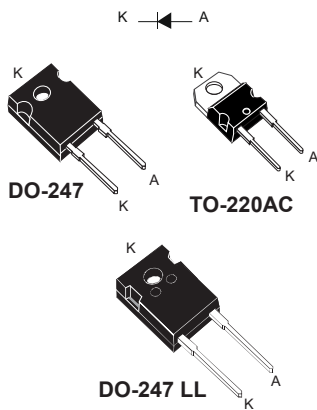


## 1200 V, 30 A ultrafast high voltage diode



## Features

- Ultrafast, soft recovery
- Low leakage current
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature capability
- ECOPACK2 compliant

## Applications

- AC-DC converter
- DC-DC stage in power supply
- DC-AC converter
- Solar inverters
- EV charging station
- Telecom power supply
- UPS

## 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.

## Product status link

[STTH3012](#)

## Product summary

|                       |        |
|-----------------------|--------|
| $I_{F(AV)}$           | 30 A   |
| $V_{RRM}$             | 1200 V |
| $V_F(\text{typ.})$    | 1.30 V |
| $t_{rr}(\text{typ.})$ | 48 ns  |
| $T_j(\text{max.})$    | 175 °C |

# 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    |   |
| $I_{F(RMS)}$ | Forward rms current                    |           | 50  | A    |   |
| $I_{F(AV)}$  | Average forward current                | DO-247    | $T_C = 140\text{ °C}$ , $\delta = 0.5$ square | 30   | A |
|              |  | DO-247 LL | $T_C = 135\text{ °C}$ , $\delta = 0.5$ square |      |   |
|              |  | TO-220AC  | $T_C = 130\text{ °C}$ , $\delta = 0.5$ square |      |   |
| $I_{FSM}$    | Surge non repetitive forward current   |           | $t_p = 10$ ms sinusoidal                      | 210  | A |
| $T_{stg}$    | Storage temperature range              |           | -65 to +175                                   | °C   |   |
| $T_j$        | Maximum operating junction temperature |           | 175   | °C   |   |

**Table 2. Thermal parameters**

| Symbol        | Parameter        |          | Typ. | Max. | Unit |
|---------------|------------------|----------|------|------|------|
| $R_{th(j-c)}$ | Junction to case | DO247    | 0.36 | 0.51 | °C/W |
|               |                  | DO247-LL | 0.37 | 0.53 |      |
|               |                  | TO-220AC | 0.44 | 0.62 |      |

For more information, please refer to the following application note:

- AN5088: Rectifiers thermal management, handling and mounting recommendation

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions       |                     | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|---------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$     | -    |      | 20   | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ °C}$ |                     | -    | 15   | 150  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 30\text{ A}$ | -    |      | 2.25 | V             |
|             |                         | $T_j = 125\text{ °C}$ |                     | -    | 1.35 | 2.05 |               |
|             |                         | $T_j = 150\text{ °C}$ |                     | -    | 1.30 | 1.95 |               |

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:

$$P = 1.60 \times I_{F(AV)} + 0.012 \times I_F^2 (RMS)$$

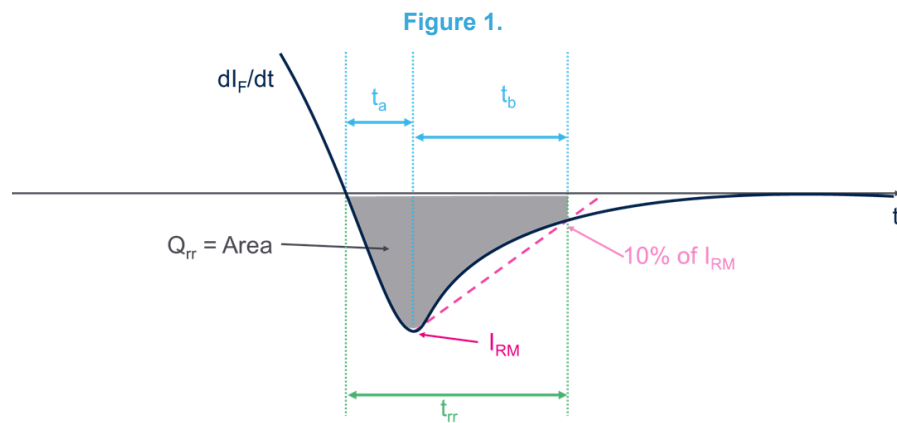
For more information, please refer to the following application notes related to the power losses:

- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

**Table 4. Dynamic electrical characteristics**

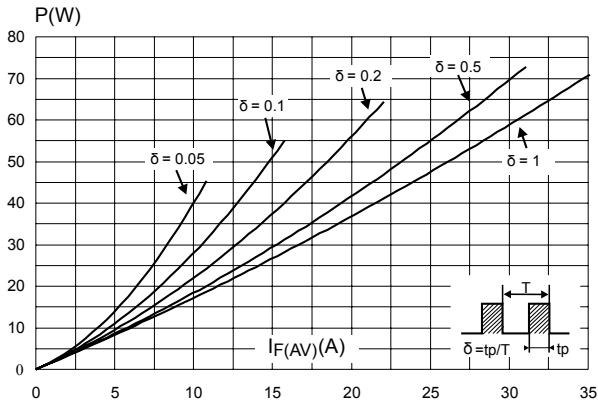
| Symbol         | Parameter                | Test conditions                   |  | Min. | Typ. | Max. | Unit |
|----------------|--------------------------|-----------------------------------|--|------|------|------|------|
| $t_{rr}^{(1)}$ | Reverse recovery time    | $T_J = 25\text{ }^\circ\text{C}$  | $I_F = 1\text{ A}, V_R = 30\text{ V}, di_F/dt = -50\text{ A}/\mu\text{s}$    | -    |      | 115  | ns   |
|                |                          |                                   | $I_F = 1\text{ A}, V_R = 30\text{ V}, di_F/dt = -100\text{ A}/\mu\text{s}$   | -    | 57   | 80   |      |
|                |                          |                                   | $I_F = 1\text{ A}, V_R = 30\text{ V}, di_F/dt = -200\text{ A}/\mu\text{s}$   |      | 48   |      |      |
| $I_{RM}^{(1)}$ | Reverse recovery current | $T_J = 125\text{ }^\circ\text{C}$ | $I_F = 30\text{ A}, V_R = 600\text{ V}, di_F/dt = -200\text{ A}/\mu\text{s}$ | -    | 25   | 35   | A    |
| $Q_{RR}^{(1)}$ | Reverse recovery charge  |                                   |  | -    | 5700 |      | nC   |

1. Measurements taken at 10% of  $I_{RM}$ ,  $S = tb/ta$

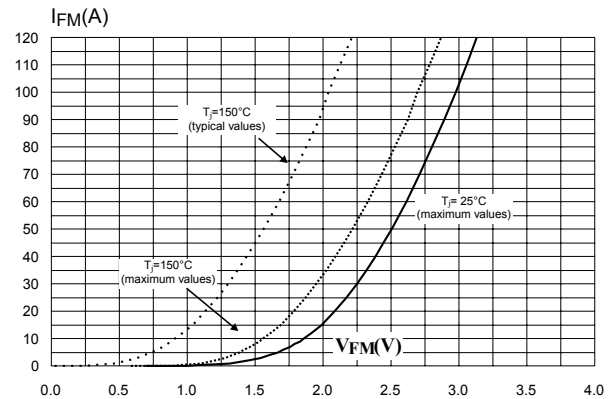


## 1.1 Characteristics (curves)

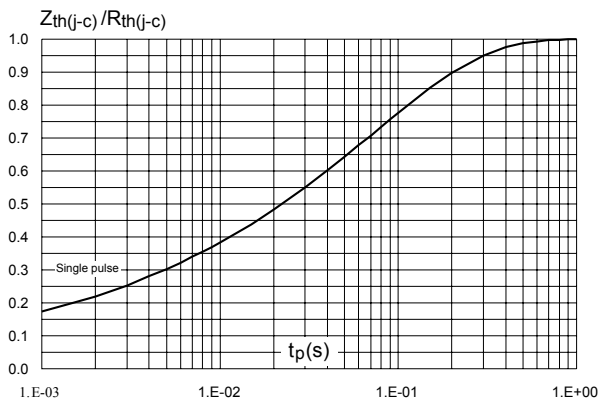
**Figure 2. Conduction losses versus average current**



