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# BT137S-800F

4Q Triac

12 June 2014

Product data sheet

## 1. General description

Planar passivated four quadrant triac in a SOT428 (DPAK) surface-mountable plastic package intended for use in general purpose bidirectional switching and phase control applications.

## 2. Features and benefits

- High blocking voltage capability
- Less sensitive gate for improved noise immunity
- Planar passivated for voltage ruggedness and reliability
- Surface-mountable package
- Triggering in all four quadrants

## 3. Applications

- General purpose motor control
- General purpose switching

## 4. Quick reference data

Table 1. Quick reference data

| Symbol                        | Parameter                            | Conditions                                                                                                                                                 | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{\text{DRM}}$              | repetitive peak off-state voltage    |                                                                                                                                                            | -   | -   | 800 | V    |
| $I_{\text{TSM}}$              | non-repetitive peak on-state current | full sine wave; $T_{\text{J}(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 65  | A    |
| $I_{\text{T(RMS)}}$           | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 102\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>                | -   | -   | 8   | A    |
| <b>Static characteristics</b> |                                      |                                                                                                                                                            |     |     |     |      |
| $I_{\text{GT}}$               | gate trigger current                 | $V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G+; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                | -   | 5   | 25  | mA   |
|                               |                                      | $V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G-; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                | -   | 8   | 25  | mA   |
|                               |                                      | $V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2- G-; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                | -   | 11  | 25  | mA   |



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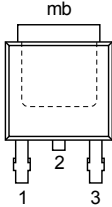
## BT137S-800F

4Q Triac

| Symbol | Parameter | Conditions                                                                                            | Min | Typ | Max | Unit |
|--------|-----------|-------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
|        |           | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_J = 25\text{ °C}$ ; <a href="#">Fig. 7</a> | -   | 30  | 70  | mA   |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                    | Simplified outline                                                                                            | Graphic symbol                                                                                    |
|-----|--------|--------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1   | T1     | main terminal 1                |  <p><b>DPAK (SOT428)</b></p> |  <p>sym051</p> |
| 2   | T2     | main terminal 2                |                                                                                                               |                                                                                                   |
| 3   | G      | gate                           |                                                                                                               |                                                                                                   |
| mb  | T2     | mounting base; main terminal 2 |                                                                                                               |                                                                                                   |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package |                                                                                 |         |
|-------------|---------|---------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                     | Version |
| BT137S-800F | DPAK    | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428  |

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## BT137S-800F

4Q Triac

## 7. Limiting values

**Table 4. Limiting values**

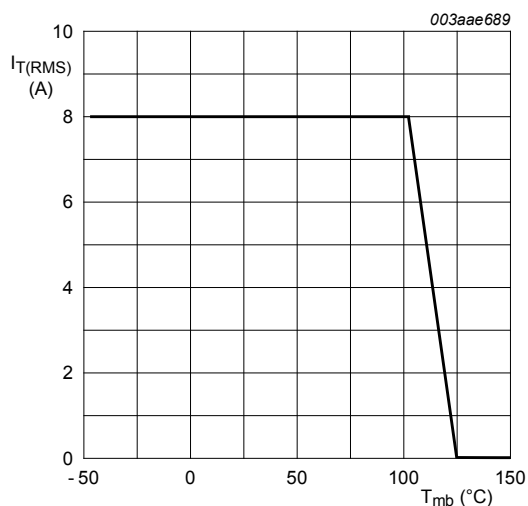
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol              | Parameter                            | Conditions                                                                                                                                          |  | Min | Max | Unit                   |
|---------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|-----|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                                     |  | -   | 800 | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 102\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>         |  | -   | 8   | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> |  | -   | 65  | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$                                                 |  | -   | 71  | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; SIN                                                                                                                 |  | -   | 21  | $\text{A}^2\text{s}$   |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ; T2+ G+                               |  | -   | 50  | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ; T2+ G-                               |  | -   | 50  | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ; T2- G-                               |  | -   | 50  | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{T}} = 12\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ ; T2- G+                               |  | -   | 10  | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | 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 | 150 | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                                     |  | -   | 125 | $^{\circ}\text{C}$     |

