

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_{RMS}
TO-220FPAC: 2000 V_{DC}

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.

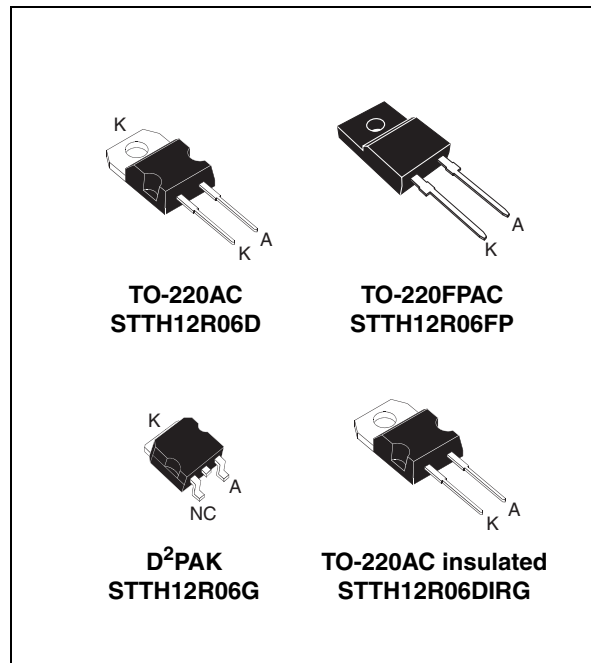


Table 1. Device summary

| 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_{RRM} | Repetitive peak reverse voltage | | 600 | V |
| $I_{F(RMS)}$ | Forward rms current | TO-220AC / TO-220FPAC / D ² PAK | 30 | A |
| | | TO-220AC ins. | 24 | |
| $I_{F(AV)}$ | Average forward current $\delta = 0.5$ | TO-220AC / D ² PAK | 12 | A |
| | | TO-220FPAC | | |
| | | TO-220AC ins. | | |
| 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 resistance

| Symbol | Parameter | | Value (max) | Unit |
|---------------|------------------|-------------------------------|-------------|------|
| $R_{th(j-c)}$ | Junction to case | TO-220AC / D ² PAK | 1.7 | °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 | $T_j = 25$ °C | $V_R = V_{RRM}$ | | 45 | μ A |
| | | $T_j = 125$ °C | | 50 | 600 | |
| V_F | Forward voltage drop | $T_j = 25$ °C | $I_F = 12$ A | | 2.9 | V |
| | | $T_j = 125$ °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 | $T_j = 25\text{ }^\circ\text{C}$ | $I_F = 0.5\text{ A}, I_{rr} = 0.25\text{ A}, I_R = 1\text{ A}$ | | | 25 | ns |
| | | | $I_F = 1\text{ A}, dI_F/dt = -50\text{ A}/\mu\text{s}, V_R = 30\text{ V}$ | | | 45 | |
| I_{RM} | Reverse recovery current | $T_j = 125\text{ }^\circ\text{C}$ | $I_F = 12\text{ A}, V_R = 400\text{ V}, dI_F/dt = -200\text{ A}/\mu\text{s}$ | | 7.0 | 8.4 | A |
| S factor | Softness factor | | | | 0.2 | | |
| Q_{rr} | Reverse recovery charges | | | | 180 | | nC |
| t_{fr} | Forward recovery time | $T_j = 25\text{ }^\circ\text{C}$ | $I_F = 12\text{ A}, dI_F/dt = 96\text{ A}/\mu\text{s}, V_{FR} = 1.1 \times V_{Fmax}$ | | | 200 | ns |
| V_{FP} | Forward recovery voltage | | | | | 5.5 | V |

