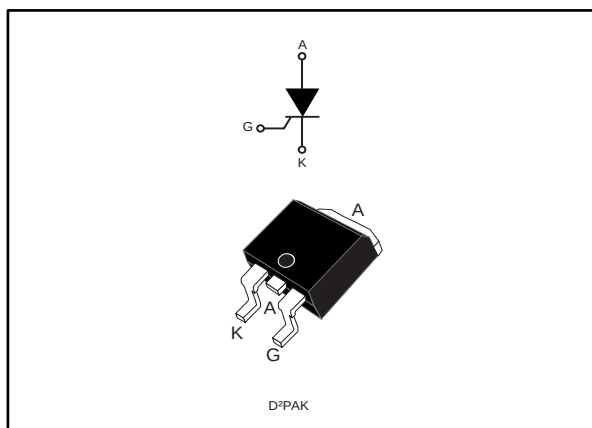


## High temperature 20 A SCRs

Datasheet - production data



### Features

- High junction temperature:  $T_j = 150\text{ }^{\circ}\text{C}$
- High noise immunity  $dV/dt = 400\text{ V}/\mu\text{s}$  up to  $150\text{ }^{\circ}\text{C}$
- Gate triggering current  $I_{GT} = 10\text{ mA}$
- Peak off-state voltage  $V_{DRM}/V_{RRM} = 600\text{ V}$
- High turn on current rise  $dI/dt = 100\text{ A}/\mu\text{s}$
- ECOPACK<sup>®</sup>2 compliant component

### Applications

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

### Description

This device offers high thermal performance during operation of up to  $20\text{ A}_{RMS}$ , thanks to a junction temperature of up to  $150\text{ }^{\circ}\text{C}$ .

Its D<sup>2</sup>PAK package allows modern SMD designs as well as compact back to back configuration.

The combination of noise immunity and low gate triggering current allows to design strong and compact control circuits.

Table 1: Device summary

| Order code | Package            | $V_{DRM}/V_{RRM}$ | $I_{GT}$ |
|------------|--------------------|-------------------|----------|
| TN2010H-6G | D <sup>2</sup> PAK | 600 V             | 10 mA    |

# 1 Characteristics

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

| Symbol            | Parameter                                                                                       |                         | Value                         | Unit      |
|-------------------|-------------------------------------------------------------------------------------------------|-------------------------|-------------------------------|-----------|
| $I_{T(RMS)}$      | RMS on-state current<br>(180 ° conduction angle)                                                |                         | $T_c = 132\text{ °C}$<br>20   | A         |
| $I_{T(AV)}$       | Average on-state current<br>(180 ° conduction angle)                                            |                         | $T_c = 132\text{ °C}$<br>12.7 | A         |
|                   |                                                                                                 |                         | $T_c = 137\text{ °C}$<br>10   |           |
|                   |                                                                                                 |                         | $T_c = 140\text{ °C}$<br>8    |           |
| $I_{TSM}$         | Non repetitive surge peak on-state current<br>( $T_j$ initial = 25 °C)                          |                         | $t_p = 8.3\text{ ms}$<br>197  | A         |
|                   |                                                                                                 |                         | $t_p = 10\text{ ms}$<br>180   |           |
| $I^2t$            | $I^2t$ value for fusing                                                                         |                         | $t_p = 10\text{ ms}$<br>162   | $A^2s$    |
| $di/dt$           | 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     | $A/\mu s$ |
| $V_{DSM}/V_{RSM}$ | Non repetitive surge peak off-state voltage                                                     |                         | $t_p = 10\text{ ms}$<br>700   | 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        |
| $T_j$             | Operating junction temperature range                                                            |                         | -40 to +150                   | °C        |

