



# IMPORTANT NOTICE

10 December 2015

## 1. Global joint venture starts operations as WeEn Semiconductors

Dear customer,

As from November 9th, 2015 NXP Semiconductors N.V. and Beijing JianGuang Asset Management Co. Ltd established Bipolar Power joint venture (JV), **WeEn Semiconductors**, which will be used in future Bipolar Power documents together with new contact details.

In this document where the previous NXP references remain, please use the new links as shown below.

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Thank you for your cooperation and understanding,

WeEn Semiconductors



## 1. General description

Planar passivated high commutation three quadrant triac in a SOT428 (DPAK) surface-mountable plastic package intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series B" triac will commute the full rated RMS current at the maximum rated junction temperature without the aid of a snubber.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- High blocking voltage capability
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by  $dV/dt$
- Less sensitive gate for very high noise immunity
- Planar passivated for voltage ruggedness and reliability
- Surface-mountable package
- Triggering in three quadrants only

## 3. Applications

- General purpose motor control circuits
- Home appliances
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

## 4. Quick reference data

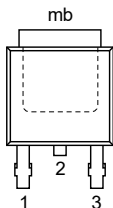
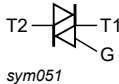
Table 1. Quick reference data

| Symbol                        | Parameter                            | Conditions   | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|--|-----|-----|-----|------|
| $V_{DRM}$                     | repetitive peak off-state voltage    |  | -   | -   | 600 | V    |
| $I_{T(RMS)}$                  | RMS on-state current                 | full sine wave; $T_{mb} \leq 107\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>       | -   | -   | 4   | A    |
| $I_{TSM}$                     | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 25  | A    |
|                               |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$   | -   | -   | 27  | A    |
| $T_j$                         | junction temperature                 |  | -   | -   | 125 | °C   |
| <b>Static characteristics</b> |                                      |  |     |     |     |      |
| $I_{GT}$                      | gate trigger current                 | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                           | -   | -   | 50  | mA   |

| Symbol                         | Parameter                             | Conditions  | Min  | Typ | Max | Unit       |
|--------------------------------|---------------------------------------|---|------|-----|-----|------------|
|                                |                                       | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ \text{ G-}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 7}$  | -    | -   | 50  | mA         |
|                                |                                       | $V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- \text{ G-}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 7}$  | -    | -   | 50  | mA         |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 9}$  | -    | -   | 30  | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 5\text{ A}; T_j = 25\text{ }^\circ\text{C}; \text{Fig. 10}$  | -    | 1.4 | 1.7 | V          |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 402\text{ V}; T_j = 125\text{ }^\circ\text{C}; (V_{DM} = 67\% \text{ of } V_{DRM}); \text{exponential waveform; gate open circuit}$                                   | 1000 | -   | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}; T_j = 125\text{ }^\circ\text{C}; I_{T(RMS)} = 4\text{ A}; dV_{com}/dt = 20\text{ V}/\mu\text{s}; (\text{snubberless condition}); \text{gate open circuit}$ | 6    | -   | -   | A/ms       |

## 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

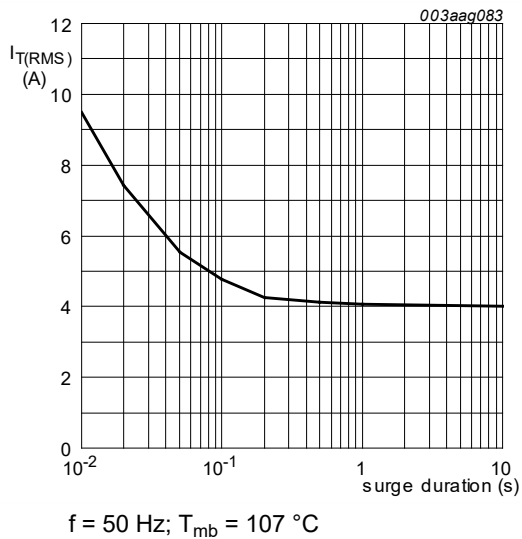
| Type number  | Package |   | Version |
|--------------|---------|---|---------|
|              | Name    | Description   |         |
| BTA204S-600B | DPAK    | plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428  |

