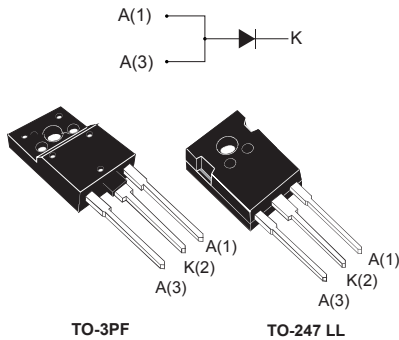


## 600 V, 30 A ultrafast high voltage diode



### Features

- Ultrafast recovery, soft recovery
- Low power losses at high switching frequency operations
- Low leakage current
- High junction temperature
- High overcurrent capability
- ECOPACK2 compliant
- Insulated package TO-3PF:
  - Insulated voltage: 2000 V<sub>RMS</sub>

### Applications

- Air conditioning equipment
- Rectification diode
- Freewheeling diode

### Description

The STTH31AC06S, implementing a new technology with very high softness during the reverse commutation, is suitable as a boost diode in PFC.

This device is highly recommended in air conditioning equipment for continuous mode interleaved power factor correction.

#### Product label



#### Product status

STTH31AC06S

#### Product summary

| Symbol         | Value  |
|----------------|--------|
| $I_{F(AV)}$    | 30 A   |
| $V_{RRM}$      | 600 V  |
| $t_{rr(typ.)}$ | 45 ns  |
| $T_{j(max.)}$  | 175 °C |
| $V_{F(typ.)}$  | 1.35 V |

# 1 Characteristics

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

| Symbol       | Parameter                              |                          | Value       | Unit |
|--------------|--|--------------------------|-------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage        |                          | 600         | V    |
| $I_{F(RMS)}$ | Forward rms current                    |                          | 45          | A    |
| $I_{F(AV)}$  | Average forward current                | $\delta = 0.5$ square    | 30          | A    |
| $I_{FSM}$    | Surge non repetitive forward current   | $t_p = 10$ ms sinusoidal | 150         | A    |
| $T_{stg}$    | Storage temperature range              |                          | -40 to +175 | °C   |
| $T_j$        | Maximum operating junction temperature |                          | +175        | °C   |

**Table 2. Maximum thermal resistance parameter**

| Symbol        | Parameter        |           | Value | Unit |
|---------------|------------------|-----------|-------|------|
| $R_{th(j-c)}$ | Junction to case | TO-247 LL | 1.25  | °C/W |
|               |                  | TO-3PF    | 2.9   |      |

For more information, refer to the following application note :

- [AN5088](#): Rectifiers thermal management, handling and mounting recommendations

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions |                 | Min. | Typ. | Max. | Unit    |
|-------------|-------------------------|-----------------|-----------------|------|------|------|---------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25$ °C   | $V_R = V_{RRM}$ | -    |      | 10   | $\mu A$ |
|             |                         | $T_j = 150$ °C  |                 | -    | 20   | 200  |         |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25$ °C   | $I_F = 30$ A    | -    | 1.55 | 2.00 | V       |
|             |                         | $T_j = 150$ °C  |                 | -    | 1.35 | 1.75 |         |

1. Pulse test:  $t_p = 5$  ms,  $\delta < 2\%$

2. Pulse test:  $t_p = 380$   $\mu s$ ,  $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 1.24 \times I_{F(AV)} + 0.017 \times I_{F(RMS)}^2$$

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

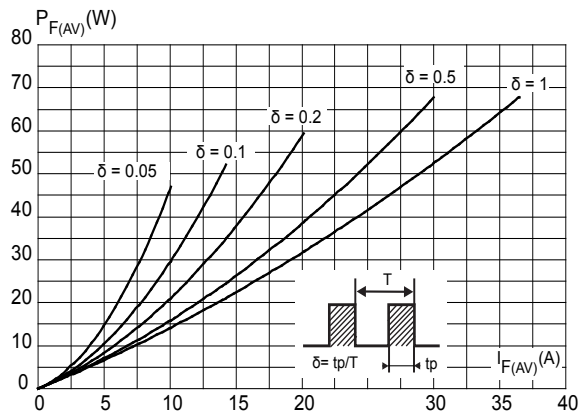
- [AN604](#): Calculation of conduction losses in a power rectifier
- [AN5028](#): Calculation of turn-off power losses generated by an ultrafast diode

