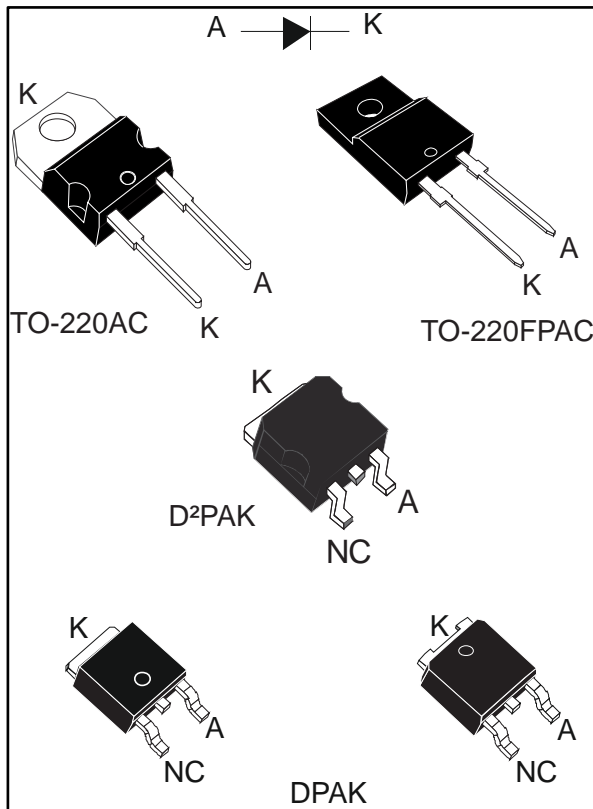


## Turbo 2 ultrafast high voltage rectifier

Datasheet - production data



### Description

The device is developed using ST's Turbo 2 600 V technology. It is well-suited as a boost diode, especially for use 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  |
|-----------------|--------|
| $I_{F(AV)}$     | 5 A    |
| $V_{RRM}$       | 600 V  |
| $T_j$ (max.)    | 175 °C |
| $V_F$ (typ.)    | 1.40 V |
| $t_{rr}$ (max.) | 25 ns  |

### Features

- Ultrafast switching
- Low reverse recovery current
- Reduces switching losses
- Low thermal resistance
- Insulated package: TO-220FPAC
  - Insulation voltage: 2000  $V_{RMS}$  sine
- ECOPACK®2 compliant component for DPAK on demand

# 1 Characteristics

**Table 2: Absolute ratings (limiting values at 25 °C, unless otherwise specified)**

| Symbol              | Parameter                                       |   | Value       | Unit |
|---------------------|---|---|-------------|------|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage                 |   | 600         | V    |
| I <sub>F(RMS)</sub> | Forward rms current                             | TO-220AC<br>TO-220FPAC<br>D <sup>2</sup> PAK                      | 20          | A    |
|                     |   | DPAK  | 10          |      |
| I <sub>F(AV)</sub>  | Average forward current<br>δ = 0.5, square wave | T <sub>C</sub> = 135 °C<br>TO-220AC<br>DPAK<br>D <sup>2</sup> PAK | 5           | A    |
|                     |   | T <sub>C</sub> = 105 °C<br>TO-220FPAC                             |             |      |
| I <sub>FSM</sub>    | Surge non repetitive forward current            | t <sub>p</sub> = 10 ms sinusoidal                                 | 50          | 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 parameter**

| Symbol               | Parameter        |                                      | Max. value | Unit |
|----------------------|------------------|--------------------------------------|------------|------|
| R <sub>th(j-c)</sub> | Junction to case | TO-220AC / DPAK / D <sup>2</sup> PAK | 3.0        | °C/W |
|                      |                  | TO-220FPAC                           | 5.5        |      |

**Table 4: Static electrical characteristics**

| Symbol                        | Parameter               | Test conditions         |                                   | Min. | Typ. | Max. | Unit |
|-------------------------------|-------------------------|-------------------------|-----------------------------------|------|------|------|------|
| I <sub>R</sub> <sup>(1)</sup> | Reverse leakage current | T <sub>j</sub> = 25 °C  | V <sub>R</sub> = V <sub>RRM</sub> | -    |      | 20   | μA   |
|                               |                         | T <sub>j</sub> = 125 °C |                                   | -    | 25   | 250  |      |
| V <sub>F</sub> <sup>(2)</sup> | Forward voltage drop    | T <sub>j</sub> = 25 °C  | I <sub>F</sub> = 5 A              | -    |      | 2.9  | V    |
|                               |                         | T <sub>j</sub> = 125 °C |                                   | -    | 1.4  | 1.8  |      |

