

## Ultrafast recovery - high voltage diode

### Main product characteristics

|                |          |
|----------------|----------|
| $I_{F(AV)}$    | 2 x 60 A |
| $V_{RRM}$      | 1000 V   |
| $T_j$          | 150° C   |
| $V_F$ (typ)    | 1.30 V   |
| $t_{rr}$ (typ) | 49 ns    |

### Features and benefits

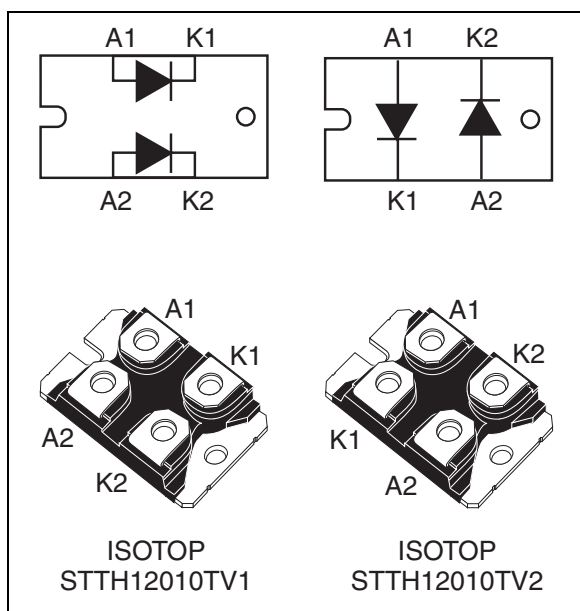
- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature
- Insulated package
  - Electrical insulation = 2500 V<sub>RMS</sub>
  - Capacitance = 45 pF

### 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.

These demanding applications include industrial power supplies, motor control, and similar industrial 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 advantage for reducing maintenance of the equipment



### Order codes

| Part Number  | Marking      |
|--------------|--------------|
| STTH12010TV1 | STTH12010TV1 |
| STTH12010TV2 | STTH12010TV2 |

# 1 Characteristics

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

| Symbol              | Parameter                              |   | Value        | Unit |
|---------------------|--|---|--------------|------|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage        |   | 1000         | V    |
| I <sub>F(RMS)</sub> | RMS forward current                    |   | 150          | A    |
| I <sub>F(AV)</sub>  | Average forward current, δ = 0.5       | Per diode T <sub>c</sub> = 50° C        | 60           | A    |
| I <sub>FRM</sub>    | Repetitive peak forward current        | t <sub>p</sub> = 5 μs, F = 5 kHz square | 750          | A    |
| I <sub>FSM</sub>    | Surge non repetitive forward current   | t <sub>p</sub> = 10 ms Sinusoidal       | 400          | A    |
| T <sub>stg</sub>    | Storage temperature range              |   | -65 to + 150 | °C   |
| T <sub>j</sub>      | Maximum operating junction temperature |   | 150          | °C   |

**Table 2. Thermal parameters**

| Symbol               | Parameter                   |           | Value | Unit |
|----------------------|-----------------------------|-----------|-------|------|
| R <sub>th(j-c)</sub> | Junction to case            | Per diode | 0.80  | °C/W |
|                      |                             | Total     | 0.45  |      |
| R <sub>th(c)</sub>   | Coupling thermal resistance |           | 0.1   |      |

When the diodes are used simultaneously:

$$\Delta T_{j(\text{diode1})} = P_{(\text{diode1})} \times R_{th(j-c)} \text{ (per diode)} + P_{(\text{diode2})} \times R_{th(c)}$$

**Table 3. 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 |                                   |      | 20   | 200  |      |
| V <sub>F</sub> <sup>(2)</sup> | Forward voltage drop    | T <sub>j</sub> = 25° C  | I <sub>F</sub> = 60 A             |      |      | 2.0  | V    |
|                               |                         | T <sub>j</sub> = 100° C |                                   |      | 1.40 | 1.80 |      |
|                               |                         | T <sub>j</sub> = 150° C |                                   |      | 1.30 | 1.70 |      |

