

## Ultrafast recovery diode

### Main product characteristics

|                |        |
|----------------|--------|
| $I_{F(AV)}$    | 30 A   |
| $V_{RRM}$      | 200 V  |
| $T_j$ (max)    | 175° C |
| $V_F$ (typ)    | 0.77 V |
| $t_{rr}$ (typ) | 22 ns  |

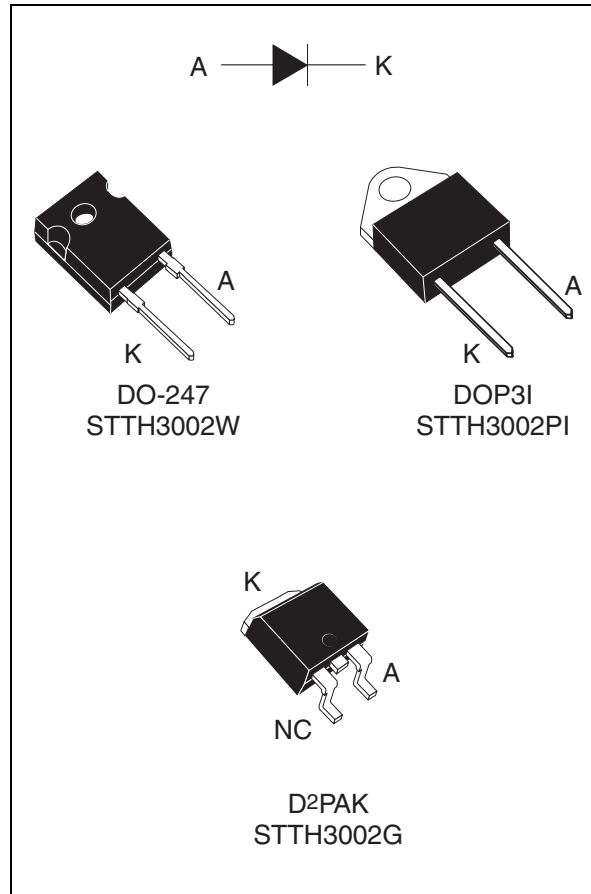
### Features and benefits

- Very low conduction losses
- Negligible switching losses
- Low forward and reverse recovery time
- High junction temperature

### Description

The STTH3002 uses ST's new 200 V planar Pt doping technology, and is specially suited for switching mode base drive and transistor circuits.

Packaged in DO-247, DOP3I, and D<sup>2</sup>PAK, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection.



### Order codes

| Part Number  | Marking  |
|--------------|----------|
| STTH3002W    | STTH3002 |
| STTH3002PI   | STTH3002 |
| STTH3002G    | STTH3002 |
| STTH3002G-TR | STTH3002 |

# 1 Characteristics

**Table 1. Absolute ratings (limiting values at  $T_j = 25^\circ\text{C}$ , unless otherwise specified)**

| Symbol       | Parameter                               |                                              | Value        | Unit             |
|--------------|-----------------------------------------|----------------------------------------------|--------------|------------------|
| $V_{RRM}$    | Repetitive peak reverse voltage         |                                              | 200          | V                |
| $I_{F(RMS)}$ | RMS forward current                     |                                              | 50           | A                |
| $I_{F(AV)}$  | Average forward current, $\delta = 0.5$ | DO-247 $T_c = 135^\circ\text{C}$             | 30           | A                |
|              |                                         | DOP3I $T_c = 115^\circ\text{C}$              |              |                  |
|              |                                         | D <sup>2</sup> PAK $T_c = 135^\circ\text{C}$ |              |                  |
| $I_{FSM}$    | Surge non repetitive forward current    | $t_p = 10\text{ ms}$ Sinusoidal              | 300          | A                |
| $T_{stg}$    | Storage temperature range               |                                              | -65 to + 175 | $^\circ\text{C}$ |
| $T_j$        | Maximum operating junction temperature  |                                              | 175          | $^\circ\text{C}$ |

**Table 2. Thermal parameters**

| Symbol        | Parameter        |                    | Value | Unit               |
|---------------|------------------|--------------------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case | DO-247             | 1.2   | $^\circ\text{C/W}$ |
|               |                  | DOP3I              | 1.8   |                    |
|               |                  | D <sup>2</sup> PAK | 1.2   |                    |