**Notes:**

(1)Pulse test: t<sub>p</sub> = 5 ms, δ < 2%

(2)Pulse test: t<sub>p</sub> = 380 μs, δ < 2%

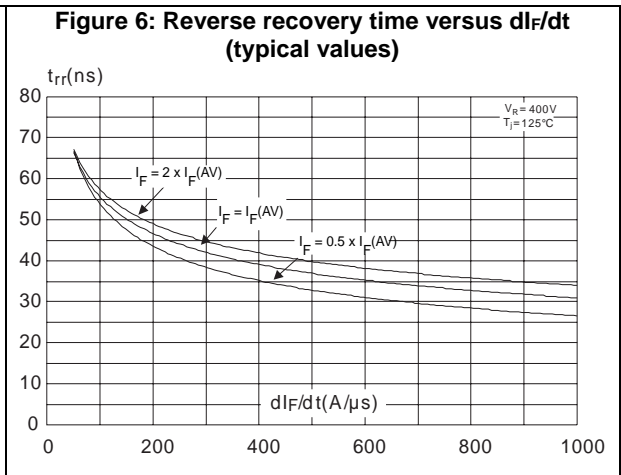
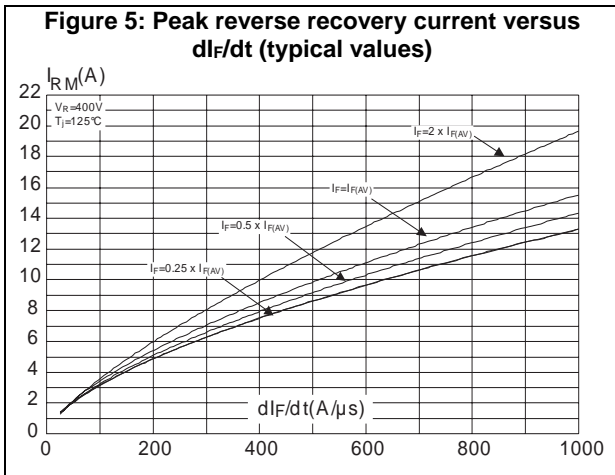
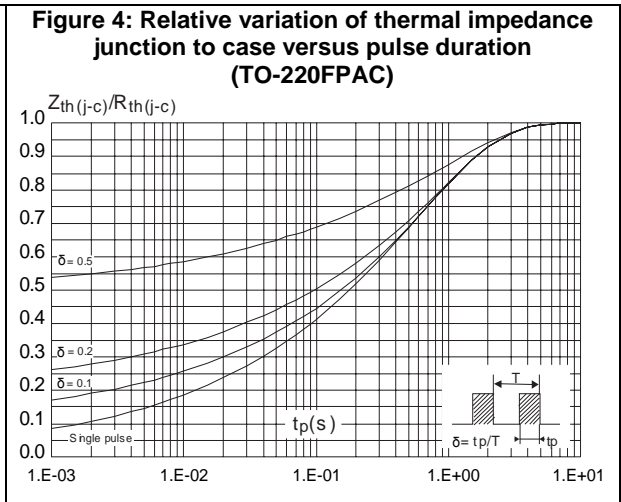
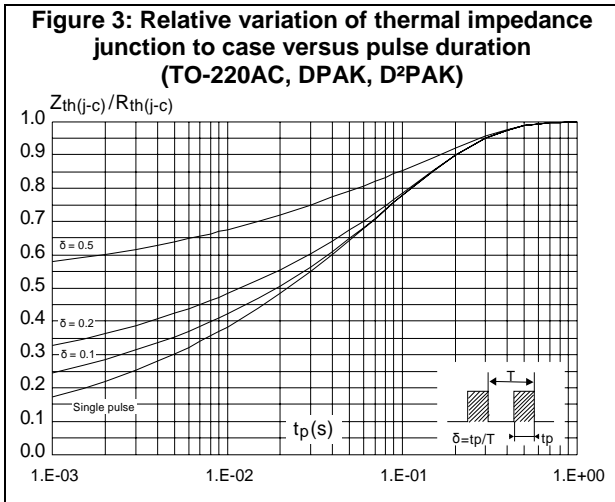
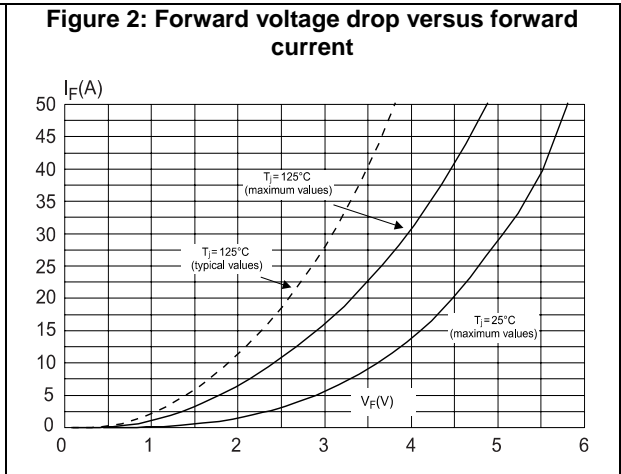
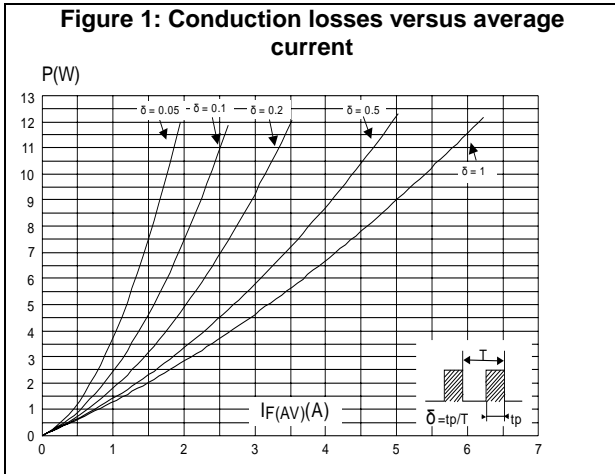
To evaluate the conduction losses, use the following equation:

$$P = 1.164 \times I_{F(AV)} + 0.128 \times I_{F(RMS)}^2$$

Table 5: Dynamic electrical characteristics

| Symbol       | Parameter                | Test conditions       |  | Min. | Typ. | Max. | Unit |
|--------------|--------------------------|-----------------------|--|------|------|------|------|
| $t_{rr}$     | Reverse recovery time    | $T_j = 25\text{ °C}$  | $I_F = 0.5\text{ A}$<br>$I_{rr} = 0.25\text{ A}$<br>$I_R = 1\text{ A}$                         | -    |      | 25   | ns   |
|              |                          |                       | $I_F = 1\text{ A}$<br>$V_R = 30\text{ V}$<br>$di_F/dt = -50\text{ A}/\mu\text{s}$              | -    |      | 40   |      |
| $I_{RM}$     | Reverse recovery current | $T_j = 125\text{ °C}$ | $I_F = 5\text{ A}$<br>$V_R = 400\text{ V}$<br>$di_F/dt = -200\text{ A}/\mu\text{s}$            | -    | 5.0  | 6.0  | A    |
| $S_{factor}$ | Softness factor          |                       |  | -    | 0.35 |      | -    |
| $Q_{rr}$     | Reverse recovery charges |                       |  | -    | 110  |      | nC   |
| $t_{fr}$     | Forward recovery time    | $T_j = 25\text{ °C}$  | $I_F = 5\text{ A}$<br>$V_{FR} = 1.1 \times V_{F(max.)}$<br>$di_F/dt = 40\text{ A}/\mu\text{s}$ | -    |      | 150  | ns   |
| $V_{FP}$     | Forward recovery voltage |                       |  | -    |      | 4.5  | V    |

