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BTA410Y-600BT

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 BT" 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
- Least sensitive gate for highest 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 | | - | - | 600 | V |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ ms}$; Fig. 4; Fig. 5 | - | - | 100 | A |
| T_j | junction temperature | | - | - | 150 | $^{\circ}\text{C}$ |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 120\text{ }^{\circ}\text{C}$; Fig. 1; Fig. 2; Fig. 3 | - | - | 10 | A |



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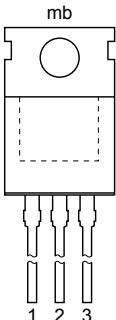
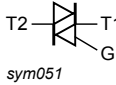
BTA410Y-600BT

3Q Hi-Com Triac

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|-------------------------|---------------------------------------|--|--|------|-----|-----|------|
| Static characteristics | | | | | | | |
| I _{GT} | gate trigger current | V _D = 12 V; I _T = 0.1 A; T2+ G+; T _j = 25 °C; Fig. 7 | | 2 | - | 50 | mA |
| | | V _D = 12 V; I _T = 0.1 A; T2+ G-; T _j = 25 °C; Fig. 7 | | 2 | - | 50 | mA |
| | | V _D = 12 V; I _T = 0.1 A; T2- G-; T _j = 25 °C; Fig. 7 | | 2 | - | 50 | mA |
| Dynamic characteristics | | | | | | | |
| dV _D /dt | rate of rise of off-state voltage | V _{DM} = 402 V; T _j = 150 °C; (V _{DM} = 67% of V _{DRM}); exponential waveform; gate open circuit | | 1000 | - | - | V/μs |
| dI _{com} /dt | rate of change of commutating current | V _D = 400 V; T _j = 150 °C; I _{T(RMS)} = 10 A; dV _{com} /dt = 20 V/μs; (snubberless condition); gate open circuit | | 20 | - | - | 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-600BT | TO-220AB | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 | SOT78D |

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BTA410Y-600BT

3Q Hi-Com 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_{DRM} | repetitive peak off-state voltage | | - | 600 | V |
| $I_{\text{T(RMS)}}$ | RMS on-state current | full sine wave; $T_{\text{mb}} \leq 120\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 10 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | 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 | A^2s |
| di_{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_{GM} | peak gate current | | - | 2 | A |
| P_{GM} | peak gate power | | - | 5 | W |
| $P_{\text{G(AV)}}$ | average gate power | over any 20 ms period | - | 0.5 | W |
| T_{stg} | storage temperature | | -40 | 150 | $^{\circ}\text{C}$ |
| T_{j} | junction temperature | | - | 150 | $^{\circ}\text{C}$ |

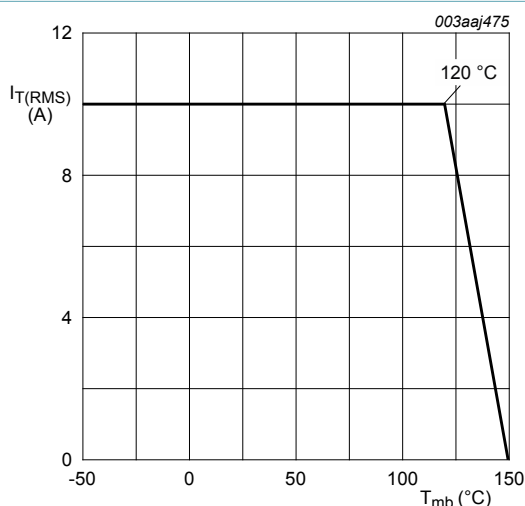
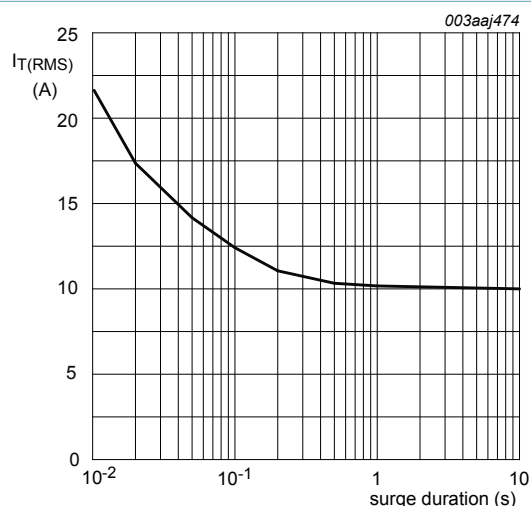


