

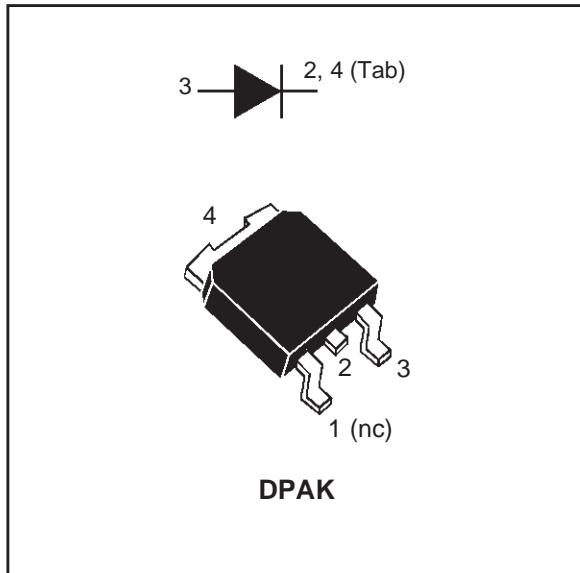
TURBOSWITCH™ "A". ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

| | |
|-----------------------------|---------------|
| I_{F(AV)} | 3 A |
| V_{RRM} | 1200 V |
| V_F (max) | 1.7 V |
| t_{rr} (typ) | 65 ns |

FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGNETIZATION AND RECTIFICATION
- ULTRA-FAST, VERY SOFT AND NOISE-FREE RECOVERY
- VERY LOW OVERALL POWER LOSSES AND PARTICULARLY LOW FORWARD VOLTAGE
- SURFACE MOUNT DEVICE
- TAPE AND REEL OPTION : -TR



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, and also in at the secondary of SMPS as high voltage rectifier diodes.

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | | Value | Unit |
|---------------------|--------------------------------------|------------------------|---------------|------|
| V _{RRM} | Repetitive peak reverse voltage | | 1200 | V |
| V _{RSM} | Non repetitive surge reverse voltage | | 1200 | V |
| I _{F(RMS)} | RMS forward current | | 8 | A |
| I _{FRM} | Repetitive peak forward current | tp = 5 µs F = 1 KHz | 50 | A |
| I _{FSM} | Surge non repetitive forward current | tp = 10ms Sine | 25 | A |
| T _{stg} | Storage temperature range | | - 65 to + 150 | °C |
| T _j | Maximum junction temperature | | 125 | °C |

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STTA312B(-TR)

THERMAL AND POWER DATA

| Symbol | Parameter | Conditions | Value | Unit |
|-----------------------|--|---|-------|------|
| R _{th} (j-c) | Junction to case thermal resistance | | 6.5 | °C/W |
| P ₁ | Conduction power dissipation | I _{F(AV)} = 3A, δ = 0.5 T _c = 80°C | 6.7 | W |
| P _{max} | Total power dissipation P _{max} = P ₁ + P ₃ (P ₃ = 10% P ₁) | T _c = 76°C | 7.5 | W |

STATIC ELECTRICAL CHARACTERISTICS (see figure 6)

| Symbol | Tests Conditions | Tests Conditions | | Min. | Typ. | Max. | Unit |
|-------------------|-------------------------|---|------------------------|------|------|------|------|
| I _R * | Reverse leakage current | V _R = 0.8 X V _{RRM} | T _j = 25°C | | | 20 | μA |
| | | | T _j = 125°C | | 150 | 400 | μA |
| V _F ** | Forward voltage drop | I _F = 3 A | T _j = 25°C | | | 1.8 | V |
| | | I _F = 3 A | T _j = 125°C | | 1.15 | 1.7 | |
| V _{to} | Threshold voltage | | T _j = 125°C | | | 1.15 | V |
| r _d | Dynamic resistance | | | | | 185 | mΩ |