# 1.1 Characteristics (curves)



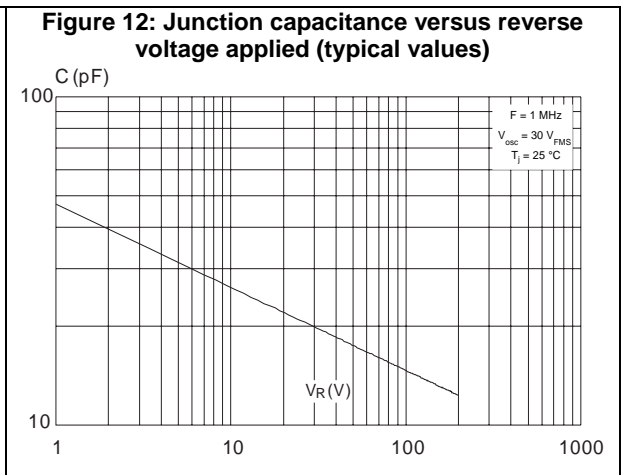
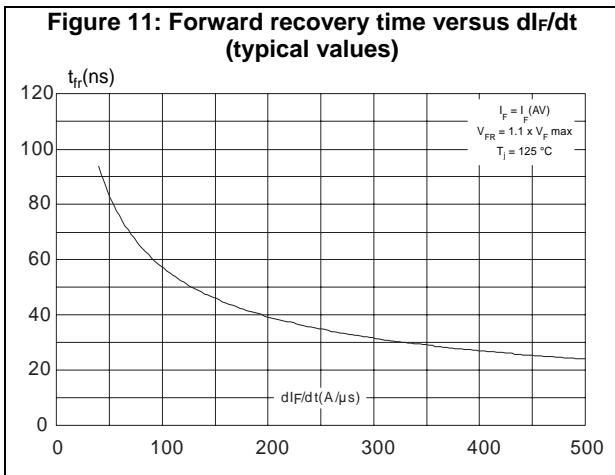
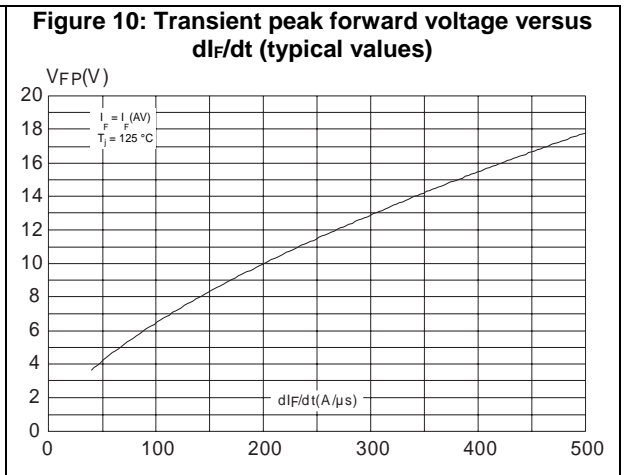
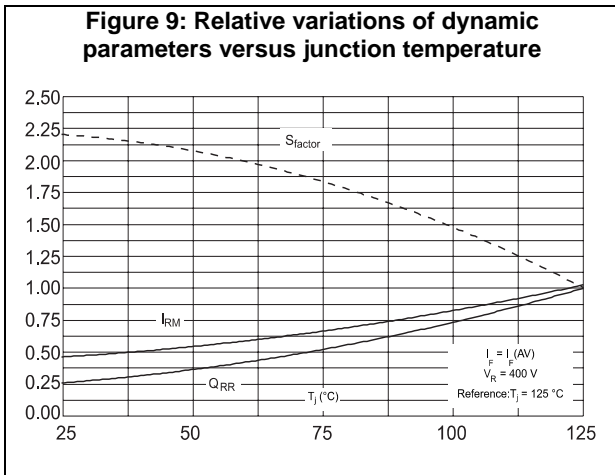
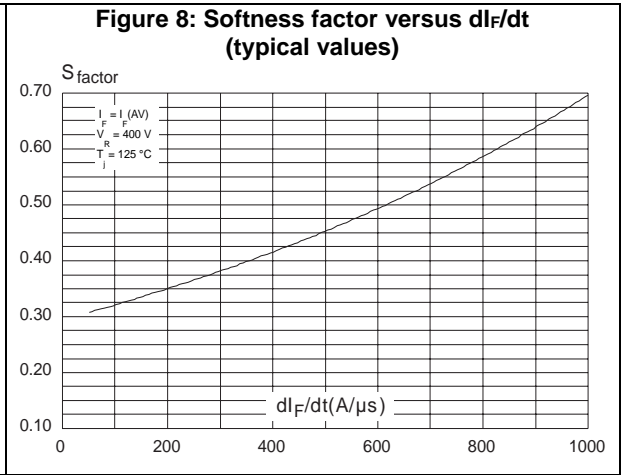
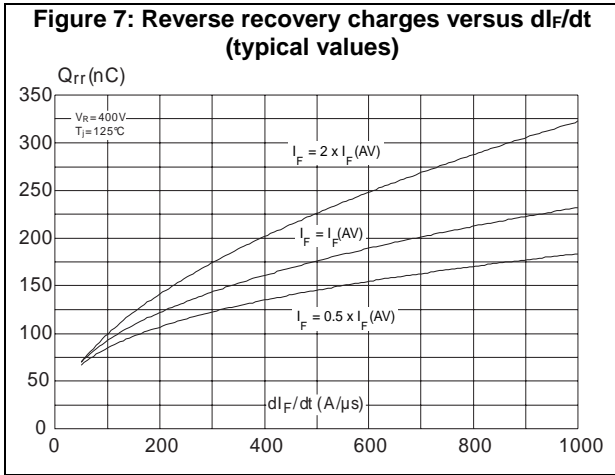


