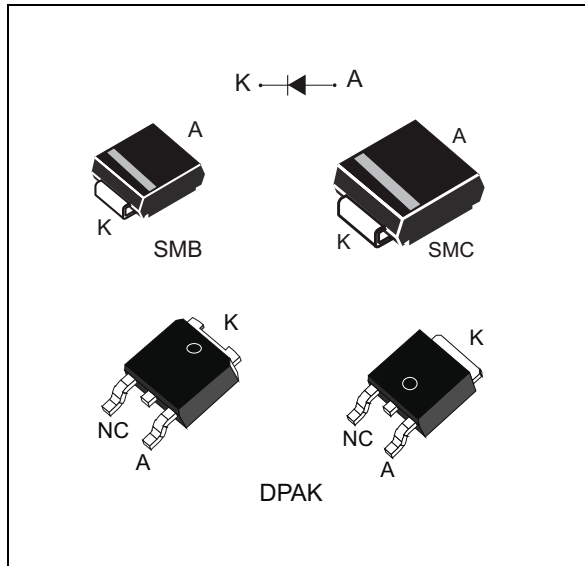


Ultrafast recovery diode

Datasheet – production data


Description

The STTH4R02 uses ST's new 200 V planar Pt doping technology, and it is specially suited for switching mode base drive and transistor circuits.

Packaged in DPAK, SMB and SMC, this device is intended for use in low voltage, high frequency inverters, freewheeling and polarity protection.

Table 1. Device summary

| Symbol | Value |
|----------------|--------|
| $I_{F(AV)}$ | 4 A |
| V_{RRM} | 200 V |
| V_F (typ) | 0.76 V |
| T_j (max) | 175 °C |
| t_{rr} (typ) | 16 ns |

Features

- Negligible switching losses
- High junction temperature
- Very low conduction losses
- Low forward and reverse recovery times
- ECOPACK[®]2 compliant component for DPAK on demand

1 Characteristics

Table 2. Absolute ratings (limiting values at 25 °C, unless otherwise specified)

| Symbol | Parameter | | Value | Unit |
|--------------|--|--------------------------|-------------|------|
| V_{RRM} | Repetitive peak reverse voltage | | 200 | V |
| $I_{F(RMS)}$ | Forward rms current | DPAK | 10 | A |
| | | SMB / SMC | 70 | |
| $I_{F(AV)}$ | Average forward current, $\delta = 0.5$, square wave | DPAK | 4 | A |
| | | SMB / SMC | | |
| I_{FSM} | Surge non repetitive forward current | $t_p = 10$ ms sinusoidal | 70 | A |
| T_{stg} | Storage temperature range | | -65 to +175 | °C |
| T_j | Maximum operating junction temperature | | 175 | °C |

Table 3. Thermal parameters

| Symbol | Parameter | | Max. value | Unit |
|---------------|------------------|-----------|------------|------|
| $R_{th(j-c)}$ | Junction to case | DPAK | 3.5 | °C/W |
| $R_{th(j-l)}$ | Junction to lead | SMB / SMC | 20 | |

Table 4. Static electrical characteristics

| Symbol | Parameter | Test conditions | | Min. | Typ. | Max. | Unit |
|-------------|-------------------------|-----------------|-----------------|------|------|------|---------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25$ °C | $V_R = V_{RRM}$ | - | | 3 | μ A |
| | | $T_j = 125$ °C | | - | 2 | 20 | |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25$ °C | $I_F = 12$ A | - | 1.15 | 1.25 | V |
| | | | $I_F = 4$ A | - | 0.95 | 1.05 | |
| | | $T_j = 150$ °C | | - | 0.76 | 0.83 | |

1. Pulse test: $t_p = 5$ ms, $\delta < 2\%$
2. Pulse test: $t_p = 380$ μ s, $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 0.67 \times I_{F(AV)} + 0.04 \times I_{F(RMS)}^2$$

Table 5. Dynamic electrical characteristics

| Symbol | Parameter | Tests conditions | | Min. | Typ. | Max. | Unit |
|----------|--------------------------|-----------------------|---|------|------|------|------|
| t_{rr} | Reverse recovery time | $T_j = 25\text{ °C}$ | $I_F = 1\text{ A}$ $di_F/dt = -50\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$ | - | 24 | 30 | ns |
| | | | $I_F = 1\text{ A}$ $di_F/dt = -100\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$ | - | 16 | 20 | |
| I_{RM} | Reverse recovery current | $T_j = 125\text{ °C}$ | $I_F = 4\text{ A}$ $di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 160\text{ V}$ | - | 4.4 | 5.5 | A |
| t_{fr} | Forward recovery time | $T_j = 25\text{ °C}$ | $I_F = 4\text{ A}$ $di_F/dt = 50\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$ | - | 80 | | ns |
| V_{FP} | Forward recovery voltage | | $I_F = 4\text{ A}$ $di_F/dt = 50\text{ A}/\mu\text{s}$ | - | 1.6 | | V |

