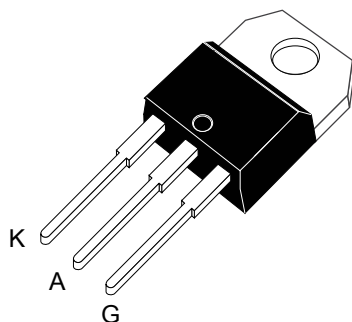


## 50 A 800 V high temperature SCR thyristors in insulated TO-220I package



TO-220AB insulated

### Features

- High junction temperature:  $T_j = 150\text{ }^{\circ}\text{C}$
- 800 V  $V_{\text{DRM}} / V_{\text{RRM}}$
- 900 V  $V_{\text{DSM}} / V_{\text{RSM}}$
- Low  $I_{\text{GT}}$ : 15 mA
- High static immunity  $dV/dt = 1000\text{ V}/\mu\text{s}$  at  $150\text{ }^{\circ}\text{C}$
- High turn-on rise  $dI/dt$  at  $200\text{ A}/\mu\text{s}$
- Halogen-free molding, lead-free plating
- ECOPACK2 compliant
- Insulated package TO-220AB:
  - Insulated voltage:  $2500\text{ V}_{\text{RMS}}$
  - Complies with UL 1554 (file ref. 81734)

### Application

- Inrush current limiting circuits in AC/DC converters
- General purpose AC line load switching
- Heating resistor control, solid state relays

### Description

Thanks to its junction temperature  $T_j$  up to  $150\text{ }^{\circ}\text{C}$ , the TN5015H-8I offers high thermal performance operation up to 50 A RMS in an insulated TO-220AB package.

Its trade-off noise immunity ( $dV/dt = 1000\text{ V}/\mu\text{s}$ ) versus its gate triggering current ( $I_{\text{GT}} = 15\text{ mA}$ ) and its turn-on current rise ( $dI/dt = 200\text{ A}/\mu\text{s}$ ) allow to design robust and compact control circuit in AC/DC converters for inrush current limiting circuits and industrial drives, such as overvoltage crowbar protection, motor control circuits and power tools.

| Product status |
|----------------|
| TN5015H-8I     |

| Product summary                 |                               |
|---------------------------------|-------------------------------|
| Order code                      | TN5015H-8I                    |
| Package                         | TO-220AB Ins.                 |
| $I_{\text{T(RMS)}}$             | 50 A                          |
| $V_{\text{DRM}}/V_{\text{RRM}}$ | 800 V                         |
| $T_j(\text{max.})$              | $150\text{ }^{\circ}\text{C}$ |

# 1 Characteristics

**Table 1. Absolute maximum ratings (limiting values),  $T_j = 25\text{ °C}$  unless otherwise specified**

| Symbol            | Parameter                                                                                      |                         | Value                        | Unit             |
|-------------------|------------------------------------------------------------------------------------------------|-------------------------|------------------------------|------------------|
| $I_{T(RMS)}$      | RMS on-state current (180 ° conduction angle)                                                  |                         | $T_c = 75\text{ °C}$<br>50   | A                |
| $I_{T(AV)}$       | Average on-state current (180 ° conduction angle)                                              |                         | $T_c = 81\text{ °C}$<br>30   | A                |
|                   |                                                                                                |                         | $T_c = 96\text{ °C}$<br>25   |                  |
|                   |                                                                                                |                         | $T_c = 110\text{ °C}$<br>20  |                  |
| $I_{TSM}$         | Non repetitive surge peak on-state current ( $T_j$ initial = 25 °C)                            |                         | $t_p = 8.3\text{ ms}$<br>550 | A                |
|                   |                                                                                                |                         | $t_p = 10\text{ ms}$<br>500  |                  |
| $I^2t$            | $I^2t$ value for fusing                                                                        |                         | $t_p = 10\text{ ms}$<br>1250 | A <sup>2</sup> s |
| $di/dt$           | $I_G = 2 \times I_{GT}$ , $tr \leq 100\text{ ns}$<br>Critical rate of rise of on-state current |                         | $f = 50\text{ Hz}$<br>200    | A/ $\mu$ s       |
| $V_{DRM}/V_{RRM}$ | Repetitive peak off-state voltage                                                              |                         | $T_j = 150\text{ °C}$<br>800 | V                |
| $V_{DSM}/V_{RSM}$ | Non repetitive surge peak off-state voltage                                                    |                         | $t_p = 10\text{ ms}$<br>900  | V                |
| $I_{GM}$          | Peak gate current                                                                              | $t_p = 20\text{ }\mu$ s | $T_j = 150\text{ °C}$<br>4   | A                |
| $P_{G(AV)}$       | Average gate power dissipation                                                                 |                         | $T_j = 150\text{ °C}$<br>1   | W                |
| $V_{RGM}$         | Maximum peak reverse gate voltage                                                              |                         | 5                            | V                |
| $T_{stg}$         | Storage junction temperature range                                                             |                         | -40 to +150                  | °C               |
| $T_j$             | Maximum operating junction temperature                                                         |                         | -40 to +150                  | °C               |
| $T_l$             | Maximum lead temperature soldering during 10 s                                                 |                         | 260                          | °C               |
| $V_{ins}$         | Insulation RMS voltage, 1 minute                                                               |                         | 2500                         | V                |

