

# 1 Characteristics

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

| Symbol       | Parameter                               |                                                    | Value        | Unit |
|--------------|-----------------------------------------|----------------------------------------------------|--------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage         |                                                    | 1200         | 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                      | 8            | A    |
|              |                                         | $T_c = 140^\circ \text{C}$                         |              |      |
|              |                                         | TO-220FPAC                                         |              |      |
|              |                                         | $T_c = 75^\circ \text{C}$                          |              |      |
|              |                                         | TO-220AC Ins                                       |              |      |
|              |                                         | $T_c = 115^\circ \text{C}$                         |              |      |
| $I_{FRM}$    | Repetitive peak forward current         | $t_p = 5 \mu\text{s}$ , $F = 5 \text{ kHz}$ square | 100          | 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 | $T_j = 25^\circ \text{C}$  | $V_R = V_{RRM}$     |      |      | 8    | $\mu\text{A}$ |
|             |                         | $T_j = 125^\circ \text{C}$ |                     |      | 5    | 50   |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25^\circ \text{C}$  | $I_F = 8 \text{ A}$ |      |      | 2.2  | V             |
|             |                         | $T_j = 125^\circ \text{C}$ |                     |      | 1.30 | 2.0  |               |
|             |                         | $T_j = 150^\circ \text{C}$ |                     |      | 1.25 | 1.9  |               |

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:

$$P = 1.5 \times I_{F(AV)} + 0.05 I_{F(RMS)}^2$$

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>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{C}$           |      |     | 100  | ns   |
|          |                          | $I_F = 1\text{ A}$ , $di_F/dt = -100\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{C}$          |      | 50  | 70   |      |
| $I_{RM}$ | Reverse recovery current | $I_F = 8\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 600\text{ V}$ , $T_j = 125^\circ\text{C}$        |      | 14  | 21   | A    |
| S        | Softness factor          | $I_F = 8\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 600\text{ V}$ , $T_j = 125^\circ\text{C}$        |      | 2   |      |      |
| $t_{fr}$ | Forward recovery time    | $I_F = 8\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ ,<br>$V_{FR} = 1.5 \times V_{Fmax}$ , $T_j = 25^\circ\text{C}$ |      |     | 400  | ns   |
| $V_{FP}$ | Forward recovery voltage | $I_F = 8\text{ A}$ , $di_F/dt = 50\text{ A}/\mu\text{s}$ ,<br>$T_j = 25^\circ\text{C}$                                  |      | 7   |      | V    |

