

## Ultrafast recovery - high voltage diode

### Main product characteristics

|                |        |
|----------------|--------|
| $I_{F(AV)}$    | 30 A   |
| $V_{RRM}$      | 1000 V |
| $T_j$          | 175° C |
| $V_F$ (typ)    | 1.30 V |
| $t_{rr}$ (typ) | 42 ns  |

### Features and benefits

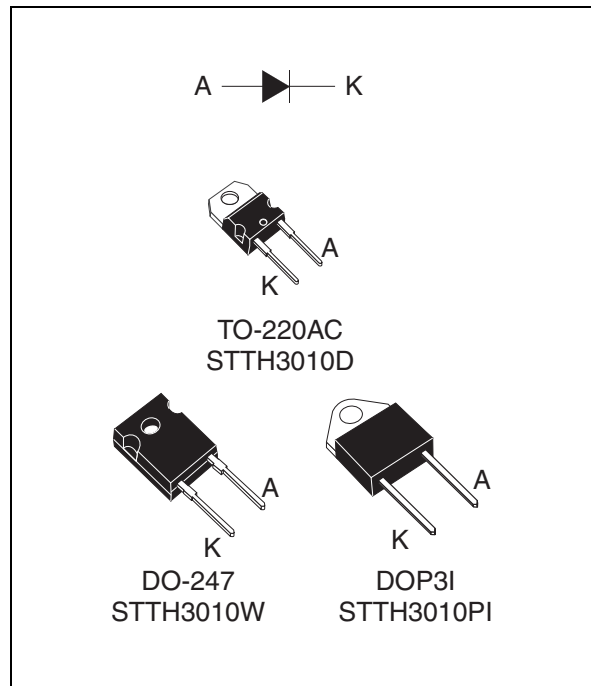
- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature
- Insulated package:
  - DOP3I
    - Electrical insulation = 2500 V<sub>RMS</sub>
    - Capacitance = 12 pF

### 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.



### Order codes

| Part Number | Marking    |
|-------------|------------|
| STTH3010D   | STTH3010D  |
| STTH3010W   | STTH3010W  |
| STTH3010PI  | STTH3010PI |

# 1 Characteristics

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

| Symbol       | Parameter                               |  | Value                      | Unit             |   |
|--------------|---|--|----------------------------|------------------|---|
| $V_{RRM}$    | Repetitive peak reverse voltage         |  | 1000                       | V                |   |
| $I_{F(RMS)}$ | RMS forward current                     |  | 50                         | A                |   |
| $I_{F(AV)}$  | Average forward current, $\delta = 0.5$ | TO-220 / DO-247                                    | $T_c = 105^\circ \text{C}$ | 30               | A |
|              |   | DOP3I  | $T_c = 65^\circ \text{C}$  |                  |   |
| $I_{FRM}$    | Repetitive peak forward current         | $t_p = 5 \mu\text{s}$ , $F = 5 \text{ kHz}$ square | 300                        | A                |   |
| $I_{FSM}$    | Surge non repetitive forward current    | $t_p = 10 \text{ ms}$ Sinusoidal                   | 180                        | A                |   |
| $T_{stg}$    | Storage temperature range               |  | -65 to + 175               | $^\circ\text{C}$ |   |
| $T_j$        | Maximum operating junction temperature  |  | 175                        | $^\circ\text{C}$ |   |

**Table 2. Thermal parameters**

| Symbol        | Parameter        |                 | Value | Unit               |
|---------------|------------------|-----------------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case | TO-220 / DO-247 | 1.1   | $^\circ\text{C/W}$ |
|               |                  | DOP3I           | 1.8   |                    |

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions            |                      | Min. | Typ | Max. | Unit          |
|-------------|-------------------------|----------------------------|----------------------|------|-----|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25^\circ \text{C}$  | $V_R = V_{RRM}$      |      |     | 15   | $\mu\text{A}$ |
|             |                         | $T_j = 125^\circ \text{C}$ |                      |      | 10  | 100  |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25^\circ \text{C}$  | $I_F = 30 \text{ A}$ |      |     | 2    | V             |
|             |                         | $T_j = 100^\circ \text{C}$ |                      |      | 1.4 | 1.8  |               |
|             |                         | $T_j = 150^\circ \text{C}$ |                      |      | 1.3 | 1.7  |               |

