



# BT137S-600E

4Q Triac

Rev. 3 — 30 March 2011

Product data sheet

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## 1. Product profile

### 1.1 General description

Planar passivated sensitive gate four quadrant triac in a SOT428 (DPAK) surface-mountable plastic package intended for use in general purpose bidirectional switching and phase control applications. This sensitive gate "series E" triac is intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

### 1.2 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
- Sensitive gate
- Surface-mountable package
- Triggering in all four quadrants

### 1.3 Applications

- General purpose motor control
- General purpose switching

### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol       | Parameter                            | Conditions                                                                                                                                             | Min | Typ | Max | Unit |
|--------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{DRM}$    | repetitive peak off-state voltage    |                                                                                                                                                        | -   | -   | 600 | V    |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>        | -   | -   | 65  | A    |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_{mb} \leq 102\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 3</a> | -   | -   | 8   | A    |

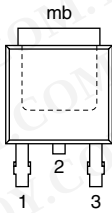
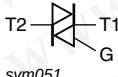


Table 1. Quick reference data ...continued

| 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+; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -   | 2.5 | 10  | mA   |
|                               |                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -   | 4   | 10  | mA   |
|                               |                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -   | 5   | 10  | mA   |
|                               |                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -   | 11  | 25  | mA   |
| $I_H$                         | holding current      | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a>                                | -   | 2.5 | 20  | mA   |

## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline                                                                  | Graphic symbol                                                                                  |
|-----|--------|-----------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1   | T1     | main terminal 1                   |  | <br>sym051 |
| 2   | T2     | main terminal 2                   |                                                                                     |                                                                                                 |
| 3   | G      | gate                              |                                                                                     |                                                                                                 |
| mb  | T2     | mounting base;<br>main terminal 2 |                                                                                     |                                                                                                 |

SOT428 (DPAK)

## 3. Ordering information

Table 3. Ordering information

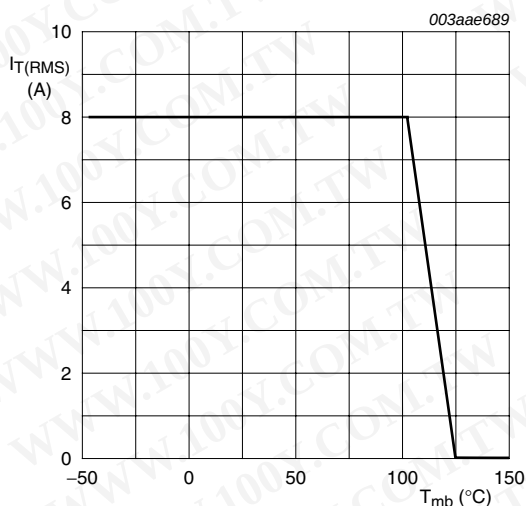
| Type number | Package |                                                                                 |         |
|-------------|---------|---------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                     | Version |
| BT137S-600E | DPAK    | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428  |

