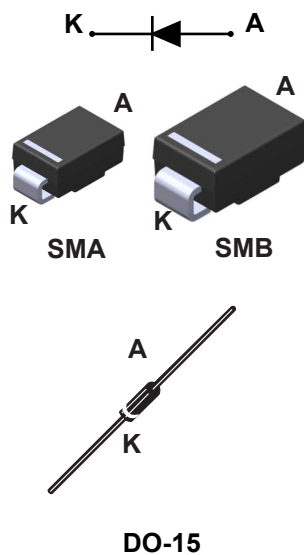


1 A - 400 V ultrafast recovery diode



Features

- Negligible switching losses
- Low forward voltage drop
- High junction temperature
- ECOPACK compliant

Applications

- Switching diode
- Telecom power

Description

The **STTH1R04** series uses ST's new 400 V planar Pt doping technology. The STTH1R04 is specially suited for switching mode base drive and transistor circuits.

Packaged in SMA, SMB and DO-15, the **STTH1R04** is ideal for use low voltage, high frequency inverters, free wheeling and polarity protection

| Product status | |
|-----------------|--------|
| STTH1R04 | |
| Product summary | |
| Symbol | Value |
| $I_{F(AV)}$ | 1 A |
| V_{RRM} | 400 V |
| $T_{j(max.)}$ | 175 °C |
| $V_{F(typ.)}$ | 0.9 V |
| $t_{rr(typ.)}$ | 14 ns |

1 Characteristics

Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)

| Symbol | Parameter | | Value | Unit | |
|-------------|--|-------|---------------------------------|------|---|
| V_{RRM} | Repetitive peak reverse voltage | | 400 | V | |
| $I_{F(AV)}$ | Average forward current $\delta = 0.5$, square wave | SMA | $T_L = 125\text{ °C}$ | 1 | A |
| | | SMB | $T_L = 140\text{ °C}$ | | |
| | | DO-15 | $T_L = 105\text{ °C}$ | | |
| I_{FSM} | Surge non repetitive forward current | | $t_p = 10\text{ ms}$ sinusoidal | 30 | A |
| T_{stg} | Storage temperature range | | -65 to +175 | °C | |
| T_j | Operating junction temperature | | +175 | °C | |

Table 2. Thermal resistance parameter

| Symbol | Parameter | | Max. value | Unit |
|---------------|------------------|--|------------|------|
| $R_{th(j-l)}$ | Junction to lead | SMA | 35 | °C/W |
| | | SMB | 25 | |
| | Junction to lead | Lead length = 10 mm on infinite heatsink | DO-15 | |

For more information, please refer to the following application note :

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics

| Symbol | Parameter | Test conditions | | Min. | Typ. | Max. | Unit |
|-------------|-------------------------|-----------------------|--------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$ | $V_R = V_{RRM}$ | - | | 5 | μA |
| | | $T_j = 125\text{ °C}$ | | - | 5 | 50 | μA |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25\text{ °C}$ | $I_F = 1\text{ A}$ | - | | 1.50 | V |
| | | $T_j = 100\text{ °C}$ | | - | 1.0 | 1.25 | |
| | | $T_j = 150\text{ °C}$ | | - | 0.9 | 1.15 | |

1. Pulse test: $t_p = 5\text{ ms}$, $\delta < 2\%$

2. Pulse test: $t_p = 380\text{ }\mu\text{s}$, $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 0.9 \times I_{F(AV)} + 0.250 \times I_F^2_{(RMS)}$$

For more information, please refer to the following application notes related to the power losses :

- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

Table 4. Dynamic characteristics ($T_j = 25\text{ °C}$ unless otherwise stated)

| Symbol | Parameters | Test conditions | Min. | Typ. | Max. | Unit |
|----------|--------------------------|---|------|------|------|------|
| t_{rr} | Reverse recovery time | $I_F = 1\text{ A}$, $di_F/dt = -50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | | 30 | ns |
| | | $I_F = 1\text{ A}$, $di_F/dt = -100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$ | - | 14 | 20 | |
| I_{RM} | Reverse recovery current | $I_F = 1\text{ A}$, $di_F/dt = -200\text{ A}/\mu\text{s}$, $V_R = 320\text{ V}$, $T_j = 125\text{ °C}$ | - | 2.5 | 3.5 | A |
| t_{fr} | Forward recovery time | $I_F = 1\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_{FR} = 1.1 \times V_{F(max)}$ | - | | 50 | ns |
| V_{FP} | Forward recovery voltage | $I_F = 1\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$ | - | 3.5 | | V |

