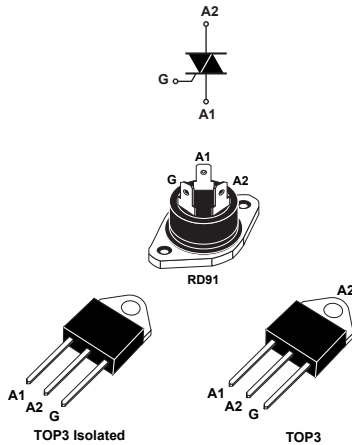


## 800 V and 600 V, 40 A standard Triacs in TOP3 and RD91 package



### Features

- High current Triac
- Low thermal resistance
- BTA40 and BTA41 UL1557 recognized components (file ref: 81734)
- RoHS (2002/95/EC) compliant packages
- UL-94, V0 flammability package resin compliance

### Application

- On/off function in static relays, heating regulation, induction motor starting circuits
- Phase control operations in light dimmers and motor speed controllers

### Description

Available in power packages, the BTA40, BTA41, and BTB41 are suitable for general purpose AC switching.

When used with the properly dimensioned heatsink, the BTA40, BTA41 and BTB41 can enable AC switching systems up to 9 kW. Refer to STMicroelectronics application note [AN533](#) for thermal management of Triacs.

The BTA40, and BTA41 provides an insulated tab (rated at 2500 V rms). They are recognized by UL. Representative samples of these components have been evaluated by UL and meet applicable UL requirements for the UL 1557 standard (file Ref. 81734).

| Product status link   |                       |
|-----------------------|-----------------------|
| <a href="#">BTA40</a> | RD91 package          |
| <a href="#">BTA41</a> | TOP3 isolated package |
| <a href="#">BTB41</a> | TOP3 package          |

| Product summary   |                |
|-------------------|----------------|
| $I_{T(RMS)}$      | 40 A           |
| $V_{DRM}/V_{RRM}$ | 600 V to 800 V |
| $I_{GT}$          | 50 mA          |

# 1 Characteristics

**Table 1. Absolute maximum ratings**

| Symbol             | Parameters                                                                                      |                         |                       | Value                    | Unit             |
|--------------------|-------------------------------------------------------------------------------------------------|-------------------------|-----------------------|--------------------------|------------------|
| $I_{T(RMS)}$       | RMS on-state current (180° conduction angle)                                                    | BTA40, BTA41            | $T_c = 80\text{ °C}$  | 40                       | A                |
|                    |                                                                                                 | BTB41                   | $T_c = 95\text{ °C}$  |                          |                  |
| $I_{TSM}$          | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25 °C)                  | $t_p = 16,7\text{ ms}$  |                       | 420                      | A                |
|                    |                                                                                                 | $t_p = 20\text{ ms}$    |                       | 400                      |                  |
| $I^2t$             | $I^2t$ value for fusing                                                                         | $t_p = 10\text{ ms}$    |                       | 1000                     | A <sup>2</sup> s |
| $di/dt$            | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ | $f = 120\text{ Hz}$     | $T_j = 125\text{ °C}$ | 50                       | A/ $\mu$ s       |
| $V_{DSM}, V_{RSM}$ | Non repetitive surge peak off-state voltage                                                     | $t_p = 20\text{ ms}$    | $T_j = 25\text{ °C}$  | $V_{DRM}, V_{RRM} + 100$ | V                |
| $I_{GM}$           | Peak gate current                                                                               | $t_p = 20\text{ }\mu$ s | $T_j = 125\text{ °C}$ | 8                        | A                |
| $P_{G(AV)}$        | Average gate power dissipation                                                                  | $T_j = 125\text{ °C}$   |                       | 1                        | W                |
| $T_{stg}$          | Storage junction temperature range                                                              |                         |                       |                          | -40 to +150 °C   |
| $T_j$              | Operating junction temperature range                                                            |                         |                       |                          | -40 to +125 °C   |

