

Features

- Ultrafast recovery
- Low power losses
- High surge capability
- Low leakage current
- High junction temperature

Description

The **STTH10R04** is an ultrafast recovery power rectifier dedicated to **energy recovery in PDP application**.

It is especially designed for clamping function in energy recovery block.

The compromise between forward voltage drop and recovery time offers optimized performances.

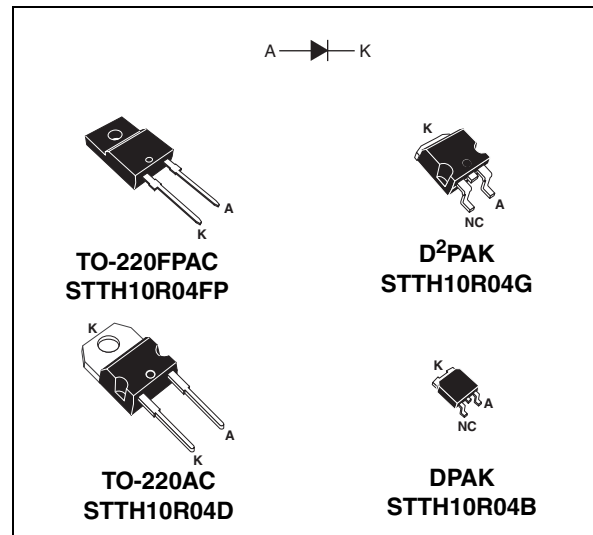


Table 1. Device summary

| | |
|----------------|--------|
| $I_{F(peak)}$ | 10 A |
| V_{RRM} | 400 V |
| t_{rr} (typ) | 15 ns |
| T_j | 175 °C |
| V_F (typ) | 1.15 V |

1 Characteristics

Table 2. Absolute ratings (limiting values)

| Symbol | Parameter | | | Value | Unit |
|----------------------|--|------------------------------------|--|--------------|------|
| V _{RRM} | Repetitive peak reverse voltage | | | 400 | V |
| I _{F(RMS)} | Forward current (rms) | | | 20 | A |
| I _{F(peak)} | Peak working forward current | DPAK, TO-220AC, D ² PAK | T _c = 135 °C δ = 0.5 Square signal | 10 | A |
| | | TO-220FPAC | T _c = 130 °C δ = 0.5 Square signal | | |
| I _{FSM} | Surge non-repetitive forward current | | t _p = 10 ms sinusoidal | 100 | A |
| T _{stg} | Storage temperature range | | | -65 to + 175 | °C |
| T _j | Maximum operating junction temperature | | | 175 | °C |

Table 3. Thermal parameters

| Symbol | Parameter | | Value | Unit |
|---------------|------------------|------------------------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case | DPAK, TO-220AC, D ² PAK | 3.5 | °C/W |
| | | TO-220FPAC | 6 | |

Table 4. Static electrical characteristics

| Symbol | Parameter | Test conditions | | Min | Typ | Max | Unit |
|-------------|-------------------------|-----------------------|---------------------|-----|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$ | $V_R = V_{RRM}$ | | | 10 | μA |
| | | $T_j = 125\text{ °C}$ | | | 10 | 100 | |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25\text{ °C}$ | $I_F = 10\text{ A}$ | | 1.5 | 1.7 | V |
| | | $T_j = 125\text{ °C}$ | | | 1.15 | 1.35 | |

