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# BTA410Y-800CT

3Q Hi-Com Triac

9 June 2014

Product data sheet

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT78D (TO-220AB) internally insulated plastic package. This "series CT" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ }^{\circ}\text{C}$ ) without the aid of a snubber. It is used in applications where "high junction operating temperature capability" is required.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by  $dV/dt$
- High  $T_{j(max)}$
- Isolated mounting base with 2500 V (RMS) isolation
- Less sensitive gate for high noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

## 3. Applications

- Electronic thermostats (heating and cooling)
- Motor controls
- 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    |  | -   | -   | 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                  |
| $T_j$        | junction temperature                 |  | -   | -   | 150 | $^{\circ}\text{C}$ |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_{mb} \leq 120\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | -   | -   | 10  | A                  |



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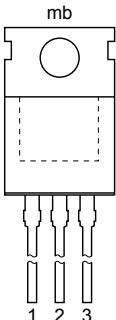
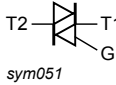
## BTA410Y-800CT

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| 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   | -   | 35  | 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   | -   | 35  | 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   | -   | 35  | mA   |
| Dynamic characteristics |                                       |  |  |     |     |     |      |
| dV <sub>D</sub> /dt     | rate of rise of off-state voltage     | V <sub>DM</sub> = 536 V; T <sub>j</sub> = 150 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit                  |  | 500 | -   | -   | V/μs |
| dI <sub>com</sub> /dt   | rate of change of commutating current | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 10 A; dV <sub>com</sub> /dt = 20 V/μs; (snubberless condition); gate open circuit |  | 8   | -   | -   | A/ms |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description             | Simplified outline   | Graphic symbol  |
|-----|--------|-------------------------|--|---|
| 1   | T1     | main terminal 1         |  <p>TO-220AB (SOT78D)</p> |  |
| 2   | T2     | main terminal 2         |  |   |
| 3   | G      | gate                    |  |   |
| mb  | n.c.   | mounting base; isolated |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number   | Package  |   |         |
|---------------|----------|---|---------|
|               | Name     | Description   | Version |
| BTA410Y-800CT | TO-220AB | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 | SOT78D  |

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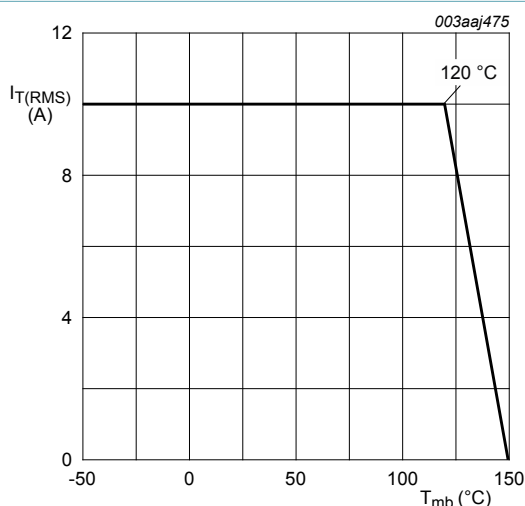
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### 7. Limiting values

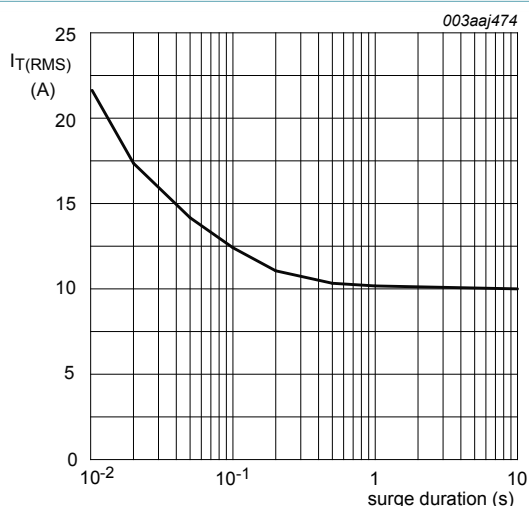
**Table 4. Limiting values**

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; $T_{\text{mb}} \leq 120\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>         | -   | 10  | 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> | -   | 100 | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$   | -   | 110 | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; sine-wave pulse   | -   | 50  | $\text{A}^2\text{s}$   |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 20\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dI_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$  | -   | 100 | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | 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                 |   | -   | 150 | $^{\circ}\text{C}$     |



