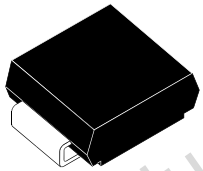
# STTA112U

## TURBOSWITCH ™ ULTRA-FAST HIGH VOLTAGE DIODE

### MAIN PRODUCT CHARACTERISTICS

| | |
|---|---|
| $I_{F(AV)}$ | 1A |
| $V_{RRM}$ | 1200V |
| $t_{rr}$ (typ) | 65ns |
| $V_F$ (max) | 1.5V |



SMB

### FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGNETIZATION AND RECTIFICATION
- ULTRA-FAST AND SOFT RECOVERY
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR
- HIGH FREQUENCY OPERATION
- HIGH REVERSE VOLTAGE CAPABILITY

### DESCRIPTION

TURBOSWITCH 1200V drastically cuts losses in all high voltage operations which require extremely fast, soft and noise-free power diodes.

Due to their optimized switching performances they also highly decrease power losses in any associated switching IGBT or MOSFET in all freewheel mode operations.

They are particularly suitable in motor control circuitries, or in primary of SMPS as snubber, clamping or demagnetizing diodes. They are also suitable for the secondary of SMPS as high voltage rectifier diodes.

### ABSOLUTE RATINGS (limiting values)

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{RRM}$ | Repetitive peak reverse voltage | | 1200 | V |
| $I_{F(RMS)}$ | RMS forward current | | 6 | A |
| $I_{FRM}$ | Repetitive peak forward current | tp = 5 µs F = 5kHz square | 10 | A |
| $I_{FSM}$ | Surge non repetitive forward current | tp = 10ms sinusoidal | 20 | A |
| $T_{stg}$ | Storage temperature range | | - 65 to + 150 | °C |
| $T_j$ | Maximum operating junction temperature | | 125 | °C |



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## THERMAL AND POWER DATA

| Symbol | Parameter | Test conditions | Value | Unit |
|---|---|---|---|---|
| $R_{th(j-l)}$ | Junction to lead thermal resistance | | 23 | °C/W |
| $P_1$ | Conduction power dissipation | $I_{F(AV)}$ = 0.8A $\delta$ = 0.5<br>Tlead= 93°C | 1.4 | W |
| $P_{max}$ | Total power dissipation<br>Pmax = P1 + P3 (P3 = 10% P1) | Tlead= 90°C | 1.5 | W |

## STATIC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_F$ * | Forward voltage drop | $I_F$ = 1A | Tj = 25°C<br>Tj = 125°C | | 1.1 | 1.65<br>1.5 | V |
| $I_R$ ** | Reverse leakage current | $V_R$ = 0.8 x $V_{RRM}$ | Tj = 25°C<br>Tj = 125°C | | 90 | 10<br>300 | µA |
| $V_{to}$ | Threshold voltage | Ip < 3.$I_{F(AV)}$ | Tj = 125°C | | | 1.15 | V |
| Rd | Dynamic resistance | | | | | 350 | mΩ |

Test pulses : * tp = 380 µs, $\delta$ < 2%
** tp = 5 ms , $\delta$ < 2%

To evaluate the maximum conduction losses use the following equation :
$P = V_{to} \times I_{F(AV)} + Rd \times I_F{}^2{}_{(RMS)}$

## DYNAMIC ELECTRICAL CHARACTERISTICS

### TURN-OFF SWITCHING

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{rr}$ | Reverse recovery time | Tj = 25°C<br>$I_F$ = 0.5 A $I_R$ = 1A Irr = 0.25A<br>$I_F$ = 1 A $dI_F/dt$ =-50A/µs $V_R$ = 30V | | 65 | 115 | ns |
| $I_{RM}$ | Maximum recovery current | Tj = 125°C $V_R$ = 600V $I_F$ = 1A<br>$dI_F/dt$ = -8 A/µs<br>$dI_F/dt$ = -50 A/µs | | 5 | 1.8 | A |
| S factor | Softness factor | Tj = 125°C $V_R$ = 600V $I_F$ =1A<br>$dI_F/dt$ = -50 A/µs | | 0.7 | | - |