**Table 3: Electrical characteristics ( $T_j = 25\text{ °C}$  unless otherwise specified)**

| Symbol   | Test conditions                                                                                                                                  |                       | Value       | Unit      |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------|-----------|
| $I_{GT}$ | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                                                                                                   |                       | Typ.<br>5   | mA        |
|          |                                                                                                                                                  |                       | Max.<br>10  |           |
| $V_{GT}$ |                                                                                                                                                  |                       | Max.<br>1.3 | V         |
| $V_{GD}$ | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$                                                                                                     | $T_j = 150\text{ °C}$ | Min.<br>0.1 | V         |
| $I_H$    | $I_T = 500\text{ mA}$ , gate open                                                                                                                |                       | Max.<br>40  | mA        |
| $I_L$    | $I_G = 1.2 \times I_{GT}$                                                                                                                        |                       | Max.<br>60  | mA        |
| $dV/dt$  | $V_D = 402\text{ V}$ , gate open                                                                                                                 | $T_j = 150\text{ °C}$ | Min.<br>400 | $V/\mu s$ |
| $t_{gt}$ | $I_{TM} = 40\text{ A}$ , $V_D = 402\text{ V}$ , $I_G = 20\text{ mA}$ , $(di_G/dt)_{\max} = 0.2\text{ A}/\mu s$                                   |                       | Typ.<br>1.9 | $\mu s$   |
| $t_q$    | $I_{TM} = 40\text{ A}$ , $V_D = 402\text{ V}$ , $(di/dt)_{\text{off}} = 30\text{ A}/\mu s$ , $V_R = 25\text{ V}$ , $dV_D/dt = 40\text{ V}/\mu s$ | $T_j = 150\text{ °C}$ | Typ.<br>70  | $\mu s$   |

Table 4: Static characteristics

| Symbol                | Test conditions                                         |                                   |      | Value | Unit          |
|-----------------------|---------------------------------------------------------|-----------------------------------|------|-------|---------------|
| $V_{TM}$              | $I_{TM} = 40\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_j = 25\text{ }^\circ\text{C}$  | Max. | 1.6   | V             |
| $V_{TO}$              | Threshold voltage                                       | $T_j = 150\text{ }^\circ\text{C}$ | Max. | 0.82  |               |
| $R_D$                 | Dynamic resistance                                      | $T_j = 150\text{ }^\circ\text{C}$ | Max. | 17.5  | m $\Omega$    |
| $I_{DRM}$ , $I_{RRM}$ | $V_D = V_{DRM}$ , $V_R = V_{RRM}$                       | $T_j = 25\text{ }^\circ\text{C}$  | Max. | 5     | $\mu\text{A}$ |
|                       |                                                         | $T_j = 125\text{ }^\circ\text{C}$ |      | 2     | mA            |
|                       |                                                         | $T_j = 150\text{ }^\circ\text{C}$ |      | 3.9   |               |

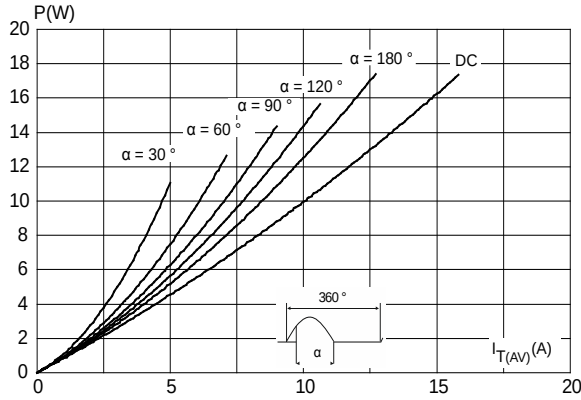
Table 5: Thermal parameters

| Symbol        | Parameter                |                             |      | Value | Unit               |
|---------------|--------------------------|-----------------------------|------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (DC)    |                             | Max. | 1.0   | $^\circ\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient (DC) | $S^{(1)} = 2.5\text{ cm}^2$ | Typ. | 45    |                    |