Pulse test : * tp = 5 ms, δ < 2 %

** tp = 380 μs, δ < 2%

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see figure 7)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|-----------------|--------------------------|------------------------|---|------|------|------|------|
| t _{rr} | | T _j = 25°C | I _F = 0.5A I _R =1A I _{rr} = 0.25A I _F = 1A dI _F /dt= 50A/μs V _R = 30V | | 65 | 115 | ns |
| I _{RM} | Maximum recovery current | T _j = 125°C | I _F = 3A V _R = 600V dI _F /dt = -16A/μs dI _F /dt = -50A/μs | | 6.0 | 3.6 | A |
| S factor | Softness factor | T _j = 125°C | V _R = 600V I _F = 3A dI _F /dt = -50A/μs | | 1.2 | | - |

TURN-ON SWITCHING (see figure 8)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|-----------------|-----------------------|-----------------------|---|------|------|------|------|
| t _{fr} | Forward recovery time | T _j = 25°C | I _F =2A dI _F /dt = 16A/μs Measured at 1.1 x V _{Fmax} | | | 900 | ns |
| V _{FP} | Peak forward voltage | | | | | 35 | V |

APPLICATION DATA

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

In such application (fig. 1 to 5), the way of calculating the power losses is given below :

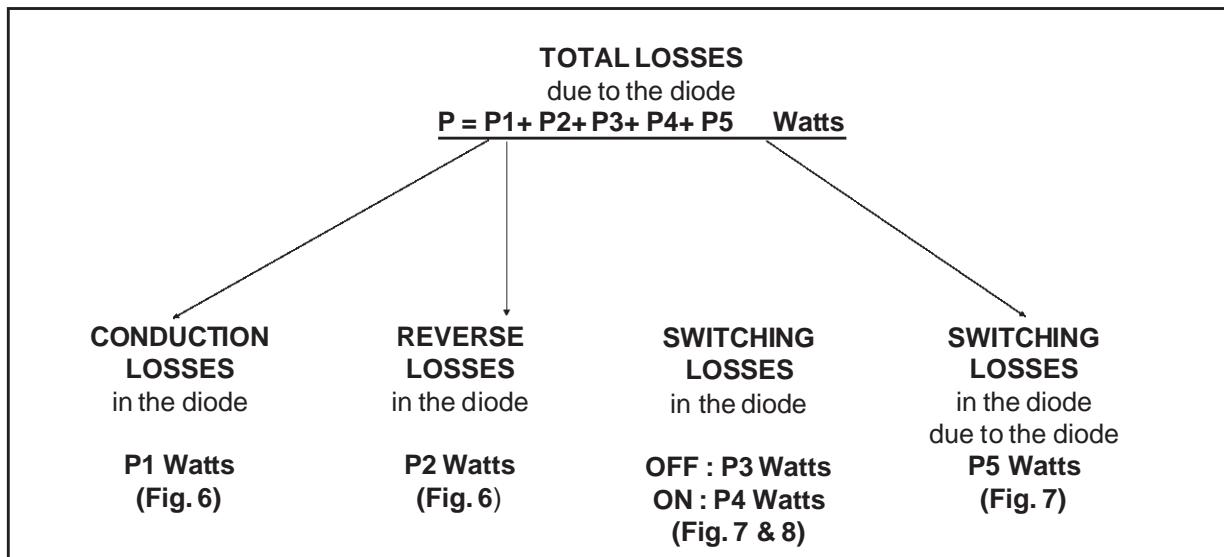
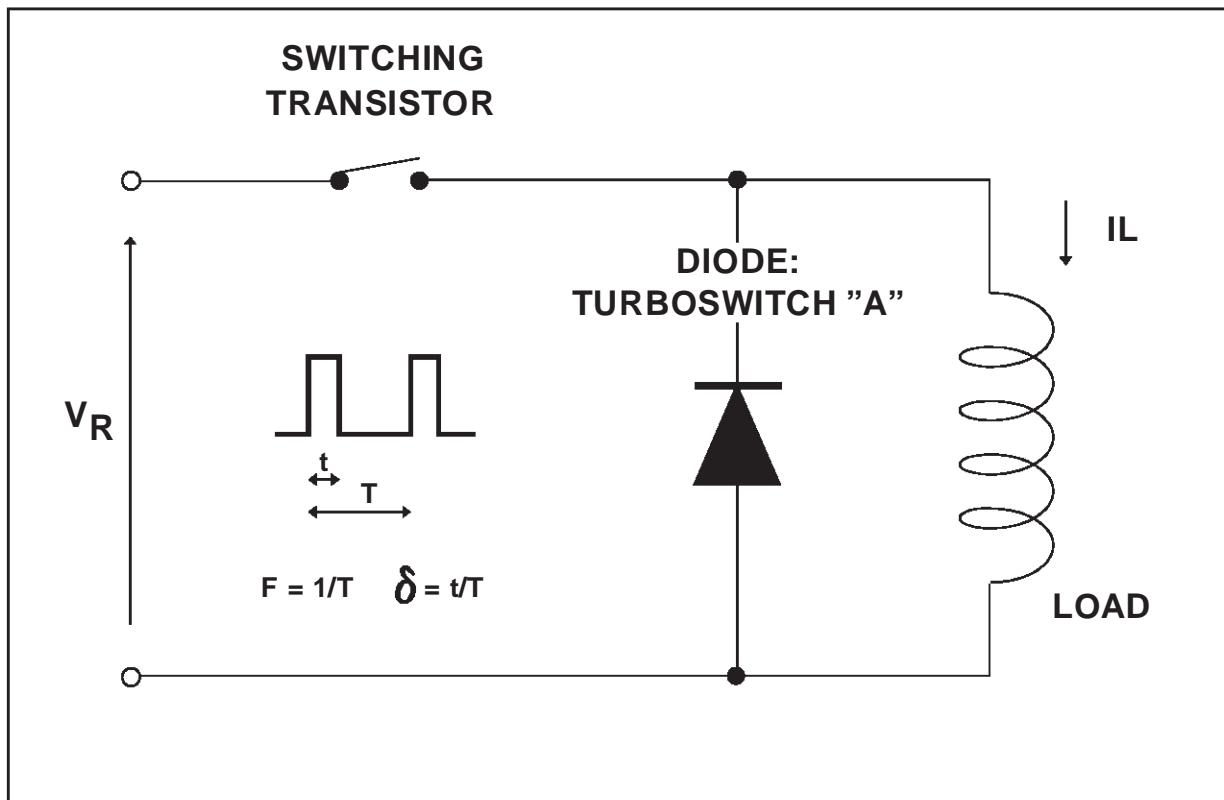


