

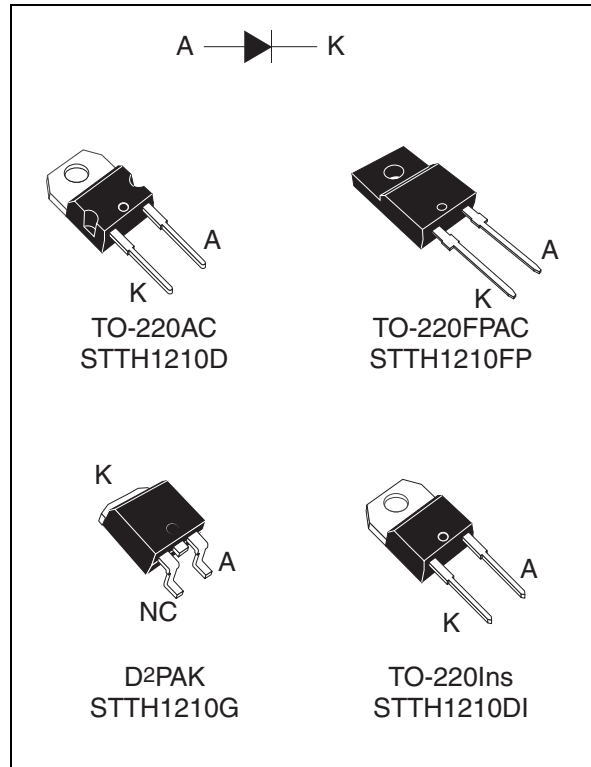
## Ultrafast recovery - high voltage diode

### 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<sub>RMS</sub>  
Capacitance = 7 pF
  - TO-220FPAC  
Electrical insulation = 2500 V<sub>RMS</sub>  
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 <sup>2</sup> PAK / TO-220FPAC   | 30           | A    |
|              |                                         | TO-220AC Ins                                 | 20           |      |
| $I_{F(AV)}$  | Average forward current, $\delta = 0.5$ | TO-220AC / D <sup>2</sup> PAK                | 12           | A    |
|              |                                         | TO-220FPAC                                   |              |      |
|              |                                         | TO-220AC Ins                                 |              |      |
| $I_{FRM}$    | Repetitive peak forward current         | $t_p = 5 \mu s$ , $F = 5 \text{ kHz}$ 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 <sup>2</sup> 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   | $\mu A$ |
|             |                         | $T_j = 125^\circ \text{C}$ |                      |      | 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:  $t_p = 380 \mu s$ ,  $\delta < 2 \%$