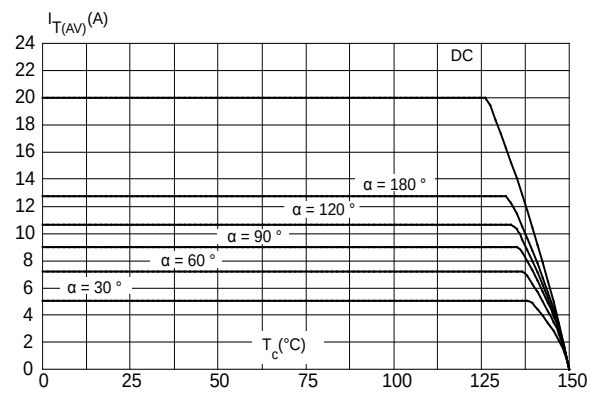
**Notes:**<sup>(1)</sup>S = Copper surface under tab

## 1.1 Characteristics (curves)

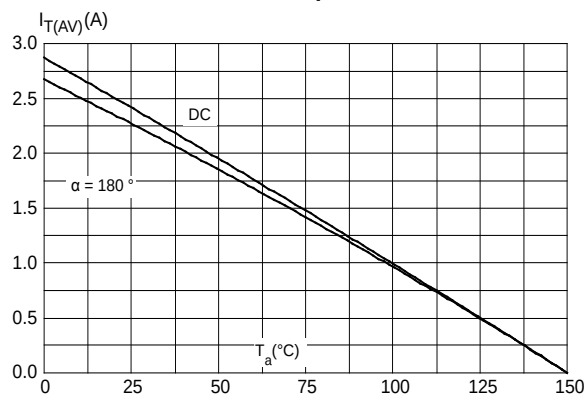
**Figure 1: Maximum power dissipation versus average on-state current**



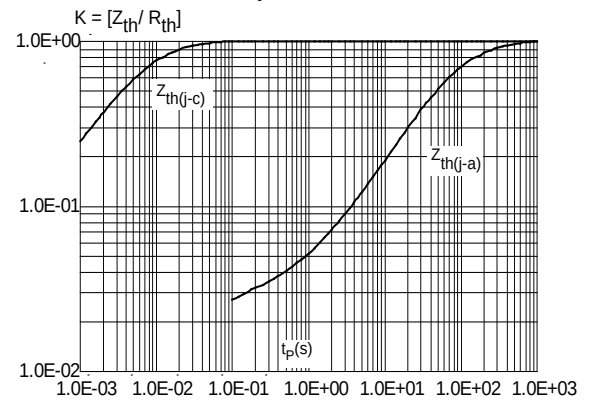
**Figure 2: Average and DC on-state current versus case temperature**



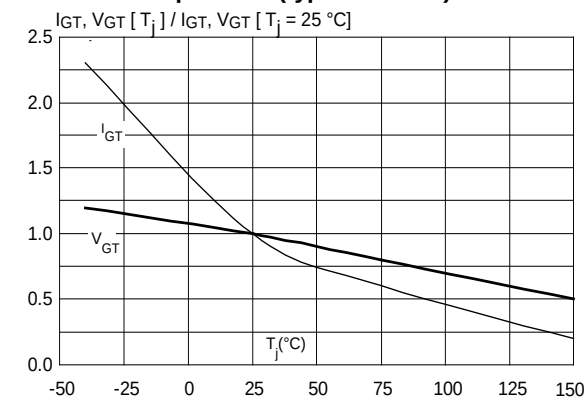
**Figure 3: Average and D.C. on state current versus ambient temperature**



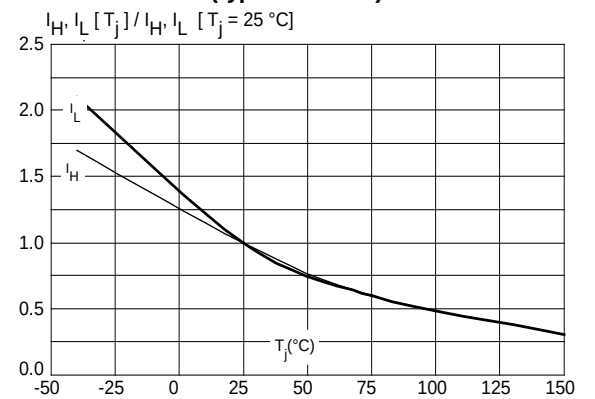
**Figure 4: Relative variation of thermal impedance versus pulse duration**