Fig. 1 : "FREEWHEEL MODE".



STTA312B(-TR)

APPLICATION DATA (Cont'd)

Fig. 2 : SNUBBER DIODE.

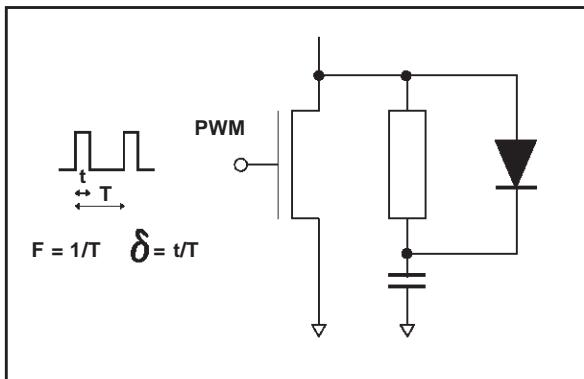


Fig. 3 : CLAMPING DIODE.

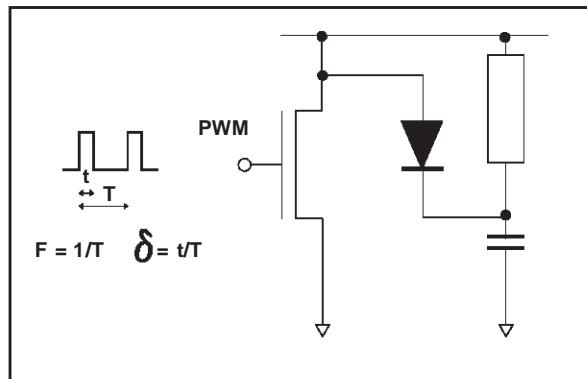


Fig. 4 : DEMAGNETIZING DIODE.