**Table 2. Electrical characteristics ( $T_j = 25\text{ °C}$ , unless otherwise specified) - standard (4 quadrants)**

| Symbol            | Parameters                                                           | Quadrant           |      | Values    | Unit       |
|-------------------|----------------------------------------------------------------------|--------------------|------|-----------|------------|
| $I_{GT}^{(1)}$    | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                       | I - II - III<br>IV | Max. | 50<br>100 | mA         |
| $V_{GT}$          |                                                                      | I - II - III       | Max. | 1.3       | V          |
| $V_{GD}$          | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$ , $T_j = 125\text{ °C}$ | I - II - III       | Min. | 0.2       | V          |
| $I_H^{(2)}$       | $I_T = 500\text{ mA}$                                                |                    | Max. | 80        | mA         |
| $I_L$             | $I_G = 1.2 I_{GT}$                                                   | I - III - IV       | Max. | 70        | mA         |
|                   |                                                                      | II                 | Max. | 160       |            |
| $dV/dt^{(2)}$     | $V_D = 67\text{ % } V_{DRM}$ gate open, $T_j = 125\text{ °C}$        |                    | Min. | 500       | V/ $\mu$ s |
| $(dV/dt)_c^{(2)}$ | $(di/dt)_c = 20\text{ A/ms}$ , $T_j = 125\text{ °C}$                 |                    | Min. | 10        | V/ $\mu$ s |

1. Minimum  $I_{GT}$  is guaranteed at 5 % of  $I_{GT}$  max.

2. For both polarities of A2 referenced to A1

**Table 3. Static electrical characteristics**

| Symbol            | Test conditions                                   | $T_j$  |      | Value | Unit       |
|-------------------|---------------------------------------------------|--------|------|-------|------------|
| $V_{TM}^{(1)}$    | $I_{TM} = 60\text{ A}$ , $t_p = 380\text{ }\mu$ s | 25 °C  | Max. | 1.55  | V          |
| $V_{TO}^{(1)}$    | threshold on-state voltage                        | 125 °C | Max. | 0.85  | V          |
| $R_D^{(1)}$       | Dynamic resistance                                | 125 °C | Max. | 10    | m $\Omega$ |
| $I_{DRM}/I_{RRM}$ | $V_T = V_{DRM}$ , $V_T = V_{RRM}$                 | 25 °C  | Max. | 5     | $\mu$ A    |
|                   |                                                   | 125 °C |      | 5     | mA         |

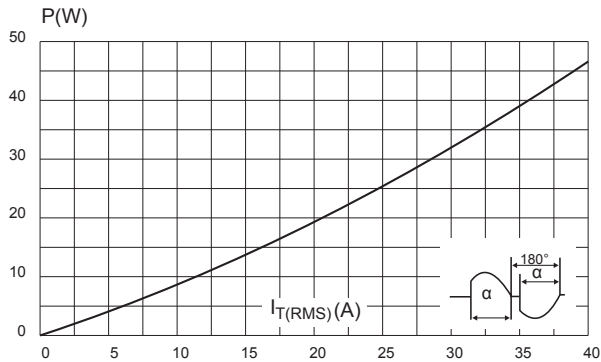
1. For both polarities of A2 referenced to A1

**Table 4. Thermal resistance**

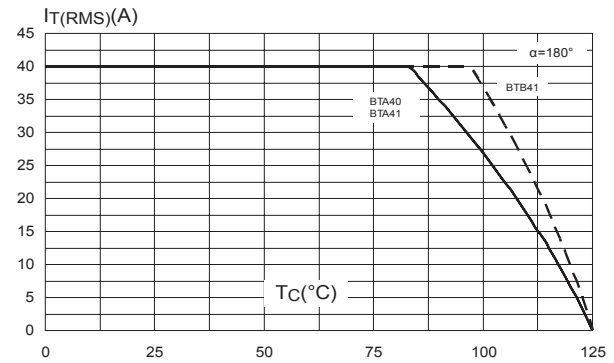
| Symbol        | Parameters            |                       | Value | Unit |
|---------------|-----------------------|-----------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case (AC) | BTA40 / BTA41         | 0.9   | °C/W |
|               |                       | BTB41                 | 0.6   |      |
| $R_{th(j-a)}$ | Junction to ambient   | BTA40 / BTA41 / BTB41 | 50    |      |