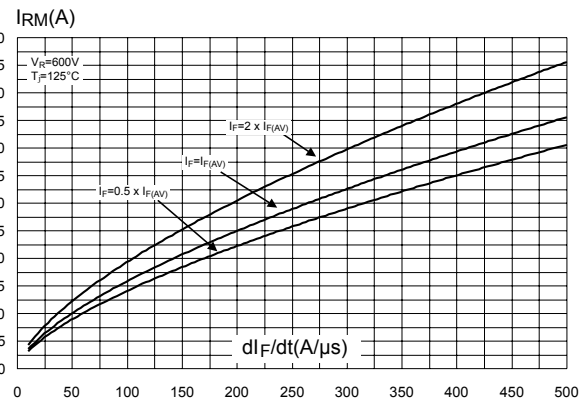
**Figure 3. Forward voltage drop versus forward current**



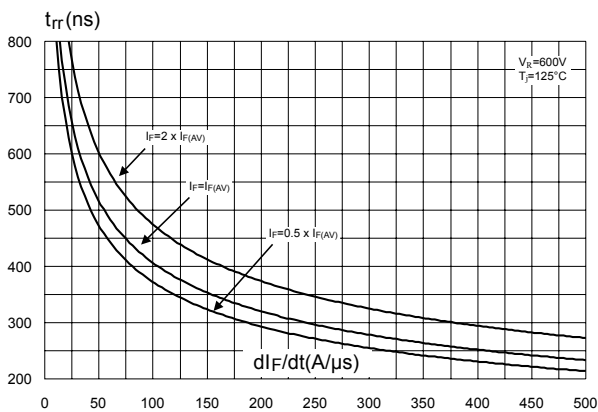
**Figure 4. Relative variation of thermal impedance junction to case versus pulse duration**



**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)**

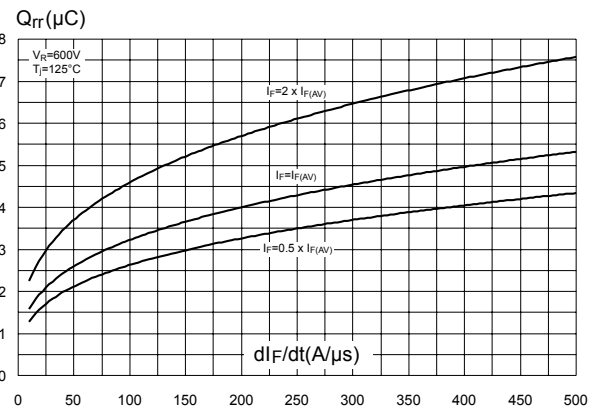


Figure 8. Softness factor versus  $di_F/dt$  (typical values)

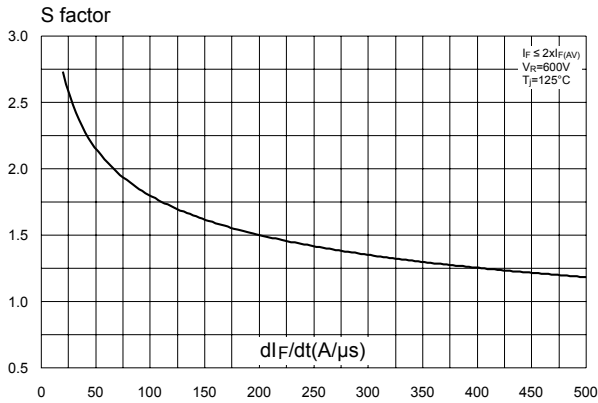


Figure 9. Relative variations of dynamic parameters versus junction temperature

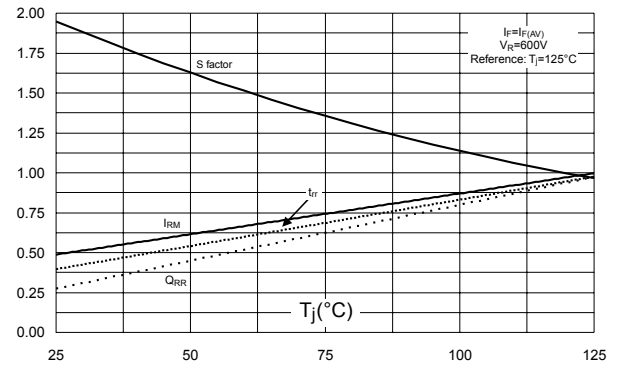


Figure 10. Transient peak forward voltage versus  $di_F/dt$  (typical values)