1.1 Characteristics (curves)

Figure 1. Average forward power dissipation versus average forward current

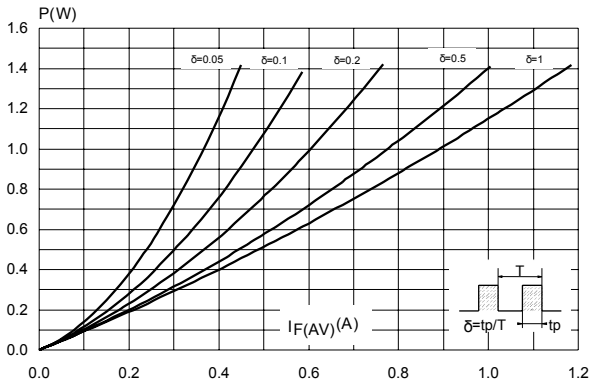


Figure 2. Forward voltage drop versus forward current

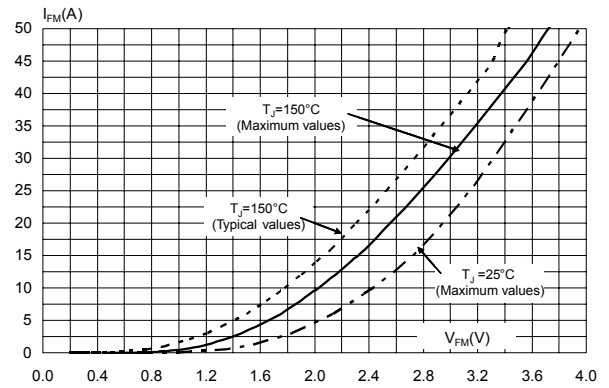


Figure 3. Relative variation of thermal impedance junction to lead versus pulse duration (SMA)

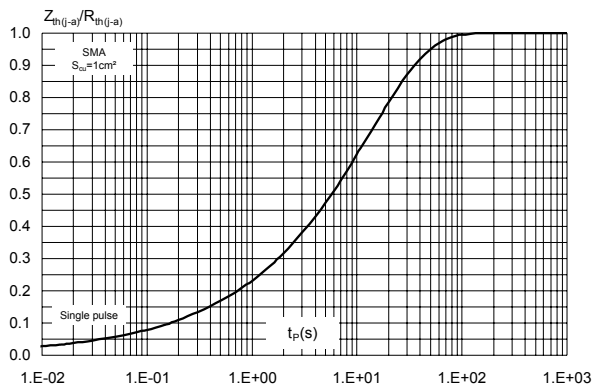


Figure 4. Relative variation of thermal impedance junction to lead versus pulse duration (SMB)

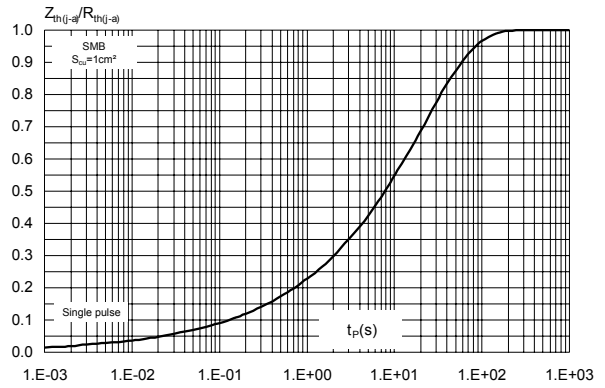


Figure 5. Relative variation of thermal impedance junction to lead versus pulse duration (DO-15)

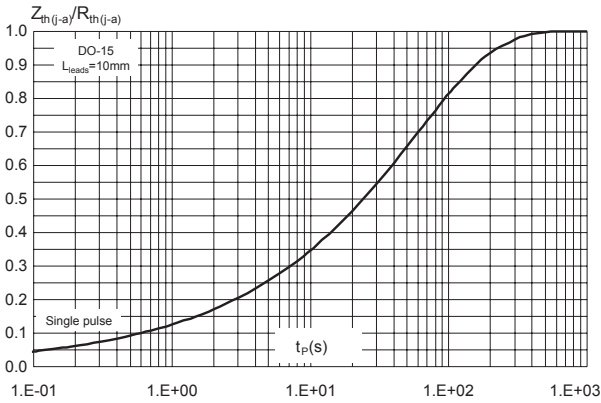


Figure 6. Reverse recovery charges versus di_F/dt (typical values)