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:

$$P = 1.3 \times I_{F(AV)} + 0.013 I_{F(RMS)}^2$$

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>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$          |      | 53  | 70   |      |
|          |                          | $I_F = 1\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$          |      | 42  | 55   |      |
| $I_{RM}$ | Reverse recovery current | $I_F = 30\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 600\text{ V}$ , $T_j = 125^\circ\text{ C}$       |      | 24  | 32   | A    |
| S        | Softness factor          | $I_F = 30\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 600\text{ V}$ , $T_j = 125^\circ\text{ C}$       |      | 1   |      |      |
| $t_{fr}$ | Forward recovery time    | $I_F = 30\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$<br>$V_{FR} = 1.5 \times V_{Fmax}$ , $T_j = 25^\circ\text{ C}$ |      |     | 450  | ns   |
| $V_{FP}$ | Forward recovery voltage | $I_F = 30\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ ,<br>$T_j = 25^\circ\text{ C}$                                |      | 5   |      | V    |

Figure 1. Conduction losses versus average current

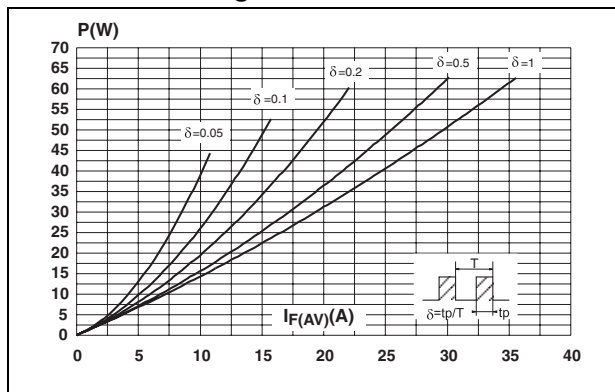


Figure 2. Forward voltage drop versus forward current

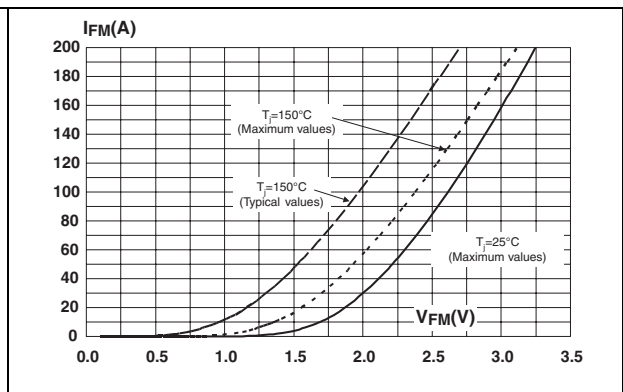


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

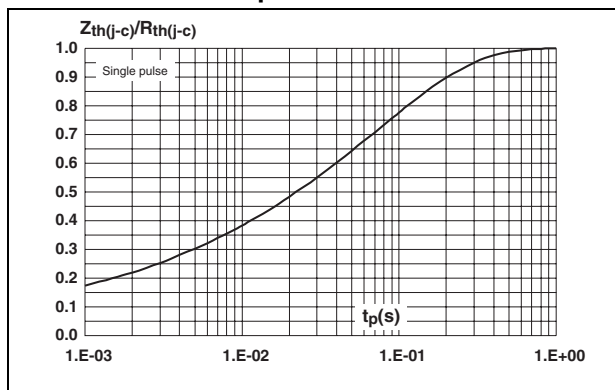


Figure 4. Peak reverse recovery current versus di\_F/dt (typical values)

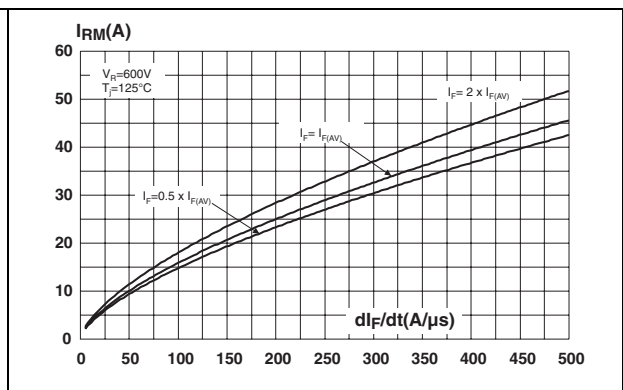


Figure 5. Reverse recovery time versus  $di_F/dt$  (typical values)