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



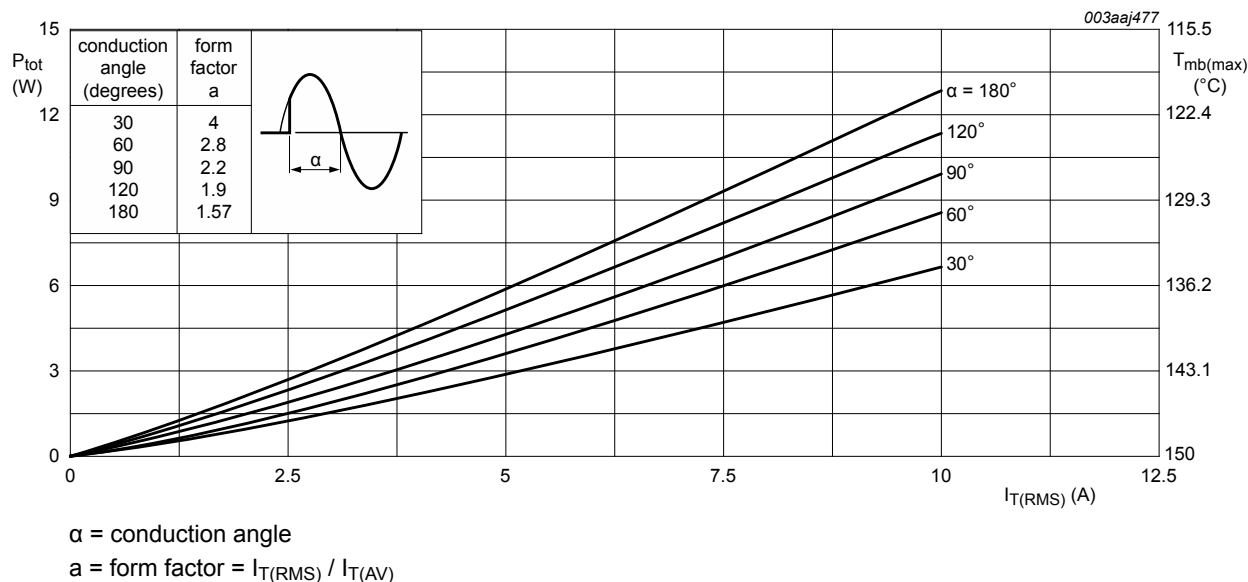
$f = 50\text{ Hz}$ ;  $T_{\text{mb}} = 120\text{ }^{\circ}\text{C}$

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

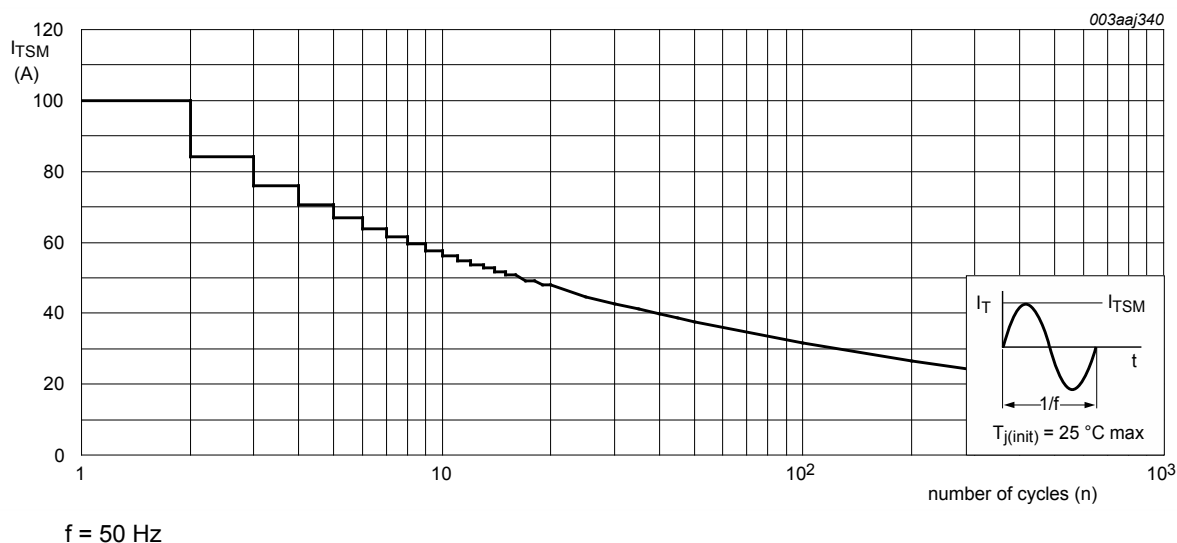
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**Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values**