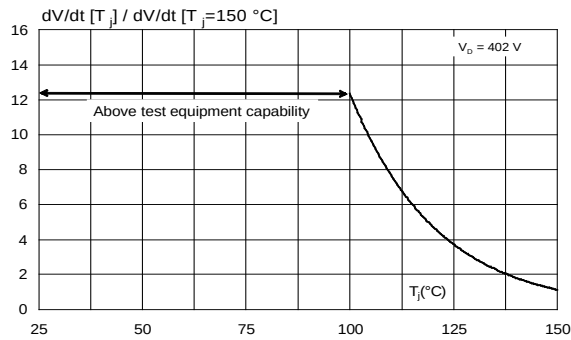
**Figure 5: Relative variation of gate triggering current and gate voltage versus junction temperature (typical values)**



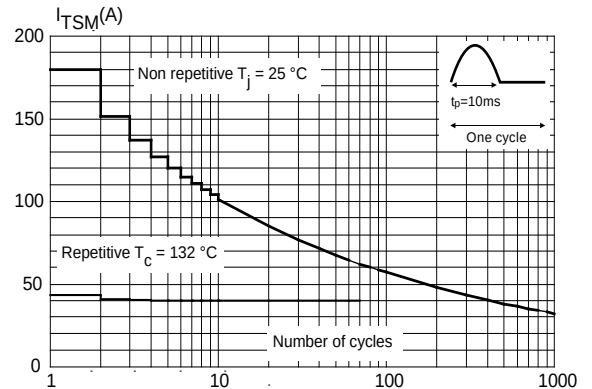
**Figure 6: Relative variation of holding and latching current versus junction temperature (typical values)**



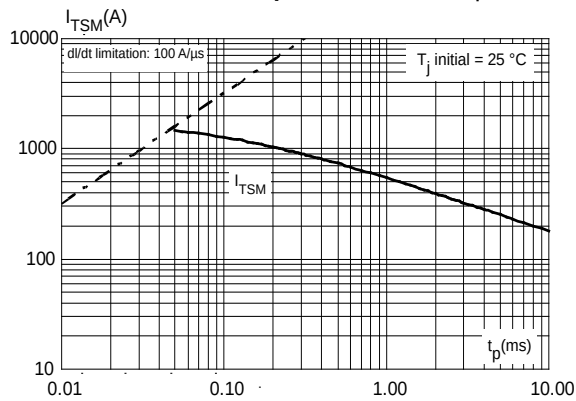
**Figure 7: Relative variation of static dV/dt immunity versus junction temperature (typical values)**



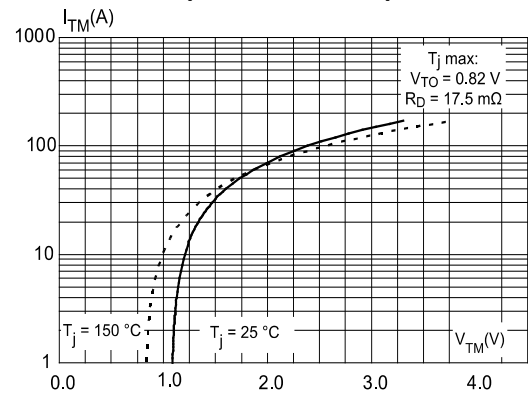
**Figure 8: Surge peak on-state current versus number of cycles**



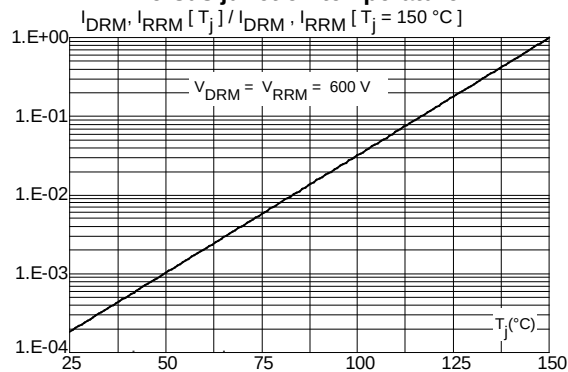
**Figure 9: Non repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10$  ms**



