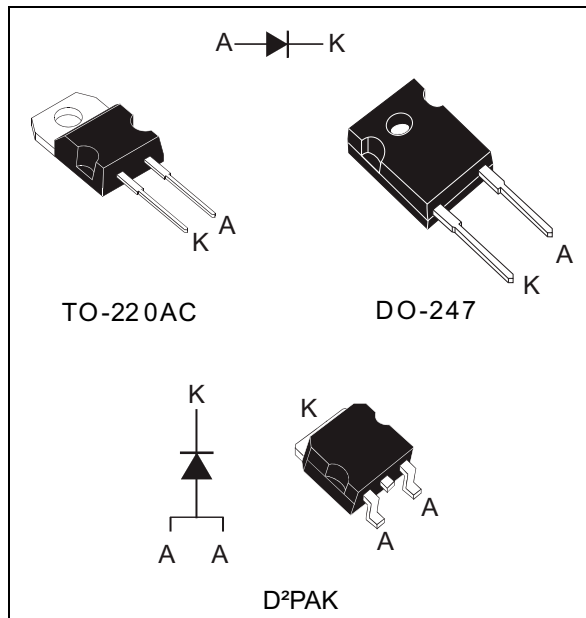


## Ultrafast recovery diode

Datasheet - production data



### Description

The compromise-free, 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.

**Table 1. Device summary**

| Symbol        | Value  |
|---------------|--------|
| $I_{F(AV)}$   | 30 A   |
| $V_{RRM}$     | 400 V  |
| $T_j(max)$    | 175° C |
| $V_F(typ)$    | 0.97 V |
| $t_{rr}(typ)$ | 24 ns  |

### Features

- Ultrafast switching
- Low reverse current
- Low thermal resistance
- Reduces switching and conduction losses
- High junction temperature
- ECOPACK®2 compliant component

# 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      |                                        |                         | 400         | V    |
| I <sub>F(RMS)</sub> | RMS forward current                  |                                        |                         | 50          | A    |
| I <sub>F(AV)</sub>  | Average forward current, δ = 0.5     | TO-220AC / DO-247 / D <sup>2</sup> PAK | T <sub>c</sub> = 120 °C | 30          | A    |
| I <sub>FRM</sub>    | Repetitive peak forward current      | t <sub>p</sub> = 10 ms, F = 1 KHz      |                         | 500         | A    |
| I <sub>FSM</sub>    | Surge non repetitive forward current | t <sub>p</sub> = 10 ms Sinusoidal      |                         | 300         | A    |
| T <sub>stg</sub>    | Storage temperature range            |                                        |                         | -65 to +175 | ° C  |
| T <sub>j</sub>      | Operating junction temperature range |                                        |                         | -40 to +175 | ° C  |

**Table 3. Thermal parameters**

| Symbol        | Parameter        |                                        | Value | Unit |
|---------------|------------------|----------------------------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case | TO-220AC / DO-247 / D <sup>2</sup> PAK | 1.15  | °C/W |

**Table 4. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions           |                     | Min | Typ  | Max  | Unit          |
|-------------|-------------------------|---------------------------|---------------------|-----|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25^\circ\text{C}$  | $V_R = V_{RRM}$     |     |      | 15   | $\mu\text{A}$ |
|             |                         | $T_j = 100^\circ\text{C}$ |                     |     | 3    | 30   |               |
|             |                         | $T_j = 125^\circ\text{C}$ |                     |     | 15   | 150  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25^\circ\text{C}$  | $I_F = 15\text{ A}$ |     |      | 1.26 | V             |
|             |                         | $T_j = 150^\circ\text{C}$ |                     |     | 0.8  | 1.0  |               |
|             |                         | $T_j = 25^\circ\text{C}$  | $I_F = 30\text{ A}$ |     |      | 1.45 |               |
|             |                         | $T_j = 100^\circ\text{C}$ |                     |     |      | 1.3  |               |
|             |                         | $T_j = 150^\circ\text{C}$ |                     |     | 0.97 | 1.2  |               |

