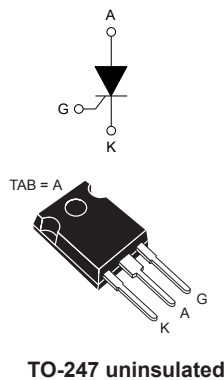


## 80 A 800 V high temperature thyristor (SCR) in TO-247 package



### Features

- High junction temperature:  $T_j = 150\text{ }^{\circ}\text{C}$
- Blocking voltage:  $V_{\text{DRM}} = V_{\text{RRM}} = 800\text{ V}$
- Nominal current:  $I_{\text{T(RMS)}} = 80\text{ A}$
- Gate triggering current:  $I_{\text{GT max.}} = 50\text{ mA}$
- High noise immunity:  $dV/dt > 1\text{ kV}/\mu\text{s}$
- Through hole package TO-247
- Increase of thermal margin due to extended  $T_j$  up to  $150\text{ }^{\circ}\text{C}$
- Low  $I_D$  and  $I_R$  in blocking state
- Ecopack2 (includes halogen free and RoHS compliance)

### Applications

- AC-DC rectifier controlled bridge
- Variable speed motor drive
- Battery charging system
- AC solid state relay
- By pass switch of UPS
- Industrial welding systems

### Description

Available in through hole package TO-247, the **TM8050H-8W** is an 800 V SCR thyristor suitable for applications where high power switching ( $I_{\text{T(RMS)}} = 80\text{ A}$ ) and low power dissipation ( $V_{\text{TM}} = 1.55\text{ V}$  at  $160\text{ A}$ ) are key features. These features make it ideal for motorbike voltage regulator, by-pass AC switch, controlled rectifier bridge, solid state relay, battery charger, welding equipment and motor driver applications.

| Product status link             |                        |
|---------------------------------|------------------------|
| <a href="#">TM8050H-8W</a>      |                        |
| Product summary                 |                        |
| $I_{\text{T(RMS)}}$             | 80 A                   |
| $V_{\text{DRM}}/V_{\text{RRM}}$ | 800 V                  |
| $I_{\text{GT}}$                 | 50 mA                  |
| $T_j$                           | 150 $^{\circ}\text{C}$ |

# 1 Characteristics

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

| Symbol                              | Parameter                                                                                       |                         |                                | Value       | Unit             |
|-------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------|--------------------------------|-------------|------------------|
| I <sub>T(RMS)</sub>                 | RMS on-state current (180 ° conduction angle)                                                   |                         | T <sub>C</sub> = 126 °C        | 80          | A                |
| I <sub>T(AV)</sub>                  | Average on-state current (180 ° conduction angle)                                               |                         |                                | 50          | A                |
| I <sub>TSM</sub>                    | Non repetitive surge peak on-state current, V <sub>R</sub> = 0 V                                | t <sub>p</sub> = 8.3 ms | T <sub>j</sub> initial = 25 °C | 731         | A                |
|                                     |                                                                                                 | t <sub>p</sub> = 10 ms  |                                | 670         |                  |
| I <sup>2</sup> t                    | I <sup>2</sup> t value for fusing                                                               |                         | T <sub>j</sub> = 25 °C         | 2245        | A <sup>2</sup> s |
| V <sub>RRM</sub> / V <sub>DRM</sub> | Maximum repetitive symmetric blocking voltage                                                   |                         |                                | 800         | V                |
| V <sub>DSM</sub>                    | Maximum non-repetitive direct blocking voltage                                                  | t <sub>p</sub> = 10 ms  |                                | 1000        | V                |
| di/dt                               | Critical rate of rise of on-state current<br>I <sub>G</sub> = 2 x I <sub>GT</sub> , tr ≤ 100 ns | f = 50 Hz               | T <sub>j</sub> = 25 °C         | 200         | A/μs             |
| I <sub>GM</sub>                     | Peak gate current                                                                               | t <sub>p</sub> = 20 μs  | T <sub>j</sub> = 150 °C        | 8           | A                |
| P <sub>G(AV)</sub>                  | Average gate power dissipation                                                                  |                         | T <sub>j</sub> = 150 °C        | 1           | W                |
| V <sub>RGM</sub>                    | Maximum peak reverse gate voltage                                                               |                         |                                | 5           | V                |
| T <sub>stg</sub>                    | Storage junction temperature range                                                              |                         |                                | -40 to +150 | °C               |
| T <sub>j</sub>                      | Maximum operating junction temperature                                                          |                         |                                | -40 to +150 | °C               |