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:

$$P = 1.3 \times I_{F(AV)} + 0.0067 I_{F(RMS)}^2$$

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>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$           |      |     | 115  | ns   |
|          |                          | $I_F = 1\text{ A}$ , $di_F/dt = -100\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$          |      | 61  | 80   |      |
|          |                          | $I_F = 1\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$          |      | 49  | 65   |      |
| $I_{RM}$ | Reverse recovery current | $I_F = 60\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 600\text{ V}$ , $T_j = 125^\circ\text{ C}$       |      | 31  | 40   | A    |
| S        | Softness factor          | $I_F = 60\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ ,<br>$V_R = 600\text{ V}$ , $T_j = 125^\circ\text{ C}$       |      | 1   |      |      |
| $t_{fr}$ | Forward recovery time    | $I_F = 60\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$<br>$V_{FR} = 1.5 \times V_{Fmax}$ , $T_j = 25^\circ\text{ C}$ |      |     | 750  | ns   |
| $V_{FP}$ | Forward recovery voltage | $I_F = 60\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ ,<br>$T_j = 25^\circ\text{ C}$                                |      | 4   |      | V    |

Figure 1. Conduction losses versus average current

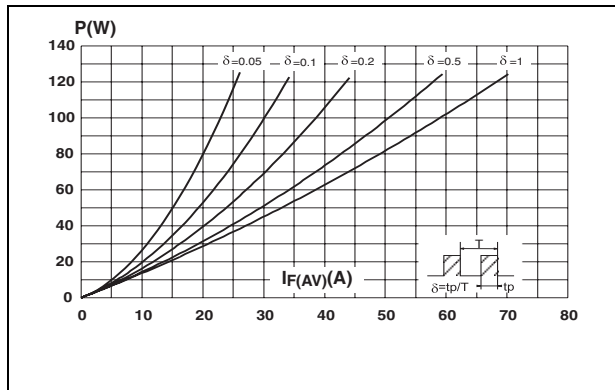


Figure 2. Forward voltage drop versus forward current

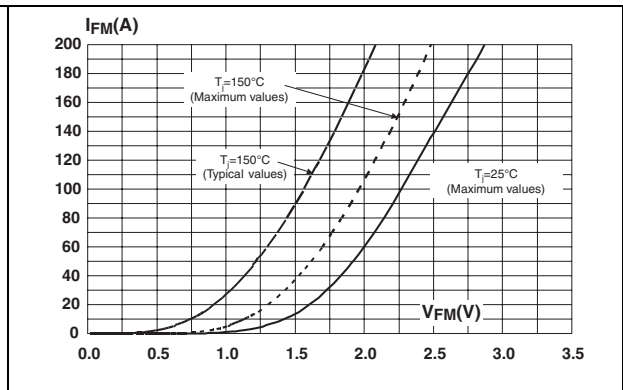


Figure 3. Relative variation of thermal impedance junction to case versus pulse duration

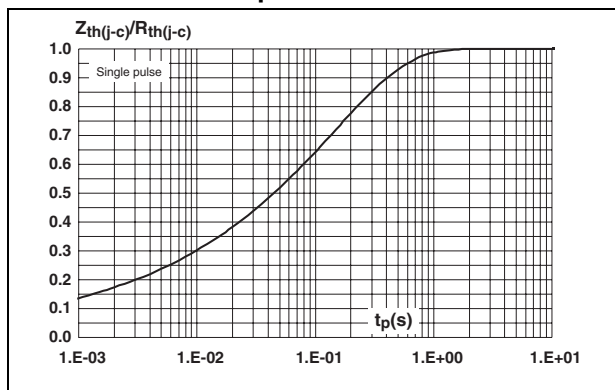
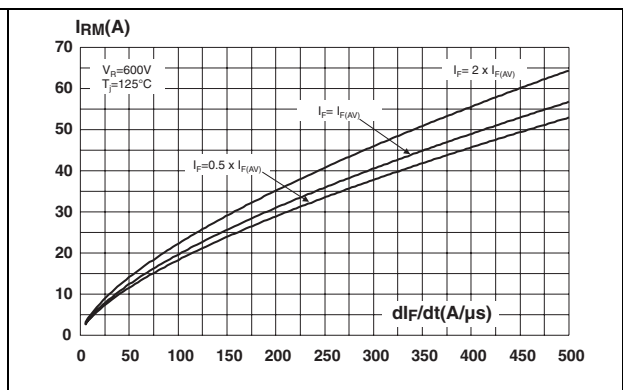
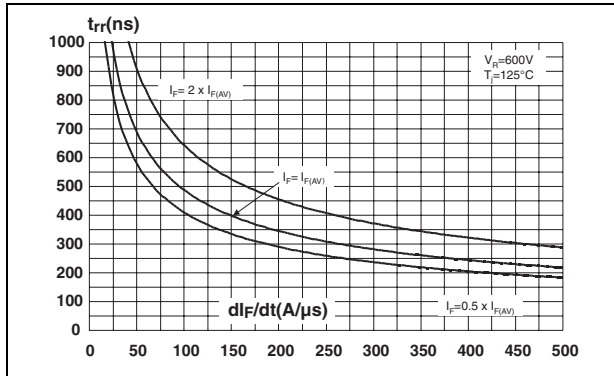


