

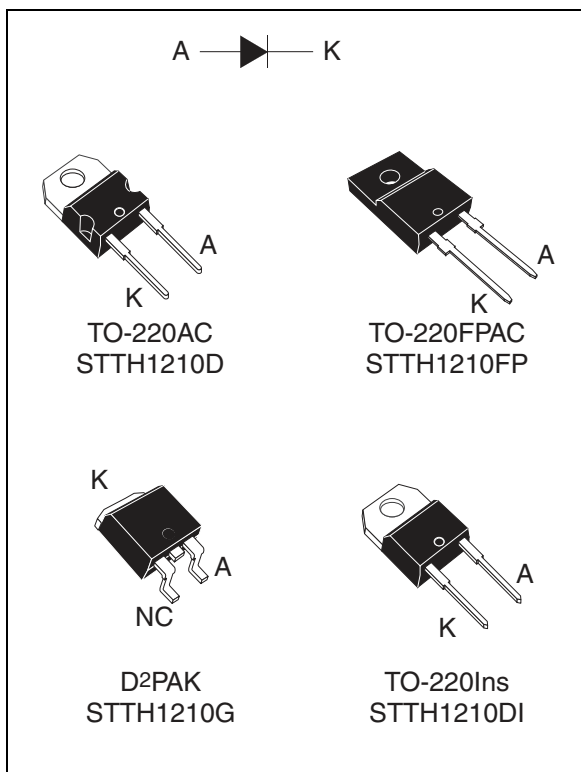
Ultrafast recovery - high voltage diode

Main product characteristics

| | |
|----------------|--------|
| $I_{F(AV)}$ | 12 A |
| V_{RRM} | 1000 V |
| T_j | 175° C |
| V_F (typ) | 1.30 V |
| t_{rr} (typ) | 48 ns |

Features and benefits

- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature
- Insulated packages:
 - TO-220Ins
Electrical insulation = 2500 V_{RMS}
Capacitance = 7 pF
 - TO-220FPAC
Electrical insulation = 2500 V_{RMS}
Capacitance = 12 pF



Description

The high quality design of this diode has produced a device with low leakage current, regularly reproducible characteristics and intrinsic ruggedness. These characteristics make it ideal for heavy duty applications that demand long term reliability.

Such demanding applications include industrial power supplies, motor control, and similar mission-critical systems that require rectification and freewheeling. These diodes also fit into auxiliary functions such as snubber, bootstrap, and demagnetization applications.

The improved performance in low leakage current, and therefore thermal runaway guard band, is an immediate competitive advantage for this device.

Order codes

| Part Number | Marking |
|--------------|------------|
| STTH1210D | STTH1210D |
| STTH1210G | STTH1210G |
| STTH1210G-TR | STTH1210G |
| STTH1210FP | STTH1210FP |
| STTH1210DI | STTH1210DI |

1 Characteristics

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

| Symbol | Parameter | | Value | Unit | |
|--------------|---|---|--------------|------|---------------------------|
| V_{RRM} | Repetitive peak reverse voltage | | 1000 | V | |
| $I_{F(RMS)}$ | RMS forward current | TO-220AC / D ² PAK / TO-220FPAC | 30 | A | |
| | | TO-220AC Ins | 20 | | |
| $I_{F(AV)}$ | Average forward current, $\delta = 0.5$ | TO-220AC / D ² PAK | 12 | A | |
| | | TO-220FPAC | | | $T_c = 125^\circ\text{C}$ |
| | | TO-220AC Ins | | | $T_c = 40^\circ\text{C}$ |
| I_{FRM} | Repetitive peak forward current | $t_p = 5\ \mu\text{s}$, $F = 5\ \text{kHz}$ square | 120 | A | |
| I_{FSM} | Surge non repetitive forward current | $t_p = 10\ \text{ms}$ Sinusoidal | 80 | A | |
| T_{stg} | Storage temperature range | | -65 to + 175 | °C | |
| T_j | Maximum operating junction temperature | | 175 | °C | |

Table 2. Thermal parameters

| Symbol | Parameter | | Value | Unit |
|---------------|------------------|-------------------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case | TO-220AC / D ² PAK | 1.9 | °C/W |
| | | TO-220FPAC | 5.4 | |
| | | TO-220AC Ins | 3.1 | |