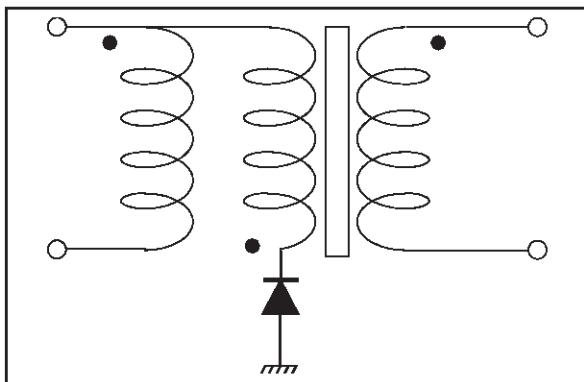


Fig. 5 : RECTIFIER DIODE.

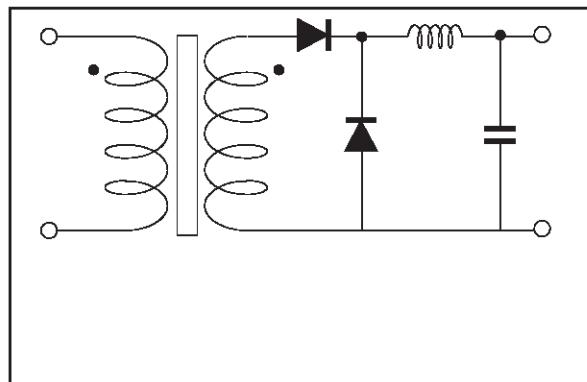
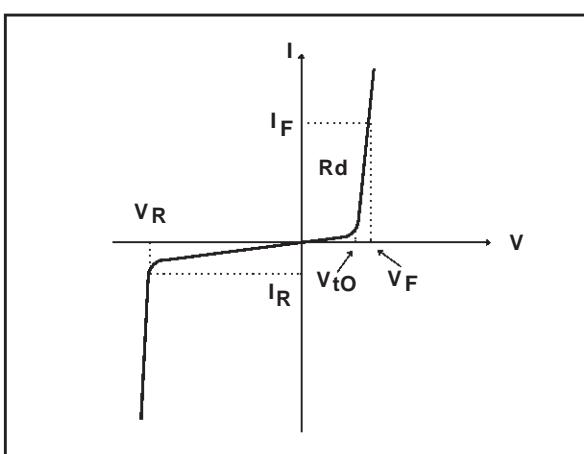


Fig. 6 : STATIC CHARACTERISTICS.



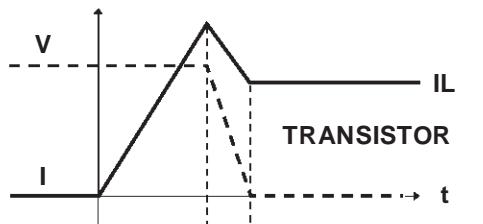
Conduction losses :

$$P_1 = V_{t0} \times I_{F(AV)} + R_d \times I_F^2 (\text{RMS})$$

Reverse losses :

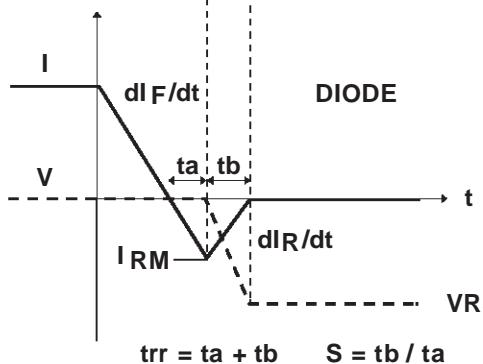
$$P_2 = V_R \times I_R \times (1 - \delta)$$