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 conduction losses use the following equation:

$$P = 0.9 \times I_{F(AV)} + 0.01 \times I_{F(RMS)}^2$$

Table 5. Dynamic characteristics

| Symbol   | Parameter                | Test conditions                                                                                                            | Min | Typ | Max | Unit |
|----------|--------------------------|----------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $t_{rr}$ | Reverse recovery time    | $I_F = 1\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_J = 25^\circ\text{ C}$            |     | 24  | 35  | ns   |
|          |                          | $I_F = 1\text{ A}$ , $di_F/dt = -15\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_J = 25^\circ\text{ C}$             |     | 78  | 100 |      |
|          |                          | $I_F = 1\text{ A}$ , $I_R = 1\text{ A}$ ,<br>$I_{RR} = 0.25\text{ A}$ , $T_J = 25^\circ\text{ C}$                          |     |     | 50  |      |
| $I_{RM}$ | Reverse recovery current | $I_F = 30\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 320\text{ V}$ , $T_J = 125^\circ\text{ C}$         |     | 10  | 14  | A    |
| $t_{fr}$ | Forward recovery time    | $I_F = 30\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{FR} = 1.1 \times V_{Fmax}$ , $T_J = 25^\circ\text{ C}$ |     |     | 500 | ns   |
| $V_{FP}$ | Forward recovery voltage | $I_F = 30\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{FR} = 1.1 \times V_{Fmax}$ , $T_J = 25^\circ\text{ C}$ |     | 2.9 |     | V    |

