

# BTA312-800C

3Q Hi-Com Triac

4 October 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Planar passivated high commutation three quadrant triac in a SOT78 (TO-220AB) plastic package intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series C" triac will commute the full RMS current at the maximum rated junction temperature without the aid of a snubber.

### 1.2 Features and benefits

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

### 1.3 Applications

- Electronic thermostats (heating and cooling)
- High power motor controls e.g. washing machines and vacuum cleaners
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

### 1.4 Quick reference data

Table 1. Quick reference data

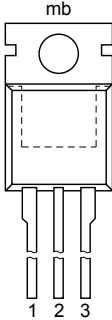
| Symbol                        | Parameter                            | Conditions                                                                                                                           | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $V_{DRM}$                     | repetitive peak off-state voltage    |                                                                                                                                      | -   | -   | 800 | V    |
| $I_{TSM}$                     | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>  | -   | -   | 100 | A    |
| $I_{T(RMS)}$                  | RMS on-state current                 | full sine wave; $T_{mb} \leq 100\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | -   | -   | 12  | A    |
| <b>Static characteristics</b> |                                      |                                                                                                                                      |     |     |     |      |
| $I_{GT}$                      | gate trigger current                 | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_2+$ G+; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                  | 2   | -   | 35  | mA   |
|                               |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_2+$ G-; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                  | 2   | -   | 35  | mA   |



| Symbol | Parameter | Conditions                                                                                                        |  | Min | Typ | Max | Unit |
|--------|-----------|-------------------------------------------------------------------------------------------------------------------|--|-----|-----|-----|------|
|        |           | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a> |  | 2   | -   | 35  | mA   |

## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                    | Simplified outline                                                                                        | Graphic symbol                                                                      |
|-----|--------|--------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | T1     | main terminal 1                |  <p>TO-220AB (SOT78)</p> |  |
| 2   | T2     | main terminal 2                |                                                                                                           |                                                                                     |
| 3   | G      | gate                           |                                                                                                           |                                                                                     |
| mb  | T2     | mounting base; main terminal 2 |                                                                                                           |                                                                                     |

## 3. Ordering information

Table 3. Ordering information

| Type number    | Package  |                                                                                  |         |
|----------------|----------|----------------------------------------------------------------------------------|---------|
|                | Name     | Description                                                                      | Version |
| BTA312-800C    | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |
| BTA312-800C/DG | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

## 4. 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    |                                                                                                                                    |  | -   | 800 | V    |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_{mb} \leq 100\text{ }^\circ\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> |  | -   | 12  | A    |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^\circ\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>  |  | -   | 100 | A    |
|              |                                      | full sine wave; $T_{j(init)} = 25\text{ }^\circ\text{C}$ ; $t_p = 16.7\text{ ms}$                                                  |  | -   | 110 | A    |

| Symbol      | Parameter                        | Conditions                                                                  | Min | Max | Unit        |
|-------------|----------------------------------|-----------------------------------------------------------------------------|-----|-----|-------------|
| $I^2t$      | $I^2t$ for fusing                | $t_p = 10\text{ ms}$ ; SIN                                                  | -   | 50  | $A^2s$      |
| $di_T/dt$   | rate of rise of on-state current | $I_T = 20\text{ A}$ ; $I_G = 0.2\text{ A}$ ; $di_G/dt = 0.2\text{ A}/\mu s$ | -   | 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 | $^{\circ}C$ |
| $T_j$       | junction temperature             |                                                                             | -   | 125 | $^{\circ}C$ |

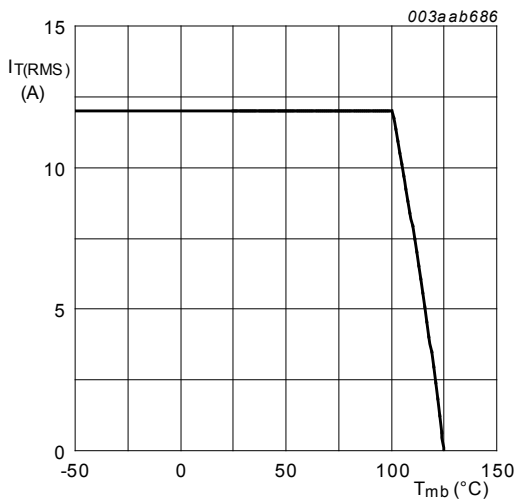
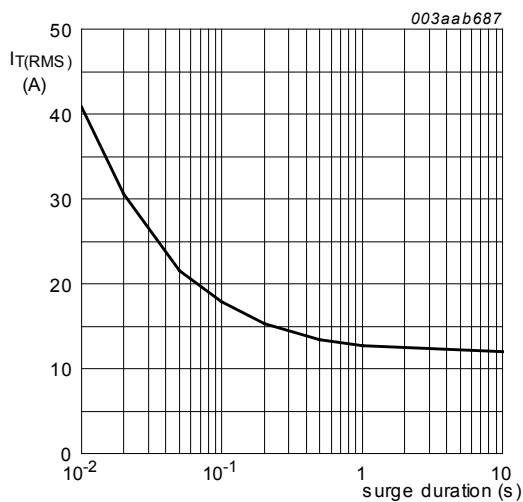


