

BTA412Y series B and C

12 A three-quadrant triacs, insulated, high commutation, high temperature

Rev. 02 — 11 March 2008

Product data sheet

1. Product profile

1.1 General description

Passivated, new generation, high commutation triacs in an internally insulated TO-220 plastic package.

1.2 Features

- Very high commutation performance
- Isolated mounting base
- High operating junction temperature
- High immunity to dV/dt
- 2500 V RMS isolation voltage

1.3 Applications

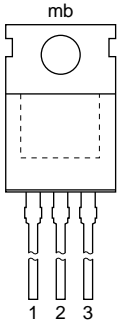

- Heating and cooking appliances
- High power motor control e.g. vacuum cleaners
- Solid state relays
- Non-linear rectifier-fed motor loads
- Electronic thermostats for heating and cooling loads

1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BTA412Y-600B/C)
- $V_{DRM} \leq 800$ V (BTA412Y-800B/C)
- $I_{T(RMS)} \leq 12$ A
- $I_{GT} \leq 50$ mA (BTA412Y series B)
- $I_{GT} \leq 35$ mA (BTA412Y series C)
- $I_{TSM} \leq 140$ A ($t = 20$ ms)

2. Pinning information

Table 1. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 | main terminal 1 (T1) |  |  |
| 2 | main terminal 2 (T2) | | |
| 3 | gate (G) | | |
| mb | mounting base; isolated | | |

SOT78D (TO-220)

3. Ordering information

Table 2. Ordering information

| Type number | Package | | Version |
|--------------|---------|-----------------------------------------------------------------------------------------|---------|
| | Name | Description | |
| BTA412Y-600B | TO-220 | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 | SOT78D |
| BTA412Y-600C | | | |
| BTA412Y-800B | | | |
| BTA412Y-800C | | | |