## 4. Limiting values

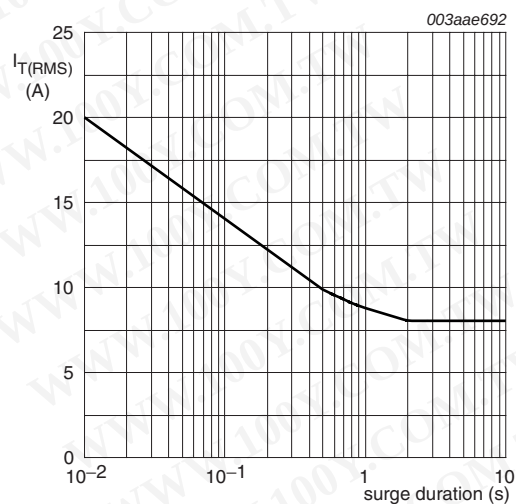
**Table 4. Limiting values**

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

| Symbol              | Parameter                            | Conditions                                                                                                                                                         | Min | Max | Unit                   |
|---------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                                                    | -   | 600 | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 102\text{ }^{\circ}\text{C}$ ;<br>see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 3</a>   | -   | 8   | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{J(init)}} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_{\text{p}} = 20\text{ ms}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a> | -   | 65  | A                      |
| $I^2t$              | $I^2t$ for fusing                    | full sine wave; $T_{\text{J(init)}} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_{\text{p}} = 16.7\text{ ms}$                                                             | -   | 71  | A                      |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ;<br>T2+ G+                                           | -   | 21  | $\text{A}^2\text{s}$   |
|                     |                                      | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ;<br>T2+ G-                                           | -   | 50  | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ;<br>T2- G-                                           | -   | 50  | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ;<br>T2- G+                                           | -   | 10  | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | peak gate current                    |                                                                                                                                                                    | -   | 2   | A                      |
| $V_{\text{GM}}$     | peak gate voltage                    |                                                                                                                                                                    | -   | 5   | V                      |
| $P_{\text{GM}}$     | 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 | 150 | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                                                    | -   | 125 | $^{\circ}\text{C}$     |



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



**Fig 2. RMS on-state current as a function of surge duration; maximum values**

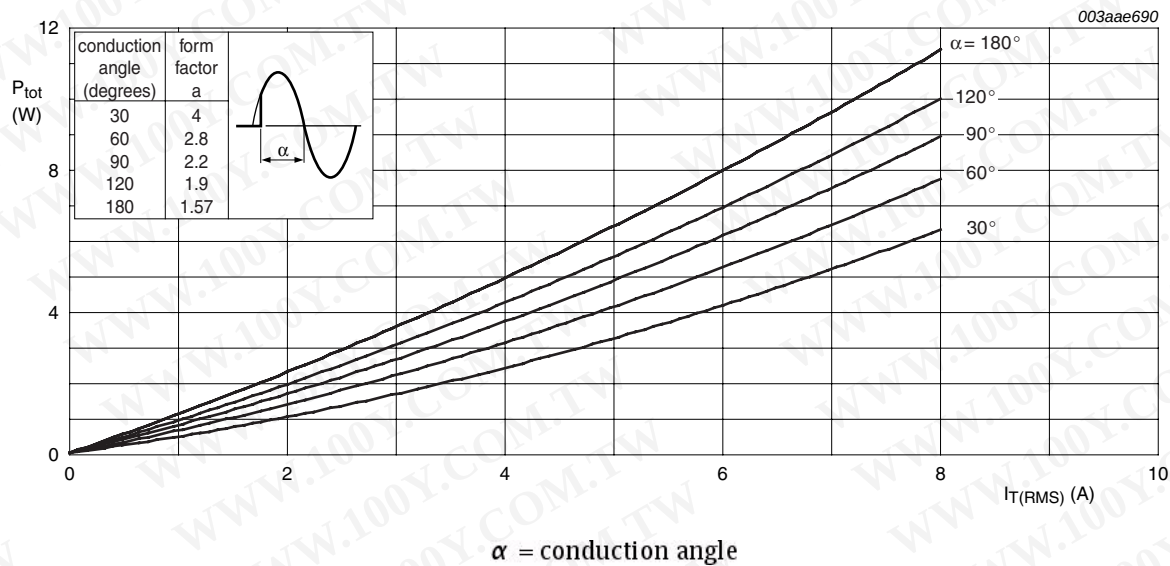


Fig 3. Total power dissipation as a function of RMS on-state current; maximum values