### TURN-ON SWITCHING

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{fr}$ | Forward recovery time | Tj = 25°C<br>$I_F$ = 1 A, $dI_F/dt$ = 8 A/µs<br>measured at 1.1 × $V_F$ max | | | 900 | ns |
| $V_{Fp}$ | Peak forward voltage | | | | 35 | V |

**Fig. 1:** Conduction losses versus average current.

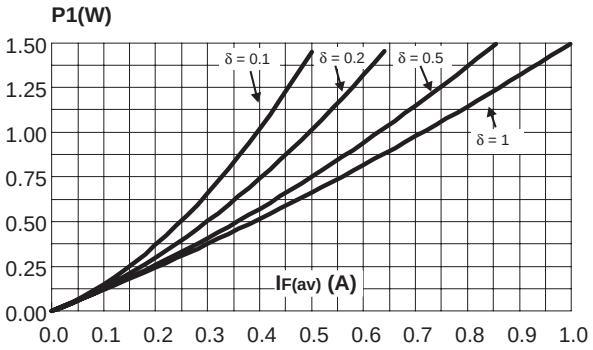



**Fig. 2:** Forward voltage drop versus forward current (Maximum values).

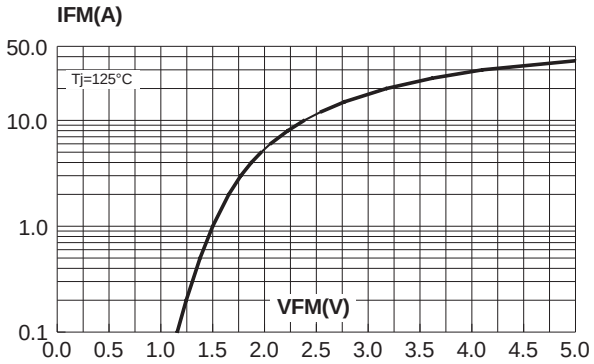



**Fig. 3:** Relative variation of thermal transient impedance junction to lead versus pulse duration.

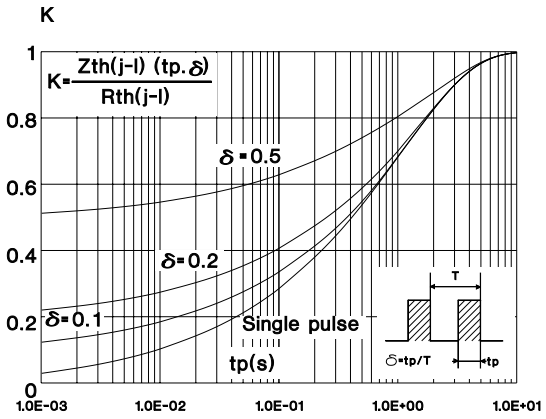



**Fig. 4:** Peak reverse recovery current versus $dI_F/dt$ (90% confidence).

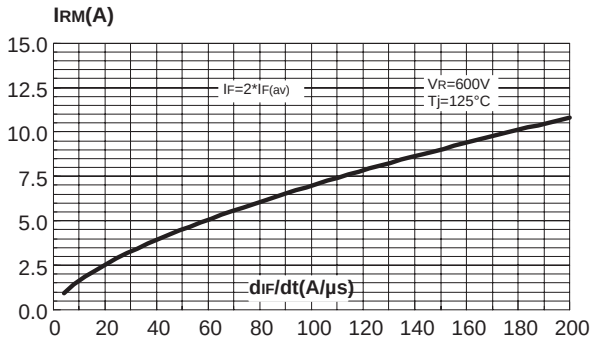



