

## Turbo 2 ultrafast high voltage rectifier

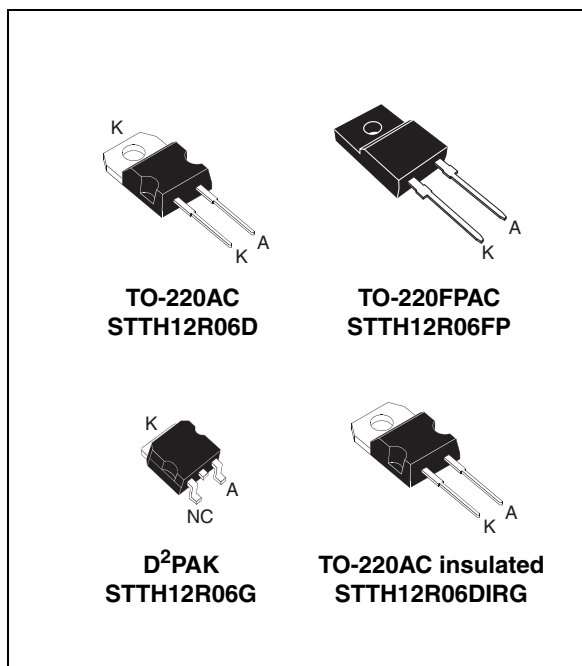
### Features

- Ultrafast switching
- Low reverse recovery current
- Low thermal resistance
- Reduces switching losses
- Package insulation voltage:  
TO220AC ins: 2500 V<sub>RMS</sub>  
TO-220FPAC: 2000 V<sub>DC</sub>

### Description

The STTH12R06 uses ST Turbo 2 600V technology and is specially suited as a boost diode in continuous mode power factor corrections and hard switching conditions.

This device is also intended for use as a free wheeling diode in power supplies and other power switching applications.



**Table 1. Device summary**

| Symbol         | Value  |
|----------------|--------|
| $I_{F(AV)}$    | 12 A   |
| $V_{RRM}$      | 600 V  |
| $I_{RM}$ (typ) | 7 A    |
| $T_j$          | 175 °C |
| $V_F$ (typ)    | 1.4 V  |
| $t_{rr}$ (max) | 25 ns  |

# 1 Characteristics

**Table 2. Absolute ratings (limiting values)**

| Symbol              | Parameter                              |                                            |                                   | Value        | Unit |
|---------------------|----------------------------------------|--------------------------------------------|-----------------------------------|--------------|------|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage        |                                            |                                   | 600          | V    |
| I <sub>F(RMS)</sub> | Forward rms current                    | TO-220AC / TO-220FPAC / D <sup>2</sup> PAK |                                   | 30           | A    |
|                     |                                        | TO-220AC ins.                              |                                   | 24           |      |
| I <sub>F(AV)</sub>  | Average forward current δ = 0.5        | TO-220AC / D <sup>2</sup> PAK              | T <sub>C</sub> = 125 °C           | 12           | A    |
|                     |                                        | TO-220FPAC                                 | T <sub>C</sub> = 50 °C            |              |      |
|                     |                                        | TO-220AC ins.                              | T <sub>C</sub> = 80 °C            |              |      |
| I <sub>FSM</sub>    | Surge non repetitive forward current   |                                            | t <sub>p</sub> = 10 ms sinusoidal | 100          | A    |
| T <sub>stg</sub>    | Storage temperature range              |                                            |                                   | -65 to + 175 | °C   |
| T <sub>j</sub>      | Maximum operating junction temperature |                                            |                                   | 175          | °C   |

**Table 3. Thermal resistance**

| Symbol        | Parameter        |                               | Value (max) | Unit                 |
|---------------|------------------|-------------------------------|-------------|----------------------|
| $R_{th(j-c)}$ | Junction to case | TO-220AC / D <sup>2</sup> PAK | 1.7         | $^{\circ}\text{C/W}$ |
|               |                  | TO-220FPAC                    | 4.4         |                      |
|               |                  | TO-220AC ins.                 | 3.3         |                      |