4. Limiting values

Table 3. Limiting values

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

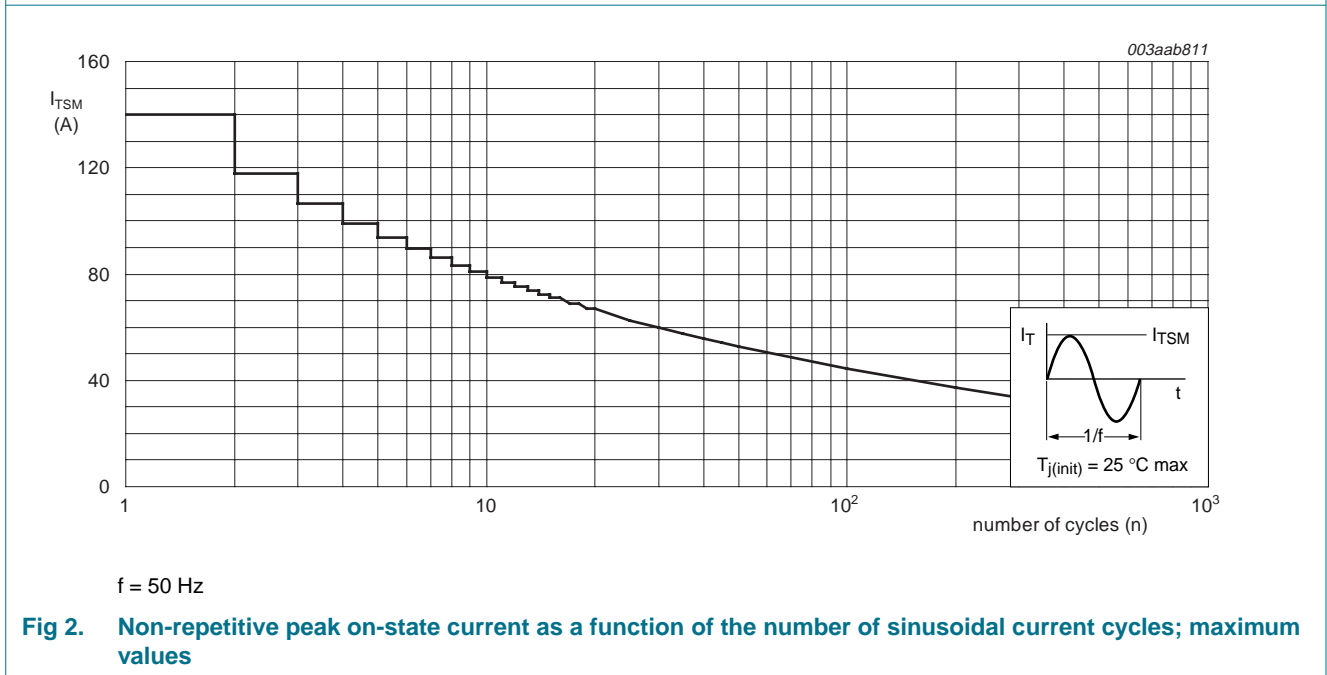
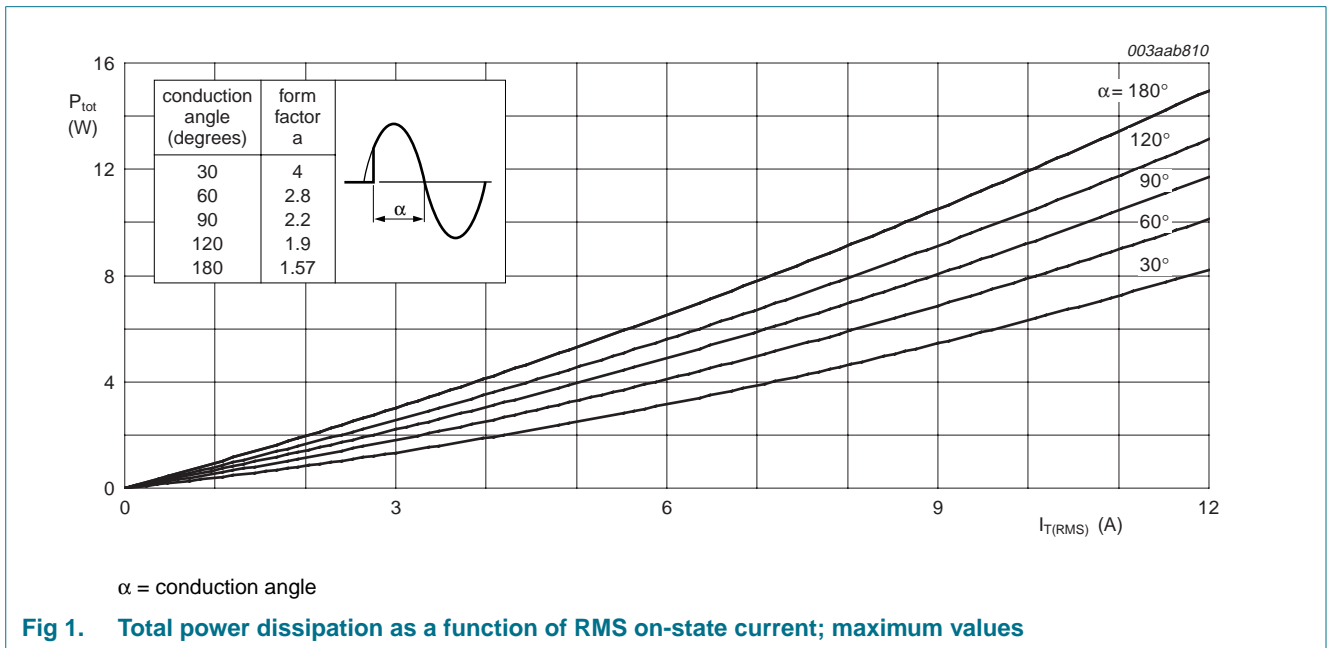
| Symbol | Parameter | Conditions | Min | Max | Unit |
|--------------|--------------------------------------|---------------------------------------------------------------------------------------------------------|-----|-----|------------------|
| V_{DRM} | repetitive peak off-state voltage | BTA412Y-600B; BTA412Y-600C | [1] | 600 | V |
| | | BTA412Y-800B; BTA412Y-800C | - | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 116\text{ °C}$; see Figure 4 and 5 | - | 12 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_j = 25\text{ °C}$ prior to surge; see Figure 2 and 3 | - | - | - |
| | | $t = 20\text{ ms}$ | - | 140 | A |
| | | $t = 16.7\text{ ms}$ | - | 153 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$ | - | 98 | A ² s |
| dl_T/dt | rate of rise of on-state current | $I_{TM} = 20\text{ A}$; $I_G = 0.2\text{ A}$; $dl_G/dt = 0.2\text{ A}/\mu\text{s}$ | - | 100 | A/ μs |
| I_{GM} | peak gate current | | - | 4 | A |
| P_{GM} | peak gate power | | - | 5 | W |