Table 3. Static electrical characteristics

| Symbol | Parameter | Test conditions | | Min. | Typ | Max. | Unit |
|-------------|-------------------------|---------------------------|----------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25^\circ\text{C}$ | $V_R = V_{RRM}$ | | | 10 | μA |
| | | $T_j = 125^\circ\text{C}$ | | | 3 | 30 | |
| $V_F^{(2)}$ | Forward voltage drop | $T_j = 25^\circ\text{C}$ | $I_F = 12\ \text{A}$ | | | 2.0 | V |
| | | $T_j = 100^\circ\text{C}$ | | | 1.40 | 1.8 | |
| | | $T_j = 150^\circ\text{C}$ | | | 1.30 | 1.7 | |

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

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

To evaluate the conduction losses use the following equation:

$$P = 1.3 \times I_{F(AV)} + 0.033 I_{F(RMS)}^2$$

Table 4. Dynamic characteristics

| Symbol | Parameter | Test conditions | Min. | Typ | Max. | Unit |
|----------|--------------------------|---|------|-----|------|------|
| t_{rr} | Reverse recovery time | $I_F = 1\text{ A}$, $di_F/dt = -50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$, $T_j = 25^\circ\text{ C}$ | | 67 | 90 | ns |
| | | $I_F = 1\text{ A}$, $di_F/dt = -100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$, $T_j = 25^\circ\text{ C}$ | | 48 | 65 | |
| I_{RM} | Reverse recovery current | $I_F = 12\text{ A}$, $di_F/dt = -200\text{ A}/\mu\text{s}$, $V_R = 600\text{ V}$, $T_j = 125^\circ\text{ C}$ | | 15 | 20 | A |
| S | Softness factor | $I_F = 12\text{ A}$, $di_F/dt = -200\text{ A}/\mu\text{s}$, $V_R = 600\text{ V}$, $T_j = 125^\circ\text{ C}$ | | 2 | | |
| t_{fr} | Forward recovery time | $I_F = 12\text{ A}$ $di_F/dt = 50\text{ A}/\mu\text{s}$ $V_{FR} = 1.5 \times V_{Fmax}$, $T_j = 25^\circ\text{ C}$ | | | 400 | ns |
| V_{FP} | Forward recovery voltage | $I_F = 12\text{ A}$, $di_F/dt = 50\text{ A}/\mu\text{s}$, $T_j = 25^\circ\text{ C}$ | | 5 | | V |

