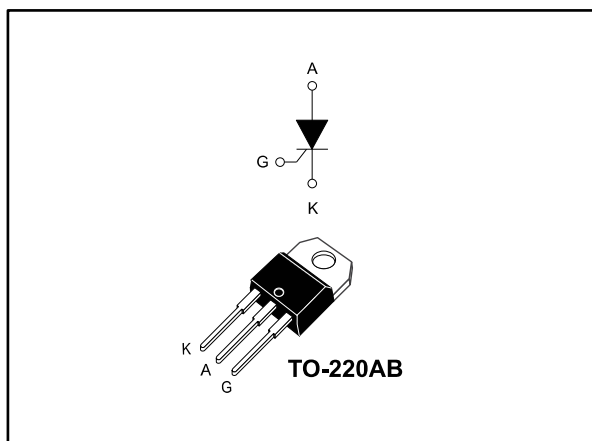


## High temperature 40 A SCRs

Datasheet - production data



### Features

- High junction temperature:  $T_j = 150\text{ }^{\circ}\text{C}$
- High noise immunity  $dV/dt = 500\text{ V}/\mu\text{s}$  up to  $150\text{ }^{\circ}\text{C}$
- Gate triggering current  $I_{GT} = 15\text{ mA}$
- Peak off-state voltage  $600\text{ V } V_{DRM}/V_{RRM}$
- High turn on current rise  $dI/dt = 100\text{ A}/\mu\text{s}$
- ECOPACK®2 compliant component
- Insulated package TO-220AB:
  - Insulated voltage:  $2500\text{ V}_{RMS}$
- Complies with UL 1557 (File ref : E81734)

### Applications

- Motorbike voltage regulator circuits
- Inrush current limiting circuit
- Motor control circuits and starters
- Solid state relays

### Description

Thanks to its junction temperature  $T_j$  up to  $150\text{ }^{\circ}\text{C}$ , the device offers high thermal performances operation up to  $40\text{ A}$ . It is fully tab insulated thanks to the ceramic inside the TO-220AB package and allows a back to back configuration.

Its trade-off noise immunity ( $dV/dt = 500\text{ V}/\mu\text{s}$ ) versus its gate triggering current ( $I_{GT} = 15\text{ mA}$ ) and its turn-on current rise ( $dI/dt = 100\text{ A}/\mu\text{s}$ ) allows to design robust and compact control circuit for voltage regulator in motorbikes and industrial drives, overvoltage crowbar protection, motor control circuits in power tools and kitchen aids, inrush current limiting circuits.

Table 1: Device summary

| Order code | Package       | $V_{DRM}/V_{RRM}$ | $I_{GT}$ |
|------------|---------------|-------------------|----------|
| TN4015H-6I | TO-220AB ins. | 600 V             | 15 mA    |

# 1 Characteristics

**Table 2: Absolute maximum ratings (limiting values),  $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified**

| Symbol            | Parameter                                                                                       |                               | Value                                           | Unit                   |
|-------------------|-------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------|------------------------|
| $I_{T(RMS)}$      | RMS on-state current<br>(180 ° conduction angle)                                                |                               | $T_c = 82\text{ }^{\circ}\text{C}$<br>40        | A                      |
| $I_{T(AV)}$       | Average on-state current<br>(180 ° conduction angle)                                            |                               | $T_c = 83\text{ }^{\circ}\text{C}$<br>25        | A                      |
|                   |                                                                                                 |                               | $T_c = 94\text{ }^{\circ}\text{C}$<br>22        |                        |
|                   |                                                                                                 |                               | $T_c = 101\text{ }^{\circ}\text{C}$<br>20       |                        |
| $I_{TSM}$         | Non repetitive surge peak on-state current                                                      |                               | $t_p = 8.3\text{ ms}$<br>394                    | A                      |
|                   |                                                                                                 |                               | $t_p = 10\text{ ms}$<br>360                     |                        |
| $I^2t$            | $I^2t$ value for fusing                                                                         |                               | $t_p = 10\text{ ms}$<br>648                     | $\text{A}^2\text{s}$   |
| $di/dt$           | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ |                               | $f = 60\text{ Hz}$<br>100                       | $\text{A}/\mu\text{s}$ |
| $V_{DRM}/V_{RRM}$ | Repetitive peak off-state voltage                                                               |                               | $T_J = 150\text{ }^{\circ}\text{C}$<br>600      | V                      |
| $V_{DSM}/V_{RSM}$ | Non repetitive surge peak off-state voltage                                                     |                               | $t_p = 10\text{ ms}$<br>$V_{DRM}/V_{RRM} + 100$ | V                      |
| $I_{GM}$          | Peak gate current                                                                               | $t_p = 20\text{ }\mu\text{s}$ | $T_J = 150\text{ }^{\circ}\text{C}$<br>4        | A                      |
| $P_{G(AV)}$       | Average gate power dissipation                                                                  |                               | $T_J = 150\text{ }^{\circ}\text{C}$<br>1        | W                      |
| $V_{RGM}$         | Maximum peak reverse gate voltage                                                               |                               | 5                                               | V                      |
| $T_{stg}$         | Storage junction temperature range                                                              |                               | -40 to +150                                     | $^{\circ}\text{C}$     |
| $T_J$             | Maximum operating junction temperature                                                          |                               | -40 to +150                                     | $^{\circ}\text{C}$     |
| $T_L$             | Maximum lead temperature soldering during 10 s                                                  |                               | 260                                             | $^{\circ}\text{C}$     |