**Table 4. Static electrical characteristics**

| Symbol | Parameter               | Test conditions                     |                     | Min. | Typ. | Max. | Unit          |
|--------|-------------------------|-------------------------------------|---------------------|------|------|------|---------------|
| $I_R$  | Reverse leakage current | $T_j = 25\text{ }^{\circ}\text{C}$  | $V_R = V_{RRM}$     |      |      | 45   | $\mu\text{A}$ |
|        |                         | $T_j = 125\text{ }^{\circ}\text{C}$ |                     |      | 50   | 600  |               |
| $V_F$  | Forward voltage drop    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 12\text{ A}$ |      |      | 2.9  | V             |
|        |                         | $T_j = 125\text{ }^{\circ}\text{C}$ |                     |      | 1.4  | 1.8  |               |

To evaluate the conduction losses use the following equation:

$$P = 1.16 \times I_{F(AV)} + 0.053 I_{F(RMS)}^2$$

Table 5. Dynamic Characteristics

| Symbol   | Parameter                | Test conditions                     |                                                                                               | Min. | Typ. | Max. | Unit |
|----------|--------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{rr}$ | Reverse recovery time    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 0.5\text{ A}$ , $I_{rr} = 0.25\text{ A}$ ,<br>$I_R = 1\text{ A}$                       |      |      | 25   | ns   |
|          |                          |                                     | $I_F = 1\text{ A}$ ,<br>$di_F/dt = -50\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$         |      |      | 45   |      |
| $I_{RM}$ | Reverse recovery current | $T_j = 125\text{ }^{\circ}\text{C}$ | $I_F = 12\text{ A}$ , $V_R = 400\text{ V}$ ,<br>$di_F/dt = -200\text{ A}/\mu\text{s}$         |      | 7.0  | 8.4  | A    |
| S factor | Softness factor          |                                     |                                                                                               |      | 0.2  |      |      |
| $Q_{rr}$ | Reverse recovery charges |                                     |                                                                                               |      | 180  |      | nC   |
| $t_{fr}$ | Forward recovery time    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 12\text{ A}$ , $di_F/dt = 96\text{ A}/\mu\text{s}$ ,<br>$V_{FR} = 1.1 \times V_{Fmax}$ |      |      | 200  | ns   |
| $V_{FP}$ | Forward recovery voltage |                                     |                                                                                               |      |      | 5.5  | V    |