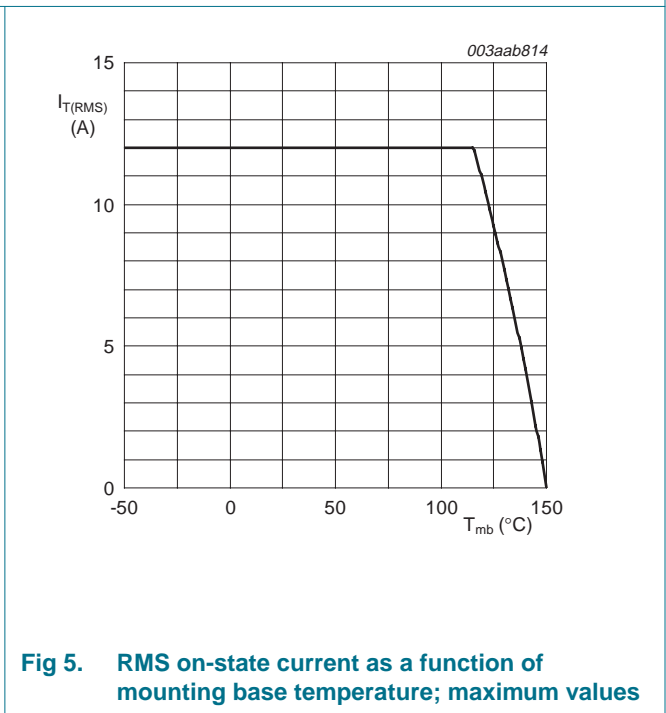
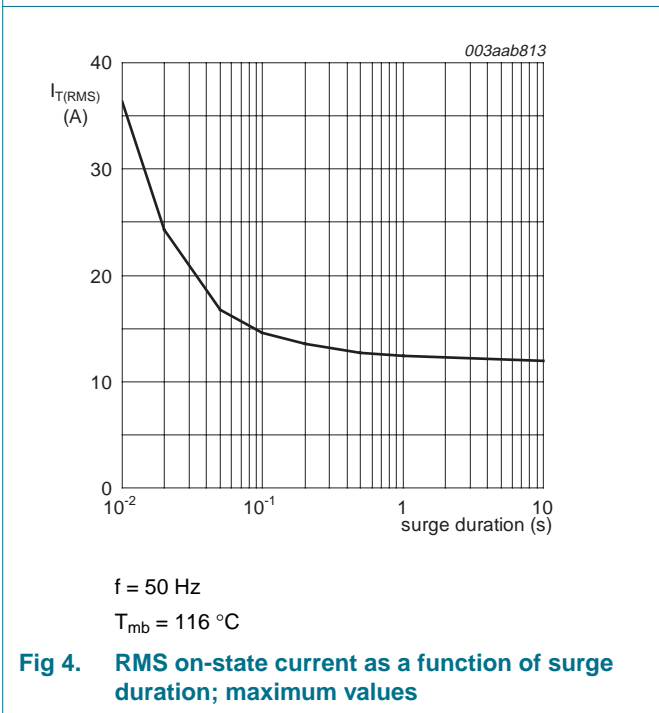
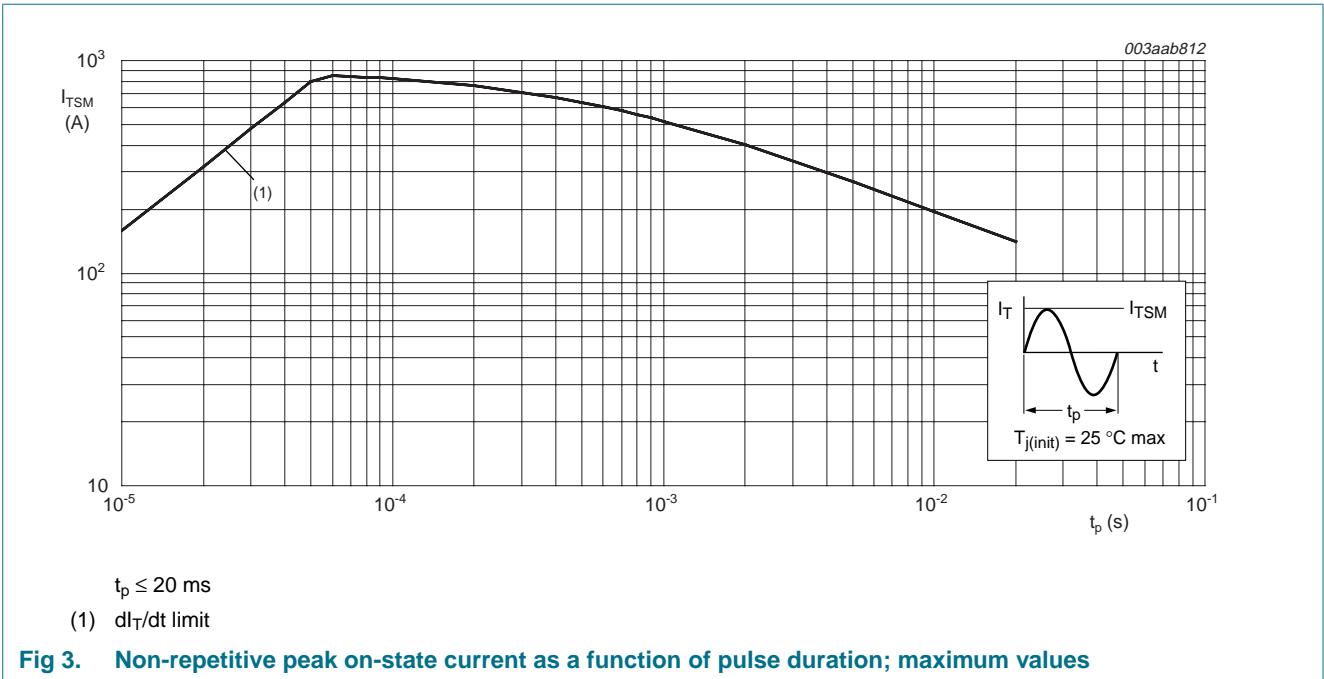
Table 3. Limiting values ...continued