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values



$f = 50\text{ Hz}$ ;  $T_{mb} = 100\text{ }^{\circ}C$

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

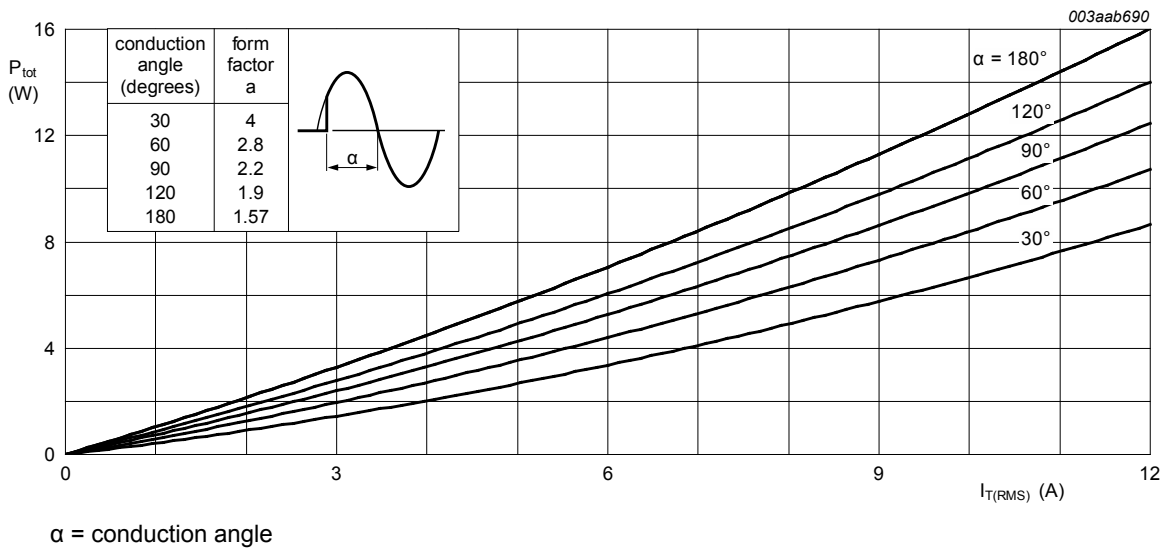


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