Figure 1. Peak current versus duty cycle

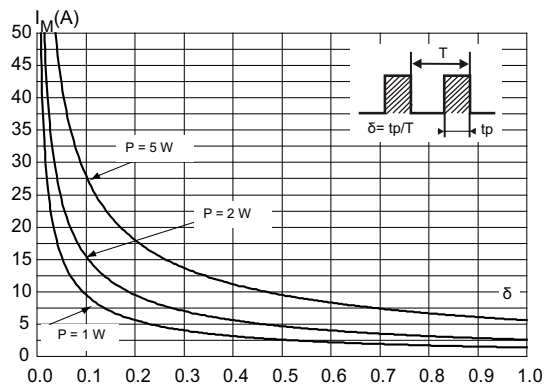


Figure 2. Forward voltage drop versus forward current (typical values)

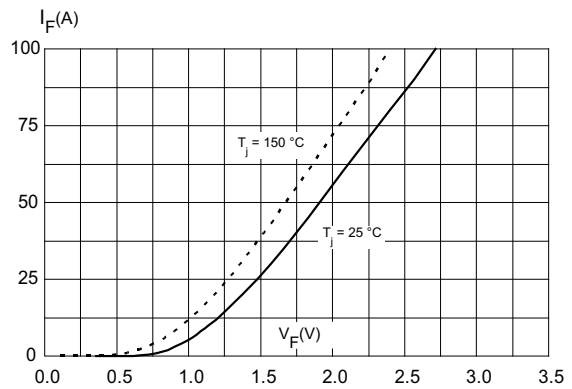


Figure 3. Forward voltage drop versus forward current (maximum values)

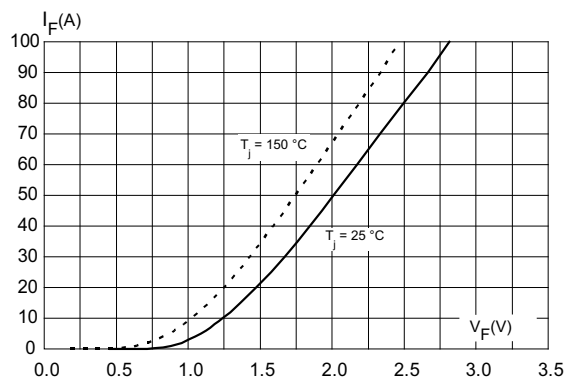


Figure 4. Relative variation of thermal impedance, junction to case, versus pulse duration

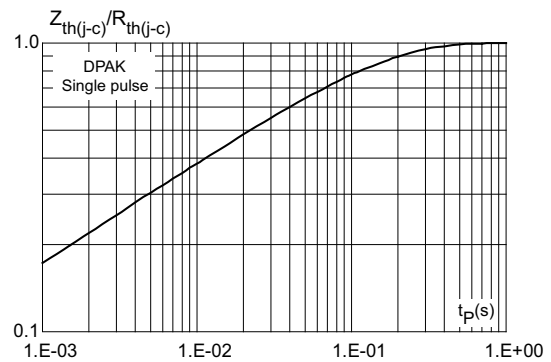


Figure 5. Relative variation of thermal impedance, junction to ambient, versus pulse duration (SMB)

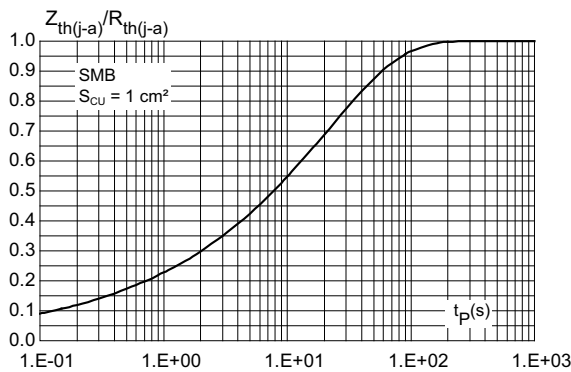


Figure 6. Relative variation of thermal impedance, junction to ambient, versus pulse duration (SMC)