## 1.1 Characteristics (curves)

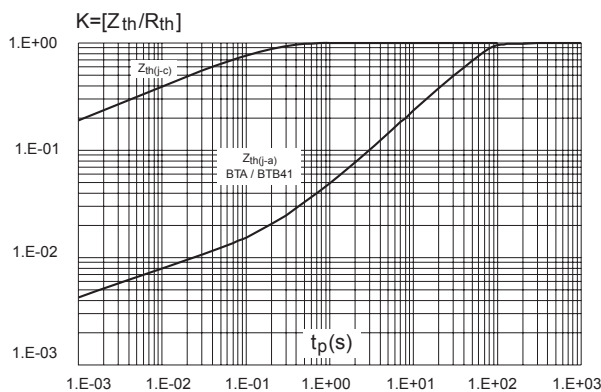
**Figure 1. Maximum power dissipation versus on-state RMS current (full cycle)**



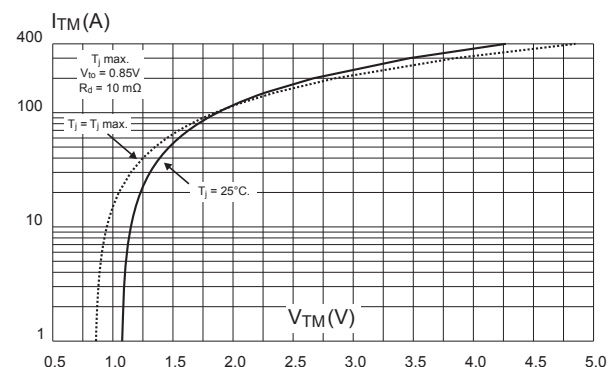
**Figure 2. RMS on-state current versus case temperature (full cycle)**



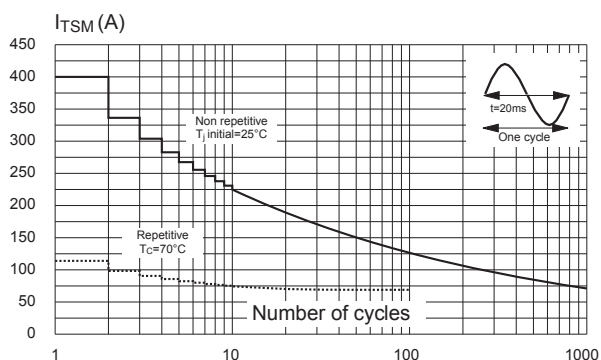
**Figure 3. Relative variation of thermal impedance versus pulse duration**



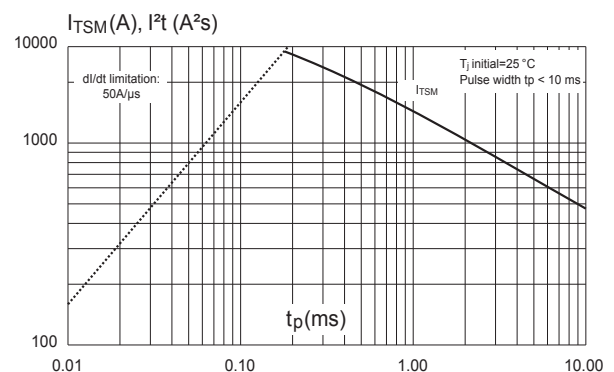
**Figure 4. On-state characteristics (maximum values)**



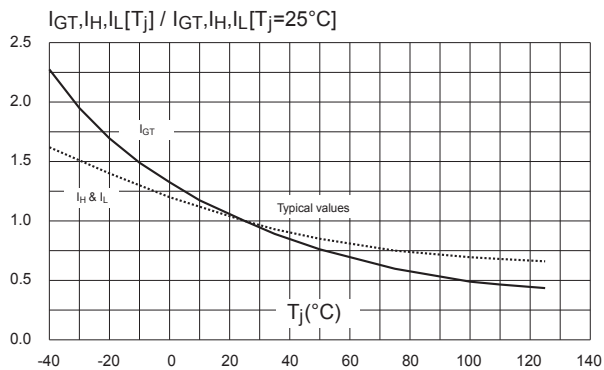
**Figure 5. Surge peak on-state current versus number of cycles**