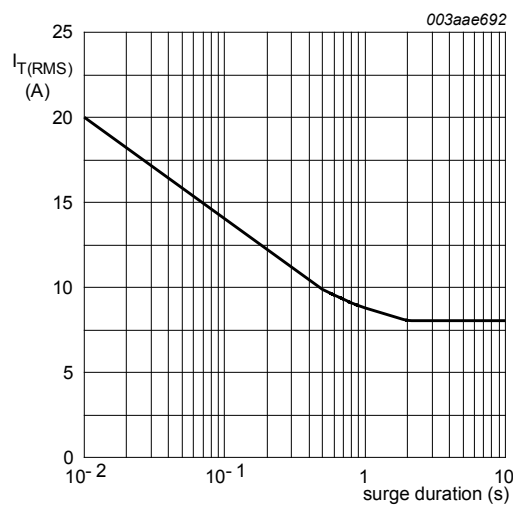
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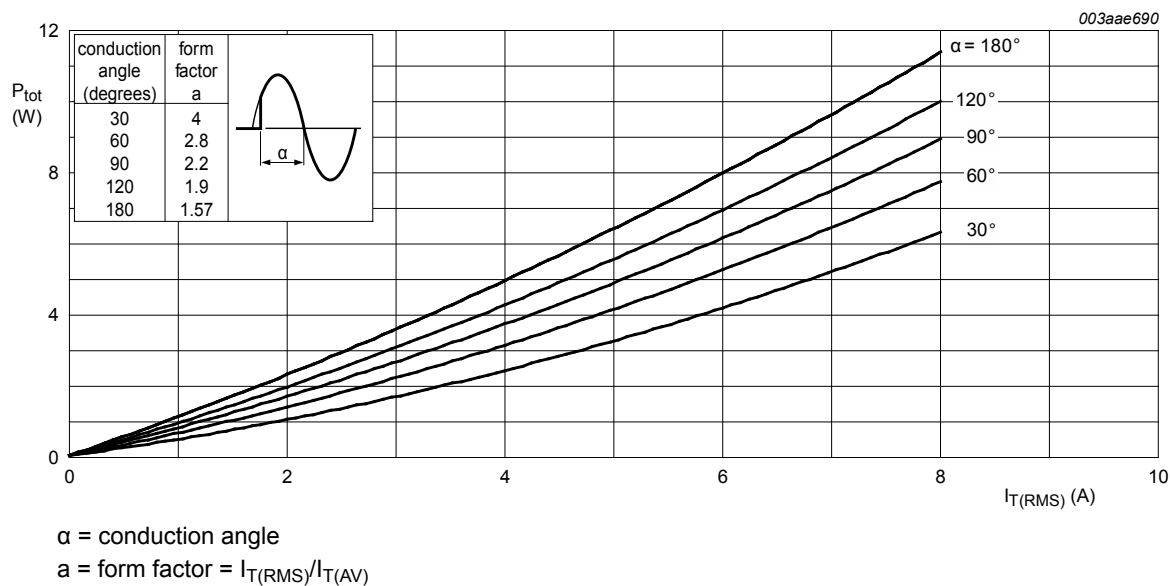


**Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values**



$f = 50 \text{ Hz}$   
 $T_{mb} \leq 102^\circ \text{C}$

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

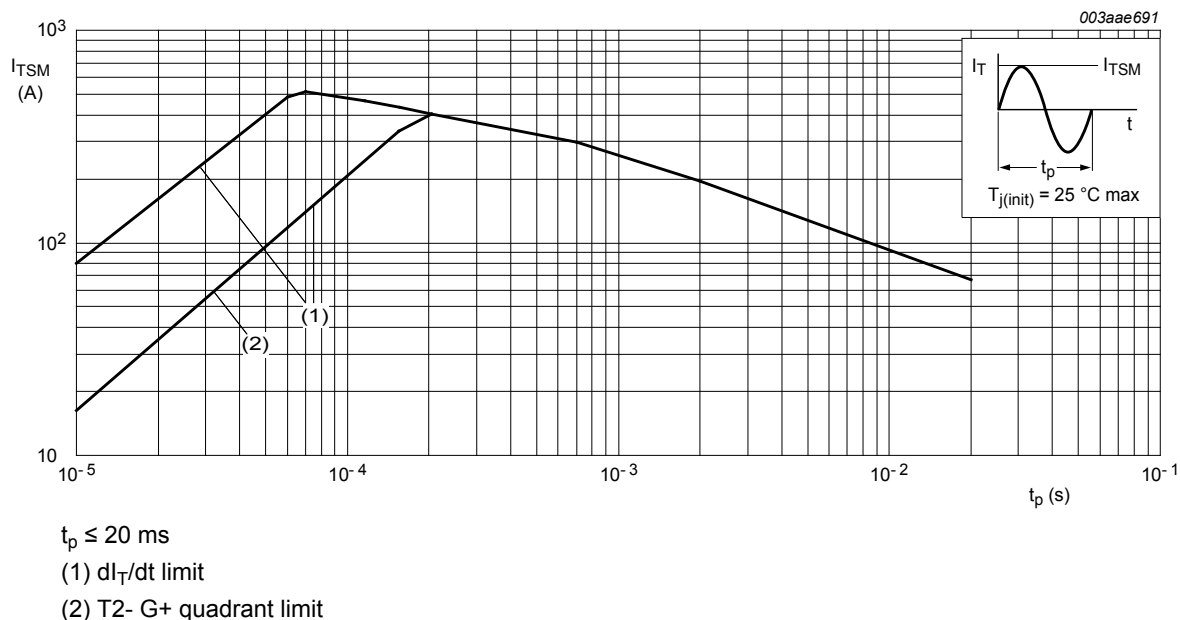


**Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values**

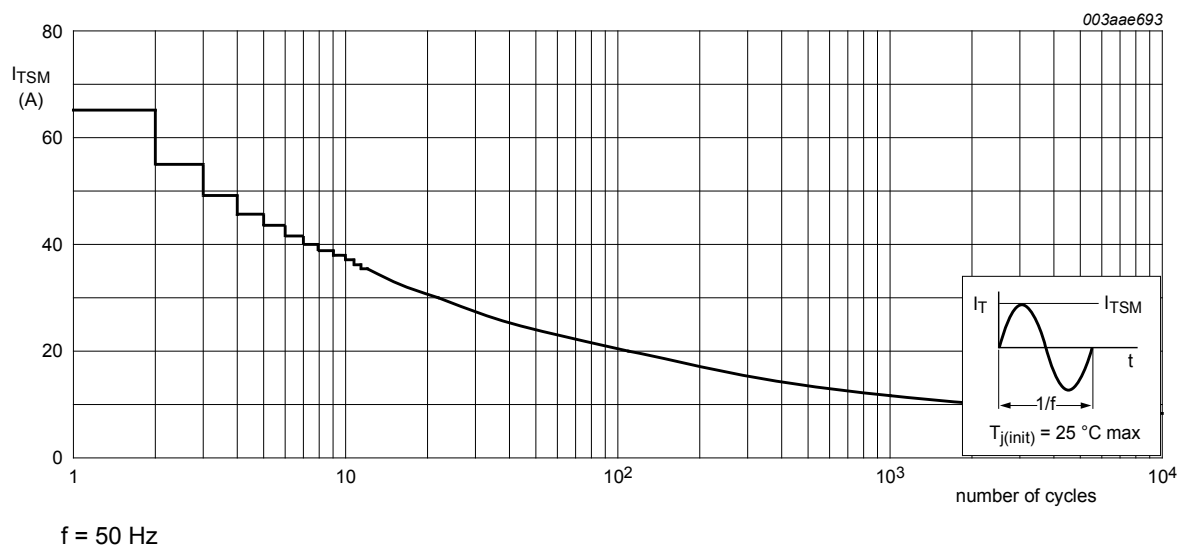
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4Q Triac