Figure 1. Conduction losses versus average current

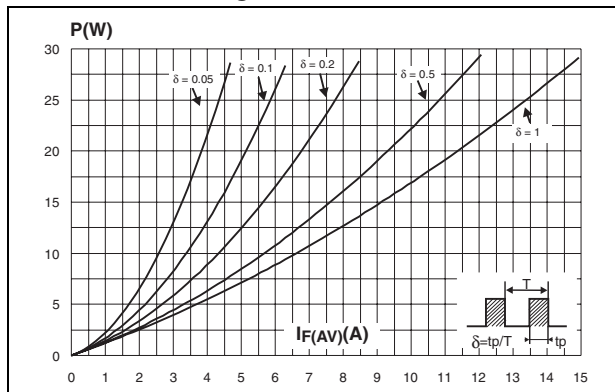


Figure 2. Forward voltage drop versus forward current

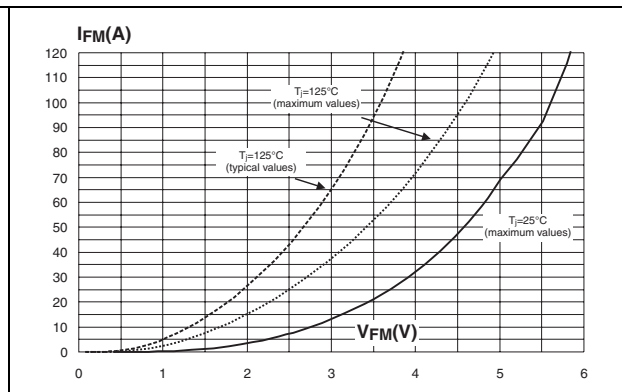


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

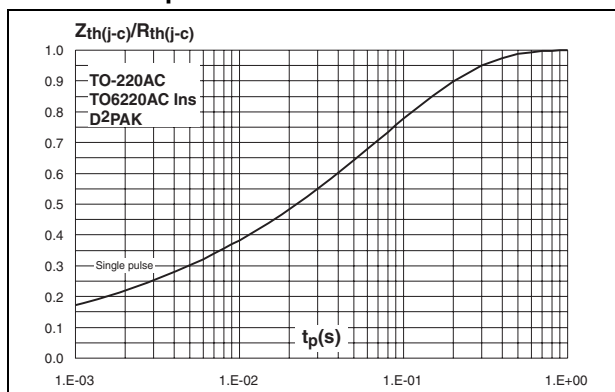


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration

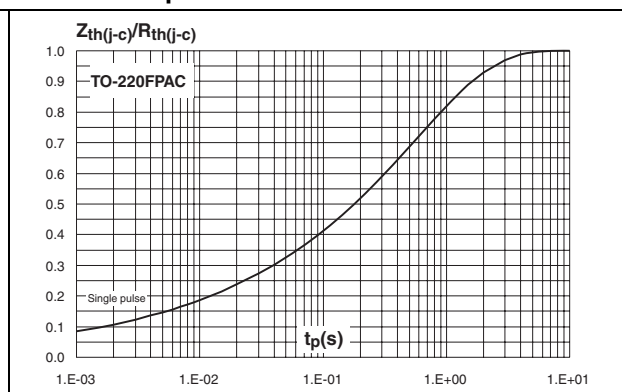


Figure 5. Peak reverse recovery current versus di_F/dt (typical values)

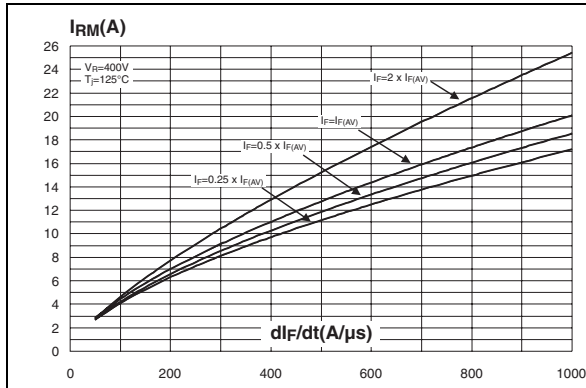


Figure 6. Reverse recovery time versus di_F/dt (typical values)

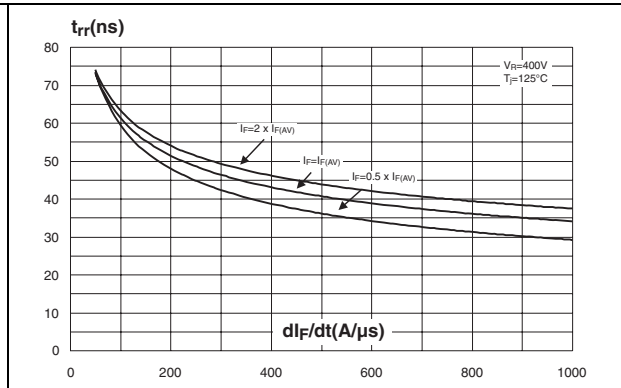


Figure 7. Reverse recovery charges versus di_F/dt (typical values)

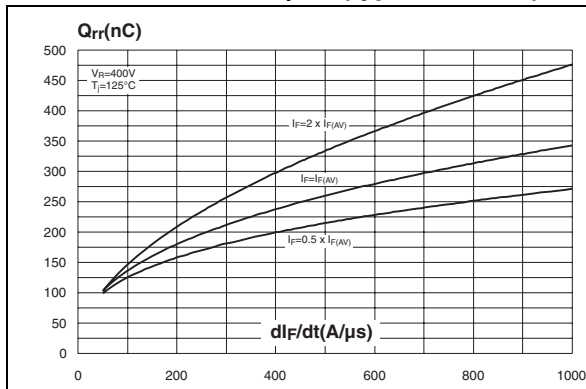


Figure 8. Softness factor versus di_F/dt (typical values)