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-------------|----------------------|-----------------------|-----|------|------|
| $P_{G(AV)}$ | average gate power | over any 20 ms period | - | 1 | W |
| T_{stg} | storage temperature | | -40 | +150 | °C |
| T_j | junction temperature | | - | 150 | °C |

[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 15 A/μs.





5. Thermal characteristics

Table 4. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---------------------------------------------------|------------------------------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | full cycle; see Figure 6 | - | - | 2.1 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 60 | - | K/W |

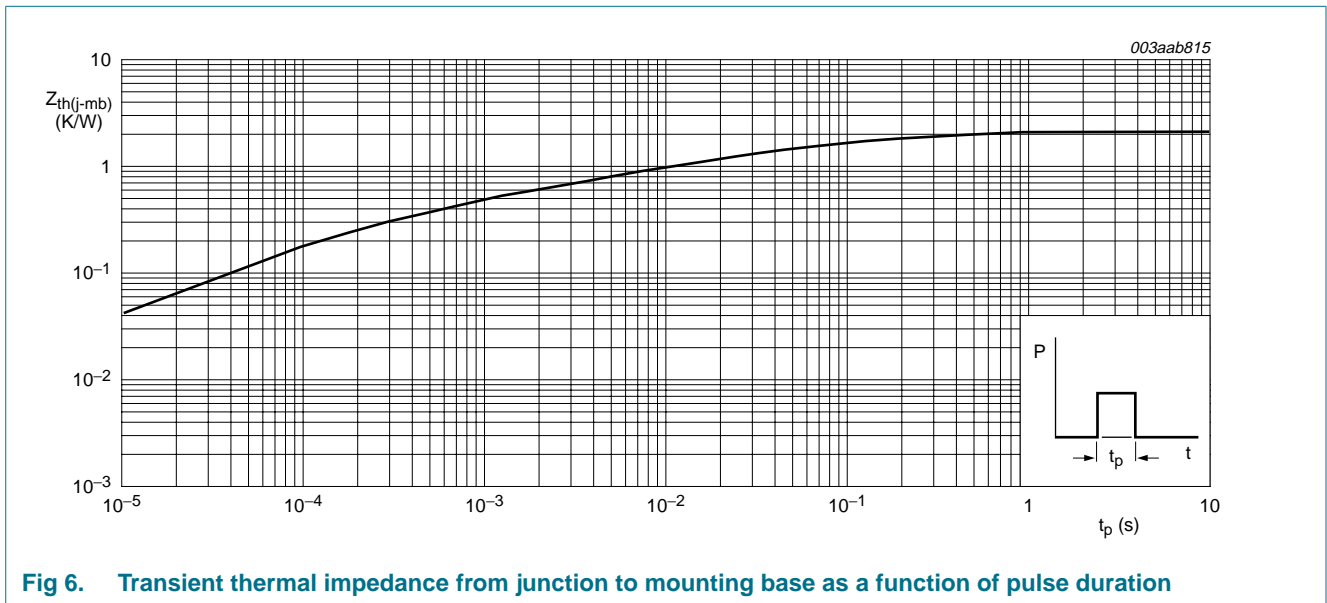


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Isolation characteristics

Table 5. Isolation limiting values and characteristics

$T_h = 25\text{ }^\circ\text{C}$ unless otherwise specified.

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

7. Static characteristics

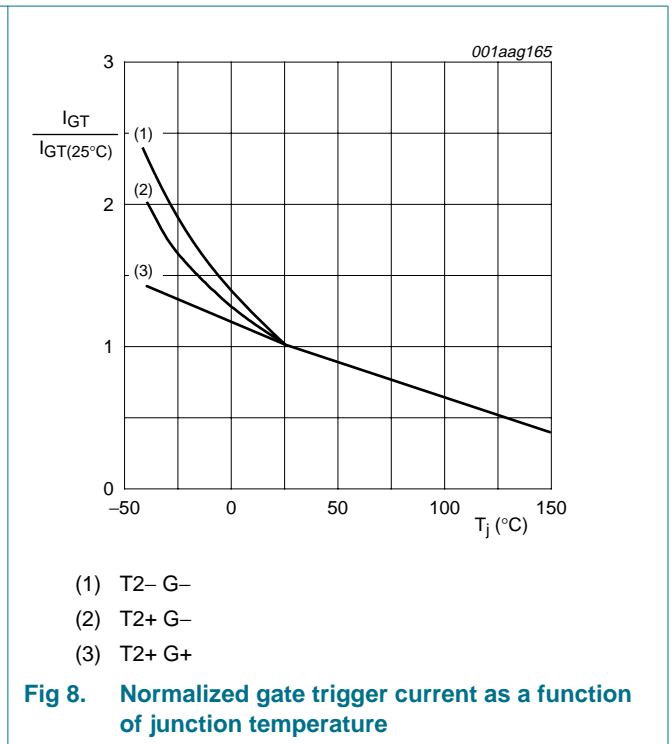
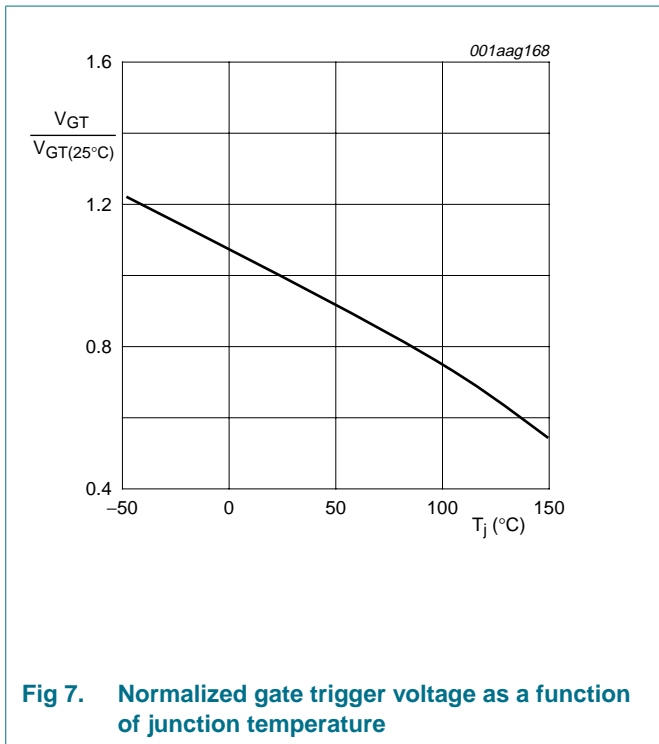
Table 6. Static characteristics
T_j = 25 °C unless otherwise specified.