## 7. Limiting values

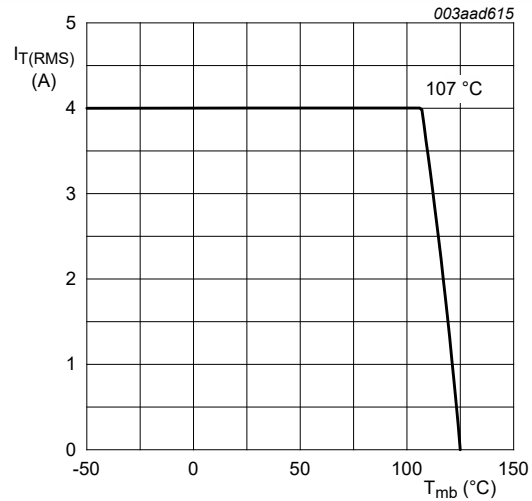
**Table 4. Limiting values**

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

| Symbol       | Parameter                            | Conditions   | Min | Max | Unit             |
|--------------|--------------------------------------|--|-----|-----|------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |  | -   | 600 | V                |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_{mb} \leq 107\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>       | -   | 4   | A                |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | 25  | A                |
|              |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$   | -   | 27  | A                |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; SIN   | -   | 3.1 | A <sup>2</sup> s |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 0.2\text{ A}$   | -   | 100 | A/ $\mu$ s       |
| $I_{GM}$     | peak gate current                    |  | -   | 2   | A                |
| $P_{GM}$     | peak gate power                      |  | -   | 5   | W                |
| $P_{G(AV)}$  | average gate power                   | over any 20 ms period  | -   | 0.5 | W                |
| $T_{stg}$    | storage temperature                  |  | -40 | 150 | °C               |
| $T_j$        | junction temperature                 |  | -   | 125 | °C               |