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions           |                     | Min. | Typ  | Max. | Unit          |
|-------------|-------------------------|---------------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25^\circ\text{C}$  | $V_R = V_{RRM}$     |      |      | 20   | $\mu\text{A}$ |
|             |                         | $T_j = 150^\circ\text{C}$ |                     |      | 20   | 200  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 125^\circ\text{C}$ | $I_F = 25\text{ A}$ |      | 0.77 | 0.85 | V             |
|             |                         | $T_j = 25^\circ\text{C}$  | $I_F = 30\text{ A}$ |      |      | 1.05 |               |
|             |                         | $T_j = 150^\circ\text{C}$ |                     |      | 0.8  | 0.88 |               |

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:

$$P = 0.67 \times I_{F(AV)} + 0.007 I_{F(RMS)}^2$$

Table 4. Dynamic characteristics

| Symbol   | Parameter                | Test conditions                                                                                                                   | Min. | Typ | Max. | Unit |
|----------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------|-----|------|------|
| $t_{rr}$ | Reverse recovery time    | $I_F = 1\text{ A}$ , $dI_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$            |      | 22  | 27   | ns   |
|          |                          | $I_F = 1\text{ A}$ , $dI_F/dt = -50\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$             |      | 40  | 50   |      |
| $I_{RM}$ | Reverse recovery current | $I_F = 30\text{ A}$ , $dI_F/dt = 200\text{ A}/\mu\text{s}$ ,<br>$V_R = 160\text{ V}$ , $T_j = 125\text{ }^\circ\text{C}$          |      | 7.6 | 9.5  | A    |
| $t_{fr}$ | Forward recovery time    | $I_F = 30\text{ A}$ , $dI_F/dt = 200\text{ A}/\mu\text{s}$ ,<br>$V_{FR} = 1.1 \times V_{Fmax}$ , $T_j = 25\text{ }^\circ\text{C}$ |      | 140 |      | ns   |
| $V_{FP}$ | Forward recovery voltage | $I_F = 30\text{ A}$ , $dI_F/dt = 200\text{ A}/\mu\text{s}$ ,<br>$V_{FR} = 1.1 \times V_{Fmax}$ , $T_j = 25\text{ }^\circ\text{C}$ |      | 2.5 |      | V    |

Figure 1. Peak current versus duty cycle

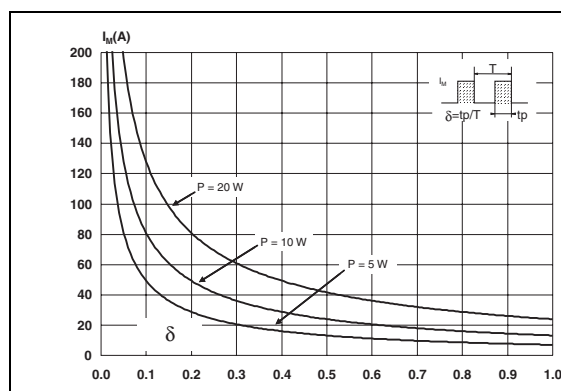


Figure 2. Forward voltage drop versus forward current (typical values)

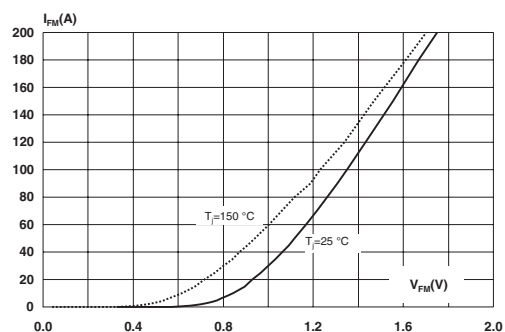


Figure 3. Forward voltage drop versus forward current (maximum values)

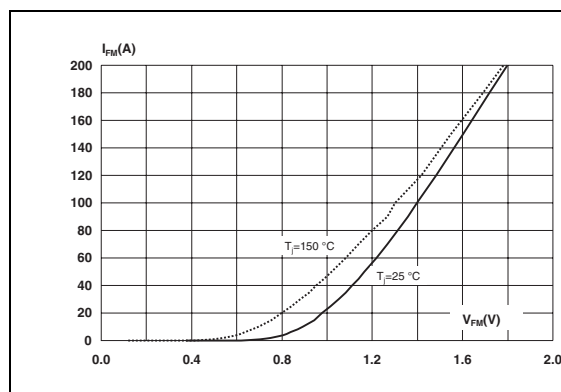
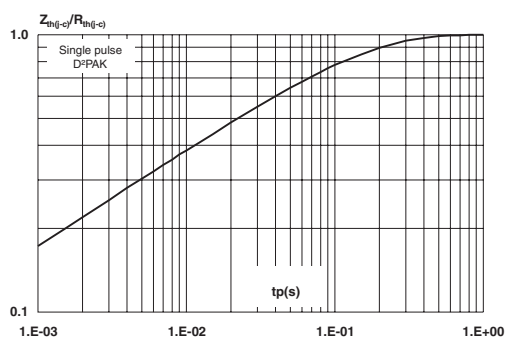
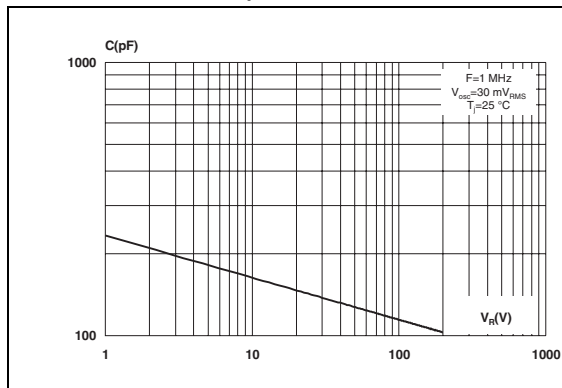


