ms | $T_j$ initial = 25 °C | 633 | A |
| | | $t_p$ = 10 ms | | 580 | |
| $V_{DRM}$ / $V_{RRM}$ | Repetitive off-state voltage (50-60 Hz) | | $T_j$ = 150 °C | 1200 | V |
| $V_{DSM}$ / $V_{RSM}$ | Maximum non-repetitive symmetric blocking voltage | $t_p$ = 10 ms | $T_j$ = 25 °C | 1500 | V |
| dI/dt | $I_G$ = 2 x $I_{GT}$ , tr ≤ 100 ns<br>Critical rate of rise of on-state current | f = 50 Hz | $T_j$ = 150 °C | 200 | A/µs |
| $I_{GM}$ | Peak forward gate current | $t_p$ = 20 µs | $T_j$ = 150 °C | 8 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j$ = 150 °C | 1 | W |
| $T_{stg}$ | Storage junction temperature range | | | -40 to +150 | °C |
| $T_j$ | Operating junction temperature | | | -40 to +150 | °C |

1. *ST recommend $I^2t$ value for fusing = 1680 $A^2s$ for $T_j$ = 25 °C and $t_P$ = 10 ms*

**Table 2. Electrical characteristics ($T_j$ = 25 °C unless otherwise specified)**

| Symbol | Test Conditions | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{GT}$ | $V_D$ = 12 V, $R_L$ = 33 Ω | | Min. | 10 | mA |
| | | | Max. | 50 | |
| $V_{GT}$ | $V_D$ = 12 V, $R_L$ = 33 Ω | | Max. | 1 | V |
| $V_{GD}$ | $V_D$ = 2/3 x $V_{DRM}$, $R_L$ = 3.3 kΩ | $T_j$ = 150 °C | Min. | 0.15 | V |
| $I_H$ | $I_T$ = 500 mA, gate open | | Max. | 100 | mA |
| $I_L$ | $I_G$ = 1.2 x $I_{GT}$ | | Max. | 125 | mA |
| $t_{gt}$ | $I_T$ = 50 A , $V_D$ = $V_{DRM}$, $I_G$ = 200 mA, $dI_G/dt$ = 0.2 A/µs | | Typ. | 3 | µs |
| dV/dt | $V_D$ = 2/3 x $V_{DRM}$, gate open | $T_j$ = 150 °C | Min. | 1000 | V/µs |
| $t_q$ | $I_T$ = 33 A, $dI_T/dt$ = 10 A/µs, $V_R$ = 75 V,<br>$V_D$ = 800 V, $dV_D/dt$ = 20 V/µs, $t_P$ = 100 µs | $T_j$ = 150 °C | Typ. | 150 | µs |
| $V_{TM}$ | $I_{TM}$ = 100 A, $t_P$ = 380 µs | | Max. | 1.55 | V |
| $V_{TO}$ | On-state threshold voltage | $T_j$ = 150 °C | Max. | 0.88 | V |
| $R_D$ | On-state dynamic resistance | $T_j$ = 150 °C | Max. | 6 | mΩ |
| $I_{DRM}/I_{RRM}$ | $V_D$ = $V_{DRM}$, $V_R$ = $V_{RRM}$ | $T_j$ = 25 °C | Max. | 5 | µA |
| | | $T_j$ = 125 °C | Max. | 3 | mA |
| | | $T_j$ = 150 °C | Max. | 7.5 | mA |
| $I_{DSM}/I_{RSM}$ | $V_D$ = $V_{DSM}$, $V_R$ = $V_{RSM}$ | $T_j$ = 25 °C | Max. | 10 | µA |

**Table 3. Thermal parameters**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{th(j-c)}$ | Junction to case (DC, max.) | TO-247 | 0.3 | °C/W |
| $R_{th(j-a)}$ | Junction to ambient (typ.) | | 50 | |