**Table 3: Electrical characteristics ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)**

| Symbol          | Test Conditions                                                                                                                          |                         | Value | Unit |      |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------|------|------|
| I <sub>GT</sub> | V <sub>D</sub> = 12 V, R <sub>L</sub> = 33 Ω                                                                                             |                         | Max.  | 15   | mA   |
| V <sub>GT</sub> |                                                                                                                                          |                         | Max.  | 1.3  | 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.  | 0.15 | V    |
| I <sub>H</sub>  | I <sub>T</sub> = 500 mA, gate open                                                                                                       |                         | Max.  | 60   | mA   |
| I <sub>L</sub>  | I <sub>G</sub> = 1.2 x I <sub>GT</sub>                                                                                                   |                         | Max.  | 80   | mA   |
| dV/dt           | V <sub>D</sub> = 402 V, gate open                                                                                                        | T <sub>j</sub> = 150 °C | Min.  | 500  | V/μs |
| t <sub>gt</sub> | I <sub>T</sub> = 80 A, V <sub>D</sub> = 600 V, I <sub>G</sub> = 100 mA, (dI <sub>G</sub> /dt) max = 0.2 A/μs                             |                         | Typ.  | 1.9  | μs   |
| t <sub>q</sub>  | V <sub>D</sub> = 402 V, I <sub>T</sub> = 40 A, V <sub>R</sub> = 25 V, dV <sub>D</sub> /dt = 50 V/μs, (dI <sub>G</sub> /dt) max = 30 A/μs | T <sub>j</sub> = 150 °C | Typ.  | 85   | μs   |

Table 4: Static characteristics

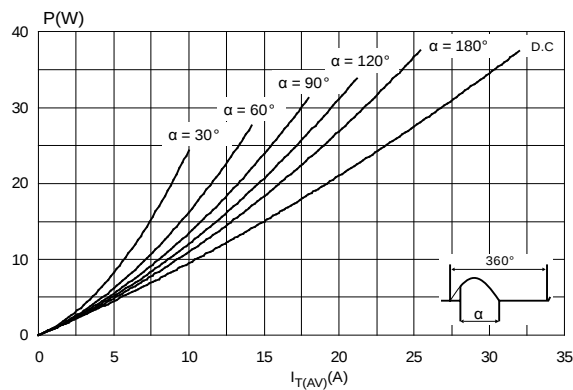
| Symbol                | Test conditions                                         |                                     |      | Value | Unit          |
|-----------------------|---------------------------------------------------------|-------------------------------------|------|-------|---------------|
| $V_{TM}$              | $I_{TM} = 80\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_j = 25\text{ }^{\circ}\text{C}$  | Max. | 1.6   | 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. | 10    | m $\Omega$    |
| $I_{DRM}$ , $I_{RRM}$ | $V_D = V_{DRM} = V_{RRM}$                               | $T_j = 25\text{ }^{\circ}\text{C}$  | Max. | 10    | $\mu\text{A}$ |
|                       |                                                         | $T_j = 150\text{ }^{\circ}\text{C}$ |      | 6     | mA            |