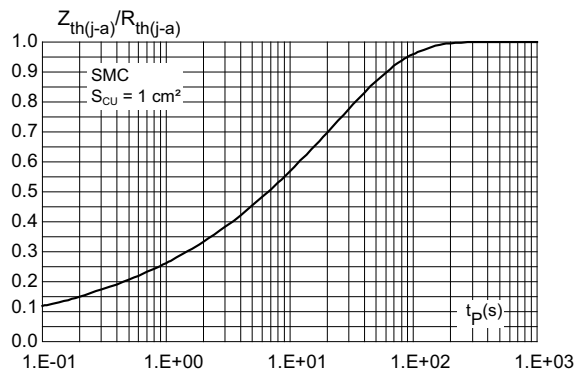


Figure 7. Junction capacitance versus reverse applied voltage (typical values)

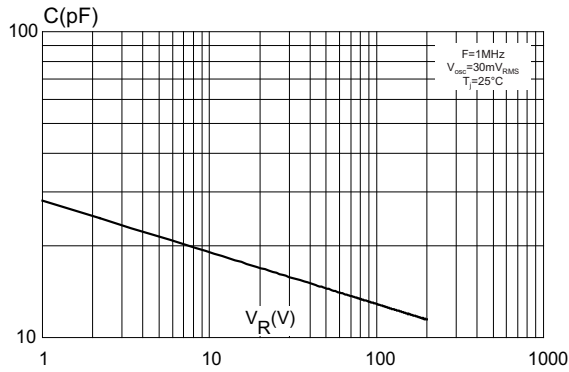


Figure 8. Reverse recovery charges versus di_F/dt (typical values)

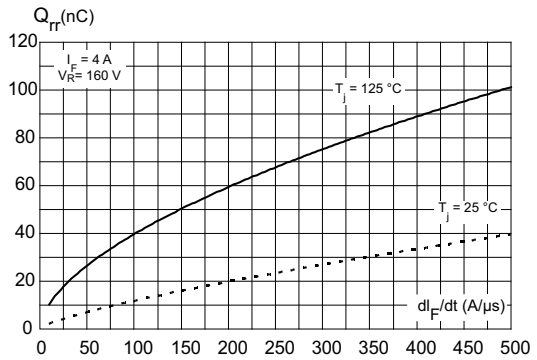


Figure 9. Reverse recovery time versus di_F/dt (typical values)

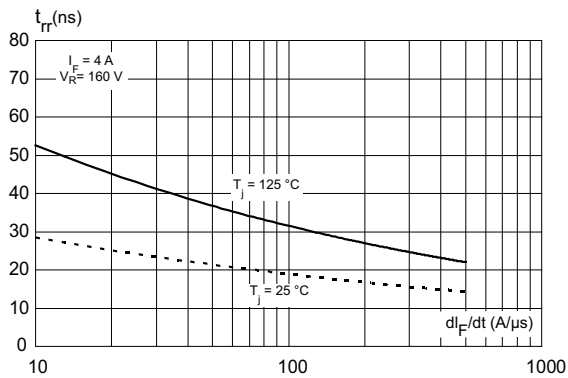


Figure 10. Peak reverse recovery current versus di_F/dt (typical values)

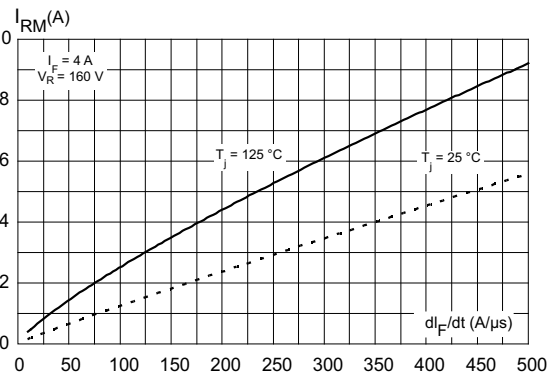


Figure 11. Dynamic parameters versus junction temperature (reference: $T_j = 125^\circ\text{C}$)

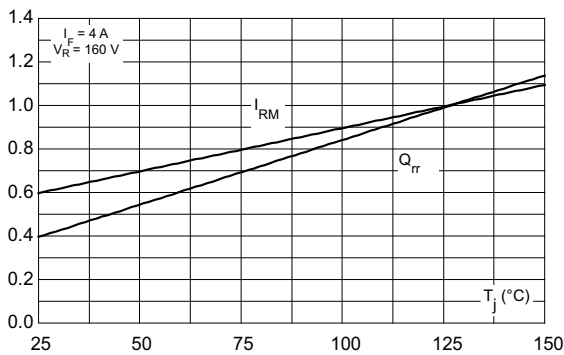


Figure 12. Thermal resistance, junction to ambient, versus copper surface under each lead