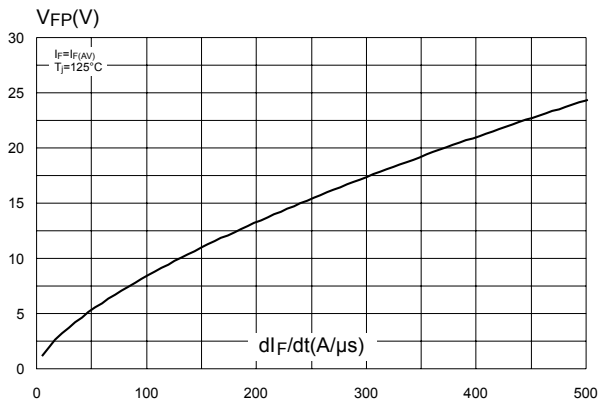


Figure 11. Forward recovery time versus  $di_F/dt$  (typical values)

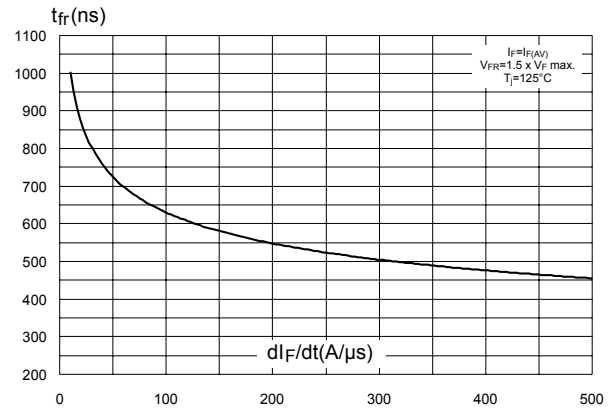
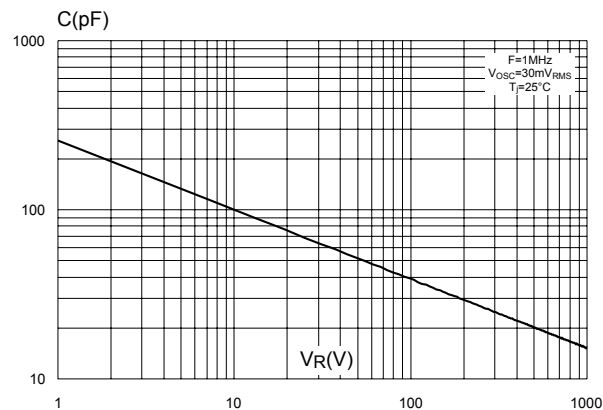


Figure 12. Junction capacitance versus reverse voltage applied (typical values)



