SGS-THOMSON MICROELECTRONICS

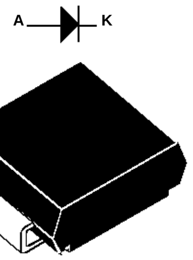
# STTA212S

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

### MAIN PRODUCTS CHARACTERISTICS

PRELIMINARY DATASHEET

| | |
|---|---|
| $I_{F(AV)}$ | **2A** |
| $V_{RRM}$ | **1200V** |
| $t_{rr}$ (typ) | **65ns** |
| $V_F$ (max) | **1.5V** |




**SOD15**
(Plastic)

### FEATURES AND BENEFITS

- SPECIFIC TO "FREEWHEEL MODE" OPERATIONS : FREEWHEEL OR BOOSTER DIODE
- ULTRA-FAST AND SOFT RECOVERY
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR
- HIGH FREQUENCY OPERATIONS
- SURFACE MOUNT DEVICE

### DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.
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 aloso highly decrease power losses in any associated switching IGBT or MOSFET in all "Freewheel Mode" operations and is particulary suitable and efficient in Motor Control circuitries, or in primary of SMPS as snubber, clamping or demagnetizing diodes, and also at the secondary of SMPS as high voltage rectifier diodes.

Packaged in SOD15 surface mount envelope, these 1200V devices are particularly intended for use on 3 phase 400V industrial mains.

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 1200 | V |
| $V_{RSM}$ | Non Repetitive Peak Reverse Voltage | 1200 | V |
| $I_{F(RMS)}$ | RMS Forward Current | 8 | A |
| $I_{FRM}$ | Repetitive Peak Forward Current (tp = 5 µs, f = 5kHz) | 50 | A |
| $T_j$ | Max. Operating Junction Temperature | 125 | °C |
| $T_{stg}$ | Storage Temperature range | - 65 to + 150 | °C |

TM : TURBOSWITCH is a trademark of SGS-THOMSON Microelectronics

## THERMAL AND POWER DATA

| Symbol | Parameter | Conditions | Value | Unit |
|---|---|---|---|---|
| $R_{th(j-l)}$ | Junction to Lead Thermal Resistance | | 21 | °C/W |
| $P_1$ | Conduction Power Dissipation (see fig. 2) | $I_{F(AV)}$ = 1.5A δ = 0.5<br>Tlead= 72°C | 2.5 | W |
| $P_{max}$ | Total Power Dissipation<br>Pmax = P1 + P3 (P3 = 10% P1) | Tlead= 67°C | 2.8 | W |

## STATIC ELECTRICAL CHARACTERISTICS (see Fig. 6)

| Symbol | Parameter | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_F$ * | Forward Voltage Drop | $I_F$ = 2A | Tj = 25°C<br>Tj = 125°C | | <br>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 | | <br>150 | 20<br>400 | µA |

Test pulses widths : * tp = 380 µs, duty cycle < 2%
** tp = 5 ms , duty cycle < 2%

## DYNAMIC ELECTRICAL CHARACTERISTICS

### TURN-OFF SWITCHING (see Fig. 7)

| 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 | | <br>65 | <br><br>115 | ns |
| $I_{RM}$ | Maximum Recovery Current | Tj = 125°C VR = 600V $I_F$ = 2A<br>$dI_F/dt$ = -16 A/µs<br>$dI_F/dt$ = -50 A/µs | | <br>6.0 | <br><br>3.6 | A |
| S factor | Softness factor | Tj = 125°C $V_R$ = 600V $I_F$ = 2A<br>$dI_F/dt$ = -50 A/µs | | TBD | | / |

### TURN-ON SWITCHING (see Fig. 8)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{fr}$ | Forward Recovery Time | Tj = 25°C<br>$I_F$ = 2 A<br>$dI_F/dt$ = 16 A/µs<br>measured at, 1.1 × $V_F$max | | | 900 | ns |
| $V_{Fp}$ | Peak Forward Voltage | | | | 35 | V |