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values



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

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

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3Q Hi-Com Triac

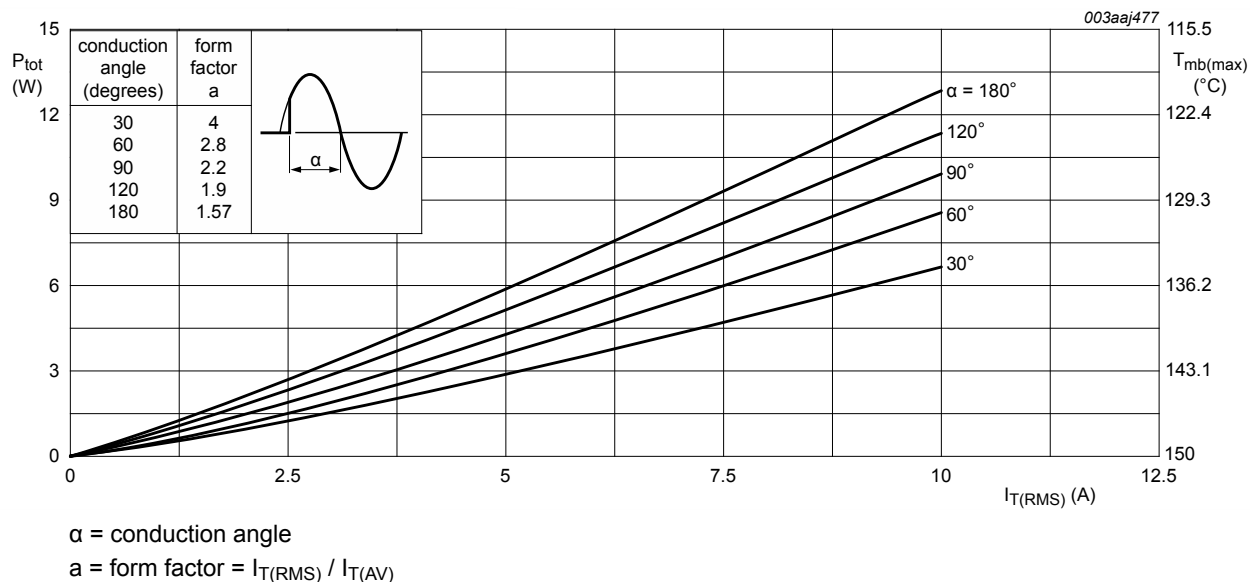


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

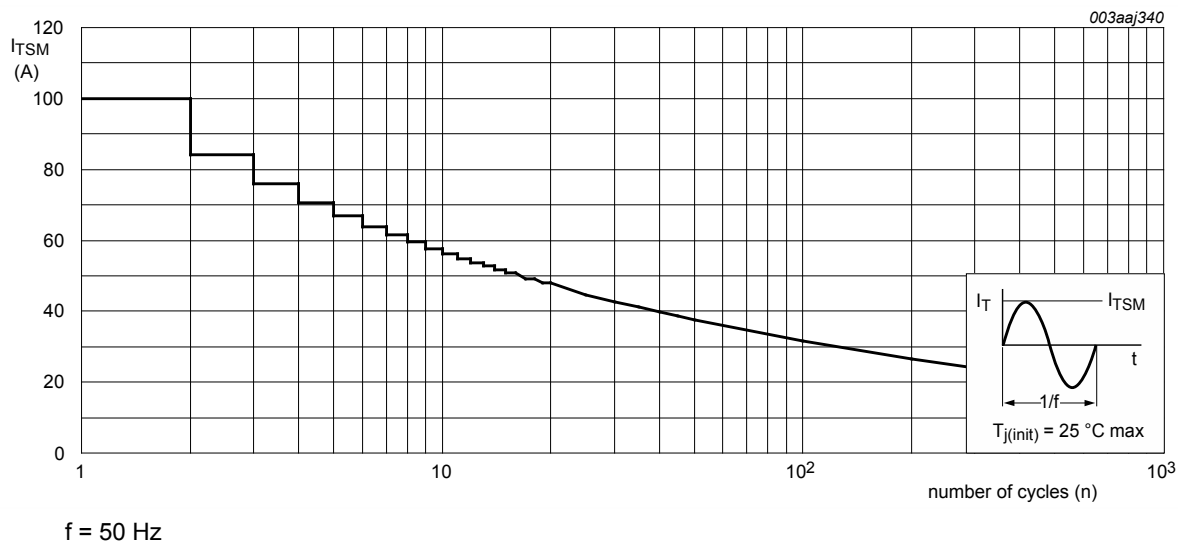


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