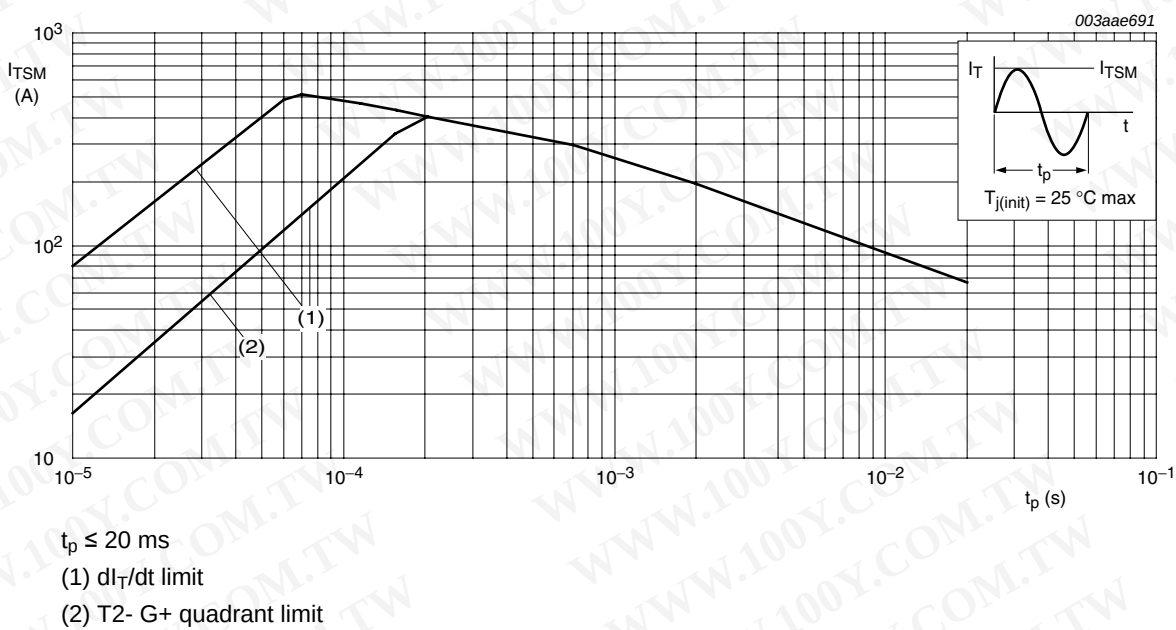
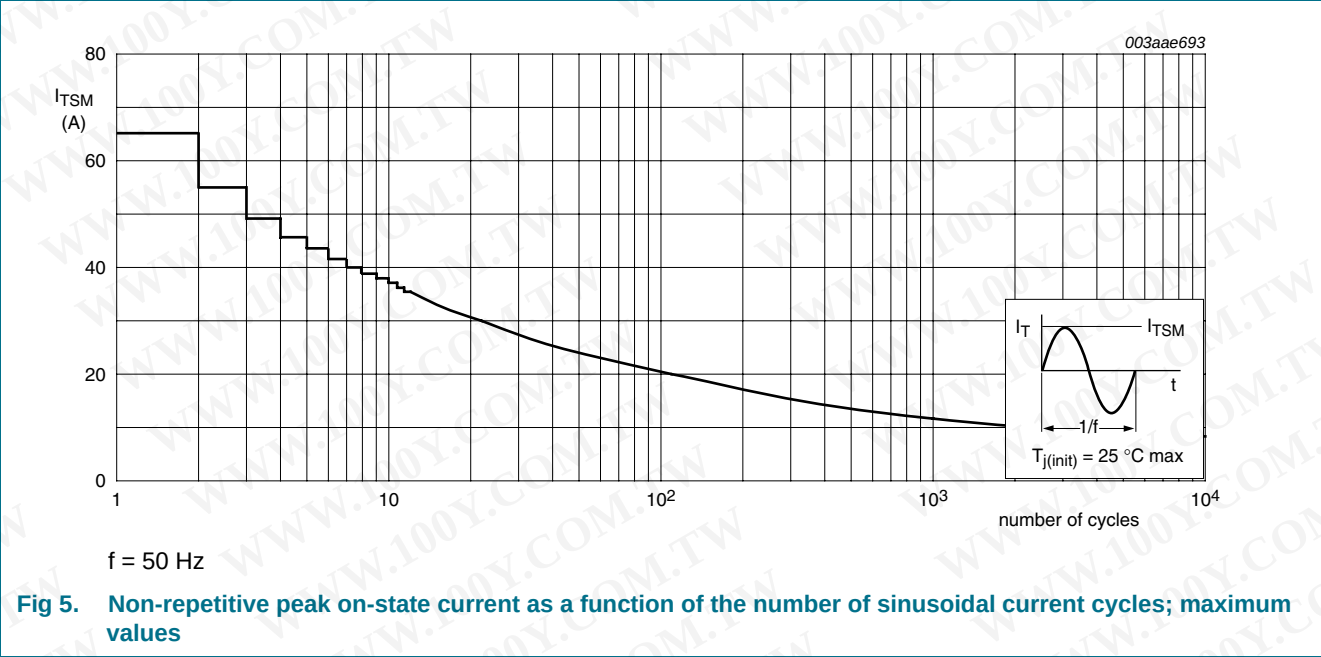