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:

$$P = 1.05 \times I_{F(AV)} + 0.03 I_{F(RMS)}^2$$

Table 5. Recovery characteristics

| Symbol | Parameter | Test conditions | | Min | Typ | Max | Unit |
|--------------|--------------------------|-----------------------|--|-----|-----|-----|------|
| t_{rr} | Reverse recovery time | $T_j = 25\text{ °C}$ | $I_F = 0.5\text{ A}$, $I_{rr} = 0.25\text{ A}$, $I_R = 1\text{ A}$ | | 15 | 20 | ns |
| | | | $I_F = 1\text{ A}$, $V_R = 30\text{ V}$, $dI_F/dt = -50\text{ A}/\mu\text{s}$ | | | 40 | |
| t_{fr} | Forward recovery time | $T_j = 25\text{ °C}$ | $I_F = 10\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$ | | | 140 | ns |
| V_{FP} | Peak forward voltage | $T_j = 25\text{ °C}$ | $I_F = 10\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$ | | | 3 | V |
| I_{RM} | Reverse recovery current | $T_j = 125\text{ °C}$ | $I_F = 10\text{ A}$, $V_{CC} = 200\text{ V}$ $dI_F/dt = 200\text{ A}/\mu\text{s}$ | | 6.2 | 8 | A |
| S_{factor} | Softness factor | | | | 0.3 | | |

Figure 1. Conduction losses versus average forward current

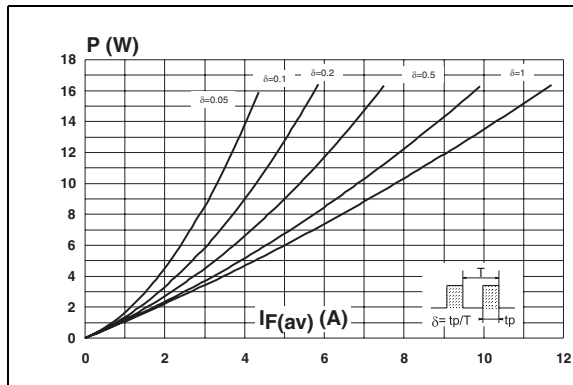


Figure 2. Forward voltage drop versus forward current

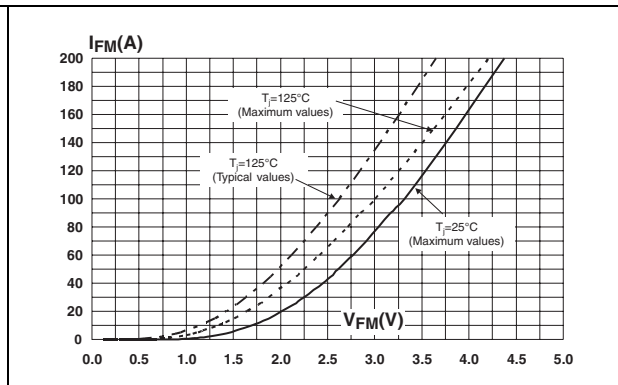


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

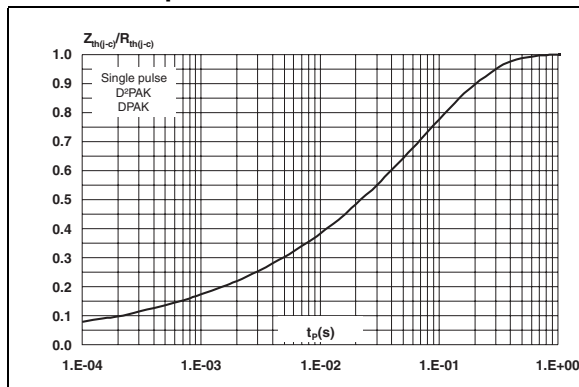


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration

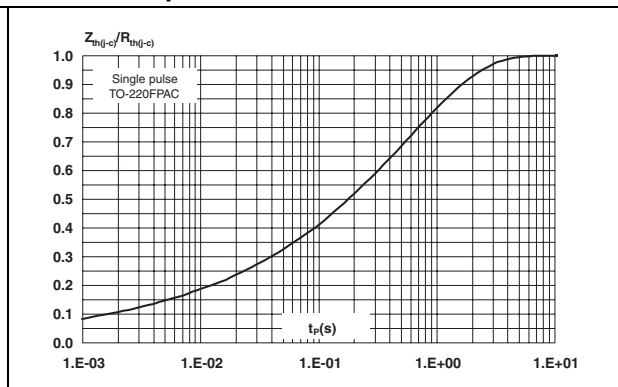


Figure 5. Peak reverse recovery current versus dI_F/dt (typical values)

