# 1 Characteristics

**Table 1. Absolute maximum ratings**

| Symbol | Parameters | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | SOT-223 | $T_{tab}$ = 90 °C | 1 | A |
| | | TO-92 | $T_L$ = 50 °C | | |
| | | SMBflat-3L | $T_{tab}$ = 107 °C | | |
| $I_{TSM}$ | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25 °C) | F = 50 Hz | $t_p$ = 20 ms | 8 | A |
| | | F = 60 Hz | $t_p$ = 16.7 ms | 8.5 | |
| $I^2t$ | $I^2t$ value for fusing | $t_p$ = 10 ms | | 0.35 | $A^2s$ |
| dI/dt | Critical rate of rise of on-state current $I_G$ = 2 x $I_{GT}$ , $t_r \leq$ 100 ns | F = 120 Hz | $T_j$ = 125 °C | 20 | A/µs |
| $I_{GM}$ | Peak gate current | $t_p$ = 20 µs | $T_j$ = 125 °C | 1 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j$ = 125 °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 °C, unless otherwise specified)**

| Symbol | Parameters | Quadrant | | Value | | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | Z01 | | | | |
| | | | | 03 | 07 | 09 | 10 | |
| $I_{GT}$(1) | $V_D$ = 12 V, $R_L$ = 30 Ω | I - II - III | Max. | 3 | 5 | 10 | 25 | mA |
| | | IV | | 5 | 7 | 10 | 25 | |
| $V_{GT}$ | | All | Max. | 1.3 | | | | V |
| $V_{GD}$ | $V_D$ = $V_{DRM}$, $R_L$ = 3.3 kΩ, $T_j$ = 125 °C | All | Min. | 0.2 | | | | V |
| $I_H$(2) | $I_T$ = 50 mA | | Max. | 7 | 10 | 10 | 25 | mA |
| $I_L$ | $I_G$ = 1.2 $I_{GT}$ | I - III - IV | Max. | 7 | 10 | 15 | 25 | mA |
| | | II | Max. | 15 | 20 | 25 | 50 | |
| dV/dt(2) | $V_D$ = 67 % $V_{DRM}$ gate open, $T_j$ = 110 °C | | Min. | 10 | 20 | 50 | 100 | V/µs |
| (dV/dt)c(2) | (dI/dt)c = 0.44 A/ms, $T_j$ = 110 °C | | Min. | 0.5 | 1 | 2 | 5 | V/µs |

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 |
|---|---|---|---|---|---|
| $V_T$[1] | $I_{TM}$ = 1.4 A, $t_p$ = 380 µs | 25 °C | Max. | 1.60 | V |
| $V_{TO}$[1] | Threshold on-state voltage | 125 °C | Max. | 0.95 | V |
| $R_d$ | Dynamic resistance | 125 °C | Max. | 400 | mΩ |
| $I_{DRM}$ | $V_{DRM}$ = $V_{RRM}$ | 25 °C | Max. | 5 | µA |
| $I_{RRM}$ | | 125 °C | | 0.5 | mA |

1. *For both polarities of A2 referenced to A1*

**Table 4. Thermal resistance**

| Symbol | Parameters | | Max. value | Unit |
|---|---|---|---|---|
| $R_{th(j-t)}$ | Max. junction to tab (AC) | SOT-223 | 25 | °C/W |
| | | SMBflat-3L | 14 | |
| $R_{th(j-l)}$ | Max. junction to lead (AC) | TO-92 | 60 | |
| $R_{th(j-a)}$ | Junction to ambient ($S$[1] = 5 cm²) | SOT-223 | 60 | |
| | | SMBflat-3L | 75 | |
| | Junction to ambient | TO-92 | 150 | |