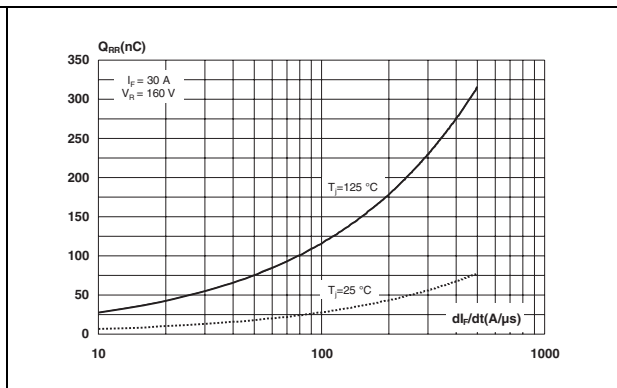
Figure 4. Relative variation of thermal impedance, junction to case, versus pulse duration



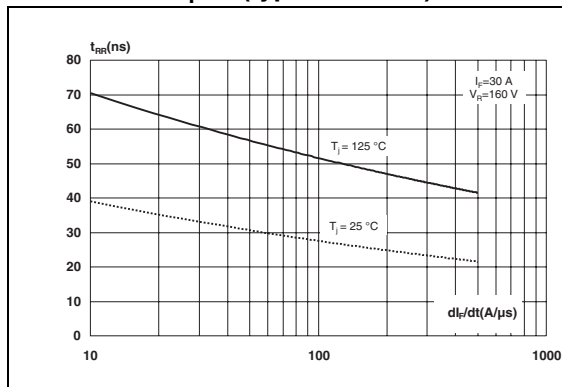
**Figure 5. Junction capacitance versus reverse voltage applied (typical values)**



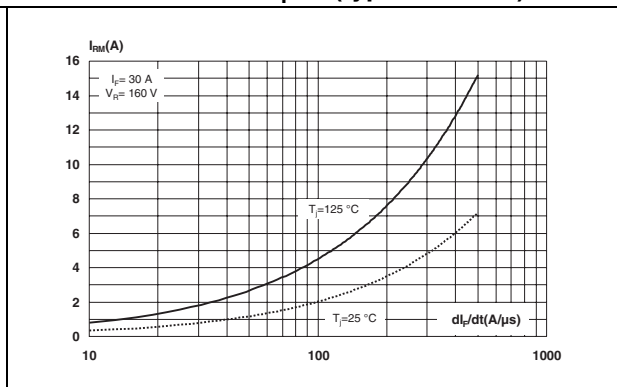
**Figure 6. Reverse recovery charges versus  $di_F/dt$  (typical values)**



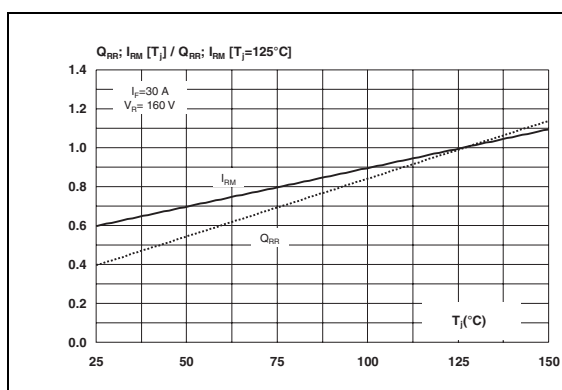
**Figure 7. Reverse recovery time versus  $di_F/dt$  (typical values)**



