

Sensitive gate 4 A SCRs

Features

- On-state rms current, 4 A
- Repetitive peak off-state voltages, 600 and 700 V
- Triggering gate current, 0.2 mA

Description

Thanks to highly sensitive triggering levels, the TS420 series is suitable for all applications where the available gate current is limited, such as motor control for hand tools, kitchen aids, overvoltage crowbar protection for low power supplies among others.

Available in through-hole or surface-mount packages, they provide an optimized performance in a limited space area.

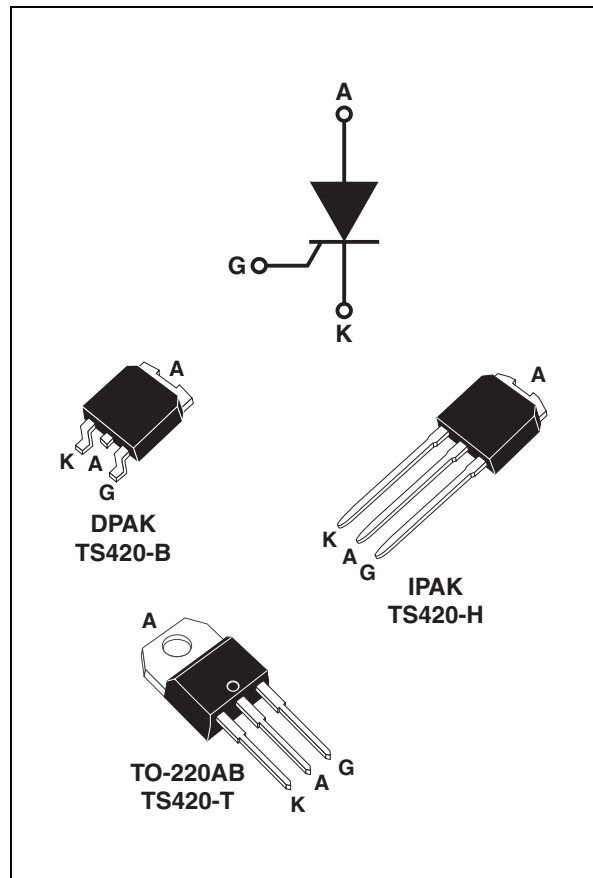


Table 1. Device summary

| Order code | Voltage (xxx) | | Sensitivity | Package |
|------------|---------------|-------|-------------|----------|
| | 600 V | 700 V | | |
| TS420-xxxB | X | X | 0.2 mA | DPAK |
| TS420-xxxH | X | X | 0.2 mA | IPAK |
| TS420-xxxT | X | X | 0.2 mA | TO-220AB |

1 Characteristics

Table 2. Absolute ratings (limiting values)

| Symbol | Parameter | | Value | Unit |
|--------------|--|-------------------------|-----------------------|-----------|
| $I_{T(RMS)}$ | On-state rms current (180° conduction angle) | | $T_I = 115\text{ °C}$ | A |
| $I_{T(AV)}$ | Average on-state current (180° conduction angle) | | $T_I = 115\text{ °C}$ | A |
| I_{TSM} | Non repetitive surge peak on-state current | $t_p = 8.3\text{ ms}$ | $T_j = 25\text{ °C}$ | 33 |
| | | $t_p = 10\text{ ms}$ | | 30 |
| I^2t | I^2t Value for fusing | $t_p = 10\text{ ms}$ | $T_j = 25\text{ °C}$ | A^2s |
| di/dt | Critical rate of rise of on-state current $I_G = 2 \times I_{GT}, t_r \leq 100\text{ ns}$ | $F = 60\text{ Hz}$ | $T_j = 125\text{ °C}$ | $A/\mu s$ |
| I_{GM} | Peak gate current | $t_p = 20\text{ }\mu s$ | $T_j = 125\text{ °C}$ | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j = 125\text{ °C}$ | W |
| T_{stg} | Storage junction temperature range | | - 40 to + 150 | °C |
| T_j | Operating junction temperature range | | - 40 to + 125 | |
| V_{RGM} | Maximum peak reverse gate voltage | | 5 | V |