Fig 4. Non-repetitive peak on-state current as a function of pulse width; maximum values

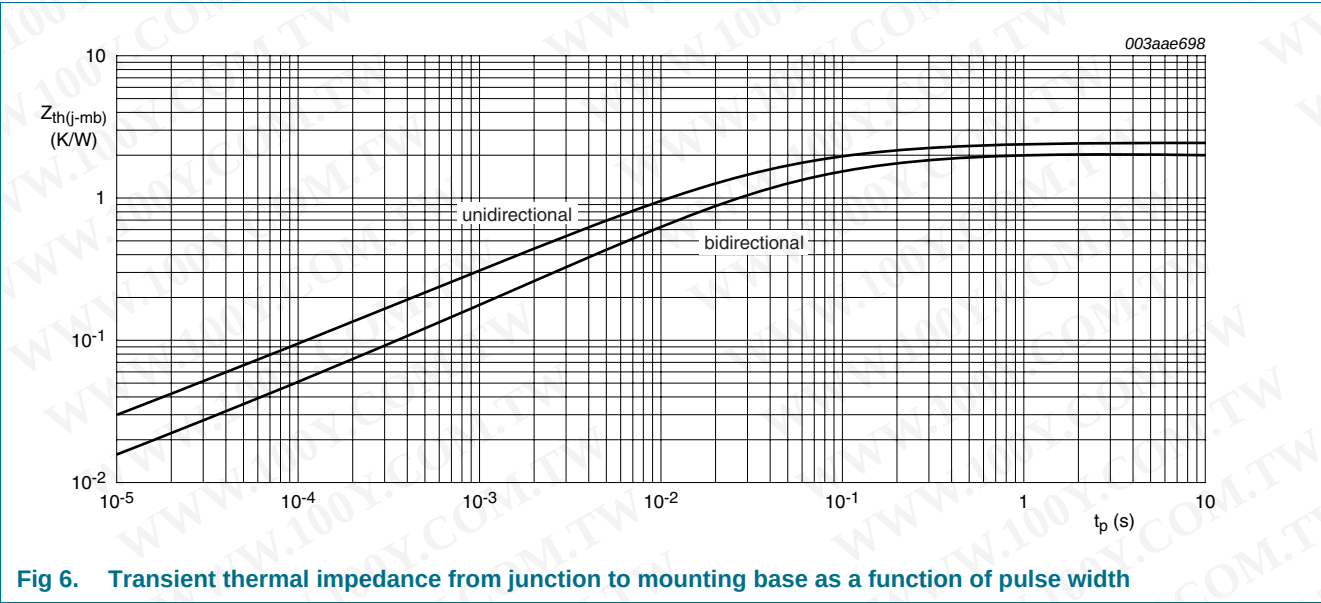




5. Thermal characteristics

Table 5. Thermal characteristics

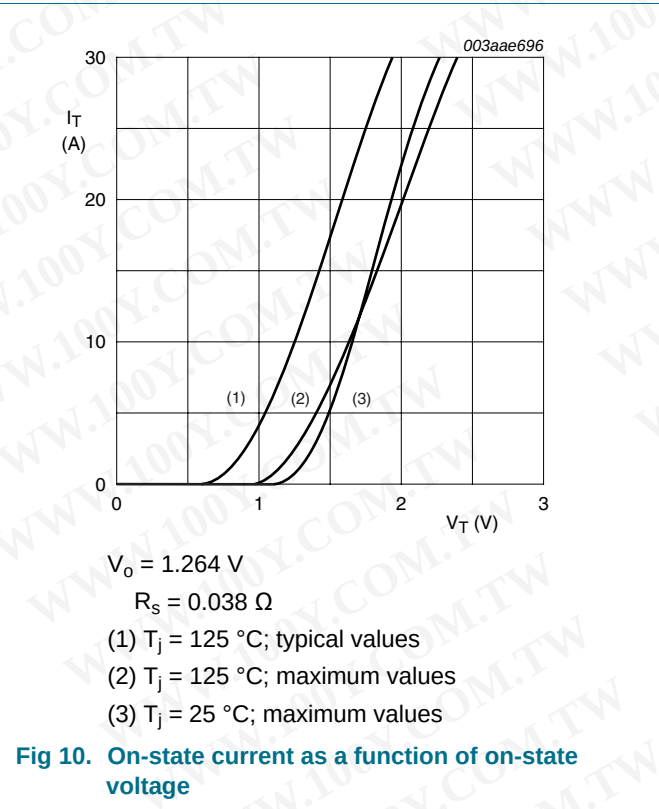
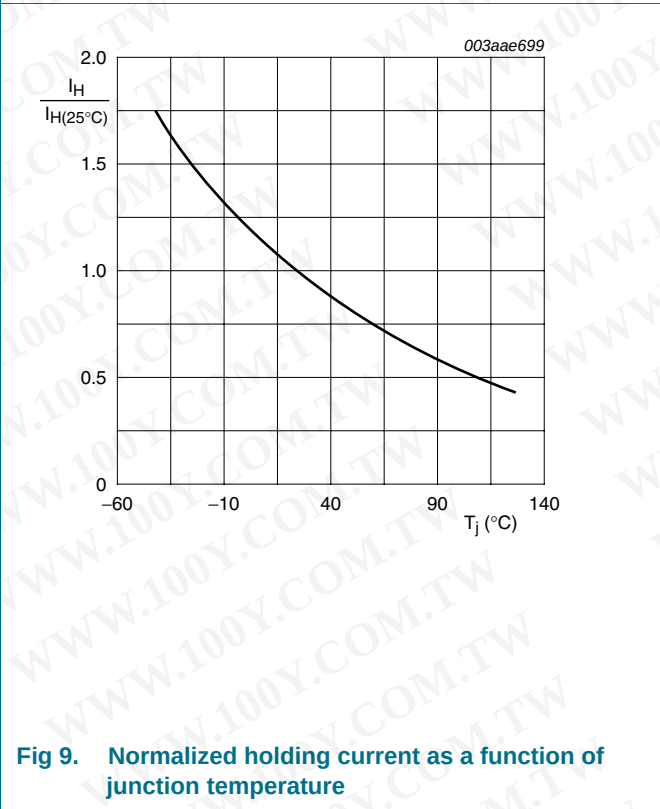
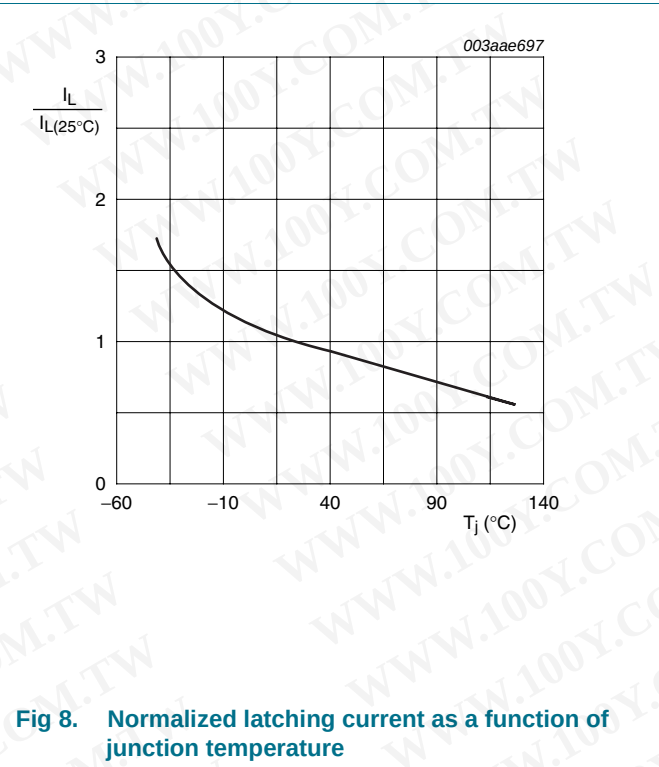
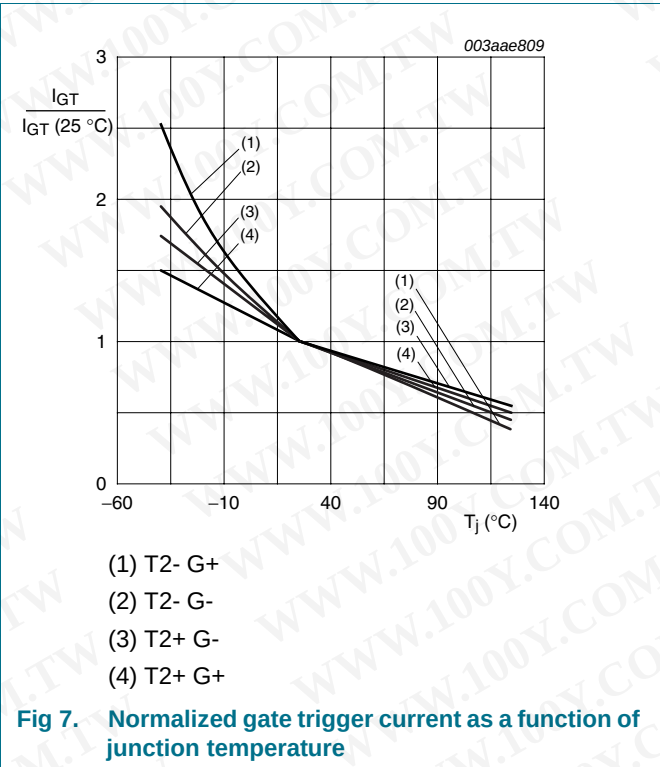
| Symbol         | Parameter                                         | Conditions                               | Min | Typ | Max | Unit |
|----------------|---------------------------------------------------|------------------------------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | half cycle; see <a href="#">Figure 6</a> | -   | -   | 2.4 | K/W  |
|                |                                                   | full cycle; see <a href="#">Figure 6</a> | -   | -   | 2   | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | PCB (FR4) mounted; minimum pad sizes     | -   | 75  | -   | K/W  |