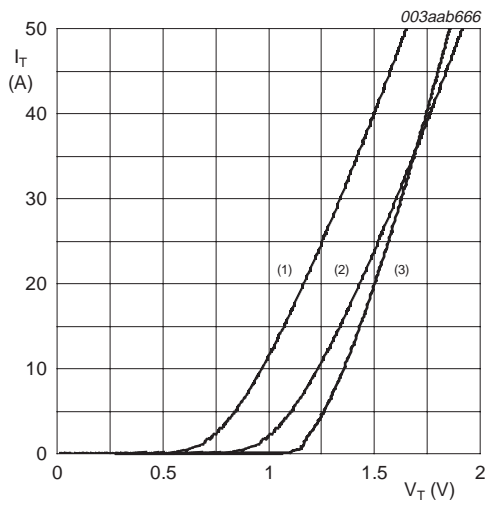
| Symbol | Parameter | Conditions | BTA412Y-600B BTA412Y-800B | | | BTA412Y-600C BTA412Y-800C | | | Unit |
|-----------------|----------------------|------------------------------------------------------------------------------|------------------------------|-----|-----|------------------------------|-----|-----|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| I _{GT} | gate trigger current | V _D = 12 V; I _T = 0.1 A; see Figure 8 | | | | | | | |
| | | T2+ G+ | 2 | - | 50 | 2 | - | 35 | mA |
| | | T2+ G- | 2 | - | 50 | 2 | - | 35 | mA |
| I _L | latching current | V _D = 12 V; I _G = 0.1 A; see Figure 10 | | | | | | | |
| | | T2+ G+ | - | - | 60 | - | - | 50 | mA |
| | | T2+ G- | - | - | 90 | - | - | 60 | mA |
| I _H | holding current | V _D = 12 V; I _G = 0.1 A; see Figure 11 | - | - | 60 | - | - | 35 | mA |
| | | T2- G- | - | - | 60 | - | - | 50 | mA |
| V _T | on-state voltage | I _T = 18 A; see Figure 9 | - | 1.3 | 1.5 | - | 1.3 | 1.5 | V |
| V _{GT} | gate trigger voltage | V _D = 12 V; I _T = 0.1 A; see Figure 7 | - | 0.8 | 1.5 | - | 0.8 | 1.5 | V |
| | | V _D = 400 V; I _T = 0.1 A; T _j = 150 °C | 0.25 | 0.4 | - | 0.25 | 0.4 | - | V |
| I _D | off-state current | V _D = V _{DRM(max)} ; T _j = 125 °C | - | 0.1 | 0.5 | - | 0.1 | 0.5 | mA |
| | | V _D = V _{DRM(max)} ; T _j = 150 °C | - | 0.4 | 2 | - | 0.4 | 2 | mA |