Figure 1. Conduction losses versus average current

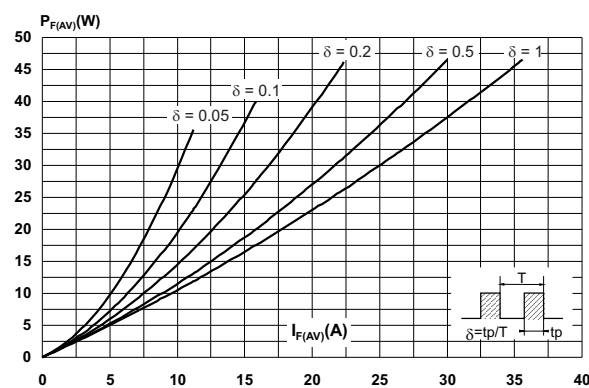


Figure 2. Forward voltage drop versus forward current

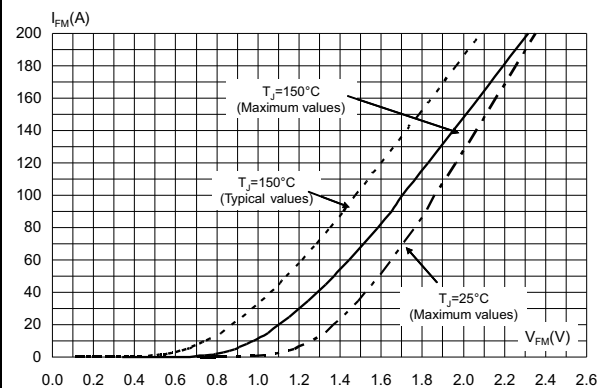
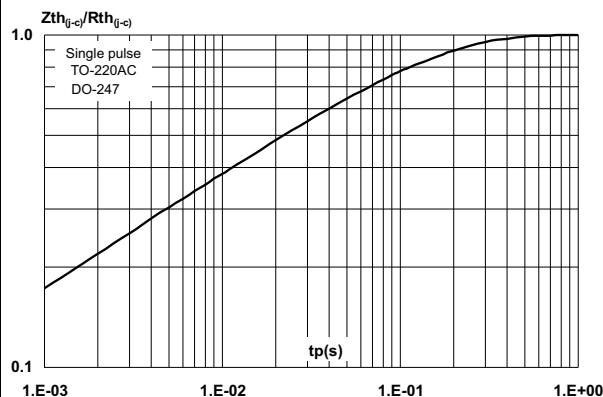
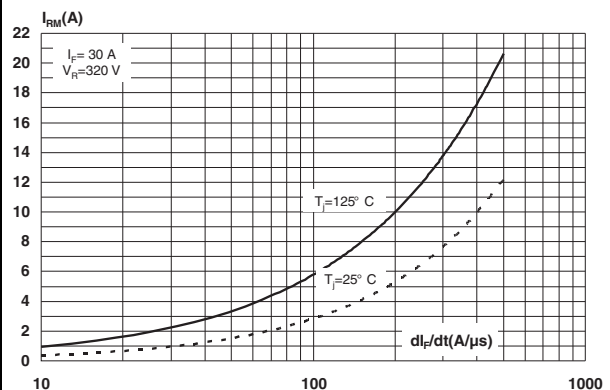
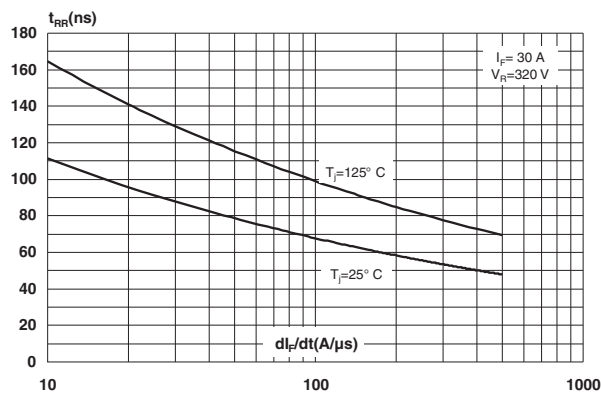


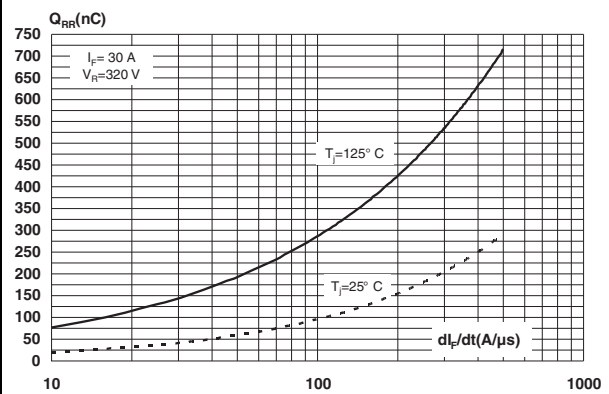
Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

Figure 4. Peak reverse recovery current versus  $di_F/dt$  (typical values)

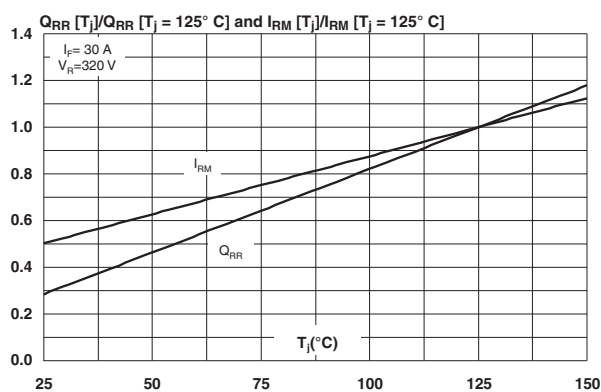
**Figure 5. Reverse recovery time versus  $di_F/dt$  (typical values)**



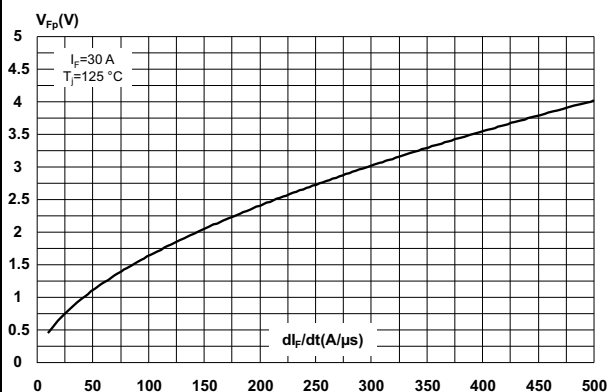
**Figure 6. Reverse recovery charges versus  $di_F/dt$  (typical values)**