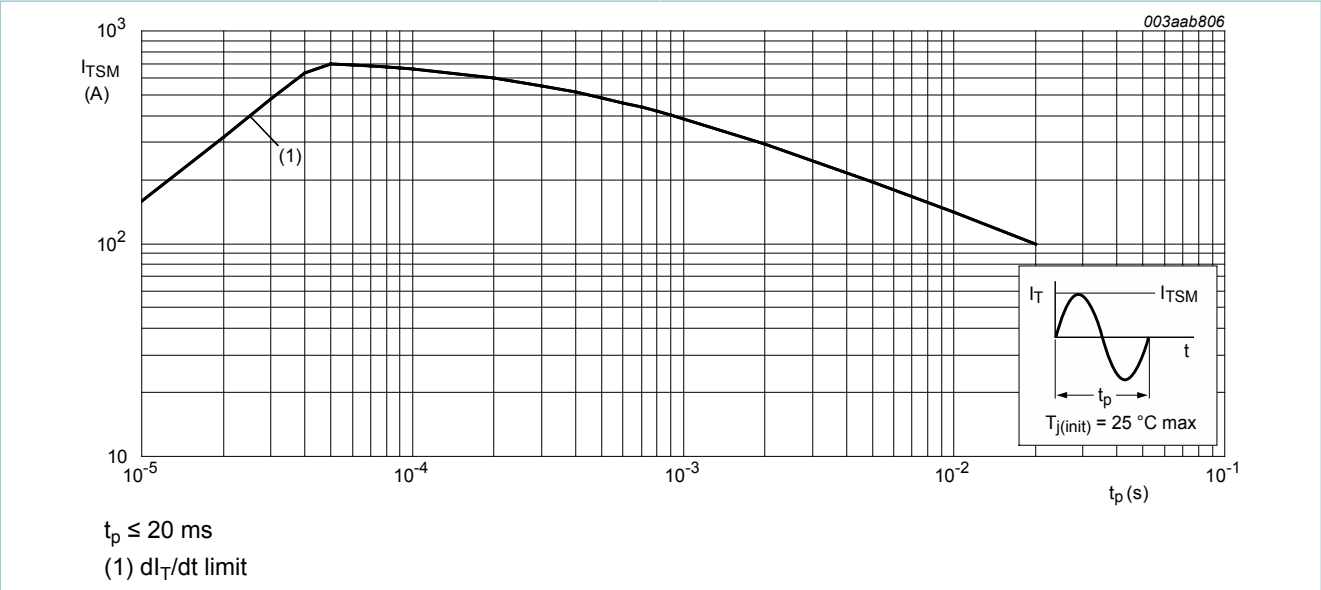


Fig. 4. Non-repetitive peak on-state current as a function of pulse duration; maximum values

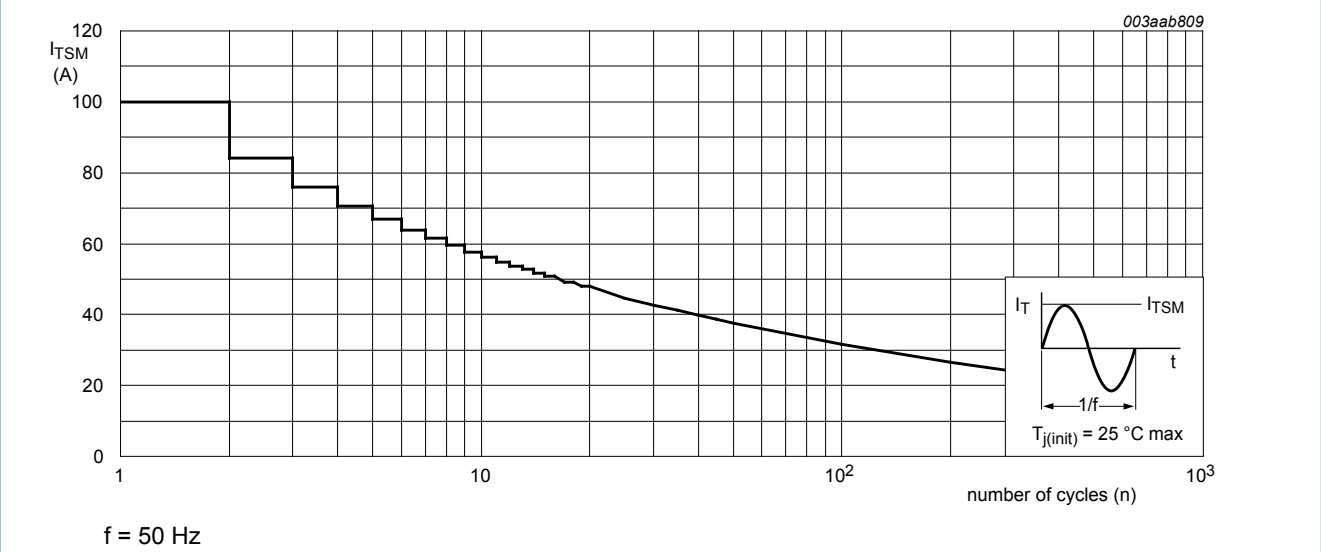
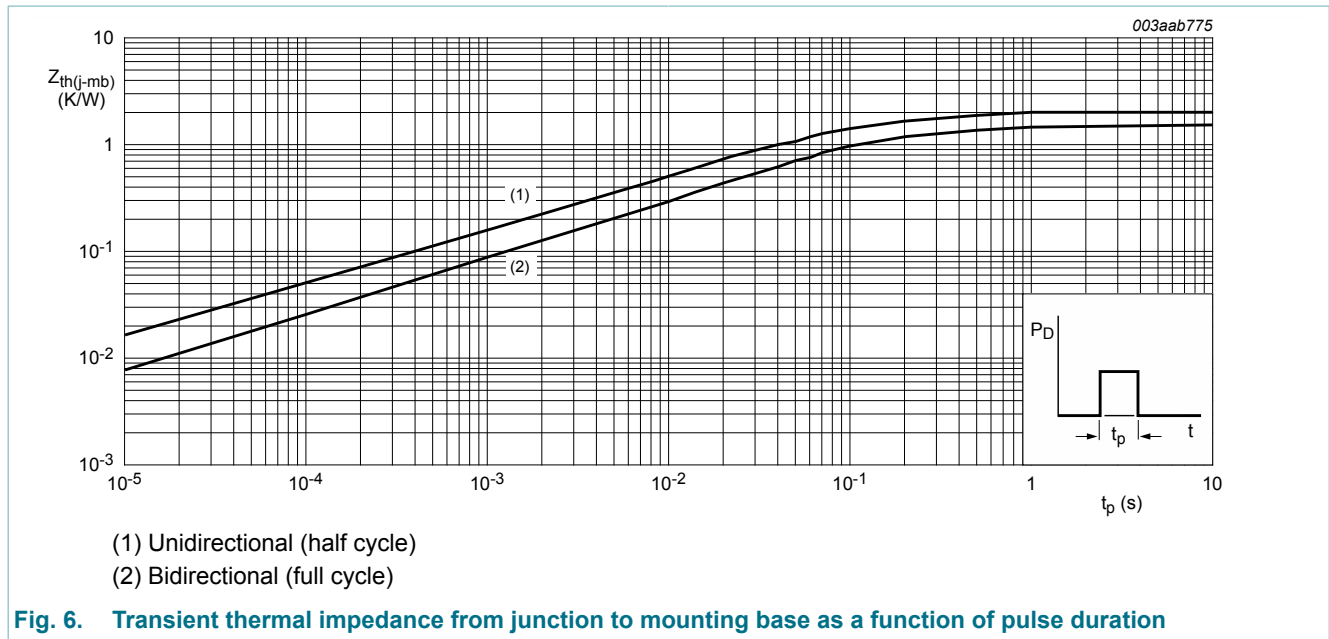


Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

## 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 | full cycle; Fig. 6 | -   | -   | 1.5 | K/W  |
|                |                                                   | half cycle; Fig. 6 | -   | -   | 2   | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air        | -   | 60  | -   | K/W  |

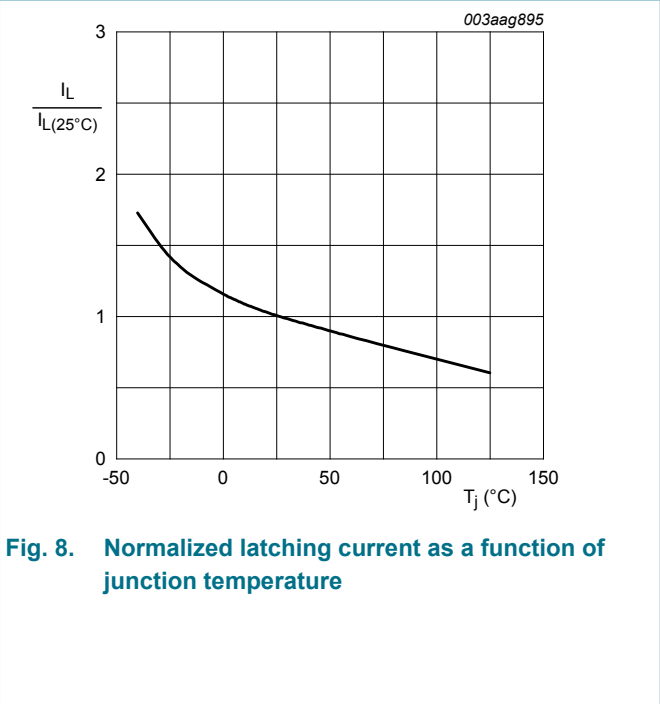
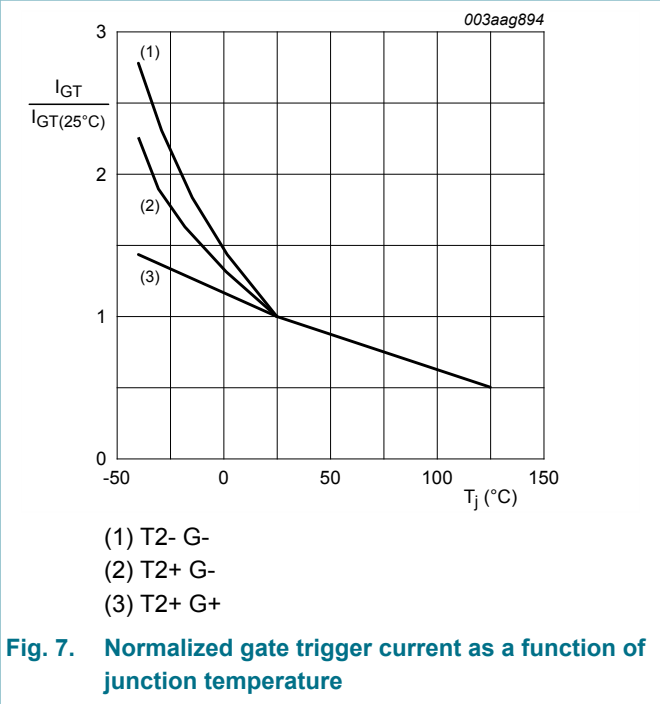