**Fig. 5:** Reverse recovery time versus $dI_F/dt$ (90% confidence).

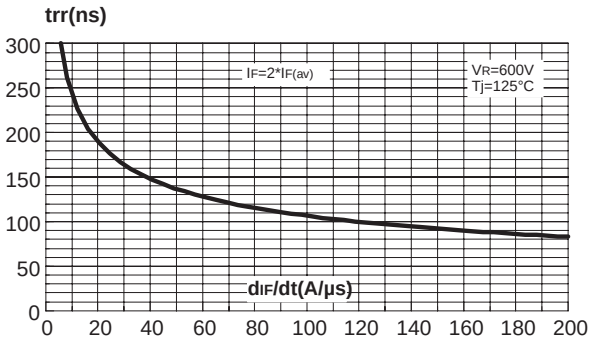



**Fig. 6:** Softness factor (tb/ta) versus $dI_F/dt$ (Typical values).

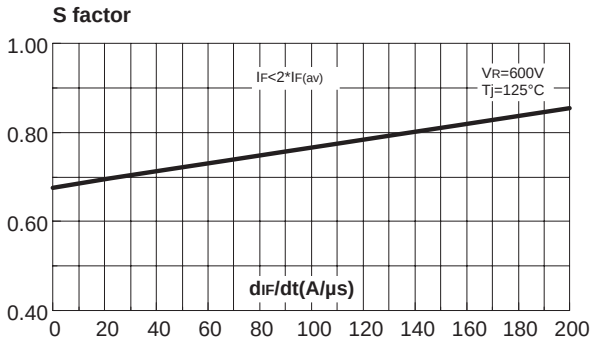


**Fig. 7:** Relative variation of dynamic parameters versus junction temperature (Reference Tj=125°C).

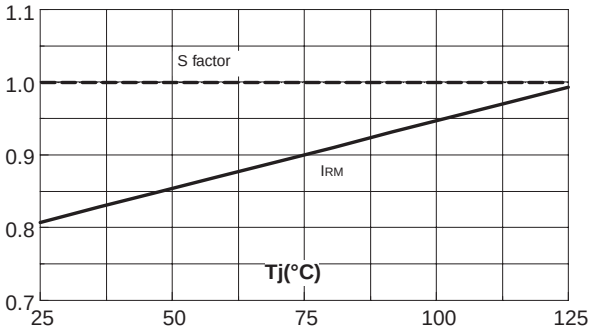



**Fig. 8:** Transient peak forward voltage versus $dI_F/dt$ (90% confidence).

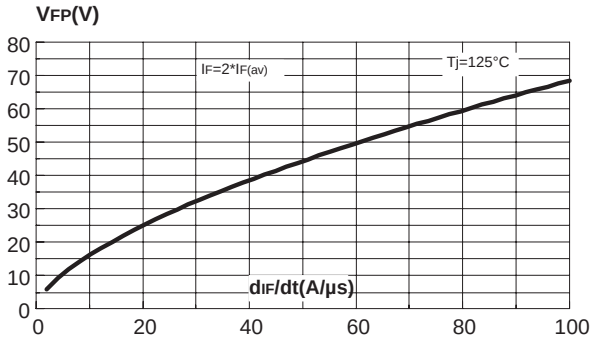
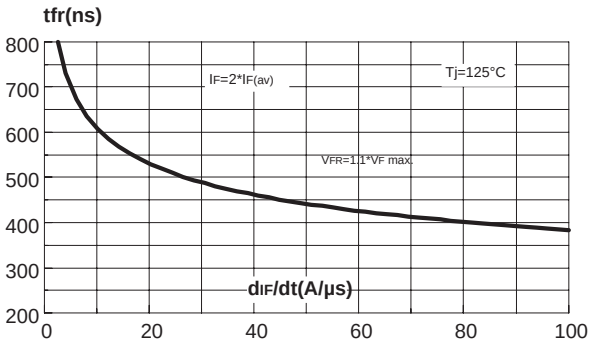



**Fig. 9:** Forward recovery time versus $dI_F/dt$ (90% confidence).



## APPLICATION DATA

The 1200V TURBOSWITCH$^{TM}$ series has been designed to provide the lowest overall power losses in all frequency or high pulsed current operations.