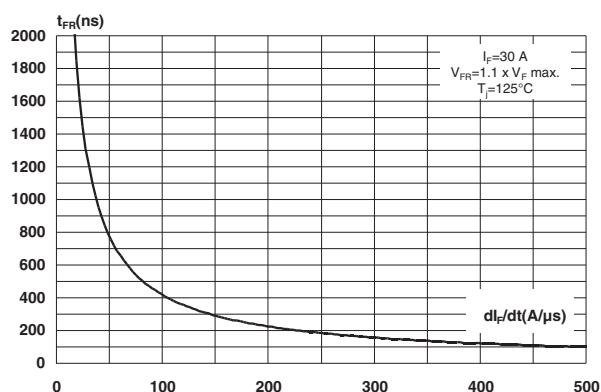
**Figure 7. Relative variations of dynamic parameters versus junction temperature**



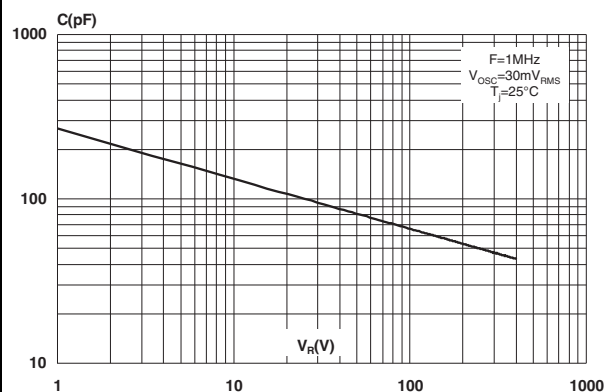
**Figure 8. Transient peak forward voltage versus  $di_F/dt$  (typical values)**

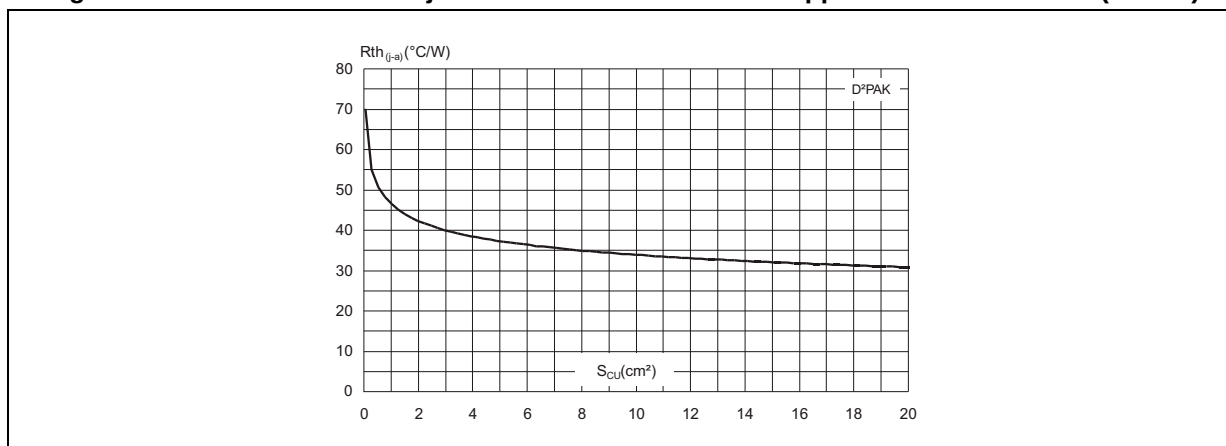


**Figure 9. Forward recovery time versus  $di_F/dt$  (typical values)**



**Figure 10. Junction capacitance versus reverse voltage applied (typical values)**



**Figure 11. Thermal resistance junction to ambient versus copper surface under tab (D<sup>2</sup>PAK)**

## 2 Package information

- Epoxy meets UL94, V0
- Lead-free package
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m (TO-220AC)
- Maximum torque value: 0.7 N·m (TO-220AC)

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.