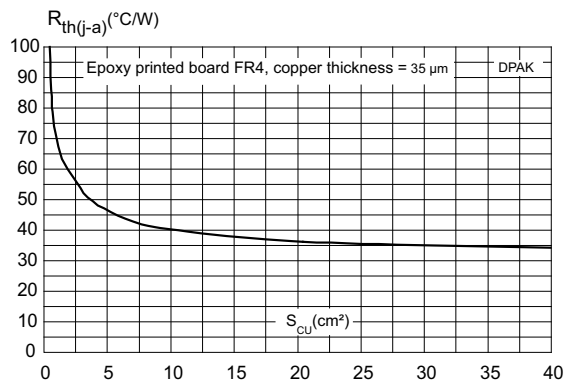


Figure 13. Thermal resistance, junction to ambient, versus copper surface under each lead

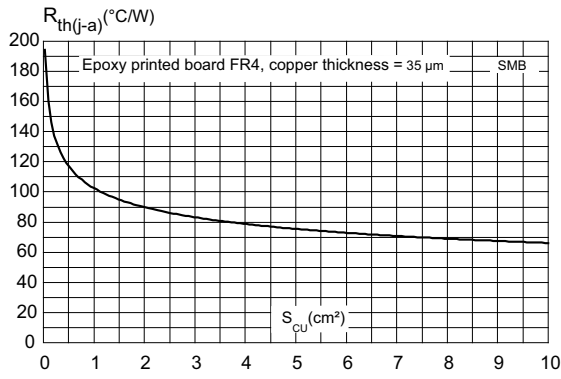
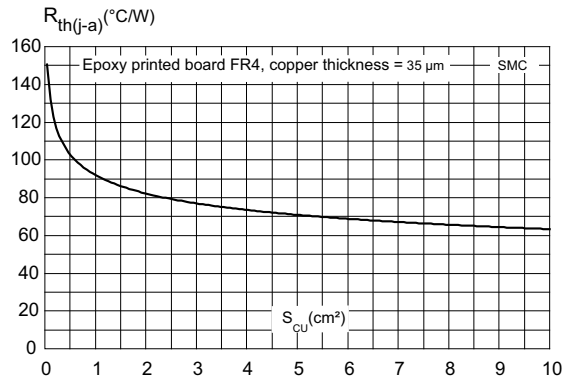


Figure 14. Thermal resistance, junction to ambient, versus copper surface under tab