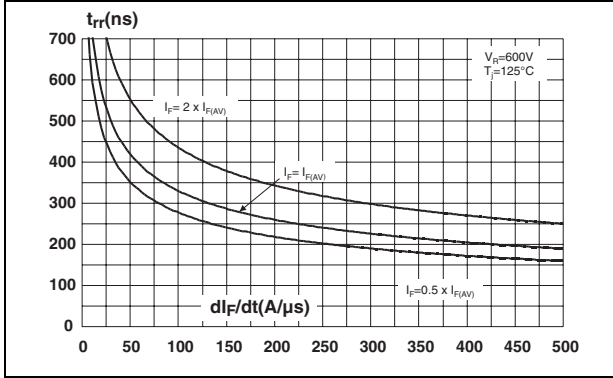


Figure 6. Reverse recovery charges versus  $di_F/dt$  (typical values)

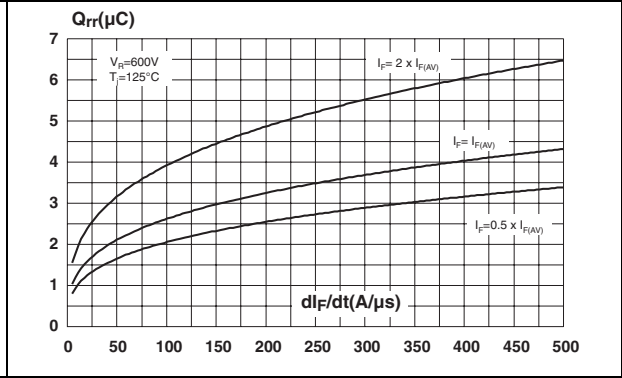


Figure 7. Softness factor versus  $di_F/dt$  (typical values)

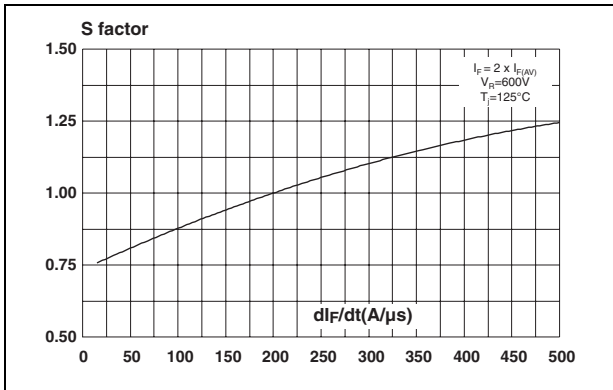
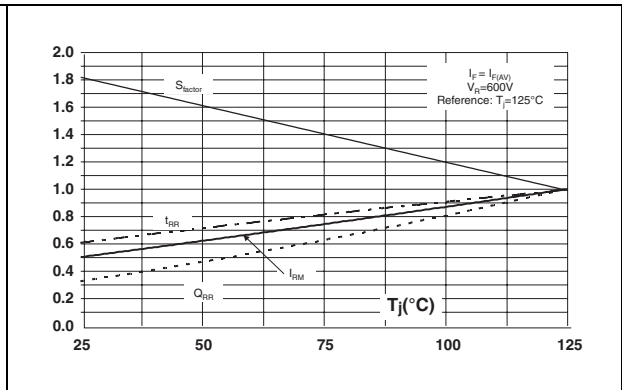
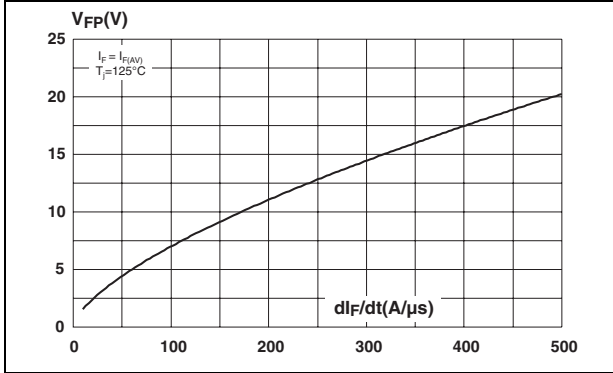