8. Dynamic characteristics

Table 7. Dynamic characteristics

| Symbol | Parameter | Conditions | BTA412Y-600B BTA412Y-800B | | | BTA412Y-600C BTA412Y-800C | | | Unit | |
|-----------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------------------|------|-----|------------------------------|-----|-----|------|------|
| | | | Min | Typ | Max | Min | Typ | Max | | |
| dV _D /dt | rate of rise of off-state voltage | V _{DM} = 0.67 × V _{DRM(max)} ; exponential waveform; gate open circuit | | | | | | | | |
| | | | T _j = 125 °C | 1000 | - | - | 500 | - | - | V/μs |
| | | | T _j = 150 °C | 600 | - | - | 300 | - | - | V/μs |
| dl _{com} /dt | rate of change of commutating current | V _{DM} = 400 V; I _{T(RMS)} = 12 A; without snubber; gate open circuit | | | | | | | | |
| | | | T _j = 125 °C | 20 | - | - | 15 | - | - | A/ms |
| | | | T _j = 150 °C | 8 | - | - | 6 | - | - | A/ms |
| t _{gt} | gate-controlled turn-on time | I _{TM} = 20 A; V _D = V _{DRM(max)} ; I _G = 0.1 A; dl _G /dt = 5 A/μs | - | 2 | - | - | 2 | - | μs | |





$V_o = 1.024 \text{ V}$
 $R_s = 0.021 \text{ } \Omega$
 (1) $T_j = 150 \text{ } ^\circ\text{C}$; typical values
 (2) $T_j = 150 \text{ } ^\circ\text{C}$; maximum values
 (3) $T_j = 25 \text{ } ^\circ\text{C}$; maximum values