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



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

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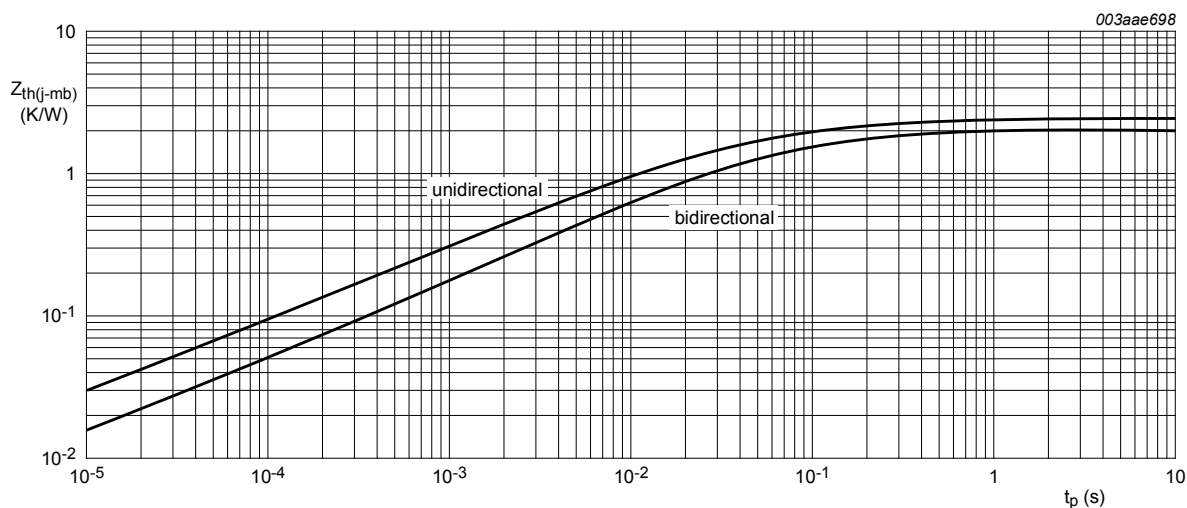
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4Q Triac

### 8. 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; Fig. 6                   | -   | -   | 2.4 | K/W  |
|                |                                                   | full cycle; Fig. 6                   | -   | -   | 2   | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | PCB (FR4) mounted; minimum pad sizes | -   | 75  | -   | K/W  |