## 1.1 Characteristics curves

**Figure 1. Maximum average power dissipation versus average on-state current**

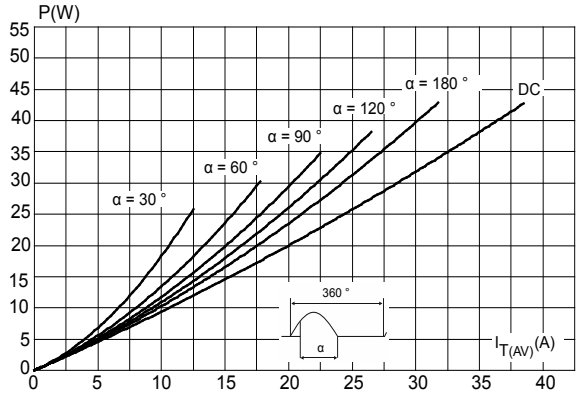



**Figure 2. Correlation between maximum average power dissipation and maximum allowable temperatures ($T_{amb}$ and $T_{case}$)**

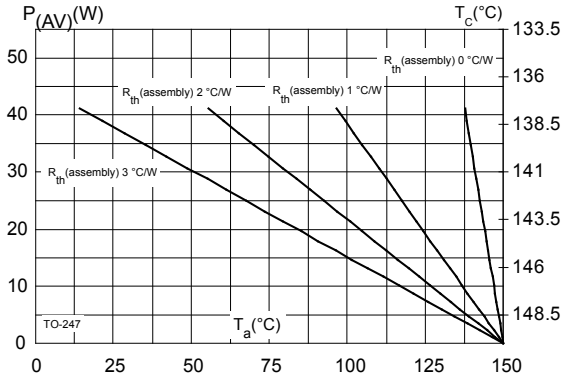



**Figure 3. Average and DC on-state current versus case temperature**

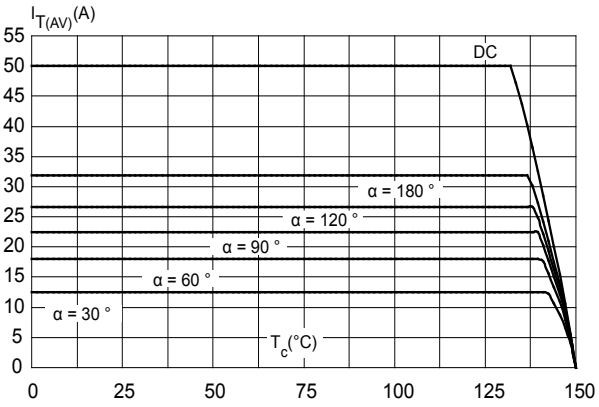



**Figure 4. Average and D.C. on-state current versus ambient temperature**

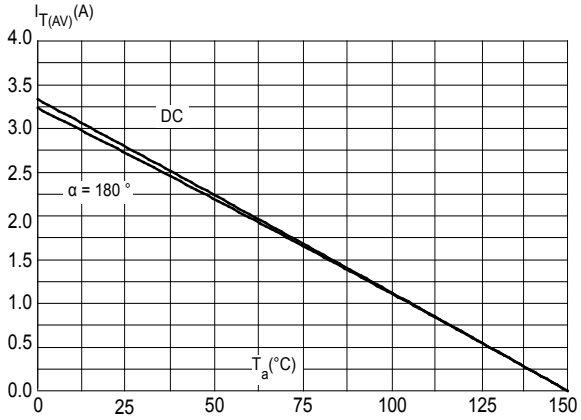



**Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration**

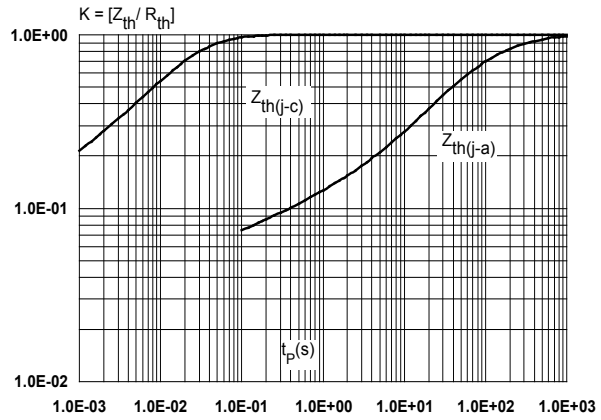



**Figure 6. Relative variation of gate trigger current and gate voltage versus junction temperature (typical values)**

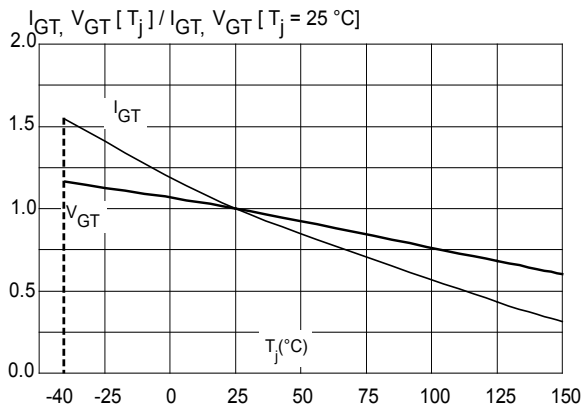


**Figure 7. Relative variation of holding and latching current versus junction temperature (typical values)**

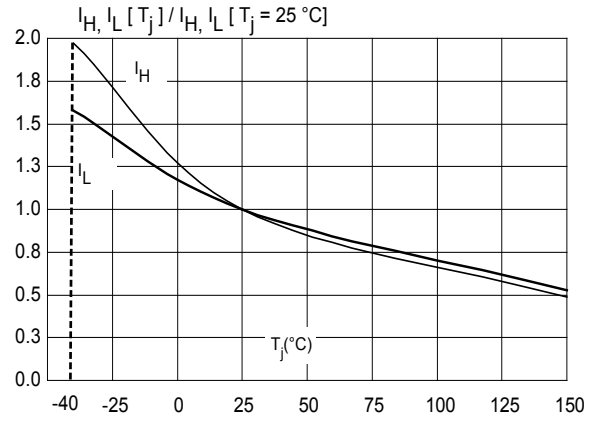



**Figure 8. Surge peak on-state current versus number of cycles**

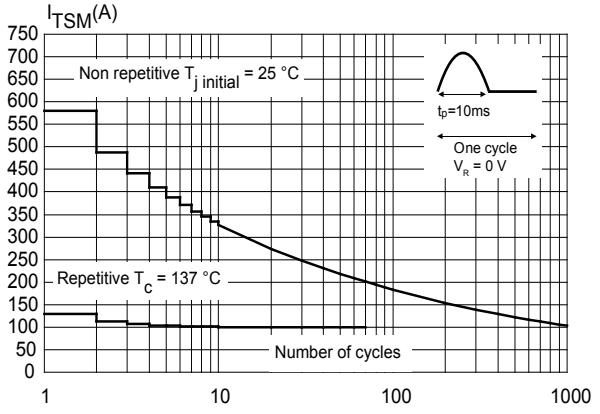