## 6. Characteristics

Table 6. 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>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -    | 2.5 | 10   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -    | 4   | 10   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -    | 5   | 10   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 7</a> | -    | 11  | 25   | mA               |
| $I_L$                          | latching current                  | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a> | -    | 3   | 25   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a> | -    | 14  | 35   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a> | -    | 3   | 25   | mA               |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a> | -    | 4   | 35   | mA               |
| $I_H$                          | holding current                   | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a>                                   | -    | 2.5 | 20   | mA               |
| $V_T$                          | on-state voltage                  | $I_T = 10\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a>                                  | -    | 1.3 | 1.65 | 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>see <a href="#">Figure 10</a>        | -    | 0.7 | 1.5  | V                |
|                                |                                   | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ }^\circ\text{C}$ ;<br>see <a href="#">Figure 10</a>      | 0.25 | 0.4 | -    | V                |
| $I_D$                          | off-state current                 | $V_D = 600\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$                                                                | -    | 0.1 | 0.5  | mA               |
| <b>Dynamic characteristics</b> |                                   |                                                                                                                         |      |     |      |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; exponential waveform; gate open circuit                   | -    | 50  | -    | V/ $\mu\text{s}$ |
| $t_{gt}$                       | gate-controlled turn-on time      | $I_{TM} = 12\text{ A}$ ; $V_D = 600\text{ V}$ ; $I_G = 0.1\text{ mA}$ ;<br>$dI_G/dt = 5\text{ A}/\mu\text{s}$           | -    | 2   | -    | $\mu\text{s}$    |