**Table 4. Dynamic electrical characteristics**

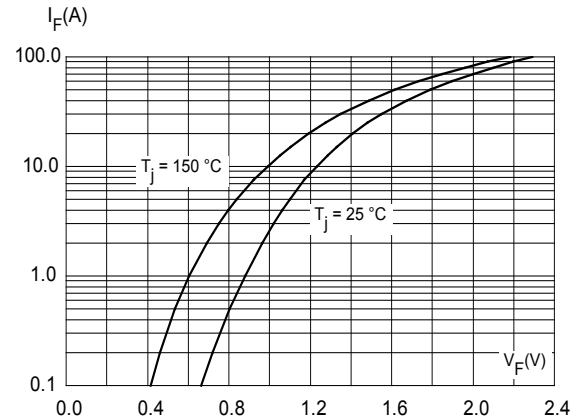
| Symbol       | Parameters               | Test conditions                     |  | Min. | Typ. | Max. | Unit          |
|--------------|--------------------------|-------------------------------------|--|------|------|------|---------------|
| $t_{rr}$     | Reverse recovery time    | $T_J = 25\text{ }^{\circ}\text{C}$  | $I_F = 1\text{ A}$<br>$di_F/dt = -100\text{ A}/\mu\text{s}$<br>$V_R = 30\text{ V}$     | -    | 45   | 65   | ns            |
| $I_{RM}$     | Reverse recovery current | $T_J = 150\text{ }^{\circ}\text{C}$ | $I_F = 30\text{ A}$<br>$di_F/dt = -1000\text{ A}/\mu\text{s}$<br>$V_R = 400\text{ V}$  | -    | 36   |      | A             |
| $Q_{rr}$     | Reverse recovery charge  |                                     |  | -    | 2.5  |      | $\mu\text{C}$ |
| $S_{factor}$ | Softness factor          |                                     |  |      | 2.2  |      |               |
| $t_{fr}$     | Forward recovery time    | $T_J = 25\text{ }^{\circ}\text{C}$  | $I_F = 30\text{ A}$<br>$di_F/dt = 500\text{ A}/\mu\text{s}$<br>$V_{FR} = 2.5\text{ V}$ |      |      | 150  | ns            |
| $V_{FP}$     | Forward recovery voltage |                                     |  |      | 5.5  |      | V             |

## 1.1 Characteristics (curves)

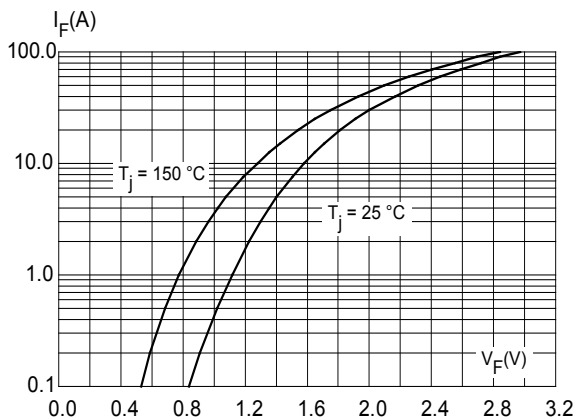
**Figure 1. Average forward power dissipation versus average forward current**



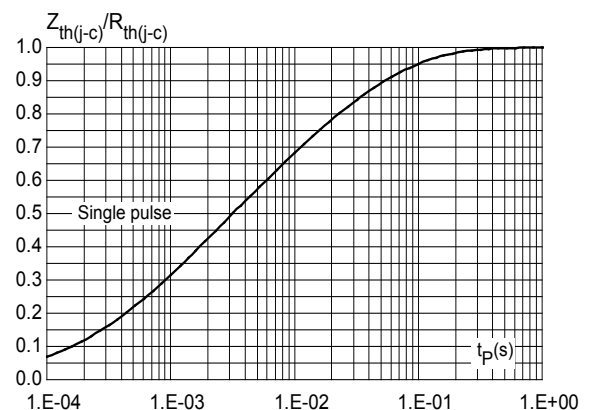
**Figure 2. Forward voltage drop versus forward current (typical values)**