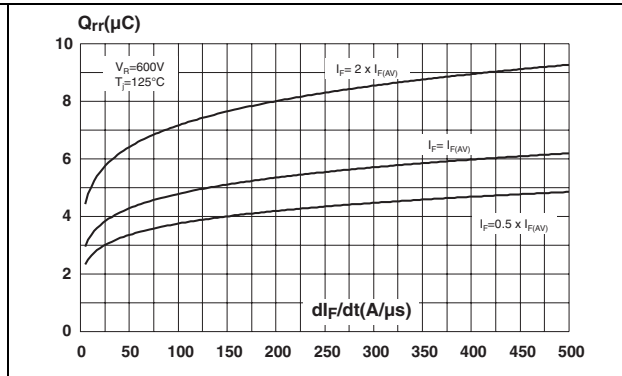
Figure 4. Peak reverse recovery current versus di\_F/dt (typical values)



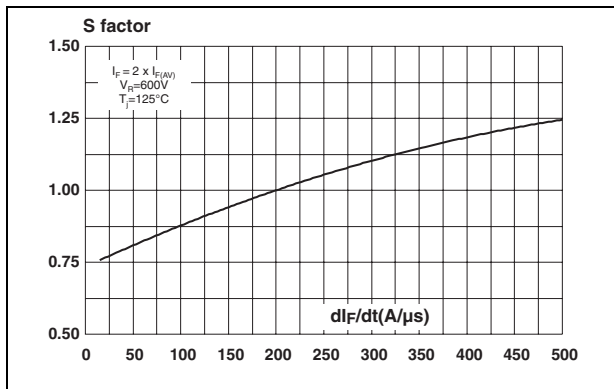
**Figure 5. Reverse recovery time versus  $di_F/dt$  (typical values)**



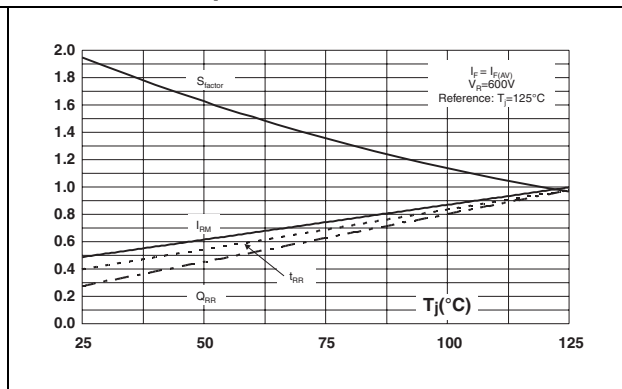
**Figure 6. Reverse recovery charges versus  $di_F/dt$  (typical values)**