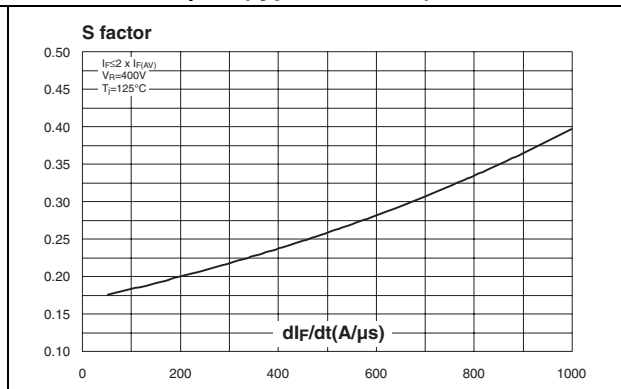


Figure 9. Relative variations of dynamic parameters versus junction temperature

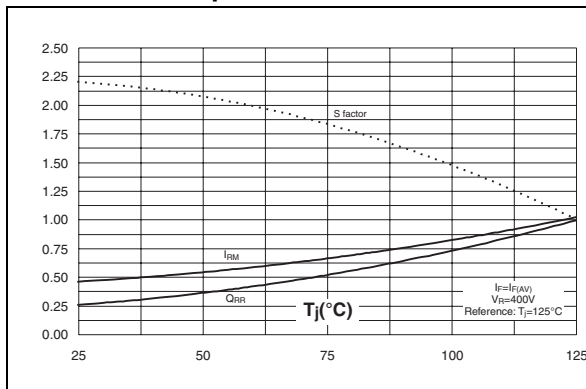


Figure 10. Transient peak forward voltage versus di_F/dt (typical values)

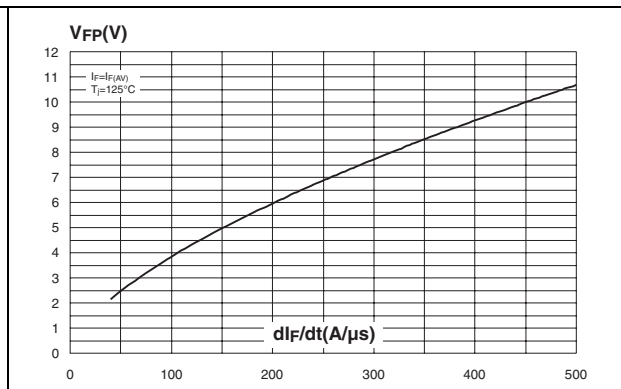


Figure 11. Forward recovery time versus di_F/dt (typical values)

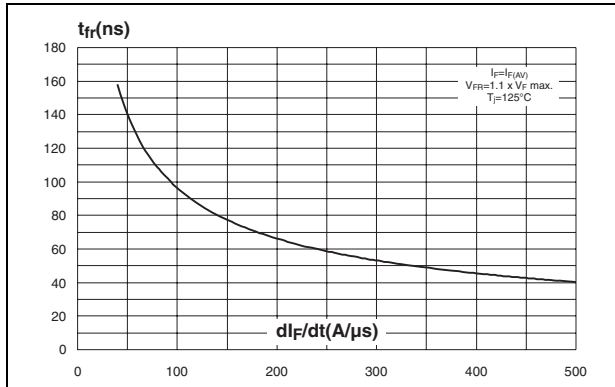


Figure 12. Junction capacitance versus reverse voltage applied (typical values)

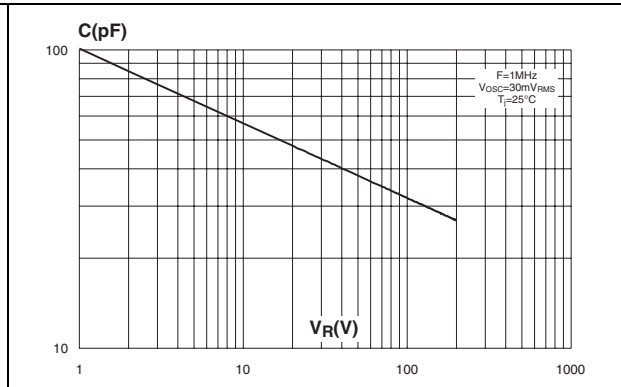
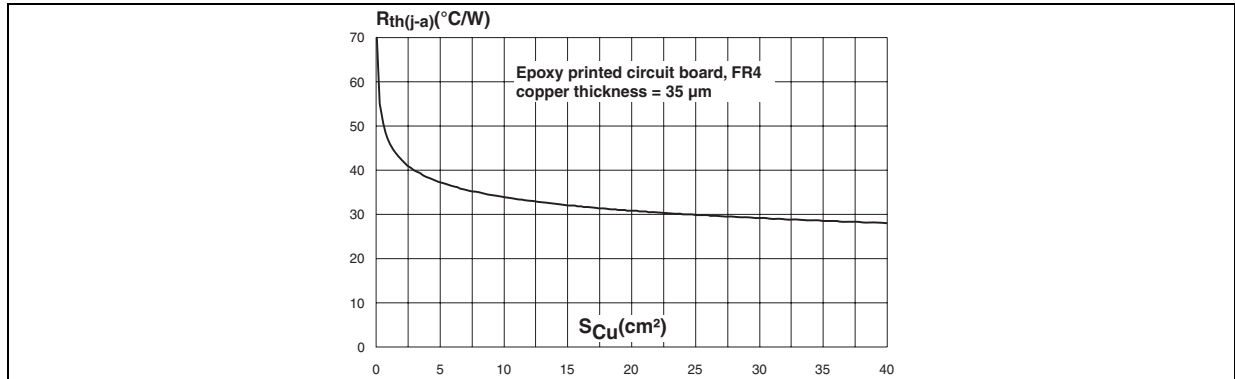