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

Figure 1. Conduction losses versus average current

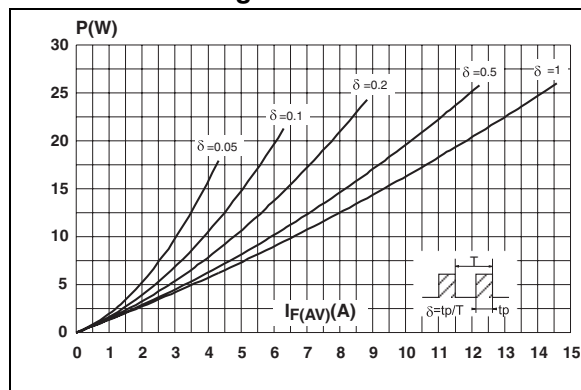


Figure 2. Forward voltage drop versus forward current

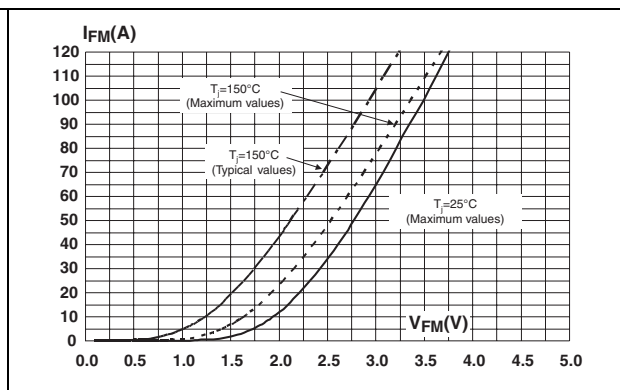


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

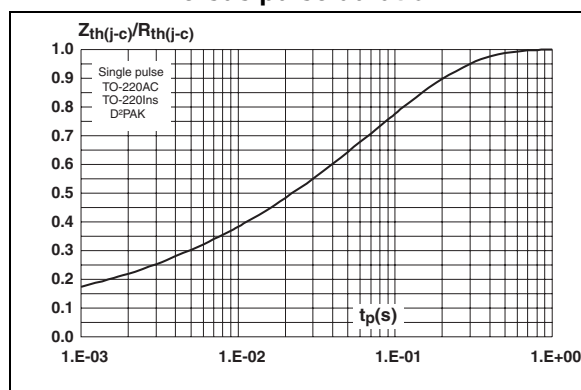
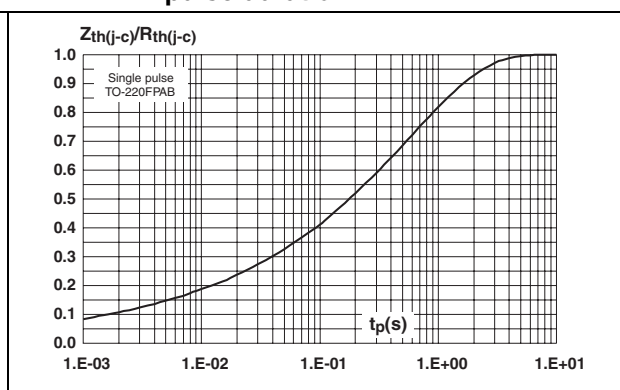
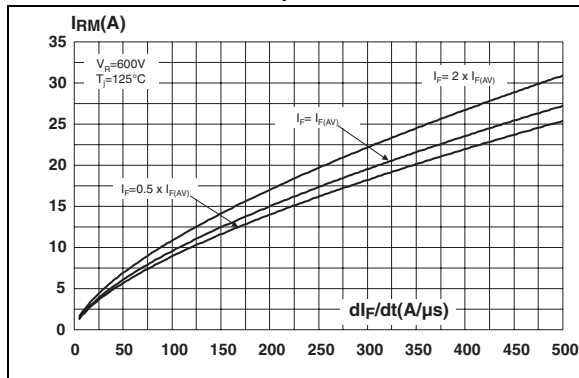


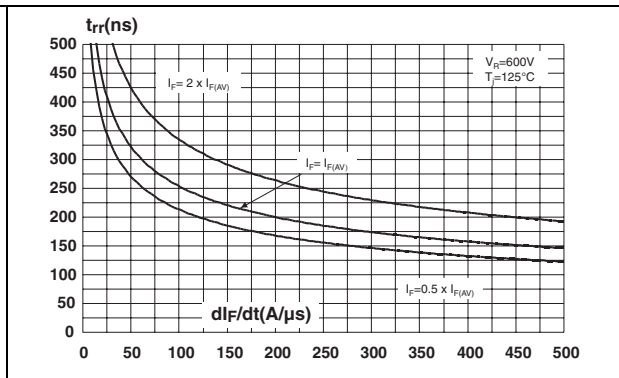
Figure 4. Relative variation of thermal impedance junction to case versus pulse duration