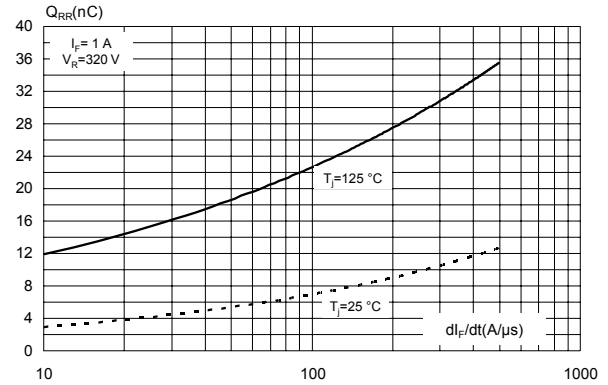


Figure 7. Junction capacitance versus reverse voltage applied (typical values)

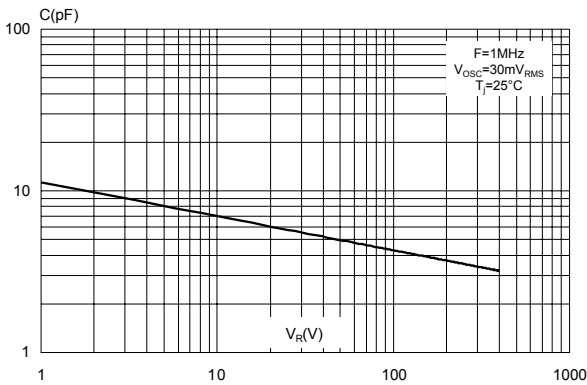


Figure 8. Reverse recovery time versus di_F/dt (typical values)

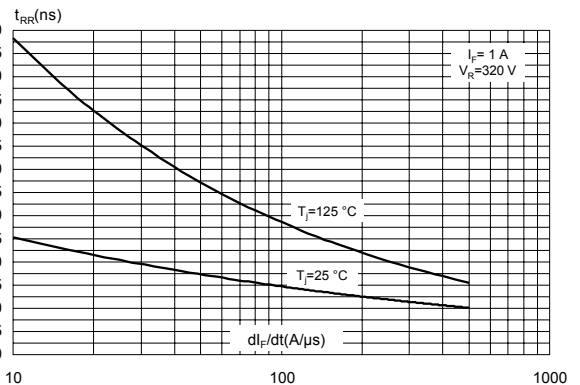


Figure 9. Peak reverse recovery current versus di_F/dt (typical values)

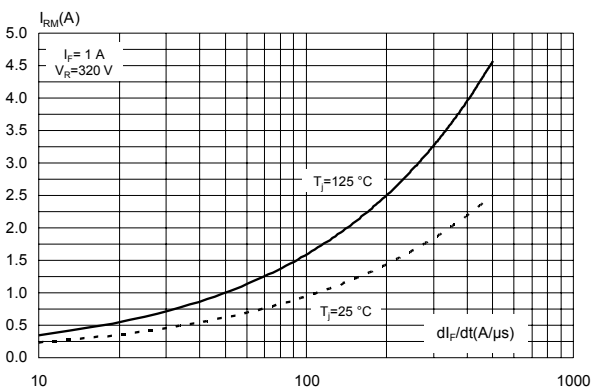


Figure 10. Relative variations of dynamic parameters versus junction temperature

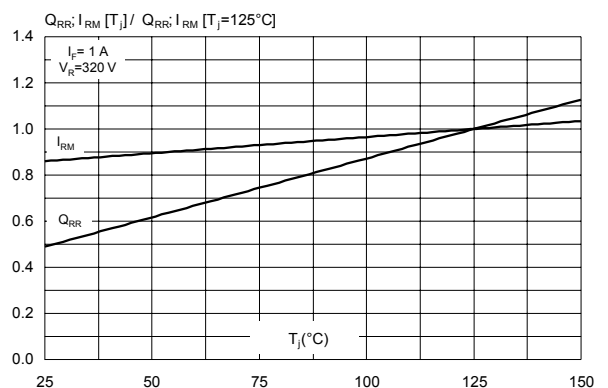


Figure 11. Transient peak forward voltage versus di_F/dt (typical values)

