

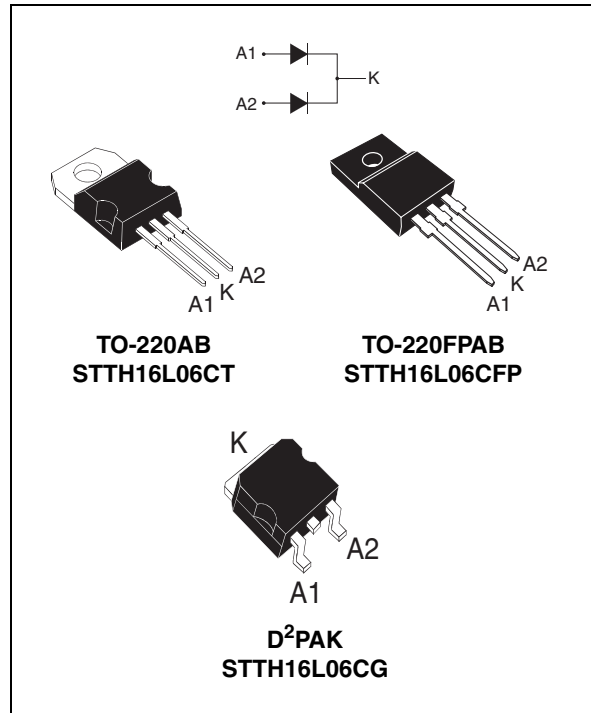
## Turbo 2 ultrafast high voltage rectifier

### Features

- Ultrafast switching
- Low reverse recovery current
- Reduces switching and conduction losses
- Low thermal resistance

### Description

The STTH16L06, which is using ST Turbo 2 600 V technology, is specially suited for use in switching power supplies, and industrial applications, as rectification and discontinuous mode PFC boost diode.



**Table 1. Device summary**

|                |                |
|----------------|----------------|
| $I_{F(AV)}$    | Up to 2 x 10 A |
| $V_{RRM}$      | 600 V          |
| $T_j$          | 175 °C         |
| $V_F$ (typ)    | 1.05 V         |
| $t_{rr}$ (max) | 35 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                    |                                  |                                   |            | 30           | A    |
| I <sub>F(AV)</sub>  | Average forward current<br>δ = 0.5     | TO-220AB /<br>D <sup>2</sup> PAK | T <sub>C</sub> = 140 °C           | Per diode  | 8            | A    |
|                     |                                        |                                  | T <sub>C</sub> = 135 °C           | Per device | 16           |      |
|                     |                                        |                                  | T <sub>C</sub> = 130 °C           | Per diode  | 10           |      |
|                     |                                        |                                  | T <sub>C</sub> = 120 °C           | Per device | 20           |      |
|                     |                                        | TO-220FPAB                       | T <sub>C</sub> = 110 °C           | Per diode  | 8            |      |
|                     |                                        |                                  | T <sub>C</sub> = 80 °C            | Per device | 16           |      |
| I <sub>FSM</sub>    | Surge non repetitive forward current   |                                  | t <sub>p</sub> = 10 ms sinusoidal |            | 120          | 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        |                               |           | Maximum | Unit                        |
|---------------|------------------|-------------------------------|-----------|---------|-----------------------------|
| $R_{th(j-c)}$ | Junction to case | TO-220AB / D <sup>2</sup> PAK | Per diode | 2.5     | $^{\circ}\text{C}/\text{W}$ |
|               |                  | TO-220FPAB                    | Per diode | 5       |                             |
|               |                  | TO-220AB / D <sup>2</sup> PAK | Total     | 1.6     |                             |
|               |                  | TO-220FPAB                    | Total     | 3.8     |                             |
| $R_{th(c)}$   | Coupling         | TO-220AB / D <sup>2</sup> PAK |           | 0.7     | $^{\circ}\text{C}/\text{W}$ |
|               |                  | TO-220FPAB                    |           | 2.5     |                             |

When the diodes 1 and 2 are used simultaneously:

$$\Delta T_j (\text{diode1}) = P_{(\text{diode1})} \times R_{th(j-c)} (\text{per diode}) + P_{(\text{diode2})} \times R_{th(c)}$$