Figure 13: Thermal resistance junction to ambient versus copper surface under tab (DPAK)

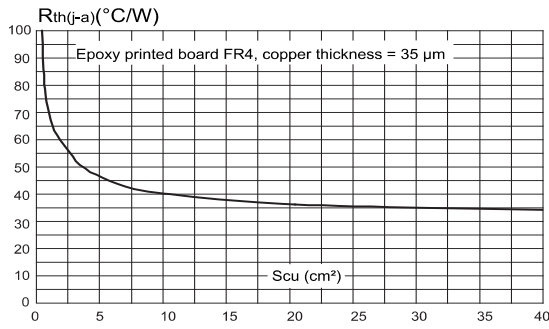
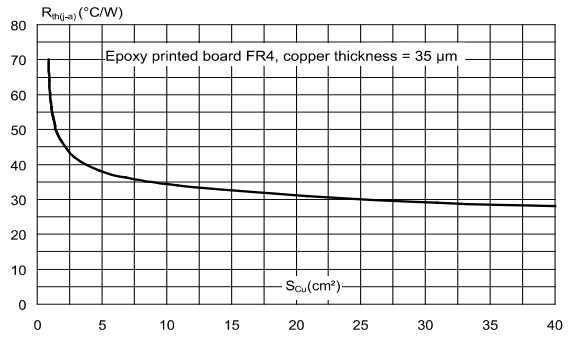


Figure 14: Thermal resistance junction to ambient versus copper surface under tab (D<sup>2</sup>PAK)



## 2 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

- Cooling method: by conduction (C)
- Epoxy meets UL 94,V0
- Recommended torque value: 0.55 N·m (for TO-220FPAC / TO-220AC)
- Maximum torque value: 0.7 N·m (for TO-220FPAC / TO-220AC)

### 2.1 TO-220AC package information

Figure 15: TO-220AC package outline

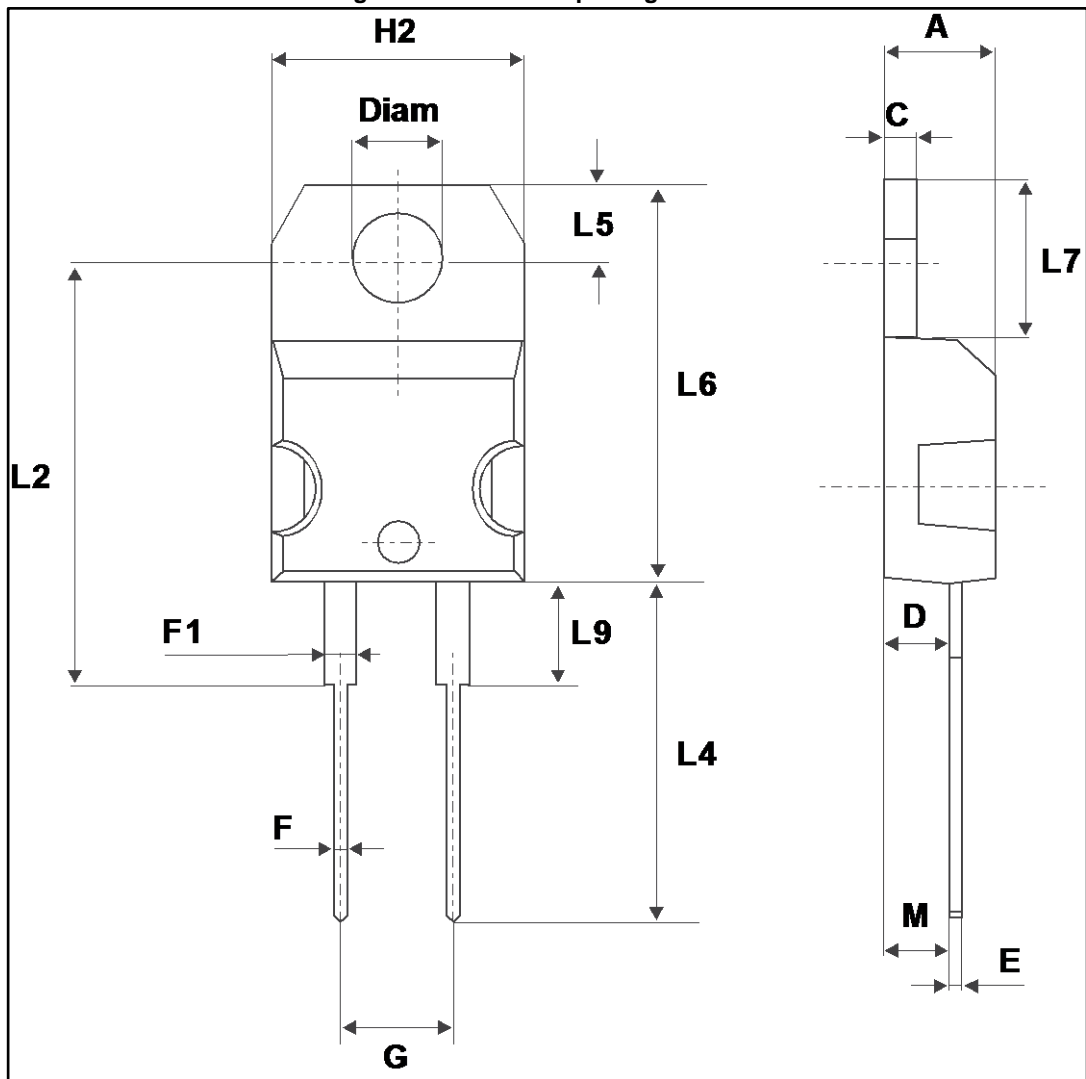


Table 6: TO-220AC package mechanical data

| 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 | 3.75        | 3.85  | 0.147      | 0.151 |