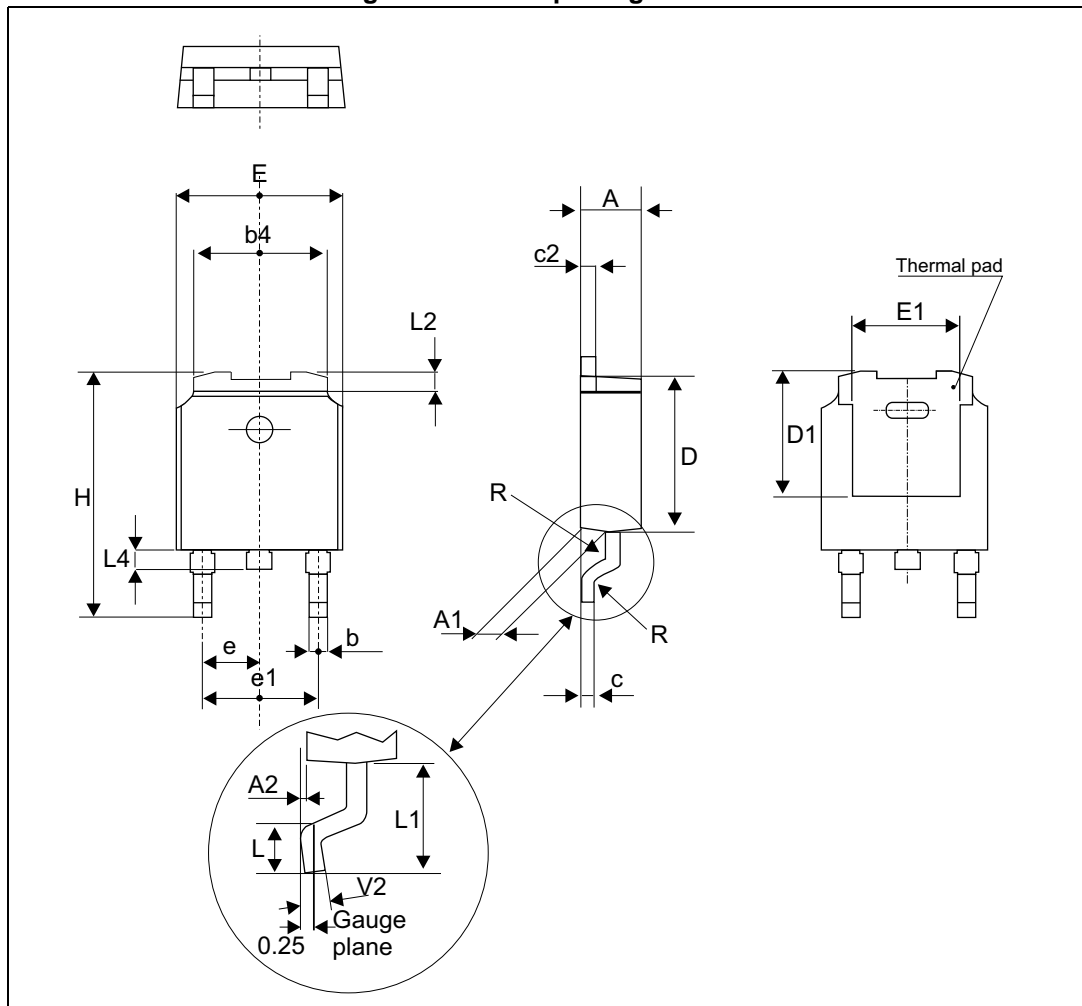
2 Package information

- Epoxy meets UL94,V0
- Cooling method: by conduction (C)
- Band indicates cathode

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 DPAK package information

Figure 15. DPAK package outline

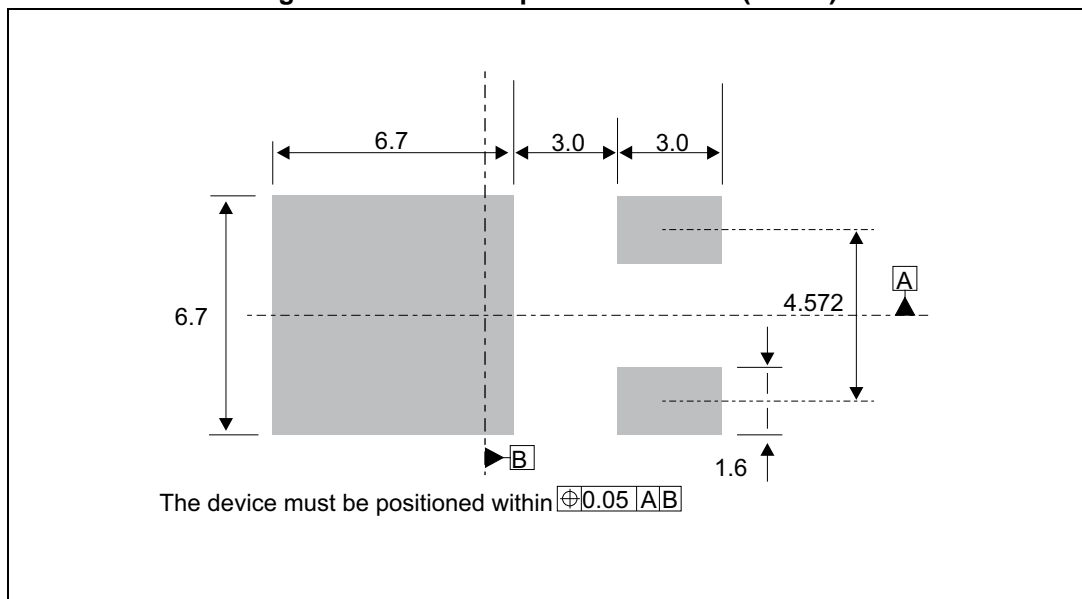


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. DPAK package mechanical data

| Ref. | Dimensions | | | | | |
|------|-------------|------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.18 | | 2.40 | 0.085 | | 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 |
| b4 | 4.95 | | 5.46 | 0.194 | | 0.214 |
| c | 0.46 | | 0.61 | 0.018 | | 0.024 |
| c2 | 0.46 | | 0.60 | 0.018 | | 0.023 |
| D | 5.97 | | 6.22 | 0.235 | | 0.244 |
| D1 | 4.95 | | 5.60 | 0.194 | | 0.220 |
| E | 6.35 | | 6.73 | 0.250 | | 0.264 |
| E1 | 4.32 | | 5.50 | 0.170 | | 0.216 |
| e | | 2.28 | | | 0.090 | |
| e1 | 4.40 | | 4.70 | 0.173 | | 0.185 |
| H | 9.35 | | 10.40 | 0.368 | | 0.409 |
| L | 1.00 | | 1.78 | 0.039 | | 0.070 |
| L2 | | | 1.27 | | | 0.050 |
| L4 | 0.60 | | 1.02 | 0.023 | | 0.040 |
| V2 | -8° | | +8° | -8° | | 8° |