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

| Symbol          | Test Conditions                                                                                                                                             |                         |      | Value | Unit |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------|-------|------|
| I <sub>GT</sub> | V <sub>D</sub> = 12 V, R <sub>L</sub> = 33 Ω                                                                                                                |                         | Min. | 2.5   | mA   |
|                 |                                                                                                                                                             |                         | Max. | 50    |      |
| V <sub>GT</sub> | V <sub>D</sub> = 12 V, R <sub>L</sub> = 33 Ω                                                                                                                |                         | Max. | 1.5   | V    |
| V <sub>GD</sub> | V <sub>D</sub> = V <sub>DRM</sub> , R <sub>L</sub> = 3.3 kΩ                                                                                                 | T <sub>j</sub> = 150 °C | Min. | 0.2   | V    |
| I <sub>H</sub>  | I <sub>T</sub> = 500 mA, gate open                                                                                                                          |                         | Max. | 100   | mA   |
| I <sub>L</sub>  | I <sub>G</sub> = 1.2 x I <sub>GT</sub>                                                                                                                      |                         | Max. | 125   | mA   |
| t <sub>gt</sub> | I <sub>T</sub> = 80 A, V <sub>D</sub> = V <sub>DRM</sub> , I <sub>G</sub> = 200 mA, dI <sub>G</sub> /dt = 0.2 A/μs                                          |                         | Typ. | 3     | μs   |
| dV/dt           | V <sub>D</sub> = 67 % V <sub>DRM</sub> , gate open                                                                                                          | T <sub>j</sub> = 150 °C | Min. | 1000  | V/μs |
| t <sub>q</sub>  | I <sub>T</sub> = 33 A, dI <sub>T</sub> /dt = 10 A/μs, V <sub>R</sub> = 75 V, V <sub>D</sub> = 400 V, dV <sub>D</sub> /dt = 20 V/μs, t <sub>p</sub> = 100 μs | T <sub>j</sub> = 150 °C | Max. | 150   | μs   |

**Table 3. Static characteristics**

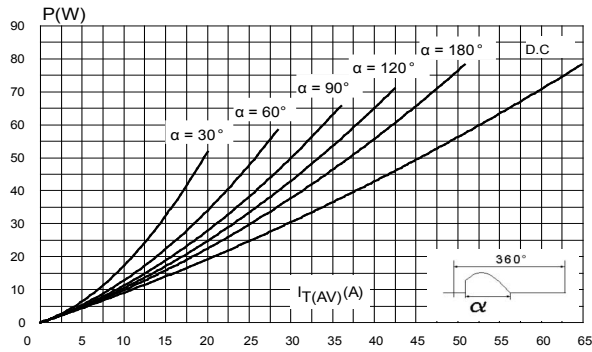
| Symbol    | Test conditions                                    |                       |      | Value | Unit       |
|-----------|----------------------------------------------------|-----------------------|------|-------|------------|
| $V_{TM}$  | $I_{TM} = 160\text{ A}$ , $t_p = 380\text{ }\mu$ s | $T_j = 25\text{ °C}$  | Max. | 1.55  | V          |
| $V_{TO}$  | On state threshold voltage                         | $T_j = 150\text{ °C}$ | Max. | 0.85  |            |
| $R_D$     | On state dynamic resistance                        | $T_j = 150\text{ °C}$ | Max. | 5.5   | m $\Omega$ |
| $I_{DRM}$ | $V_D = V_{DRM} = V_R = V_{RRM} = 800\text{ V}$     | $T_j = 25\text{ °C}$  | Max. | 20    | $\mu$ A    |
| $I_{RRM}$ |                                                    | $T_j = 150\text{ °C}$ | Max. | 2.5   | mA         |