1. *Copper surface under tab.*

## 1.1 Characteristics (curves)

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

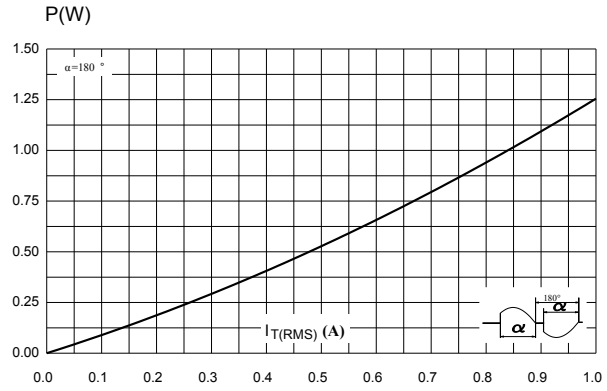



**Figure 2. RMS on-state current versus lead (TO-92) or tab (SOT-223, SMBflat-3L) temperature (full cycle)**

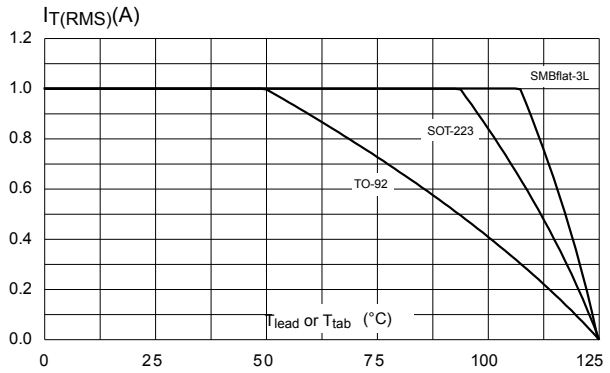



**Figure 3. On-state rms current versus ambient temperature(free air convection full cycle)**

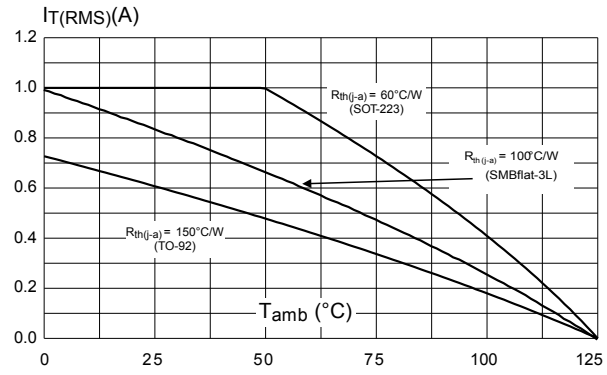



**Figure 4. Relative variation of thermal impedance versus pulse duration ($Z_{th(j-a)}$)**

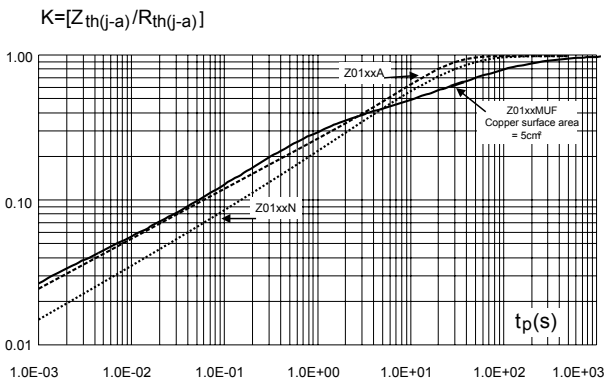