Figure 1. Conduction losses versus average current

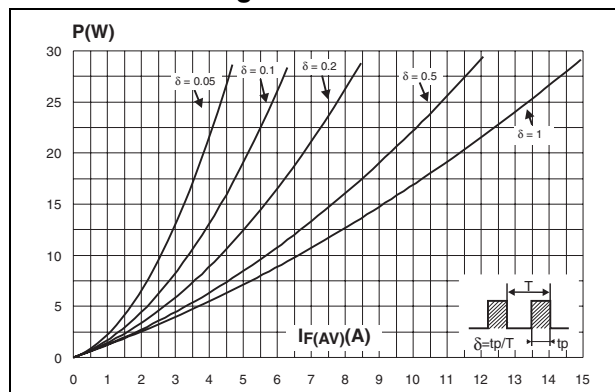


Figure 2. Forward voltage drop versus forward current

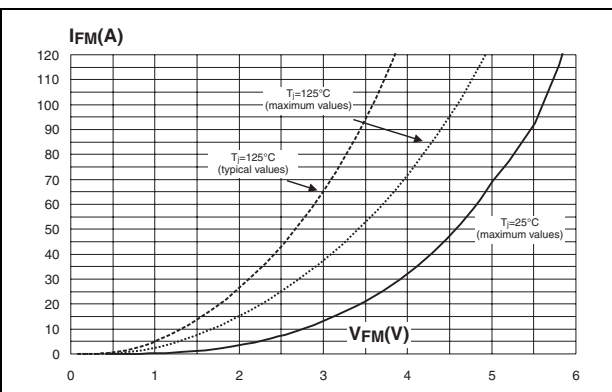


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

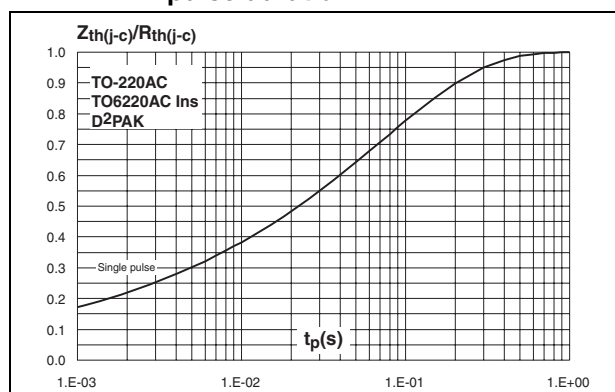
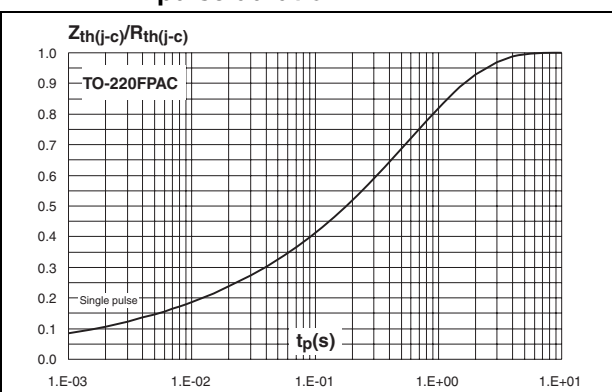
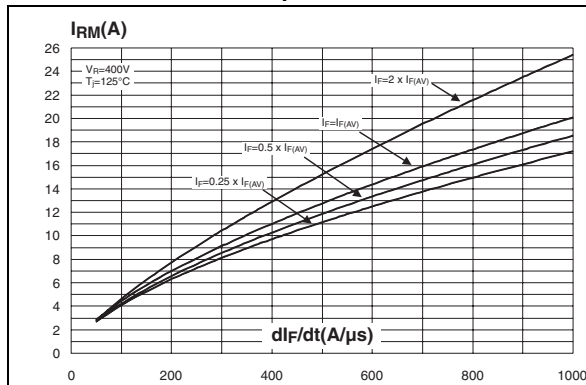


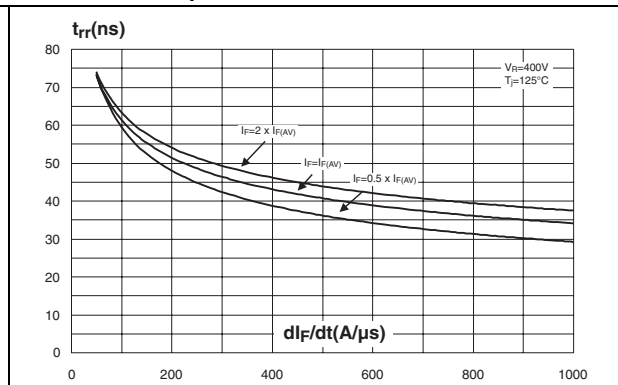
Figure 4. Relative variation of thermal impedance junction to case versus pulse duration



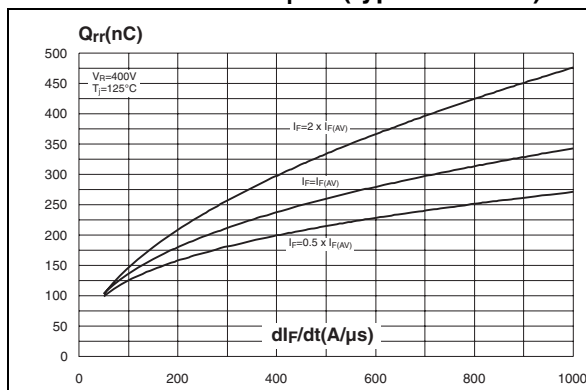
**Figure 5. Peak reverse recovery current versus  $dl_F/dt$  (typical values)**



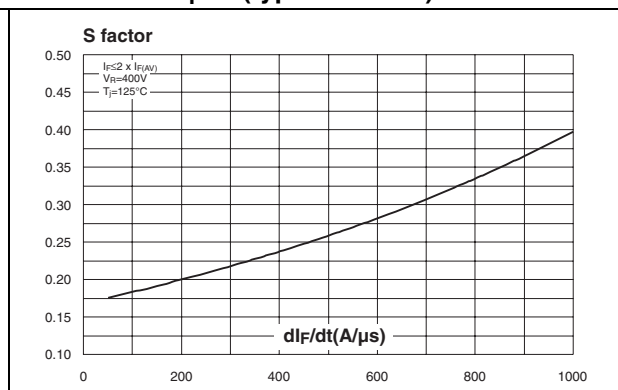
**Figure 6. Reverse recovery time versus  $dl_F/dt$  (typical values)**