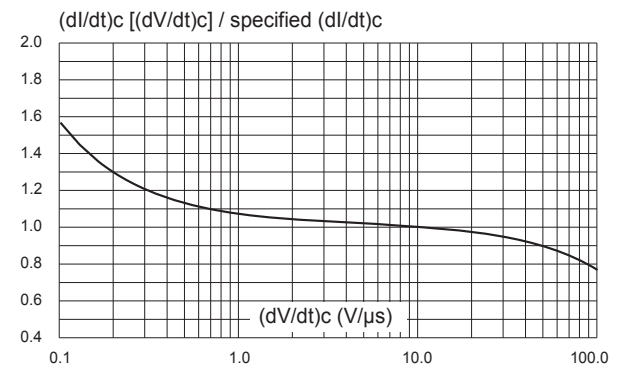
**Figure 6. Non-repetitive surge peak on-state current for a sinusoidal pulse**



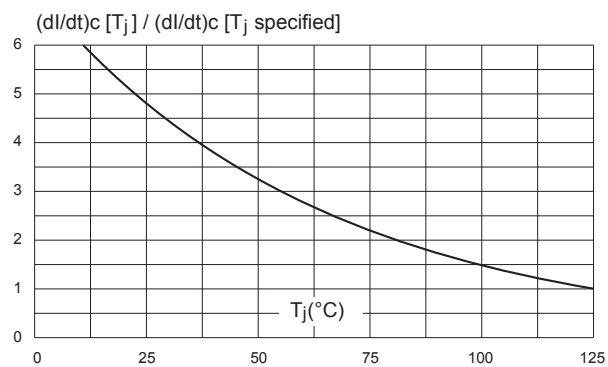
**Figure 7. Relative variation of gate trigger current, holding and latching current versus junction temperature**



**Figure 8. Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values)**



**Figure 9. Relative variation of critical rate of decrease of main current versus junction temperature (typical values)**



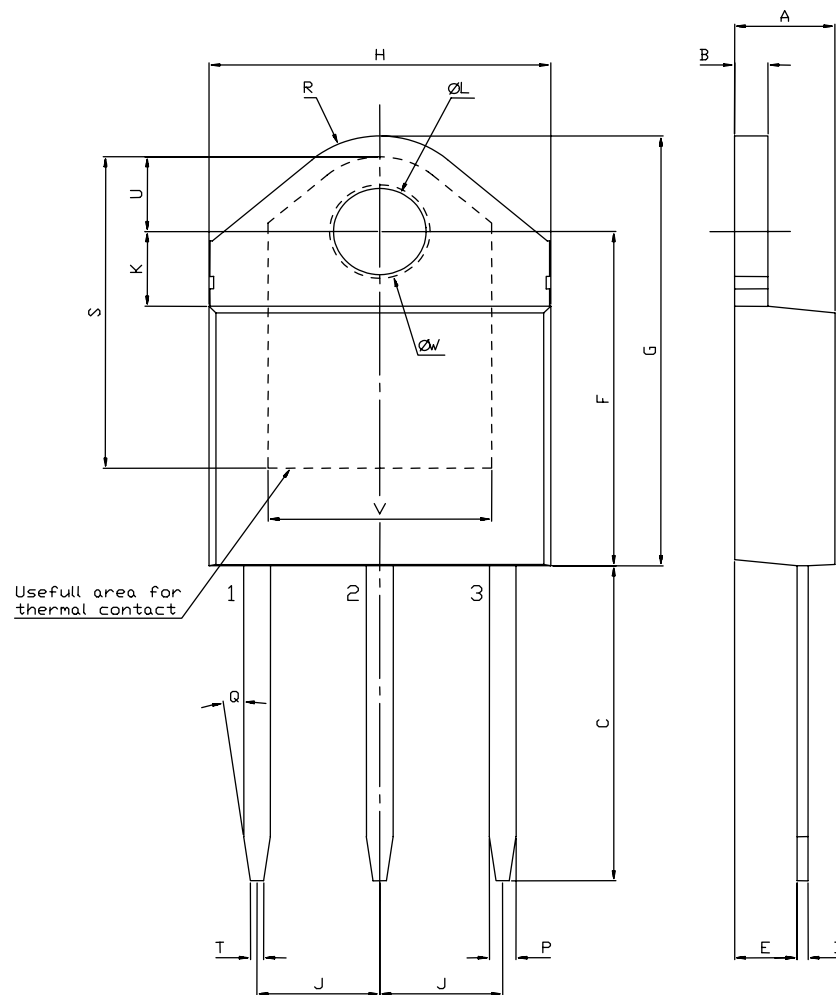
## 2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 2.1 TOP3 insulated and non-insulated package information