**Figure 5. Relative variation of holding current and latching current versus junction temperature (typ. values)**

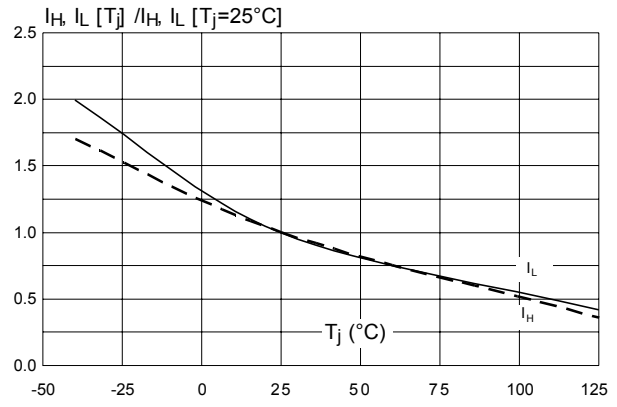



**Figure 6. Relative variation of gate trigger current ($I_{GT}$) and voltage ($V_{GT}$) versus junction temperature**

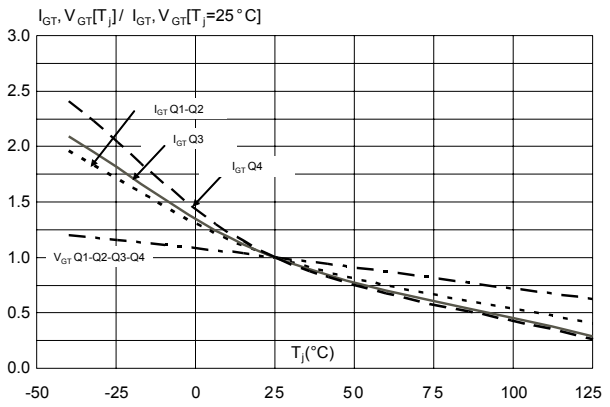



**Figure 7. Surge peak on-state current versus number of cycles**

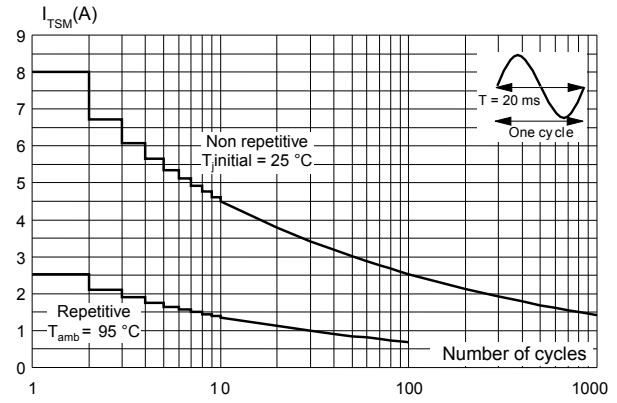



**Figure 8. Non-repetitive surge peak on-state current and corresponding value of $I^2t$ sinusoidal pulse width**

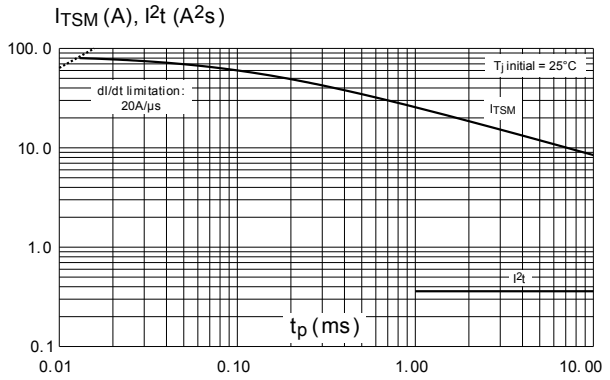