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

| Symbol   | Test conditions                                                                                                |                       | Value                            | Unit       |
|----------|----------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------|------------|
| $I_{GT}$ | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                                                                 |                       | Min. 5                           | mA         |
|          |                                                                                                                |                       | Max. 15                          |            |
| $V_{GT}$ |                                                                                                                |                       | Max. 1.3                         | V          |
| $V_{GD}$ | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$                                                                   | $T_j = 150\text{ °C}$ | Min. 0.2                         | V          |
| $I_H$    | $I_T = 500\text{ mA}$ , gate open                                                                              |                       | Max. 50                          | mA         |
| $I_L$    | $I_G = 1.2 \times I_{GT}$                                                                                      |                       | Max. 70                          | mA         |
| $dV/dt$  | $V_D = 536\text{ V}$ , gate open                                                                               | $T_j = 150\text{ °C}$ | Min. 1000                        | V/ $\mu$ s |
| $t_{gt}$ | $I_{TM} = 100\text{ A}$ , $V_D = 536\text{ V}$ , $I_G = 30\text{ mA}$ , $(dI_G/dt)_{max} = 0.2\text{ A}/\mu$ s |                       | Typ. 1.9                         | $\mu$ s    |
| $t_q$    | $I_T = 100\text{ A}$ , $V_D = 536\text{ V}$ , $V_R = 25\text{ V}$ , $dV_D/dt = 40\text{ V}/\mu$ s              |                       | $T_j = 125\text{ °C}$<br>Typ. 70 | $\mu$ s    |
|          |                                                                                                                |                       | $T_j = 150\text{ °C}$<br>Typ. 85 | $\mu$ s    |

**Table 3. Static characteristics**

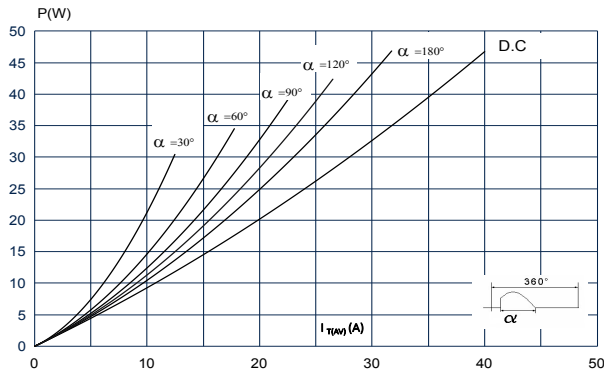
| Symbol                | Test conditions                                          |                                   |      | Value | Unit          |
|-----------------------|----------------------------------------------------------|-----------------------------------|------|-------|---------------|
| $V_{TM}$              | $I_{TM} = 100\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_j = 25\text{ }^\circ\text{C}$  | Max. | 1.55  | V             |
| $V_{TO}$              | Threshold voltage                                        | $T_j = 150\text{ }^\circ\text{C}$ | Max. | 0.85  |               |
| $R_D$                 | Dynamic resistance                                       | $T_j = 150\text{ }^\circ\text{C}$ | Max. | 8     | m $\Omega$    |
| $I_{DRM}$ , $I_{RRM}$ | $V_D = V_{DRM} = V_{RRM}$                                | $T_j = 25\text{ }^\circ\text{C}$  | Max. | 2.5   | $\mu\text{A}$ |
|                       |                                                          | $T_j = 150\text{ }^\circ\text{C}$ |      | 12    | mA            |