Figure 1. Conduction losses versus average current

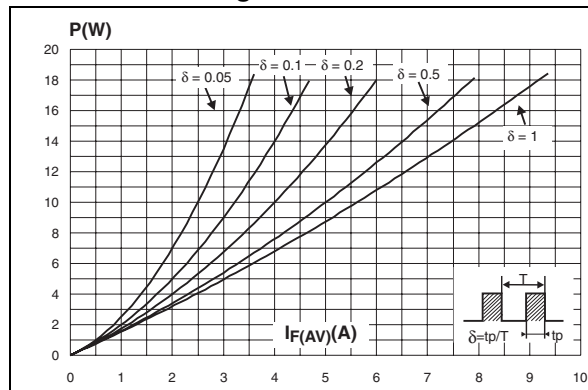


Figure 2. Forward voltage drop versus forward current

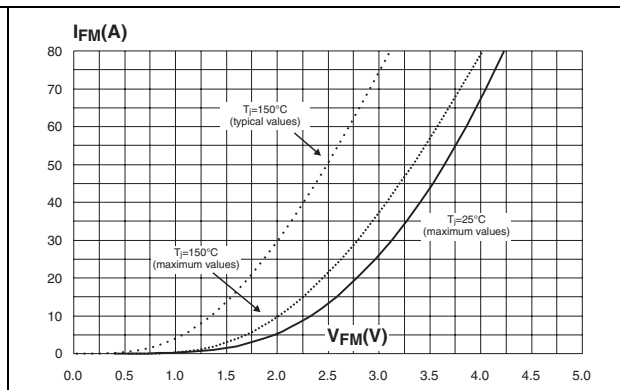


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

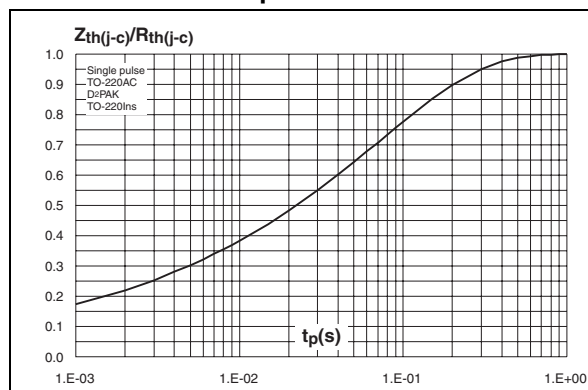
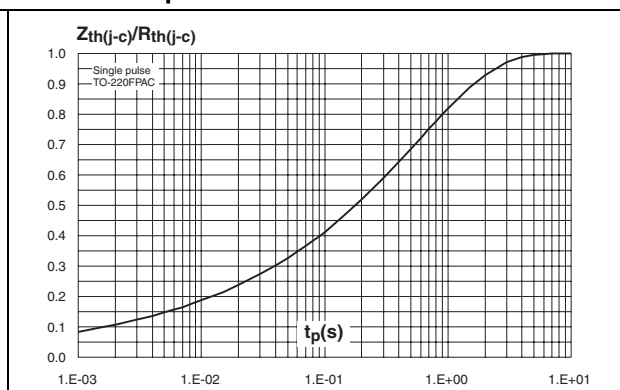
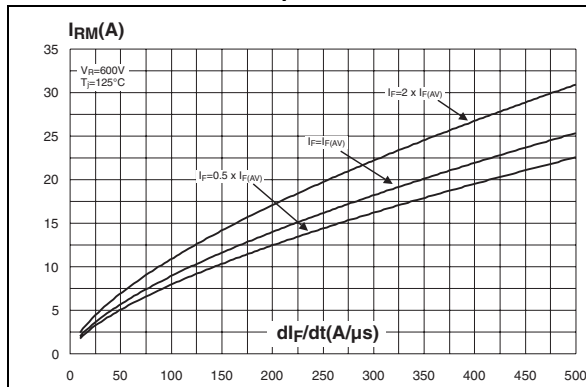


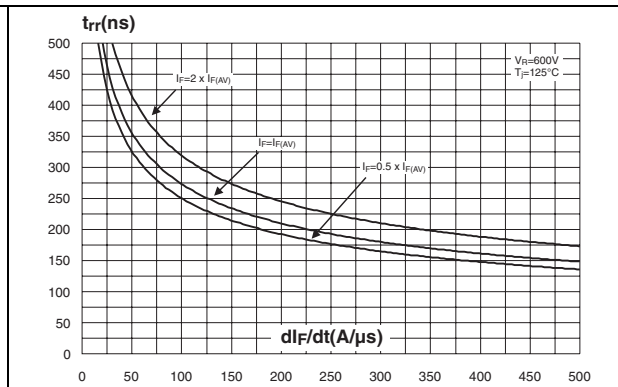
Figure 4. Relative variation of thermal impedance junction to case versus pulse duration



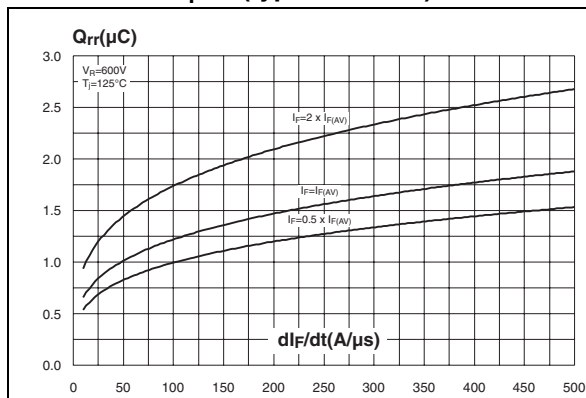
**Figure 5. Peak reverse recovery current versus  $dl_F/dt$  (typical values)**



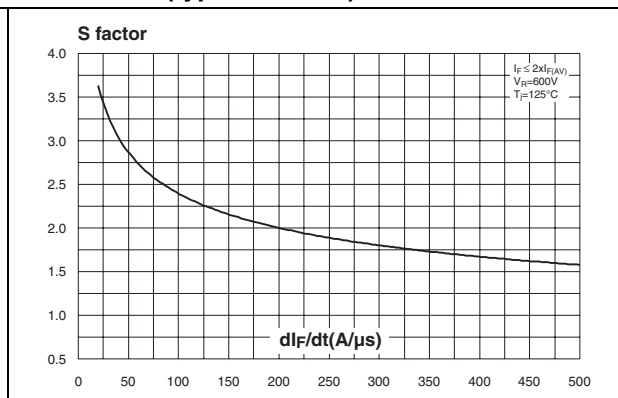
**Figure 6. Reverse recovery time versus  $dl_F/dt$  (typical values)**