**Fig. 1. RMS on-state current as a function of surge duration; maximum values**



**Fig. 2. RMS on-state current as a function of mounting base temperature; maximum values**

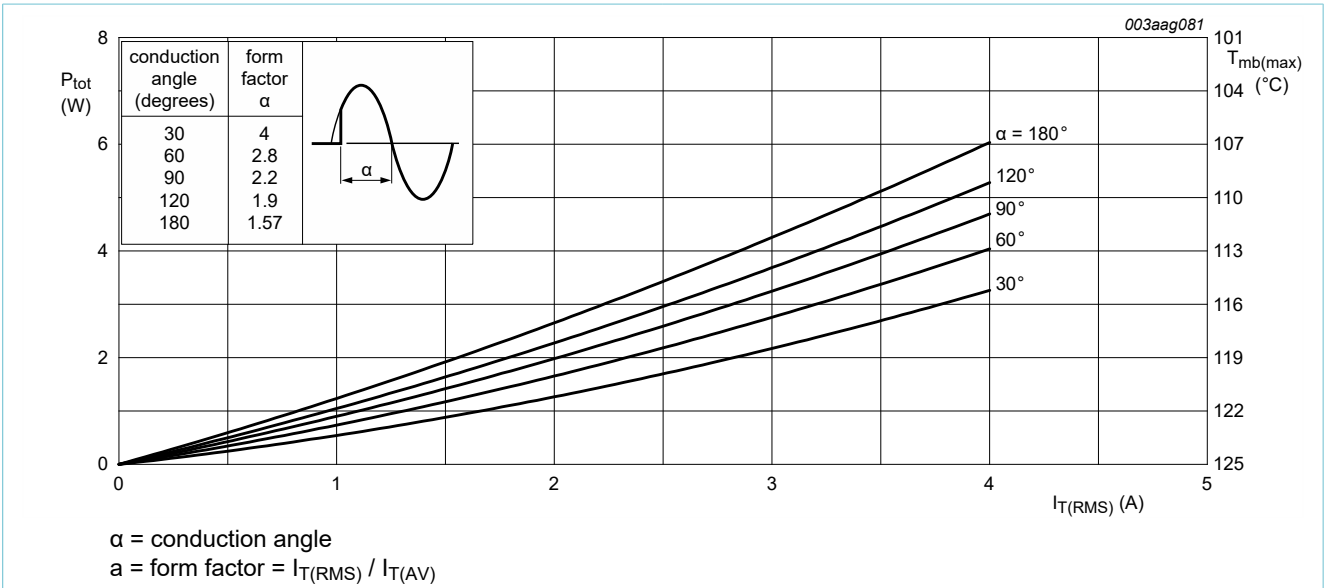


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

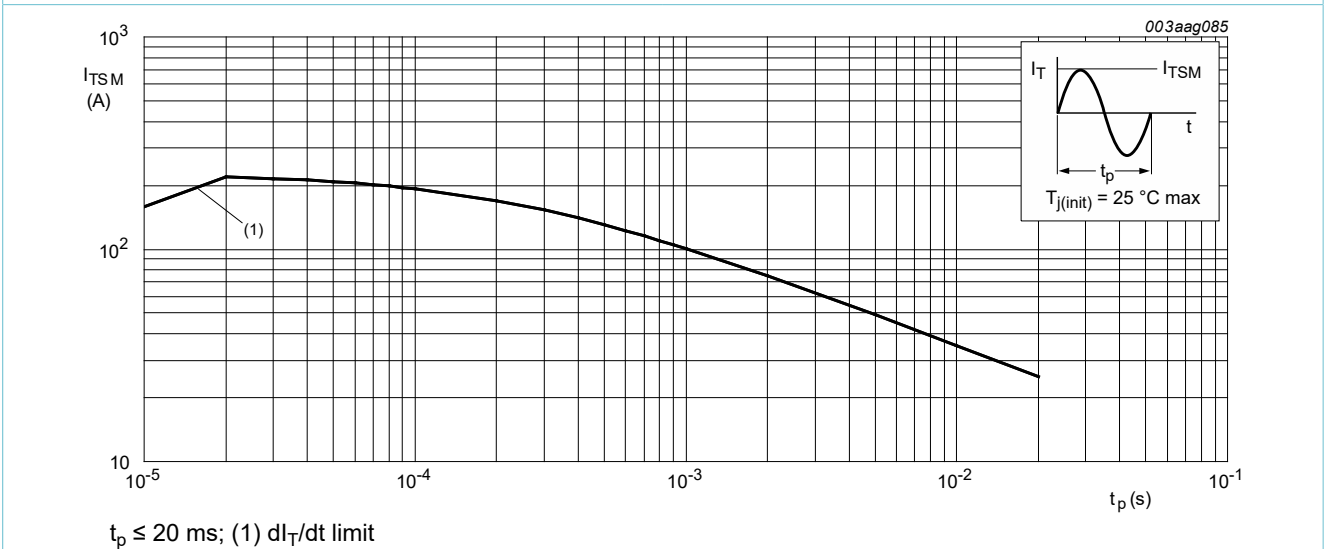
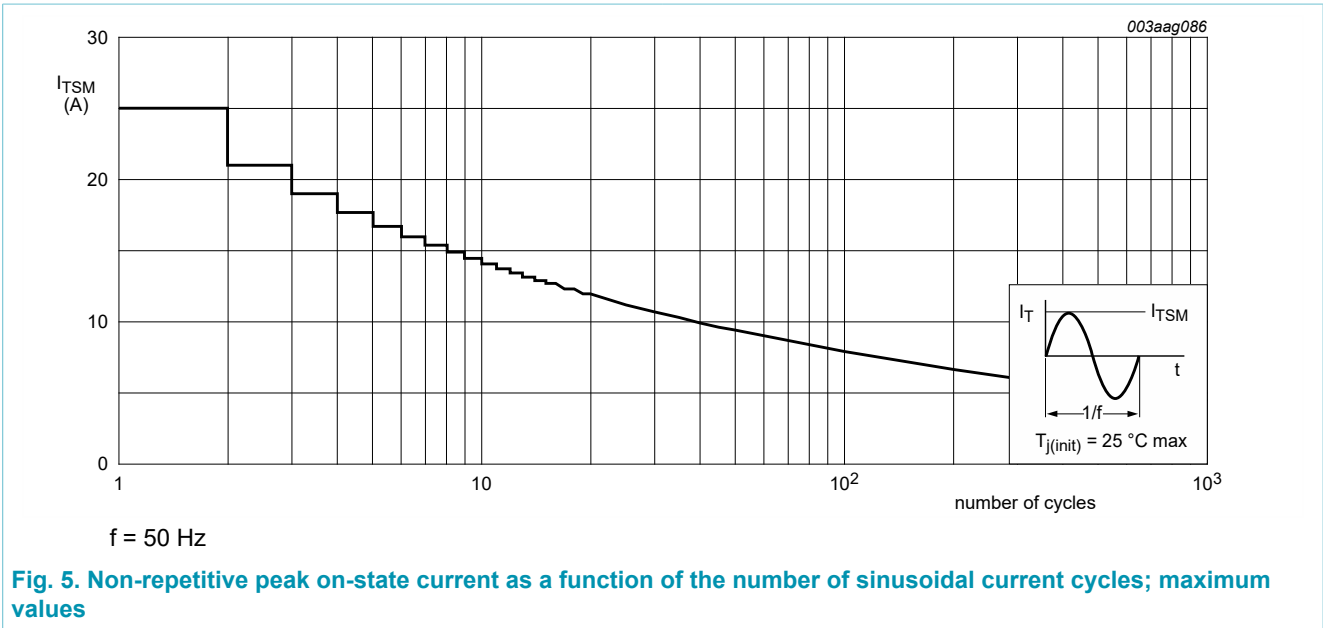