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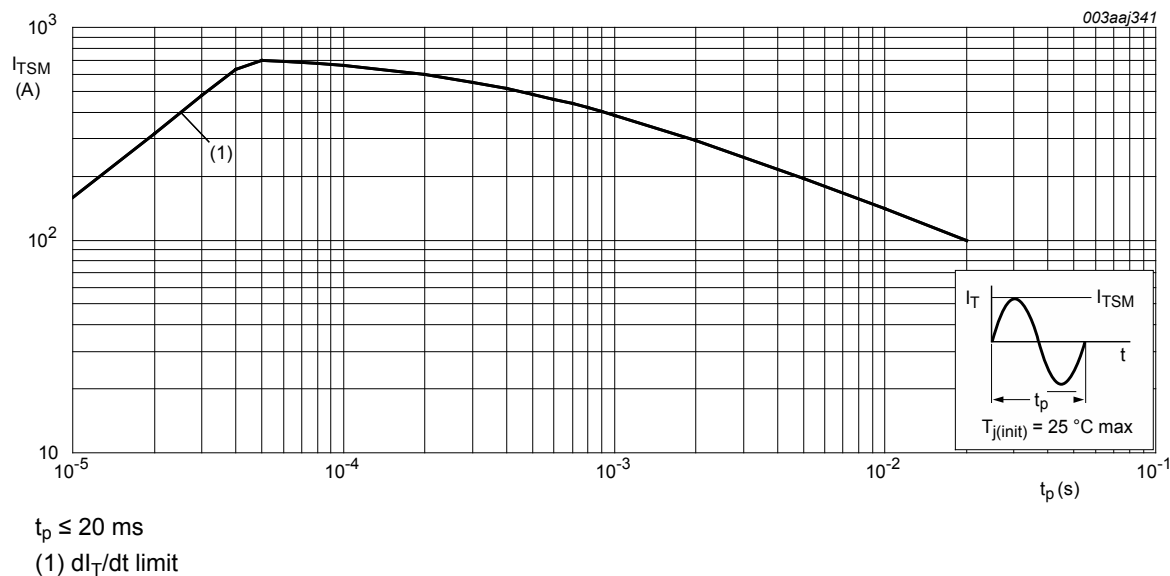


Fig. 5. Non-repetitive peak on-state current as a function of pulse duration; maximum values

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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 |

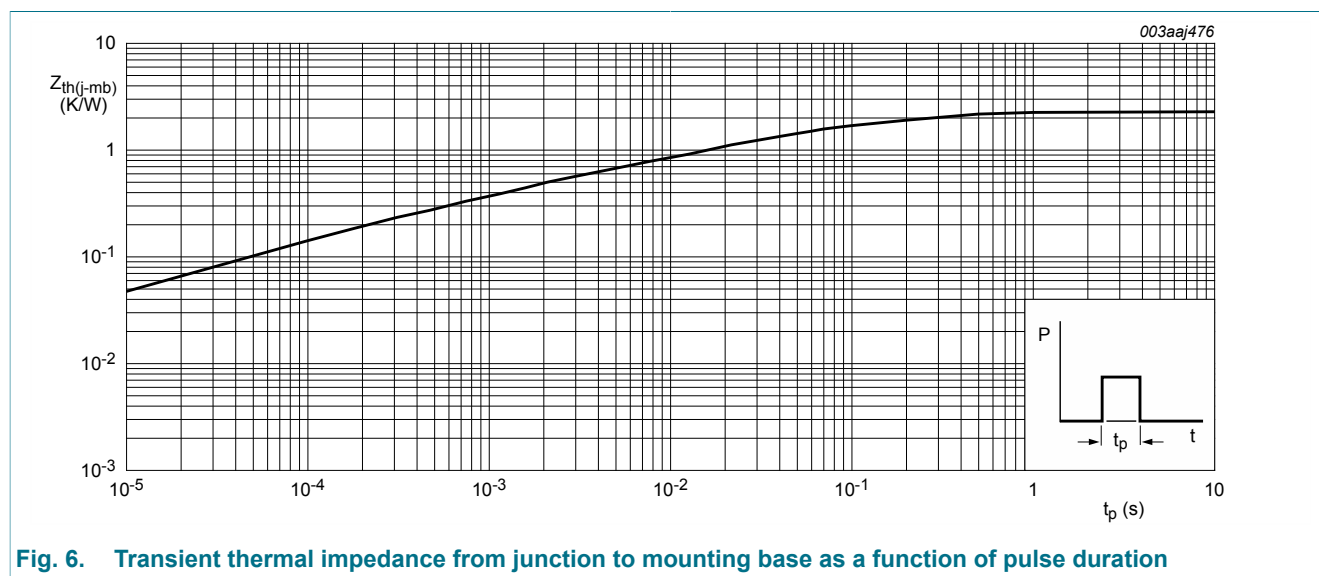


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

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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BTA410Y-600BT