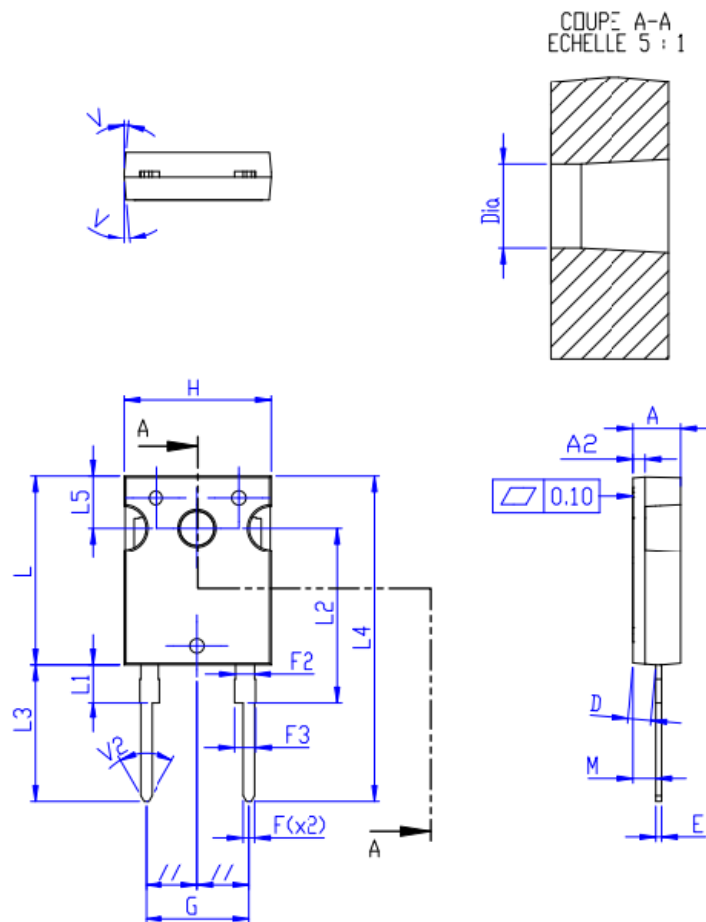
## 2 Package information

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.

### 2.1 DO-247 package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1.0 N·m

Figure 13. DO-247 package outline



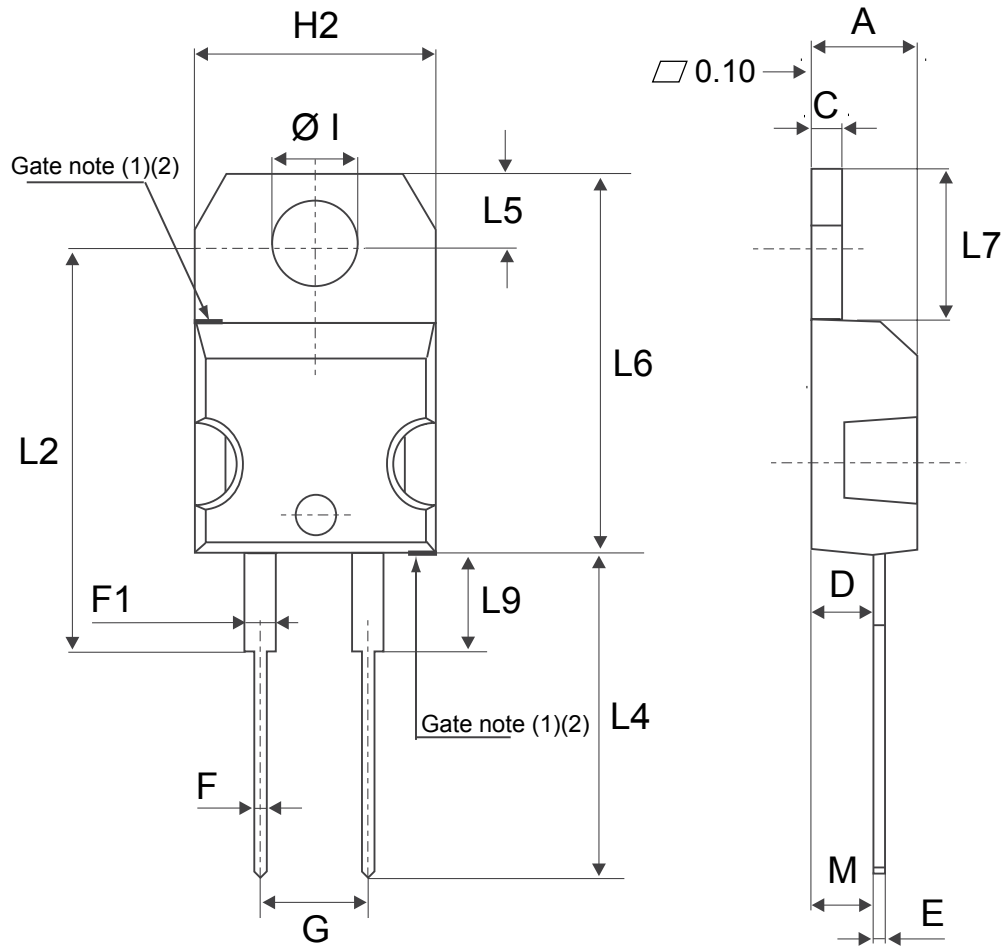
**Table 5. DO-247 package mechanical data**