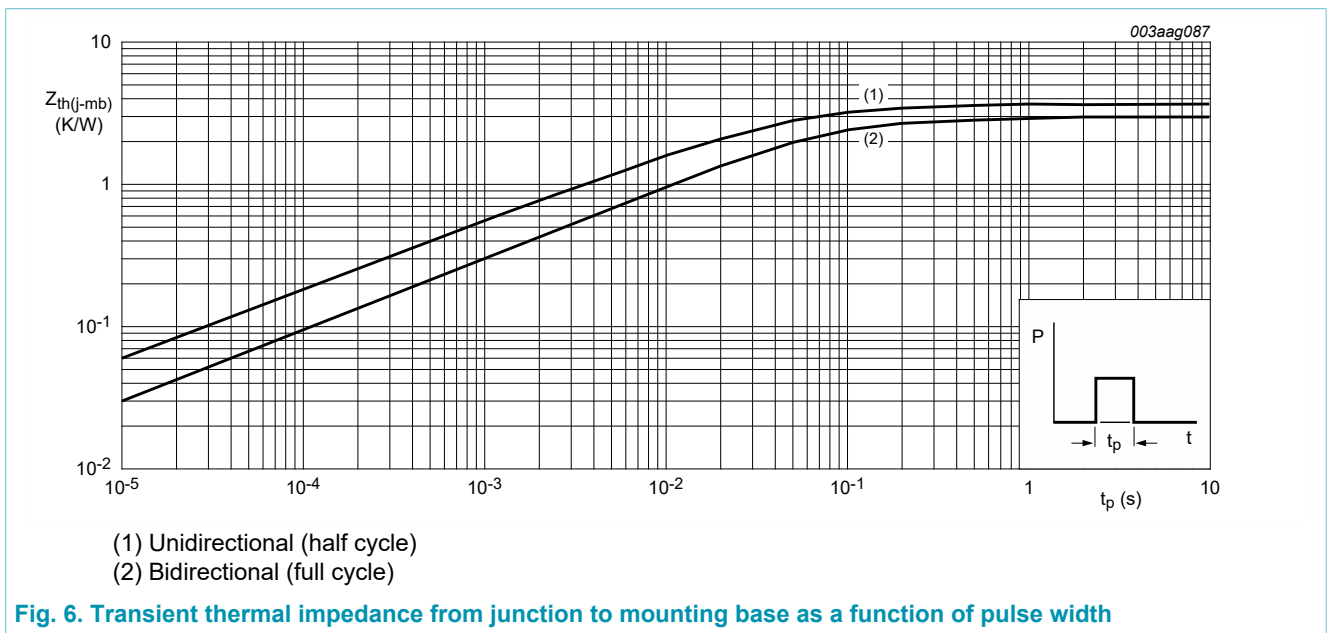
Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



