

## 1. General description

Planar passivated very sensitive gate four quadrant triac in a TO252 (DPAK) surface-mountable plastic package intended for use in general purpose bidirectional switching and phase control applications, where high sensitivity is required in all four quadrants. This very sensitive gate "series D" triac is intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

## 2. Features and benefits

- Direct triggering from low power drivers and logic ICs
- High blocking voltage capability
- Low holding current for low current loads and lowest EMI at commutation
- Planar passivated for voltage ruggedness and reliability
- Surface-mountable package
- Triggering in all four quadrants
- Very sensitive gate

## 3. Applications

- General purpose motor control
- General purpose switching

## 4. Quick reference data

Table 1. Quick reference data

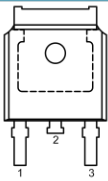
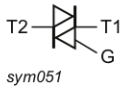
| Table 1. Quick reference data |                                      |                                                                                                                          |        |     |     |      |      |
|-------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------|-----|-----|------|------|
| Symbol                        | Parameter                            | Conditions                                                                                                               | Values |     |     | Unit |      |
| Absolute maximum rating       |                                      |                                                                                                                          |        |     |     |      |      |
| V <sub>DRM</sub>              | repetitive peak off-state voltage    |                                                                                                                          | 800    |     |     | V    |      |
| I <sub>T(RMS)</sub>           | RMS on-state current                 | full sine wave; T <sub>mb</sub> ≤ 107 °C;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>    | 4      |     |     | A    |      |
| I <sub>TSM</sub>              | non-repetitive peak on-state current | full sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 20 ms;<br><a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | 25     |     |     | A    |      |
|                               |                                      | full sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 16.7 ms                                                   | 27     |     |     | A    |      |
| T <sub>j</sub>                | junction temperature                 |                                                                                                                          | 125    |     |     | °C   |      |
| Symbol                        | Parameter                            | Conditions                                                                                                               |        | Min | Typ | Max  | Unit |
| Static characteristics        |                                      |                                                                                                                          |        |     |     |      |      |
| I <sub>GT</sub>               | gate trigger current                 | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>                 |        | -   | 2   | 5    | mA   |
|                               |                                      | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>                 |        | -   | 2.5 | 5    | mA   |

| Symbol                         | Parameter                         | Conditions                                                                                                                              |  | Min | Typ | Max | Unit             |
|--------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--|-----|-----|-----|------------------|
| <b>Static characteristics</b>  |                                   |                                                                                                                                         |  |     |     |     |                  |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -   | 2.5 | 5   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -   | 5   | 10  | mA               |
| $I_H$                          | holding current                   | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                                         |  | -   | 1.2 | 10  | mA               |
| $V_T$                          | on-state voltage                  | $I_T = 5\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>                                                         |  | -   | 1.4 | 1.7 | V                |
| <b>Dynamic characteristics</b> |                                   |                                                                                                                                         |  |     |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage | $V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit |  | -   | 5   | -   | V/ $\mu\text{s}$ |

Note: Although not recommended, off-state voltages up to 900V may be applied without damage, but the triac may switch to the on-state.

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                                 | Simplified outline                                                                 | Graphic symbol                                                                        |
|-----|--------|---------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1   | T1     | main terminal 1                             |  |  |
| 2   | T2     | main terminal 2                             |                                                                                    |                                                                                       |
| 3   | G      | gate                                        |                                                                                    |                                                                                       |
| mb  | T2     | mounting base; connected to main terminal 2 |                                                                                    |                                                                                       |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package Name | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|-------------|--------------|-----------------------|----------------|------------------------|-----------------|--------------------|
| BT136S-800D | TO252        | BT136S-800DJ          | Reel           | 2500                   | TO252N          | 14-Nov-2016        |

## 7. Marking

Table 4. Marking codes

| Type number | Marking codes |
|-------------|---------------|
| BT136S-800D | 136S8D        |

