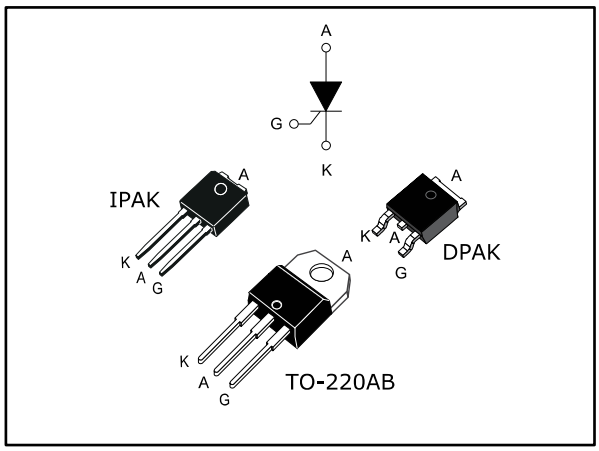
# TS420

## Sensitive gate 4 A SCRs

Datasheet - production data




## Features

- On-state RMS current: 4 A
- Repetitive peak off-state voltage ($V_{DRM}$, $V_{RRM}$) 600 V
- Triggering gate current, $I_{GT}$ 0.2 mA

## Description

Thanks to highly sensitive triggering levels, the device 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 and surface-mount packages, they provide an optimized performance in a limited space area.

**Table 1: Device summary**

| Order code | Sensitivity | Package |
|---|---|---|
| TS420-600B | 0.2 mA | DPAK |
| TS420-600H | | IPAK |
| TS420-600T | | TO-220AB |



This is information on a product in full production.

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# 1 Characteristics

**Table 2: Absolute ratings (limiting values)**

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (180 ° conduction angle) | | $T_C$ = 115°C | 4 | A |
| $I_{T(AV)}$ | Average on-state current (180 ° conduction angle) | | $T_C$ = 115°C | 2.5 | A |
| $I_{TSM}$ | Non repetitive surge peak on-state current | $t_p$ = 8.3 ms | $T_{j\ initial}$ = 25 °C | 33 | A |
| | | $t_p$ = 10 ms | | 30 | |
| $I^2t$ | $I^2t$ value for fusing | $t_p$ = 10 ms | $T_j$ = 25 °C | 4.5 | $A^2s$ |
| dI/dt | Critical rate of rise of on-state current $I_G$ = 10 mA, $dI_G$ / dt = 0.1 A/µs | f = 60 Hz | $T_j$ = 125 °C | 50 | A/µs |
| $I_{GM}$ | Peak gate current | $t_p$ = 20 µs | | 1.2 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | | 0.2 | W |
| $V_{RGM}$ | Maximum peak reverse gate voltage | | | 5 | V |
| $T_{stg}$ | Storage junction temperature range | | | -40 to +150 | °C |
| $T_j$ | Maximum operating junction temperature | | | -40 to +125 | °C |

**Table 3: Device timings**

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

**Table 4: Electrical characteristics ($T_j$ = 25 °C unless otherwise specified)**

| Symbol | Test Conditions | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{GT}$ | $V_D$ = 12 V, $R_L$ = 33 Ω | | Max. | 200 | µA |
| $V_{GT}$ | | | Max. | 0.8 | V |
| $V_{GD}$ | $V_D$ = $V_{DRM}$, $R_L$ = 33 kΩ, $R_{GK}$ = 220 Ω | $T_j$ = 125 °C | Min. | 0.1 | V |
| $I_H$ | $I_T$ = 50 mA, $R_{GK}$ = 1 kΩ | | Max. | 5 | mA |
| $I_L$ | $I_G$ = 2 mA, $R_{GK}$ = 1 kΩ | | Max. | 6 | mA |
| dV/dt | $V_D$ = 67 % $V_{DRM}$, $R_{GK}$ = 220 Ω | $T_j$ = 125 °C | Min. | 5 | V/µs |
| $V_{TM}$ | $I_{TM}$ = 8 A, $t_P$ = 380 µs | $T_j$ = 25 °C | Max. | 1.6 | V |
| $V_{T0}$ | Threshold voltage | $T_j$ = 125 °C | Max. | 0.85 | V |
| $R_D$ | Dynamic resistance | $T_j$ = 125 °C | Max. | 90 | mΩ |
| $I_{DRM}$ | $V_D$ = $V_R$ =$V_{DRM}$ = $V_{RRM;}$ $R_{GK}$ = 220 Ω | $T_j$ = 25 °C | Max. | 5 | µA |
| $I_{RRM}$ | | $T_j$ = 125 °C | | 1 | mA |