Figure 1. Conduction losses versus average current

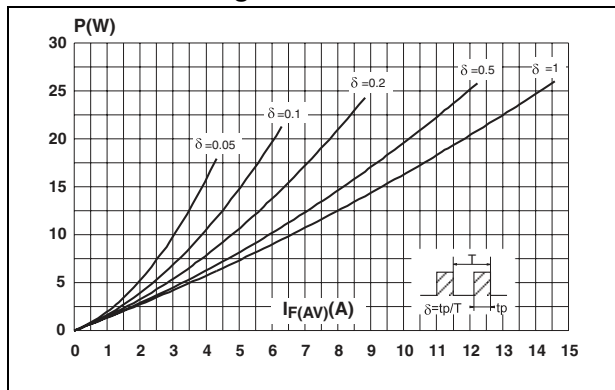


Figure 2. Forward voltage drop versus forward current

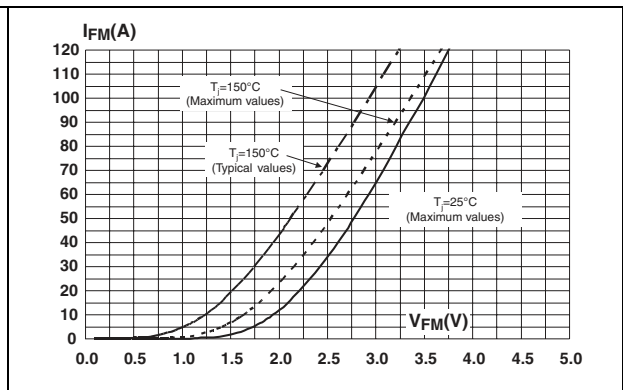


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

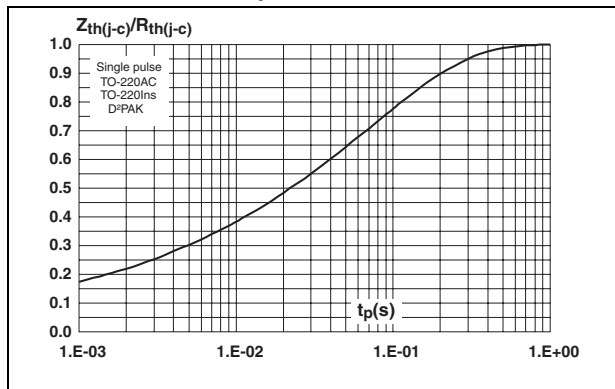


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration

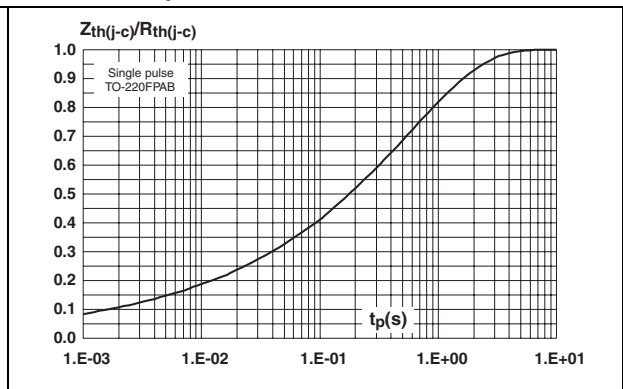


Figure 5. Peak reverse recovery current versus di_F/dt (typical values)

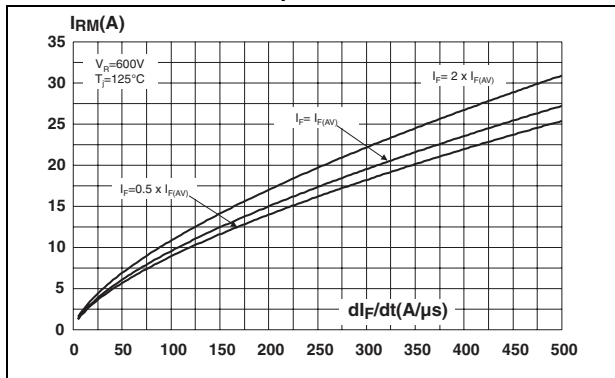


Figure 6. Reverse recovery time versus di_F/dt (typical values)

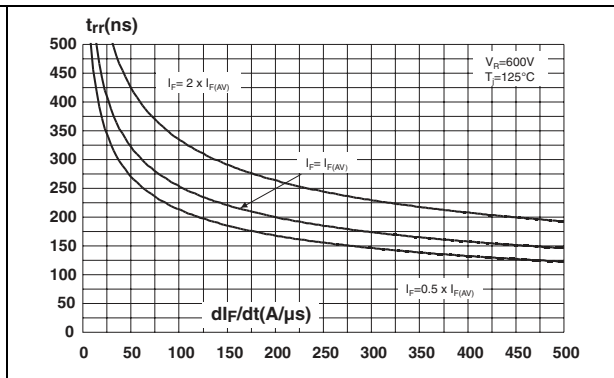


Figure 7. Reverse recovery charges versus di_F/dt (typical values)

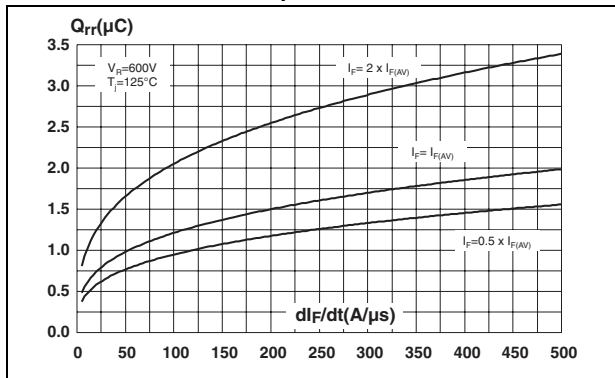


Figure 8. Softness factor versus di_F/dt (typical values)