Table 3. Device timings

| Symbol | Parameter | Test conditions | Value | Unit |
|----------|----------------------------------|---|------------|---------|
| t_{GT} | Gate controlled turn on time | $I_{TM} = 10\text{ A}, V_D = V_{DRM(max)}, I_{GT} = 10\text{ mA}, di_G/dt = 0.2\text{ A}/\mu s, R_G = 1\text{ k}\Omega, T_j = 25\text{ °C}$ | 0.5 (Typ.) | μs |
| t_Q | Circuit controlled turn off time | $V_D = 67\% V_{DRM(max)}, T_j = 125\text{ °C}, I_{TM} = 8\text{ A}, V_R = 10\text{ V}, di_T/dt = 10\text{ A}/\mu s, dV_D/dt = 2\text{ V}/\mu s, R_G = 1\text{ k}\Omega$ | 60 (Typ.) | |

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

| Symbol | Test conditions | | Value | Unit | | |
|------------------------|---|-----------------------|-----------------------|---------------|------------------|------------|
| I_{GT} | $V_D = 12\text{ V}$, $R_L = 33\ \Omega$ | MAX. | 200 | μA | | |
| V_{GT} | | MAX. | 0.8 | V | | |
| V_{GD} | $V_D = V_{DRM}$, $R_L = 33\ \text{k}\Omega$, $R_{GK} = 220\ \Omega$ | $T_j = 125\text{ °C}$ | MIN. | 0.1 | V | |
| V_{RG} | $I_{RG} = 10\ \mu\text{A}$ | | MIN. | 8 | V | |
| I_H | $I_T = 50\ \text{mA}$, $R_{GK} = 1\ \text{k}\Omega$ | | MAX. | 5 | mA | |
| I_L | $I_G = 1\ \text{mA}$, $R_{GK} = 1\ \text{k}\Omega$ | | MAX. | 6 | mA | |
| dV/dt | $V_D = 67\% V_{DRM}$, $R_{GK} = 220\ \Omega$ | $T_j = 125\text{ °C}$ | MIN. | 5 | V/ μs | |
| V_{TM} | $I_{TM} = 8\ \text{A}$, $t_p = 380\ \mu\text{s}$ | $T_j = 25\text{ °C}$ | MAX. | 1.6 | V | |
| V_{t0} | Threshold voltage | | $T_j = 125\text{ °C}$ | MAX. | 0.85 | V |
| R_d | Dynamic resistance | | $T_j = 125\text{ °C}$ | MAX. | 90 | m Ω |
| I_{DRM} I_{RRM} | $V_{DRM} = V_{RRM}$, $R_{GK} = 220\ \Omega$ | $T_j = 25\text{ °C}$ | MAX. | 5 | μA | |
| | | $T_j = 125\text{ °C}$ | | 1 | mA | |

Table 5. Thermal resistance

| Symbol | Parameter | | Value | Unit | |
|---------------|--------------------------|------------------------------|----------|-----------------------------|-----------------------------|
| $R_{th(j-c)}$ | Junction to case (DC) | | 3.0 | $^{\circ}\text{C}/\text{W}$ | |
| $R_{th(j-a)}$ | Junction to ambient (DC) | $S^{(1)} = 0.5\ \text{cm}^2$ | DPAK | 70 | $^{\circ}\text{C}/\text{W}$ |
| | | | IPAK | 100 | |
| | | | TO-220AB | 60 | |