**Table 5: Thermal parameters**

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Junction to case (DC) | | | 3.0 | °C/W |
| $R_{th(j-a)}$ | Junction to ambient (DC) | S[(1)] = 0.5 cm² | DPAK | 70 | |
| | | | IPAK | 100 | |
| | | | TO-220AB | 60 | |

**Notes:**

(1)Copper surface under tab

# 1.1 Characteristics (curves)

**Figure 1: Maximum average power dissipation versus average on-state current**

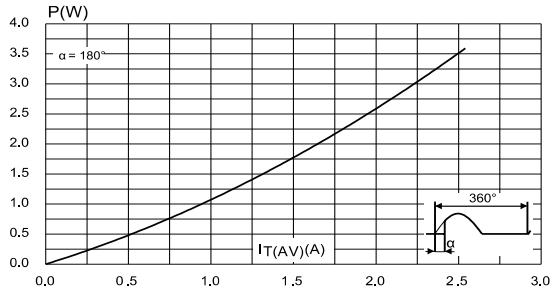



**Figure 2: Average and DC on-state current versus case temperature**

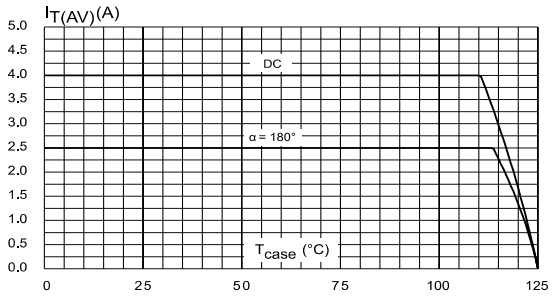



**Figure 3: Average and D.C. on state current versus ambient temperature (DPAK)**

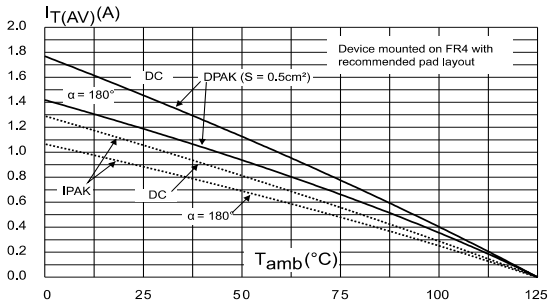



**Figure 4: Relative variation of thermal impedance junction to ambient versus pulse duration (DPAK)**

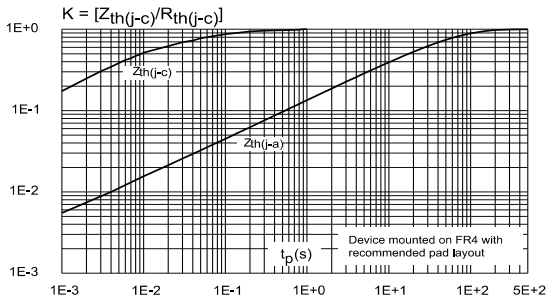