Table 5: Thermal parameters

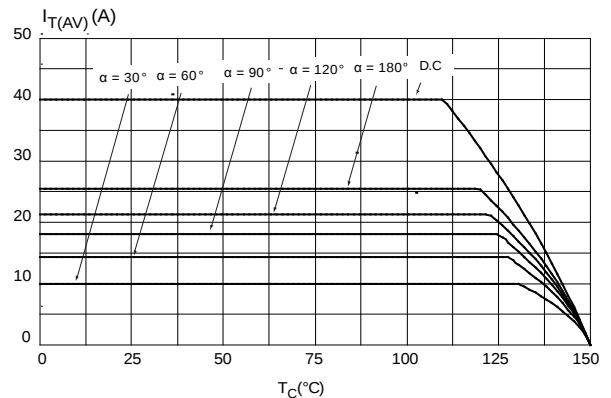
| Symbol        | Parameter                |      | Value | Unit                 |
|---------------|--------------------------|------|-------|----------------------|
| $R_{th(j-c)}$ | Junction to case (DC)    | Max. | 1.8   | $^{\circ}\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient (DC) | Typ. | 60    |                      |

## 1.1 Characteristics (curves)

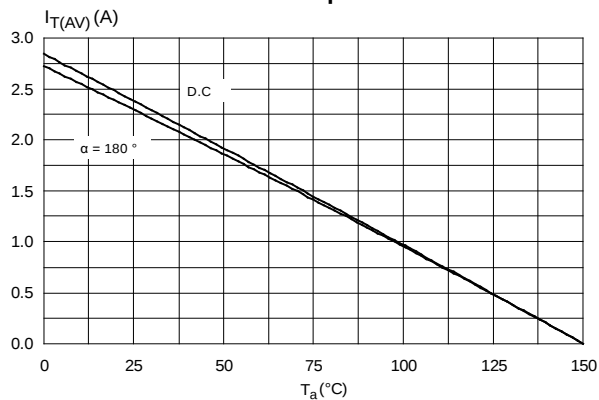
**Figure 1: Maximum average power dissipation versus average on-state current**



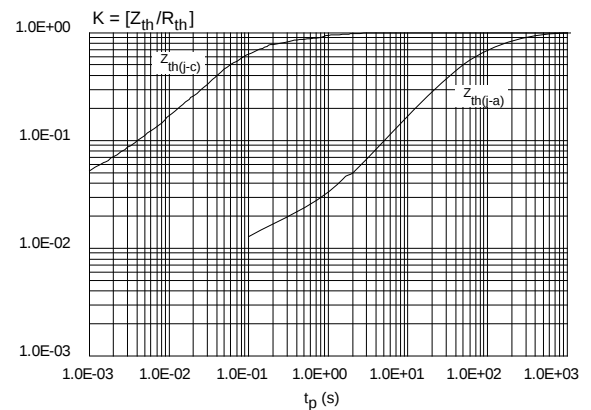
**Figure 2: Average and DC on-state current versus case temperature**



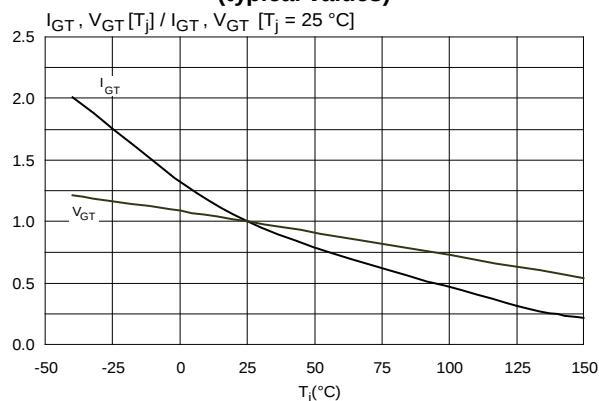
**Figure 3: Average and D.C. on state current versus ambient temperature**