1. Copper under surface tab

Figure 1. Maximum average power dissipation versus average on-state current

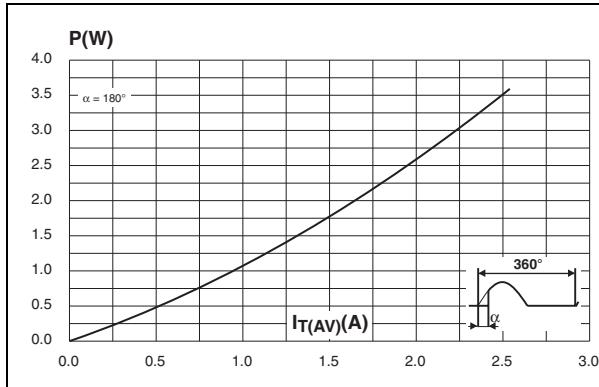


Figure 2. Average and DC on-state current versus case temperature

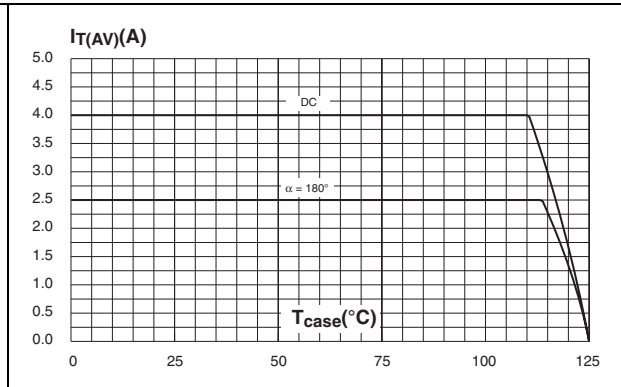


Figure 3. Average and DC on-state current versus ambient temperature (DPAK)

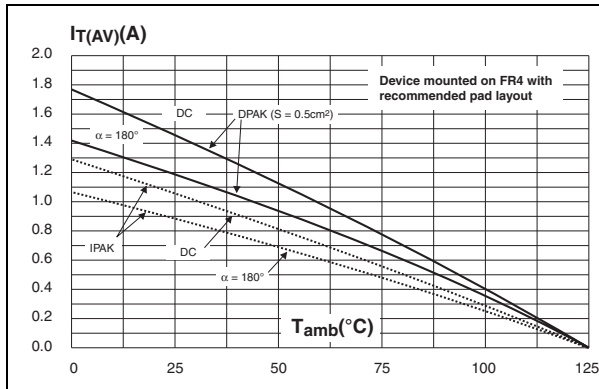


Figure 4. Relative variation of thermal impedance junction to ambient versus pulse duration (DPAK)

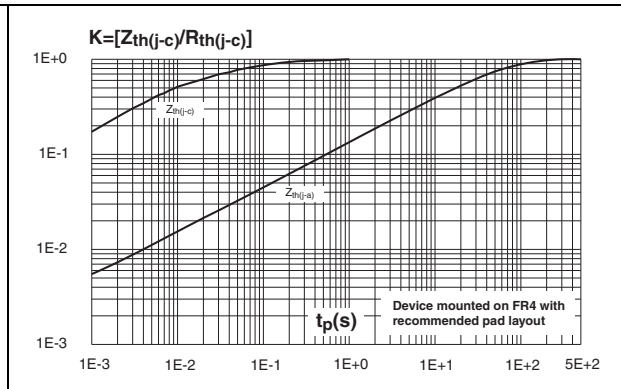


Figure 5. Relative variation of gate trigger current and holding current versus junction temperature

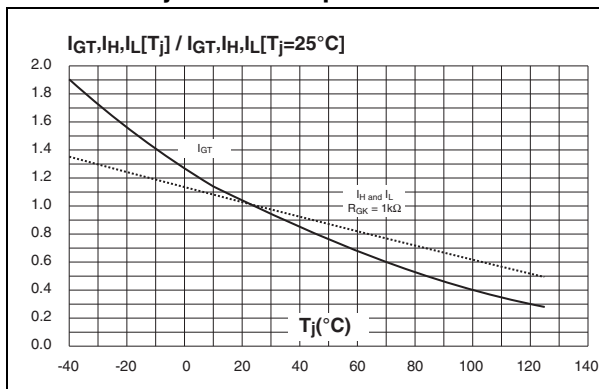


Figure 6. Relative variation of holding current versus gate-cathode resistance (typical values)