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

Figure 12. D<sup>2</sup>PAK package outline

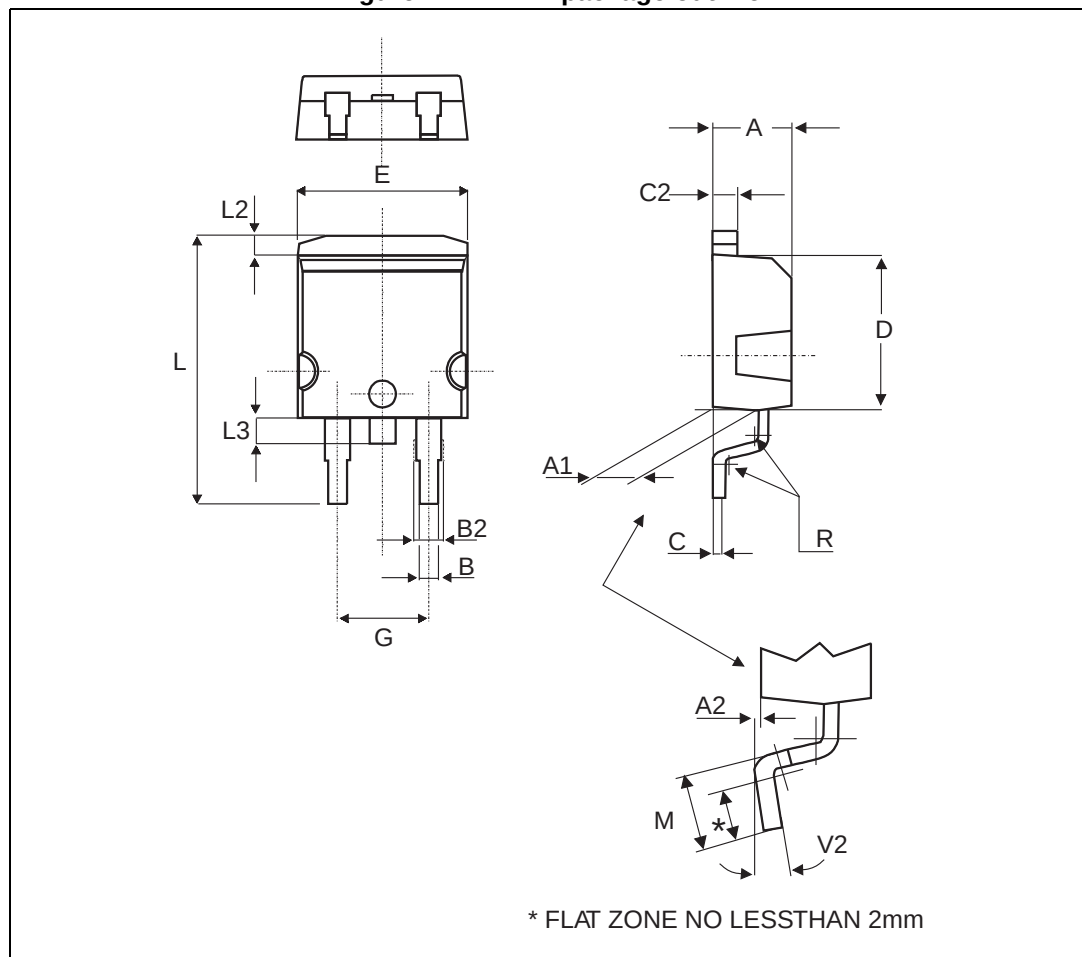
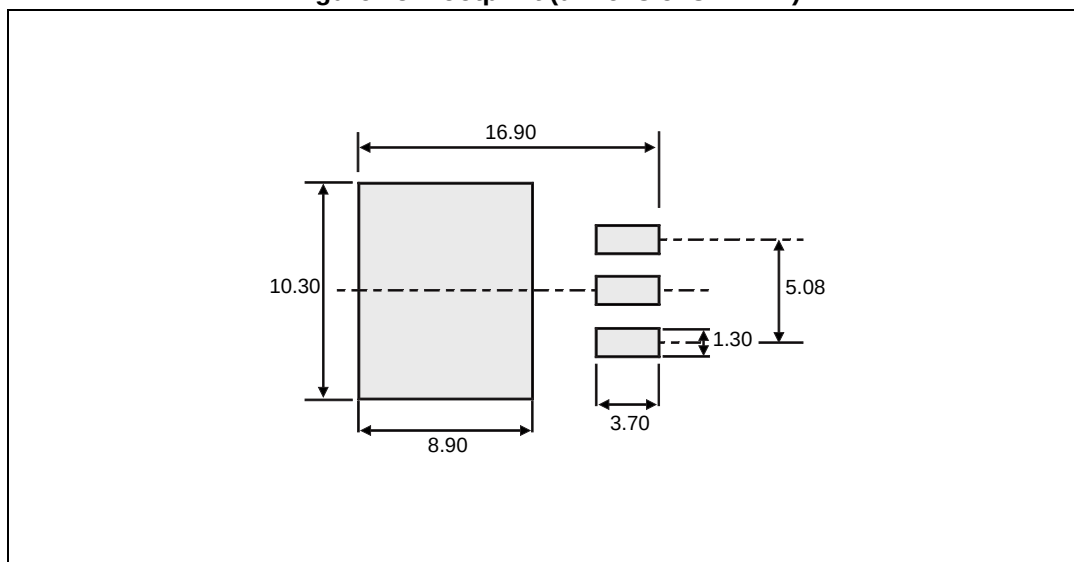


