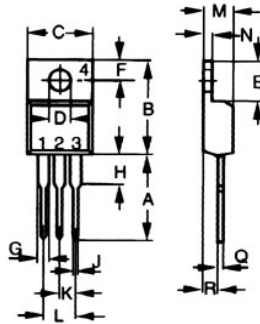


Dimensions TO-220



| Dim. | Inches |       | Millimeter |       |
|------|--------|-------|------------|-------|
|      | Min.   | Max.  | Min.       | Max.  |
| A    | 0.500  | 0.550 | 12.70      | 13.97 |
| B    | 0.580  | 0.630 | 14.73      | 16.00 |
| C    | 0.390  | 0.420 | 9.91       | 10.66 |
| D    | 0.139  | 0.161 | 3.54       | 4.08  |
| E    | 0.230  | 0.270 | 5.85       | 6.85  |
| F    | 0.100  | 0.125 | 2.54       | 3.18  |
| G    | 0.045  | 0.065 | 1.15       | 1.65  |
| H    | 0.110  | 0.230 | 2.79       | 5.84  |
| J    | 0.025  | 0.040 | 0.64       | 1.01  |
| K    | 0.100  | BSC   | 2.54       | BSC   |
| M    | 0.170  | 0.190 | 4.32       | 4.82  |
| N    | 0.045  | 0.055 | 1.14       | 1.39  |
| Q    | 0.014  | 0.022 | 0.35       | 0.56  |
| R    | 0.090  | 0.110 | 2.29       | 2.79  |

## ABSOLUTE MAXIMUM RATINGS

| Symbol             | Parameter                                                                                    |            |                           | Value                          | Unit                 |
|--------------------|----------------------------------------------------------------------------------------------|------------|---------------------------|--------------------------------|----------------------|
| $I_{T(RMS)}$       | RMS on-state current (full sine wave)                                                        | TO-220AB   | $T_c = 110^\circ\text{C}$ | 8                              | A                    |
| $I_{TSM}$          | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25^\circ\text{C}$ ) | F = 60 Hz  | t = 16.7 ms               | 84                             | A                    |
|                    |                                                                                              | F = 50 Hz  | t = 20 ms                 | 80                             |                      |
| $I^2t$             | $I^2t$ Value for fusing                                                                      | tp = 10 ms |                           | 36                             | $\text{A}^2\text{s}$ |
| di/dt              | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , tr ≤ 100 ns           | F = 120 Hz | $T_j = 125^\circ\text{C}$ | 50                             | A/μs                 |
| $I_{GM}$           | Peak gate current                                                                            | tp = 20 μs | $T_j = 125^\circ\text{C}$ | 4                              | A                    |
| $P_{G(AV)}$        | Average gate power dissipation                                                               |            | $T_j = 125^\circ\text{C}$ | 1                              | W                    |
| $T_{stg}$<br>$T_j$ | Storage junction temperature range<br>Operating junction temperature range                   |            |                           | - 40 to + 150<br>- 40 to + 125 | $^\circ\text{C}$     |

## ELECTRICAL CHARACTERISTICS ( $T_j = 25^\circ\text{C}$ , unless otherwise specified)

### ■ SNUBBERLESS™ and LOGIC LEVEL(3 Quadrants)

| Symbol       | Test Conditions                                                      | Quadrant     |      | BTA/BTB |      | Unit |
|--------------|----------------------------------------------------------------------|--------------|------|---------|------|------|
|              |                                                                      |              |      | CW      | BW   |      |
| $I_{GT}(1)$  | $V_D = 12\text{ V}$ $R_L = 30\ \Omega$                               | I - II - III | MAX. | 35      | 50   | mA   |
| $V_{GT}$     |                                                                      | I - II - III | MAX. | 1.3     |      | V    |
| $V_{GD}$     | $V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_j = 125^\circ\text{C}$ | I - II - III | MIN. | 0.2     |      | V    |
| $I_H(2)$     | $I_T = 100\text{ mA}$                                                |              | MAX. | 35      | 50   | mA   |
| $I_L$        | $I_G = 1.2 I_{GT}$                                                   | I - III      | MAX. | 50      | 70   | mA   |
|              |                                                                      | II           |      | 60      | 80   |      |
| dV/dt (2)    | $V_D = 67\% V_{DRM}$ gate open $T_j = 125^\circ\text{C}$             |              | MIN. | 400     | 1000 | V/μs |
| (di/dt)c (2) | Without snubber $T_j = 125^\circ\text{C}$                            |              | MIN. | 4.5     | 7    | A/ms |