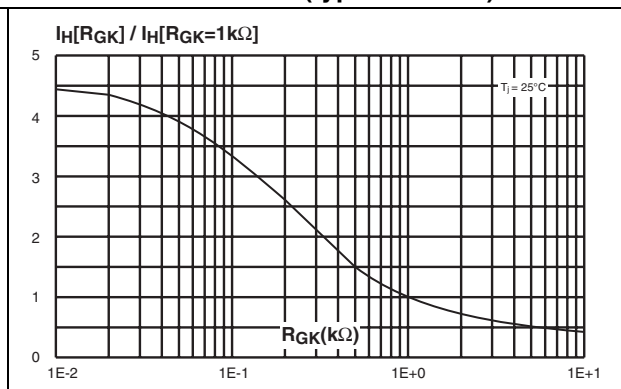


Figure 7. Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)

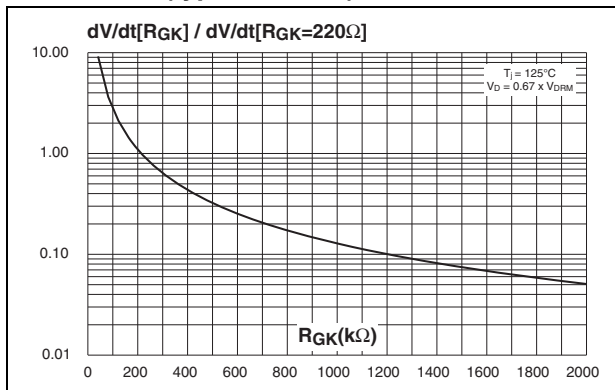


Figure 8. Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)

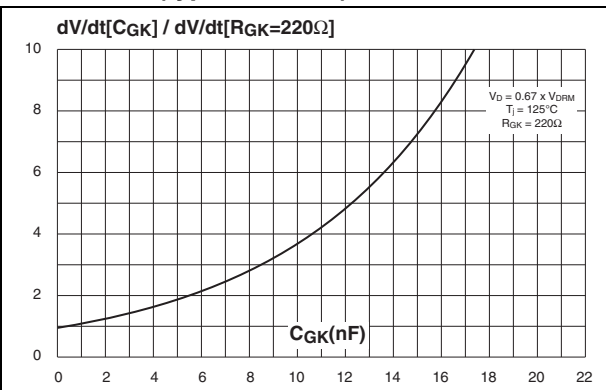


Figure 9. Surge peak on-state current versus number of cycles

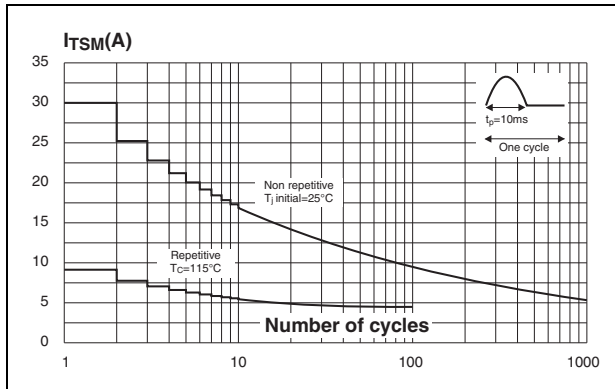


Figure 10. Non-repetitive surge peak on-state current, and corresponding values of I²t