## APPLICATION DATA

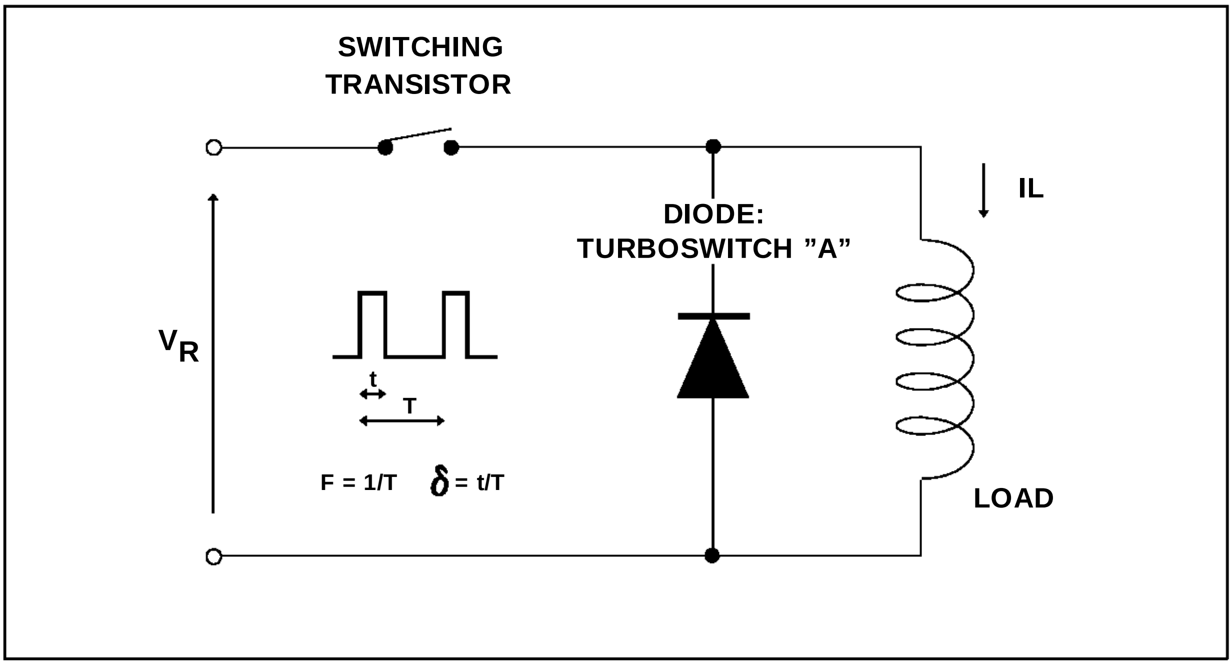
The 1200V TURBOSWITCH has been designed to provide the lowest overall power losses in any all high frequency or high pulsed current operations.

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

**TOTAL LOSSES**
due to the diode
**P = P1+ P2+ P3+ P4+ P5 Watts**

| **CONDUCTION LOSSES** in the diode | **REVERSE LOSSES** in the diode | **SWITCHING LOSSES** in the diode | **SWITCHING LOSSES** in the transistor due to the diode |
|---|---|---|---|
| **P1 Watts (Fig. 6)** | **P2 Watts (Fig. 6)** | **OFF : P3 Watts<br>ON : P4 Watts<br>(Fig. 7 & 8)** | **P2 Watts (Fig. 7)** |