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

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4Q Triac

### 9. Characteristics

Table 6. Characteristics

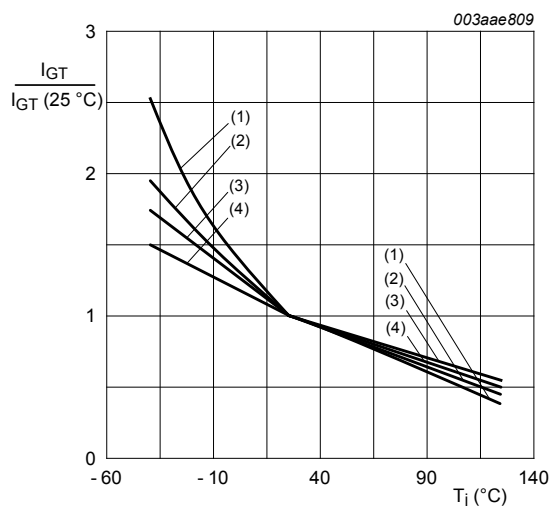
| Symbol                         | Parameter                             | Conditions                                                                                                                              | Min  | Typ | Max  | Unit             |
|--------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------|-----|------|------------------|
| <b>Static characteristics</b>  |                                       |                                                                                                                                         |      |     |      |                  |
| $I_{GT}$                       | gate trigger current                  | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       | -    | 5   | 25   | 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>                       | -    | 8   | 25   | 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>                       | -    | 11  | 25   | 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>                       | -    | 30  | 70   | 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>                       | -    | 7   | 30   | 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>                       | -    | 16  | 45   | 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>                       | -    | 5   | 30   | 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>                       | -    | 7   | 45   | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                                         | -    | 5   | 20   | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 10\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 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><a href="#">Fig. 11</a>                              | -    | 0.7 | 1    | V                |
|                                |                                       | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 11</a>                            | 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 | 50   | 250 | -    | V/ $\mu\text{s}$ |
| $dV_{com}/dt$                  | rate of change of commutating voltage | $V_D = 400\text{ V}$ ; $T_j = 95\text{ }^\circ\text{C}$ ; $dI_{com}/dt = 3.6\text{ A/ms}$ ; $I_T = 8\text{ A}$ ; gate open circuit      | -    | 20  | -    | V/ $\mu\text{s}$ |
| $t_{gt}$                       | gate-controlled turn-on time          | $I_{TM} = 12\text{ A}$ ; $V_D = 800\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$                               | -    | 2   | -    | $\mu\text{s}$    |



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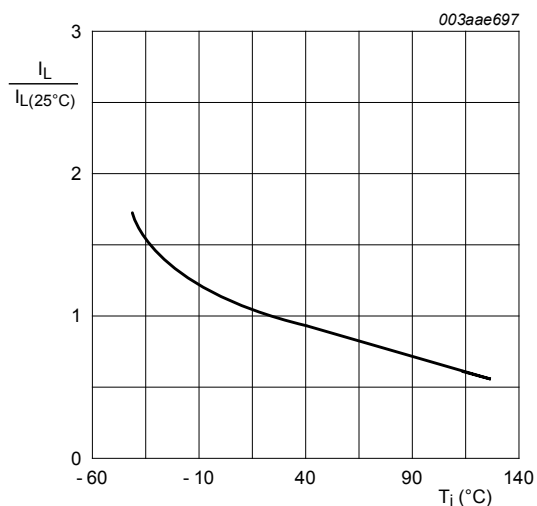
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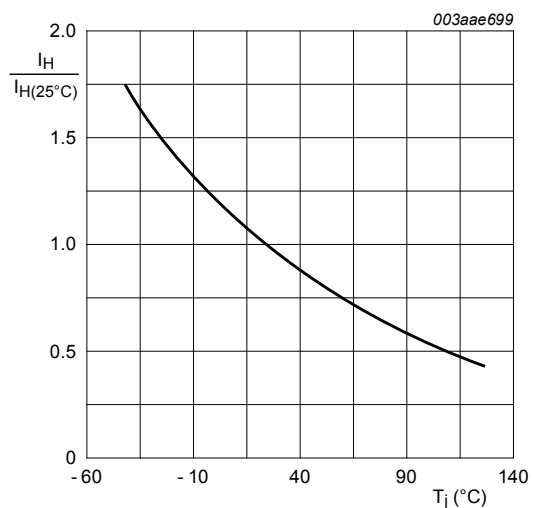


- (1) T2- G+
- (2) T2- G-
- (3) T2+ G-
- (4) T2+ G+

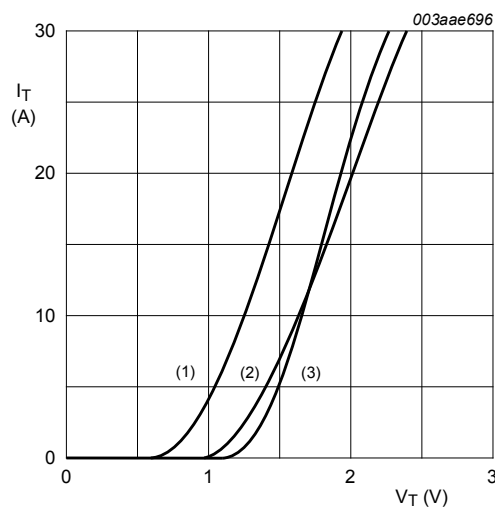
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