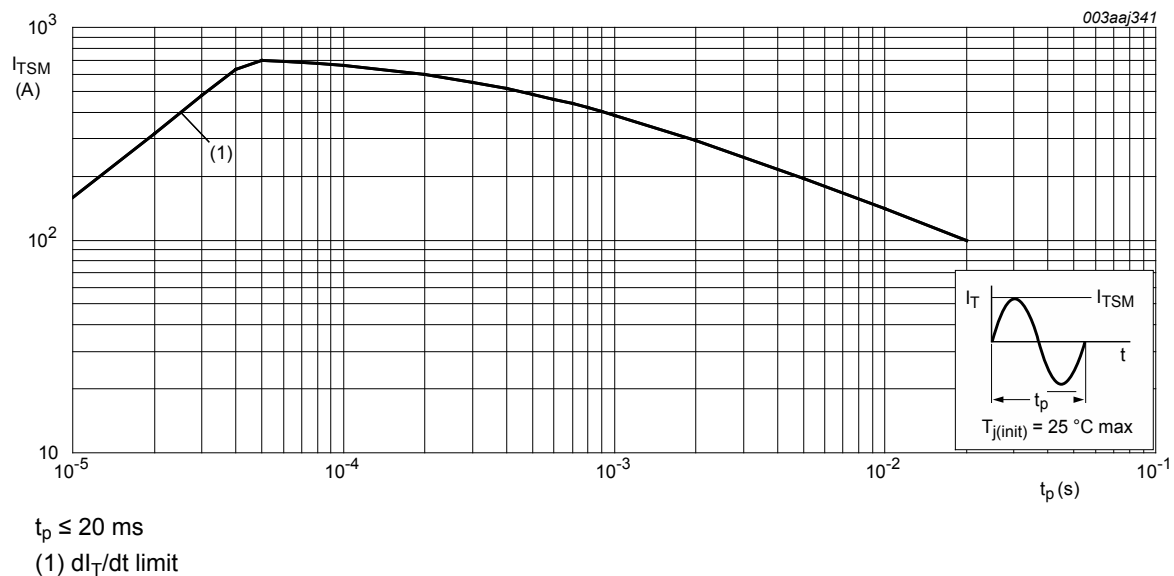


**Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**

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**Fig. 5. Non-repetitive peak on-state current as a function of pulse duration; maximum values**