### 8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol                | Parameter  | Conditions                          | Min | Typ | Max | Unit |
|-----------------------|--|-------------------------------------|-----|-----|-----|------|
| R <sub>th(j-mb)</sub> | thermal resistance from junction to mounting base    | full cycle; Fig. 6                  | -   | -   | 3   | K/W  |
|                       |  | half cycle; Fig. 6                  | -   | -   | 3.7 | K/W  |
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient free air | printed circuit board (FR4) mounted | -   | 75  | -   | K/W  |

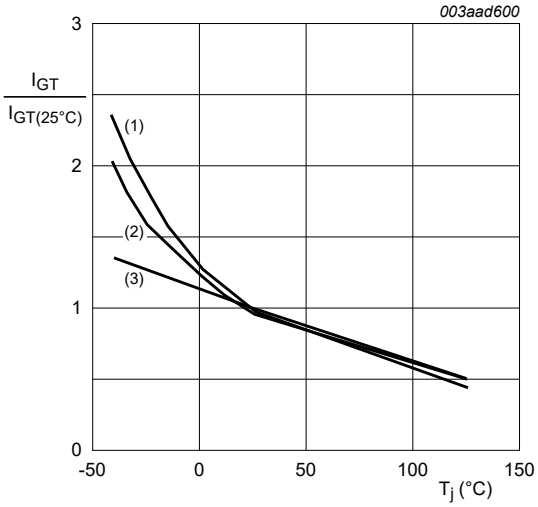


## 9. Characteristics

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>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>   | -    | -   | 50  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>   | -    | -   | 50  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>   | -    | -   | 50  | mA         |
| $I_L$                          | latching current                      | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>   | -    | -   | 30  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>   | -    | -   | 45  | mA         |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>   | -    | -   | 30  | mA         |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>   | -    | -   | 30  | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 5\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>   | -    | 1.4 | 1.7 | V          |
| $V_{GT}$                       | gate trigger voltage                  | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ;<br><a href="#">Fig. 11</a>  | -    | 0.7 | 1   | V          |
|                                |                                       | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$ ;<br><a href="#">Fig. 11</a>  | 0.25 | 0.4 | -   | V          |
| $I_D$                          | off-state current                     | $V_D = 600\text{ V}$ ; $T_j = 125\text{ °C}$  | -    | 0.1 | 0.5 | mA         |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit                                     | 1000 | -   | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 4\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 6    | -   | -   | A/ms       |