**Figure 5: Relative variation of gate trigger current and holding current versus junction temperature**

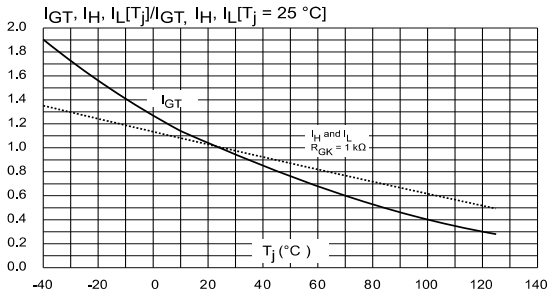



**Figure 6: Relative variation of holding current versus gate-cathode resistance (typical values)**

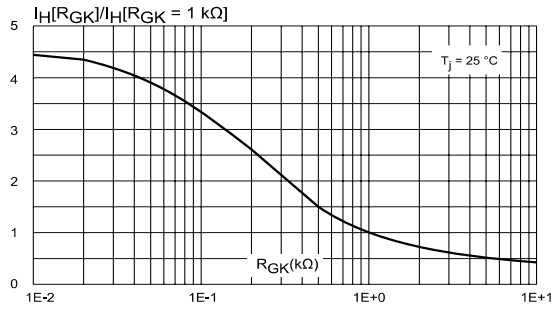


**Figure 7: Relative variation of dV/dt immunity versus gate-cathode resistance (typical values)**

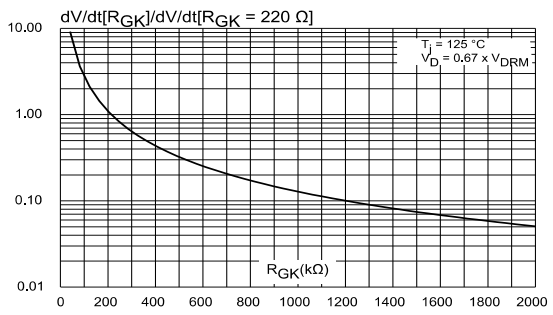



**Figure 8: Relative variation of dV/dt immunity versus gate-cathode capacitance (typical values)**

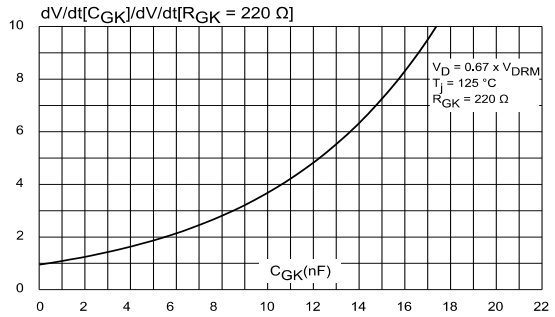



**Figure 9: Surge peak on-state current versus number of cycles**

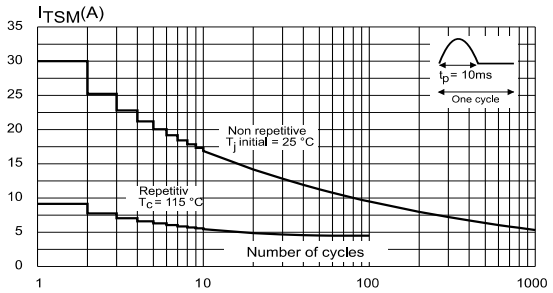



**Figure 10: Non-repetitive surge peak on-state current**

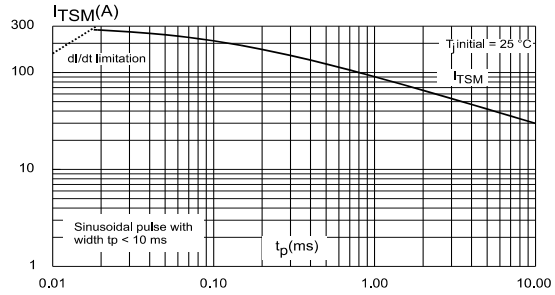



**Figure 11: On-state characteristics (maximum values)**

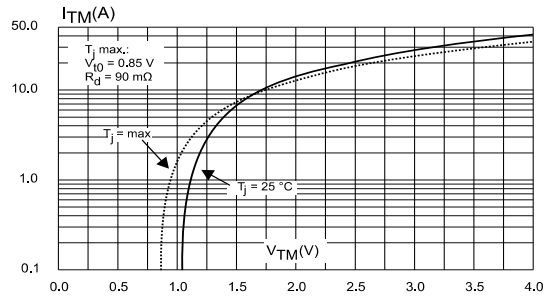
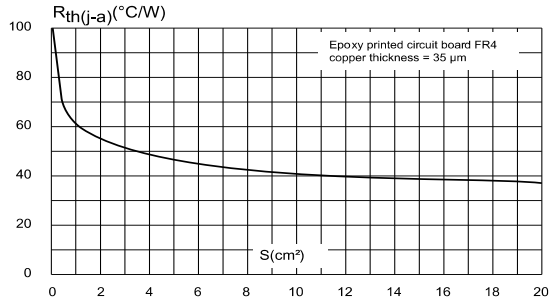