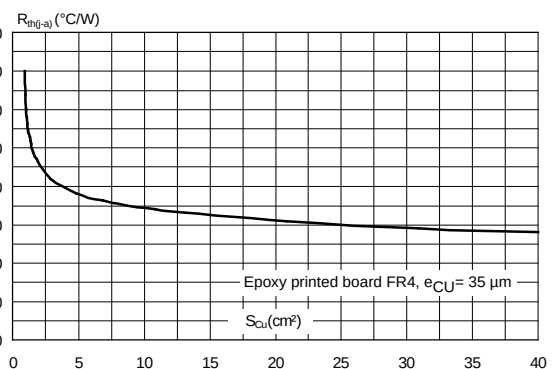
**Figure 10: On-state characteristics (maximum values)**



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



**Figure 12: Thermal resistance junction to ambient versus copper surface under tab (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.

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

### 2.1 D<sup>2</sup>PAK package information

Figure 13: D<sup>2</sup>PAK package outline

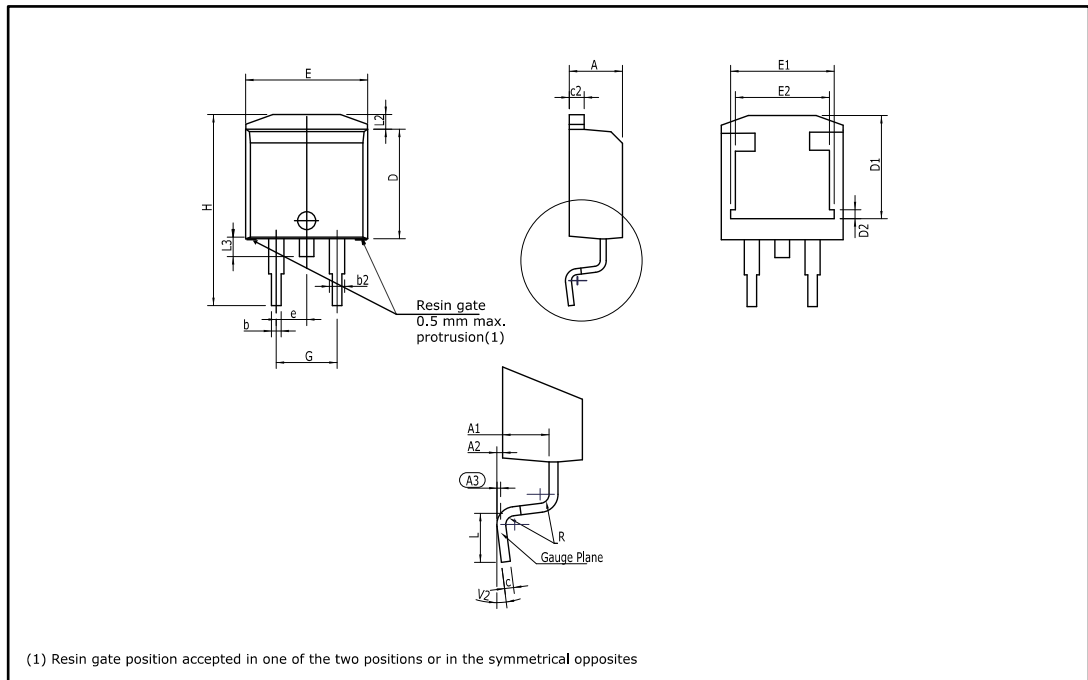
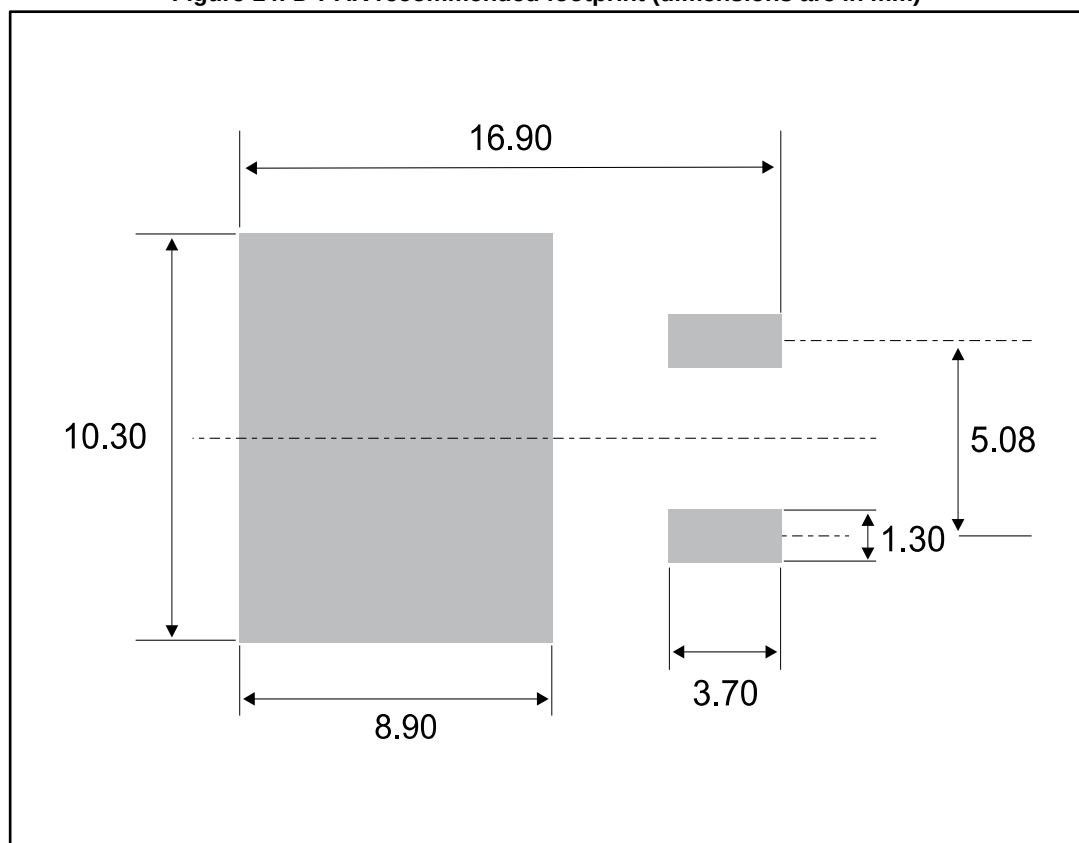