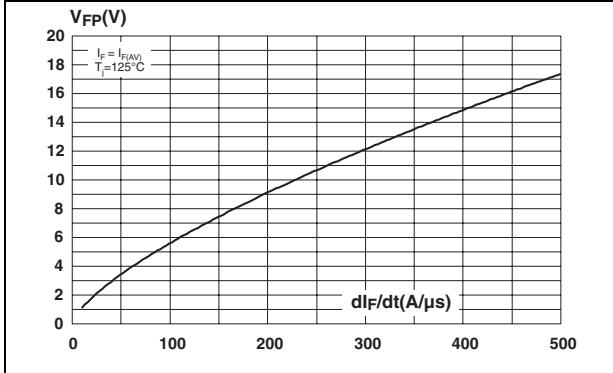
**Figure 7. Softness factor versus  $di_F/dt$  (typical values)**



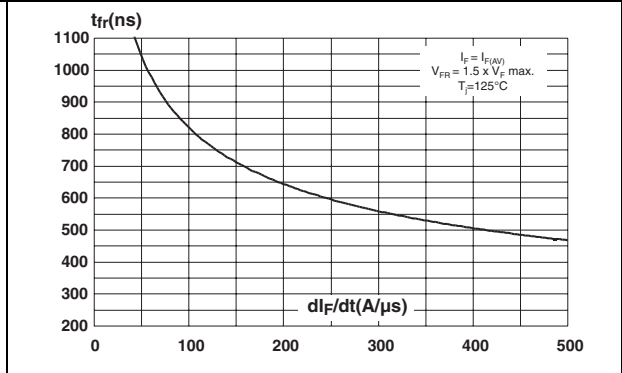
**Figure 8. Relative variations of dynamic parameters versus junction temperature**



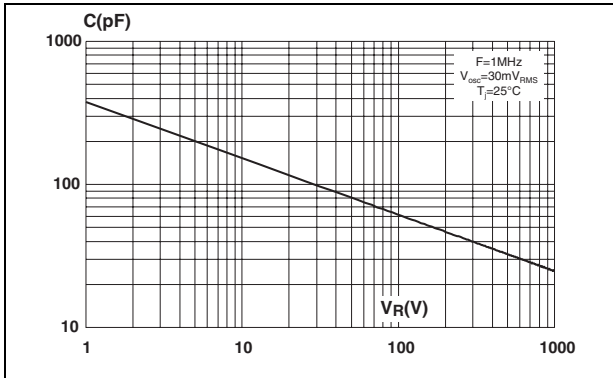
**Figure 9. Transient peak forward voltage versus  $di_F/dt$  (typical values)**



**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)

Table 5. ISOTOP dimensions

| REF. | DIMENSIONS  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 11.80       | 12.20 | 0.465      | 0.480 |
| A1   | 8.90        | 9.10  | 0.350      | 0.358 |
| B    | 7.8         | 8.20  | 0.307      | 0.323 |
| C    | 0.75        | 0.85  | 0.030      | 0.033 |
| C2   | 1.95        | 2.05  | 0.077      | 0.081 |
| D    | 37.80       | 38.20 | 1.488      | 1.504 |
| D1   | 31.50       | 31.70 | 1.240      | 1.248 |
| E    | 25.15       | 25.50 | 0.990      | 1.004 |
| E1   | 23.85       | 24.15 | 0.939      | 0.951 |
| E2   | 24.80 typ.  |       | 0.976 typ. |       |
| G    | 14.90       | 15.10 | 0.587      | 0.594 |
| G1   | 12.60       | 12.80 | 0.496      | 0.504 |
| G2   | 3.50        | 4.30  | 0.138      | 0.169 |
| F    | 4.10        | 4.30  | 0.161      | 0.169 |
| F1   | 4.60        | 5.00  | 0.181      | 0.197 |
| P    | 4.00        | 4.30  | 0.157      | 0.69  |
| P1   | 4.00        | 4.40  | 0.157      | 0.173 |
| S    | 30.10       | 30.30 | 1.185      | 1.193 |

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 |
|--------------|--------------|---------|--------|----------|---------------|
| STTH12010TV1 | STTH12010TV1 | ISOTOP  | 27 g   | 10       | Tube          |
| STTH12010TV2 | STTH12010TV2 | ISOTOP  | 27 g   | 10       | Tube          |

### 4 Revision history

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

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