APPLICATION DATA (Cont'd)



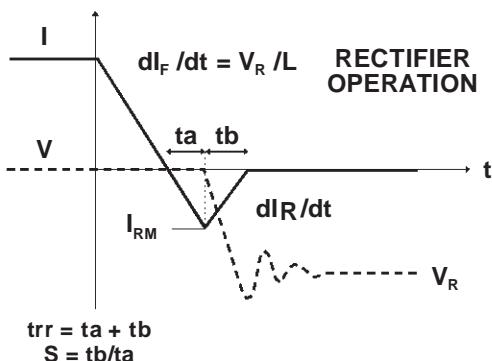
Turn-on losses:
(in the transistor, due to the diode)

$$P_5 = \frac{V_R \times I_{RM}^2 \times (3+2 \times S) F}{6 \times dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S+2) \times F}{2 \times dI_F/dt}$$



Turn-off losses:

$$P_3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

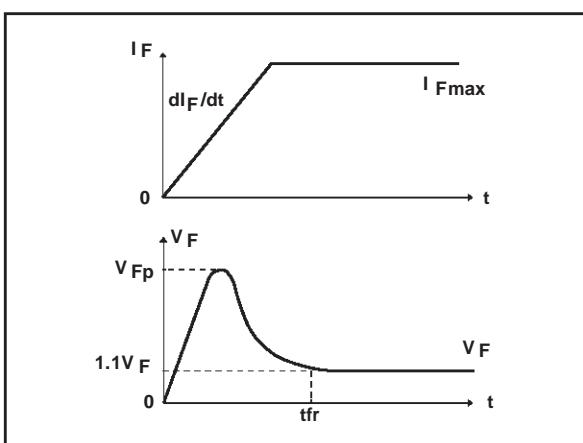


Turn-off losses :
with non negligible serial inductance

$$P_3' = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt} + \frac{L \times I_{RM}^2 \times F}{2}$$

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

Fig. 8 : TURN-ON CHARACTERISTICS.



Turn-on losses:

$$P_4 = 0.4 (V_{FP} - V_F) \times I_{Fmax} \times t_{fr} \times F$$

Ratings and characteristics curves are ON GOING.

STTA312B(-TR)

Fig. 9: Conductionlosses versus average current.

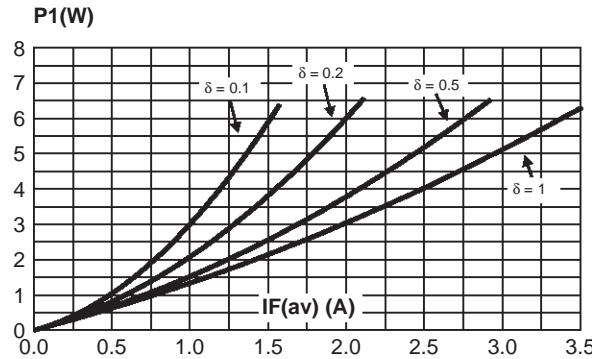


Fig. 10: Switching OFF losses versus dI_F/dt .

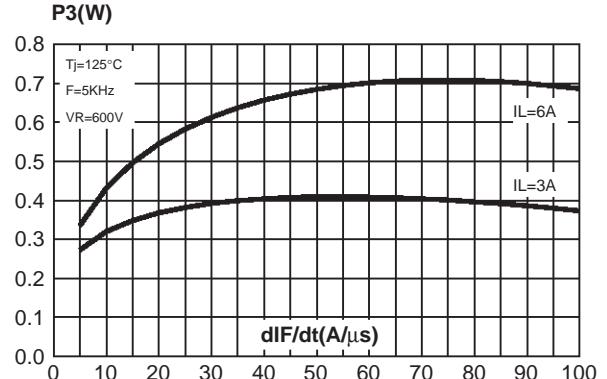


Fig. 11: Switching ON losses versus dI_F/dt .