In such application (fig. A to D), the way of calculating the power losses is given below :

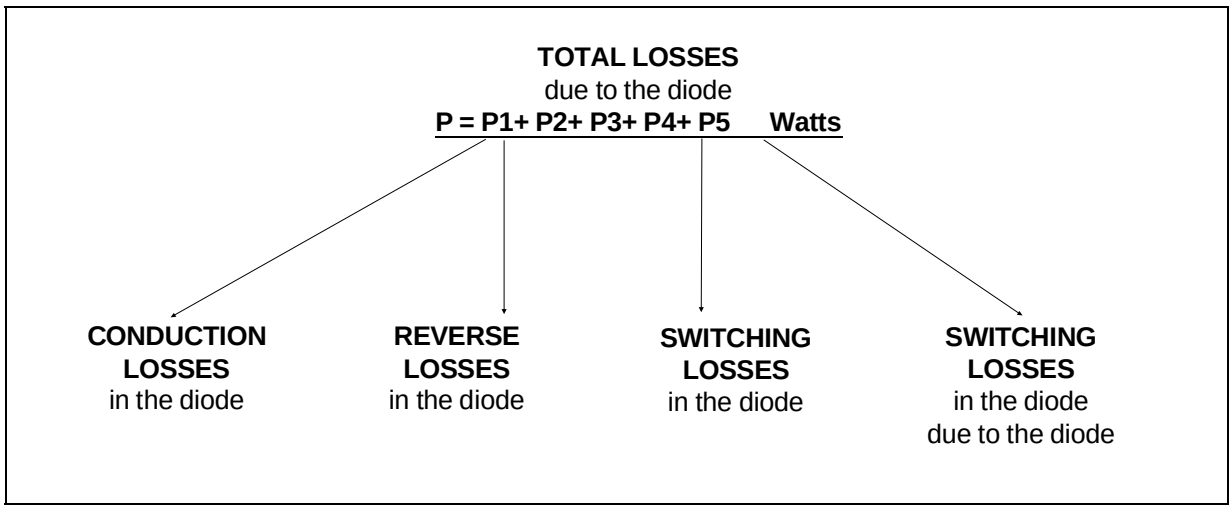
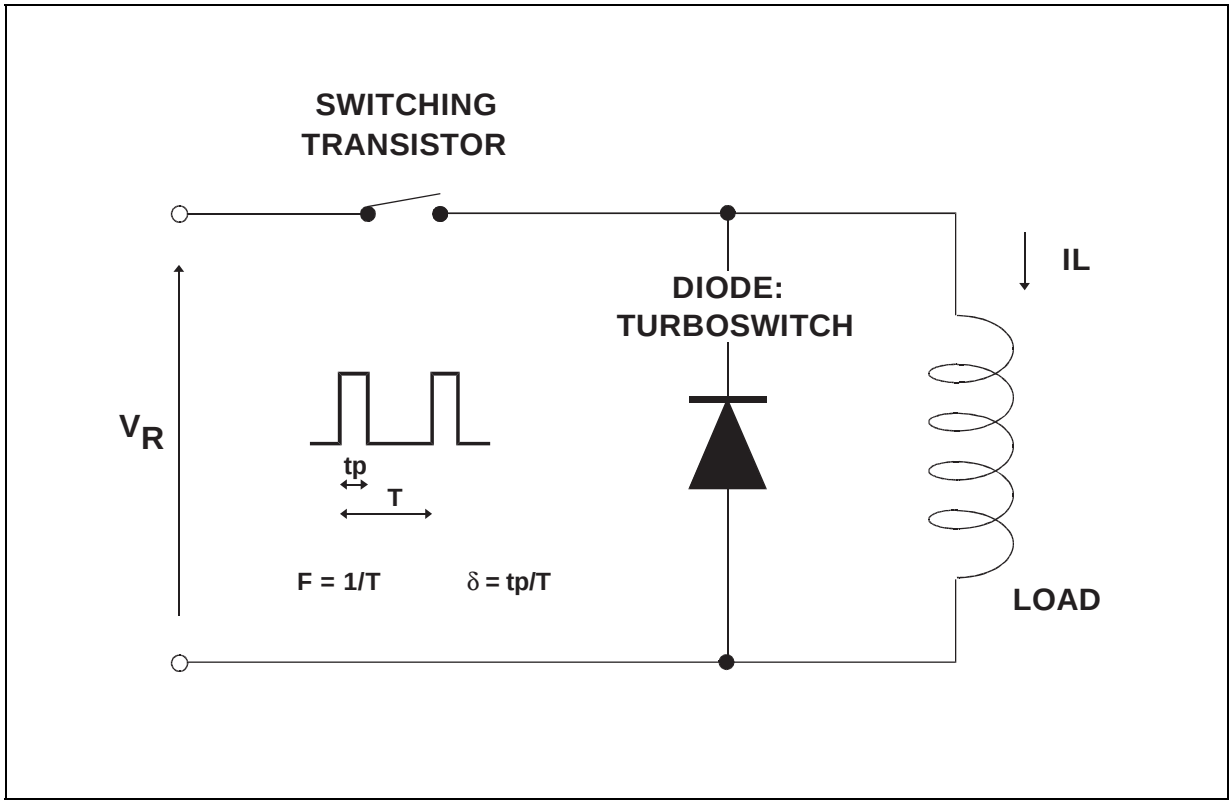