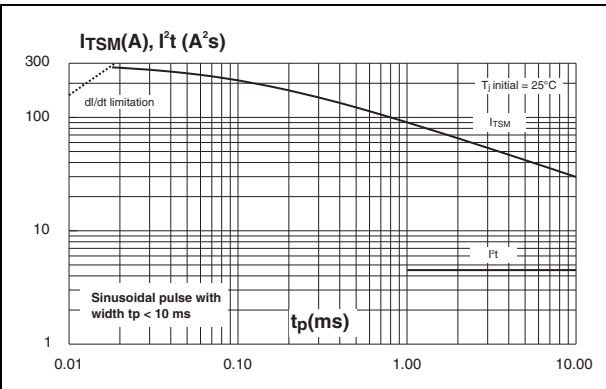


Figure 11. On-state characteristics (maximum values)

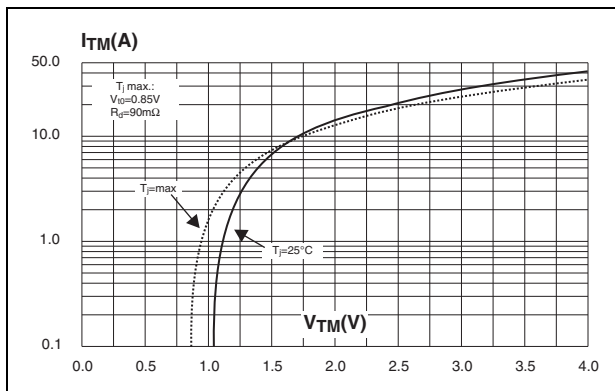
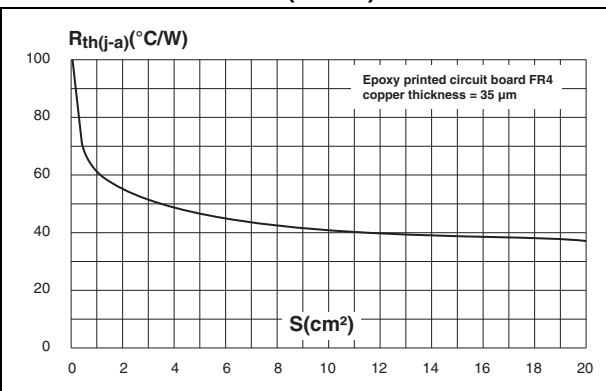
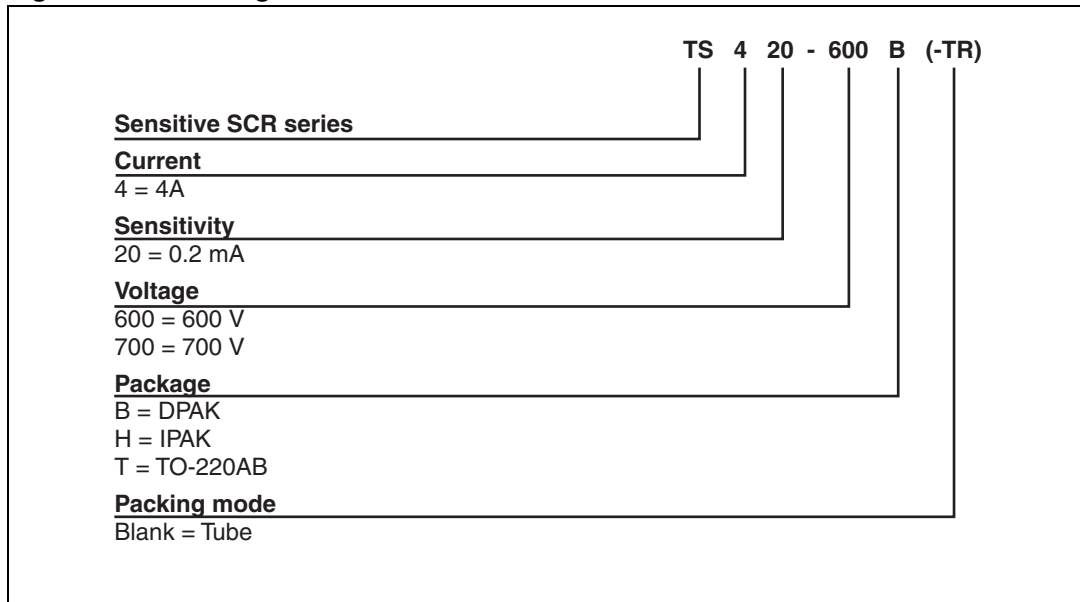