**Table 4. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions                     |                     | Min. | Typ  | Max. | Unit          |
|-------------|-------------------------|-------------------------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ }^{\circ}\text{C}$  | $V_R = V_{RRM}$     |      |      | 8    | $\mu\text{A}$ |
|             |                         | $T_j = 150\text{ }^{\circ}\text{C}$ |                     |      | 25   | 240  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 8\text{ A}$  |      |      | 1.8  | V             |
|             |                         | $T_j = 150\text{ }^{\circ}\text{C}$ |                     |      | 1.05 | 1.35 |               |
|             |                         | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 16\text{ A}$ |      |      | 2.08 |               |
|             |                         | $T_j = 150\text{ }^{\circ}\text{C}$ |                     |      | 1.28 | 1.64 |               |

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 maximum conduction losses use the following equation:

$$P = 1.06 \times I_{F(AV)} + 0.036 I_{F(RMS)}^2$$

Table 5. Dynamic electrical characteristics

| Symbol   | Parameter                | Test conditions                     |                                                                                      | Min. | Typ | Max. | Unit |
|----------|--------------------------|-------------------------------------|--------------------------------------------------------------------------------------|------|-----|------|------|
| $t_{rr}$ | Reverse recovery time    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 0.5\text{ A}, I_{rr} = 0.25\text{ A}, I_R = 1\text{ A}$                       |      |     | 35   | ns   |
|          |                          |                                     | $I_F = 1\text{ A}, dI_F/dt = 50\text{ A}/\mu\text{s}, V_R = 30\text{ V}$             |      | 40  | 55   |      |
| $I_{RM}$ | Reverse recovery current | $T_j = 125\text{ }^{\circ}\text{C}$ | $I_F = 8\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}, V_R = 400\text{ V}$           |      | 4.5 | 6.5  | A    |
| $t_{fr}$ | Forward recovery time    | $T_j = 25\text{ }^{\circ}\text{C}$  | $I_F = 8\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}, V_{FR} = 1.1 \times V_{Fmax}$ |      |     | 200  | ns   |
| $V_{FP}$ | Forward recovery voltage |                                     |                                                                                      |      | 3.5 |      | V    |

Figure 1. Conduction losses versus average current

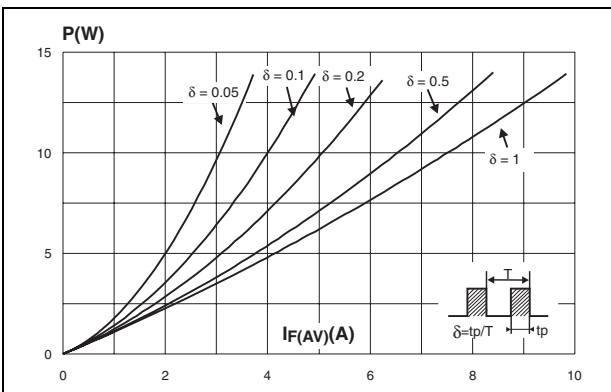


Figure 2. Forward voltage drop versus forward current

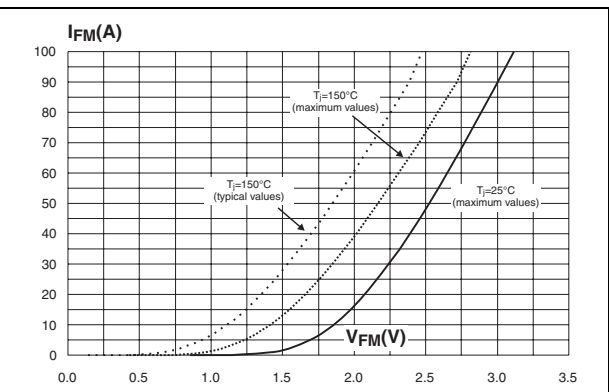


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration (TO-220AB, D<sup>2</sup>PAK)