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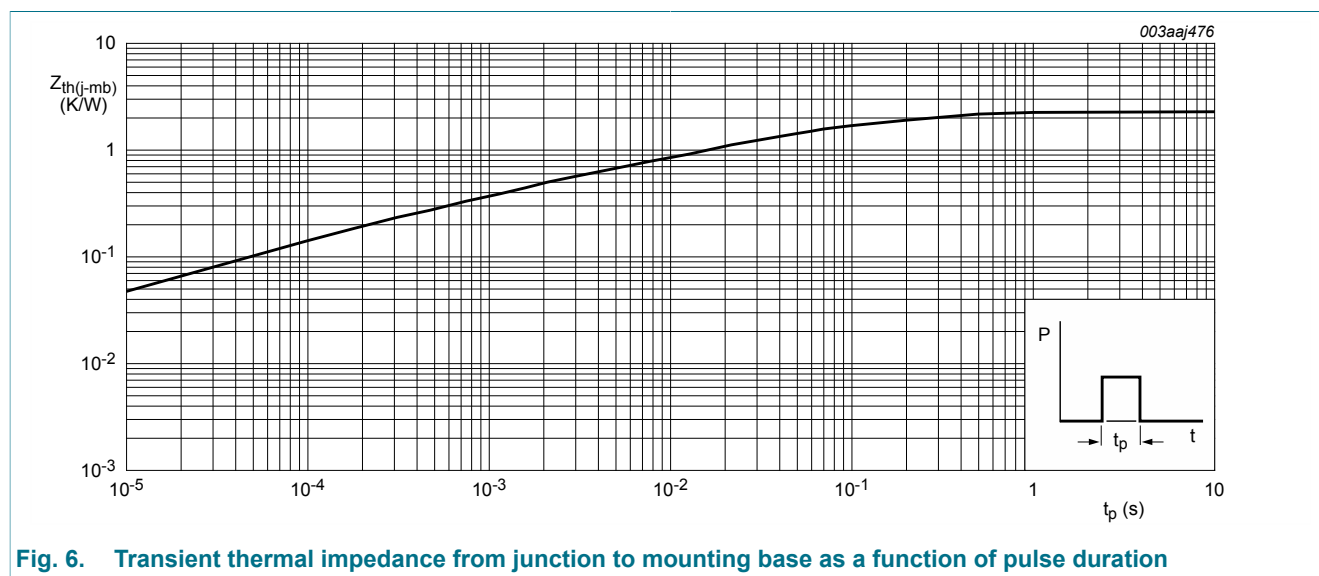
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### 8. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol         | Parameter   | Conditions         | Min | Typ | Max | Unit |
|----------------|---|--------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | full cycle; Fig. 6 | -   | -   | 2.3 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air        | -   | 60  | -   | K/W  |



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

### 9. Isolation characteristics

**Table 6. Isolation characteristics**

| Symbol          | Parameter             | Conditions  | Min | Typ | Max  | Unit |
|-----------------|-----------------------|---|-----|-----|------|------|
| $V_{isol(RMS)}$ | RMS isolation voltage | from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_{mb} = 25\text{ }^{\circ}\text{C}$ | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | from main terminal 2 to external heatsink; $f = 1\text{ MHz}$ ; $T_{mb} = 25\text{ }^{\circ}\text{C}$   | -   | 10  | -    | pF   |

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## 10. Characteristics

Table 7. Characteristics

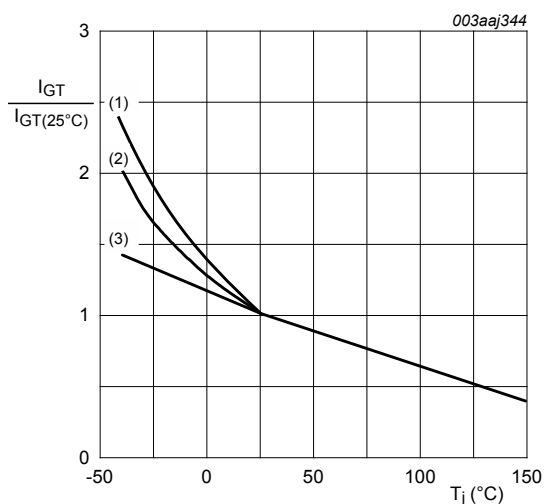
| Symbol                         | Parameter                             | Conditions   | Min  | Typ | Max | Unit             |
|--------------------------------|---------------------------------------|--|------|-----|-----|------------------|
| <b>Static characteristics</b>  |                                       |  |      |     |     |                  |
| $I_{GT}$                       | 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    | -   | 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                  | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>   | -    | 0.7 | 1   | V                |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>   | 0.25 | 0.4 | -   | V                |
| $I_D$                          | off-state current                     | $V_D = 800\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$   | -    | 0.4 | 2   | mA               |
| <b>Dynamic characteristics</b> |                                       |  |      |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit                                      | 500  | -   | -   | V/ $\mu\text{s}$ |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 8    | -   | -   | A/ms             |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit                          | 13   | -   | -   | A/ms             |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit                           | 20   | -   | -   | A/ms             |