| Symbol          | Test Conditions                                               | Quadrant           |      | Value     | Unit             |
|-----------------|---------------------------------------------------------------|--------------------|------|-----------|------------------|
| $I_{GT}$ (1)    | $V_D = 12\text{ V}$ $R_L = 30\ \Omega$                        | I - II - III<br>IV | MAX. | 50<br>100 | mA               |
| $V_{GT}$        |                                                               | ALL                | MAX. | 1.3       | V                |
| $V_{GD}$        | $V_D = V_{DRM}$ $R_L = 3.3\ \Omega$ $T_j = 125^\circ\text{C}$ | ALL                | MIN. | 0.2       | V                |
| $I_H$ (2)       | $I_T = 500\text{ mA}$                                         |                    | MAX. | 50        | mA               |
| $I_L$           | $I_G = 1.2\ I_{GT}$                                           | I - III - IV       | MAX. | 50        | mA               |
|                 |                                                               | II                 |      | 100       |                  |
| $dV/dt$ (2)     | $V_D = 67\ \% V_{DRM}$ gate open $T_j = 125^\circ\text{C}$    |                    | MIN. | 400       | V/ $\mu\text{s}$ |
| $(dV/dt)_c$ (2) | $(dI/dt)_c = 3.5\text{ A/ms}$ $T_j = 125^\circ\text{C}$       |                    | MIN. | 10        | V/ $\mu\text{s}$ |

## STATIC CHARACTERISTICS

| Symbol       | Test Conditions                                 |                           |      | Value | Unit             |
|--------------|-------------------------------------------------|---------------------------|------|-------|------------------|
| $V_{TM}$ (2) | $I_{TM} = 11\text{ A}$ $t_p = 380\ \mu\text{s}$ | $T_j = 25^\circ\text{C}$  | MAX. | 1.55  | V                |
| $V_{to}$ (2) | Threshold voltage                               | $T_j = 125^\circ\text{C}$ | MAX. | 0.85  | V                |
| $R_d$ (2)    | Dynamic resistance                              | $T_j = 125^\circ\text{C}$ | MAX. | 50    | $\text{m}\Omega$ |
| $I_{DRM}$    | $V_{DRM} = V_{RRM}$                             | $T_j = 25^\circ\text{C}$  | MAX. | 5     | $\mu\text{A}$    |
| $I_{RRM}$    |                                                 | $T_j = 125^\circ\text{C}$ |      | 1     | mA               |

**Note 1:** minimum IGT is guaranteed at 5% of IGT max.

**Note 2:** for both polarities of A2 referenced to A1

## THERMAL RESISTANCES

| Symbol        | Parameter             | Value | Unit               |
|---------------|-----------------------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (AC) | 1.6   | $^\circ\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient   | 60    | $^\circ\text{C/W}$ |

## PRODUCT SELECTOR

| Part Number | Voltage (xxx)        | Sensitivity | Type     | Package  |
|-------------|----------------------|-------------|----------|----------|
|             | 200 V    ~ 1000 V    |             |          |          |
| BTB/BTA08   | X                  X | 50 mA       | Standard | TO-220AB |

## OTHER INFORMATION

| Part Number | Marking   | Weight | Base quantity | Packing mode |
|-------------|-----------|--------|---------------|--------------|
| BTB/BTA08   | BTB/BTA08 | 2.3 g  | 250           | Bulk         |

Fig. 1: Maximum power dissipation versus RMS on-state current (full cycle).

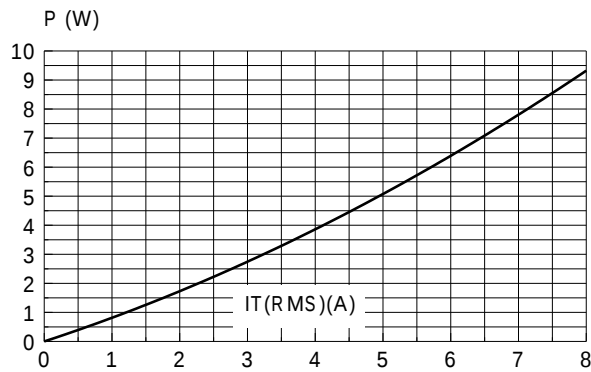


Fig. 2-1: RMS on-state current versus case temperature (full cycle).