**Figure 9. On-state characteristics (maximum values) ($I_{TM}$ = f($V_{TM}$))**

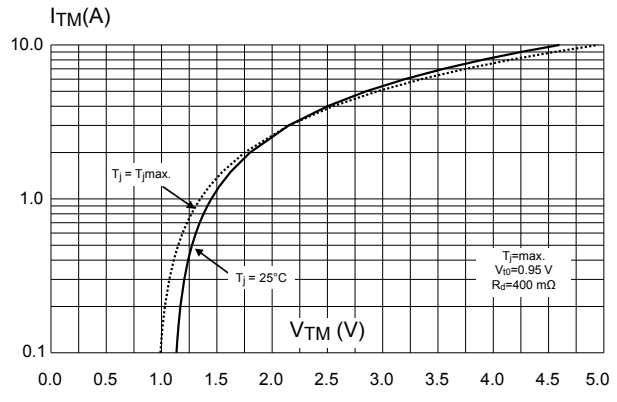



**Figure 10. Relative variation of critical rate of decrease of main current (dI/dt) versus junction temperature**

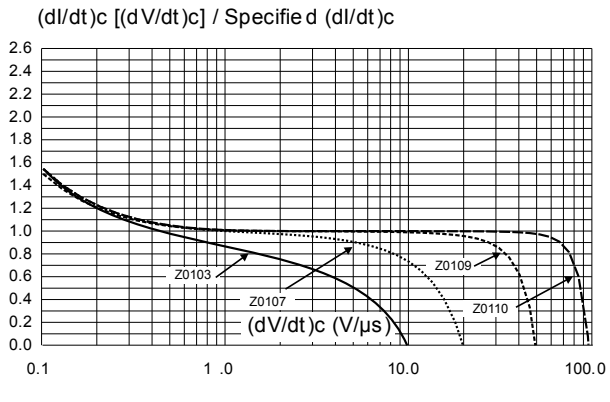


**Figure 11. Relative variation of critical rate of decrease of main current (dI/dt) versus junction temperature**

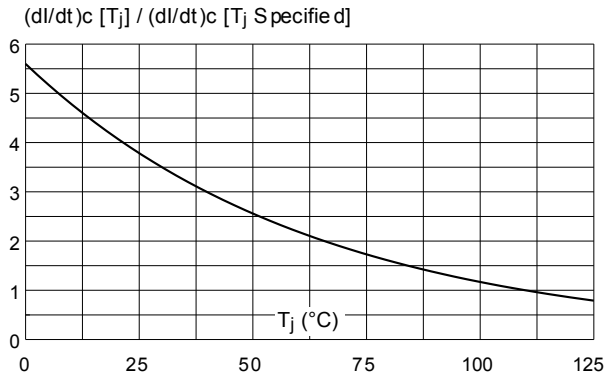



**Figure 12. SOT-223 and SMBflat-3L thermal resistance junction to ambient versus copper surface under case**

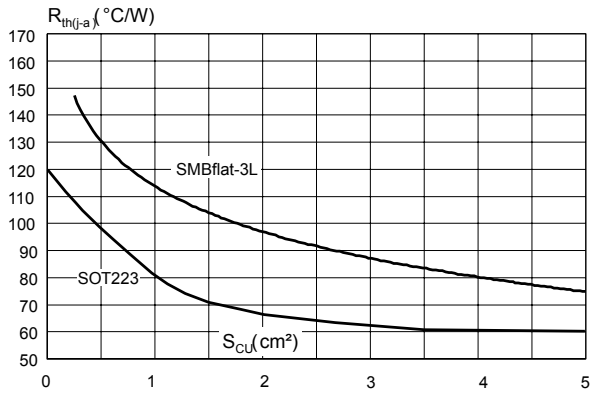
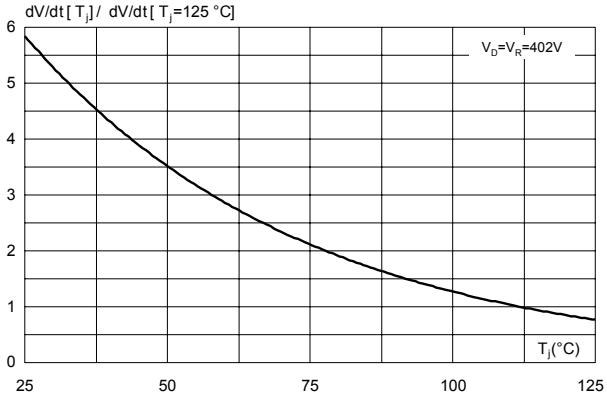