**Table 4. Thermal parameters**

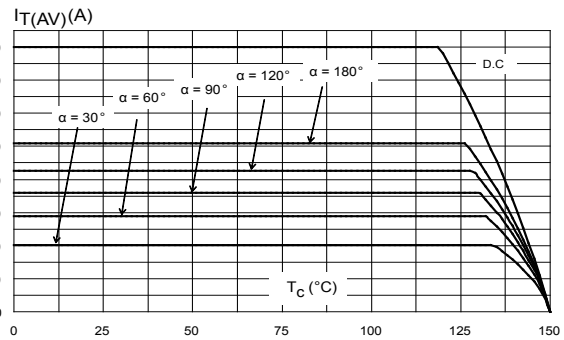
| Symbol        | Parameter                     | Value | Unit |
|---------------|-------------------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case (DC,max.)    | 0.30  | °C/W |
| $R_{th(j-a)}$ | Junction to ambient DC (typ.) | 50    |      |

## 1.1 Characteristics curves

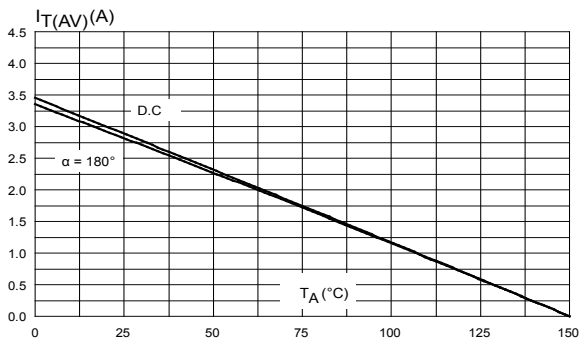
**Figure 1. Maximum average power dissipation versus average on-state current**



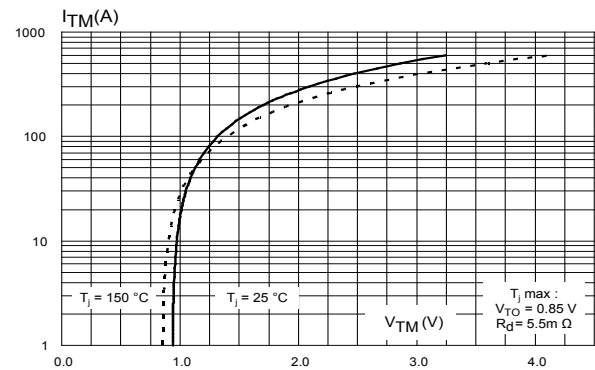
**Figure 2. Average and DC on-state current versus case temperature**



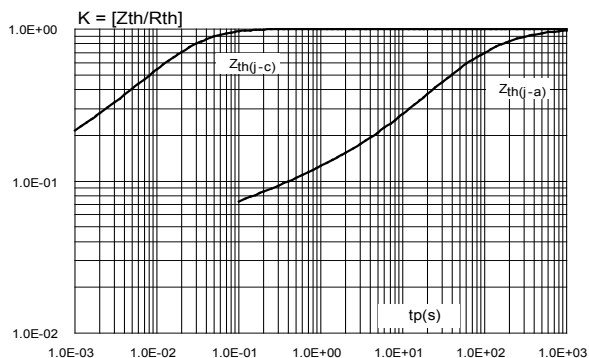
**Figure 3. Average and D.C. on state current versus ambient temperature**



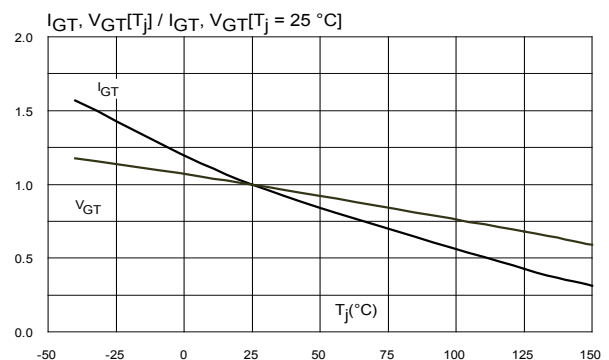
**Figure 4. On-state characteristics (maximum values)**



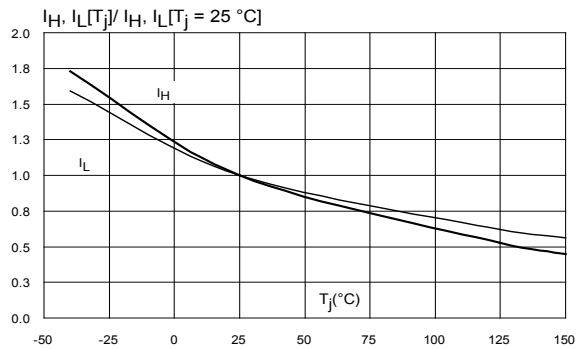
**Figure 5. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration**