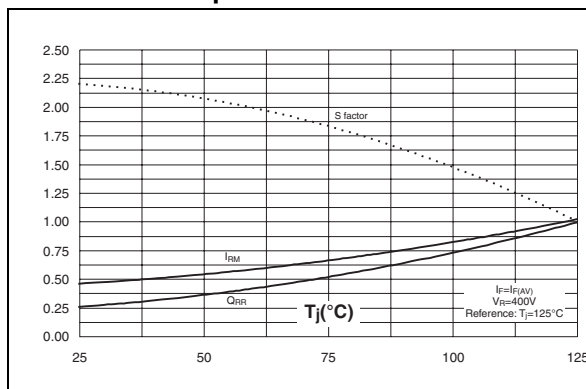
**Figure 7. Reverse recovery charges versus  $dl_F/dt$  (typical values)**



**Figure 8. 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)**

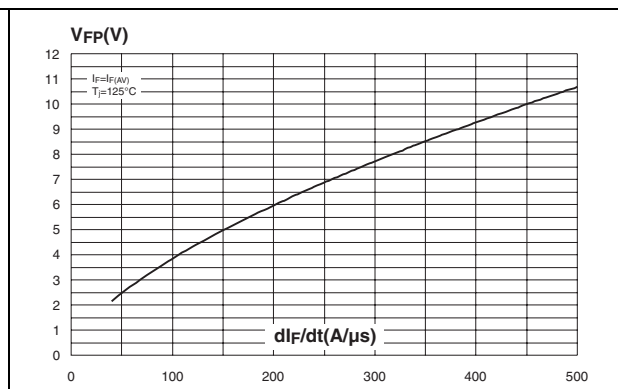


Figure 11. Forward recovery time versus  $dI_F/dt$  (typical values)

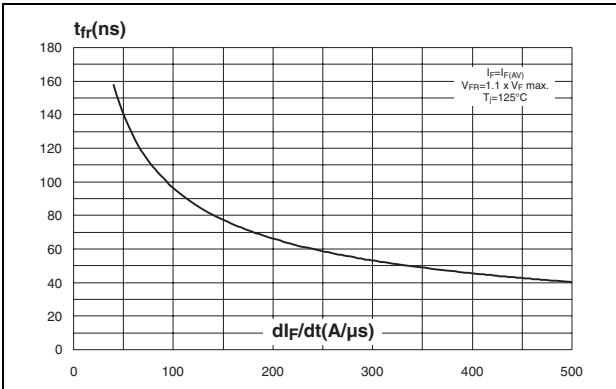


Figure 12. Junction capacitance versus reverse voltage applied (typical values)

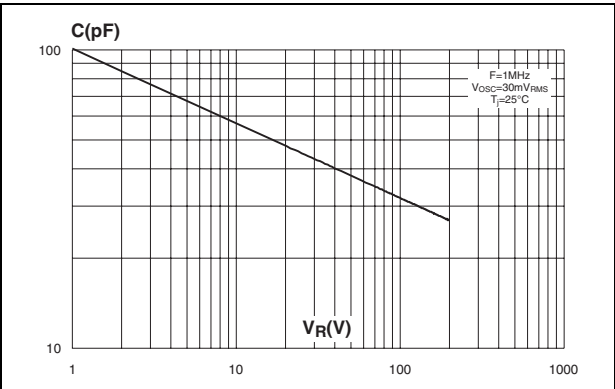
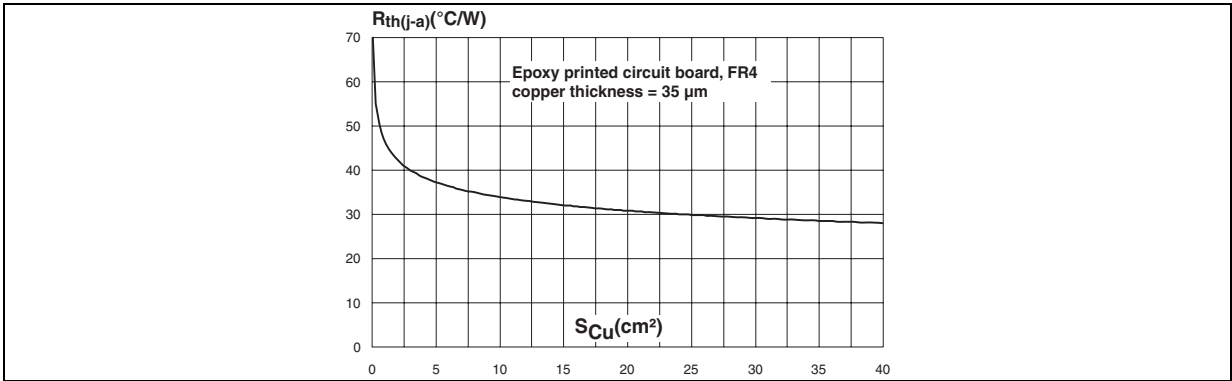