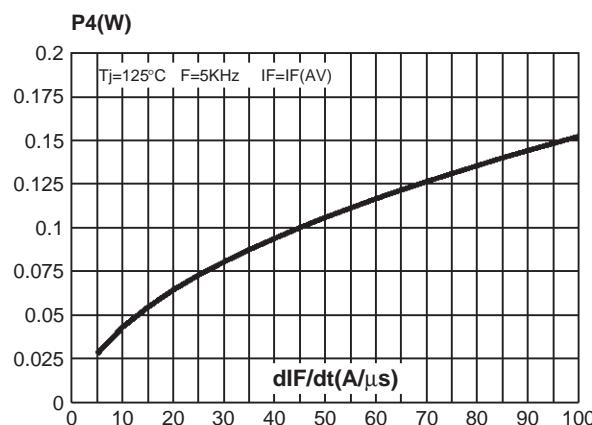


Fig. 12: Switching losses in transistor due to the diode.

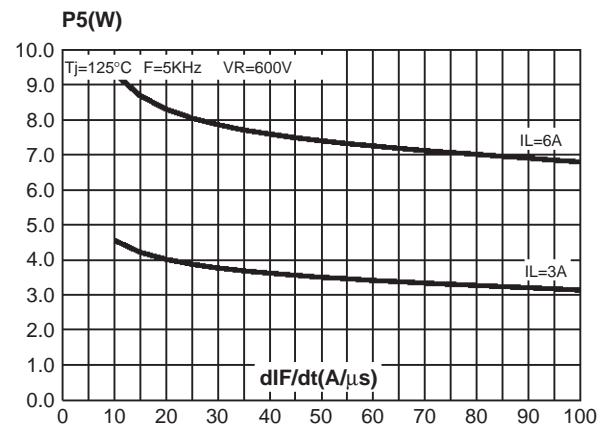


Fig. 13: Forward voltage drop versus forward current (maximum values).

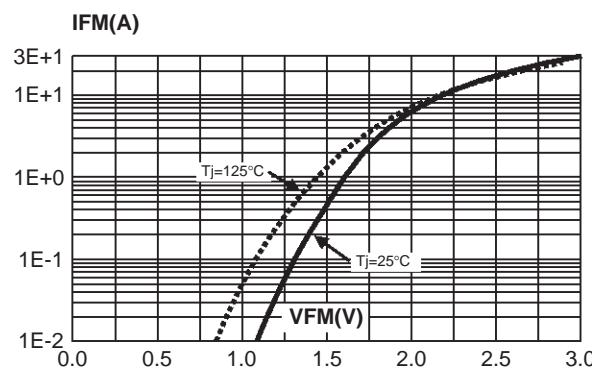


Fig. 14: Relative variation of thermal impedance junction to case versus pulse duration.

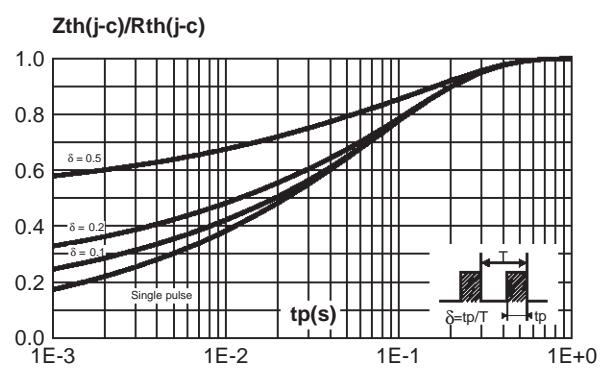


Fig. 15: Peak reverse recovery current versus dI_F/dt (90% confidence).

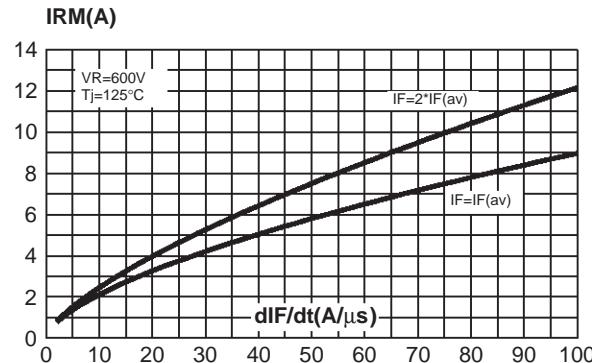


Fig. 16: Reverse recovery time versus dI_F/dt (90% confidence).