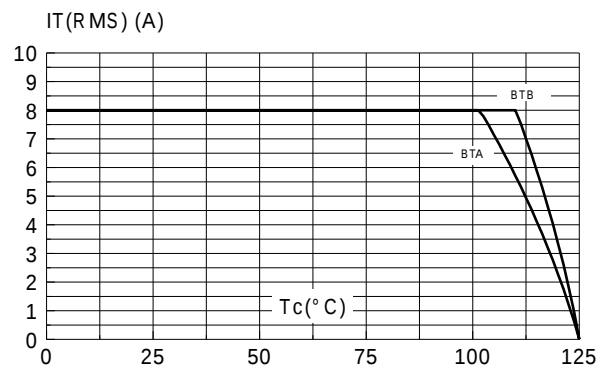


Fig. 2-2: RMS on-state current versus ambient temperature (printed circuit board FR4, copper thickness: 35 $\mu$ m), full cycle.

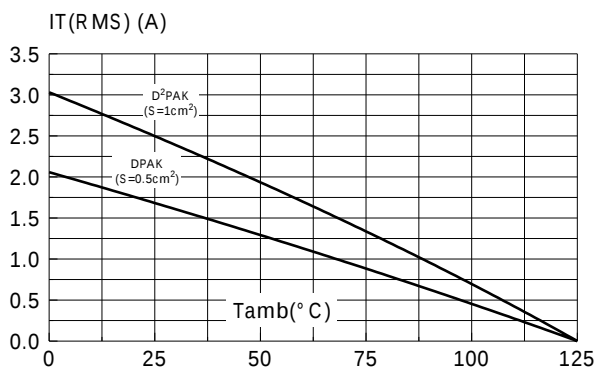


Fig. 3: Relative variation of thermal impedance versus pulse duration.

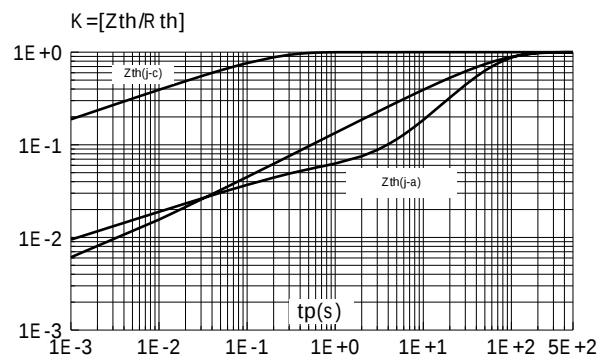


Fig. 4: On-state characteristics (maximum values).

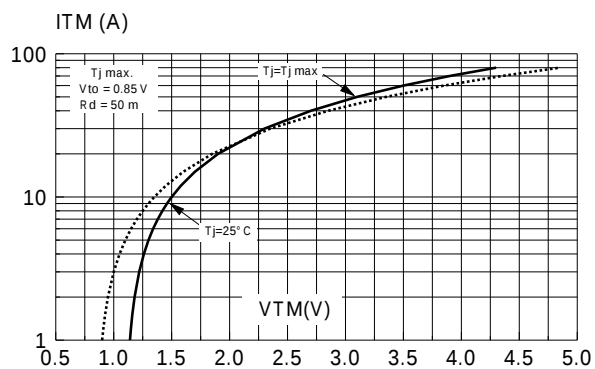


Fig. 5: Surge peak on-state current versus number of cycles.

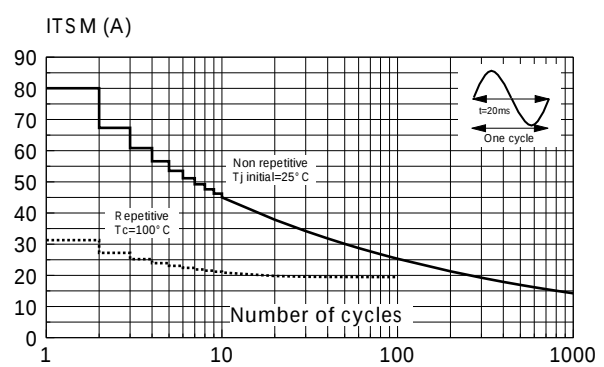


Fig. 6 Non-repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10\text{ms}$ , and corresponding value of  $I^2t$ .