Figure 12. Thermal resistance junction to ambient versus copper surface under tab (DPAK)



2 Ordering information scheme

Figure 13. Ordering information scheme



3 Package information

- Epoxy meets UL94, V0
- Recommended torque 0.4 to 0.6 N·m (TO-220AB)

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Table 6. DPAK dimensions

| Ref. | Dimensions | | | |
|------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 2.20 | 2.40 | 0.086 | 0.094 |
| A1 | 0.90 | 1.10 | 0.035 | 0.043 |
| A2 | 0.03 | 0.23 | 0.001 | 0.009 |
| B | 0.64 | 0.90 | 0.025 | 0.035 |
| B2 | 5.20 | 5.40 | 0.204 | 0.212 |
| C | 0.45 | 0.60 | 0.017 | 0.023 |
| C2 | 0.48 | 0.60 | 0.018 | 0.023 |
| D | 6.00 | 6.20 | 0.236 | 0.244 |
| E | 6.40 | 6.60 | 0.251 | 0.259 |
| G | 4.40 | 4.60 | 0.173 | 0.181 |
| H | 9.35 | 10.10 | 0.368 | 0.397 |
| L2 | 0.80 typ. | | 0.031 typ. | |
| L4 | 0.60 | 1.00 | 0.023 | 0.039 |
| V2 | 0° | 8° | 0° | 8° |

Figure 14. Footprint (dimensions in mm)

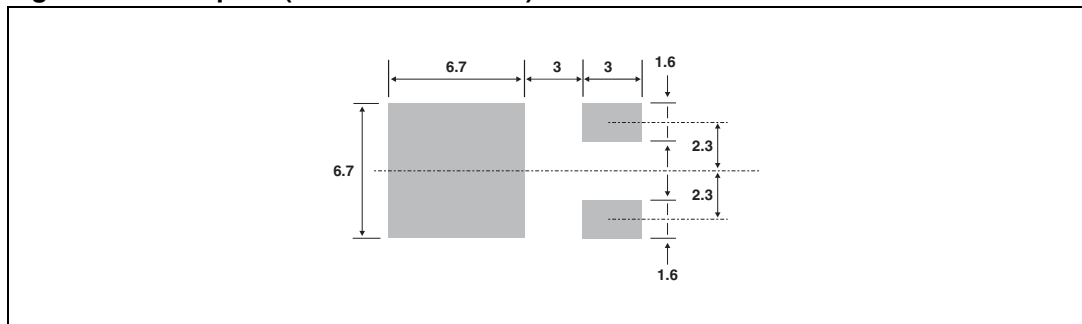
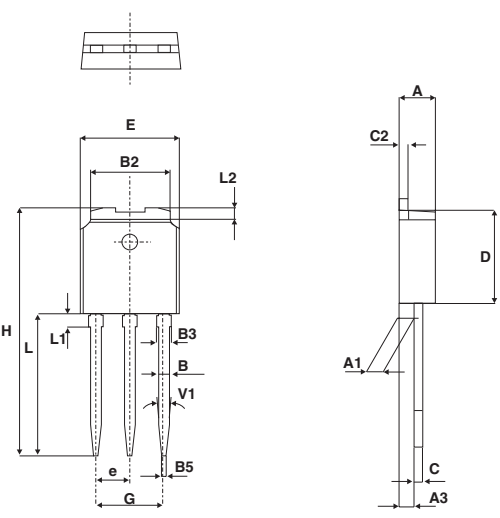
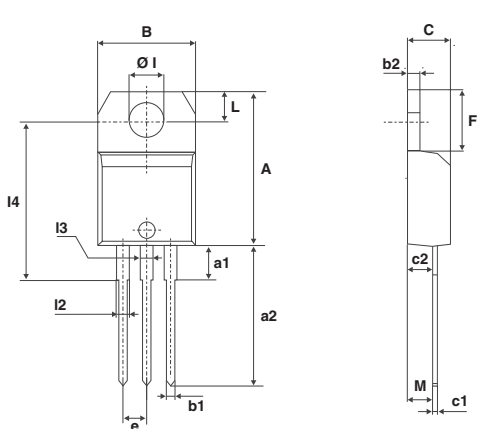