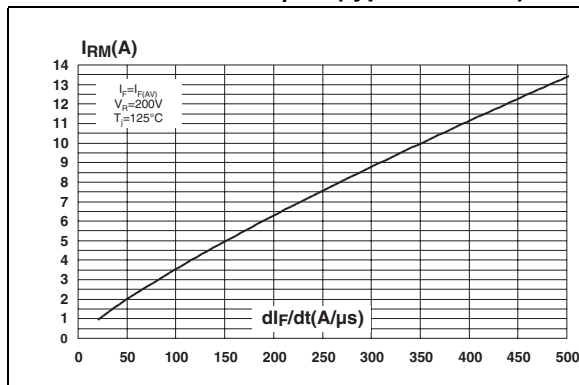


Figure 6. Reverse recovery time versus dI_F/dt (typical values)

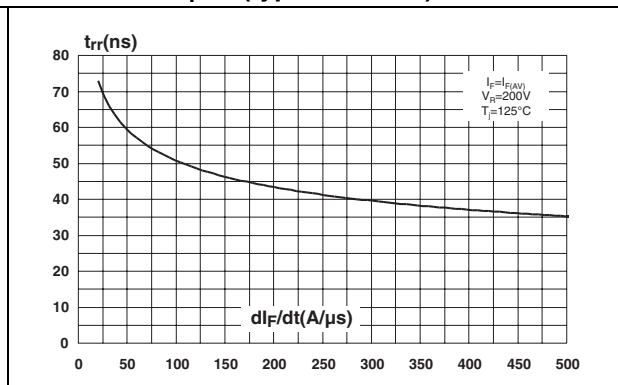


Figure 7. Reverse recovery charges versus dl_F/dt (typical values)

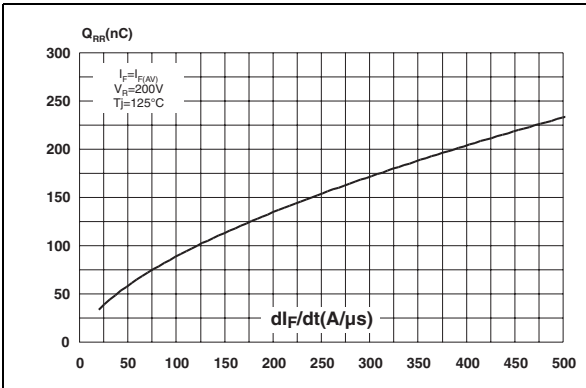


Figure 8. Reverse recovery softness factor versus dl_F/dt (typical values)