3Q Hi-Com Triac

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|------|-----|-----|------------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 2 | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 2 | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 2 | - | 50 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | - | 60 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | - | 90 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | - | 60 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | - | 60 | mA |
| V_T | on-state voltage | $I_T = 15\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.3 | 1.6 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 11 | - | 0.8 | 1 | V |
| | | $V_D = 400\text{ V}$; $T_j = 150\text{ }^\circ\text{C}$; Fig. 11 | 0.25 | 0.4 | - | V |
| I_D | off-state current | $V_D = 600\text{ V}$; $T_j = 150\text{ }^\circ\text{C}$ | - | 0.4 | 2 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 150\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 1000 | - | - | V/ μs |
| 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 | 20 | - | - | 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 | 28 | - | - | 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 | 45 | - | - | A/ms |

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3Q Hi-Com Triac

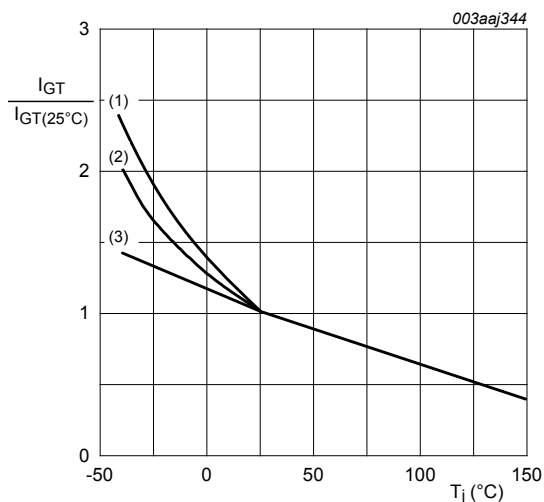


Fig. 7. Normalized gate trigger current as a function of junction temperature

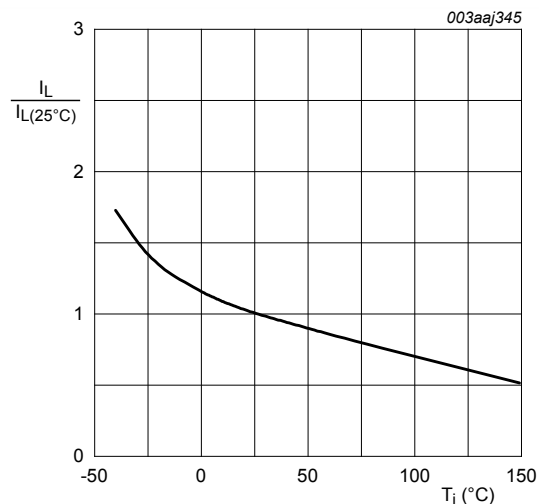


Fig. 8. Normalized latching current as a function of junction temperature

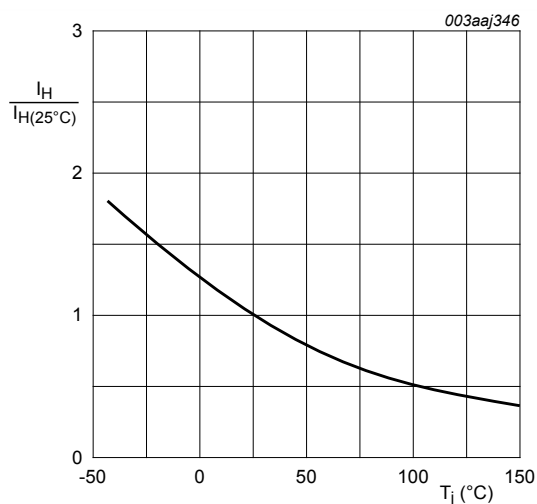
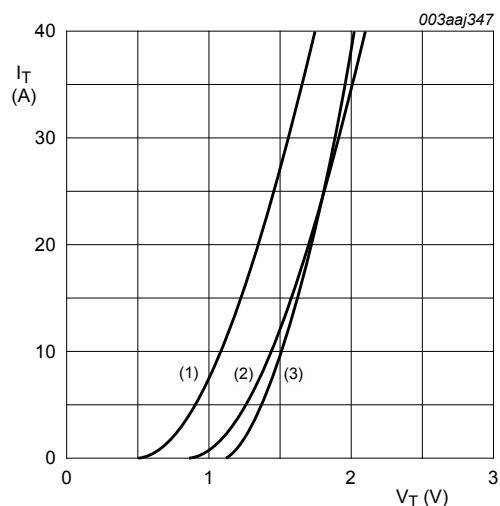