**Figure 13. Relative variation of static dV/dt immunity versus junction temperature (gate open)**



# 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.

## 2.1 SOT-223 package information

- Epoxy meets UL94, V0
- Lead free plating + halogen-free molding resin

**Figure 14. SOT-223 package outline**

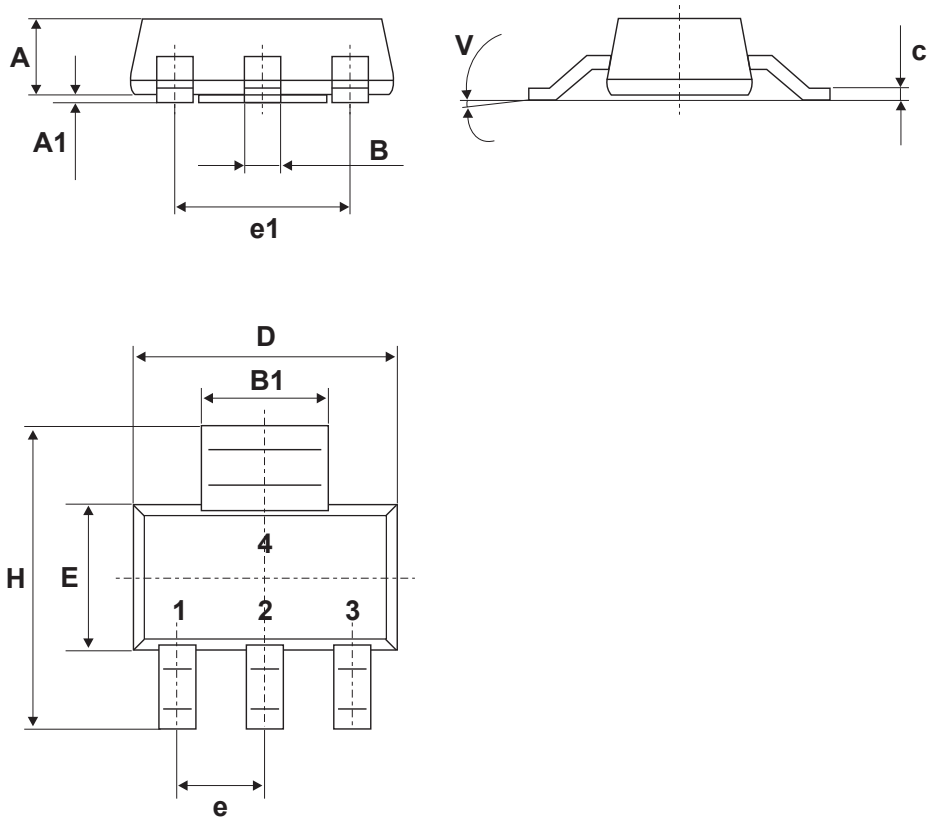
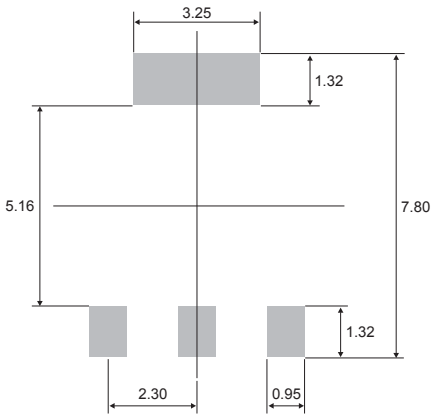


**Table 5. SOT-223 package mechanical data**

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.80 | | | 0.0709 |
| A1 | | 0.02 | 0.10 | | 0.0008 | 0.0039 |
| B | 0.60 | 0.70 | 0.85 | 0.024 | 0.0276 | 0.0335 |
| B1 | 2.90 | 3.00 | 3.15 | 0.114 | 0.1181 | 0.1240 |
| c | 0.24 | 0.26 | 0.35 | 0.009 | 0.0102 | 0.0138 |
| D | 6.30 | 6.50 | 6.70 | 0.248 | 0.2559 | 0.2638 |
| e | | 2.3 | | | 0.0906 | |
| e1 | | 4.6 | | | 0.1811 | |
| E | 3.30 | 3.50 | 3.70 | 0.130 | 0.1378 | 0.1457 |
| H | 6.70 | 7.00 | 7.30 | 0.264 | 0.2756 | 0.2874 |
| V | 10° max. | | | | | |