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



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



$V_o = 1.264 \text{ V}$

$R_s = 0.038 \Omega$

(1)  $T_J = 125^\circ\text{C}$ ; typical values

(2)  $T_J = 125^\circ\text{C}$ ; maximum values

(3)  $T_J = 25^\circ\text{C}$ ; maximum values

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

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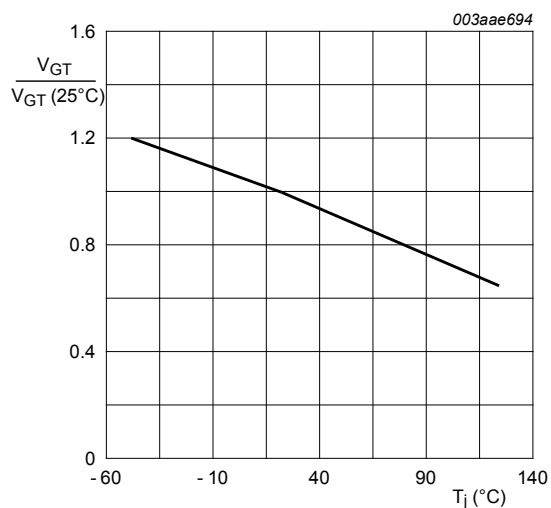


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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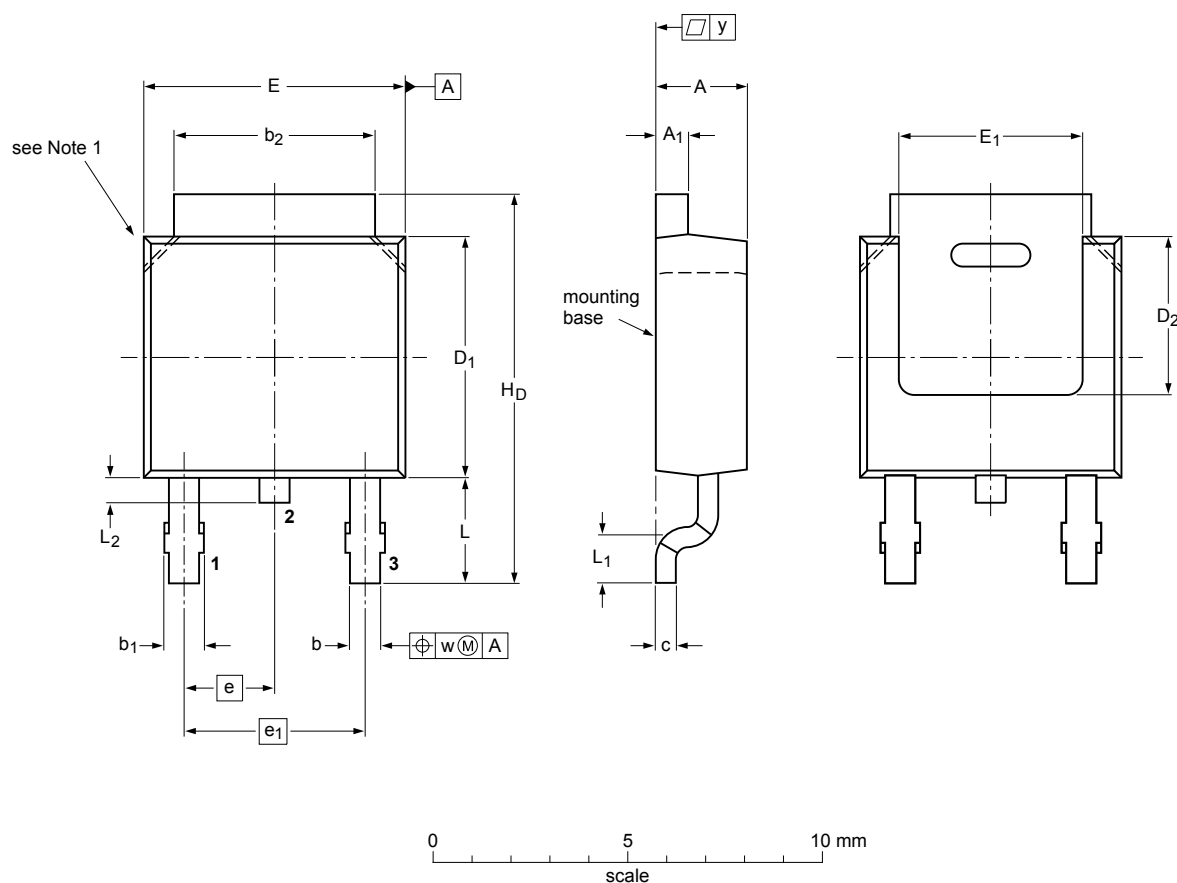
## BT137S-800F