Fig. 9. Normalized holding current as a function of junction temperature



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

(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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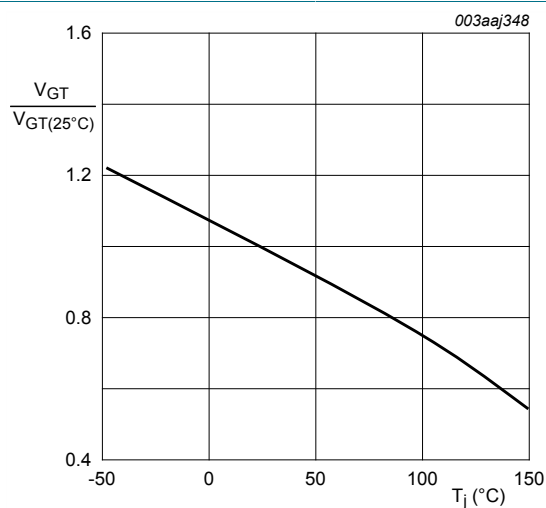


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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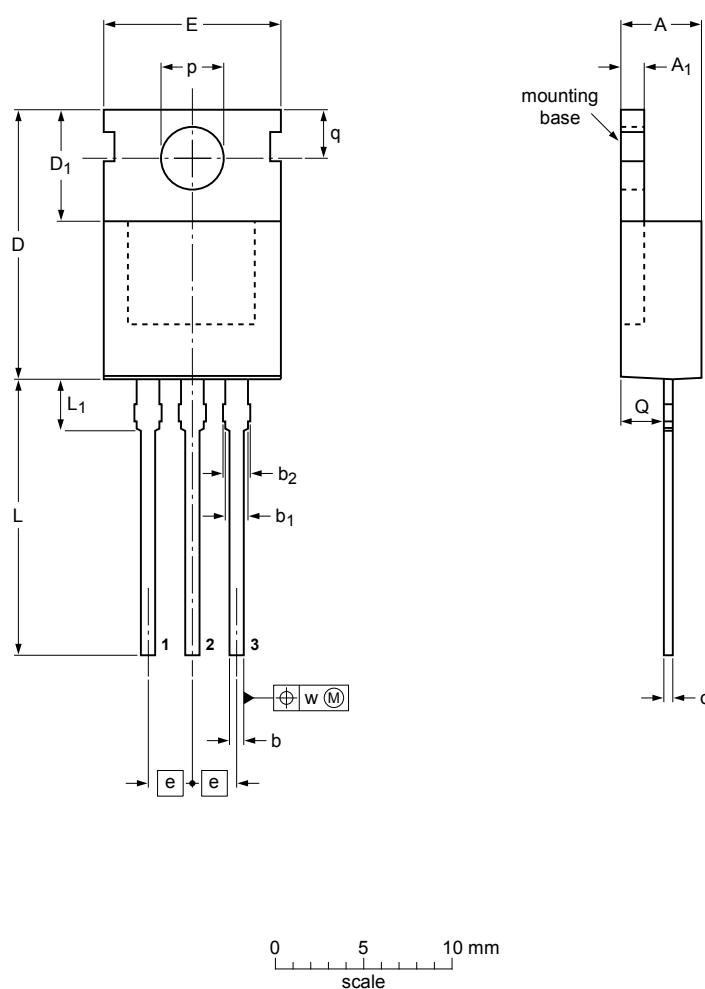
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11. Package outline

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

SOT78D



DIMENSIONS (mm are the original dimensions)

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

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

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

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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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- [2] The term 'short data sheet' is explained in section "Definitions".
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BTA410Y-600BT

3Q Hi-Com Triac

13. 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 | Isolation characteristics | 6 |
| 10 | Characteristics | 7 |
| 11 | Package outline | 10 |
| 12 | Legal information | 11 |
| 12.1 | Data sheet status | 11 |
| 12.2 | Definitions | 11 |
| 12.3 | Disclaimers | 11 |
| 12.4 | Trademarks | 12 |

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