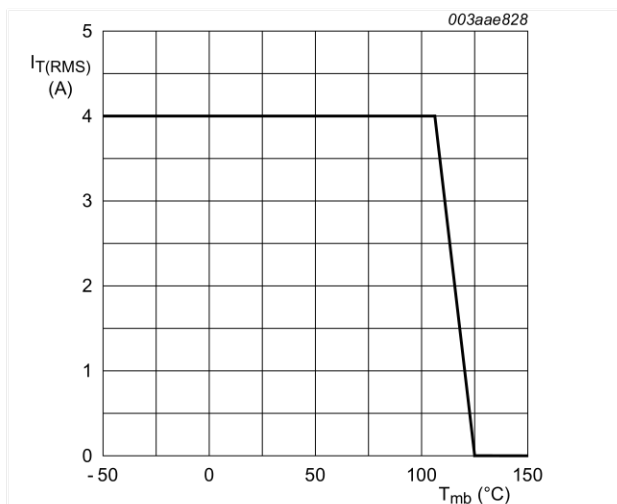
## 8. Limiting values

**Table 5. Limiting values**

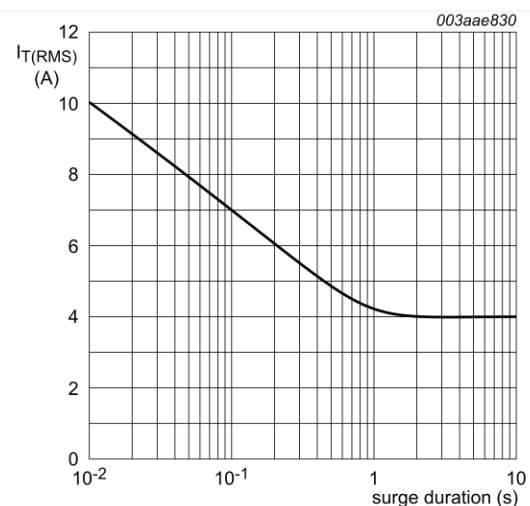
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol              | Parameter                            | Conditions                                                                                                                                           | Values     | Unit                   |
|---------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                                      | 800        | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 107\text{ }^{\circ}\text{C}$ ;<br><a href="#">Fig 1</a> ; <a href="#">Fig 2</a> ; <a href="#">Fig 3</a>          | 4          | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ;<br><a href="#">Fig 4</a> ; <a href="#">Fig 5</a> | 25         | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$                                                  | 27         | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; SIN                                                                                                                  | 3.1        | $\text{A}^2\text{s}$   |
| $dI_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{G}} = 20\text{ mA}$                                                                                                                        | 50         | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | peak gate current                    |                                                                                                                                                      | 2          | A                      |
| $P_{\text{GM}}$     | peak gate power                      |                                                                                                                                                      | 5          | W                      |
| $P_{\text{G(AV)}}$  | average gate power                   | over any 20 ms period                                                                                                                                | 0.5        | W                      |
| $T_{\text{stg}}$    | storage temperature                  |                                                                                                                                                      | -40 to 150 | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                                      | 125        | $^{\circ}\text{C}$     |

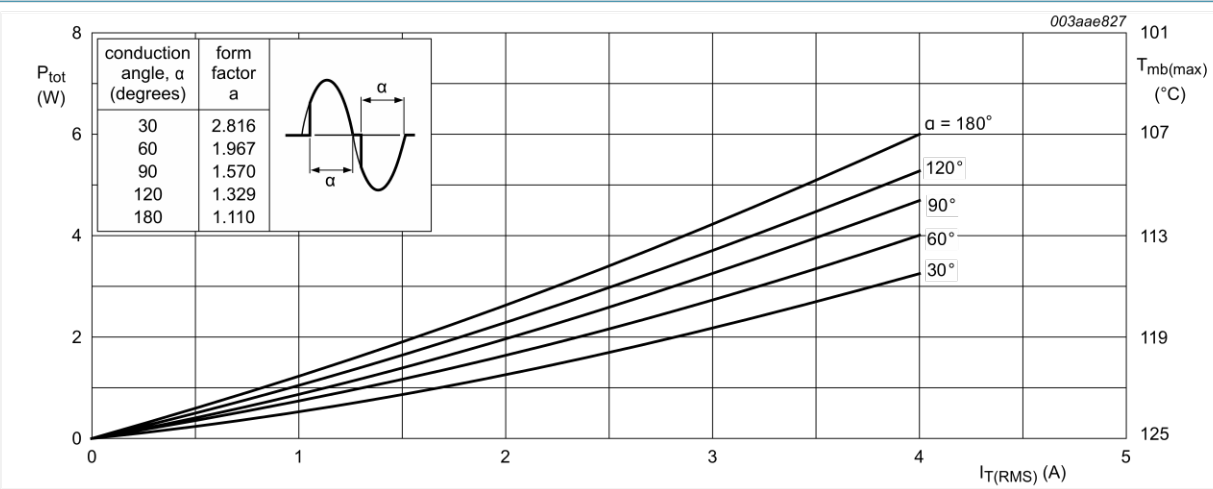
Note: Although not recommended, off-state voltages up to 900V may be applied without damage, but the triac may switch to the on-state.



**Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values**

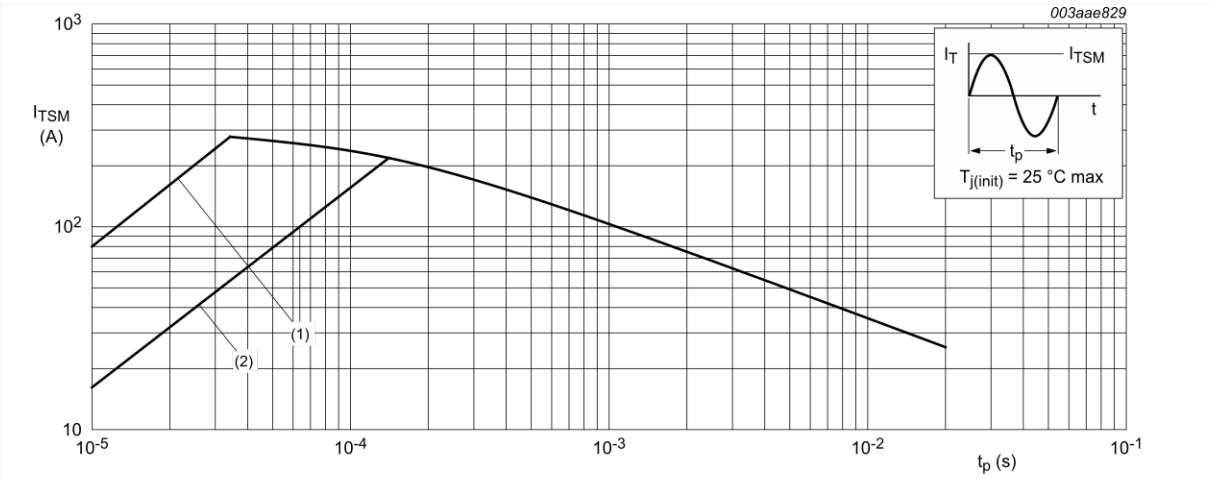


$f = 50\text{ Hz}$ ;  $T_{\text{mb}} = 107\text{ }^{\circ}\text{C}$   
**Fig. 2. RMS on-state current as a function of surge duration; maximum values**



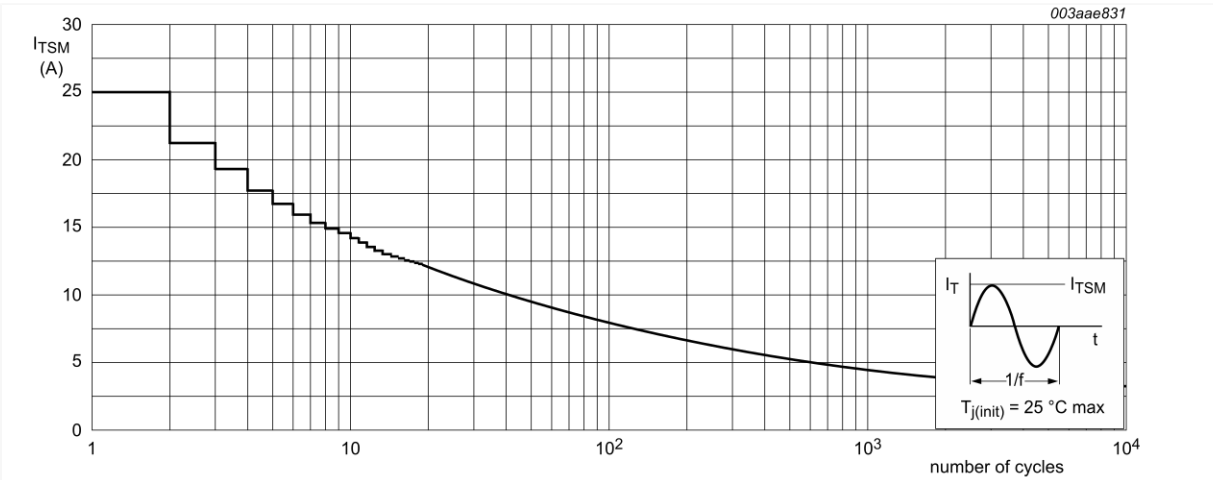
$\alpha$  = conduction angle  
 $a$  = form factor =  $I_{T(RMS)} / I_{T(AV)}$

Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values



$t_p \leq 20$  ms  
(1)  $dI_T/dt$  limit  
(2) T2- G+ quadrant limit

Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



$f = 50$  Hz

Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter                                         | Conditions        | Min | Typ | Max | Unit |
|----------------|---------------------------------------------------|-------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | full; Fig 6       | -   | -   | 3   | K/W  |
|                |                                                   | half cycle; Fig 6 | -   | -   | 3.7 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air       | -   | 75  | -   | K/W  |

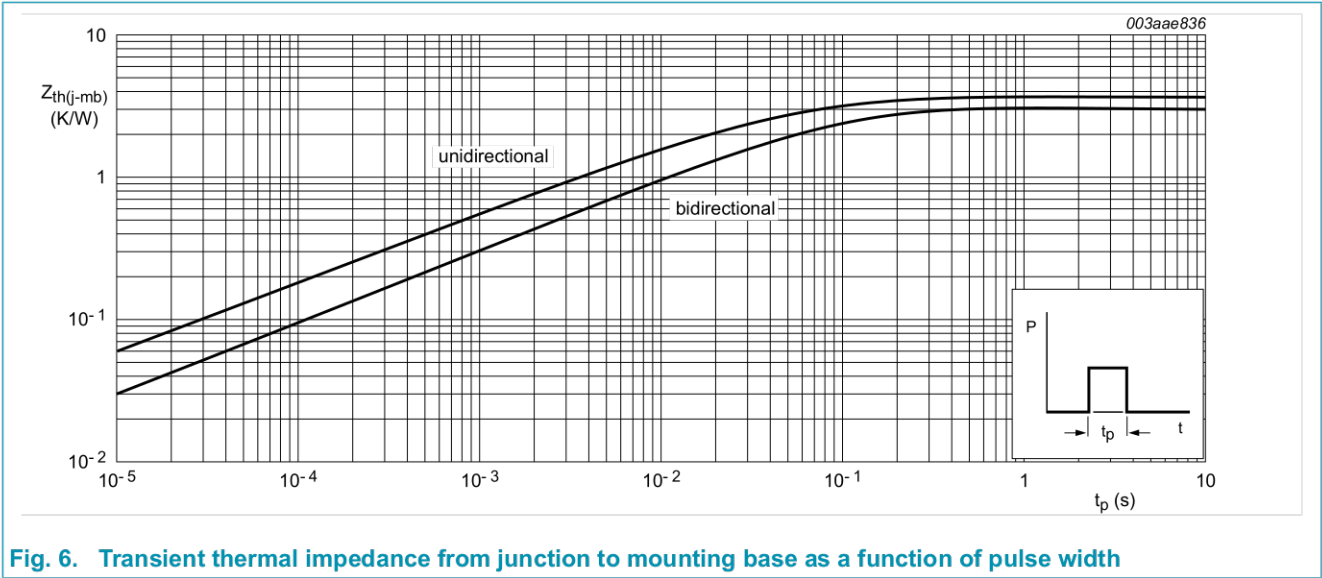
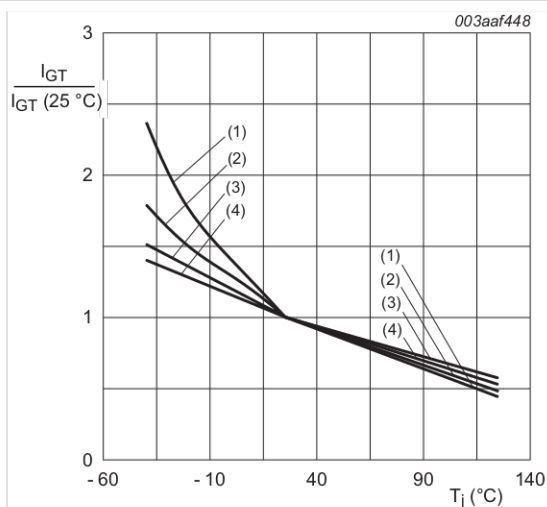