- Epoxy meets UL94, V0
- Lead-free packages
- Recommended torque: 1.05 N·m (max. torque: 1.2 N·m)

**Figure 10. TOP3 insulated and non-insulated package outline**



**Table 5. TOP3 insulated and non-insulated mechanical data**

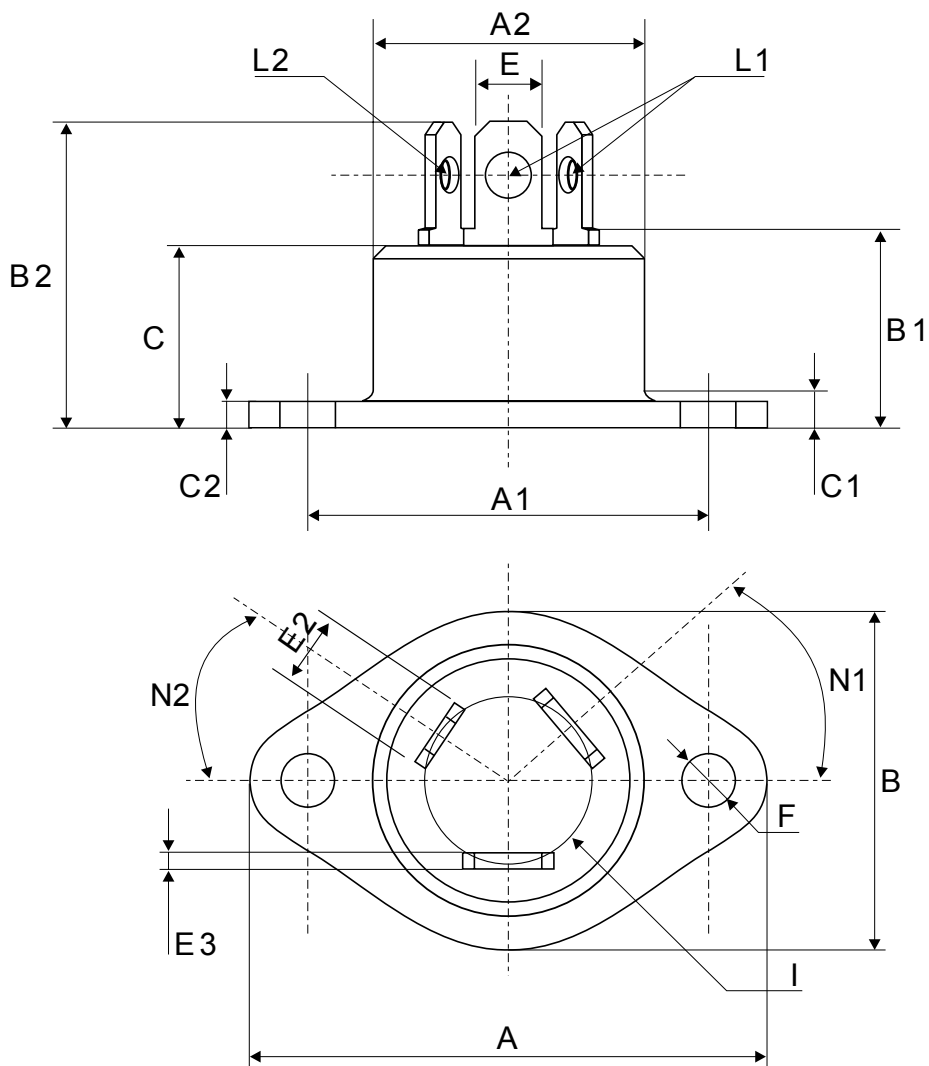
| Ref. | Dimensions |      |       |                       |        |        |
|------|------------|------|-------|-----------------------|--------|--------|
|      | mm         |      |       | Inches <sup>(1)</sup> |        |        |
|      | Min.       | Typ. | Max.  | Min.                  | Typ.   | Max.   |
| A    | 4.40       |      | 4.60  | 0.1732                |        | 0.1812 |
| B    | 1.45       |      | 1.55  | 0.0570                |        | 0.0611 |
| C    | 14.35      |      | 15.60 | 0.5649                |        | 0.6142 |
| D    | 0.50       |      | 0.70  | 0.0196                |        | 0.0276 |
| E    | 2.70       |      | 2.90  | 0.1062                |        | 0.1142 |
| F    | 15.80      |      | 16.50 | 0.6220                |        | 0.6497 |
| G    | 20.40      |      | 21.10 | 0.8031                |        | 0.8308 |
| H    | 15.10      |      | 15.50 | 0.5944                |        | 0.6103 |
| J    | 5.40       |      | 5.65  | 0.2125                |        | 0.2225 |
| K    | 3.40       |      | 3.65  | 0.1338                |        | 0.1438 |
| L    | 4.08       |      | 4.17  | 0.1606                |        | 0.1642 |
| P    | 1.10       |      | 1.30  | 0.0430                |        | 0.0510 |
| R    |            | 4.60 |       |                       | 0.1811 |        |