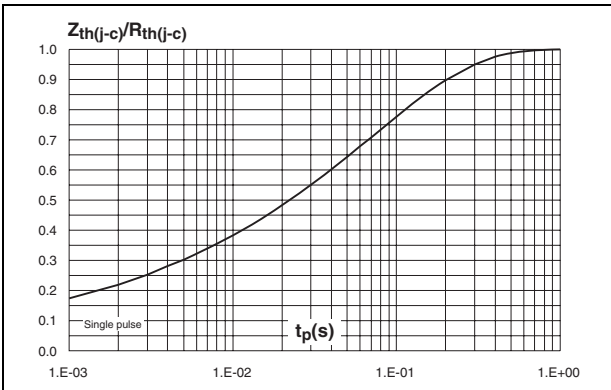
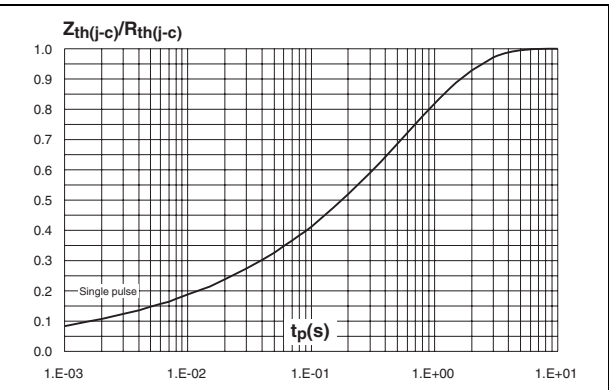
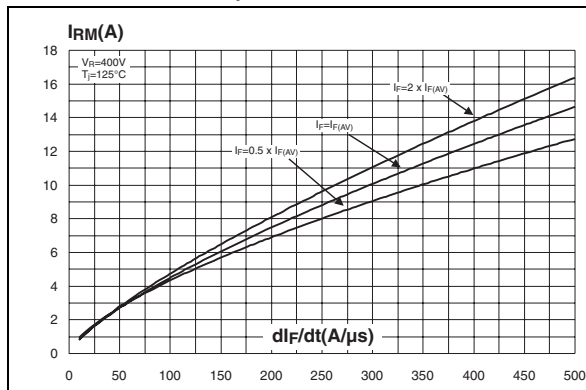


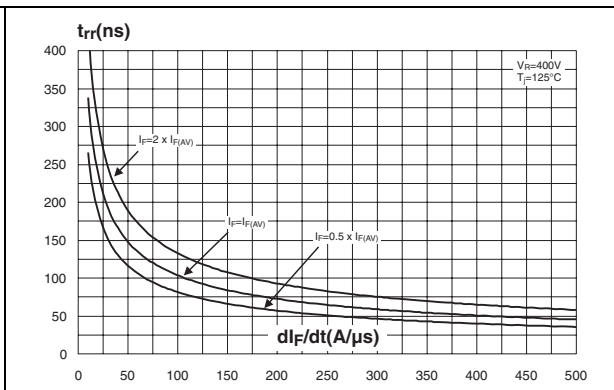
Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (TO-220FPAB)



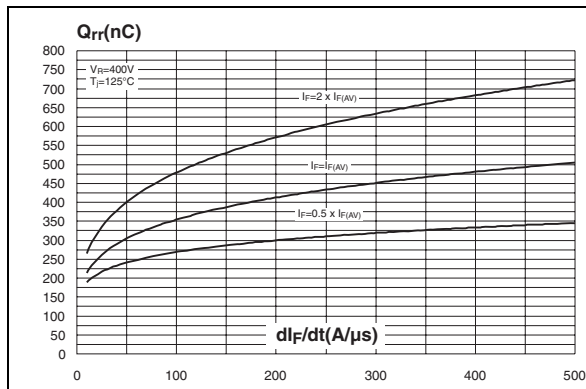
**Figure 5. Peak reverse recovery current versus  $dl_F/dt$  (typical values, per diode)**



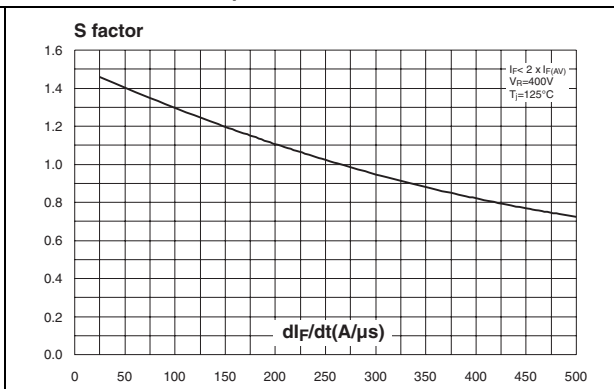
**Figure 6. Reverse recovery time versus  $dl_F/dt$  (typical values, per diode)**



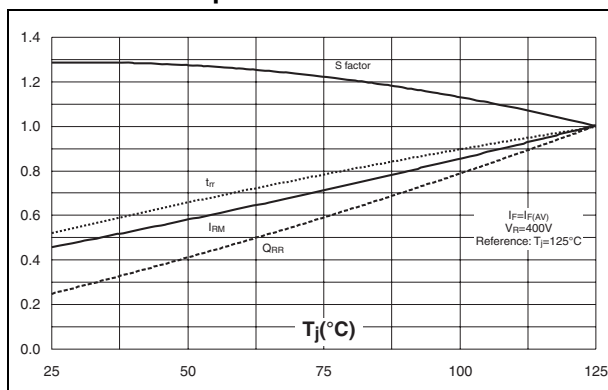
**Figure 7. Reverse recovery charges versus  $dl_F/dt$  (typical values, per diode)**