**Figure 12: Thermal resistance junction to ambient versus copper surface under tab**



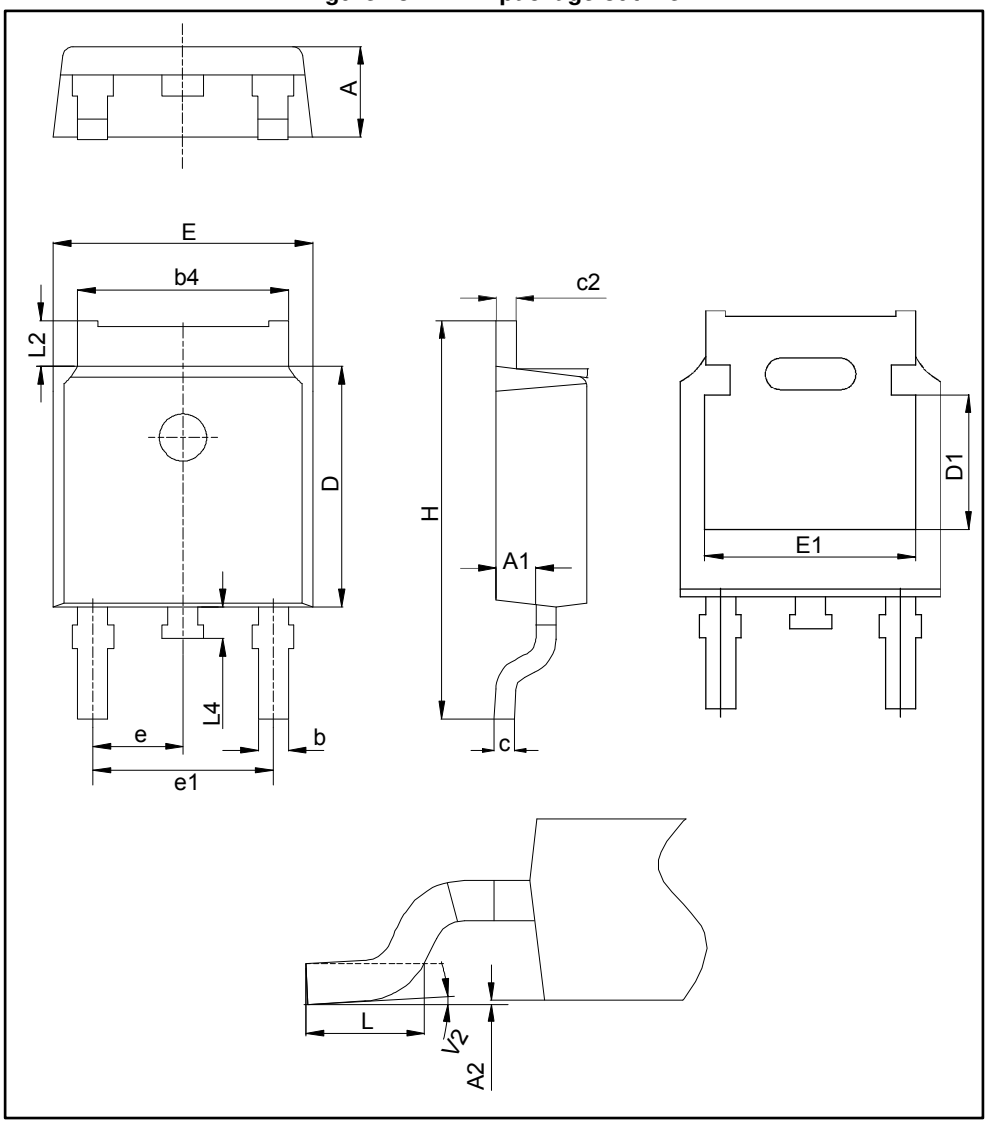
# 2 Package information

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***. ECOPACK® is an ST trademark.