**Table 4. Thermal parameters**

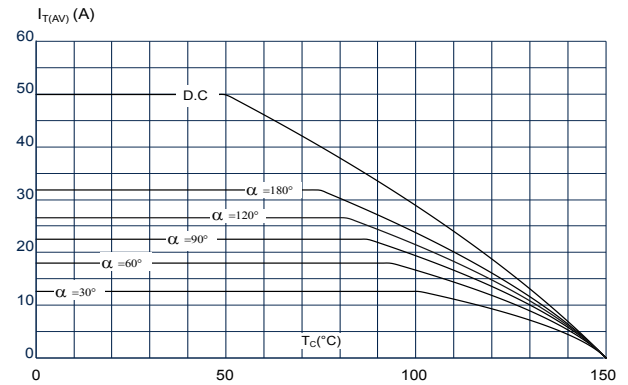
| Symbol        | Parameter             |      | Value | Unit               |
|---------------|-----------------------|------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (DC) | Max. | 1.6   | $^\circ\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient   | Typ. | 60    |                    |

## 1.1 Characteristics curves

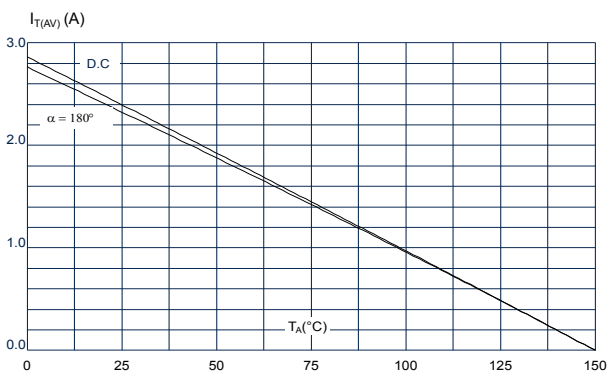
**Figure 1. Maximum average power dissipation versus average on-state current**



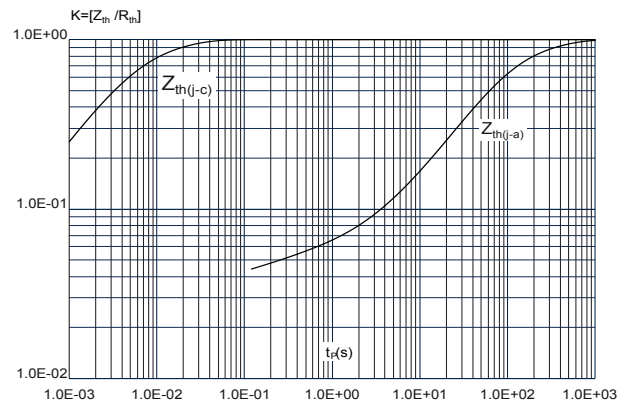
**Figure 2. Average and DC on-state current versus case temperature**



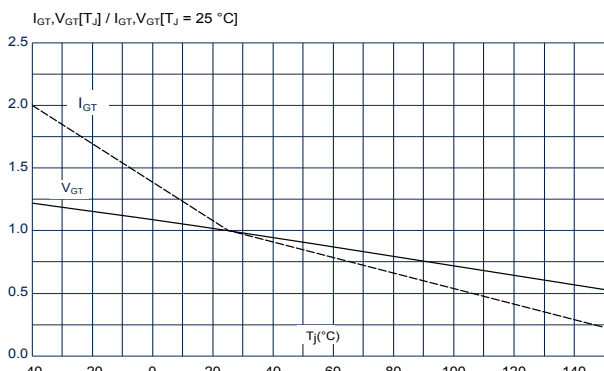
**Figure 3. Average and D.C. on state current versus ambient temperature**