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### 10. Package outline

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

SOT428



Dimensions (mm are the original dimensions)

| Unit | A    | A <sub>1</sub> | b    | b <sub>1</sub> | b <sub>2</sub> | c    | D <sub>1</sub> | D <sub>2</sub> | E    | E <sub>1</sub> | e     | e <sub>1</sub> | H <sub>D</sub> | L    | L <sub>1</sub> | L <sub>2</sub> | w   | y   |
|------|------|----------------|------|----------------|----------------|------|----------------|----------------|------|----------------|-------|----------------|----------------|------|----------------|----------------|-----|-----|
| max  | 2.38 | 0.93           | 0.89 | 1.1            | 5.46           | 0.56 | 6.22           |                | 6.73 |                |       |                | 10.4           | 2.95 |                | 0.9            |     | 0.2 |
| nom  |      |                |      |                |                |      |                |                |      |                | 2.285 | 4.57           |                |      |                |                | 0.2 |     |
| min  | 2.22 | 0.46           | 0.71 | 0.9            | 5.00           | 0.20 | 5.98           | 4.0            | 6.47 | 4.45           |       |                | 9.6            | 2.55 | 0.5            | 0.5            |     |     |

Note

1. Plastic body may have 45° chamfer.

sot428\_po

| Outline version | References |        |       |  | European projection                                                                   | Issue date             |
|-----------------|------------|--------|-------|--|---------------------------------------------------------------------------------------|------------------------|
|                 | IEC        | JEDEC  | JEITA |  |                                                                                       |                        |
| SOT428          |            | TO-252 | SC-63 |  |  | -06-03-16-<br>14-06-10 |

Fig. 12. Package outline DPAK (SOT428)

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4Q Triac

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| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
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| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
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## 12. Contents

|      |                               |    |
|------|-------------------------------|----|
| 1    | General description .....     | 1  |
| 2    | Features and benefits .....   | 1  |
| 3    | Applications .....            | 1  |
| 4    | Quick reference data .....    | 1  |
| 5    | Pinning information .....     | 2  |
| 6    | Ordering information .....    | 2  |
| 7    | Limiting values .....         | 3  |
| 8    | Thermal characteristics ..... | 6  |
| 9    | Characteristics .....         | 7  |
| 10   | Package outline .....         | 10 |
| 11   | Legal information .....       | 11 |
| 11.1 | Data sheet status .....       | 11 |
| 11.2 | Definitions .....             | 11 |
| 11.3 | Disclaimers .....             | 11 |
| 11.4 | Trademarks .....              | 12 |

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