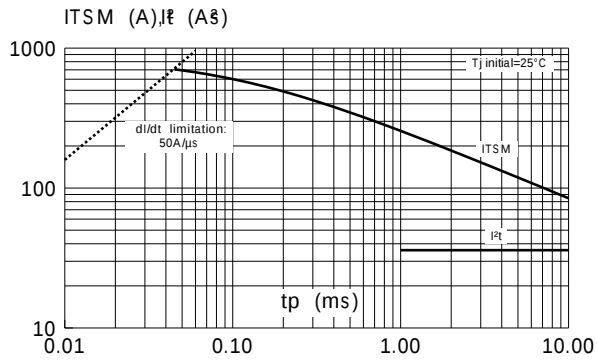


Fig. 8: Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values). Standard Types

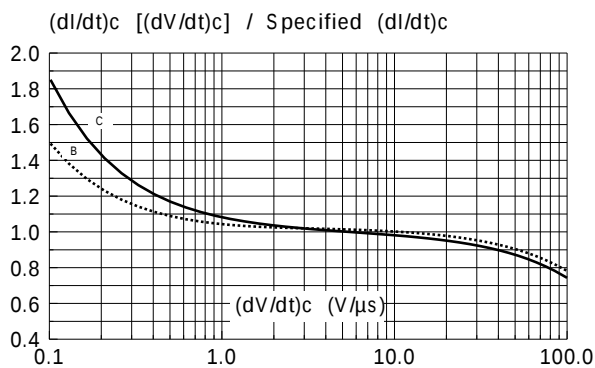


Fig. 9: DPAK and D<sup>2</sup>PAK Thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR 4, copper thickness: 35 μm).

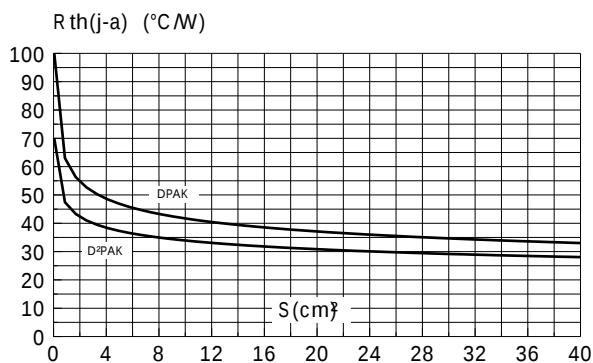


Fig. 7 Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values).

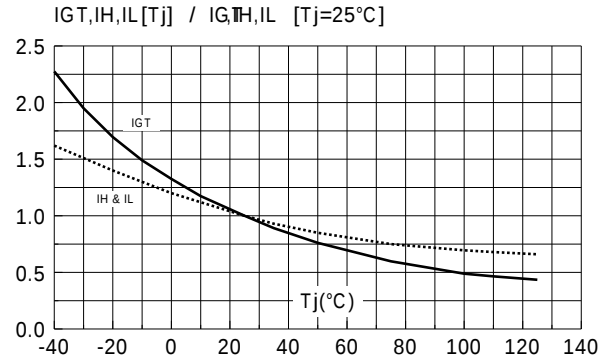


Fig. 9: Relative variation of critical rate of decrease of main current versus junction temperature.

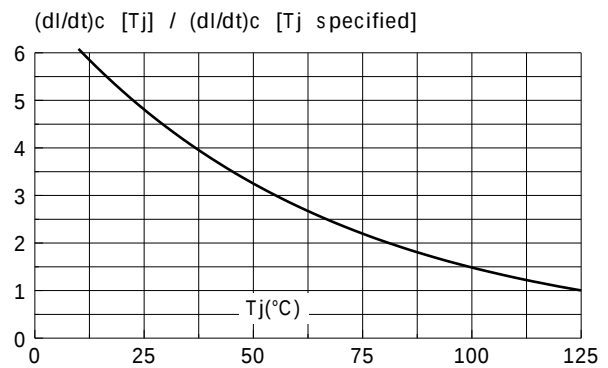


Fig. 6: Non-repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10\text{ms}$ , and corresponding value of  $I^2t$ .