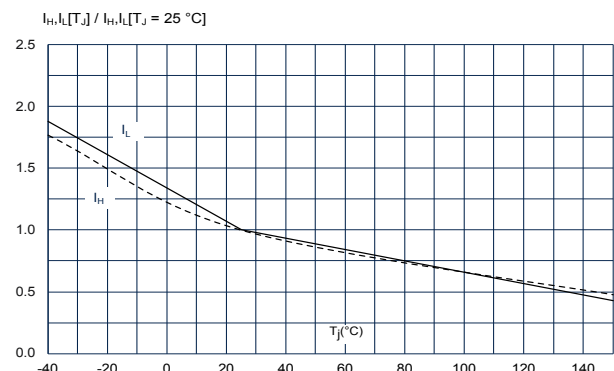
**Figure 4. Relative variation of thermal impedance junction to case and junction to ambient versus pulse duration**

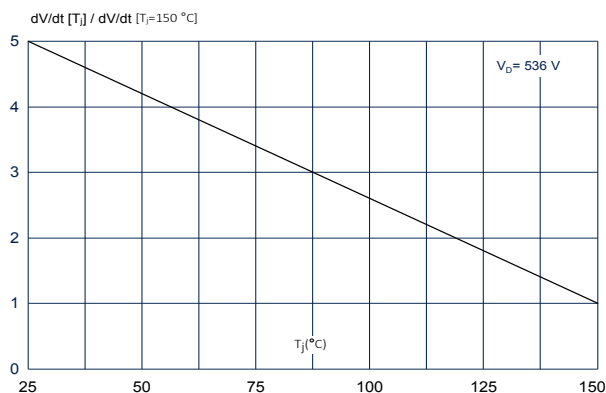
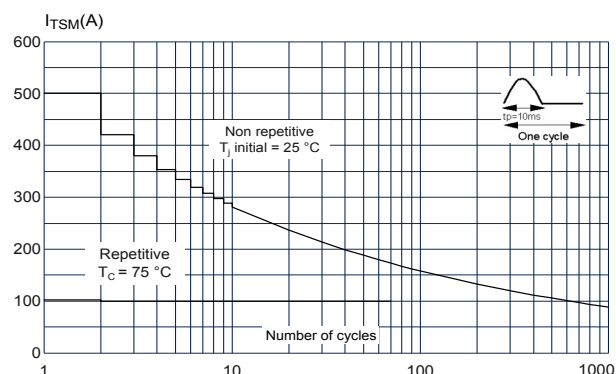
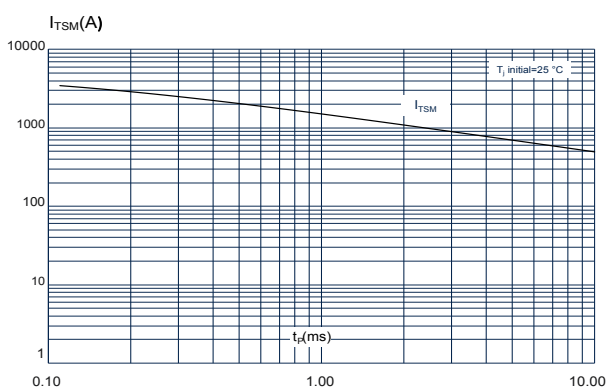
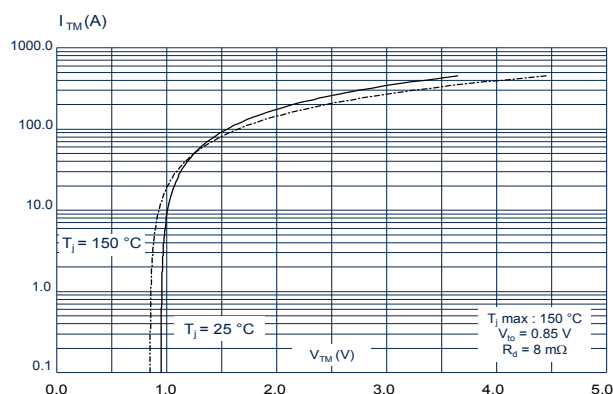
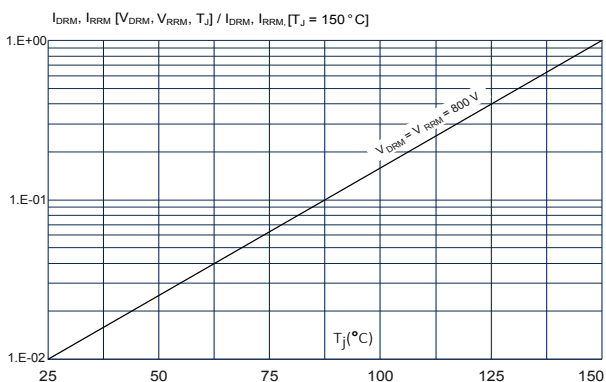
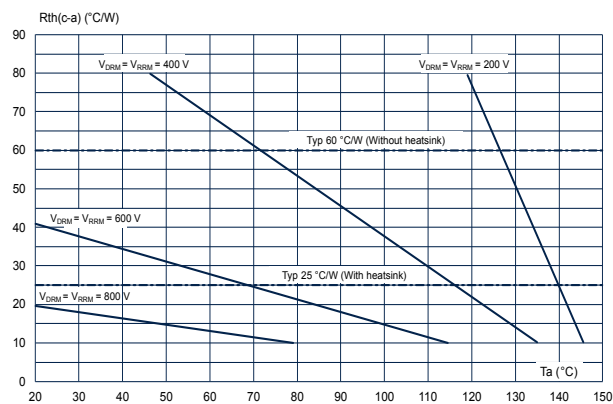