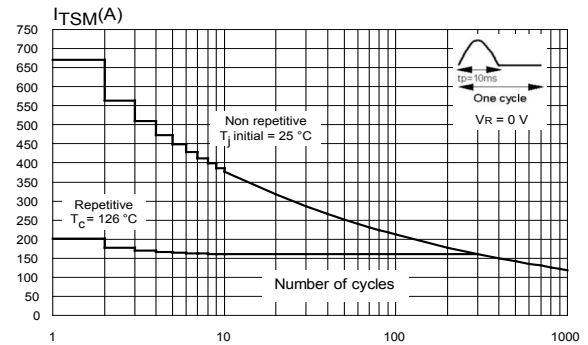
**Figure 6. Relative variation of gate trigger current and gate voltage versus junction temperature**



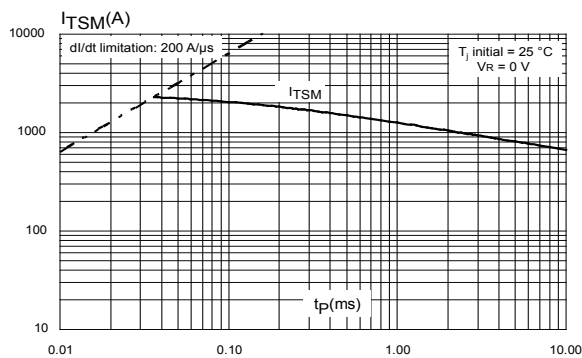
**Figure 7. Relative variation of holding current and latching current versus junction temperature (typical values)**



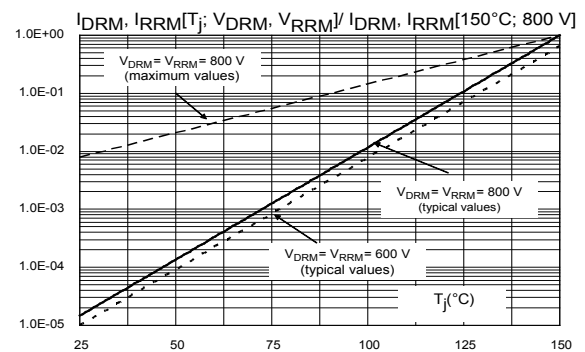
**Figure 8. Surge peak on state current versus number of cycles**



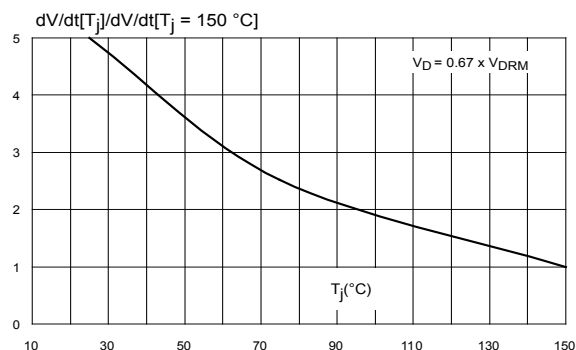
**Figure 9. Non repetitive surge peak on state current for a half cycle sine pulse versus pulse width  $t_p < 10$  ms**



**Figure 10. Relative variation of leakage current versus junction temperature for different values of blocking voltage**