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

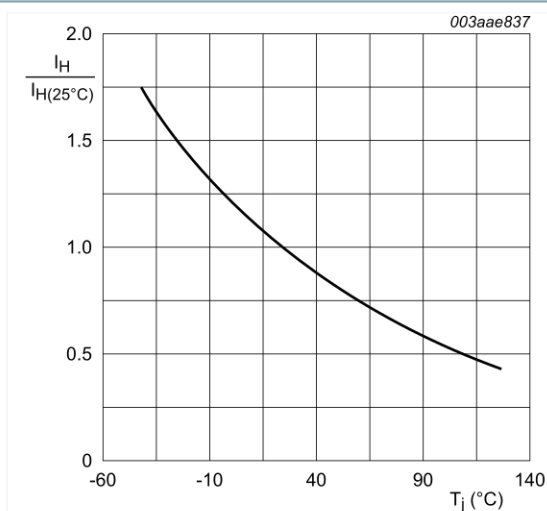
## 10. Characteristics

Table 7. Characteristics

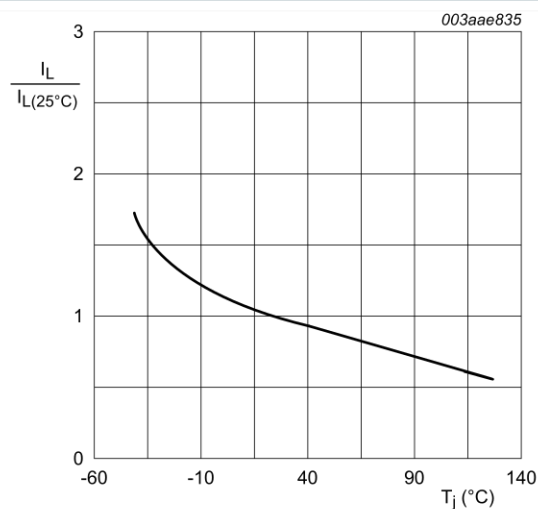
| Symbol                         | Parameter                         | Conditions                                                                                                                              |  | Min  | Typ | Max | Unit             |
|--------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--|------|-----|-----|------------------|
| <b>Static characteristics</b>  |                                   |                                                                                                                                         |  |      |     |     |                  |
| $I_{GT}$                       | gate trigger current              | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 2   | 5   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 2.5 | 5   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 2.5 | 5   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 5   | 10  | mA               |
| $I_L$                          | latching current                  | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 1.6 | 10  | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 4.5 | 15  | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 1.2 | 10  | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 2.2 | 15  | mA               |
| $I_H$                          | holding current                   | $V_D = 12\text{ V}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                                         |  | -    | 1.2 | 10  | mA               |
| $V_T$                          | on-state voltage                  | $I_T = 5\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>                                                         |  | -    | 1.4 | 1.7 | V                |
| $V_{GT}$                       | gate trigger voltage              | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 11</a>                              |  | -    | 0.7 | 1   | V                |
|                                |                                   | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 125\text{ }^\circ\text{C}$                                                         |  | 0.25 | 0.4 | -   | V                |
| $I_D$                          | off-state current                 | $V_D = 800\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$                                                                                |  | -    | 0.1 | 0.5 | mA               |
| <b>Dynamic characteristics</b> |                                   |                                                                                                                                         |  |      |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage | $V_{DM} = 536\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit |  | -    | 5   | -   | V/ $\mu\text{s}$ |



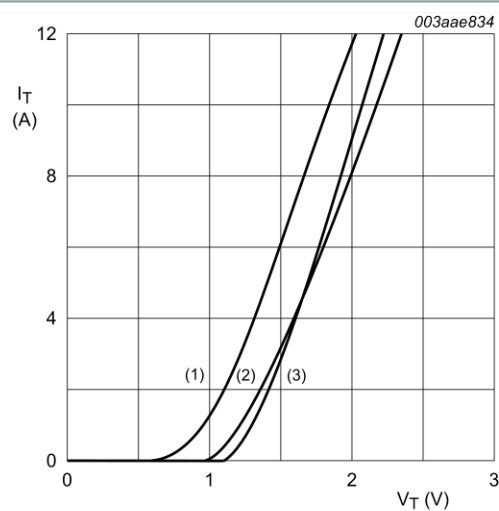
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