Figure 13. Thermal resistance junction to ambient versus copper surface under tab



## 2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.4 to 0.6 N·m

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**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. |       |
| Dia. 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. TO-220AC (nins. and ins. 20-up) dimensions

| Ref. | Dimensions  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A    | 15.20       |       | 15.90 | 0.598  |       | 0.625 |
| a1   |             | 3.75  |       |        | 0.147 |       |
| a2   | 13.00       |       | 14.00 | 0.511  |       | 0.551 |
| B    | 10.00       |       | 10.40 | 0.393  |       | 0.409 |
| b1   | 0.61        |       | 0.88  | 0.024  |       | 0.034 |
| b2   | 1.23        |       | 1.32  | 0.048  |       | 0.051 |
| C    | 4.40        |       | 4.60  | 0.173  |       | 0.181 |
| c1   | 0.49        |       | 0.70  | 0.019  |       | 0.027 |
| c2   | 2.40        |       | 2.72  | 0.094  |       | 0.107 |
| e    | 4.80        |       | 5.40  | 0.189  |       | 0.212 |
| F    | 6.20        |       | 6.60  | 0.244  |       | 0.259 |
| ØI   | 3.75        |       | 3.85  | 0.147  |       | 0.151 |
| l4   | 15.80       | 16.40 | 16.80 | 0.622  | 0.646 | 0.661 |
| L    | 2.65        |       | 2.95  | 0.104  |       | 0.116 |
| l2   | 1.14        |       | 1.70  | 0.044  |       | 0.066 |
| M    |             | 2.60  |       |        | 0.102 |       |



Technical drawing of a 100mm x 100mm x 10mm plate. The drawing includes a top view, a side view, and a detail view of the corner. Dimensions are labeled as follows:

- Top View:** L (Overall Length), L2 (Distance from top edge to top of plate), L3 (Distance from top of plate to bottom edge), E (Overall Width), B (Distance from bottom edge to bottom of plate), B2 (Distance from bottom of plate to bottom edge), G (Distance from bottom edge to bottom of plate).
- Side View:** A (Overall Height), C2 (Distance from top edge to top of plate), D (Distance from top of plate to bottom edge), C (Distance from bottom edge to bottom of plate), R (Radius of corner).
- Detail View:** A1 (Distance from top edge to top of plate), A2 (Distance from top of plate to bottom edge), M (Distance from bottom edge to bottom of plate), V2 (Distance from bottom of plate to bottom edge).

\* FLAT ZONE NO LESS THAN 2mm

| 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°    |

Technical drawing of a rectangular block with dimensions and a stepped profile. The main block has a width of 16.90 and a height of 10.30. A smaller section on the right has a width of 3.70 and a height of 5.08. The distance between the main block and the smaller section is 8.90. The smaller section has a height of 1.30 from the bottom.

### 3 Ordering information

**Table 10. Ordering information**

| Order code    | Marking     | Package            | Weight | Base qty | Delivery mode |
|---------------|-------------|--------------------|--------|----------|---------------|
| STTH12R06D    | STTH12R06D  | TO-220AC           | 1.90 g | 50       | Tube          |
| STTH12R06G    | STTH12R06G  | D <sup>2</sup> PAK | 1.48 g | 50       | Tube          |
| STTH12R06G-TR | STTH12R06G  | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |
| STTH12R06FP   | STTH12R06FP | TO-220FPAC         | 1.70 g | 50       | Tube          |
| STTH12R06DIRG | STTH12R06DI | TO-220AC ins.      | 1.86 g | 50       | Tube          |

### 4 Revision history

**Table 11. Document revision history**

| Date         | Revision | Changes                                                                       |
|--------------|----------|-------------------------------------------------------------------------------|
| January-2002 | 1        | Initial release.                                                              |
| 18-Oct-2004  | 2        | D <sup>2</sup> PAK and TO-220AC insulated packages added                      |
| 10-Aug-2006  | 3        | Reformatted to current standards. Added package insulation voltages on page 1 |
| 15-Feb-2010  | 4        | Corrected typographical error in order codes in <a href="#">Table 10</a> .    |

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