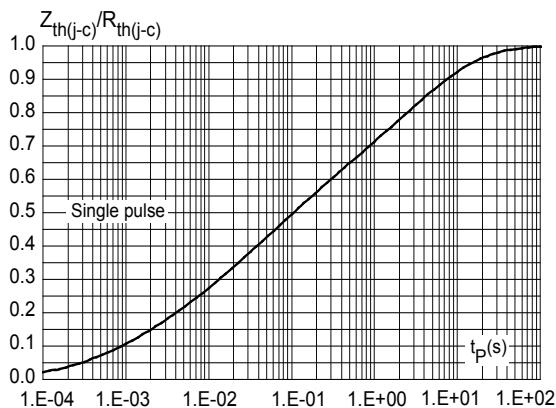
**Figure 3. Forward voltage drop versus forward current (maximum values)**



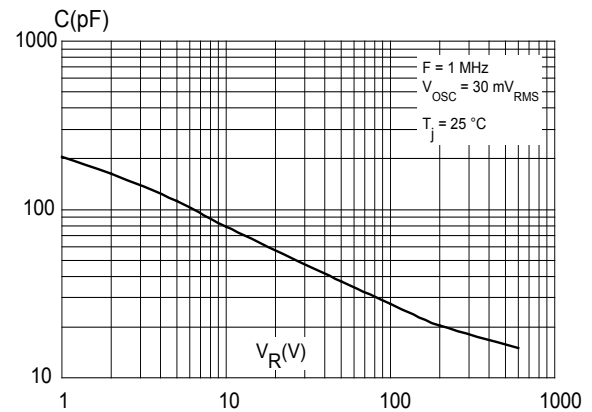
**Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (TO-247 LL)**