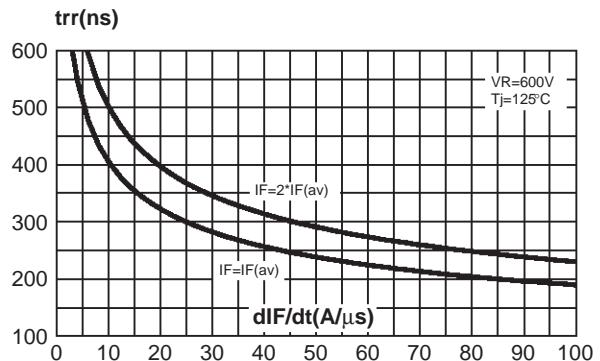


Fig. 17: Softness factor tb/ta versus dI_F/dt (typical values).

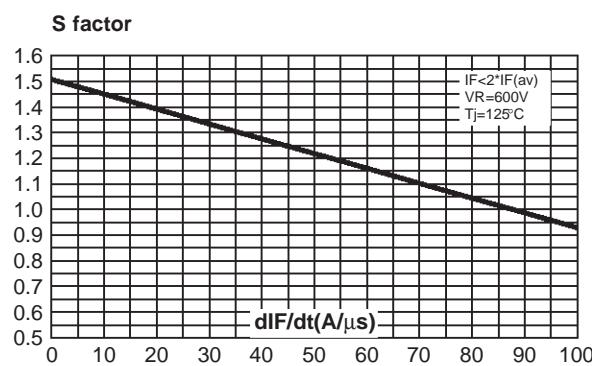


Fig. 18: Relative variation of dynamic parameters versus junction temperature (reference: $Tj = 125°C$).

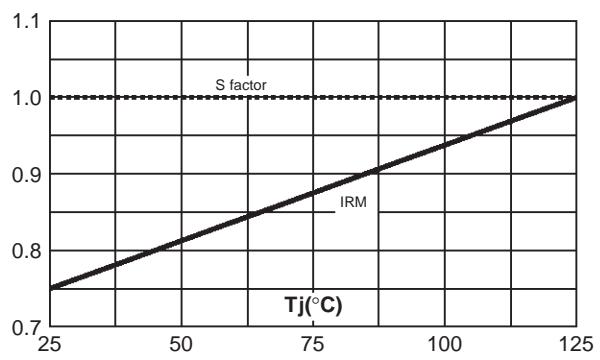


Fig. 19: Transient peak forward voltage versus dI_F/dt (90% confidence).