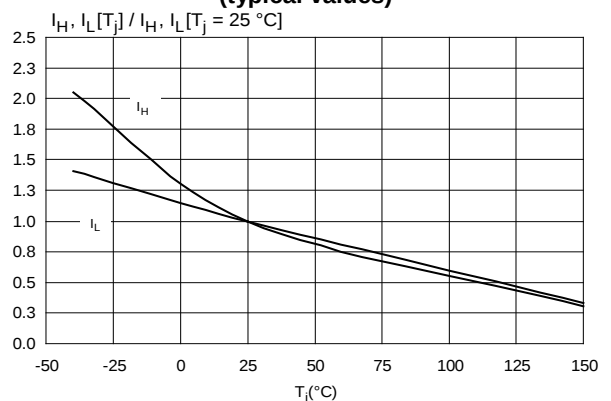
**Figure 4: Relative variation of thermal impedance versus pulse duration**



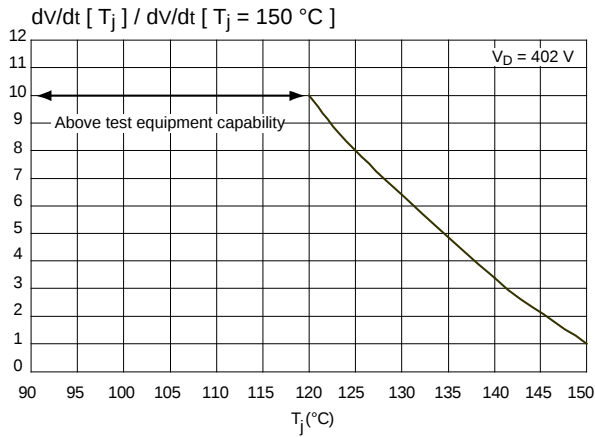
**Figure 5: Relative variation of gate trigger current and gate voltage versus junction temperature (typical values)**



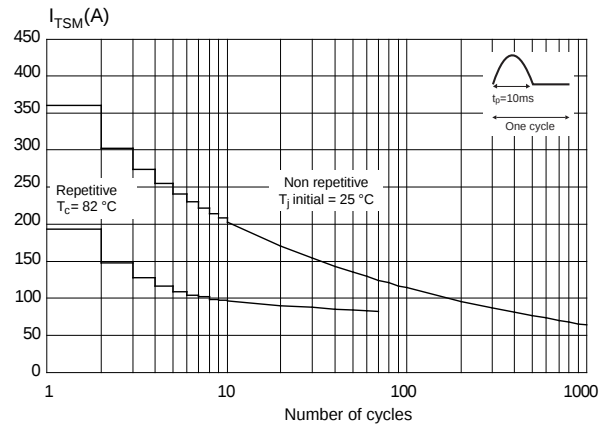
**Figure 6: Relative variation of holding and latching current versus junction temperature (typical values)**



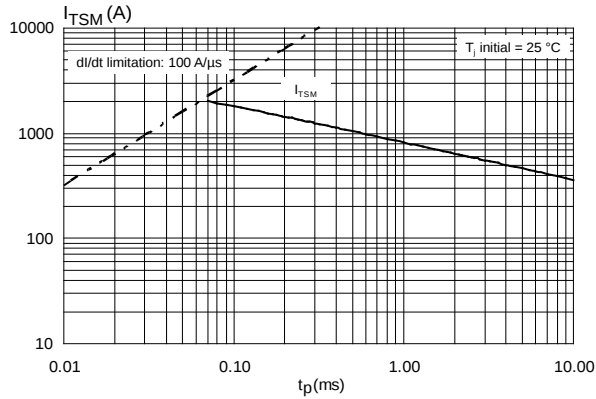
**Figure 7: Relative variation of static dV/dt immunity versus junction temperature (typical values)**



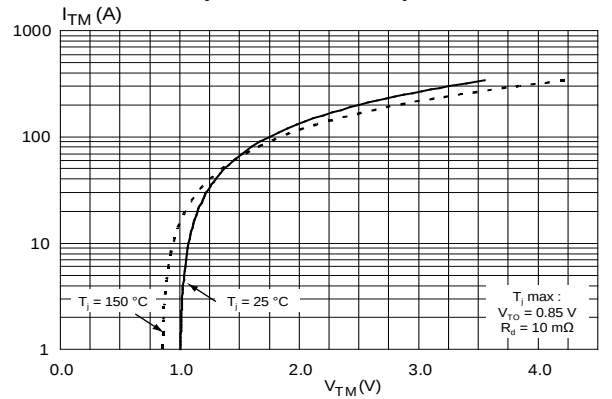
**Figure 8: Surge peak on-state current versus number of cycles**