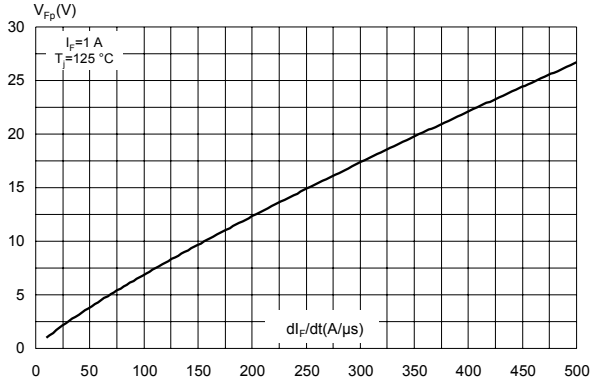


Figure 12. Forward recovery time versus di_F/dt (typical values)

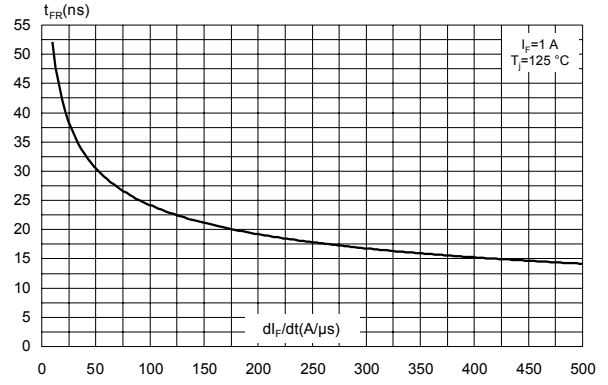


Figure 13. Thermal resistance junction to ambient versus copper surface under each lead (typical values)

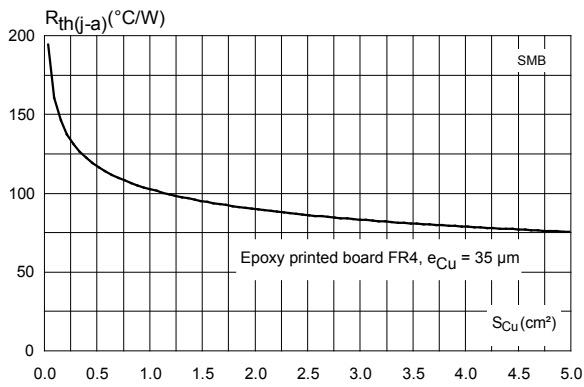


Figure 14. Thermal resistance junction to ambient versus copper surface under each lead (typical values)

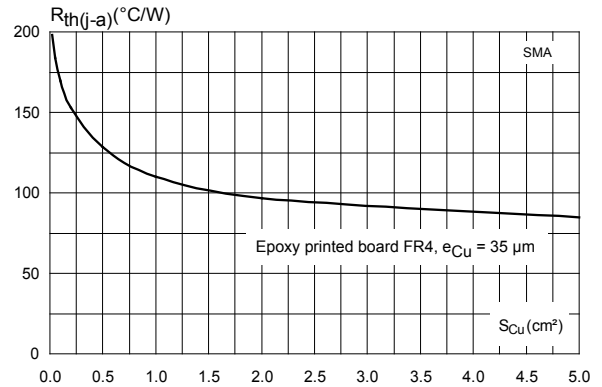
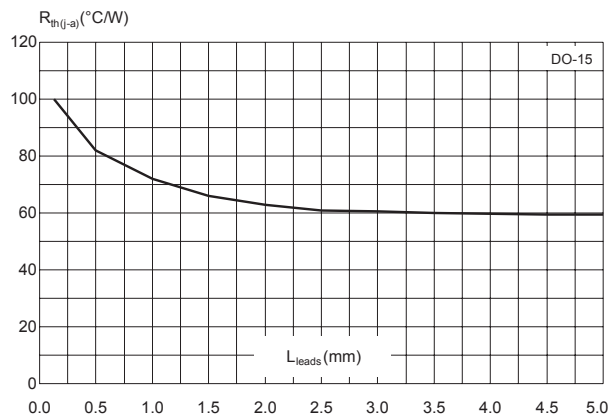