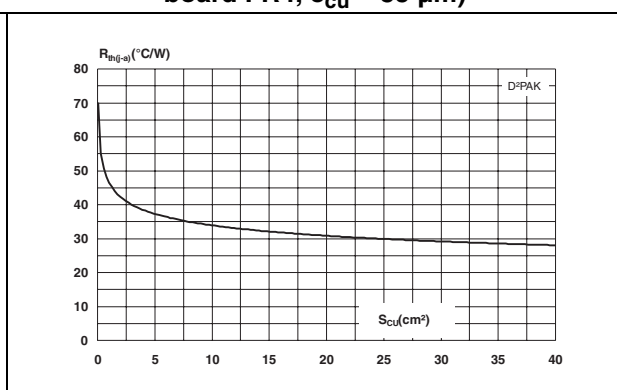
**Figure 8. Peak reverse recovery current versus  $di_F/dt$  (typical values)**



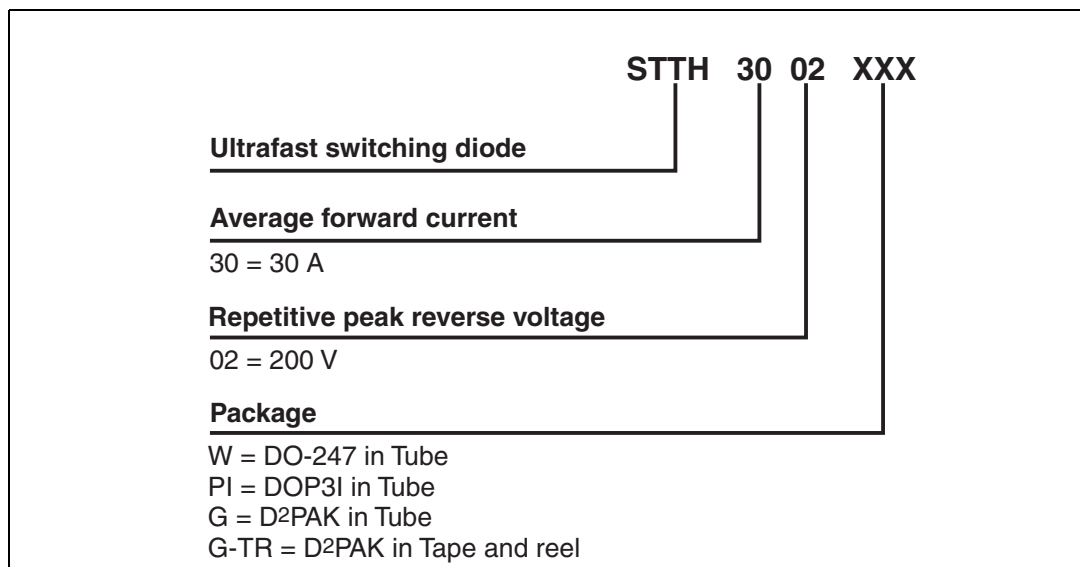
**Figure 9. Dynamic parameters versus junction temperature**



**Figure 10. Thermal resistance, junction to ambient, versus copper surface under tab (Epoxy printed circuit board FR4,  $e_{Cu} = 35 \mu m$ )**



## 2 Ordering information scheme



### 3 Package information

Epoxy meets UL94, V0

Cooling method: by conduction (C)

Recommended torque value: 0.8 Nm

Maximum torque value: 1.0 Nm

**Table 5. DO-247 dimensions**

| REF. | DIMENSIONS  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A    | 4.85        |       | 5.15  | 0.191  |       | 0.203 |
| D    | 2.20        |       | 2.60  | 0.086  |       | 0.102 |
| E    | 0.40        |       | 0.80  | 0.015  |       | 0.031 |
| F    | 1.00        |       | 1.40  | 0.039  |       | 0.055 |
| F2   |             | 2.00  |       |        | 0.078 |       |
| F3   | 2.00        |       | 2.40  | 0.078  |       | 0.094 |
| G    |             | 10.90 |       |        | 0.429 |       |
| H    | 15.45       |       | 15.75 | 0.608  |       | 0.620 |
| L    | 19.85       |       | 20.15 | 0.781  |       | 0.793 |
| L1   | 3.70        |       | 4.30  | 0.145  |       | 0.169 |
| L2   |             | 18.50 |       |        | 0.728 |       |
| L3   | 14.20       |       | 14.80 | 0.559  |       | 0.582 |
| L4   |             | 34.60 |       |        | 1.362 |       |
| L5   |             | 5.50  |       |        | 0.216 |       |
| M    | 2.00        |       | 3.00  | 0.078  |       | 0.118 |
| V    |             | 5°    |       |        | 5°    |       |
| V2   |             | 60°   |       |        | 60°   |       |
| Dia. | 3.55        |       | 3.65  | 0.139  |       | 0.143 |