Figure 16. DPAK footprint dimensions (in mm)



2.2 SMB package information

Figure 17. SMB package outline

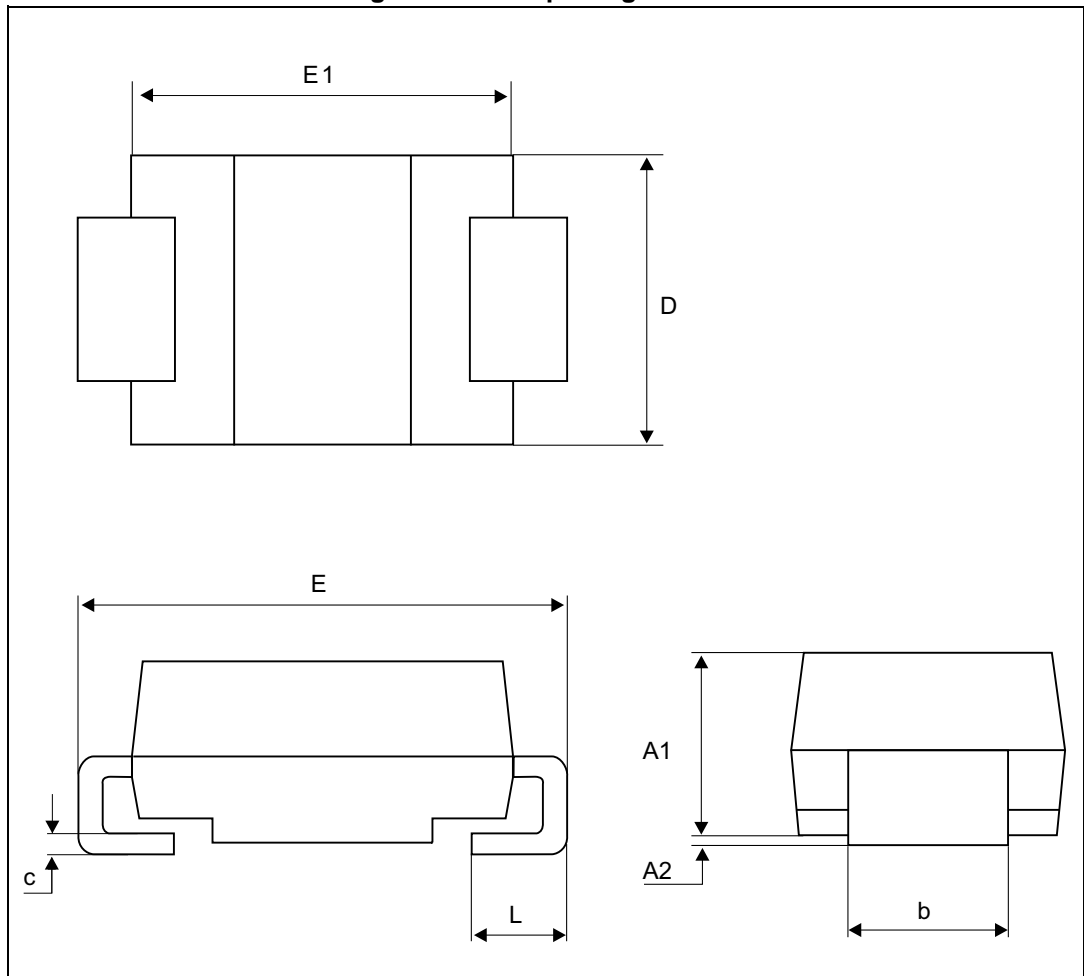
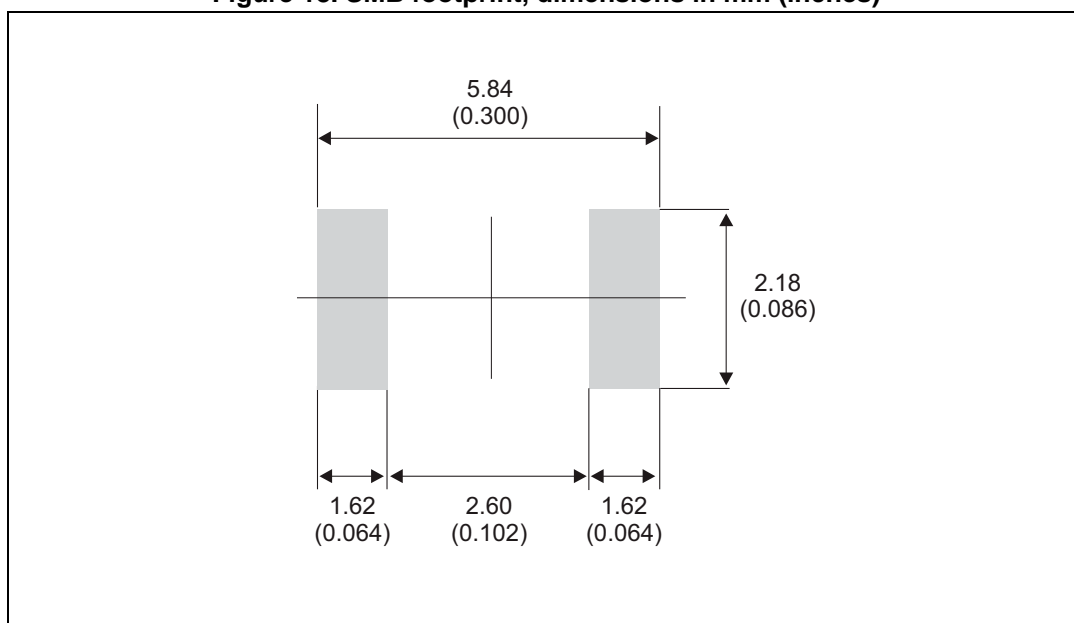