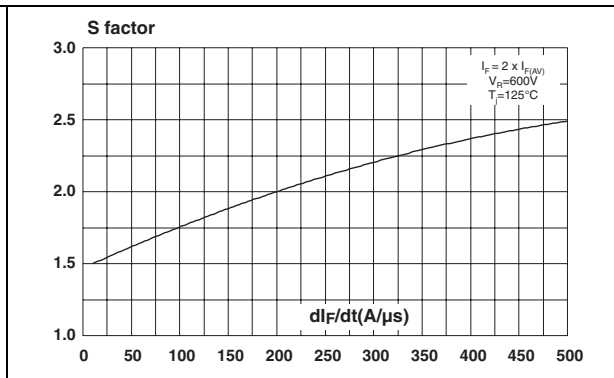


Figure 9. Relative variations of dynamic parameters versus junction temperature

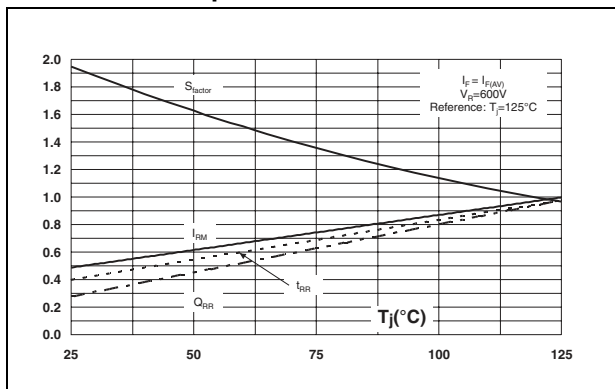


Figure 10. Transient peak forward voltage versus di_F/dt (typical values)

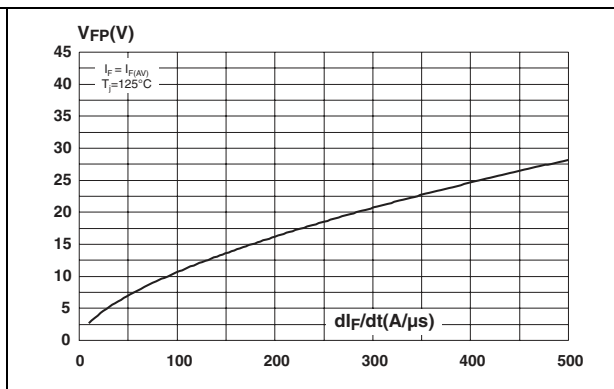


Figure 11. Forward recovery time versus dI_F/dt (typical values)

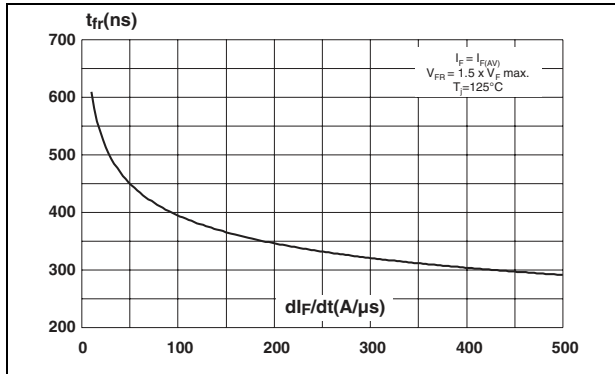


Figure 12. Junction capacitance versus reverse voltage applied (typical values)

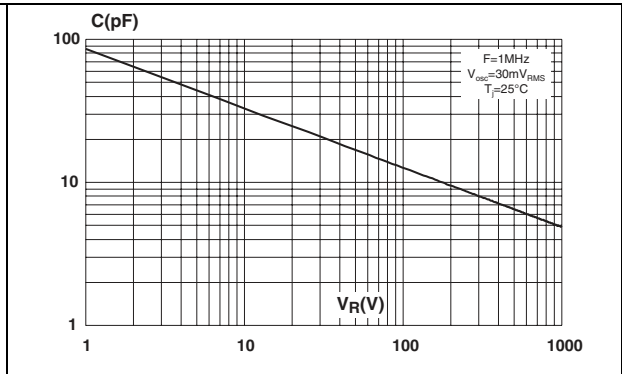
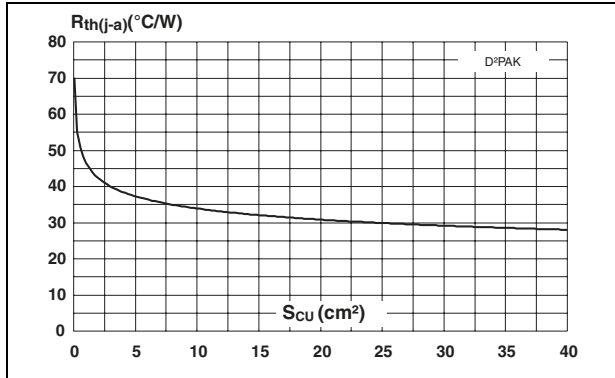


Figure 13. Thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4, $e_{Cu} = 35 \mu\text{m}$)



2 Package information

Epoxy meets UL94, V0

Cooling method: by conduction (C)

Recommended torque value: 0.55 Nm (TO-220AC, TC-220Ins, TO-220FPAC)