1. Inches given for reference only

## 2.2 RD91 package information

- Epoxy meets UL94, V0
- Cooling method: Conduction
- Recommended torque: 0.9 to 1.2 N·m

**Figure 11. RD91 package outline**





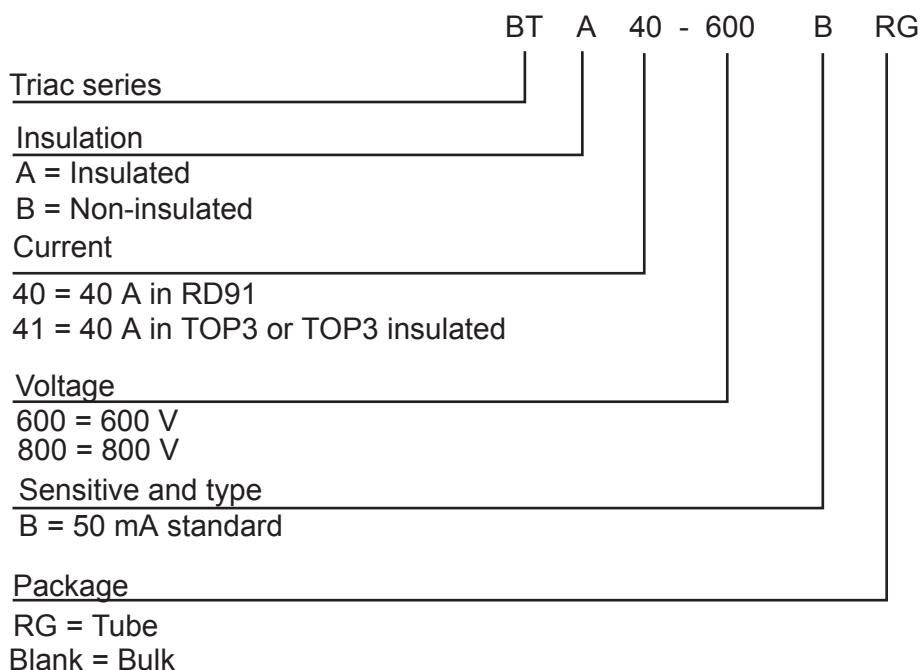
**Table 6. RD91 mechanical data**

| Ref. | Dimensions |      |       |                       |      |       |
|------|------------|------|-------|-----------------------|------|-------|
|      | mm         |      |       | Inches <sup>(1)</sup> |      |       |
|      | Min.       | Typ. | Max.  | Min.                  | Typ. | Max.  |
| A    |            |      | 40.00 |                       |      | 1.575 |
| A1   | 30.10      |      | 30.30 | 1.185                 |      | 1.193 |
| A2   |            |      | 22.00 |                       |      | 0.867 |
| B    |            |      | 27.00 |                       |      | 1.063 |
| B1   | 13.50      |      | 16.50 | 0.531                 |      | 0.650 |
| B2   |            |      | 24.00 |                       |      | 0.945 |
| C    |            |      | 14.00 |                       |      | 0.552 |
| C1   |            |      | 3.50  |                       |      | 0.138 |
| C2   | 1.90       |      | 2.10  | 0.074                 |      | 0.083 |
| E    | 6.10       |      | 6.50  | 0.240                 |      | 0.256 |
| E2   | 4.80       |      | 5.20  | 0.188                 |      | 0.205 |
| E3   | 0.70       |      | 0.90  | 0.027                 |      | 0.036 |
| F    | 4.00       |      | 4.30  | 0.157                 |      | 0.170 |
| I    | 11.20      |      | 11.60 | 0.440                 |      | 0.536 |
| L1   | 3.10       |      | 3.50  | 0.122                 |      | 0.138 |
| L2   | 1.70       |      | 1.90  | 0.066                 |      | 0.075 |
| N1   | 33°        |      | 43°   | 33°                   |      | 43°   |
| N2   | 28°        |      | 38°   | 28°                   |      | 38°   |

1. Inches given for reference only

### 3 Ordering information

**Figure 12.** Ordering information scheme (BTA40, BTA41 and BTB-41 series)



**Table 7.** Ordering information

| Order code   | Marking   | Package   | Weight | Base qty. | Delivery mode |
|--------------|-----------|-----------|--------|-----------|---------------|