Figure 15. Thermal resistance junction to ambient versus lead length, DO-15



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 SMB package information

- Epoxy meets UL94, V0
- Lead-free package

Figure 16. SMB package outline

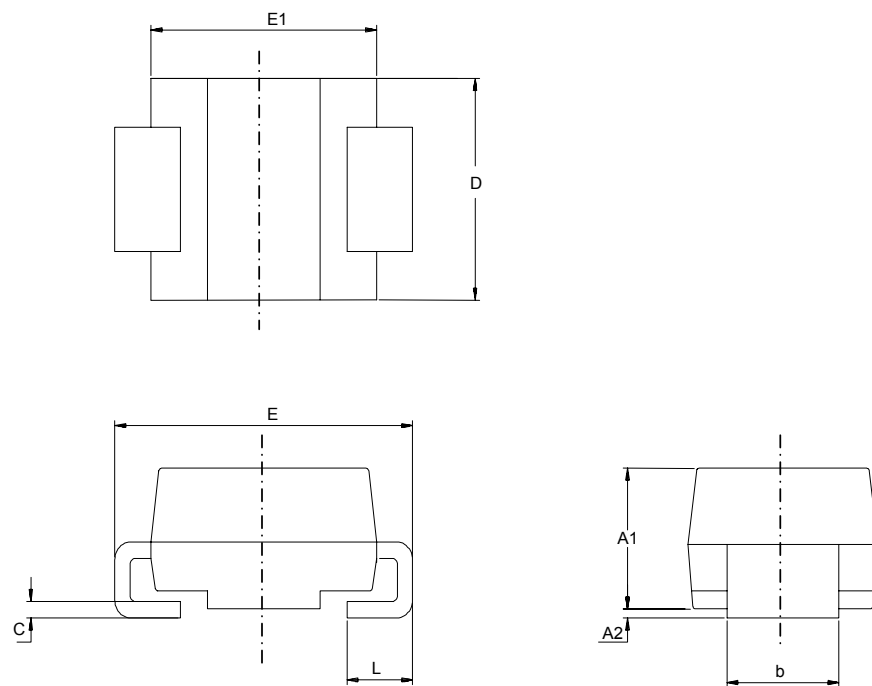
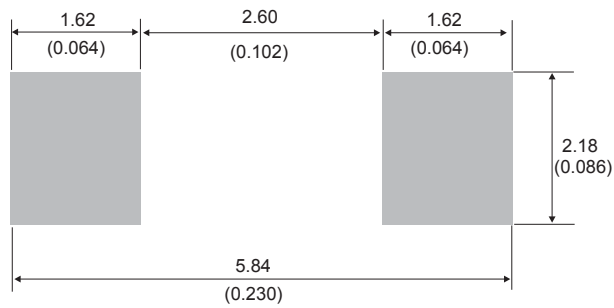


Table 5. SMB package mechanical data

| Ref. | Dimensions | | | |
|------|-------------|------|-----------------------------|-------|
| | Millimeters | | Inches (for reference only) | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.074 | 0.097 |
| A2 | 0.05 | 0.20 | 0.001 | 0.008 |
| b | 1.95 | 2.20 | 0.076 | 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 |