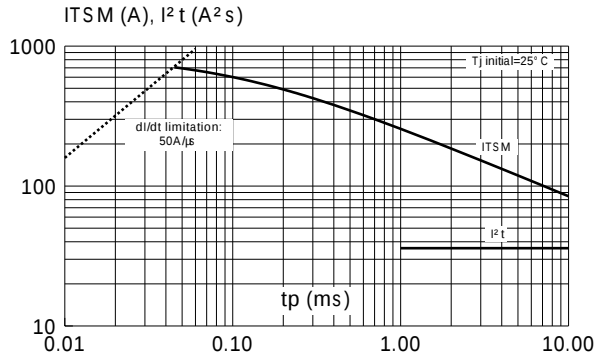


Fig. 8-1: Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values). Snubberless & Logic Level Types

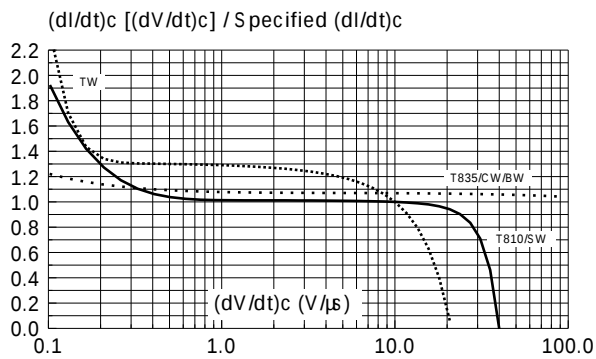


Fig. 9: Relative variation of critical rate of decrease of main current versus junction temperature.

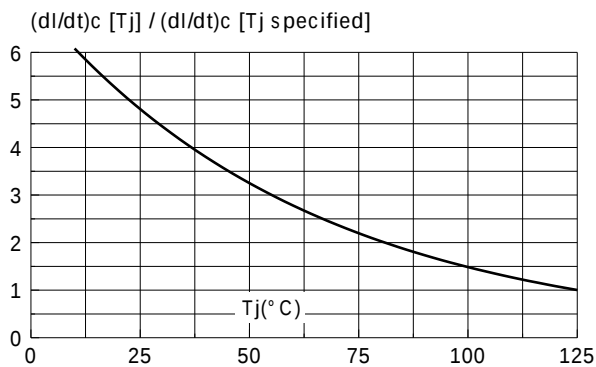


Fig. 7: Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values).

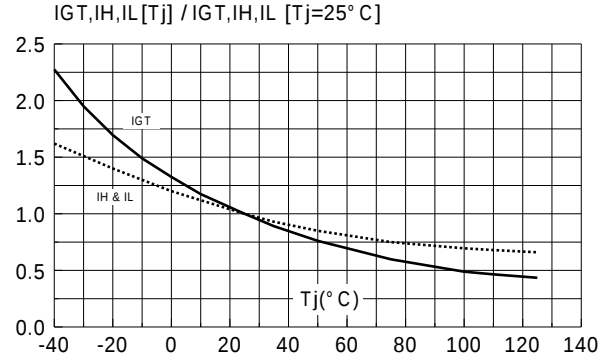


Fig. 8-2: Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values). Standard Types

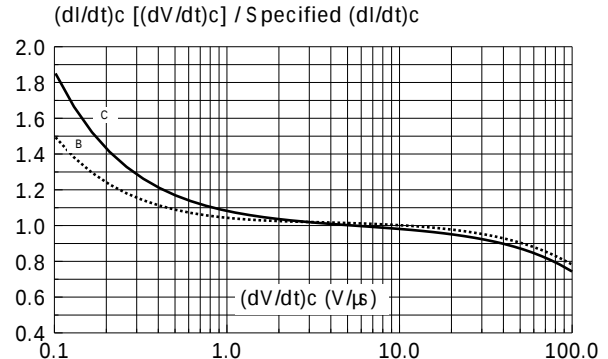


Fig. 10: DPAK and D<sup>2</sup>PAK Thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 μm).