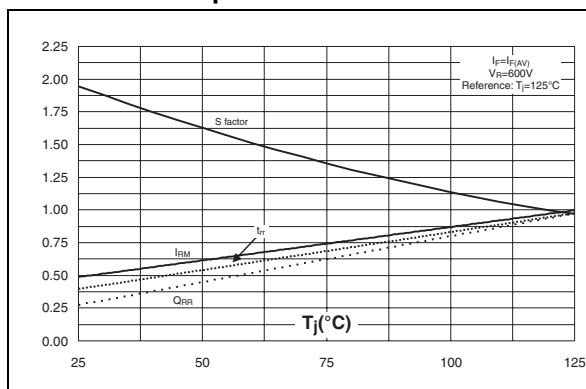
**Figure 7. Reverse recovery charges versus  $dl_F/dt$  (typical values)**



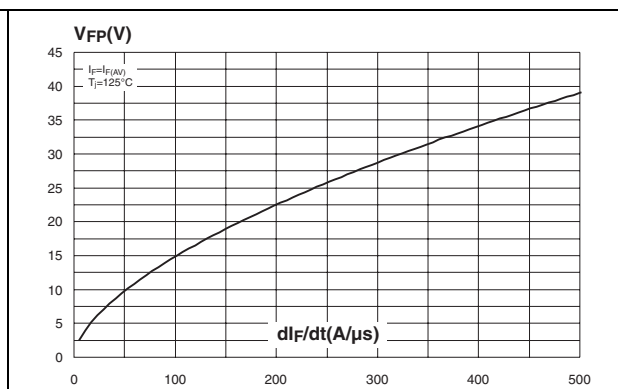
**Figure 8. Softness factor versus  $dl_F/dt$  (typical values)**



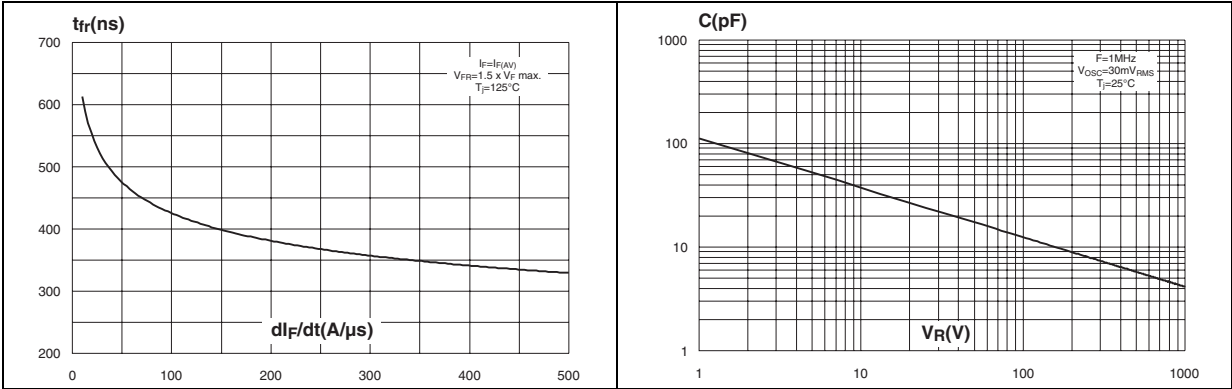
**Figure 9. Relative variations of dynamic parameters versus junction temperature**



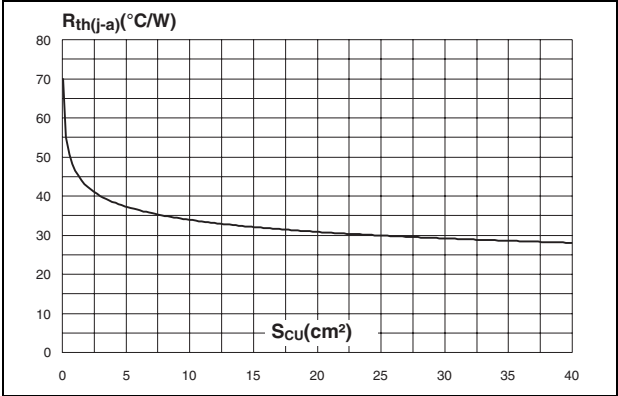
**Figure 10. Transient peak forward voltage versus  $dl_F/dt$  (typical values)**



**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 (Epoxy printed circuit board FR4,  $e_{Cu} = 35\ \mu\text{m}$ )**