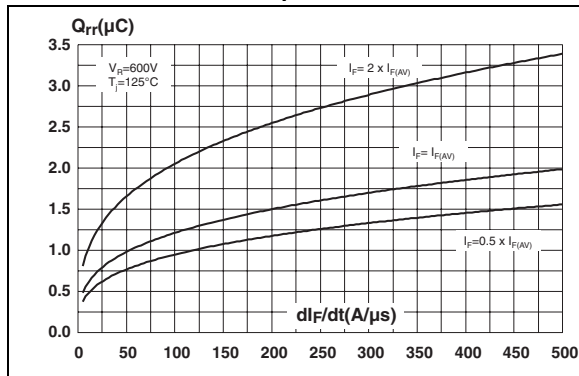
**Figure 5. Peak reverse recovery current versus  $di_F/dt$  (typical values)**



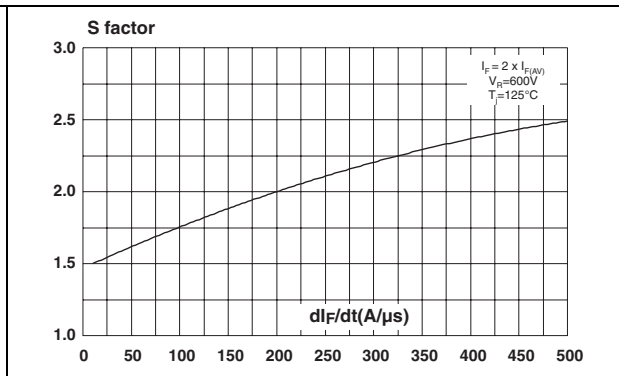
**Figure 6. Reverse recovery time versus  $di_F/dt$  (typical values)**



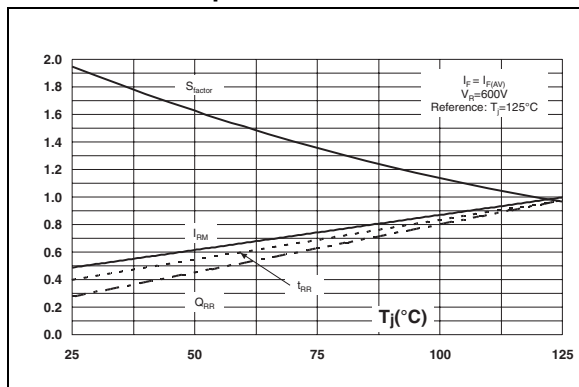
**Figure 7. Reverse recovery charges versus  $di_F/dt$  (typical values)**



**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)**

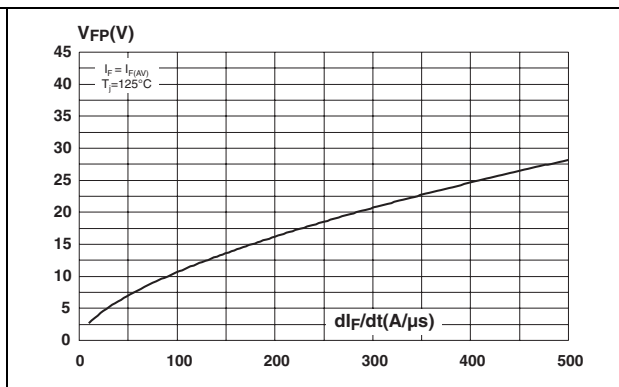


Figure 11. Forward recovery time versus  $dI_F/dt$  (typical values)

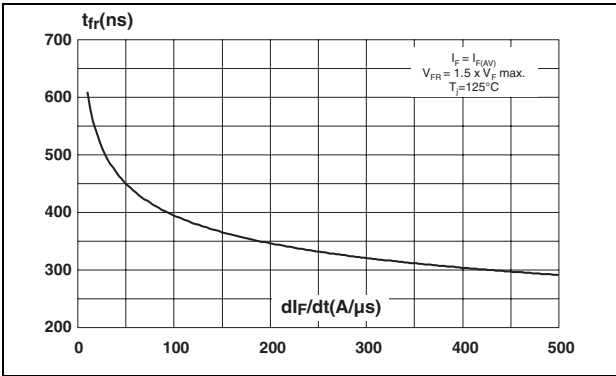


Figure 12. Junction capacitance versus reverse voltage applied (typical values)