| BTA40-600B   | BTA40600B | RD91      | 20 g   | 25        | Bulk          |
| BTA40-800B   | BTA40800B | RD91      | 20 g   | 25        | Bulk          |
| BTA41-600BRG | BTA41600B | TOP3 Ins. | 4.5 g  | 30        | Tube          |
| BTA41-800BRG | BTA41800B | TOP3 Ins. | 4.5 g  | 30        | Tube          |
| BTB41-600BRG | BTB41600B | TOP3      | 4.5 g  | 30        | Tube          |
| BTB41-800BRG | BTB41800B | TOP3      | 4.5 g  | 30        | Tube          |

## Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes                                                                                                                               |
|-------------|----------|---------------------------------------------------------------------------------------------------------------------------------------|
| Sep-2003    | 5        | Last update.                                                                                                                          |
| 25-Mar-2005 | 6        | TOP3 delivery mode changed from bulk to tube.                                                                                         |
| 14-Oct-2005 | 7        | T <sub>c</sub> values for I <sub>T</sub> changed in Table 3. ECOPACK statement added.                                                 |
| 10-Aug-2009 | 8        | Updated Table 2 to correctly place packages. Updated Figure 2. Table 5 changed to correctly place TOP3.<br>Updated ECOPACK statement. |
| 02-Dec-2020 | 9        | Updated Figure 6 and Figure 12. Added Application section. Minor text changes.                                                        |
| 28-Jan-2021 | 10       | Updated Table 1 and Table 4.                                                                                                          |
| 24-Mar-2021 | 11       | Updated coverimage.                                                                                                                   |
| 08-Feb-2023 | 12       | Updated <a href="#">Section Description</a> .                                                                                         |
| 26-Jul-2023 | 13       | Updated <a href="#">Table 5. TOP3 insulated and non-insulated mechanical data</a> .                                                   |

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