

## Ultrafast high voltage rectifier

**Table 1: Main product characteristics**

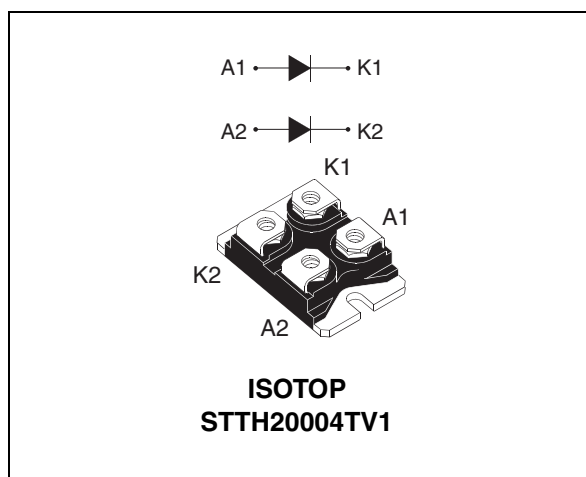
|                |                 |
|----------------|-----------------|
| $I_{F(AV)}$    | Up to 2 x 120 A |
| $V_{RRM}$      | 400 V           |
| $T_j$ (max)    | 150°C           |
| $V_F$ (typ)    | 0.83 V          |
| $t_{rr}$ (max) | 60 ns           |

### Features and benefits

- Ultrafast switching
- Low reverse current
- Low thermal resistance
- Reduces switching & conduction losses

### Description

The STTH20004TV1 uses ST new 400V technology and is specially suited for use in switching power supplies, welding equipment, and industrial applications, as an output rectification diode.



**Table 2: Order codes**

| Part number  | Marking      |
|--------------|--------------|
| STTH20004TV1 | STTH20004TV1 |

**Table 3: Absolute ratings** (limiting values, per diode)

| Symbol       | Parameter                              |                                                   | Value        | Unit |
|--------------|----------------------------------------|---------------------------------------------------|--------------|------|
| $V_{RRM}$    | Repetitive peak reverse voltage        |                                                   | 400          | V    |
| $I_{F(RMS)}$ | RMS forward current                    |                                                   | 200          | A    |
| $I_{F(AV)}$  | Average forward current                | $T_c = 90^\circ\text{C}$ $\delta = 0.5$ Per diode | 100          | A    |
|              |                                        | $T_c = 73^\circ\text{C}$ $\delta = 0.5$ Per diode | 120          |      |
| $I_{FSM}$    | Surge non repetitive forward current   | $t_p = 10$ ms sinusoidal                          | 900          | A    |
| $T_{stg}$    | Storage temperature range              |                                                   | -55 to + 150 | °C   |
| $T_j$        | Maximum operating junction temperature |                                                   | 150          | °C   |

Table 4: Thermal resistance

| Symbol        | Parameter        |           | Value (max). | Unit |
|---------------|------------------|-----------|--------------|------|
| $R_{th(j-c)}$ | Junction to case | Per diode | 0.50         | °C/W |
|               |                  | Total     | 0.30         |      |
| $R_{th(c)}$   | Coupling         |           | 0.10         | °C/W |

When diodes 1 and 2 are used simultaneously:

$$\Delta T_j(\text{diode 1}) = P(\text{diode 1}) \times R_{th(j-c)}(\text{Per diode}) + P(\text{diode 2}) \times R_{th(c)}$$

Table 5: Static electrical characteristics (per diode)

| Symbol     | Parameter               | Test conditions       |                      | Min. | Typ  | Max. | Unit          |
|------------|-------------------------|-----------------------|----------------------|------|------|------|---------------|
| $I_R^*$    | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$      |      |      | 100  | $\mu\text{A}$ |
|            |                         | $T_j = 125\text{ °C}$ |                      |      | 100  | 1000 |               |
| $V_F^{**}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 100\text{ A}$ |      |      | 1.2  | V             |
|            |                         | $T_j = 150\text{ °C}$ |                      |      | 0.83 | 1.0  |               |

Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

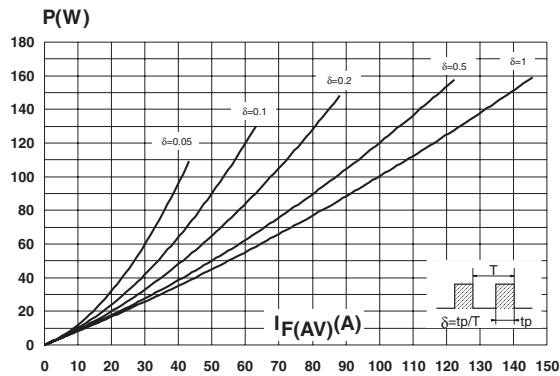
$t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses use the following equation:  $P = 0.8 \times I_{F(AV)} + 0.002 I_{F(RMS)}^2$