## 2.2 TO-220FPAC package information

Figure 16: TO-220FPAC package outline

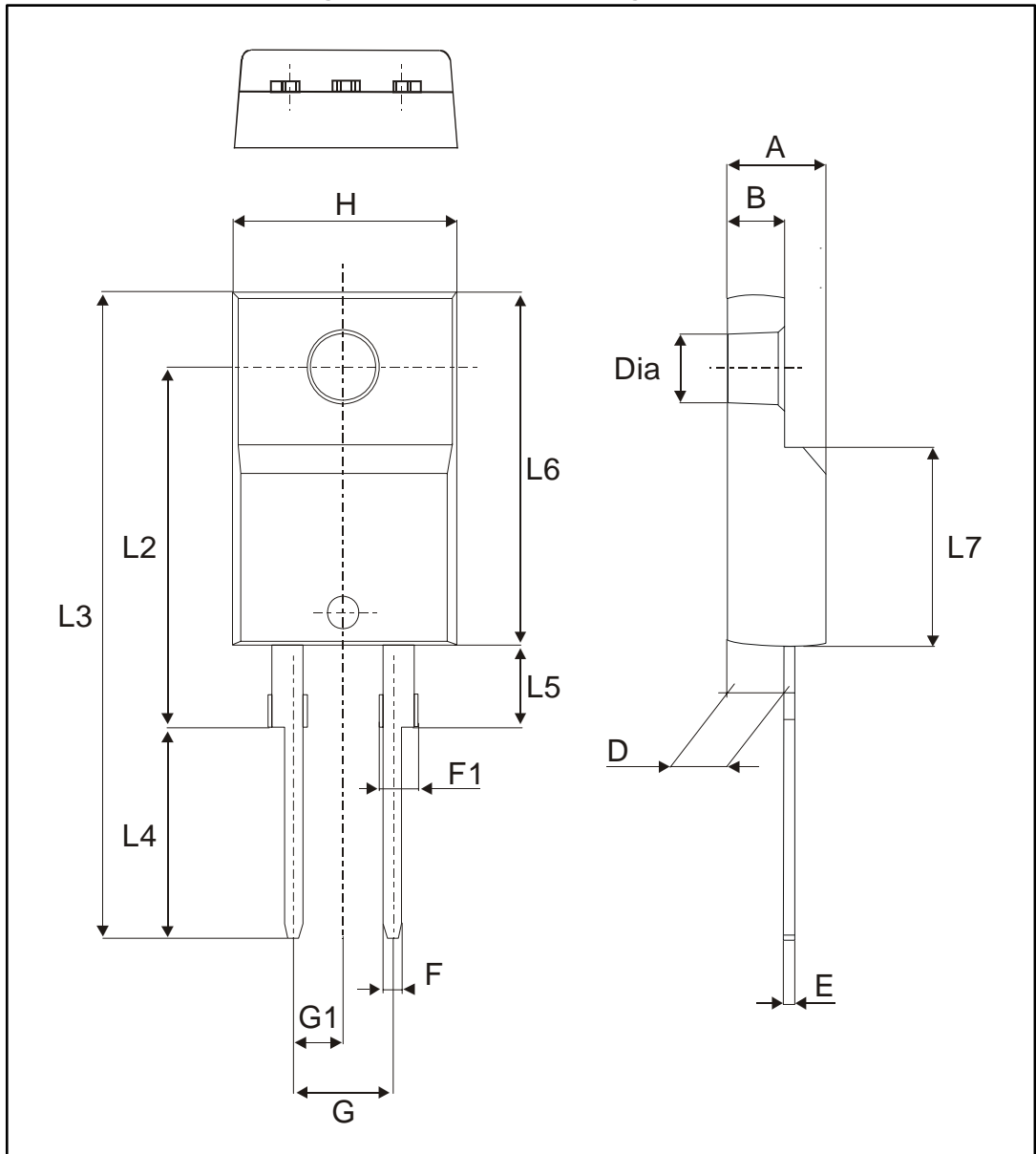
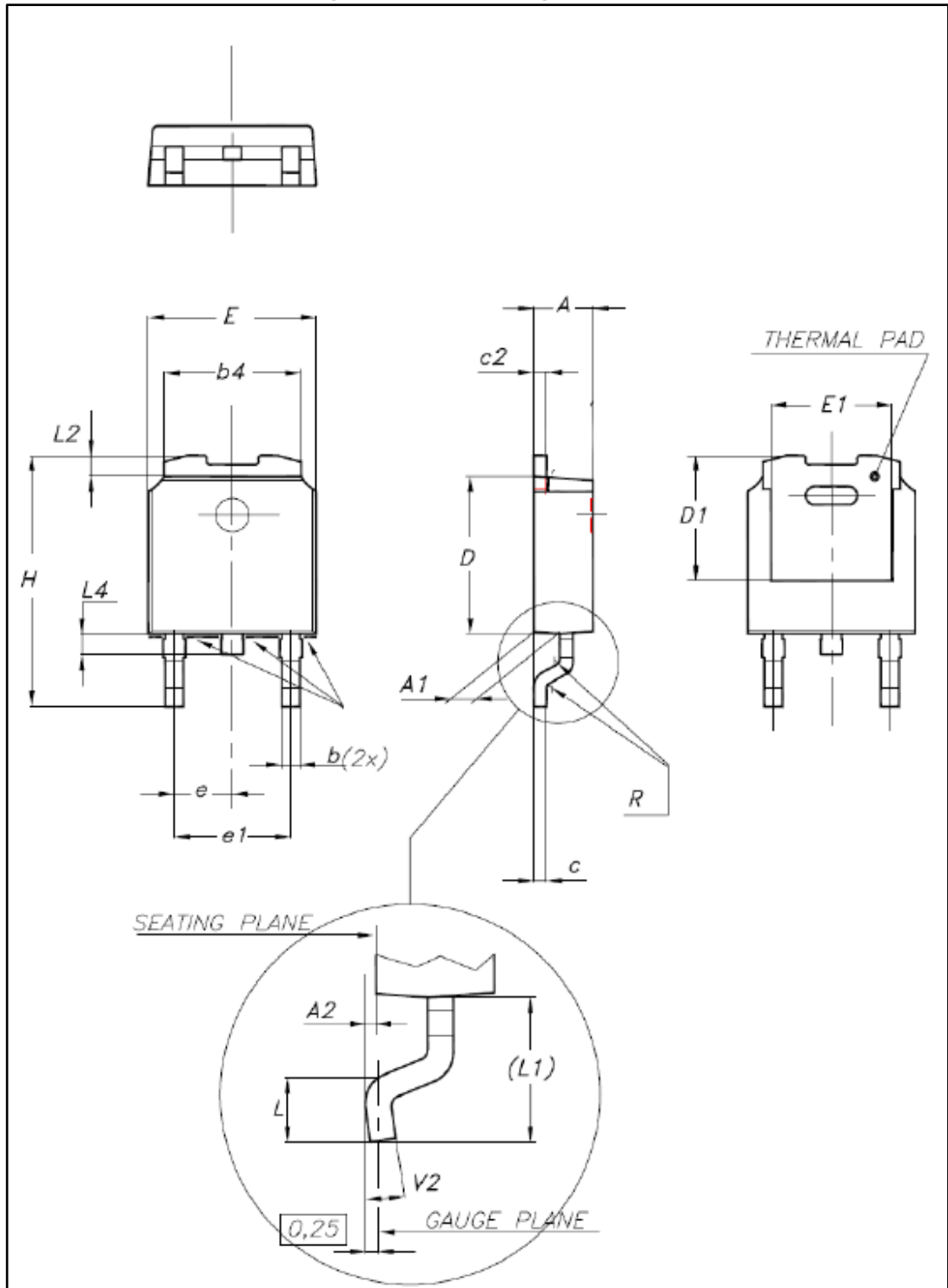