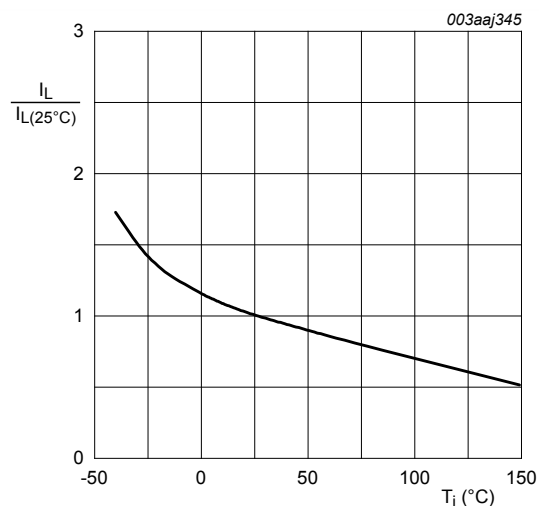
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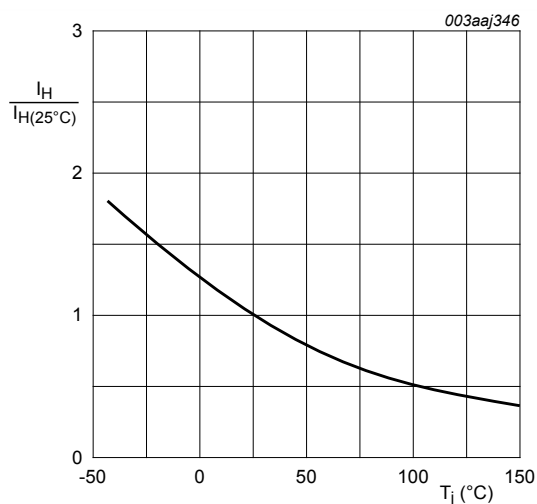
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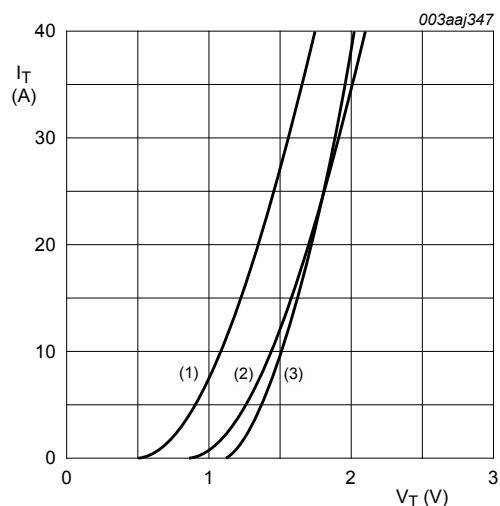
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



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



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



$V_o = 1.142 \text{ V}$ ;  $R_s = 0.027 \Omega$

(1)  $T_J = 150^{\circ}\text{C}$ ; typical values

(2)  $T_J = 150^{\circ}\text{C}$ ; 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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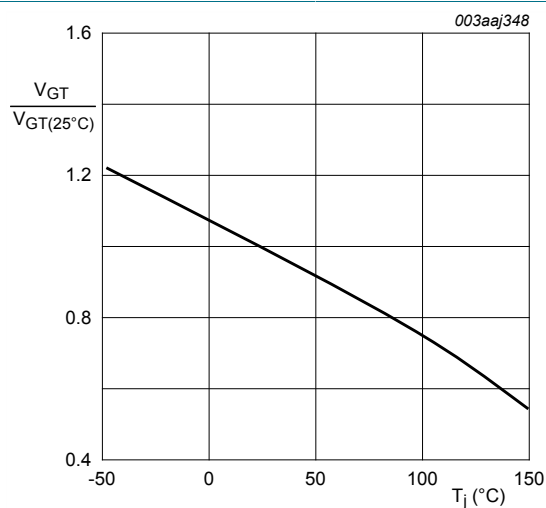