7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

SOT428

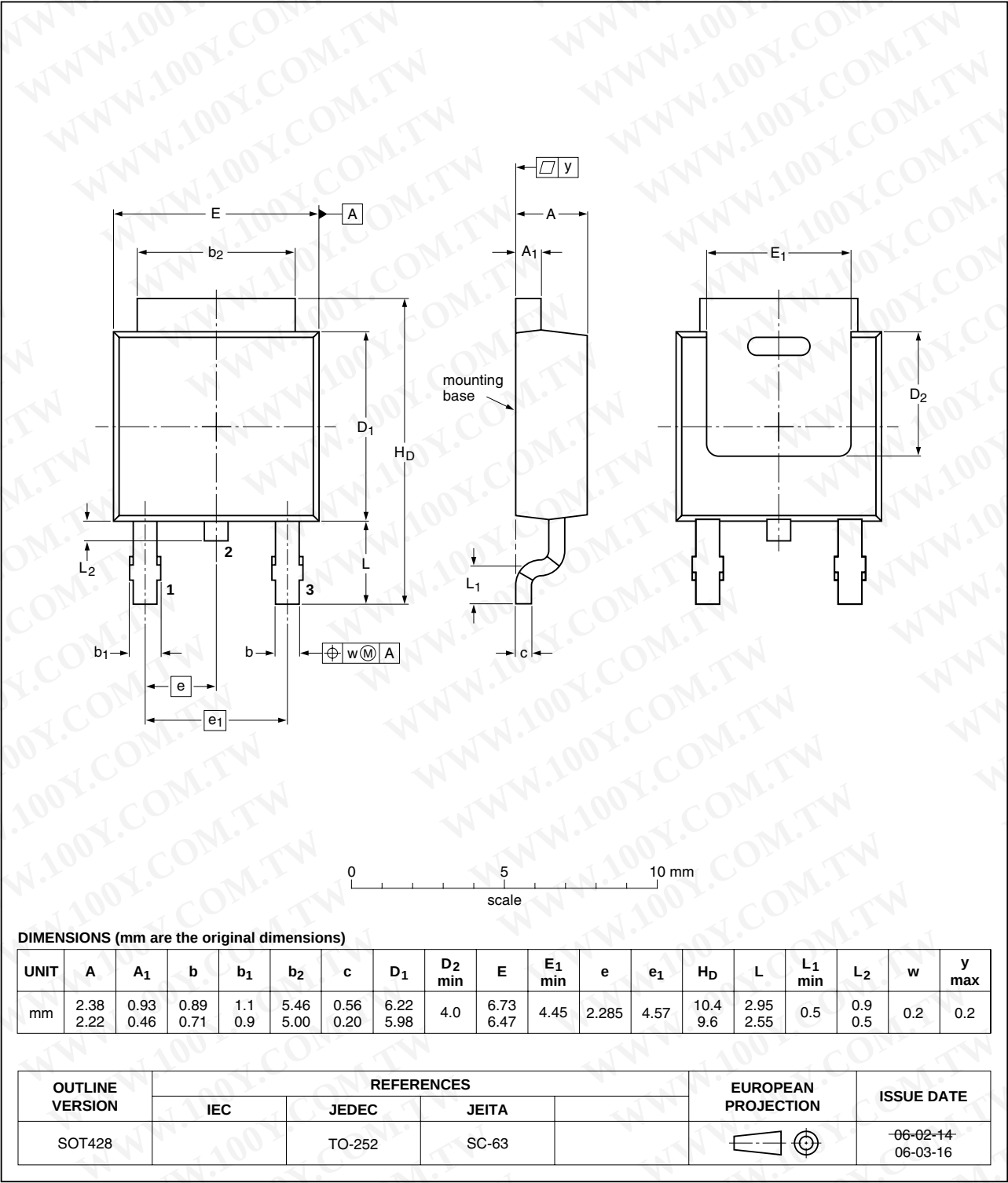


Fig 11. Package outline SOT428 (DPAK)