- Epoxy meets UL 94,V0
- Lead-free packages
- Recommended torque value: 0.4 to 0.6 N·m

## 2.1 DPAK package information

**Figure 13: DPAK package outline**




This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

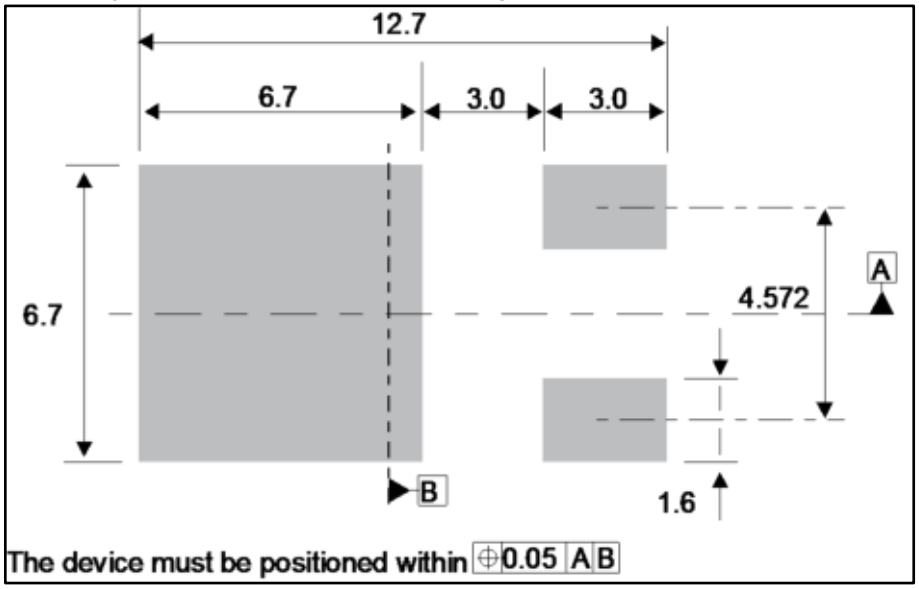
**Table 6: DPAK package mechanical data**

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.18 | | 2.40 | 0.0858 | | 0.0945 |
| A1 | 0.90 | | 1.10 | 0.0354 | | 0.0433 |
| A2 | 0.03 | | 0.23 | 0.0012 | | 0.0091 |
| b | 0.64 | | 0.90 | 0.0252 | | 0.354 |
| b4 | 4.95 | | 5.46 | 0.1949 | | 0.2150 |
| c | 0.46 | | 0.61 | 0.0181 | | 0.0240 |
| c2 | 0.46 | | 0.60 | 0.0181 | | 0.0236 |
| D | 5.97 | | 6.22 | 0.2350 | | 0.2449 |
| D1 | 5.10 | | | 0.2007 | | |
| E | 6.35 | | 6.73 | 0.2500 | | 0.2650 |
| E1 | 4.32 | | | 0.1701 | | |
| e | | 2.29 | | | 0.0900 | |
| e1 | | 4.57 | | | 0.1800 | |
| H | 9.35 | | 10.40 | 0.3681 | | 0.4094 |
| L | 1.00 | | 1.78 | 0.0394 | | 0.0701 |
| L2 | | | 1.27 | | | 0.0500 |
| L4 | 0.60 | | 1.02 | 0.0236 | | 0.0402 |
| V2 | 0° | | +8° | 0° | | +8° |