**Figure 8. Reverse recovery softness factor versus  $dl_F/dt$  (typical values, per diode)**



**Figure 9. Relative variations of dynamic parameters versus junction temperature**



**Figure 10. Transient peak forward voltage versus  $dl_F/dt$  (typical values, per diode)**

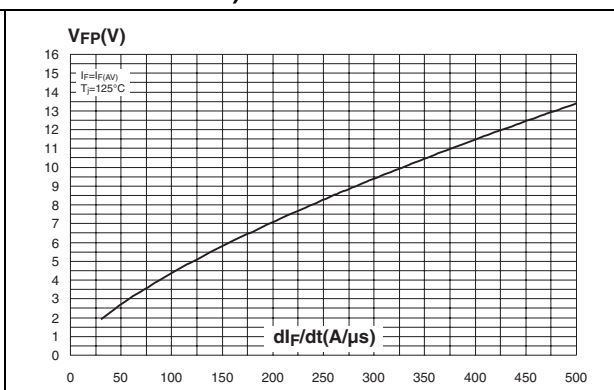


Figure 11. Forward recovery time versus  $di_F/dt$  (typical values, per diode)

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

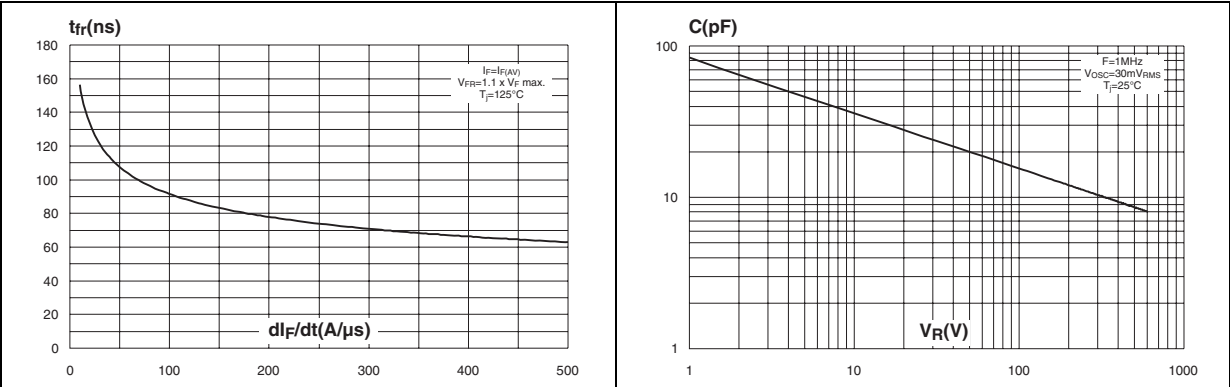
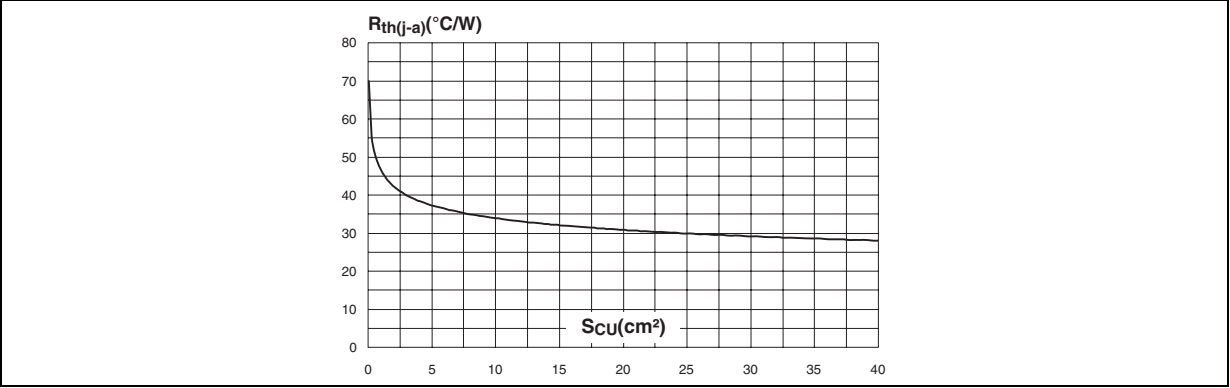