# 2 Package mechanical data

Epoxy meets UL94, V0

Cooling method: by conduction (C)

Recommended torque value: 0.55 Nm (TO-220AC)

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

Table 5. T0-220AC dimensions

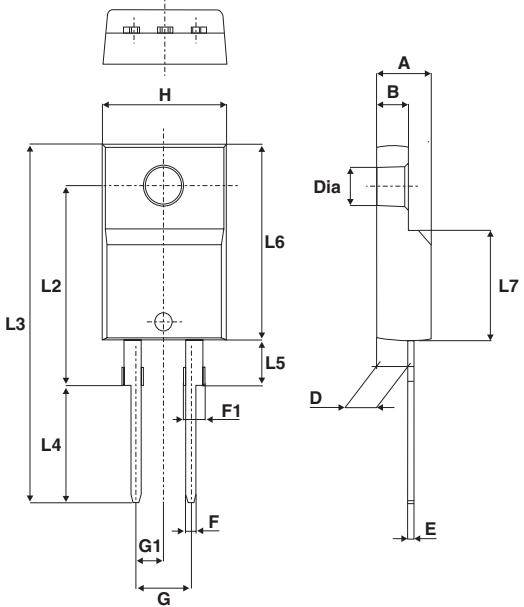
| REF.    | DIMENSIONS  |       |            |       |
|---------|-------------|-------|------------|-------|
|         | Millimeters |       | Inches     |       |
|         | Min.        | Max.  | Min.       | Max.  |
| A       | 4.40        | 4.60  | 0.173      | 0.181 |
| C       | 1.23        | 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 |
| I4  | 15.80       | 16.40 | 16.80 | 0.622  | 0.646 | 0.661 |
| L   | 2.65        |       | 2.95  | 0.104  |       | 0.116 |
| I2  | 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 |

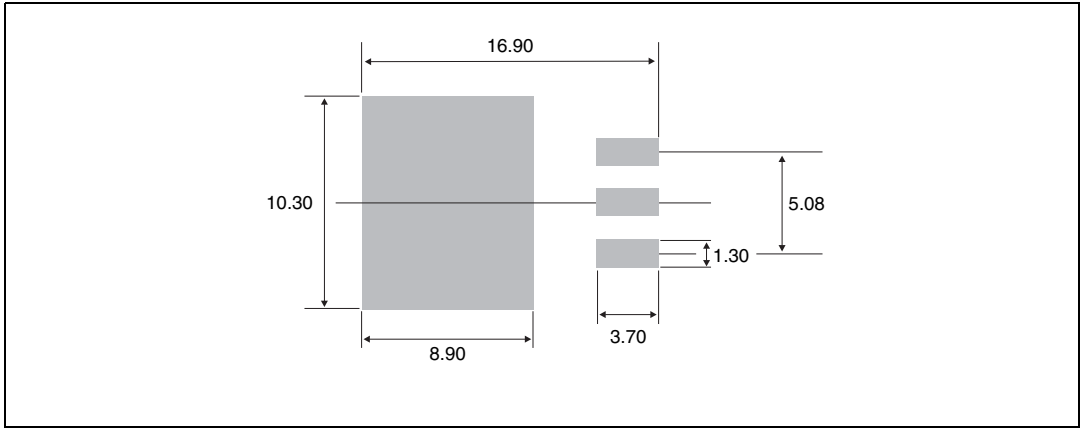


The mechanical drawing illustrates the T0-220FPAC package. The top view shows a rectangular body with a central circular feature and a top flange. Dimensions A through H define the top and side profiles. The side view shows the package's height and the location of the mounting pins. Dimensions L2 through L7 define the lengths of various sections, while L3 and L4 define the total height. The diameter of the mounting holes is indicated as Dia. The drawing uses standard mechanical notation for dimensions and tolerances.

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. D<sup>2</sup>PAK 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](http://www.st.com).

### 3 Ordering information

| Part Number | Marking   | Package            | Weight | Base qty | Delivery mode |
|-------------|-----------|--------------------|--------|----------|---------------|
| STTH812D    | STTH812D  | TO-220AC           | 1.86 g | 50       | Tube          |
| STTH812DI   | STTH812DI | TO-220Ins          | 1.86 g | 50       | Tube          |
| STTH812FP   | STTH812FP | TO-220FPAC         | 2.2 g  | 50       | Tube          |
| STTH812G    | STTH812G  | D <sup>2</sup> PAK | 1.48 g | 50       | Tube          |
| STTH812G-TR | STTH812G  | 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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