**Figure 9. Non repetitive surge peak on-state current for a sinusoidal pulse (tp < 10 ms)**

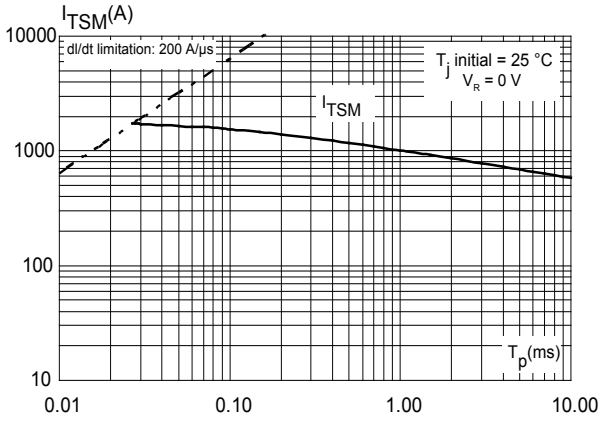



**Figure 10. On-state characteristics (maximum values)**

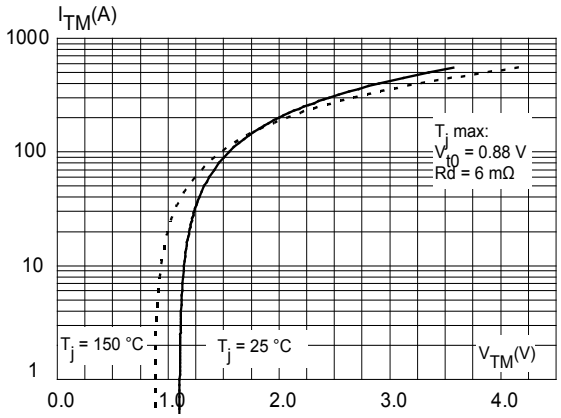
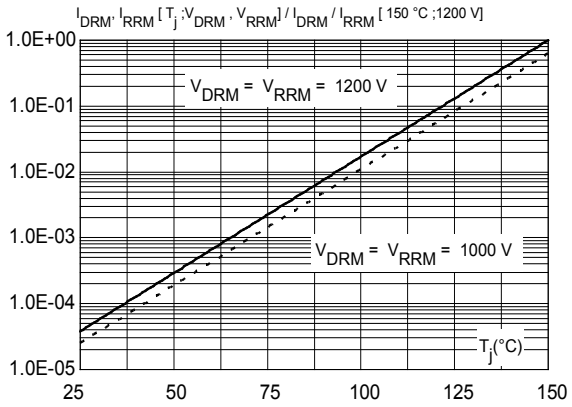



**Figure 11. Relative variation of leakage current versus junction temperature for different values of blocking voltage (typical values)**



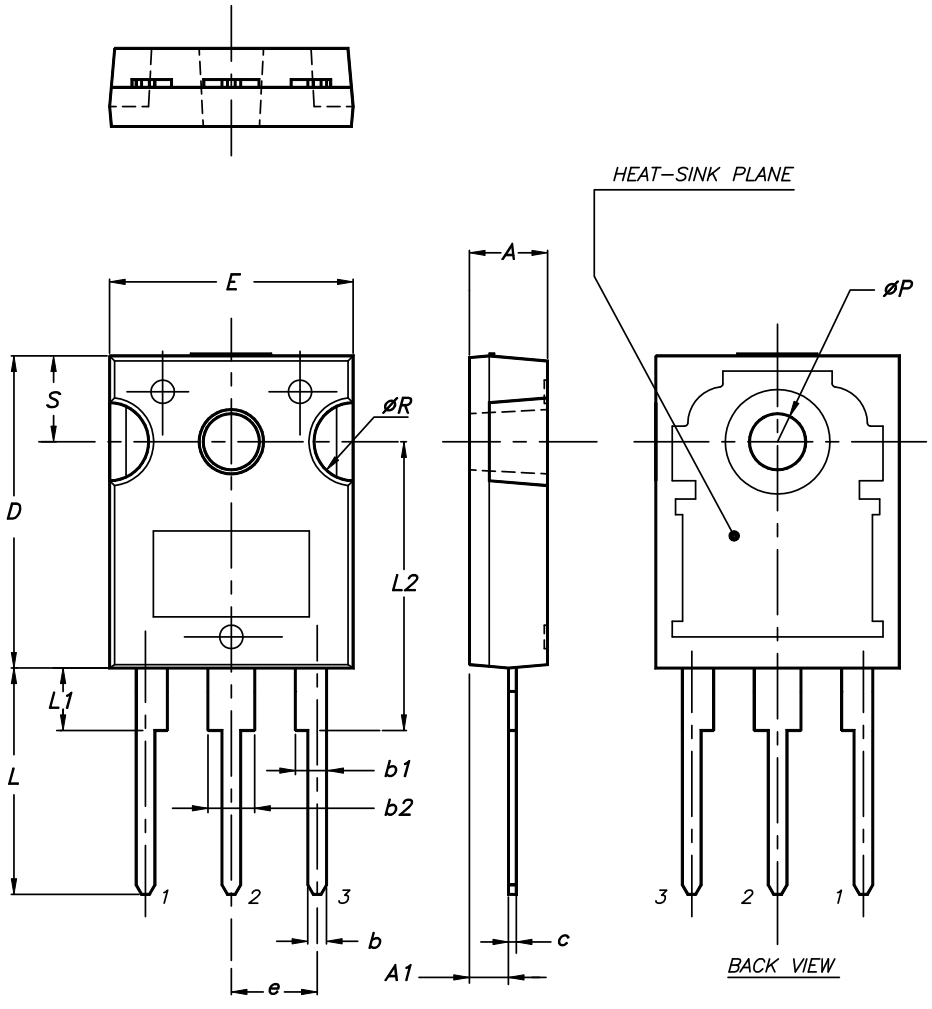
# 2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