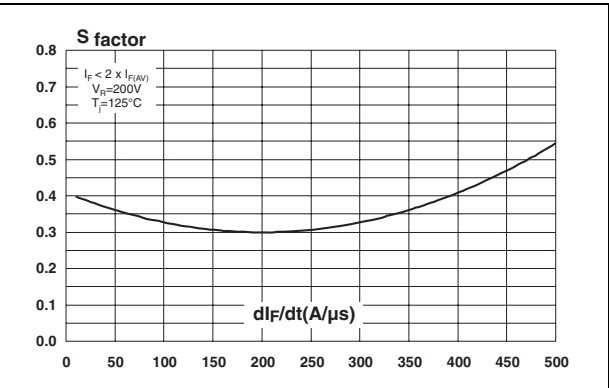


Figure 9. Relative variations of dynamic parameters versus junction temperature

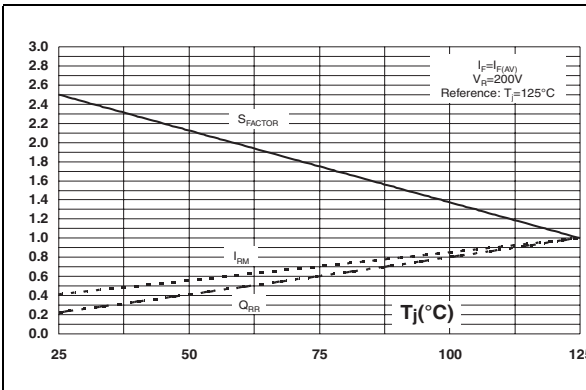


Figure 10. Transient peak forward voltage versus dl_F/dt (typical values)

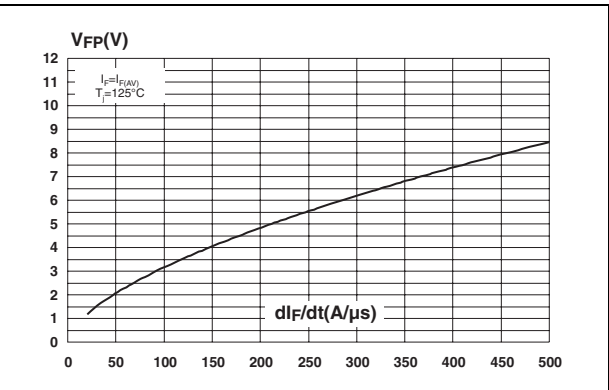


Figure 11. Forward recovery time versus di_F/dt (typical values)

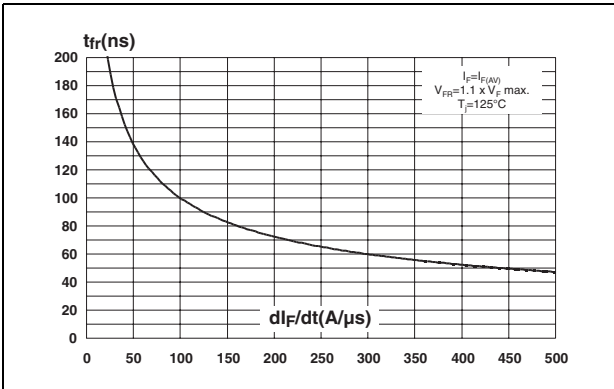


Figure 12. Junction capacitance versus reverse voltage applied (typical values)

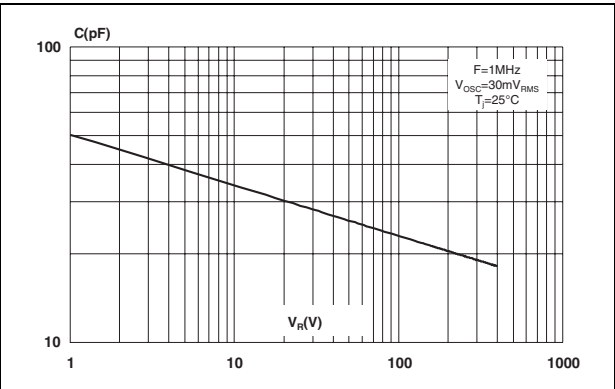


Figure 13. Thermal resistance, junction to ambient, versus copper surface under tab (epoxy printed board FR4, copper thickness = 35 μm) D²PAK