Table 7. IPAK dimensions



| Ref. | Dimensions | | | | | |
|------|-------------|-------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 | 0.086 | | 0.094 |
| A1 | 0.90 | | 1.10 | 0.035 | | 0.043 |
| A3 | 0.70 | | 1.30 | 0.027 | | 0.051 |
| B | 0.64 | | 0.90 | 0.025 | | 0.035 |
| B2 | 5.20 | | 5.40 | 0.204 | | 0.212 |
| B3 | | | 0.95 | | | 0.037 |
| B5 | | 0.30 | | | 0.035 | |
| C | 0.45 | | 0.60 | 0.017 | | 0.023 |
| C2 | 0.48 | | 0.60 | 0.019 | | 0.023 |
| D | 6 | | 6.20 | 0.236 | | 0.244 |
| E | 6.40 | | 6.60 | 0.252 | | 0.260 |
| e | | 2.28 | | | 0.090 | |
| G | 4.40 | | 4.60 | 0.173 | | 0.181 |
| H | | 16.10 | | | 0.634 | |
| L | 9 | | 9.40 | 0.354 | | 0.370 |
| L1 | 0.8 | | 1.20 | 0.031 | | 0.047 |
| L2 | | 0.80 | 1 | | 0.031 | 0.039 |
| V1 | | 10° | | | 10° | |

Table 8. TO-220AB dimensions



| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.598 | | 0.625 |
| a1 | | 3.75 | | | 0.147 | |
| a2 | 13.00 | | 14.00 | 0.511 | | 0.551 |
| B | 10.00 | | 10.40 | 0.393 | | 0.409 |
| b1 | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b2 | 1.23 | | 1.32 | 0.048 | | 0.051 |
| C | 4.40 | | 4.60 | 0.173 | | 0.181 |
| c1 | 0.49 | | 0.70 | 0.019 | | 0.027 |
| c2 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| F | 6.20 | | 6.60 | 0.244 | | 0.259 |
| ØI | 3.75 | | 3.85 | 0.147 | | 0.151 |
| I4 | 15.80 | 16.40 | 16.80 | 0.622 | 0.646 | 0.661 |
| L | 2.65 | | 2.95 | 0.104 | | 0.116 |
| I2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| I3 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| M | | 2.60 | | | 0.102 | |

4 Ordering information

Table 9. Ordering information

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|---------------|-----------|----------|--------|----------|---------------|
| TS420-600B | TS420600 | DPAK | 0.3 g | 75 | Tube |
| TS420-600B-TR | TS420600 | | | 2500 | Tape and reel |
| TS420-600H | TS420600 | IPAK | 0.4 g | 75 | Tube |
| TS420-600T | TS420600T | TO-220AB | 2.3 g | 50 | Tube |
| TS420-700B | TS420700 | DPAK | 0.3 g | 75 | Tube |
| TS420-700B-TR | TS420700 | | | 2500 | Tape and reel |
| TS420-700H | TS420700 | IPAK | 0.4 g | 75 | Tube |
| TS420-700T | TS420700T | TO-220AB | 2.3 g | 50 | Tube |

5 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| Sep-2000 | 3 | Previous release. |
| 26-Jan-2010 | 4 | Updated package illustration for TO-220AB on front page and Table 8 . Added Table 3 . |

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