Table 7: TO-220FPAC package mechanical data

| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.40        | 4.60  | 0.173      | 0.181 |
| B    | 2.50        | 2.70  | 0.098      | 0.106 |
| D    | 2.50        | 2.75  | 0.098      | 0.108 |
| E    | 0.45        | 0.70  | 0.018      | 0.027 |
| F    | 0.75        | 1.00  | 0.030      | 0.039 |
| F1   | 1.15        | 1.70  | 0.045      | 0.067 |
| G    | 4.95        | 5.20  | 0.195      | 0.205 |
| G1   | 2.40        | 2.70  | 0.094      | 0.106 |
| H    | 10.00       | 10.40 | 0.393      | 0.409 |
| L2   | 16.00 typ.  |       | 0.630 typ. |       |
| L3   | 28.60       | 30.60 | 0.126      | 1.205 |
| L4   | 9.80        | 10.60 | 0.386      | 0.417 |
| L5   | 2.90        | 3.60  | 0.114      | 0.142 |
| L6   | 15.90       | 16.40 | 0.626      | 0.646 |
| L7   | 9.00        | 9.30  | 0.354      | 0.366 |
| Dia. | 3.00        | 3.20  | 0.118      | 0.126 |

### 2.3 DPAK package information

Figure 17: DPAK package outline

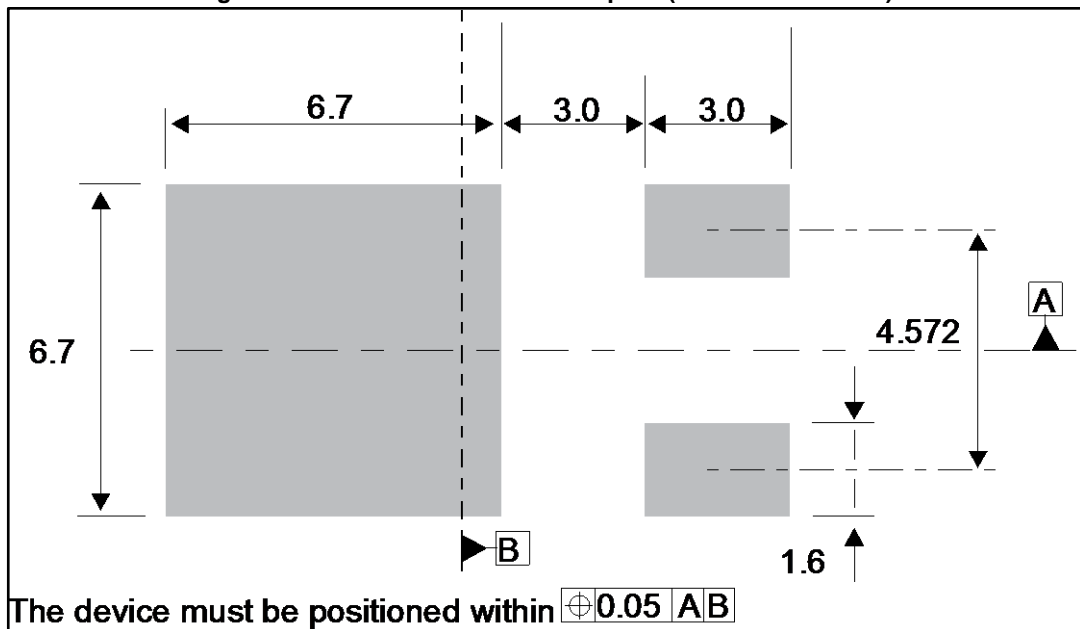


This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 8: DPAK package mechanical data