Table 6: D<sup>2</sup>PAK package mechanical data

| Ref. | Dimensions  |      |       |                       |        |        |
|------|-------------|------|-------|-----------------------|--------|--------|
|      | Millimeters |      |       | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ. | Max.  | Min.                  | Typ.   | Max.   |
| A    | 4.30        |      | 4.60  | 0.1693                |        | 0.1811 |
| A1   | 2.49        |      | 2.69  | 0.0980                |        | 0.1059 |
| A2   | 0.03        |      | 0.23  | 0.0012                |        | 0.0091 |
| A3   |             | 0.25 |       |                       | 0.0098 |        |
| b    | 0.70        |      | 0.93  | 0.0276                |        | 0.0366 |
| b2   | 1.25        |      | 1.7   | 0.0492                |        | 0.0669 |
| c    | 0.45        |      | 0.60  | 0.0177                |        | 0.0236 |
| c2   | 1.21        |      | 1.36  | 0.0476                |        | 0.0535 |
| D    | 8.95        |      | 9.35  | 0.3524                |        | 0.3681 |
| D1   | 7.50        |      | 8.00  | 0.2953                |        | 0.3150 |
| D2   | 1.30        |      | 1.70  | 0.0512                |        | 0.0669 |
| e    | 2.54        |      |       | 0.1                   |        |        |
| E    | 10.00       |      | 10.28 | 0.3937                |        | 0.4047 |
| E1   | 8.30        |      | 8.70  | 0.3268                |        | 0.3425 |
| E2   | 6.85        |      | 7.25  | 0.2697                |        | 0.2854 |
| G    | 4.88        |      | 5.28  | 0.1921                |        | 0.2079 |
| H    | 15          |      | 15.85 | 0.5906                |        | 0.6240 |
| L    | 1.78        |      | 2.28  | 0.0701                |        | 0.0898 |
| L2   | 1.27        |      | 1.40  | 0.0500                |        | 0.0551 |
| L3   | 1.40        |      | 1.75  | 0.0551                |        | 0.0689 |
| R    |             | 0.40 |       |                       | 0.0157 |        |
| V2   | 0°          |      | 8°    | 0°                    |        | 8°     |