Fig 9. On-state current as a function of on-state voltage

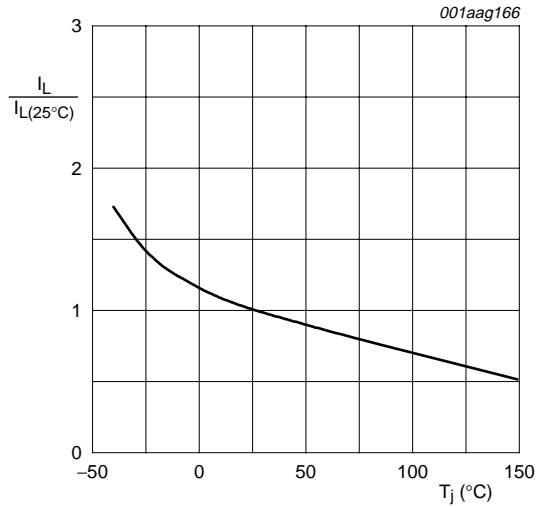


Fig 10. Normalized latching current as a function of junction temperature

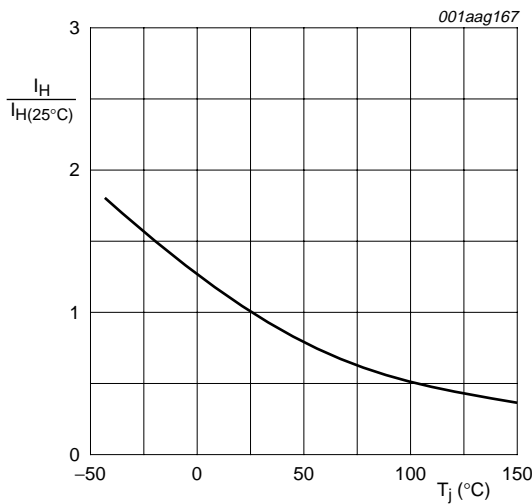


Fig 11. Normalized holding current as a function of junction temperature

9. Package outline

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

SOT78D

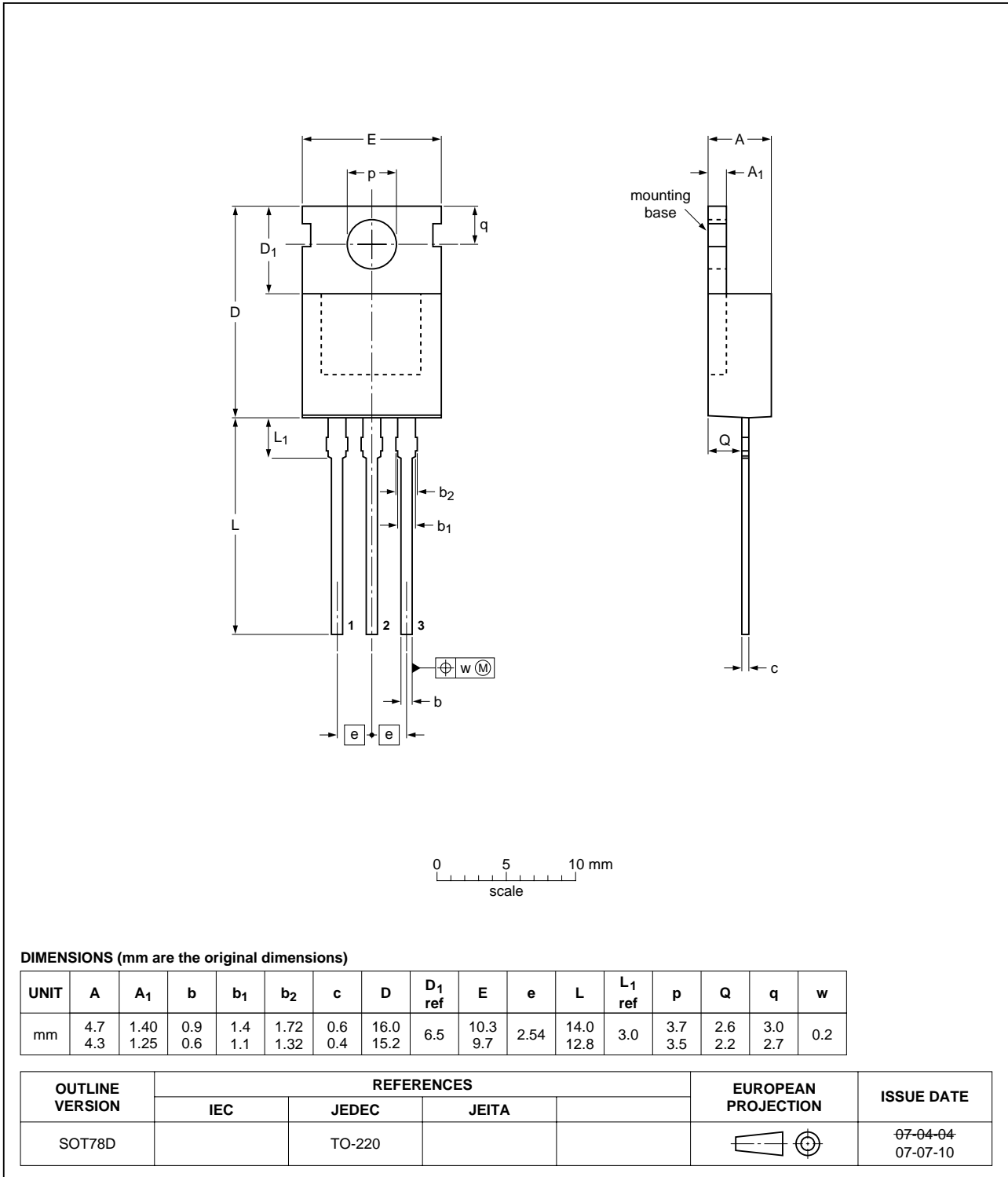


Fig 12. Package outline SOT78D (TO-220)

10. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------------------|
| BTA412Y_SER_B_C_2 | 20080311 | Product data sheet | - | BTA412Y_SER_B_C_1 |
| Modifications: | <ul style="list-style-type: none"> • Table 3 “Limiting values” updated values for I_{GM} and $P_{G(AV)}$ • Table 3 “Limiting values” updated I^2t condition symbol | | | |
| BTA412Y_SER_B_C_1 | 20071003 | Product data sheet | - | - |

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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. |
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[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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