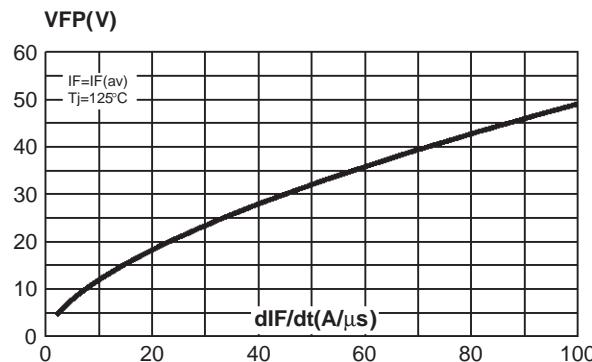
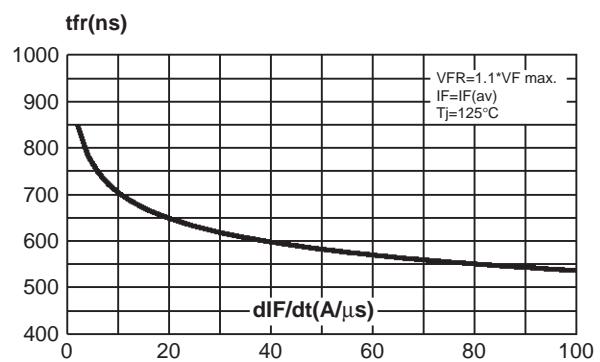
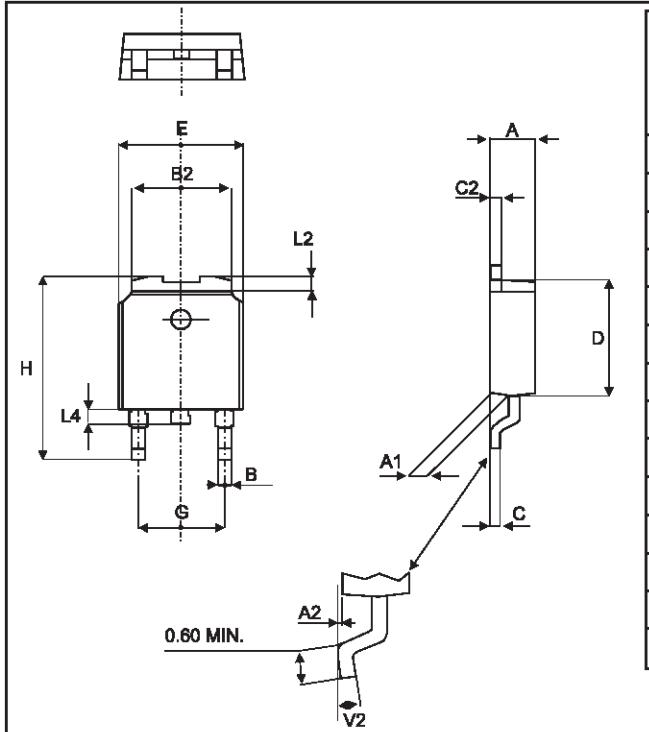


Fig. 20: Forward recovery time versus dI_F/dt (90% confidence).



STTA312B(-TR)

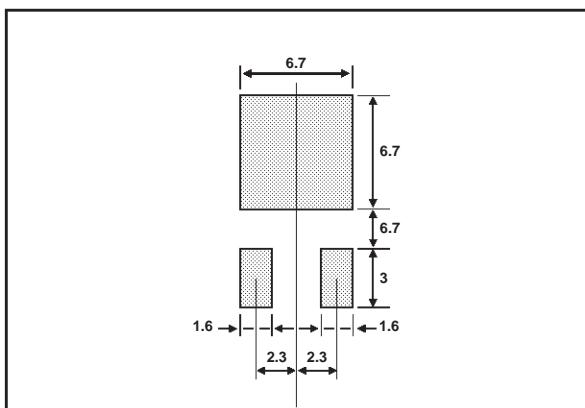
PACKAGE MECHANICAL DATA DPAK



| REF. | DIMENSIONS | | | | | |
|------|-------------|------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 | 0.086 | | 0.094 |
| A1 | 0.90 | | 1.10 | 0.035 | | 0.043 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.64 | | 0.90 | 0.025 | | 0.035 |
| B2 | 5.20 | | 5.40 | 0.204 | | 0.212 |
| C | 0.45 | | 0.60 | 0.017 | | 0.023 |
| C2 | 0.48 | | 0.60 | 0.018 | | 0.023 |
| D | 6.00 | | 6.20 | 0.236 | | 0.244 |
| E | 6.40 | | 6.60 | 0.251 | | 0.259 |
| G | 4.40 | | 4.60 | 0.173 | | 0.181 |
| H | 9.35 | | 10.10 | 0.368 | | 0.397 |
| L2 | | 0.80 | | | 0.031 | |
| L4 | 0.60 | | 1.00 | 0.023 | | 0.039 |
| V2 | 0° | | 8° | 0° | | 8° |

FOOTPRINT DIMENSIONS (in millimeters)

DPAK



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