**Fig. 1 :** "FREEWHEEL" MODE



## APPLICATION DATA (Cont'd)

**Fig. 2 :** SNUBBER DIODE.

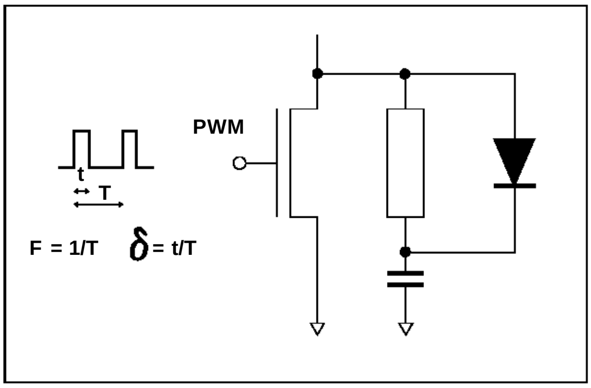



**Fig. 3 :** CLAMPING DIODE.

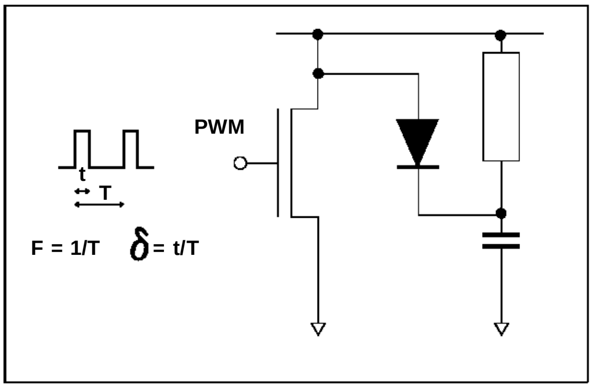



**Fig. 4 :** DEMAGNETIZING DIODE.

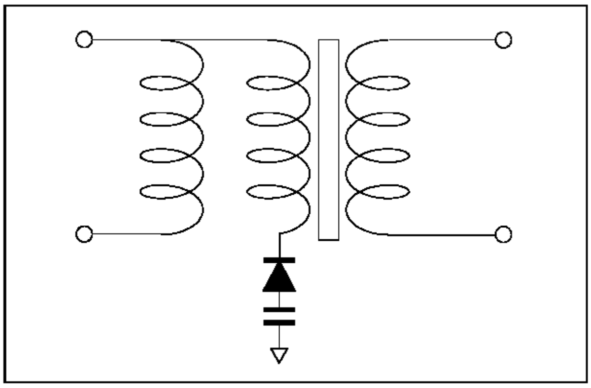


**Fig. 5 :** RECTIFIER DIODE.

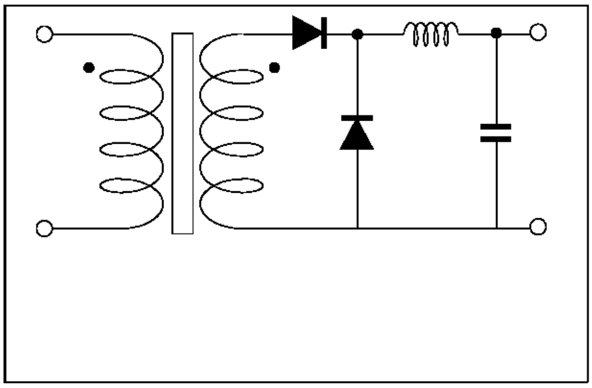
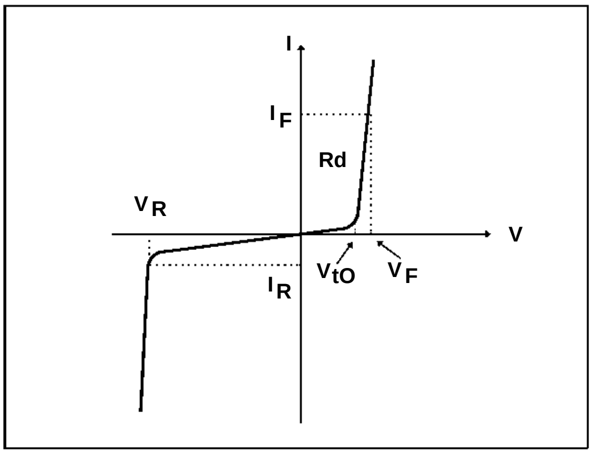


**Fig. 6 :** STATIC CHARACTERISTICS




**Conduction** losses :

$P1 = V_{t0} \times I_{F(AV)} + R_d \times I_F{}^2{}_{(RMS)}$

with

$V_{t0} = 1.15$ V
$R_d = 0.175$ Ohm
(Max values at 125°C)