## 6. Characteristics

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>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a> | 2    | -   | 35  | 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    | -   | 35  | 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    | -   | 35  | 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> | -    | -   | 50  | 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> | -    | -   | 60  | 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> | -    | -   | 50  | mA   |
| $I_H$                         | holding current      | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                   | -    | -   | 35  | mA   |
| $V_T$                         | on-state voltage     | $I_T = 15\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>                                  | -    | 1.3 | 1.6 | V    |
| $V_{GT}$                      | gate trigger voltage | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 11</a>      | 0.25 | 0.4 | -   | V    |
|                               |                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 11</a>        | -    | 0.8 | 1.5 | V    |
| $I_D$                         | off-state current    | $V_D = 800\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$                                                          | -    | 0.1 | 0.5 | mA   |

| Symbol                  | Parameter                             | Conditions                                                                                                                                                                     | Min | Typ | Max | Unit                   |
|-------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------------------------|
| Dynamic characteristics |                                       |                                                                                                                                                                                |     |     |     |                        |
| $dV_D/dt$               | 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                                      | 500 | -   | -   | $\text{V}/\mu\text{s}$ |
| $dI_{com}/dt$           | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 20  | -   | -   | $\text{A}/\text{ms}$   |



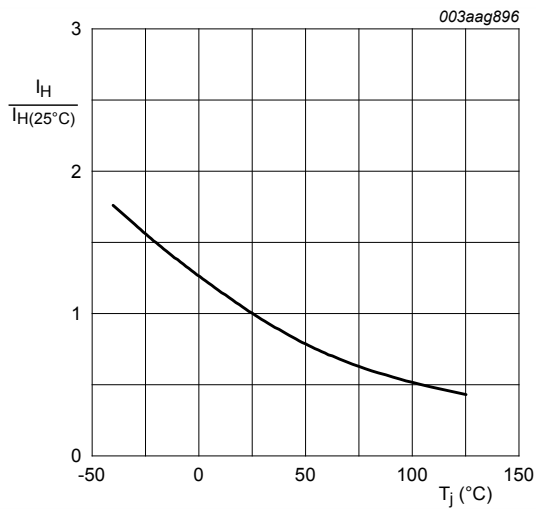
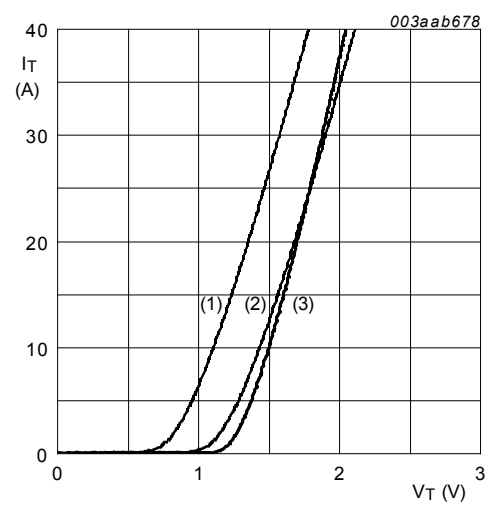


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.164\text{ V}; R_s = 0.027\ \Omega$   
(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

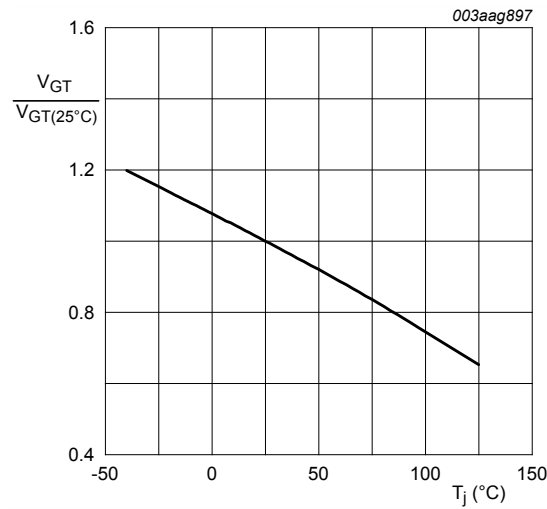


Fig. 11. Normalized gate trigger voltage as a function of junction temperature





## 8. Legal information

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| Document status [1][2]         | Product status [3] | 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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