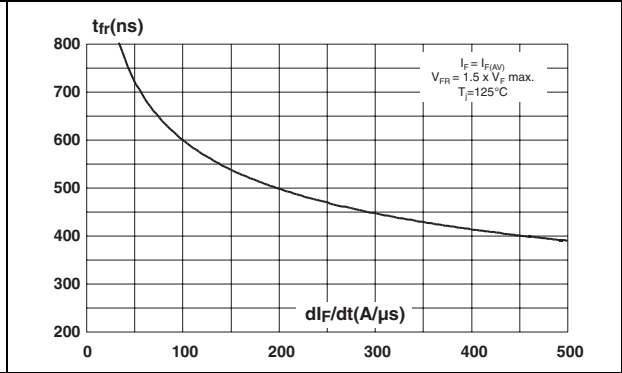
Figure 8. Relative variations of dynamic parameters versus junction temperature



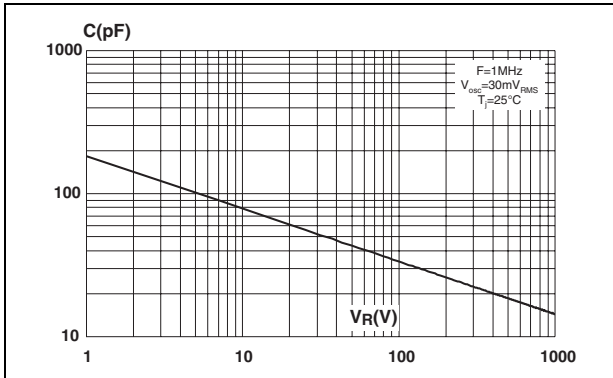
**Figure 9. Transient peak forward voltage versus  $di_F/dt$  (typical values)**



**Figure 10. Forward recovery time versus  $di_F/dt$  (typical values)**



**Figure 11. Junction capacitance versus reverse voltage applied (typical values)**



## 2 Package information

Epoxy meets UL94, V0

Cooling method: by conduction (C)

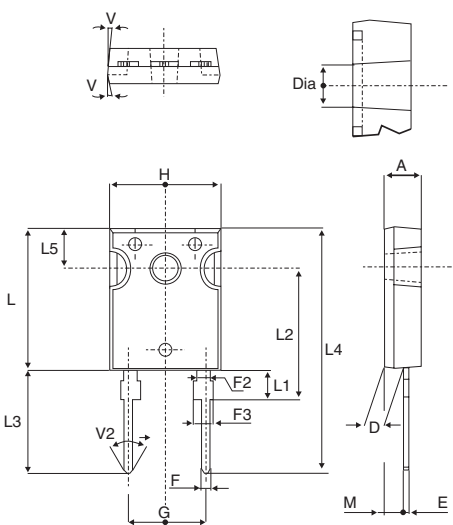
Recommended torque value: 0.55 Nm (TO-220AC)

Recommended torque value: 0.80 Nm (SOD93, DOP31, and DO-247)

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

Maximum torque value: 1.0 Nm (SOD93, DOP31, and DO-247)

**Table 5. DO-247 dimensions**



| REF. | DIMENSIONS  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        |       | Max   | Min.   |       | 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 |

Table 6. 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 7. DOP3I dimensions

| REF. | DIMENSIONS  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.40        | 4.60  | 0.173      | 0.181 |
| b    | 1.20        | 1.40  | 0.047      | 0.055 |
| c    | 1.45        | 1.55  | 0.057      | 0.061 |
| c1   | 0.50        | 0.70  | 0.020      | 0.028 |
| D    | 12.15       | 13.10 | 0.474      | 0.516 |
| E    | 15.10       | 15.50 | 0.594      | 0.610 |
| E1   | 7.55        | 7.75  | 0.297      | 0.305 |
| e    | 10.80       | 11.30 | 0.425      | 0.445 |
| G    | 20.4        | 21.10 | 0.815      | 0.831 |
| L    | 14.35       | 15.60 | 0.565      | 0.614 |
| P    | 4.08        | 4.17  | 0.161      | 0.164 |
| Q    | 2.70        | 2.90  | 0.106      | 0.114 |
| R    | 4.60 typ.   |       | 0.181 typ. |       |
| Y    | 15.80       | 16.50 | 0.622      | 0.650 |

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 |
|-------------|------------|----------|--------|----------|---------------|
| STTH3010D   | STTH3010D  | TO-220AC | 1.86 g | 50       | Tube          |
| STTH3010PI  | STTH3010PI | DOP3I    | 4.46 g | 30       | Tube          |
| STTH3010W   | STTH3010W  | DO-247   | 4.4 g  | 30       | Tube          |

### 4 Revision history

| Date        | Revision | Description of Changes |
|-------------|----------|------------------------|
| 02-Mar-2006 | 1        | First issue.           |

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