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

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

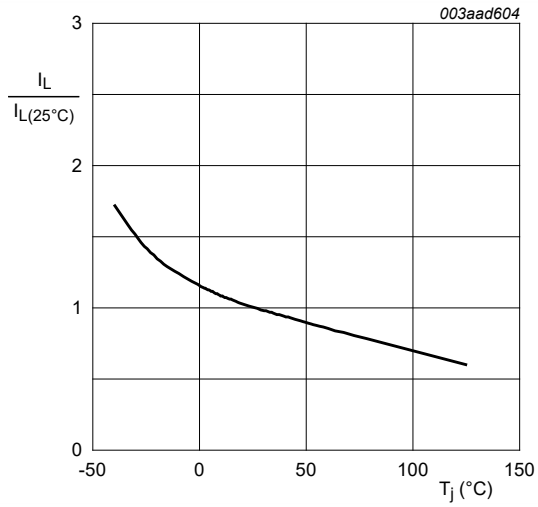


Fig. 8. Normalized latching current as a function of junction temperature

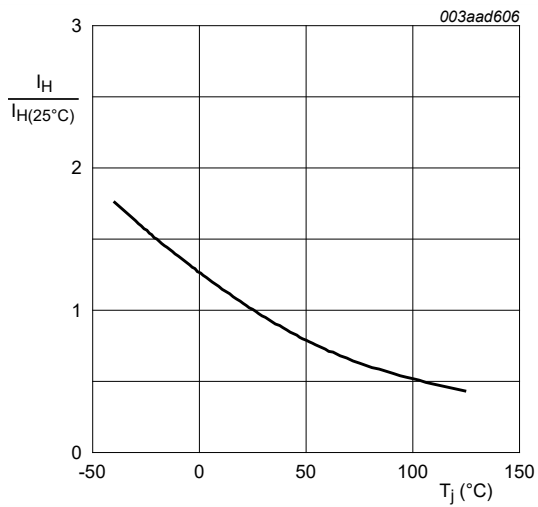
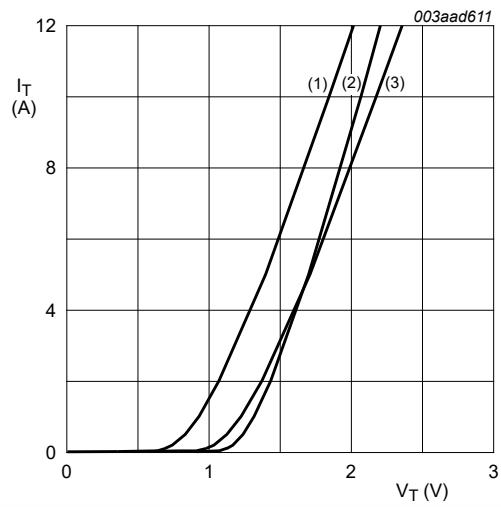


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.27 \text{ V}; R_s = 0.091 \Omega$

- (1)  $T_j = 125 \text{ }^\circ\text{C}$ ; typical values
- (2)  $T_j = 125 \text{ }^\circ\text{C}$ ; maximum values
- (3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