Table 7. SMB package mechanical data

| Ref. | Dimensions | | | |
|------|-------------|------|--------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.075 | 0.096 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 1.95 | 2.20 | 0.077 | 0.087 |
| c | 0.15 | 0.40 | 0.006 | 0.016 |
| D | 3.30 | 3.95 | 0.130 | 0.156 |
| E | 5.10 | 5.60 | 0.201 | 0.220 |
| E1 | 4.05 | 4.60 | 0.159 | 0.181 |
| L | 0.75 | 1.50 | 0.030 | 0.059 |

Figure 18. SMB footprint, dimensions in mm (inches)



2.3 SMC package information

Figure 19. SMC package outline

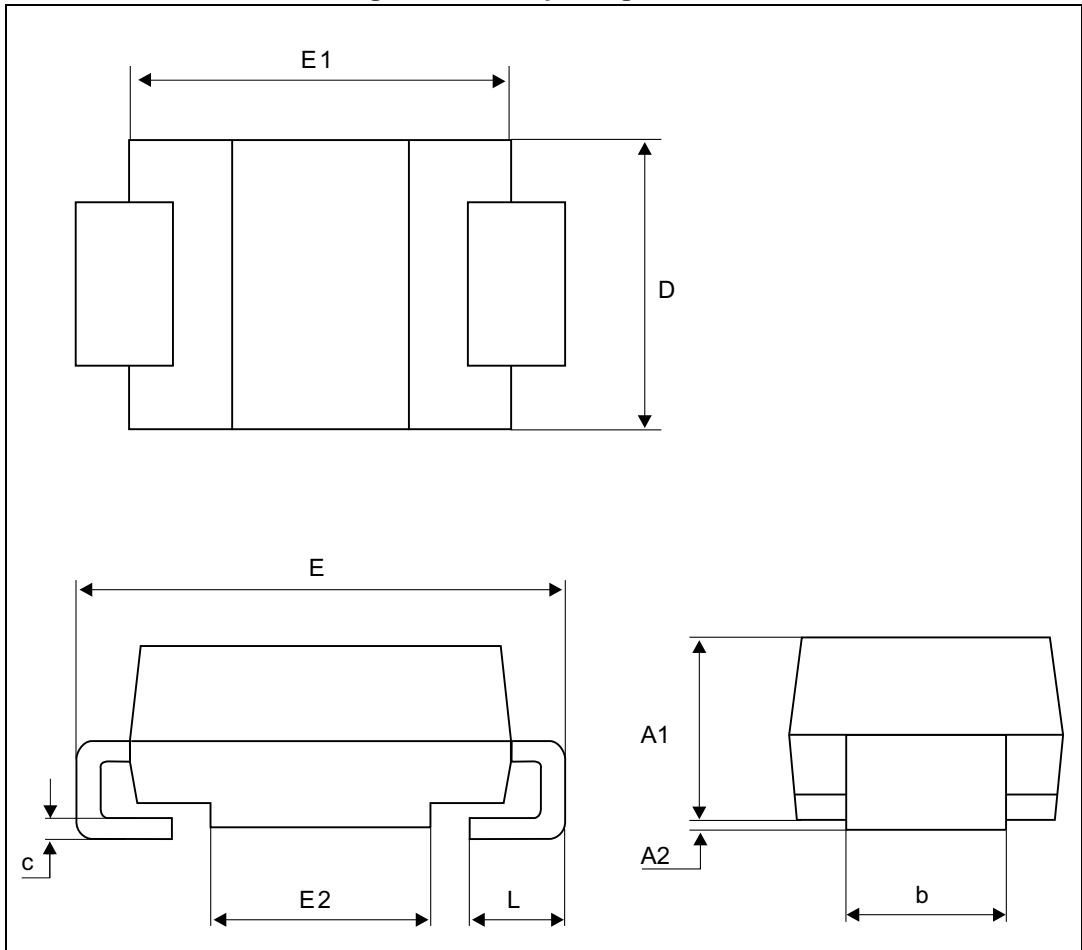
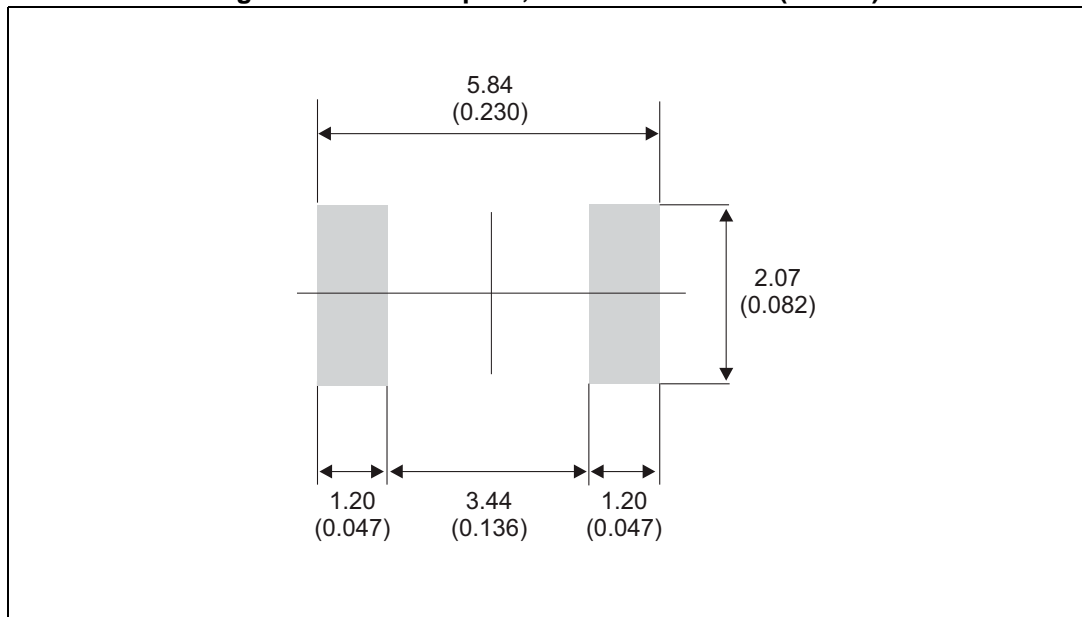


Table 8. SMC package mechanical data

| Ref. | Dimensions | | | |
|------------------|-------------|------|--------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.075 | 0.096 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b ⁽¹⁾ | 2.90 | 3.20 | 0.114 | 0.126 |
| c ⁽¹⁾ | 0.15 | 0.40 | 0.006 | 0.016 |
| D | 5.55 | 6.25 | 0.218 | 0.246 |
| E | 7.75 | 8.15 | 0.305 | 0.321 |
| E1 | 6.60 | 7.15 | 0.260 | 0.281 |
| E2 | 4.40 | 4.70 | 0.173 | 0.185 |
| L | 0.75 | 1.50 | 0.030 | 0.059 |

1. Dimensions b and c apply to plated leads

Figure 20. SMC footprint, dimensions in mm (inches)



3 Ordering information

Table 9. Ordering information

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|--------------|-----------|---------|---------|----------|---------------|
| STTH4R02B-TR | STTH 4R02 | DPAK | 0.32 g | 2500 | Tape and reel |
| STTH4R02U | 4R2U | SMB | 0.110 g | 2500 | Tape and reel |
| STTH4R02S | 4R2S | SMC | 0.243 g | 2500 | Tape and reel |

4 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 03-May-2006 | 1 | First issue. |
| 10-Oct-2006 | 2 | Added SMC package |
| 13-Apr-2010 | 3 | Updated ECOPACK statement. Updated dimensions tables for SMB and SMC. |
| 01-Jul-2010 | 4 | Separated junction to lead values from junction to case values in <i>Table 3</i> . |
| 20-Nov-2014 | 5 | Removed TO-220AC, TO-220FPAC and DO-201AB package informations. |
| 02-Nov-2016 | 6 | Updated DPAK package information and reformatted to current standard. |

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