**Figure 5. Relative variation of gate trigger current and gate voltage versus junction temperature**



**Figure 6. Relative variation of holding and latching current versus junction temperature**



**Figure 7. Relative variation of static dV/dt immunity versus junction temperature**

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

**Figure 9. Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10\text{ ms}$** 

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

**Figure 11. Relative variation of leakage current versus junction temperature**

**Figure 12. Recommended maximum case-to-ambient thermal resistance versus ambient temperature for different peak off-state voltages**


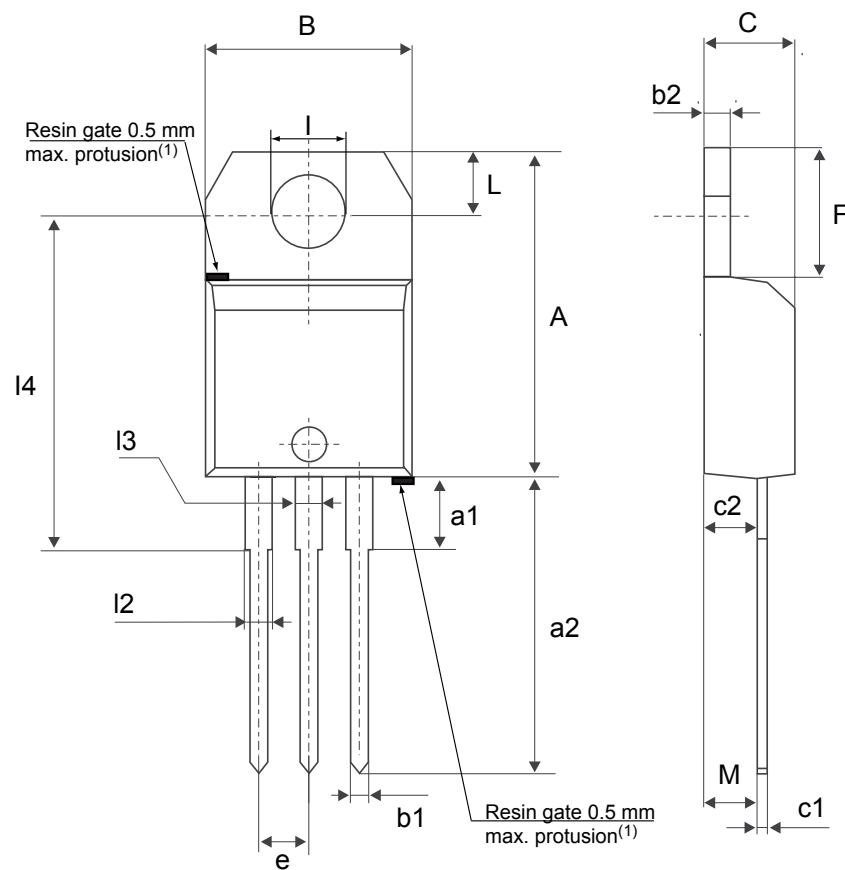
## 2 Package information

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-220AB insulated package information

- Molding compound resin is halogen-free and meets flammability standard UL94 level 0
- Lead-free package leads finishing
- **ECOPACK2** compliant
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

**Figure 13. TO-220AB package outline**



(1) Resin gate position accepted in one of the two positions or in the symmetrical opposites.