| Ref. | Dimensions  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 2.18        | 2.40  | 0.085      | 0.094 |
| A1   | 0.90        | 1.10  | 0.035      | 0.043 |
| A2   | 0.03        | 0.23  | 0.001      | 0.009 |
| b    | 0.64        | 0.90  | 0.025      | 0.035 |
| b4   | 4.95        | 5.46  | 0.194      | 0.215 |
| c    | 0.46        | 0.61  | 0.018      | 0.024 |
| c2   | 0.46        | 0.60  | 0.018      | 0.023 |
| D    | 5.97        | 6.22  | 0.235      | 0.244 |
| D1   | 4.95        | 5.60  | 0.194      | 0.220 |
| E    | 6.35        | 6.73  | 0.250      | 0.265 |
| E1   | 4.32        | 5.50  | 0.170      | 0.216 |
| e    | 2.286 typ.  |       | 0.090 typ. |       |
| e1   | 4.40        | 4.70  | 0.173      | 0.185 |
| H    | 9.35        | 10.40 | 0.368      | 0.409 |
| L    | 1.0         | 1.78  | 0.039      | 0.070 |
| L2   |             | 1.27  |            | 0.050 |
| L4   | 0.60        | 1.02  | 0.023      | 0.040 |
| V2   | -8°         | +8°   | -8°        | +8°   |

Figure 18: DPAK recommended footprint (dimensions in mm)



## 2.4 D<sup>2</sup>PAK package information

Figure 19: D<sup>2</sup>PAK package outline

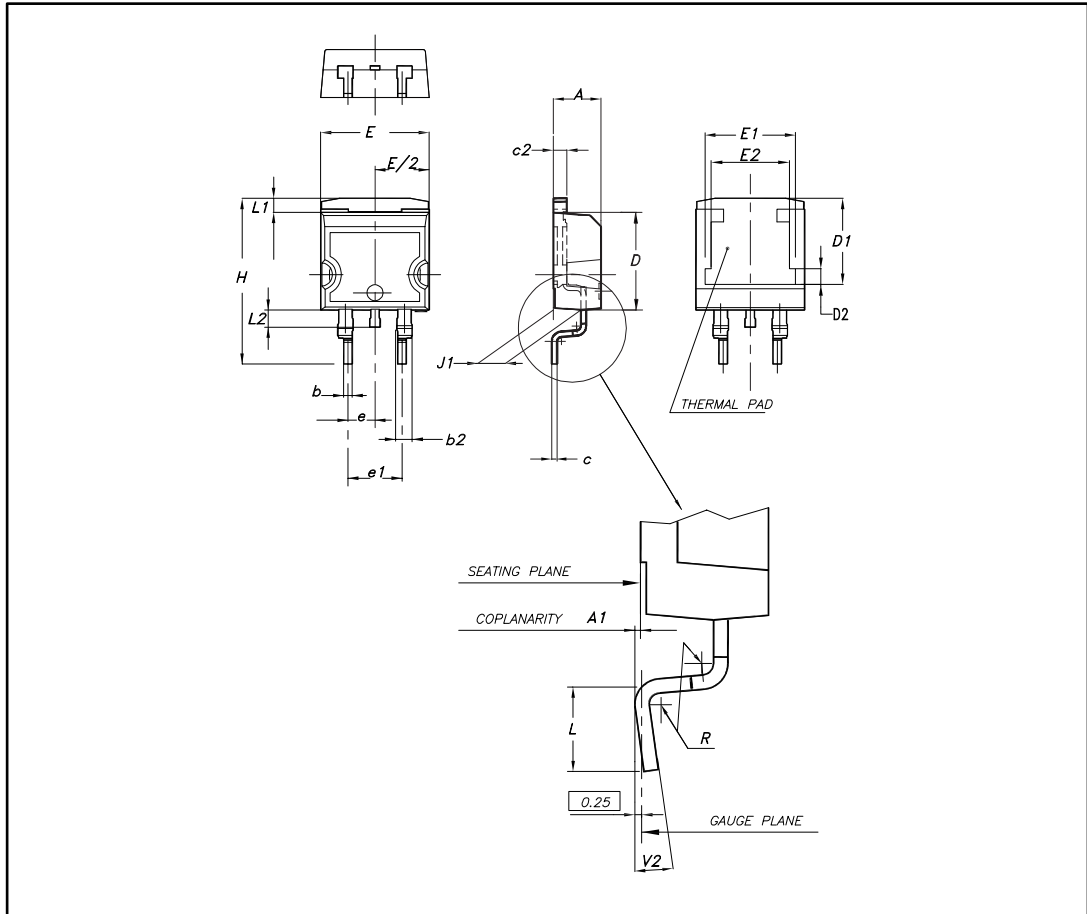
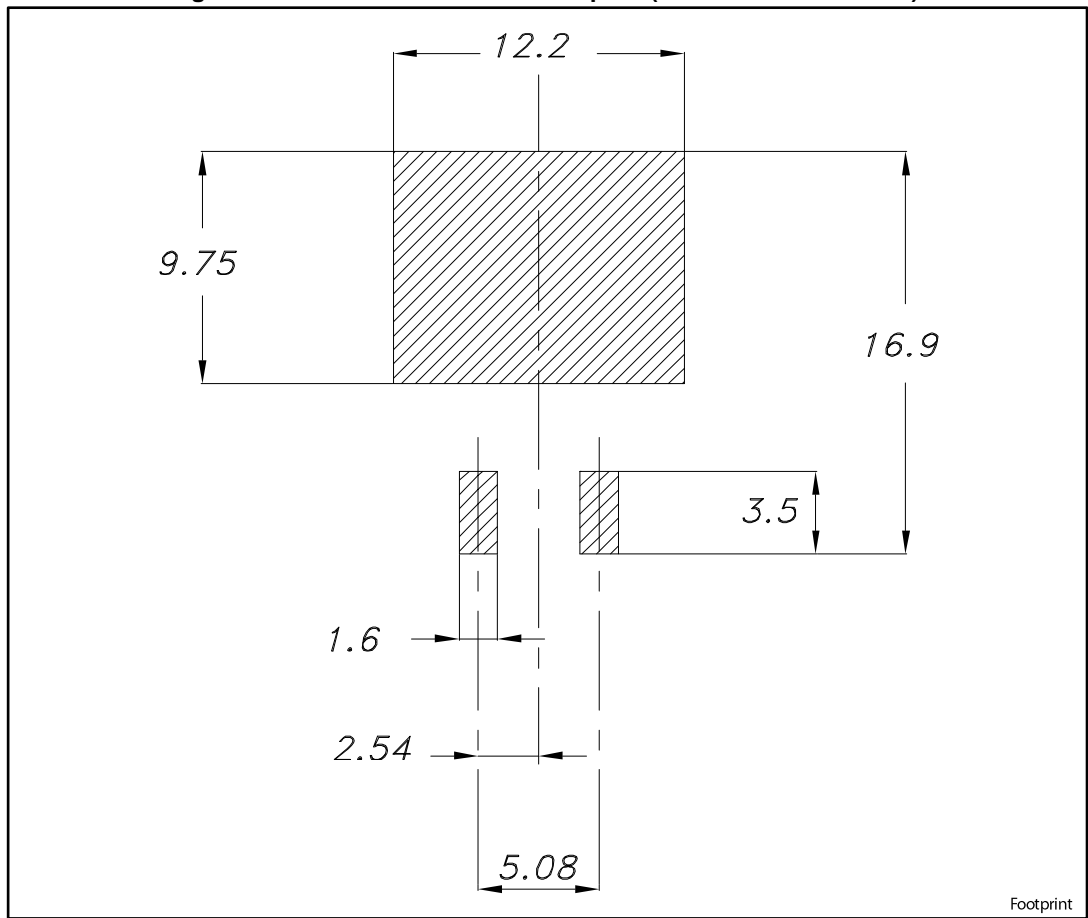