**Figure 11. Relative variation of static dV/dt immunity versus junction temperature (typical values)**



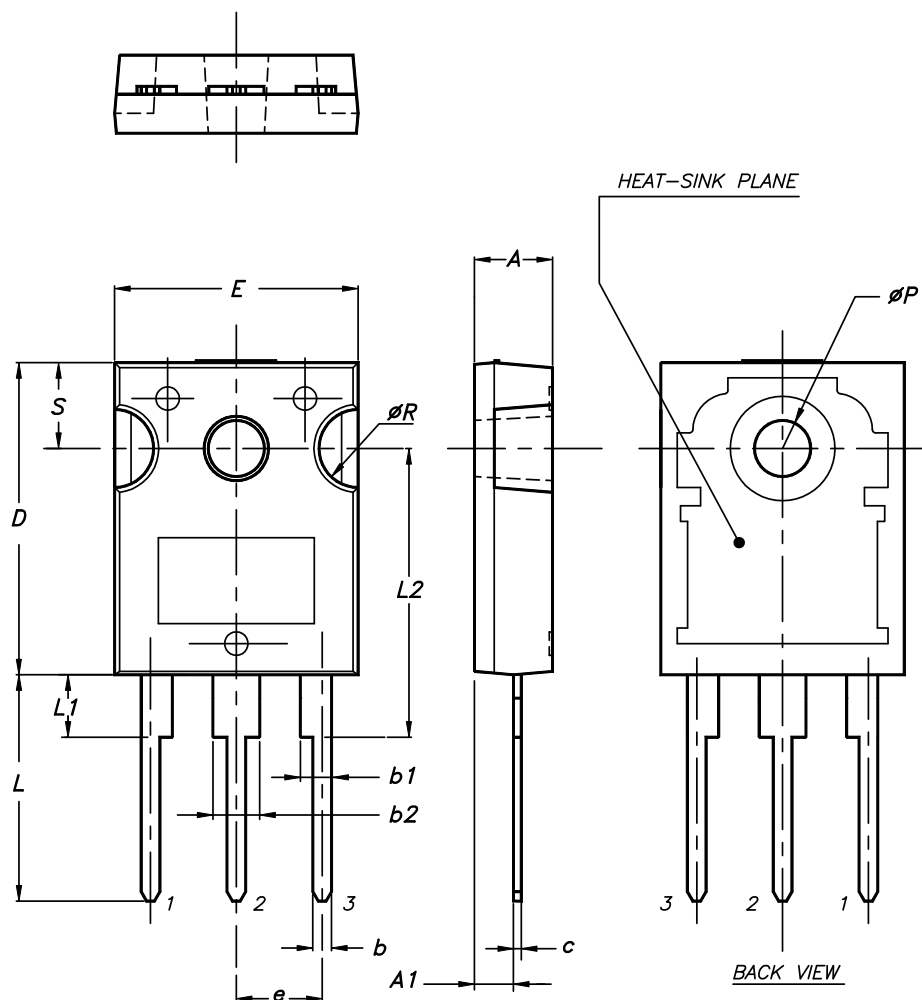
## 2 Package information

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](http://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

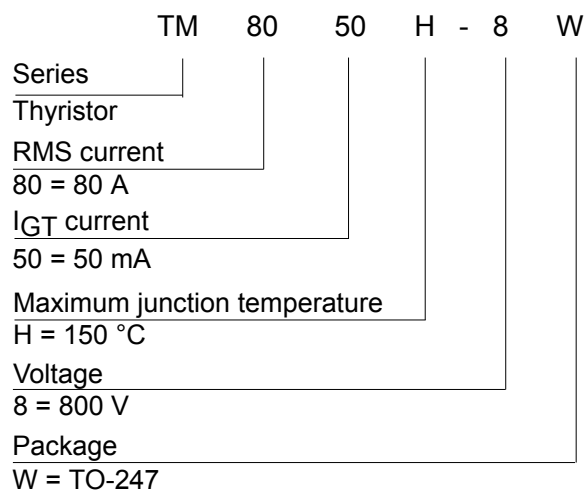
**Table 5. TO-247 package mechanical data**

| Dim.              | Dimensions  |       |       |                       |        |        |
|-------------------|-------------|-------|-------|-----------------------|--------|--------|
|                   | Millimeters |       |       | Inches <sup>(1)</sup> |        |        |
|                   | 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 <sup>(2)</sup>  | 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 <sup>(3)</sup> | 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

**Figure 13. Ordering information scheme**



**Table 6. Ordering information**

| Order code | Marking  | Package | Weight | Base qty. | Delivery mode |
|------------|----------|---------|--------|-----------|---------------|
| TM8050H-8W | TM8050H8 | TO-247  | 4.43 g | 30        | Tube          |

## Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes                                                    |
|-------------|----------|------------------------------------------------------------|
| 03-May-2016 | 1        | Initial release.                                           |
| 08-Aug-2019 | 2        | Updated Table 1, Figure 8 and Figure 9. Minor text change. |
| 04-Jan-2023 | 3        | Updated Table 1 and Figure 1.                              |

**IMPORTANT NOTICE – READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2023 STMicroelectronics – All rights reserved