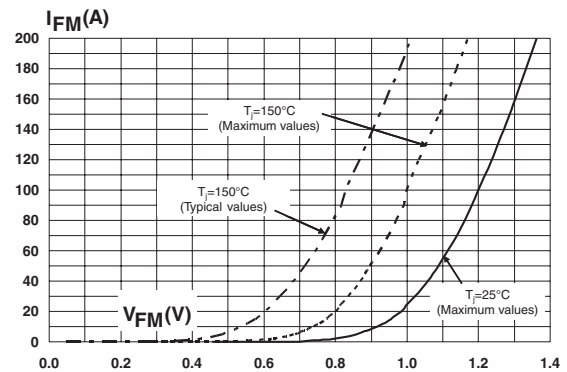
Table 6: Dynamic characteristics (per diode)

| Symbol       | Parameter                | Test conditions       |                                                                                             | Min | Typ | Max | Unit |
|--------------|--------------------------|-----------------------|---------------------------------------------------------------------------------------------|-----|-----|-----|------|
| $t_{rr}$     | Reverse recovery time    | $T_j = 25\text{ °C}$  | $I_F = 1\text{ A}$ $di_F/dt = 50\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$                  |     | 75  | 100 | ns   |
|              |                          |                       | $I_F = 1\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$                 |     | 45  | 60  |      |
| $I_{RM}$     | Reverse recovery current | $T_j = 125\text{ °C}$ | $I_F = 100\text{ A}$ $V_R = 200\text{ V}$<br>$di_F/dt = 100\text{ A}/\mu\text{s}$           |     |     | 18  | A    |
| $S_{factor}$ | Softness factor          | $T_j = 125\text{ °C}$ | $I_F = 100\text{ A}$ $V_R = 200\text{ V}$<br>$di_F/dt = 100\text{ A}/\mu\text{s}$           |     | 0.4 |     |      |
| $t_{fr}$     | Forward recovery time    | $T_j = 25\text{ °C}$  | $I_F = 100\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$<br>$V_{FR} = 1.1 \times V_{Fmax}$ |     |     | 800 | ns   |
| $V_{FP}$     | Forward recovery voltage | $T_j = 25\text{ °C}$  | $I_F = 100\text{ A}$ $di_F/dt = 200\text{ A}/\mu\text{s}$<br>$V_{FR} = 1.1 \times V_{Fmax}$ |     | 2.6 |     | V    |

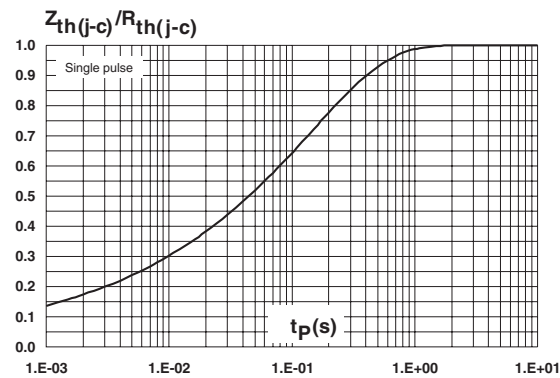
**Figure 1: Conduction losses versus average forward current (per diode)**



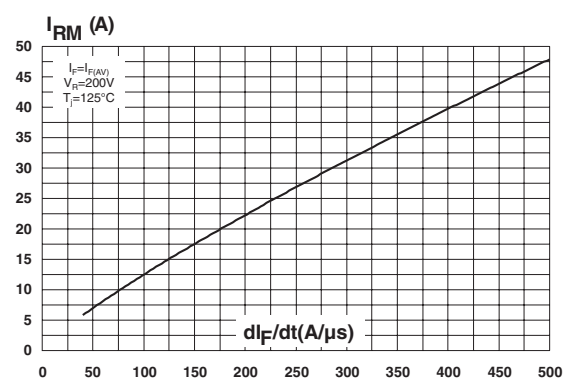
**Figure 2: Forward voltage drop versus forward current (per diode)**



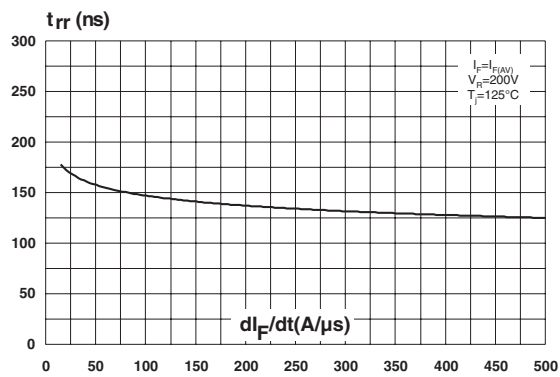
**Figure 3: Relative variation of thermal impedance junction to case versus pulse duration**



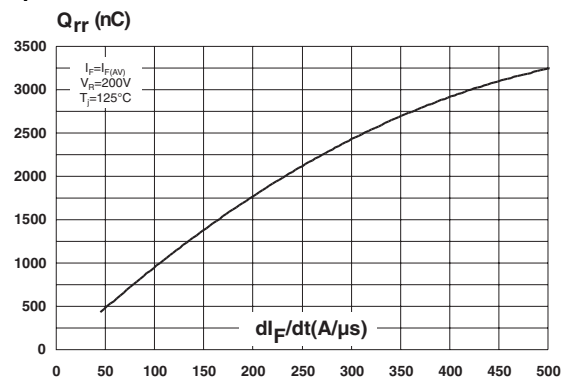
**Figure 4: Peak reverse recovery current versus  $di_F/dt$  (typical values, per diode)**