Table 9: D<sup>2</sup>PAK package mechanical data

| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 4.40        |      | 4.60  | 0.173  |       | 0.181 |
| A1   | 0.03        |      | 0.23  | 0.001  |       | 0.009 |
| b    | 0.70        |      | 0.93  | 0.028  |       | 0.037 |
| b2   | 1.14        |      | 1.70  | 0.045  |       | 0.067 |
| c    | 0.45        |      | 0.60  | 0.018  |       | 0.024 |
| c2   | 1.23        |      | 1.36  | 0.048  |       | 0.053 |
| D    | 8.95        |      | 9.35  | 0.352  |       | 0.368 |
| D1   | 7.50        | 7.75 | 8.00  | 0.295  | 0.305 | 0.315 |
| D2   | 1.10        | 1.30 | 1.50  | 0.043  | 0.051 | 0.060 |
| E    | 10          |      | 10.40 | 0.394  |       | 0.409 |
| E1   | 8.50        | 8.70 | 8.90  | 0.335  | 0.343 | 0.346 |
| E2   | 6.85        | 7.05 | 7.25  | 0.266  | 0.278 | 0.282 |
| e    |             | 2.54 |       |        | 0.100 |       |
| e1   | 4.88        |      | 5.28  | 0.190  |       | 0.205 |
| H    | 15          |      | 15.85 | 0.591  |       | 0.624 |
| J1   | 2.49        |      | 2.69  | 0.097  |       | 0.106 |
| L    | 2.29        |      | 2.79  | 0.090  |       | 0.110 |
| L1   | 1.27        |      | 1.40  | 0.049  |       | 0.055 |
| L2   | 1.30        |      | 1.75  | 0.050  |       | 0.069 |
| R    |             | 0.4  |       |        | 0.015 |       |
| V2   | 0°          |      | 8°    | 0°     |       | 8°    |

Figure 20: D<sup>2</sup>PAK recommended footprint (dimensions are in mm)



Footprint

### 3 Ordering information

Table 10: Ordering information

| Order code   | Marking    | Package            | Weight | Base qty. | Delivery mode |
|--------------|------------|--------------------|--------|-----------|---------------|
| STTH5R06D    | STTH5R06D  | TO-220AC           | 1.90 g | 50        | Tube          |
| STTH5R06G-TR | STTH5R06G  | D <sup>2</sup> PAK | 1.48 g | 1000      | Tape and reel |
| STTH5R06FP   | STTH5R06FP | TO-220FPAC         | 1.90 g | 50        | Tube          |
| STTH5R06B    | STTH5 R06B | DPAK               | 0.30 g | 75        | Tube          |
| STTH5R06B-TR | STTH5 R06B | DPAK               | 0.30 g | 2500      | Tape and reel |

### 4 Revision history

Table 11: Document revision history

| Date        | Revision | Changes  |
|-------------|----------|--|
| 17-Feb-2011 | 9        | Last issue.  |
| 01-Aug-2014 | 10       | Added insulated package text in <i>Features</i> . Corrected typographical errors in <i>Table 10</i> . Updated TO-220FPAC, D <sup>2</sup> PAK and DPAK package information and reformatted to current standard. |
| 18-Sep-2014 | 11       | Updated <i>Figure 18</i> , <i>Figure 19</i> and <i>Table 4</i> .   |
| 19-Oct-2016 | 12       | Updated DPAK package information and reformatted to current standard.  |



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