**Notes:**

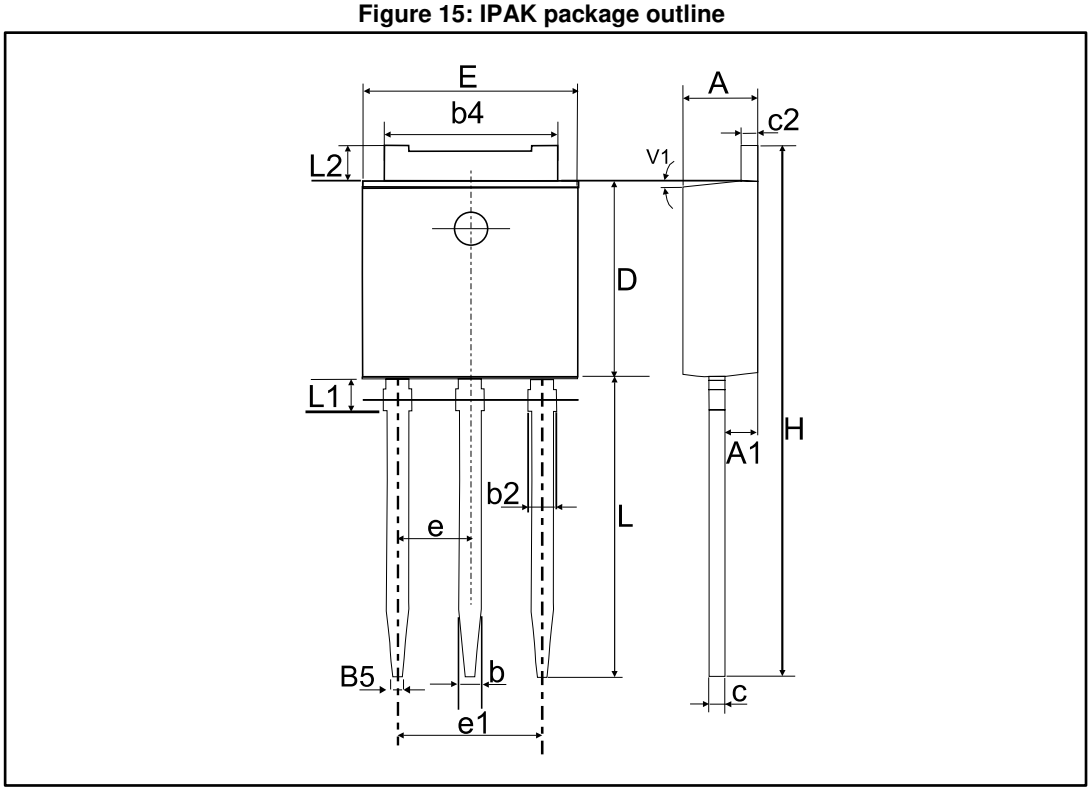
[1]Dimensions in inches are given for reference only