| Ref.  | Dimensions  |      |       |                             |        |        |
|-------|-------------|------|-------|-----------------------------|--------|--------|
|       | Millimeters |      |       | Inches (for reference only) |        |        |
|       | Min.        | Typ. | Max.  | Min.                        | Typ.   | Max.   |
| A     | 4.90        |      | 5.10  | 0.1920                      |        | 0.2010 |
| A2    | 1.17        |      | 1.37  | 0.0460                      |        | 0.0540 |
| D     | 2.2         |      | 2.6   | 0.0866                      |        | 0.1023 |
| E     | 0.4         |      | 0.8   | 0.0157                      |        | 0.0314 |
| F     | 1           |      | 1.4   | 0.0393                      |        | 0.0551 |
| F2    |             | 2    |       |                             | 0.0787 |        |
| F3    | 2           |      | 2.4   | 0.0787                      |        | 0.0944 |
| G     |             | 10.9 |       |                             | 0.4291 |        |
| H     | 15.45       |      | 15.75 | 0.6082                      |        | 0.6200 |
| L     | 19.85       |      | 20.15 | 0.7814                      |        | 0.7933 |
| L1    | 3.7         |      | 4.3   | 0.1456                      |        | 0.1692 |
| L2    |             | 18.5 |       |                             | 0.7283 |        |
| L3    | 14.2        |      | 14.8  | 0.5590                      |        | 0.5826 |
| L4    |             | 34.6 |       |                             | 1.3622 |        |
| L5    |             | 5.5  |       |                             | 0.2165 |        |
| M     | 2           |      | 3     | 0.0787                      |        | 0.1181 |
| V     |             | 5°   |       |                             | 5°     |        |
| V2    |             | 60°  |       |                             | 60°    |        |
| Diam. | 3.55        |      | 3.65  | 0.1397                      |        | 0.1437 |

## 2.2 TO-220AC package information

- Epoxy meets UL 94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 14. TO-220AC package outline



(1) :Max resin gate protusion 0.5 mm

(2) :Resin gate position is accepted in each of the two positions shown on the drawings or their symmetrical

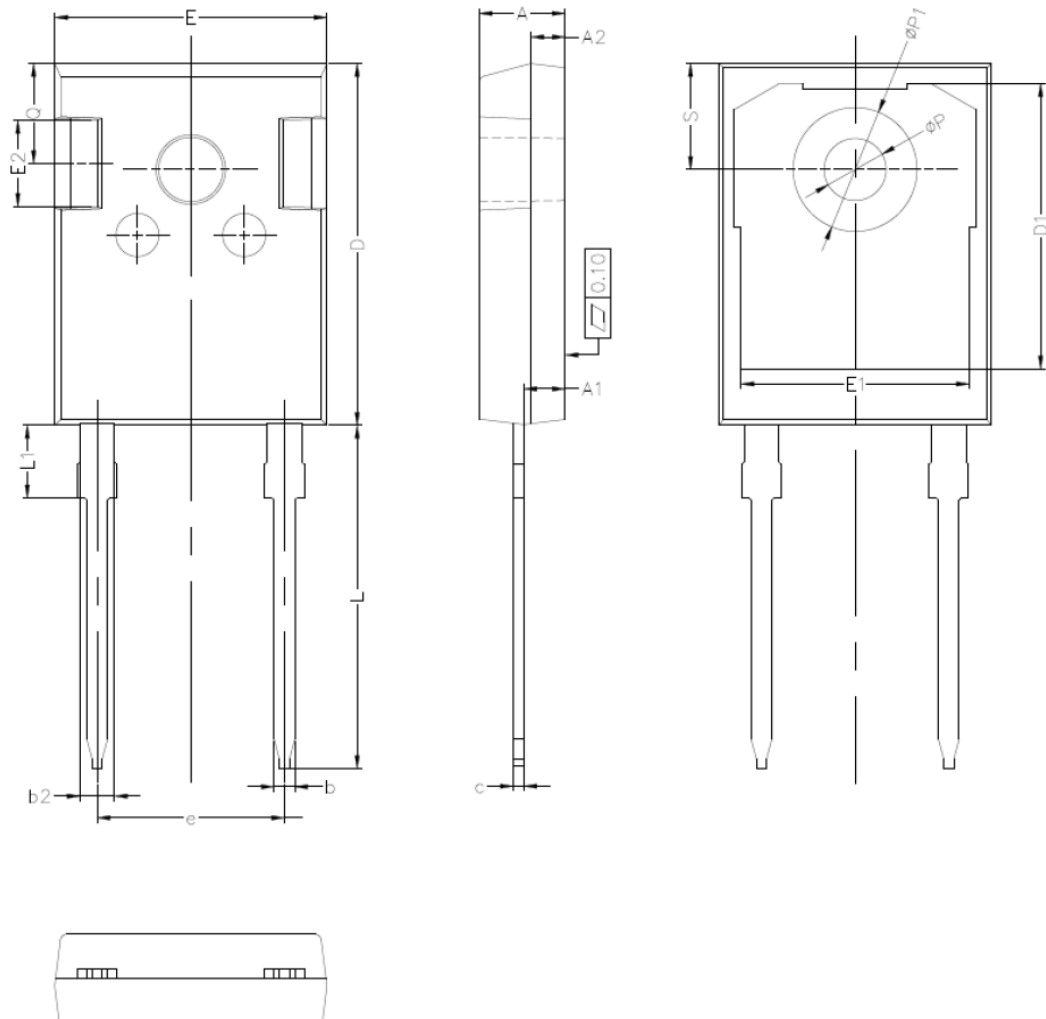
**Table 6. TO-220AC package mechanical data**