## 2.1 TO-247 package information

- Epoxy meets UL 94,V0
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1 N·m

**Figure 12. TO-247 package outline**




0075325_9

Table 4. **TO-247 package mechanical data**

| Dim. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.85 | | 5.15 | 0.1909 | | 0.2028 |
| A1 | 2.20 | | 2.60 | 0.0866 | | 0.1024 |
| b | 1.0 | | 1.40 | 0.0394 | | 0.0551 |
| b1 | 2.0 | | 2.40 | 0.0787 | | 0.0945 |
| b2 | 3.0 | | 3.40 | 0.1181 | | 0.1339 |
| c | 0.40 | | 0.80 | 0.0157 | | 0.0315 |
| D[2] | 19.85 | | 20.15 | 0.7815 | | 0.7933 |
| E | 15.45 | | 15.75 | 0.6083 | | 0.6201 |
| e | 5.30 | 5.45 | 5.60 | 0.2087 | 0.2146 | 0.2205 |
| L | 14.20 | | 14.80 | 0.5591 | | 0.5827 |
| L1 | 3.70 | | 4.30 | 0.1457 | | 0.1693 |
| L2 | | 18.50 | | | 0.7283 | |
| ØP[3] | 3.55 | | 3.65 | 0.1398 | | 0.1437 |
| ØR | 4.50 | | 5.50 | 0.1772 | | 0.2165 |
| S | 5.30 | 5.50 | 5.70 | 0.2087 | 0.2165 | 0.2244 |

1. *Inch dimensions given only for reference*
2. *Dimension D plus gate protrusion does not exceed 20.5 mm*
3. *Resin thickness around the mounting hole is not less than 0.9 mm*

# 3 Ordering information

Table 5. **Ordering information**

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|---|---|---|---|---|---|
| TN5050H-12WY | TN5050H12Y | TO-247 | 4.43 g | 30 | Tube |

## Revision history

Table 6. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 07-Jan-2015 | 1 | Initial release. |
| 17-Oct-2017 | 2 | Updated TO-247 package information. |
| 20-Dec-2017 | 3 | Updated Table 5: "TO-247 package mechanical data". |
| 11-Sep-2019 | 4 | Updated Table 1 and Figure 8. Minor text change. |
| 27-Feb-2020 | 5 | Minor text change to improve the readability of the document. |
| 19-Oct-2023 | 6 | Updated *Product summary* and Table 1. |

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