**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration (TO-3PF)**



**Figure 6. Junction capacitance versus reverse voltage applied (typical values)**



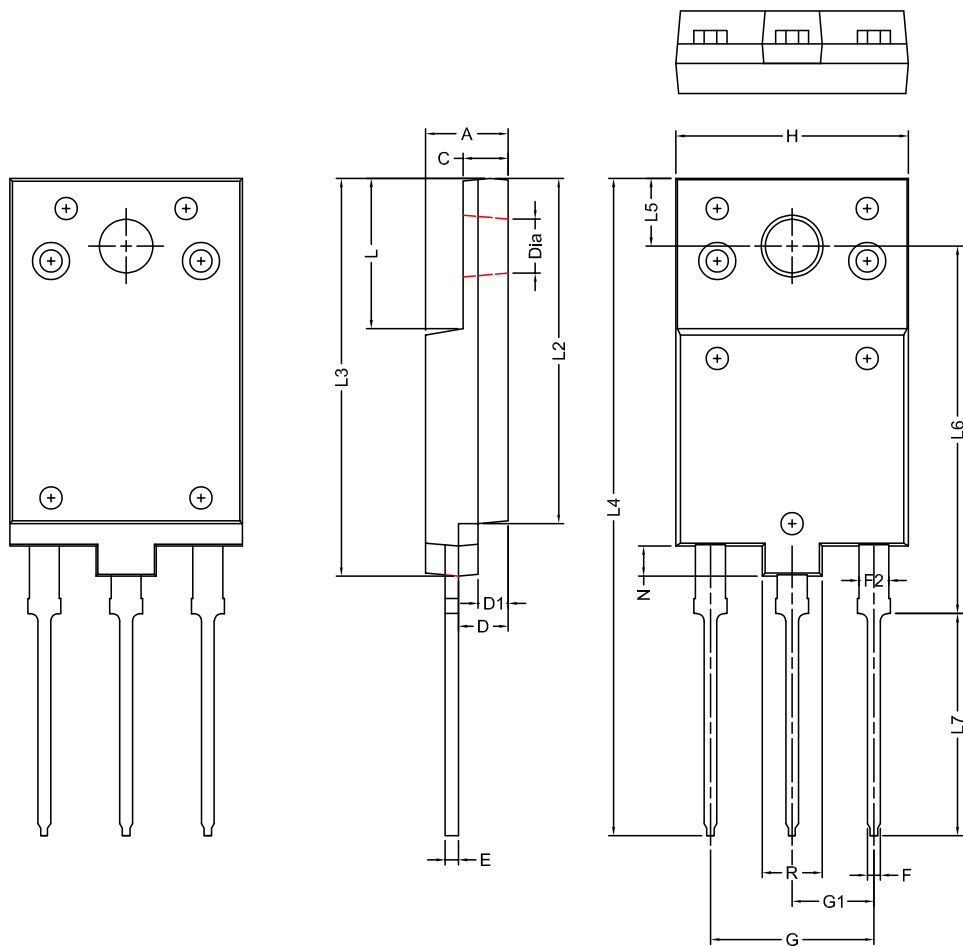
## 2 Package information

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 TO-3PF package information

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

**Figure 7. TO-3PF package outline**



7627132\_2\_9

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

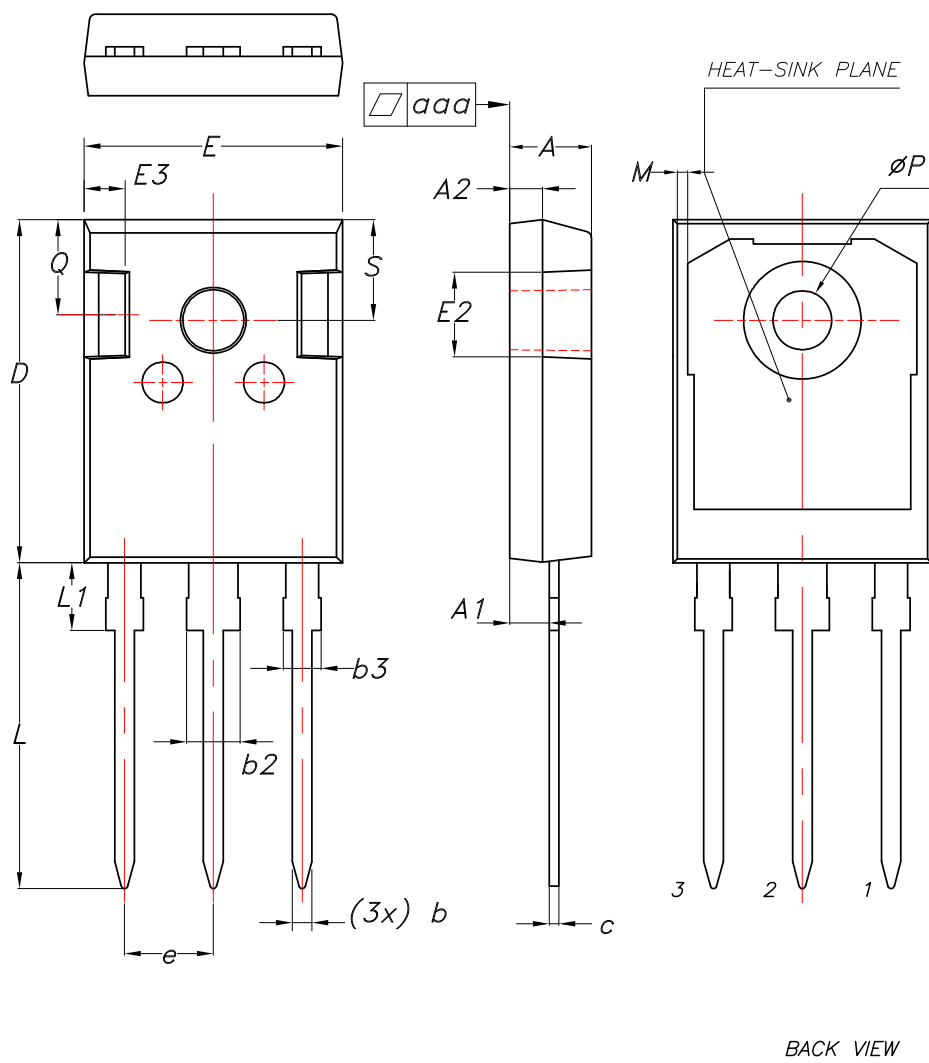
**Table 5. TO-3PF mechanical data**

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 5.30  | 5.50  | 5.70  |
| C    | 2.80  | 3.00  | 3.20  |
| D    | 3.10  | 3.30  | 3.50  |
| D1   | 1.80  | 2.00  | 2.20  |
| E    | 0.80  | 0.95  | 1.10  |
| F    | 0.65  | 0.80  | 0.95  |
| F2   | 1.80  | 2.00  | 2.20  |
| G    | 10.30 | 10.90 | 11.50 |
| G1   |       | 5.45  |       |
| H    | 15.30 | 15.50 | 15.70 |
| L    | 9.80  | 10.00 | 10.20 |
| L2   | 22.80 | 23.00 | 23.20 |
| L3   | 26.30 | 26.50 | 26.70 |
| L4   | 43.20 | 43.80 | 44.40 |
| L5   | 4.30  | 4.50  | 4.70  |
| L6   | 24.30 | 24.50 | 24.70 |
| L7   | 14.60 | 14.80 | 15.00 |
| N    | 1.80  | 2.00  | 2.20  |
| R    | 3.80  | 4.00  | 4.20  |
| Dia  | 3.40  | 3.60  | 3.80  |

## 2.2 TO-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 8. TO-247 LL package outline**



8463846\_6

**Table 6. TO-247 LL package mechanical data**

| Dim. | mm.   |       |       | Inches (only for reference) |        |        |
|------|-------|-------|-------|-----------------------------|--------|--------|
|      | Min.  | Typ.  | Max.  | Min.                        | Typ.   | Max.   |
| A    | 4.90  | 5.00  | 5.10  | 0.192                       | 0.196  | 0.200  |
| A1   | 2.31  | 2.41  | 2.51  | 0.090                       | 0.094  | 0.098  |
| A2   | 1.90  | 2.00  | 2.10  | 0.074                       | 0.078  | 0.082  |
| b    | 1.16  |       | 1.26  | 0.045                       |        | 0.049  |