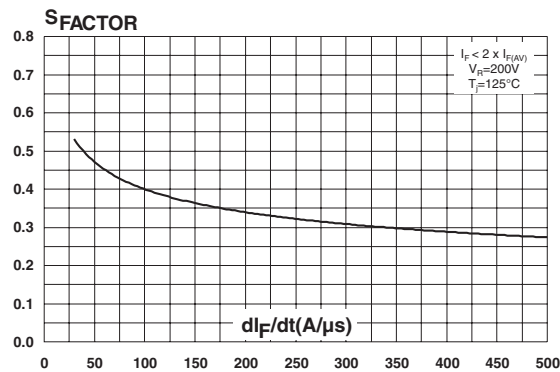
**Figure 5: Reverse recovery time versus  $di_F/dt$  (typical values, per diode)**



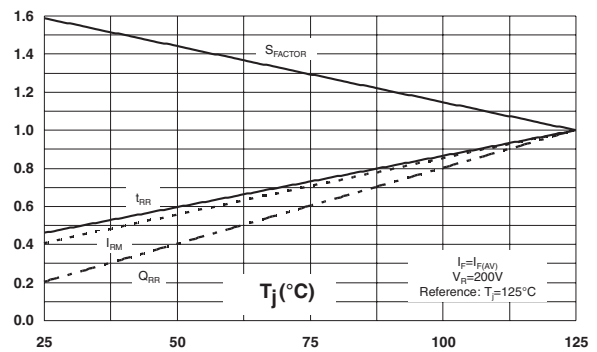
**Figure 6: Reverse recovery charges versus  $di_F/dt$  (typical values, per diode)**



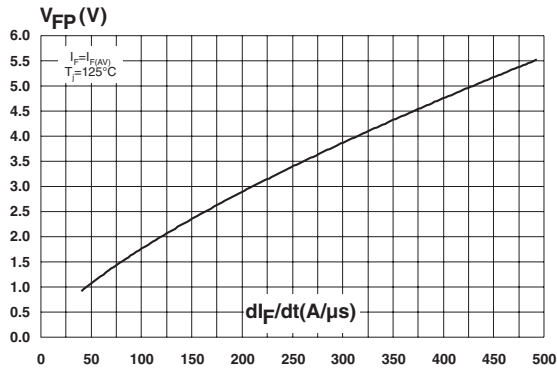
**Figure 7: Reverse recovery softness factor versus  $di_F/dt$  (typical values, per diode)**



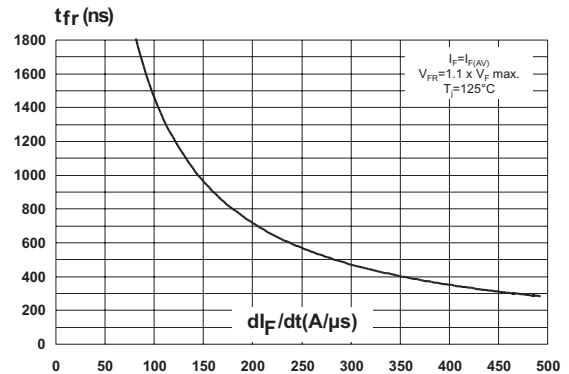
**Figure 8: Relative variations of dynamic parameters versus junction temperature**



**Figure 9: Transient peak forward voltage versus  $di_F/dt$  (typical values, per diode)**



**Figure 10: Forward recovery time versus  $di_F/dt$  (typical values, per diode)**



**Figure 11: Junction capacitance versus reverse voltage applied (typical values, per diode)**

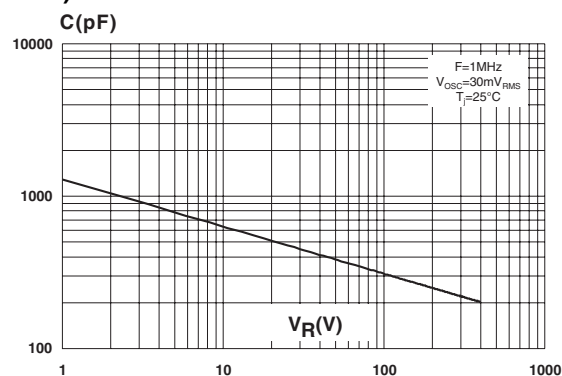


Figure 12: ISOTOP Package mechanical data

| 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).

Table 7: Ordering information

| Ordering type | Marking      | Package | Weight                   | Base qty            | Delivery mode |
|---------------|--------------|---------|--------------------------|---------------------|---------------|
| STTH20004TV1  | STTH20004TV1 | ISOTOP  | 27 g<br>(without screws) | 10<br>(with screws) | Tube          |

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)

Table 8: Revision history

| Date        | Revision | Description of Changes |
|-------------|----------|------------------------|
| 18-Oct-2005 | 1        | First issue            |

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