Figure 17. SMB recommended footprint



2.2 SMA package information

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

Figure 18. SMA package outline

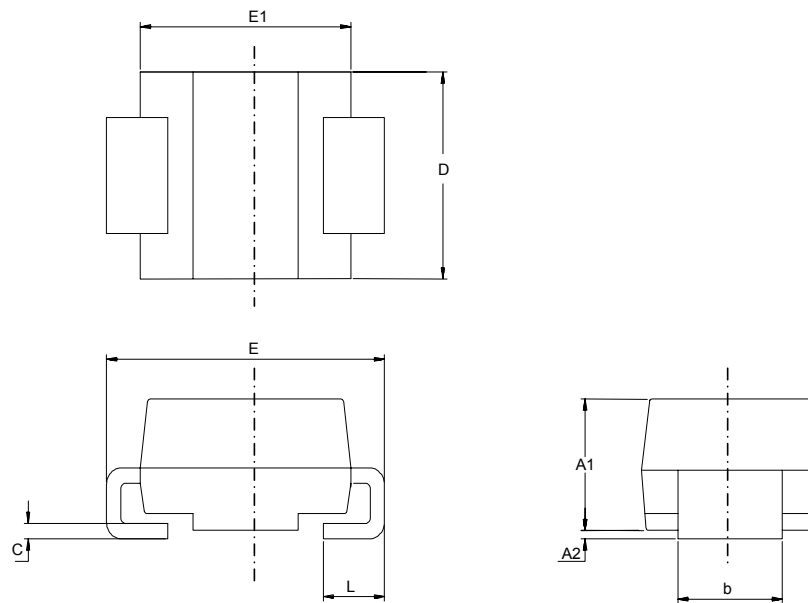
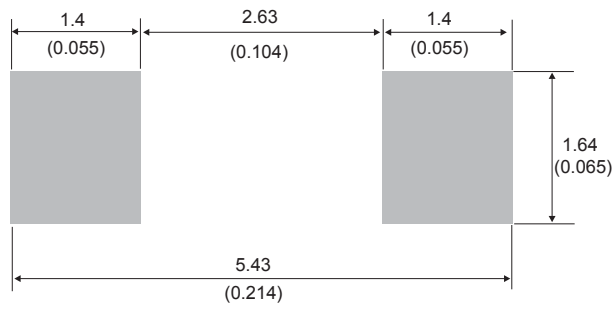


Table 6. SMA package mechanical data

| Ref. | Dimensions | | | |
|------|-------------|------|-----------------------------|-------|
| | Millimeters | | Inches (for reference only) | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.074 | 0.097 |
| A2 | 0.05 | 0.20 | 0.001 | 0.008 |
| b | 1.25 | 1.65 | 0.049 | 0.065 |
| c | 0.15 | 0.40 | 0.005 | 0.016 |
| D | 2.25 | 2.90 | 0.088 | 0.115 |
| E | 4.80 | 5.35 | 0.188 | 0.211 |
| E1 | 3.95 | 4.60 | 0.155 | 0.182 |
| L | 0.75 | 1.50 | 0.029 | 0.060 |

Figure 19. SMA recommended footprint in mm (inches)



2.3 DO-15 package information

- Epoxy meets UL 94, V0

Figure 20. DO-15 package outline

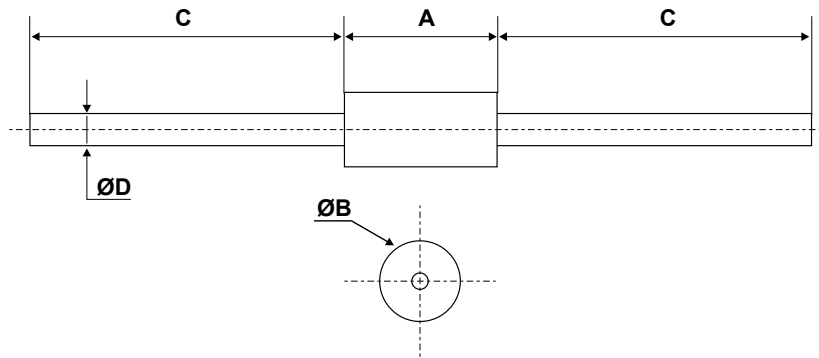


Table 7. DO-15 package mechanical data

| Ref. | Dimensions | | | | | |
|------|-------------|------|-------|-----------------------------|------|--------|
| | Millimeters | | | Inches (for reference only) | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 6.05 | - | 6.75 | 0.238 | - | 0.266 |
| B | 2.95 | - | 3.53 | 0.116 | - | 0.139 |
| C | 26.00 | - | 31.00 | 1.024 | - | 1.220 |
| D | 0.71 | - | 0.88 | 0.028 | - | 0.0035 |

3 Ordering information

Table 8. Ordering information

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|-------------|-----------|---------|---------|-----------|---------------|
| STTH1R04A | HR4 | SMA | 0.068 g | 5000 | Tape and reel |
| STTH1R04U | BR4 | SMB | 0.107 g | 2500 | Tape and reel |
| STTH1R04QRL | STTH1R04Q | DO-15 | 0.400 g | 6000 | Tape and reel |

Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 30-May-2008 | 1 | First issue. |
| 12-Nov-2015 | 2 | Updated Figure 3, Figure 4, Figure 5 and Figure 6. Minor text changes. |
| 13-Nov-2018 | 3 | Removed DO-41 package information. |
| 15-Mar-2019 | 4 | Updated Table 3. Static electrical characteristics . |

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