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

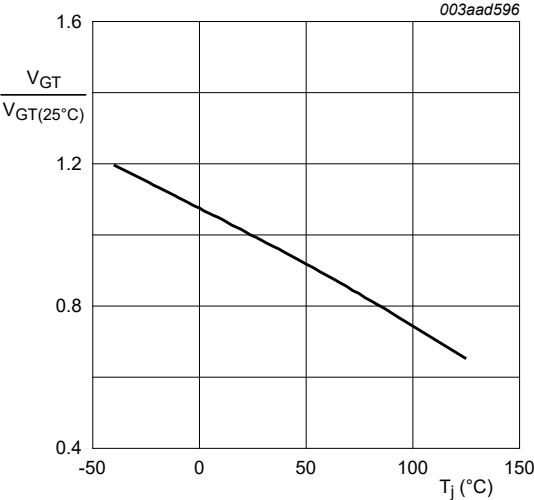
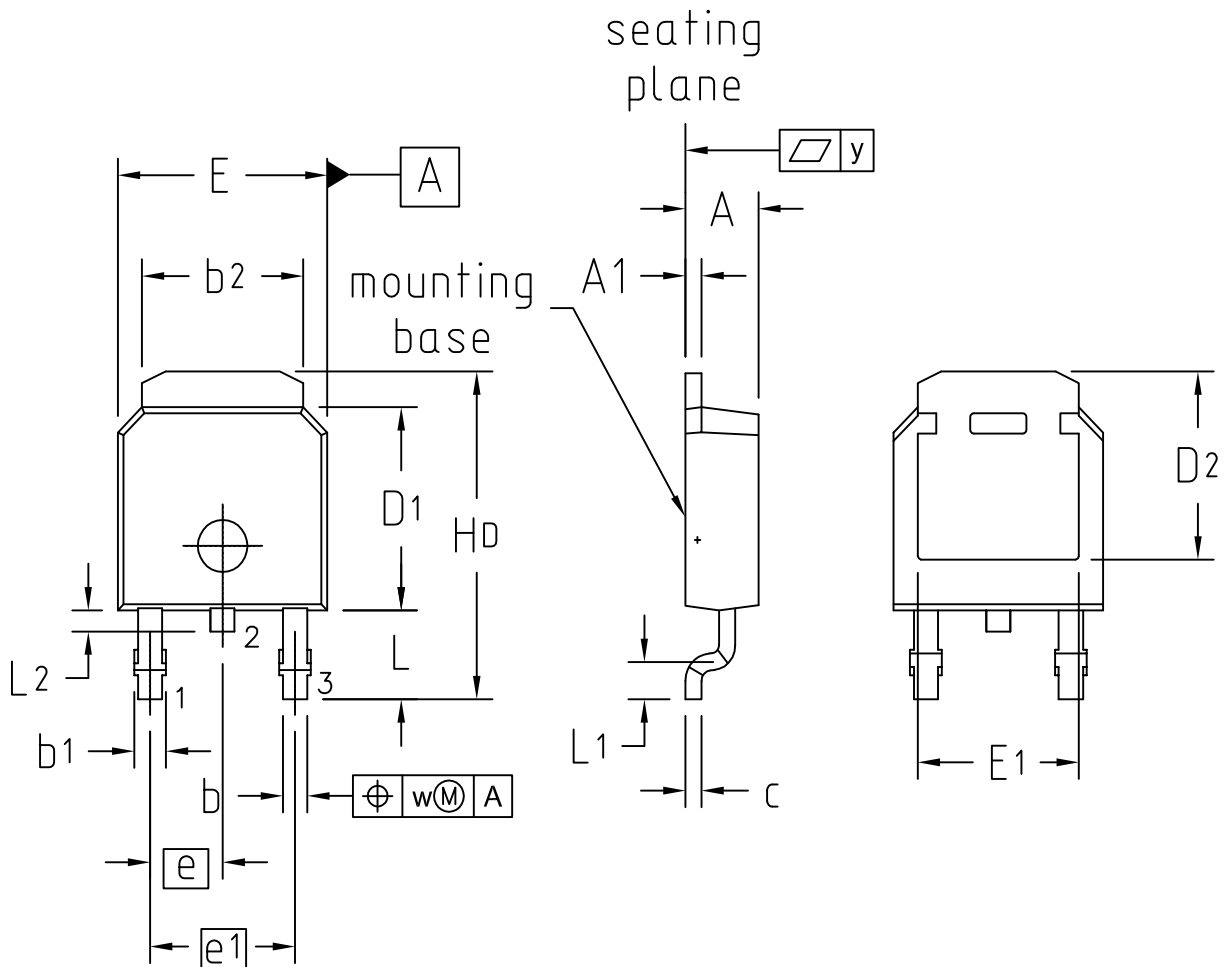


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

10. Package outline

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

SOT428



| 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    |
|------|------|----------------|------|----------------|----------------|------|----------------|----------------|------|----------------|-------|----------------|----------------|------|----------------|----------------|-----|------|
| mm   | 2.38 | 0.93           | 0.89 | 1.1            | 5.46           | 0.56 | 6.22           | 4.00           | 6.73 | 4.45           | 2.285 | 4.57           | 10.40          | 2.95 | 0.5            | 0.90           | 0.2 | 0.20 |
|      | 2.22 | 0.46           | 0.71 | 0.9            | 5.00           | 0.20 | 5.98           | min.           | 6.47 | min.           |       |                | 9.60           | 2.55 | min.           | 0.50           | 0.2 | max. |

| OUTLINE VERSION | REFERENCES |        |      |  | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|------|--|---------------------|------------|
|                 | IEC        | JEDEC  | EIAJ |  |                     |            |
| SOT428          |            | TO-252 |      |  |                     |            |

Fig. 12. Package outline DPAK (SOT428)

## 11. 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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| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 11 October 2016

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