Table 6. D<sup>2</sup>PAK package mechanical data

| 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 13. Footprint (dimensions in mm)



## 2.2 DO-247 package information

Figure 14. DO-247 package outline

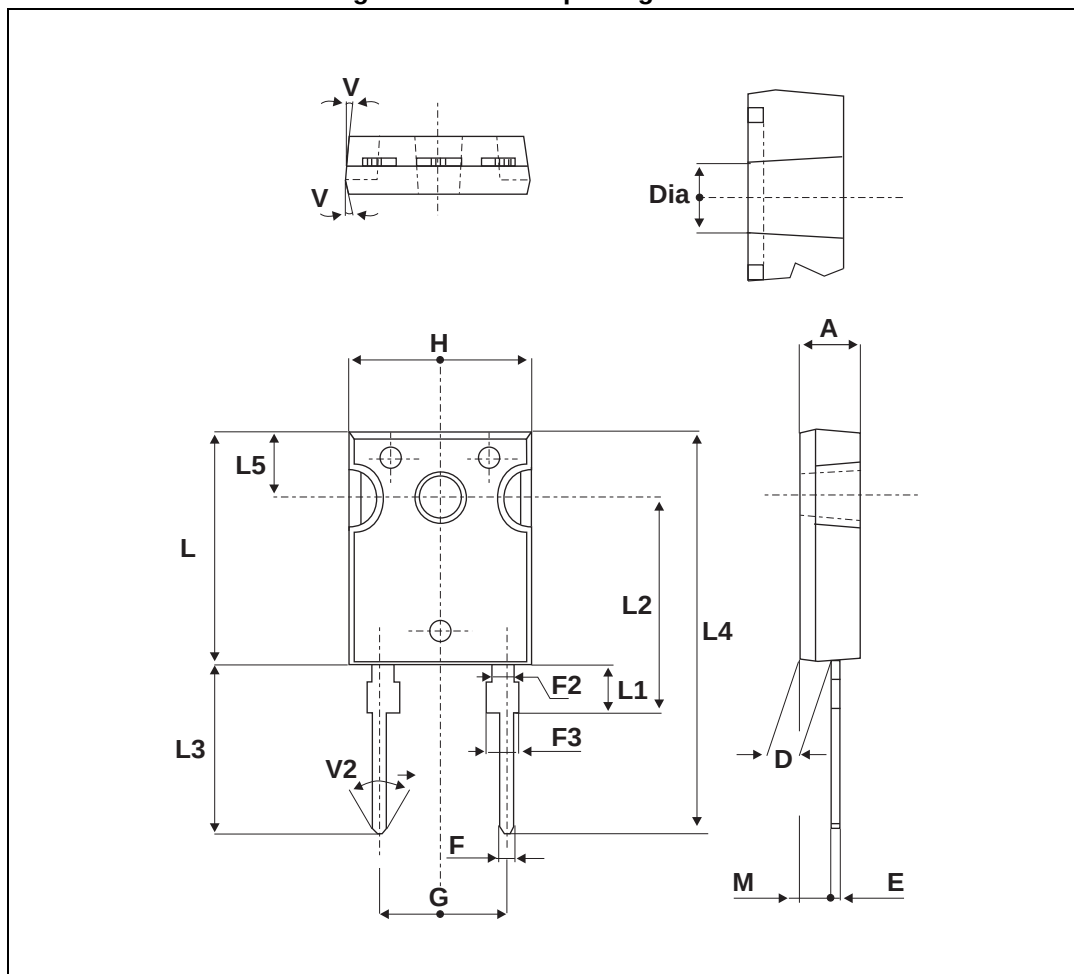




Table 7. DO-247 package mechanical data

| Ref. | Dimensions  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A    | 4.85        |       | 5.15  | 0.191  |       | 0.203 |
| D    | 2.20        |       | 2.60  | 0.086  |       | 0.102 |
| E    | 0.40        |       | 0.80  | 0.015  |       | 0.031 |
| F    | 1.00        |       | 1.40  | 0.039  |       | 0.055 |
| F2   |             | 2.00  |       |        | 0.078 |       |
| F3   | 2.00        |       | 2.40  | 0.078  |       | 0.094 |
| G    |             | 10.90 |       |        | 0.429 |       |
| H    | 15.45       |       | 15.75 | 0.608  |       | 0.620 |
| L    | 19.85       |       | 20.15 | 0.781  |       | 0.793 |
| L1   | 3.70        |       | 4.30  | 0.145  |       | 0.169 |
| L2   |             | 18.50 |       |        | 0.728 |       |
| L3   | 14.20       |       | 14.80 | 0.559  |       | 0.582 |
| L4   |             | 34.60 |       |        | 1.362 |       |
| L5   |             | 5.50  |       |        | 0.216 |       |
| M    | 2.00        |       | 3.00  | 0.078  |       | 0.118 |
| V    |             | 5°    |       |        | 5°    |       |
| V2   |             | 60°   |       |        | 60°   |       |
| Dia. | 3.55        |       | 3.65  | 0.139  |       | 0.143 |