**Figure 14: DPAK recommended footprint (dimensions are in mm)**



## 2.2 IPAK package information

**Figure 15: IPAK package outline**




This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

**Table 7: IPAK package mechanical data**

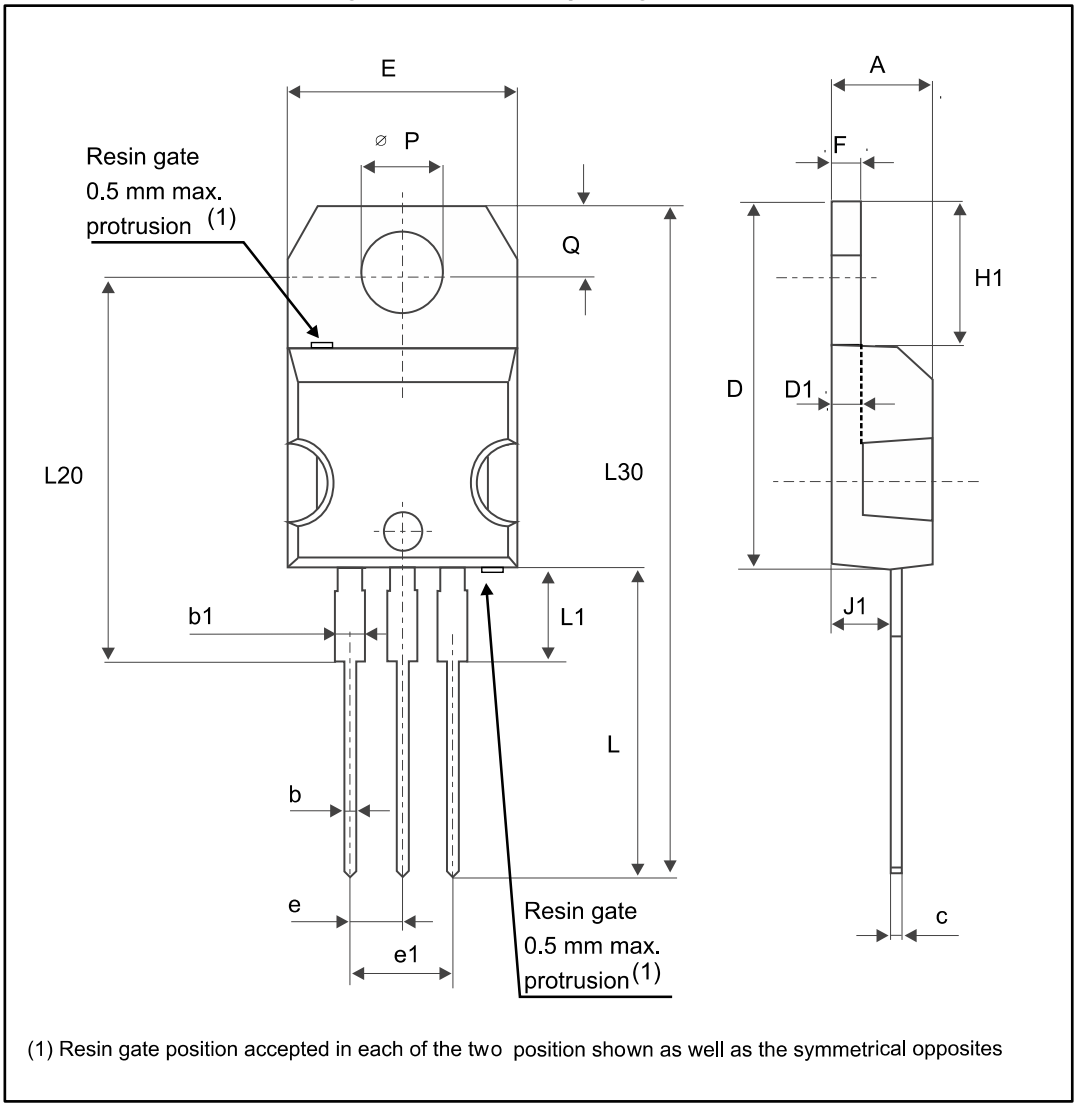
| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 | 0.0866 | | 0.0945 |
| A1 | 0.90 | | 1.10 | 0.0354 | | 0.0433 |
| b | 0.64 | | 0.90 | 0.0252 | | 0.0354 |
| b2 | | | 0.95 | | | 0.0374 |
| b4 | 5.20 | | 5.43 | 0.2047 | | 0.2138 |
| B5 | | 0.30 | | | 0.0118 | |
| c | 0.45 | | 0.60 | 0.0177 | | 0.0236 |
| c2 | 0.46 | | 0.60 | 0.0181 | | 0.0236 |
| D | 6.00 | | 6.20 | 0.2362 | | 0.2441 |
| E | 6.40 | | 6.65 | 0.2520 | | 0.2618 |
| e | | 2.28 | | | 0.0898 | |
| e1 | 4.40 | | 4.60 | 0.1732 | | 0.1811 |
| H | | 16.10 | | | 0.6339 | |
| L | 9.00 | | 9.60 | 0.3545 | | 0.3780 |
| L1 | 0.80 | | 1.20 | 0.0315 | | 0.0472 |
| L2 | | 0.80 | 1.25 | | 0.0315 | 0.0492 |
| V1 | | 10° | | | 10° | |

**Notes:**

(1)Inch dimensions are for reference only.