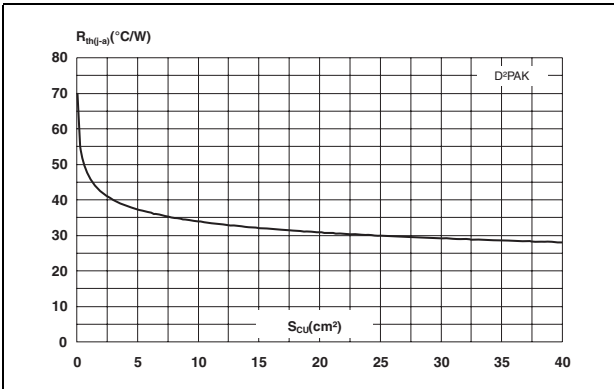
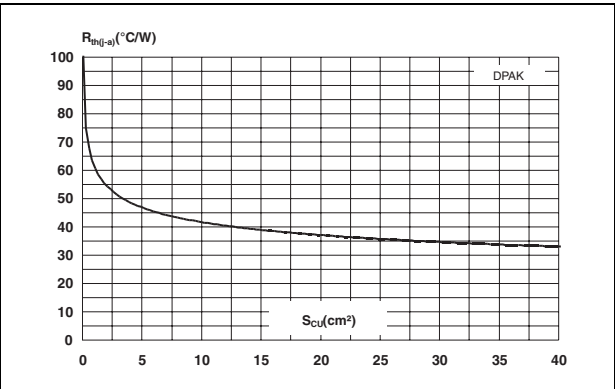


Figure 14. Thermal resistance, junction to ambient, versus copper surface under tab (epoxy printed board FR4, copper thickness = 35 μm) DPAK



2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1.0 N·m

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Table 6. TO-220AC dimensions

| Ref. | Dimensions | | | |
|---------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| C | 1.23 | 1.32 | 0.048 | 0.051 |
| D | 2.40 | 2.72 | 0.094 | 0.107 |
| E | 0.49 | 0.70 | 0.019 | 0.027 |
| F | 0.61 | 0.88 | 0.024 | 0.034 |
| F1 | 1.14 | 1.70 | 0.044 | 0.066 |
| G | 4.95 | 5.15 | 0.194 | 0.202 |
| H2 | 10.00 | 10.40 | 0.393 | 0.409 |
| L2 | 16.40 typ. | | 0.645 typ. | |
| L4 | 13.00 | 14.00 | 0.511 | 0.551 |
| L5 | 2.65 | 2.95 | 0.104 | 0.116 |
| L6 | 15.25 | 15.75 | 0.600 | 0.620 |
| L7 | 6.20 | 6.60 | 0.244 | 0.259 |
| L9 | 3.50 | 3.93 | 0.137 | 0.154 |
| M | 2.6 typ. | | 0.102 typ. | |
| Diam. I | 3.75 | 3.85 | 0.147 | 0.151 |