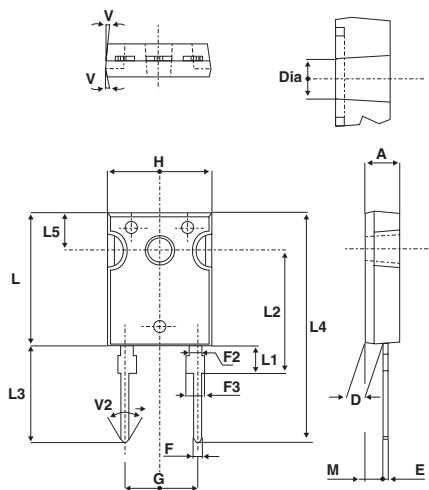
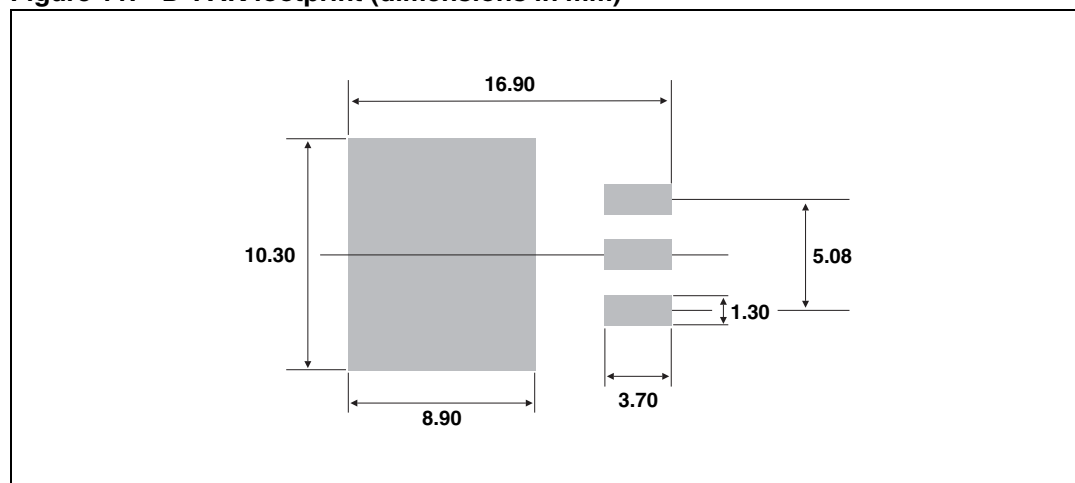


Table 6. DOP3I dimensions

| REF | DIMENSIONS  |       |            |       |
|-----|-------------|-------|------------|-------|
|     | Millimeters |       | Inches     |       |
|     | Min.        | Max.  | Min.       | Max.  |
| A   | 4.40        | 4.60  | 0.173      | 0.181 |
| b   | 1.20        | 1.40  | 0.047      | 0.055 |
| c   | 1.45        | 1.55  | 0.057      | 0.061 |
| c1  | 0.50        | 0.70  | 0.020      | 0.028 |
| D   | 12.15       | 13.10 | 0.474      | 0.516 |
| E   | 15.10       | 15.50 | 0.594      | 0.610 |
| E1  | 7.55        | 7.75  | 0.297      | 0.305 |
| e   | 10.80       | 11.30 | 0.425      | 0.445 |
| G   | 20.4        | 21.10 | 0.815      | 0.831 |
| L   | 14.35       | 15.60 | 0.565      | 0.614 |
| P   | 4.08        | 4.17  | 0.161      | 0.164 |
| Q   | 2.70        | 2.90  | 0.106      | 0.114 |
| R   | 4.60 typ.   |       | 0.181 typ. |       |
| Y   | 15.80       | 16.50 | 0.622      | 0.650 |

Table 7. D<sup>2</sup>PAK 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°    |

Figure 11. D<sup>2</sup>PAK footprint (dimensions in mm)

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](http://www.st.com).



## 4 Ordering information

| Part Number  | Marking  | Package            | Weight | Base qty | Delivery mode |
|--------------|----------|--------------------|--------|----------|---------------|
| STTH3002W    | STTH3002 | DO-247             | 4.4 g  | 30       | Tube          |
| STTH3002PI   | STTH3002 | DOP3I              | 4.46 g | 30       | Tube          |
| STTH3002G    | STTH3002 | D <sup>2</sup> PAK | 1.48 g | 50       | Tube          |
| STTH3002G-TR | STTH3002 | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |

## 5 Revision history

| Date        | Revision | Description of Changes |
|-------------|----------|------------------------|
| 03-May-2006 | 1        | First issue            |

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