| Ref. | Dimensions  |       |                             |       |
|------|-------------|-------|-----------------------------|-------|
|      | Millimeters |       | Inches (for reference only) |       |
|      | 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    | 2.60 typ.   |       | 0.102 typ.                  |       |
| Diam | 3.75        | 3.85  | 0.147                       | 0.151 |

### 2.3 DO-247 LL package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.8 N·m
- Maximum torque value: 1.0 N·m

Figure 15. DO-247 LL package outline



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

**Table 7. DO-247 LL package mechanical data**

| Ref. | Dimensions  |       |                             |       |
|------|-------------|-------|-----------------------------|-------|
|      | Millimeters |       | Inches (for reference only) |       |
|      | Min.        | Max.  | Min.                        | Max.  |
| A    | 4.70        | 5.31  | 0.185                       | 0.209 |
| A1   | 2.21        | 2.59  | 0.087                       | 0.102 |
| A2   | 1.50        | 2.49  | 0.059                       | 0.098 |
| b    | 0.99        | 1.40  | 0.039                       | 0.055 |
| b2   | 1.65        | 2.39  | 0.065                       | 0.094 |
| c    | 0.38        | 0.89  | 0.015                       | 0.035 |
| D    | 20.80       | 21.46 | 0.819                       | 0.845 |
| D1   | 13.08       |       | 0.515                       |       |
| E    | 15.49       | 16.26 | 0.610                       | 0.640 |
| e    | 10.88 typ.  |       | 0.428                       |       |
| E1   | 13.06       |       | 0.514                       |       |
| E2   | 3.43        | 5.10  | 0.135                       | 0.200 |
| L    | 19.80       | 20.32 | 0.779                       | 0.800 |
| L1   |             | 4.50  |                             | 0.177 |
| P    | 3.50        | 3.70  | 0.137                       | 0.146 |
| P1   | 7.00        | 7.40  | 0.275                       | 0.292 |
| Q    | 5.38        | 6.20  | 0.219                       | 0.244 |
| S    | 6.16 typ.   |       | 0.243                       |       |

### 3 Ordering information

**Table 8. Ordering information**

| Order code | Marking    | Package   | Weight | Base qty. | Delivery mode |
|------------|------------|-----------|--------|-----------|---------------|
| STTH3012D  | STTH3012D  | TO-220AC  | 1.86 g | 50        | Tube          |
| STTH3012W  | STTH3012W  | DO-247    | 4.40 g | 30        | Tube          |
| STTH3012WL | STTH3012WL | DO-247 LL | 5.90 g | 30        | Tube          |

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## Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 02-Mar-2006 | 1        | First issue.   |
| 17-May-2022 | 2        | Added DO-247-LL package information. Minor text changes. |

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