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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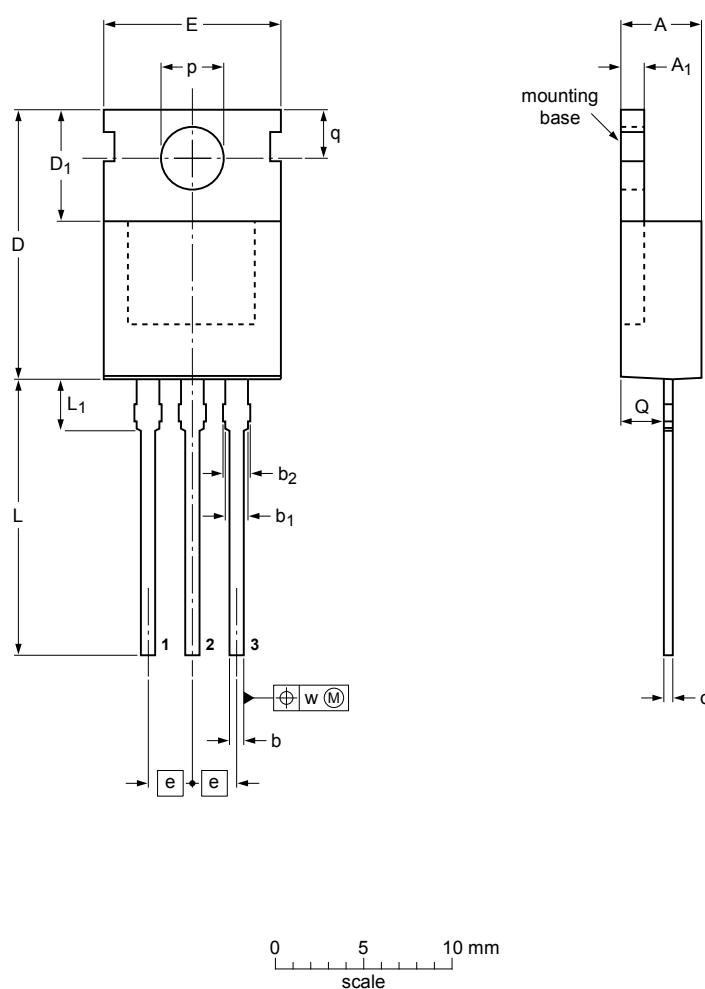
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### 11. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220

SOT78D



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub> | b          | b <sub>1</sub> | b <sub>2</sub> | c          | D            | D <sub>1</sub><br>ref | E           | e    | L            | L <sub>1</sub><br>ref | p          | Q          | q          | w   |
|------|------------|----------------|------------|----------------|----------------|------------|--------------|-----------------------|-------------|------|--------------|-----------------------|------------|------------|------------|-----|
| mm   | 4.7<br>4.3 | 1.40<br>1.25   | 0.9<br>0.6 | 1.4<br>1.1     | 1.72<br>1.32   | 0.6<br>0.4 | 16.0<br>15.2 | 6.5                   | 10.3<br>9.7 | 2.54 | 14.0<br>12.8 | 3.0                   | 3.7<br>3.5 | 2.6<br>2.2 | 3.0<br>2.7 | 0.2 |

| OUTLINE<br>VERSION | REFERENCES |        |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|--------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC  | JEITA |  |                        |                      |
| SOT78D             |            | TO-220 |       |  |                        | 07-04-04<br>07-07-10 |

Fig. 12. Package outline TO-220AB (SOT78D)

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## 12. Legal information

### 12.1 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. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| 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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## NXP Semiconductors

## BTA410Y-800CT

3Q Hi-Com Triac

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