1. *Inches only for reference*

**Figure 15. SOT-223 footprint (dimensions in mm)**



## 2.2 TO-92 package information

- Epoxy meets UL94, V0
- Lead free plating + halogen-free molding resin

**Figure 16. TO-92 package outline**

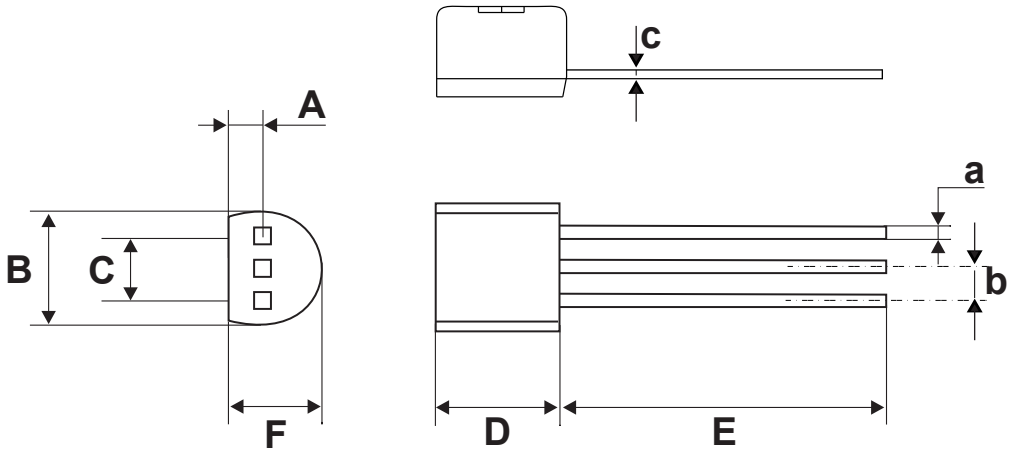



**Table 6. TO-92 package mechanical data**

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 1.35 | | | 0.0531 | |
| B | | | 4.70 | | | 0.1850 |
| C | | 2.54 | | | 0.1000 | |
| D | 4.40 | | | 0.1732 | | |
| E | 12.70 | | | 0.5000 | | |
| F | | | 3.70 | | | 0.1457 |
| a | | | 0.50 | | | 0.0197 |
| b | | 1.27 | | | 0.500 | |
| c | | | 0.48 | | | 0.0189 |

1. *Inches dimensions given for information*

## 2.3 SMBflat-3L package information

- Epoxy meets UL94, V0
- Lead-free package

**Figure 17. SMBflat-3L package outline**

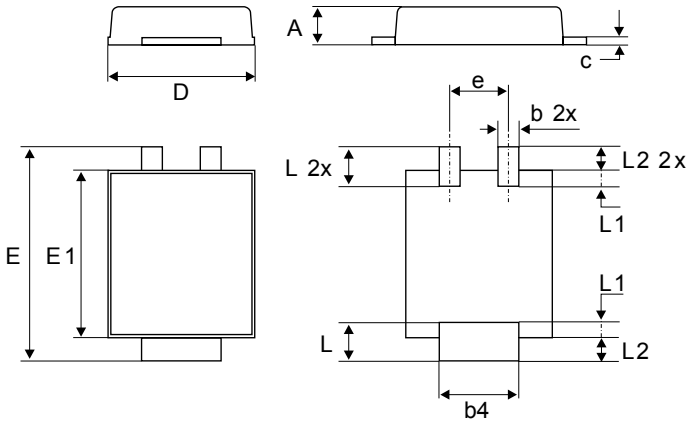



**Table 7. SMBflat-3L mechanical data**

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 0.90 | | 1.10 | 0.035 | | 0.044 |
| b | 0.35 | | 0.65 | 0.014 | | 0.026 |
| b4 | 1.95 | | 2.20 | 0.070 | | 0.087 |
| c | 0.15 | | 0.40 | 0.005 | | 0.016 |
| D | 3.30 | | 3.95 | 0.129 | | 0.156 |
| E | 5.10 | | 5.60 | 0.200 | | 0.221 |
| E1 | 4.05 | | 4.60 | 0.159 | | 0.182 |
| L | 0.75 | | 1.50 | 0.029 | | 0.060 |
| L1 | | 0.40 | | | 0.016 | |
| L2 | | 0.60 | | | 0.024 | |
| e | | 1.60 | | | 0.063 | |