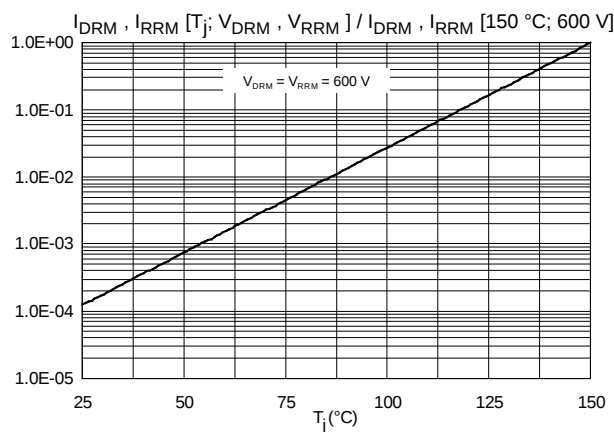
**Figure 9: Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10\text{ ms}$**



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



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



## 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.

- Epoxy meets UL94, V0
- Lead-free, halogen-free package

### 2.1 TO-220AB insulated package information

Figure 12: TO-220AB insulated package outline

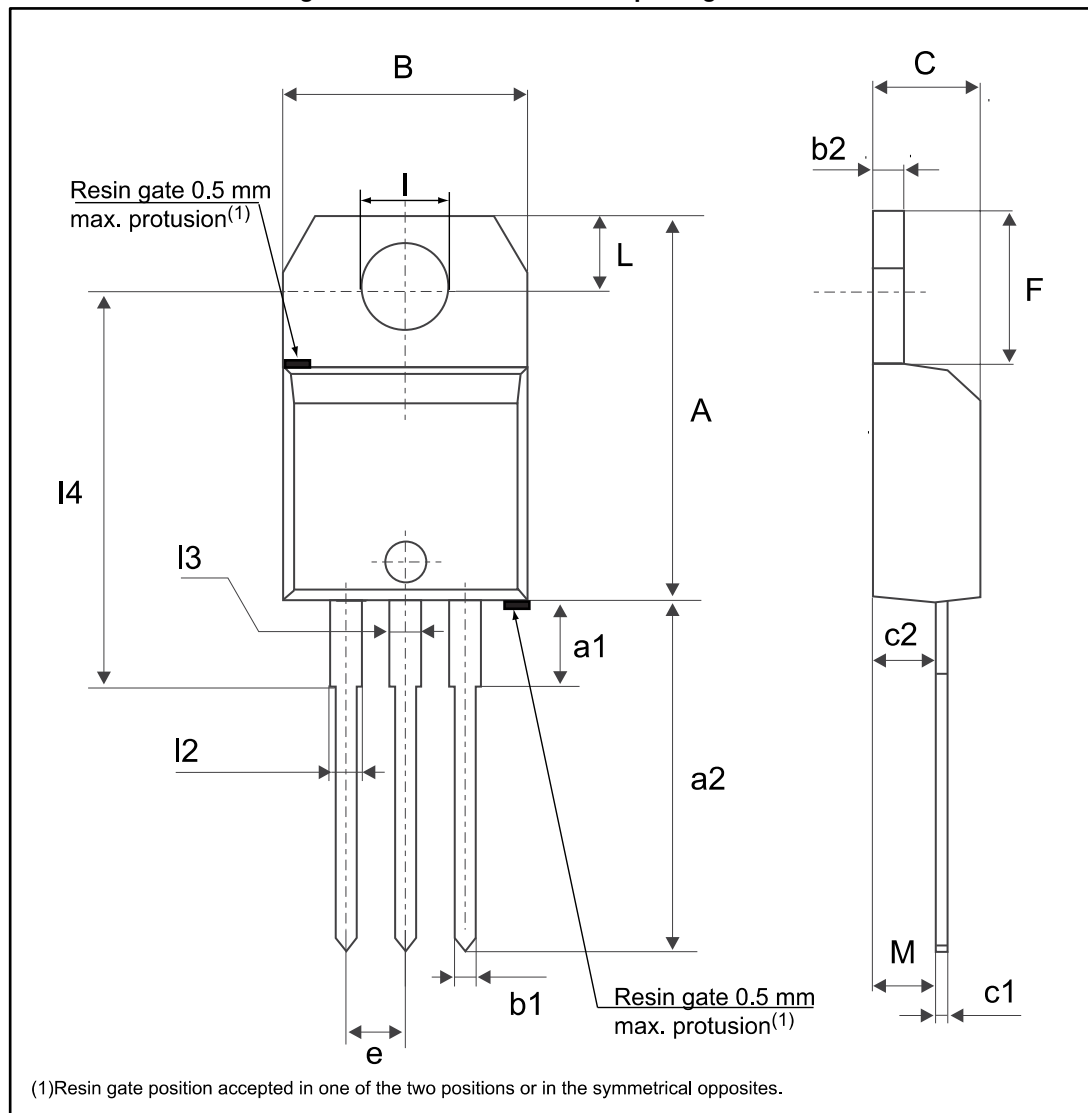


Table 6: TO-220AB insulated package mechanical data

| Ref. | Dimensions  |       |       |        |        |        |
|------|-------------|-------|-------|--------|--------|--------|
|      | Millimeters |       |       | Inches |        |        |
|      | 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       |       | 10.4  | 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 |
| ØI   | 3.73        |       | 3.88  | 0.1469 |        | 0.1528 |
| I4   | 15.80       | 16.40 | 16.8  | 0.6220 | 0.6457 | 0.6614 |