**Table 5. TO-220AB package mechanical data**

| Ref. | Dimensions  |       |       |                       |        |        |
|------|-------------|-------|-------|-----------------------|--------|--------|
|      | Millimeters |       |       | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ.  | Max.  | Min.                  | Typ.   | Max.   |
| A    | 15.20       |       | 15.90 | 0.5984                |        | 0.6260 |
| a1   |             | 3.75  |       |                       | 0.1476 |        |
| a2   | 13.00       |       | 14.00 | 0.5118                |        | 0.5512 |
| B    | 10.00       |       | 10.40 | 0.3937                |        | 0.4094 |
| b1   | 0.61        |       | 0.88  | 0.0240                |        | 0.0346 |
| b2   | 1.23        |       | 1.32  | 0.0484                |        | 0.0520 |
| C    | 4.40        |       | 4.60  | 0.1732                |        | 0.1811 |
| c1   | 0.49        |       | 0.70  | 0.0193                |        | 0.0276 |
| c2   | 2.40        |       | 2.72  | 0.0945                |        | 0.1071 |
| e    | 2.40        |       | 2.70  | 0.0945                |        | 0.1063 |
| F    | 6.20        |       | 6.60  | 0.2441                |        | 0.2598 |
| I    | 3.73        |       | 3.88  | 0.1469                |        | 0.1528 |
| L    | 2.65        |       | 2.95  | 0.1043                |        | 0.1161 |
| l2   | 1.14        |       | 1.70  | 0.0449                |        | 0.0669 |
| l3   | 1.14        |       | 1.70  | 0.0449                |        | 0.0669 |
| l4   | 15.80       | 16.40 | 16.80 | 0.6220                | 0.6457 | 0.6614 |
| M    |             | 2.6   |       |                       | 0.1024 |        |

1. Inch dimensions are for reference only.

### 3 Ordering information

Figure 14. Ordering information scheme

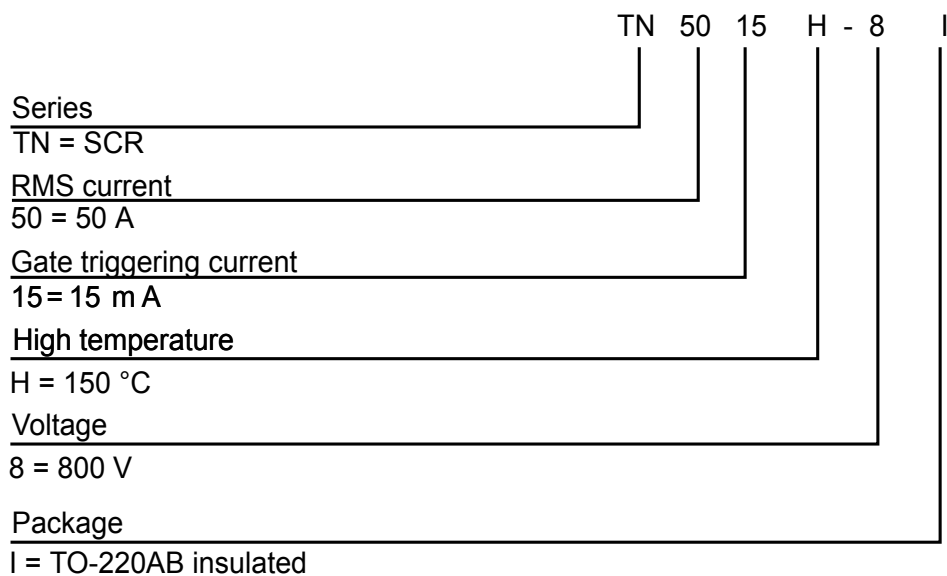


Table 6. Ordering information

| Order code | Marking   | Package       | Weight | Base qty. | Delivery mode |
|------------|-----------|---------------|--------|-----------|---------------|
| TN5015H-8I | TN5015H8I | TO-220AB ins. | 1.9 g  | 50        | Tube          |

## Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes                                                           |
|-------------|----------|-------------------------------------------------------------------|
| 26-Oct-2023 | 1        | Initial release.                                                  |
| 29-Apr-2024 | 2        | Updated <a href="#">Table 3</a> , and <a href="#">Figure 12</a> . |

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