Figure 18. **Footprint recommendations, dimensions in mm (inches)**

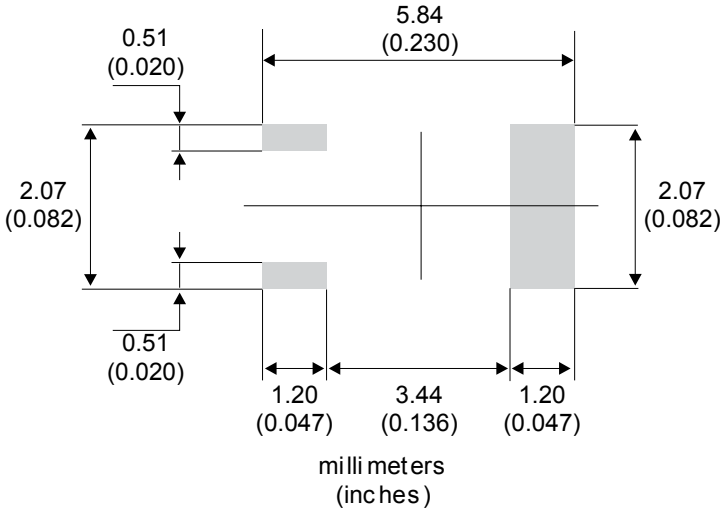
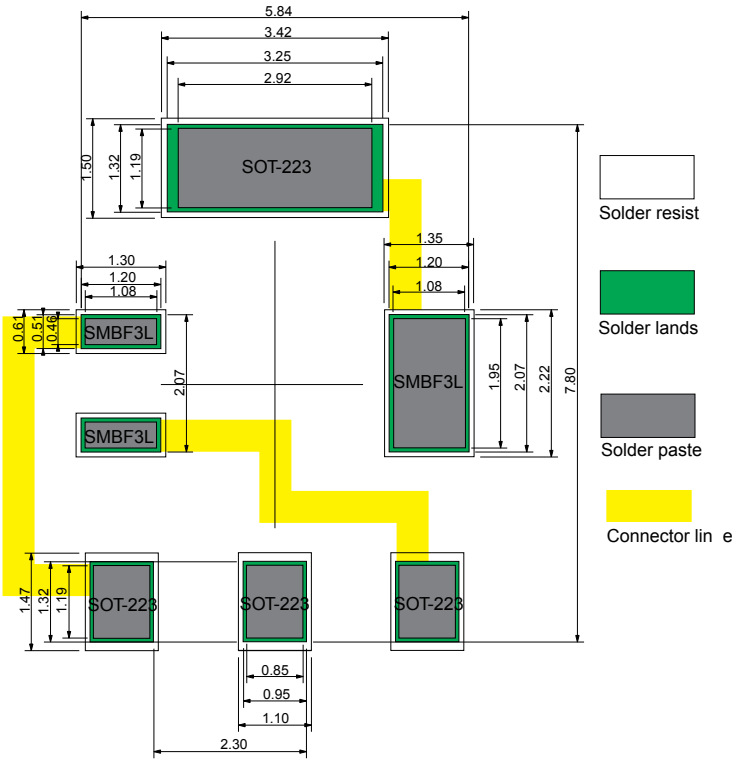
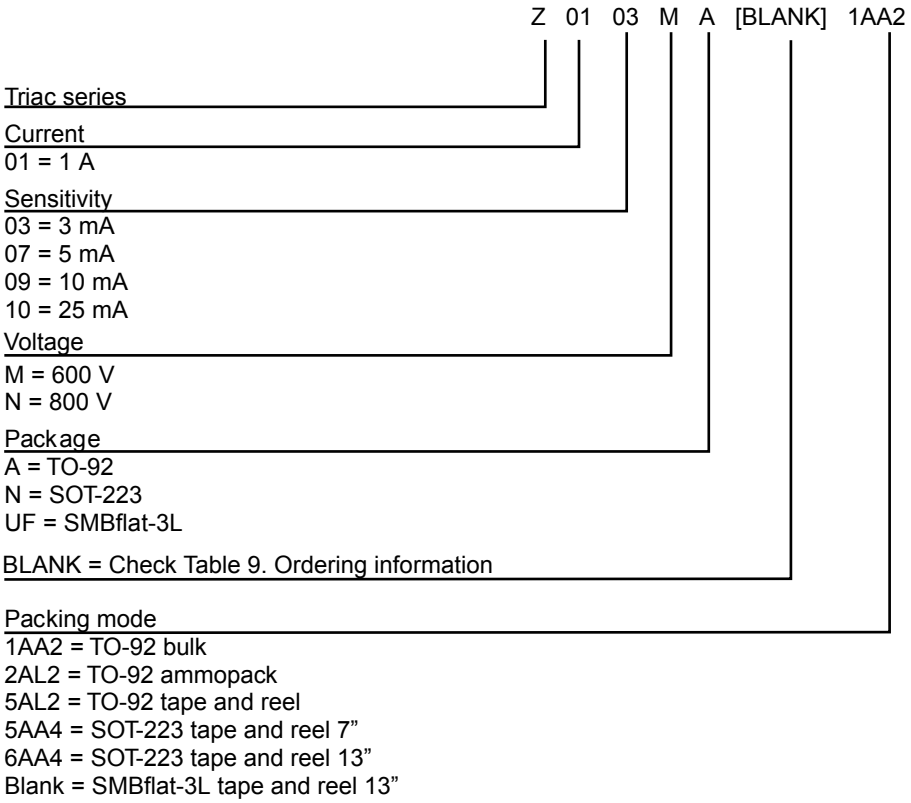