Figure 13. Thermal resistance junction to ambient versus copper surface under tab (epoxy FR4, copper thickness = 35  $\mu$ m) (D<sup>2</sup>PAK)



## 2 Package mechanical data

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

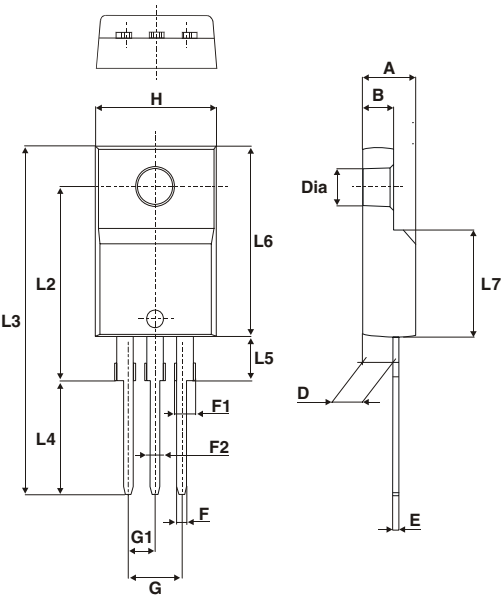
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**Table 6. TO-220AB dimensions**

| 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 |
| F2    | 1.14        | 1.70  | 0.044      | 0.066 |
| G     | 4.95        | 5.15  | 0.194      | 0.202 |
| G1    | 2.40        | 2.70  | 0.094      | 0.106 |
| H2    | 10          | 10.40 | 0.393      | 0.409 |
| L2    | 16.4 typ.   |       | 0.645 typ. |       |
| L4    | 13          | 14    | 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. | 3.75        | 3.85  | 0.147      | 0.151 |

Table 7. TO-220FPAB 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 |
| F2   | 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 |

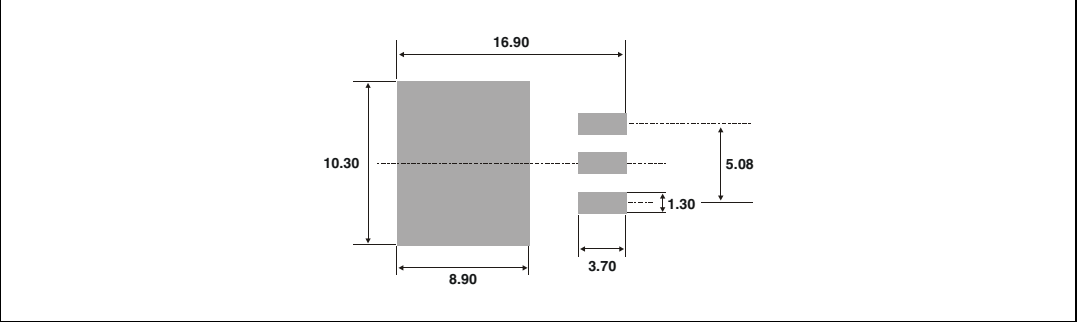


The technical drawing illustrates the TO-220FPAB package in three views: top, side, and a detail of the mounting tab. The top view shows the package body with dimensions H (width), L2 (lead length), L3 (total length), L4 (lead length to mounting tab), L5 (lead length to mounting tab), L6 (body length), and L7 (lead length to mounting tab). The side view shows the package body with dimensions A (height), B (height), D (height), E (height), F (height), F1 (height), F2 (height), G (height), G1 (height), and H (height). The detail view shows the mounting tab with dimensions Dia. (diameter), D (height), and E (height).

Table 8. 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 14. Footprint (dimensions in mm)





### 3 Ordering information

**Table 9. Ordering information**

| Order code     | Marking      | Package            | Weight | Base qty | Delivery mode |
|----------------|--------------|--------------------|--------|----------|---------------|
| STTH16L06CT    | STTH16L06CT  | TO-220AB           | 2.23 g | 50       | Tube          |
| STTH16L06CG    | STTH16L06CG  | D <sup>2</sup> PAK | 1.48 g | 50       | Tube          |
| STTH16L06CG-TR | STTH16L06CG  | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |
| STTH16L06CFP   | STTH16L06CFP | TO-220FPAB         | 1.70 g | 50       | Tube          |

### 4 Revision history

**Table 10. Document revision history**

| Date        | Revision | Description of Changes     |
|-------------|----------|----------------------------|
| 07-Sep-2004 | 1        | First issue                |
| 07-Apr-2011 | 2        | Updated ECOPACK statement. |

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