| b2   |       |       | 3.25  |                             |        | 0.128  |
| b3   |       |       | 2.25  |                             |        | 0.089  |
| c    | 0.59  |       | 0.66  | 0.0232                      |        | 0.0260 |
| D    | 20.90 | 21.00 | 21.10 | 0.8228                      | 0.826  | 0.830  |
| E    | 15.70 | 15.80 | 15.90 | 0.6181                      | 0.622  | 0.626  |
| E2   | 4.90  | 5.00  | 5.10  | 0.192                       | 0.196  | 0.200  |
| E3   | 2.40  | 2.50  | 2.60  | 0.094                       | 0.098  | 0.102  |
| e    | 5.34  | 5.44  | 5.54  | 0.2102                      | 0.2142 | 0.2181 |
| L    | 19.80 | 19.92 | 20.10 | 0.779                       | 0.784  | 0.792  |
| L1   |       |       | 4.30  |                             |        | 0.170  |
| M    | 0.35  |       | 0.95  | 0.013                       |        | 0.038  |
| P    | 3.50  | 3.60  | 3.70  | 0.137                       | 0.141  | 0.145  |
| Q    | 5.60  |       | 6.00  | 0.220                       |        | 0.236  |
| S    | 6.05  | 6.15  | 6.25  | 0.238                       | 0.242  | 0.246  |
| aaa  |       | 0.04  | 0.10  |                             | 0.001  | 0.004  |



### 3 Ordering information

**Table 7. Ordering information**

| Order code    | Marking       | Package   | Weight | Base qty. | Delivery mode |
|---------------|---------------|-----------|--------|-----------|---------------|
| STTH31AC06SWL | STTH31AC06SWL | TO-247 LL | 4.36 g | 30        | Tube          |
| STTH31AC06SPF | TH31AC06      | TO-3PF    | 5.6 g  | 50        | Tube          |

## Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 30-Sep-2014 | 1        | First release.  |
| 23-Mar-2016 | 2        | Added TO-3PF package information.   |
| 30-Oct-2025 | 3        | Added <a href="#">Section Applications</a> , and updated <a href="#">Section 2: Package information</a> . |

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