## 2.3 TO-220AB package information

**Figure 16: TO-220AB package outline**




(1) Resin gate position accepted in each of the two position shown as well as the symmetrical opposites

**Table 8: TO-220AB package mechanical data**

| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches[1] | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.1732 | 0.1811 |
| b | 0.61 | 0.88 | 0.0240 | 0.0346 |
| b1 | 1.14 | 1.55 | 0.0449 | 0.0610 |
| c | 0.48 | 0.70 | 0.0189 | 0.0276 |
| D | 15.25 | 15.75 | 0.6004 | 0.6201 |
| D1 | 1.27 typ. | | 0.0500 typ. | |
| E | 10.00 | 10.40 | 0.3937 | 0.4094 |
| e | 2.40 | 2.70 | 0.0945 | 0.1063 |
| e1 | 4.95 | 5.15 | 0.1949 | 0.2028 |
| F | 1.23 | 1.32 | 0.0484 | 0.0520 |
| H1 | 6.20 | 6.60 | 0.2441 | 0.2598 |
| J1 | 2.40 | 2.72 | 0.0945 | 0.1071 |
| L | 13.00 | 14.00 | 0.5118 | 0.5512 |
| L1 | 3.50 | 3.93 | 0.1378 | 0.1547 |
| L20 | 16.40 typ. | | 0.6457 typ. | |
| L30 | 28.90 typ. | | 1.1378 typ. | |
| ØP | 3.75 | 3.85 | 0.1476 | 0.1516 |
| Q | 2.65 | 2.95 | 0.1043 | 0.1161 |

**Notes:**

[1]Inch dimensions are for reference only.

# 3 Ordering information

**Figure 17: Ordering information scheme**

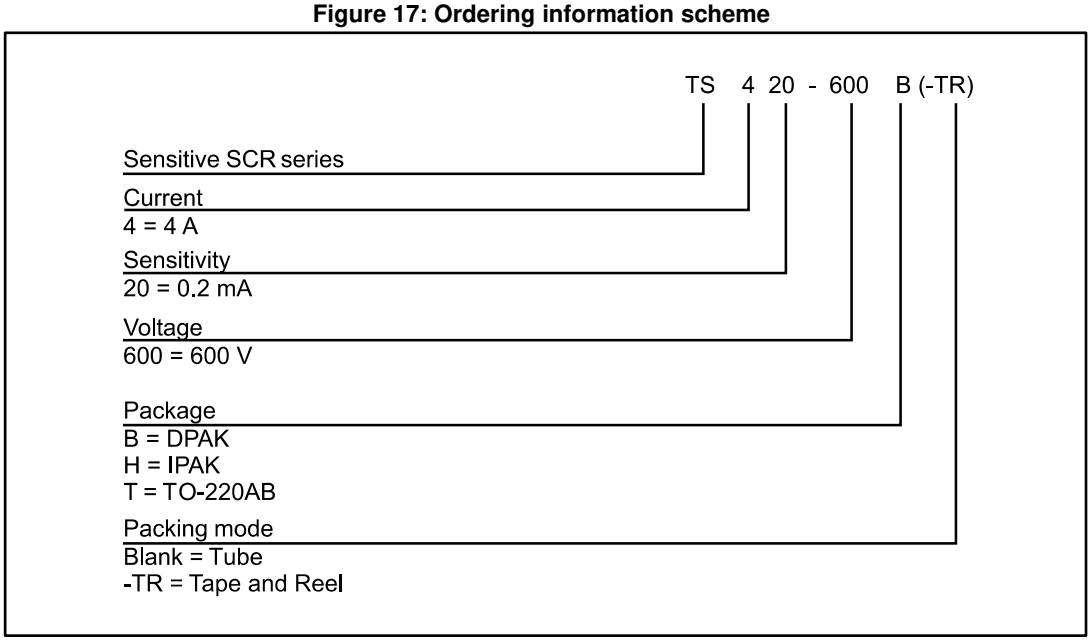



**Table 9: Ordering information**

| 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 |

# 4 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 5. |
| 28-May-2014 | 5 | Updated DPAK package information and reformatted to current standard. |
| 10-May-2016 | 6 | Updated cover page.<br>Updated *Table 4: "Electrical characteristics (Tj = 25 °C unless otherwise specified)"*, *Figure 10: "Non-repetitive surge peak on-state current "* and *Table 9: "Ordering information"*.<br>Complete update of Package information section. |
| 10-Oct-2017 | 7 | Updated DPAK and D²PAK package information. |

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