## 2.3 TO-220AC package information

Figure 15. TO-220AC package outline

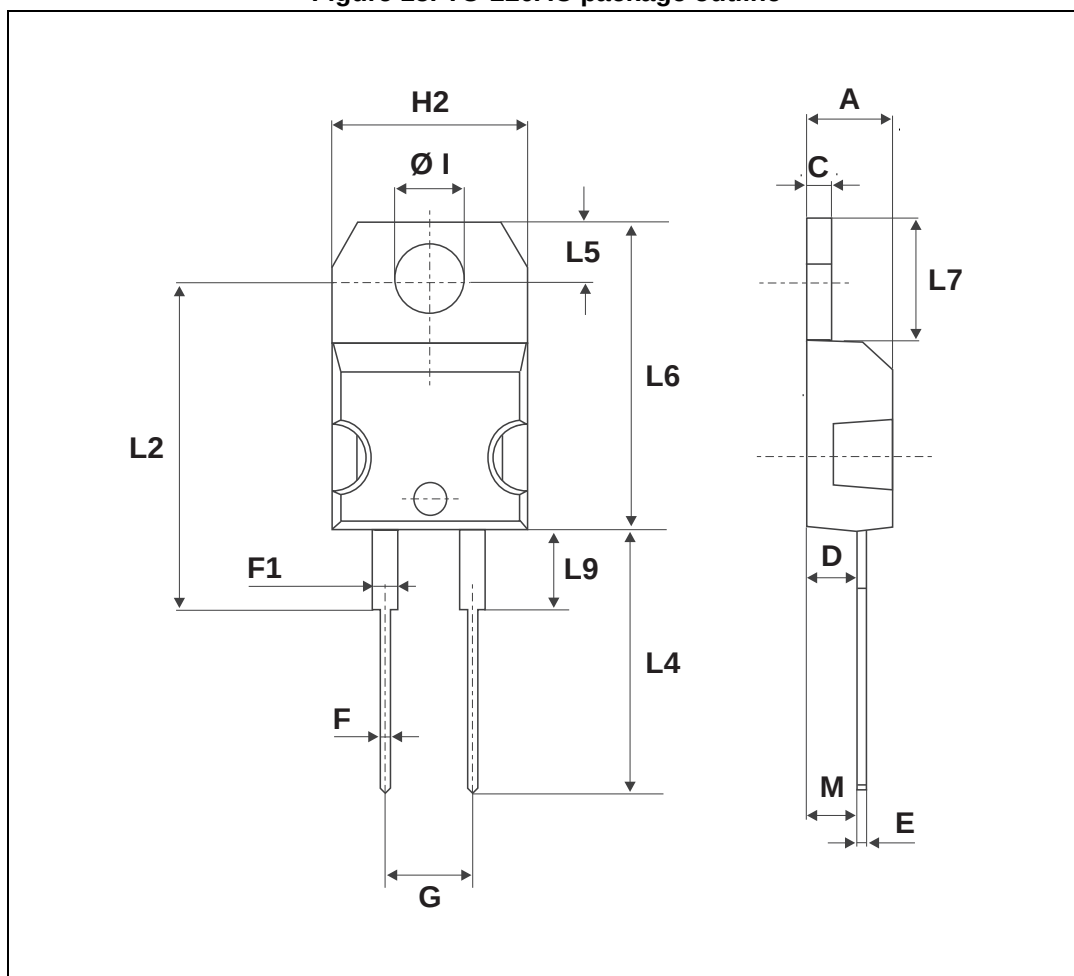


Table 8. TO-220AC package mechanical data

| Ref.    | Dimensions  |      |       |        |       |       |
|---------|-------------|------|-------|--------|-------|-------|
|         | Millimeters |      |       | Inches |       |       |
|         | Min.        | Typ. | Max.  | Min.   | Typ.  | 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      |             | 16.4 |       |        | 0.645 |       |
| 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  |       |        | 0.102 |       |
| Diam. I | 3.75        |      | 3.85  | 0.147  |       | 0.151 |

### 3 Ordering information

**Table 9. Ordering information**

| Order code    | Marking    | Package            | Weight | Base qty | Delivery mode |
|---------------|------------|--------------------|--------|----------|---------------|
| STTH30R04D    | STTH30R04D | TO-220AC           | 1.86 g | 50       | Tube          |
| STTH30R04G    | STTH30R04G | D <sup>2</sup> PAK | 1.48 g | 50       | Tube          |
| STTH30R04G-TR | STTH30R04G | D <sup>2</sup> PAK | 1.48 g | 1000     | Tape and reel |
| STTH30R04W    | STTH30R04W | DO-247             | 4.40 g | 30       | Tube          |

### 4 Revision history

**Table 10. Document revision history**

| Date        | Revision | Description of changes                                                                                     |
|-------------|----------|------------------------------------------------------------------------------------------------------------|
| 31-Mar-2007 | 1        | First issue.                                                                                               |
| 11-Dec-2015 | 2        | Updated <a href="#">Table 4</a> and reformatted to current standard.<br>Removed DOP3I package information. |

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