Figure 13. Thermal resistance junction to ambient versus copper surface under tab



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® 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.

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 |

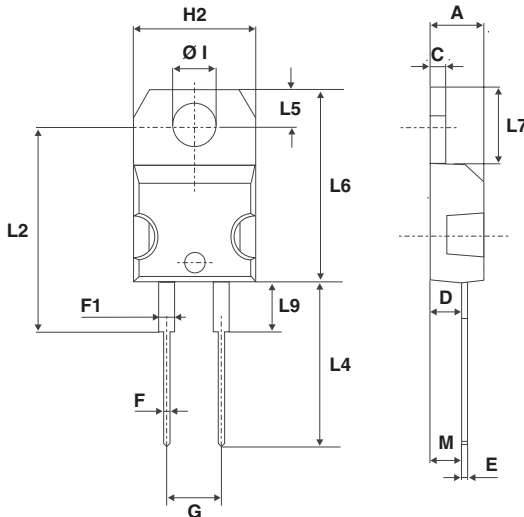
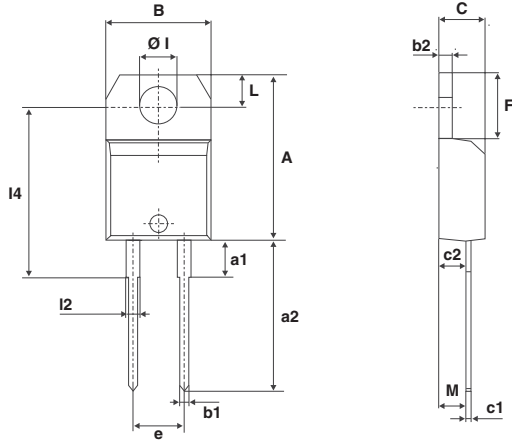


Table 7. TO-220FPAC dimensions

| 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

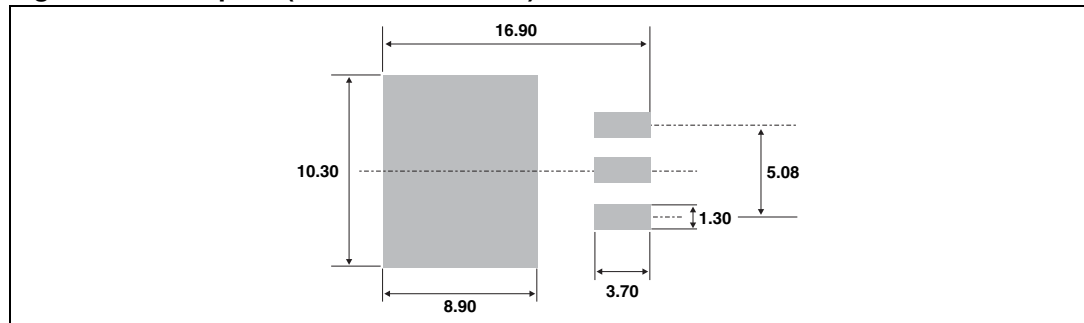


| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.598 | | 0.625 |
| a1 | | 3.75 | | | 0.147 | |
| a2 | 13.00 | | 14.00 | 0.511 | | 0.551 |
| B | 10.00 | | 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 |
| Ø1 | 3.75 | | 3.85 | 0.147 | | 0.151 |
| l1 | 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 | |

Table 9. D²PAK 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 14. Footprint (dimensions in mm)



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 ² PAK | 1.48 g | 50 | Tube |
| STTH12R06G-TR | STTH12R06G | D ² 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 ² 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 Table 10 . |

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