**Fig. A :** "FREEWHEEL MODE"**.**



## APPLICATION DATA (Cont'd)

**Fig. B :** SNUBBER DIODE.

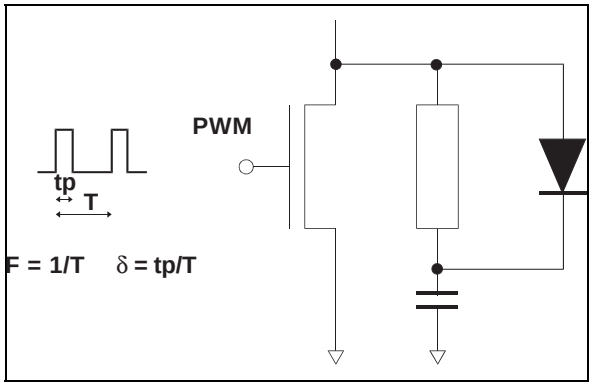



**Fig. C :** DEMAGNETIZING DIODE.

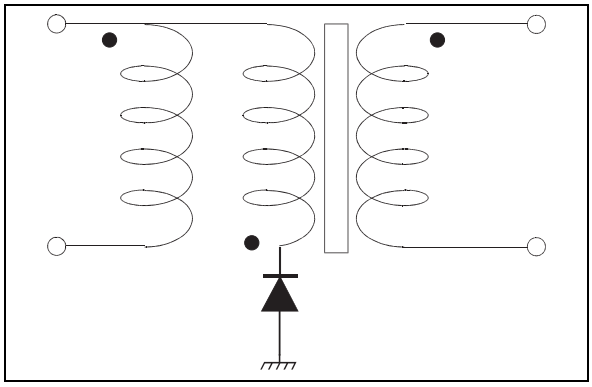


**Fig. D :** RECTIFIER DIODE.

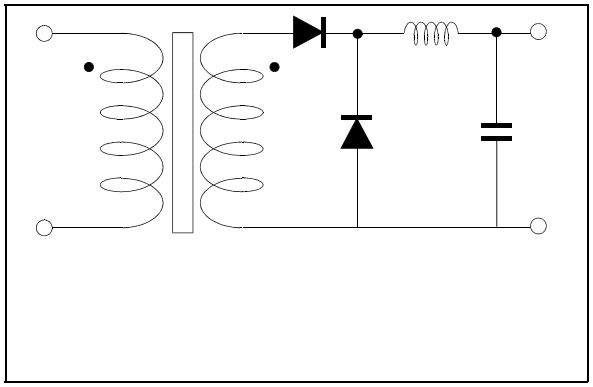
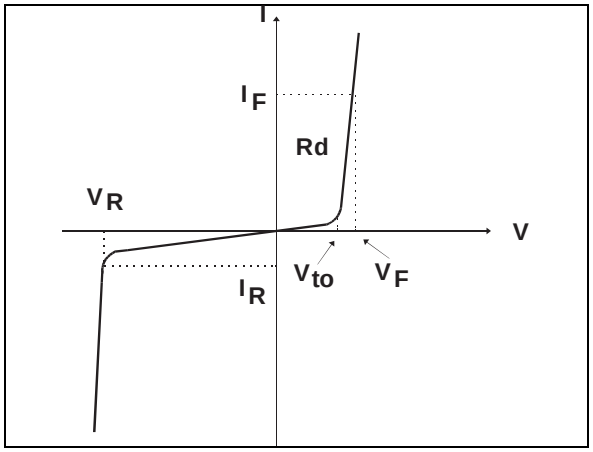


**Fig. E :** STATIC CHARACTERISTICS.




**Conduction** losses :

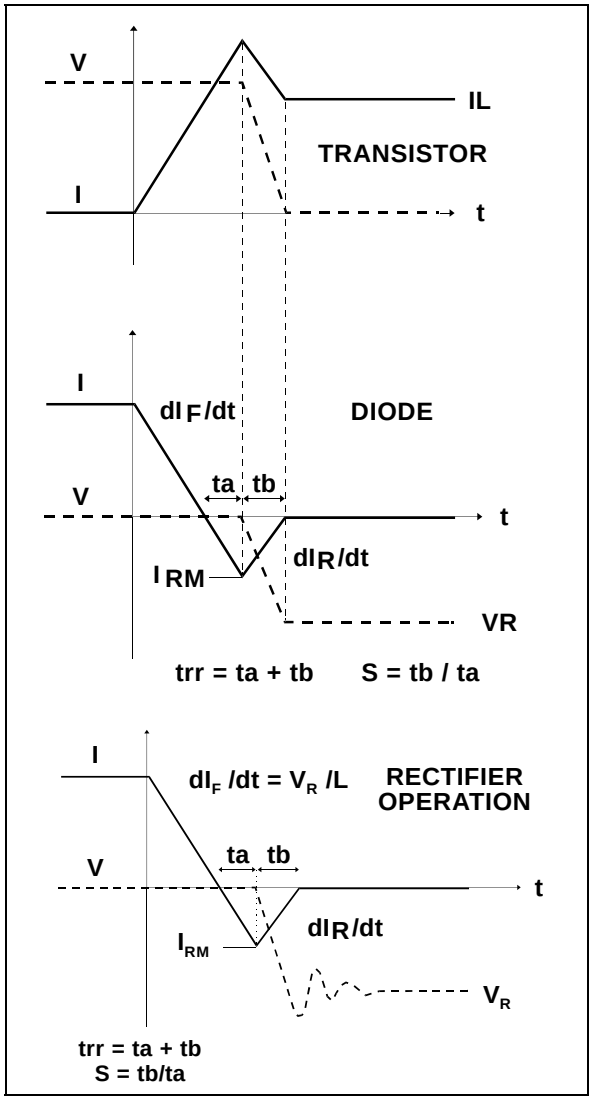
$P1 = V_{to} \times I_{F(AV)} + R_d \times I_F{}^2{}_{(RMS)}$

**Reverse** losses :

$P2 = V_R \times I_R \times (1 - \delta)$

## APPLICATION DATA (Cont'd)

**Fig. F :** TURN-OFF CHARACTERISTICS.




**Turn-on** losses :
(in the transistor, due to the diode)

$$P5 = \frac{V_R \times I_{RM}^2 \times (3+2 \times S)\ F}{6\ x\ dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S+2) \times F}{2 \times d_{IF}/dt}$$