Maximum torque value: 0.7 Nm (TO-220AC, TO-220Ins, TO-220FPAC)

Table 5. T0-220AC 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 |

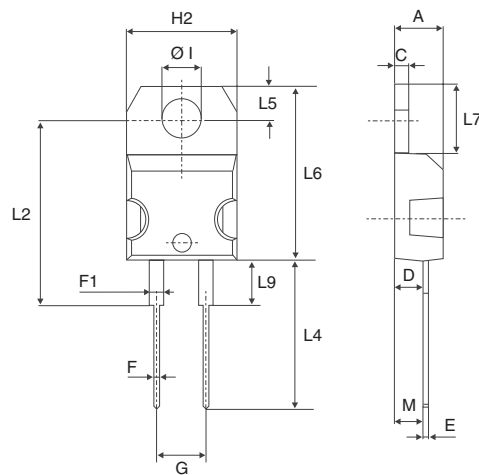


Table 6. T0-220Ins dimensions

| REF | DIMENSIONS | | | | | |
|-----|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | | Max. | Min. | | 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 | |

Table 7. T0-220FPAC 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 |

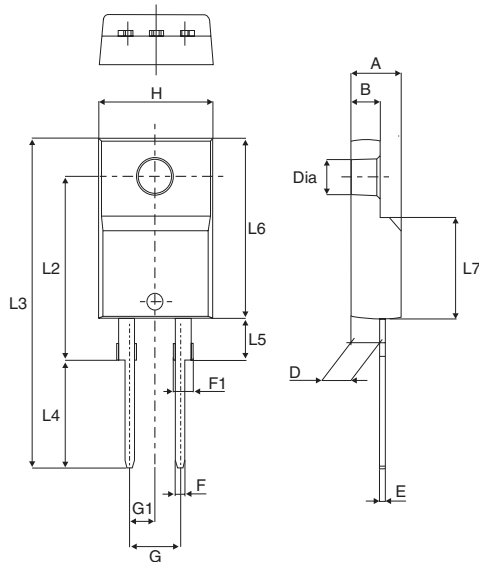
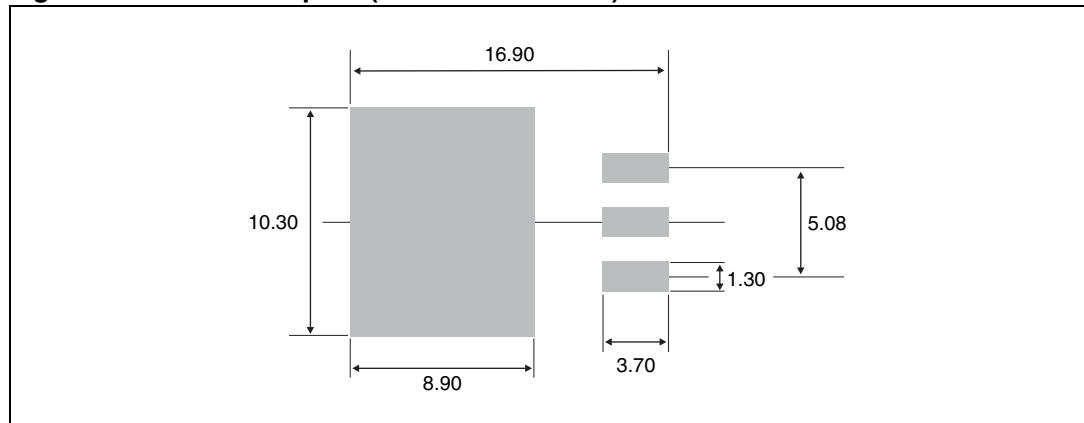


Table 8. D²PAK dimensions

| 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. D²PAK 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.

3 Ordering information

| Part Number | Marking | Package | Weight | Base qty | Delivery mode |
|--------------|------------|--------------------|--------|----------|---------------|
| STTH1210D | STTH1210D | TO-220AC | 1.86 g | 50 | Tube |
| STTH1210DI | STTH1210DI | TO-220Ins | 1.86 g | 50 | Tube |
| STTH1210FP | STTH1210FP | TO-220FPAC | 2.2 g | 50 | Tube |
| STTH1210G | STTH1210G | D ² PAK | 1.48 g | 50 | Tube |
| STTH1210G-TR | STTH1210G | D ² PAK | 1.48 g | 1000 | Tape & reel |

4 Revision history

| Date | Revision | Description of Changes |
|-------------|----------|------------------------|
| 02-Mar-2006 | 1 | First issue. |

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