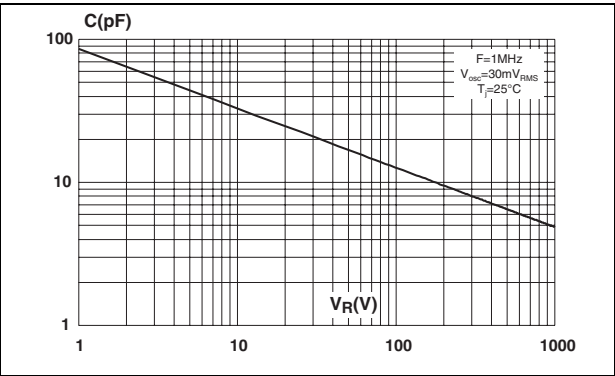
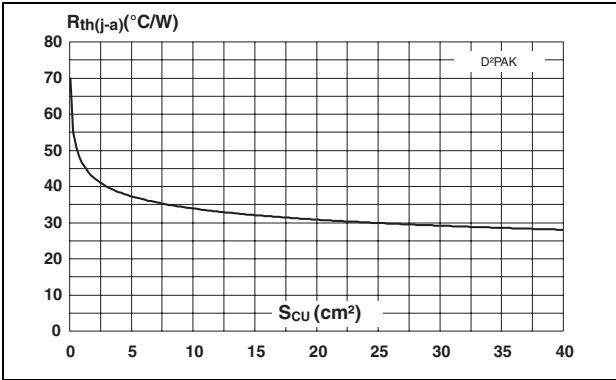


Figure 13. Thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4,  $e_{Cu} = 35 \mu\text{m}$ )



## 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 |

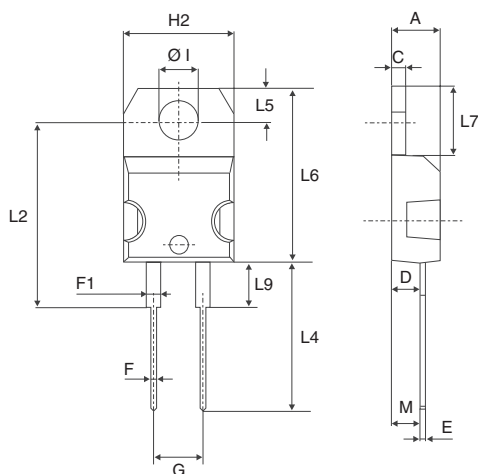


Table 6. T0-220Ins dimensions

| 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 |



Technical drawing of a 1/2" x 1/2" x 1/2" V-Pipe Connector. The drawing includes three views: a front view, a side view, and a detail view of the corner joint.

**Front View Dimensions:**

- A:** Overall width of the connector.
- A1:** Width of the top flange.
- A2:** Width of the bottom flange.
- B:** Thickness of the top flange.
- B2:** Thickness of the bottom flange.
- C:** Width of the central opening.
- C2:** Width of the central opening at the top.
- D:** Height of the central opening.
- E:** Overall height of the connector.
- G:** Distance from the center of the opening to the side edge.
- L:** Overall length of the connector.
- L2:** Length of the top flange.
- L3:** Length of the bottom flange.
- M:** Distance from the center of the opening to the side edge at the bottom.
- R:** Radius of the corner joint.
- V2:** Angle of the corner joint.

**Detail View Dimensions:**

- 2mm min. FLAT ZONE:** Minimum flat zone at the corner joint.

| 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 showing the front and side views of a mechanical part with the following dimensions:

- Overall width: 16.90
- Overall height: 10.30
- Base width: 8.90
- Side view width: 3.70
- Side view height: 5.08
- Side view detail height: 1.30



### 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 <sup>2</sup> PAK | 1.48 g | 50       | Tube          |
| STTH1210G-TR | STTH1210G  | D <sup>2</sup> 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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