8. Soldering

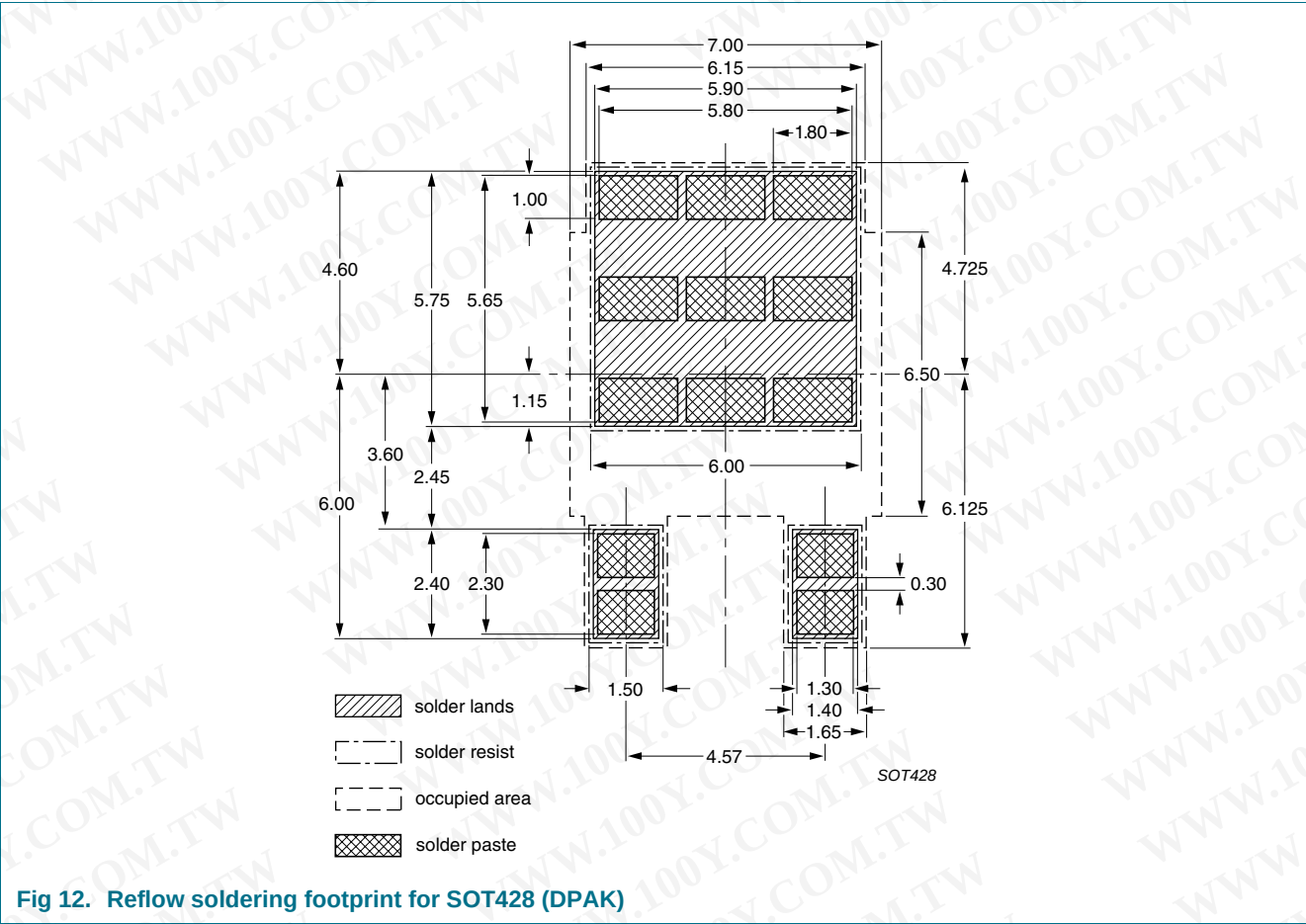


Fig 12. Reflow soldering footprint for SOT428 (DPAK)

## 9. Revision history

Table 7. Revision history

| Document ID       | Release date                                                                                                                                                                                                                                                                                                                      | Data sheet status     | Change notice | Supersedes        |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|-------------------|
| BT137S-600E v.3   | 20110330                                                                                                                                                                                                                                                                                                                          | Product data sheet    | -             | BT137S_SERIES_E_2 |
| Modifications:    | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Type number BT137S-600E separated from data sheet BT137S_SERIES_E_2.</li></ul> |                       |               |                   |
| BT137S_SERIES_E_2 | 20010601                                                                                                                                                                                                                                                                                                                          | Product specification | -             | BT137S_SERIES_E_1 |

## 10. Legal information

### 10.1 Data sheet status

| Document status <sup>[1] [2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|------------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet       | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet     | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet         | Production                    | This document contains the product specification.                                     |

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[2] The term 'short data sheet' is explained in section "Definitions".

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