Figure 19. **Footprint and connectors for SOT-223 or SMBflat-3L (dimensions in mm)**



# 3 Ordering information

**Figure 20. Ordering information scheme**



## 3.1 Product selector

Table 8. **Product selector**

| Part Number | | Sensitivity | Type | Package |
|---|---|---|---|---|
| 600 | 800 | | | |
| Z0103MA | Z0103NA | 3 mA | Standard | TO-92 |
| Z0103MN | Z0103NN | | | SOT-223 |
| Z0107MA | Z0107NA | 5 mA | | TO-92 |
| Z0107MN | Z0107NN | | | SOT-223 |
| Z0109MA | Z0109NA | 10 mA | | TO-92 |
| Z0109MN | Z0109NN | | | SOT-223 |
| Z0110MA | Z0110NA | 25 mA | | TO-92 |
| Z0110MN | Z0110NN | | | SOT-223 |
| Z0103MUF | | 3 mA | | SMBflat-3L |
| Z0107MUF | | 5 mA | | |
| Z0109MUF | | 10 mA | | |

## 3.2 Ordering information

**Table 9. Ordering information**

| Order code[1] | Marking[1] | Package | Weight | Base qty. | Delivery mode |
|---|---|---|---|---|---|
| Z01xxyA 1AA2 | Z01xxyA | TO-92 | 0.2 g | 2500 | Bulk |
| Z01xxyA 2AL2 | | | | 2000 | Ammopack |
| Z01xxyA 5AL2 | | | | 2000 | Tape and reel |
| Z0103yN 5AA4 | Z3y | SOT-223 | 0.12 g | 1000 | |
| Z0103MN 6AA4 | Z3M | | | 4000 | |
| Z0107yN 5AA4 | Z7y | | | 1000 | |
| Z0107MN 6AA4 | Z7M | | | 4000 | |
| Z0109yN 5AA4 | Z9y | | | 1000 | |
| Z0109NN6AA4 | Z9N | | | 4000 | |
| Z0103MUF | Z3M | SMBflat-3L | 46.78 mg | 5000 | |
| Z0107MUF | Z7M | | | 5000 | |
| Z0109MUF | Z9M | | | 5000 | |

1. *xx = sensitive, y = voltage, and check Figure 20. Ordering information scheme.*

## Revision history

Table 10. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| Oct-2001 | 4 | Last update. |
| 10-Feb-2005 | 5 | Package: TO-92 tape and reel delivery mode 5AL2 added. |
| 09-May-2005 | 6 | Table 4 on page 2: typo. mistake corrected<br>1. (dV/dt)c instead of (dI/dt)c<br>2. V/µs unit instead of A/ms |
| 21-Apr-2006 | 7 | Reformatted to current standard. Table 2 on page 2: Typo corrected. Values for IGT split into two separate rows. |
| 10-Oct-2010 | 8 | Table 2: modified test conditions for (dV/dt)c. Changed “ambient” to “lead or tab” in Figure 2. |
| 20-Oct-2010 | 9 | Package: SOT-223 13” tape and reel added = 6AA4. |
| 14-Dec-2010 | 10 | Added package SMBflat-3L. Updated dimensions in Table 6.<br>Updated Figure 3 and Figure 12. Updated Table 5: Product Selector. |
| 02-May-2019 | 11 | Updated Table 9. Ordering information.<br>Minor text changed. |

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Z0109MN 5AA4 Z0109MA 1AA2 Z0109NN 5AA4 Z0103MA 1AA2 Z0103MN 5AA4 Z0103NA 1AA2 Z0107SN 5AA4 Z0107MN 5AA4 Z0107MA 1AA2 Z0107NN 5AA4 Z0110MN 5AA4 Z0110MA 1AA2 Z0107MA 2AL2 Z0103MA 2AL2 Z0107MA 5AL2 Z0103MA 5AL2 Z0107MN6AA4 Z0103MN 6AA4 Z0107NA 1AA2 Z0107NA 2AL2 Z0103NA 2AL2 Z0107NA 5AL2 Z0109MA 2AL2 Z0109MA 5AL2 Z0103MUF Z0107MUF Z0109MUF Z0109MN 6AA4 Z0103NN5AA4 Z0109NA 2AL2 Z0109SN 5AA4 Z0110SN 5AA4 Z0109NN6AA4