**Fig. 9. Normalized holding current as a function of junction temperature**



**Fig. 8. Normalized latching current as a function of junction temperature**



**Fig. 10. On-state current as a function of on-state voltage**

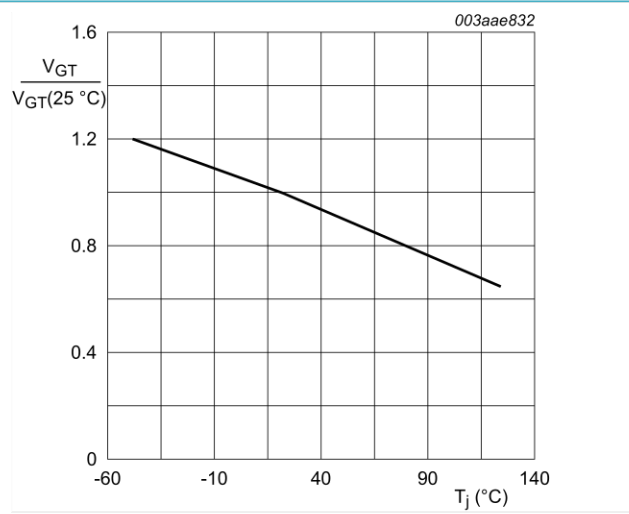
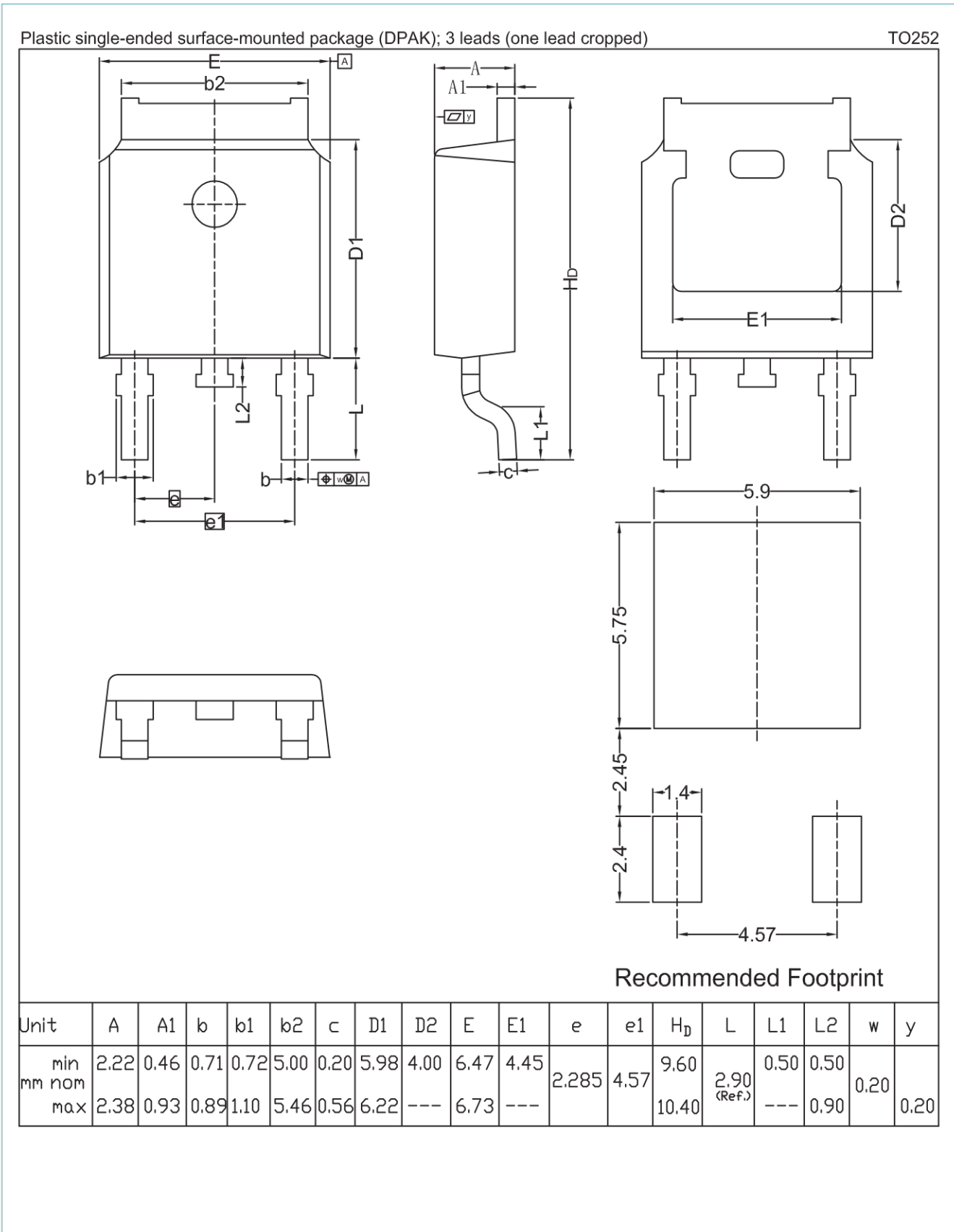


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline



## 12. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
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