**Notes:**<sup>(1)</sup>Dimensions in inches are given for reference only

Figure 14: D<sup>2</sup>PAK recommended footprint (dimensions are in mm)



### 3 Ordering information

Figure 15: Ordering information scheme

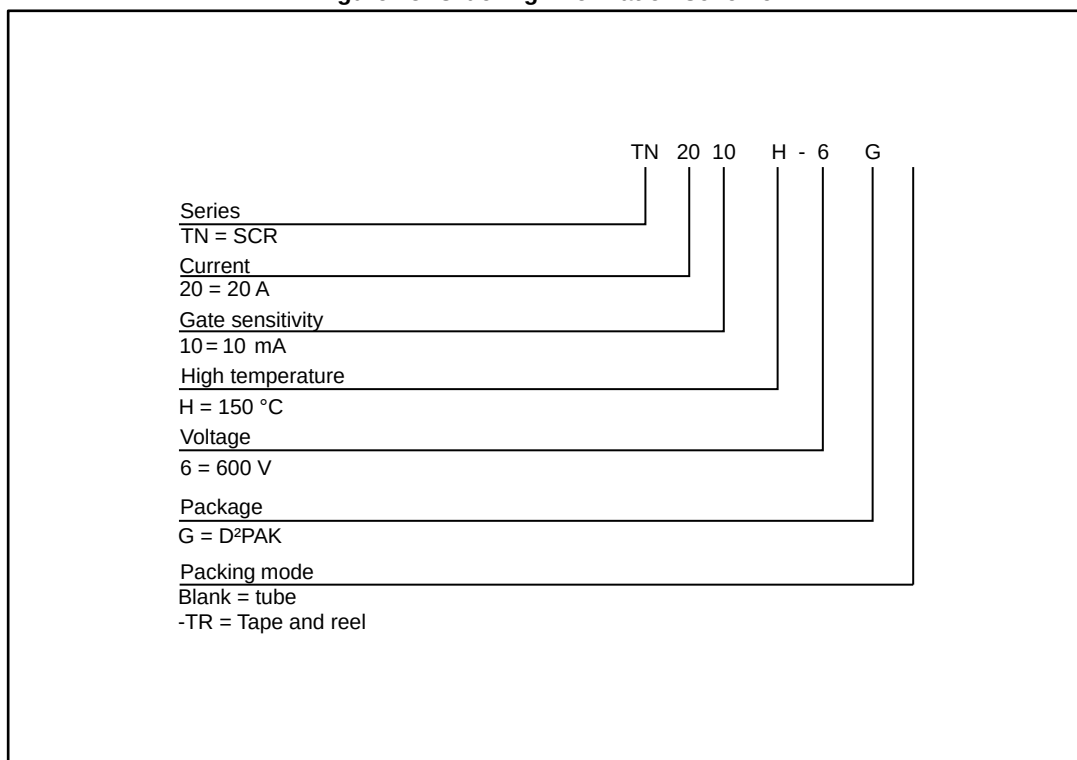


Table 7: Ordering information

| Order code    | Marking  | Package            | Weight | Base qty. | Delivery mode |
|---------------|----------|--------------------|--------|-----------|---------------|
| TN2010H-6G    | TN2010H6 | D <sup>2</sup> PAK | 2.3 g  | 50        | Tube          |
| TN2010H-6G-TR |          |                    |        | 1000      | Tape and reel |

### 4 Revision history

Table 8: Document revision history

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 24-Aug-2017 | 1        | Initial release. |

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