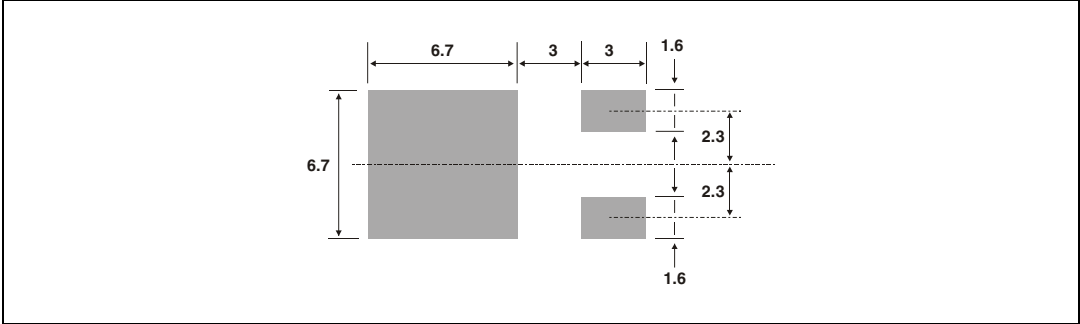
Table 7. TO-220FPAC dimensions

| Ref. | Dimensions | | | |
|------|-------------|------|-----------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.4 | 4.6 | 0.173 | 0.181 |
| B | 2.5 | 2.7 | 0.098 | 0.106 |
| D | 2.5 | 2.75 | 0.098 | 0.108 |
| E | 0.45 | 0.70 | 0.018 | 0.027 |
| F | 0.75 | 1 | 0.030 | 0.039 |
| F1 | 1.15 | 1.70 | 0.045 | 0.067 |
| G | 4.95 | 5.20 | 0.195 | 0.205 |
| G1 | 2.4 | 2.7 | 0.094 | 0.106 |
| H | 10 | 10.4 | 0.393 | 0.409 |
| L2 | 16 Typ. | | 0.63 Typ. | |
| L3 | 28.6 | 30.6 | 1.126 | 1.205 |
| L4 | 9.8 | 10.6 | 0.386 | 0.417 |
| L5 | 2.9 | 3.6 | 0.114 | 0.142 |
| L6 | 15.9 | 16.4 | 0.626 | 0.646 |
| L7 | 9.00 | 9.30 | 0.354 | 0.366 |
| Dia. | 3.00 | 3.20 | 0.118 | 0.126 |

Table 8. 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 15. DPAK footprint (dimensions in mm)



Technical drawing of a 1/2 inch diameter ball valve. The drawing includes a top view, a side view, and a detail view of the handle. Dimensions are provided in both millimeters and inches.

Dimensions:

| Ref. | Dimensions | | | |
|------|-------------|-------|------------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 4.40 | 4.60 | 0.173 | 0.181 |
| A1 | 2.49 | 2.69 | 0.098 | 0.106 |
| A2 | 0.03 | 0.23 | 0.001 | 0.009 |
| B | 0.70 | 0.93 | 0.027 | 0.037 |
| B2 | 1.14 | 1.70 | 0.045 | 0.067 |
| C | 0.45 | 0.60 | 0.017 | 0.024 |
| C2 | 1.23 | 1.36 | 0.048 | 0.054 |
| D | 8.95 | 9.35 | 0.352 | 0.368 |
| E | 10.00 | 10.40 | 0.393 | 0.409 |
| G | 4.88 | 5.28 | 0.192 | 0.208 |
| L | 15.00 | 15.85 | 0.590 | 0.624 |
| L2 | 1.27 | 1.40 | 0.050 | 0.055 |
| L3 | 1.40 | 1.75 | 0.055 | 0.069 |
| M | 2.40 | 3.20 | 0.094 | 0.126 |
| R | 0.40 typ. | | 0.016 typ. | |
| V2 | 0° | 8° | 0° | 8° |

* FLAT ZONE NO LESS THAN 2mm

Technical drawing of a stepped profile. The profile consists of a main rectangular block and three smaller rectangular blocks stacked vertically on its right side. The main block has a width of 16.90 and a height of 10.30. The three smaller blocks have a combined width of 8.90 and a total height of 5.08. The bottom-most of these three blocks has a height of 1.30. The width of the bottom-most block is 3.70. The top-most block is 3.70 wide. The middle block is 3.70 wide. The total width of the profile is 16.90. The total height of the profile is 10.30 + 5.08 = 15.38.

3 Ordering information

Table 10. Ordering information

| Order code | Marking | Package | Weight | Base qty | Delivery mode |
|---------------|-------------|--------------------|--------|----------|---------------|
| STTH10R04FP | STTH10R04FP | TO-220FPAC | 1.64 g | 50 | Tube |
| STTH10R04B | STTH10R04B | DPAK | 0.3g | 75 | Tube |
| STTH10R04B-TR | STTH10R04B | | | 2500 | Tape and reel |
| STTH10R04G | STTH10R04G | D ² PAK | 1.48 g | 50 | Tube |
| STTH10R04G-TR | STTH10R04G | | | 1000 | Tape and reel |
| STTH10R04D | STTH10R04D | TO-220AC | 1.86 g | 50 | Tube |

4 Revision history

Table 11. Document revision history

| Date | Revision | Description of changes |
|-------------|----------|------------------------|
| 07-Nov-2007 | 1 | First issue |

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