**Turn-off** losses :

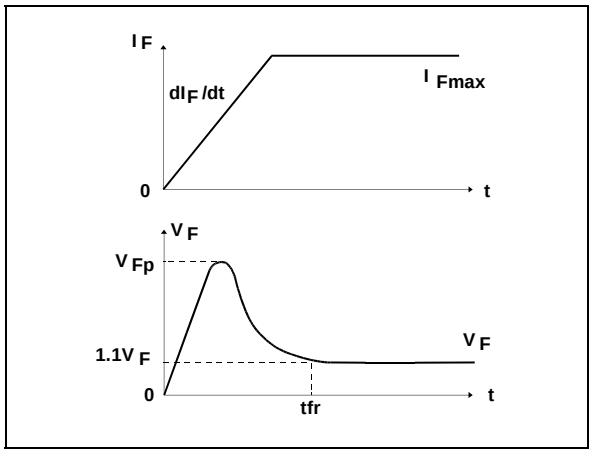
$$P3 = \frac{V_R \times I_{RM}^2 \times \times S \times F}{6\ x\ dI_F/dt}$$

**Turn-off** losses :
with non negligible serial inductance

$$P3' = \frac{V_R \times I_{RM}^2 \times S \times F}{6\ x\ dI_F/dt} + \frac{L \times I_{RM}^2 \times F}{2}$$

P3, P3' and P5 are suitable for power MOSFET and IGBT

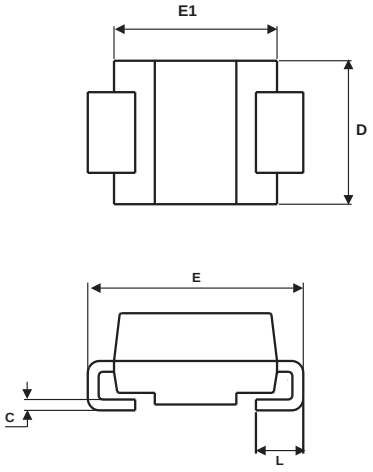
**Fig. G :** TURN-ON CHARACTERISTICS.




**Turn-on** losses :
$P4 = 0.4\ (V_{FP} - V_F) \times I_{Fmax} \times t_{fr} \times F$

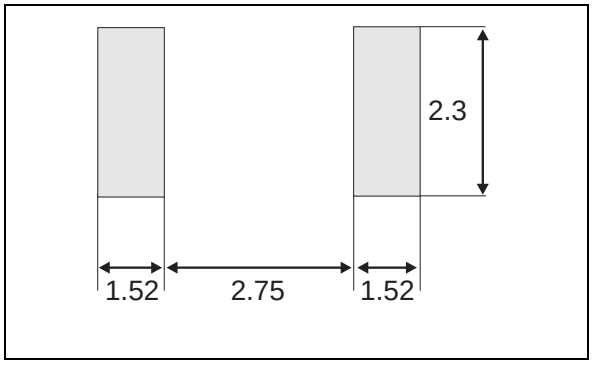
## PACKAGE MECHANICAL DATA

SMB




| REF. | DIMENSIONS | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.075 | 0.096 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 1.95 | 2.20 | 0.077 | 0.087 |
| c | 0.15 | 0.41 | 0.006 | 0.016 |
| E | 5.10 | 5.60 | 0.201 | 0.220 |
| E1 | 4.05 | 4.60 | 0.159 | 0.181 |
| D | 3.30 | 3.95 | 0.130 | 0.156 |
| L | 0.75 | 1.60 | 0.030 | 0.063 |

**FOOTPRINT DIMENSIONS** (in millimeters)




| Ordering type | Marking | Package | Weight | Base qty | Delivery mode |
|---|---|---|---|---|---|
| STTA112U | T03 | SMB | 0.107g | 2500 | Tape & reel |

- Epoxy meets UL94,V0
- Band indicates cathode