| L    | 2.65        |       | 2.95  | 0.1043 |        | 0.1161 |
| I2   | 1.14        |       | 1.70  | 0.0449 |        | 0.0669 |
| I3   | 1.14        |       | 1.70  | 0.0449 |        | 0.0669 |
| M    |             | 2.60  |       |        | 0.1024 |        |

### 3 Ordering information

Figure 13: Ordering information scheme

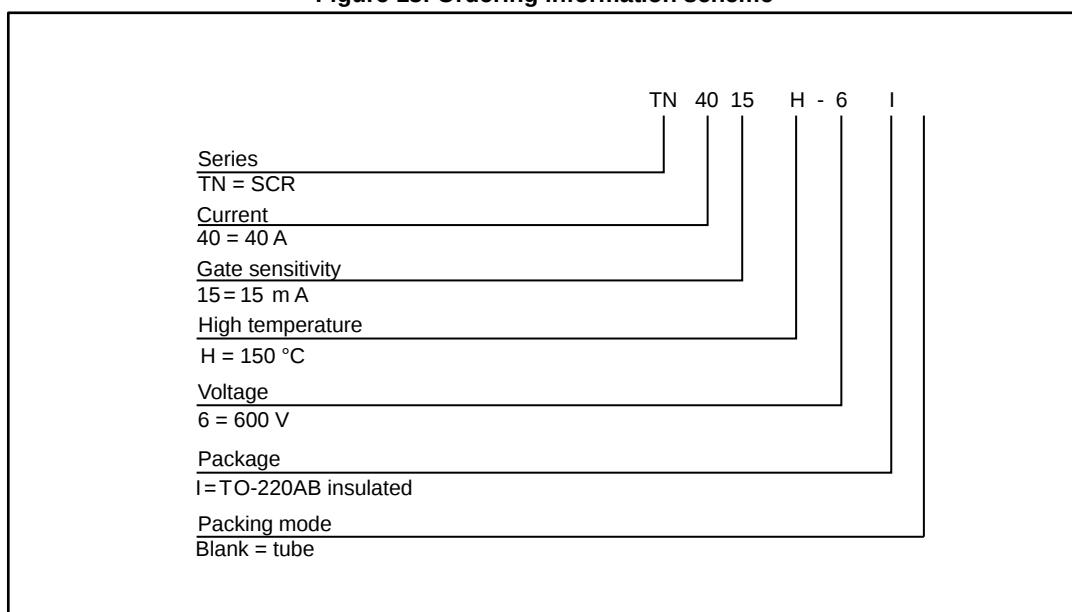


Table 7: Ordering information

| Order code | Marking   | Package       | Weight | Base qty. | Delivery mode |
|------------|-----------|---------------|--------|-----------|---------------|
| TN4015H-6I | TN4015H6I | TO-220AB Ins. | 2.3 g  | 50        | Tube          |

### 4 Revision history

Table 8: Document revision history

| Date        | Revision | Changes              |
|-------------|----------|----------------------|
| 05-Oct-2016 | 1        | Initial release.     |
| 25-Nov-2016 | 2        | Updated cover image. |

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