**Reverse** losses :

$P2 = V_R \times I_{R} \times (1 - \delta)$

## APPLICATION DATA (Cont'd)

**Fig. 7 :** TURN-OFF CHARACTERISTICS

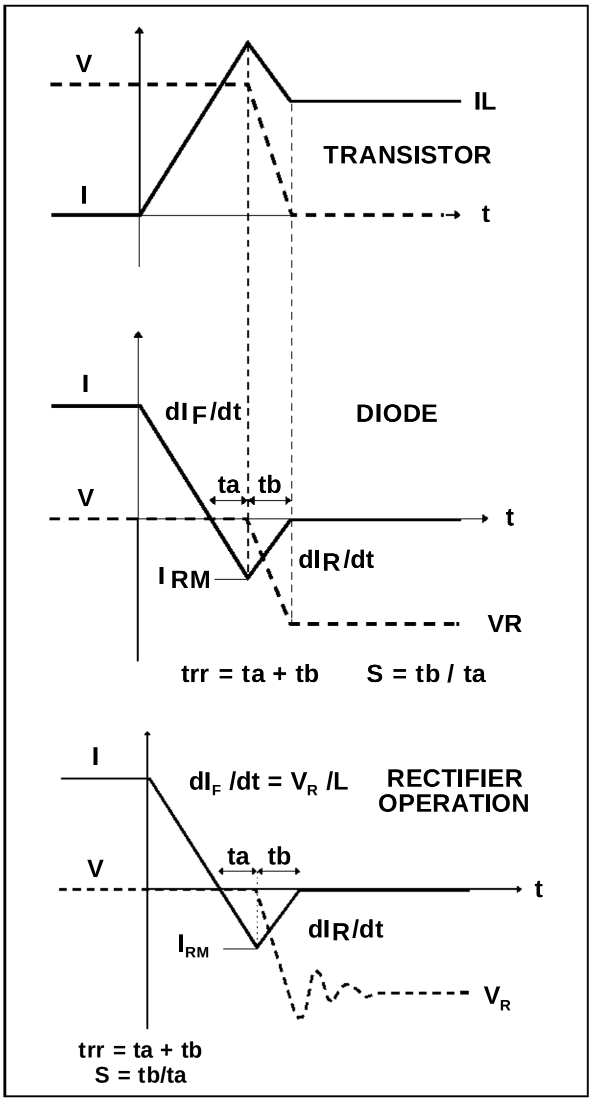
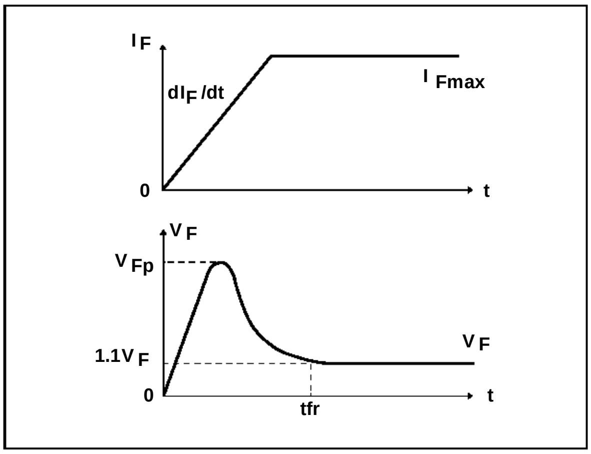



**Fig. 8 :** TURN-ON CHARACTERISTICS




Ratings and characteristics curves are ON GOING.

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

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

**Turn-off** losses (in the diode) :

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

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

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

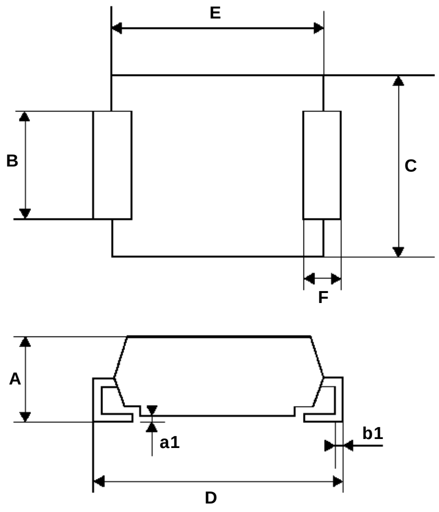
P3, P3' and P5 are suitable for power MOSFET and IGBT

**Turn-on** losses :

$P4 = 0.4\ (V_{FP} - V_F)\ x\ I_{Fmax}\ x\ t_{fr}\ x\ F$

## PACKAGE MECHANICAL DATA

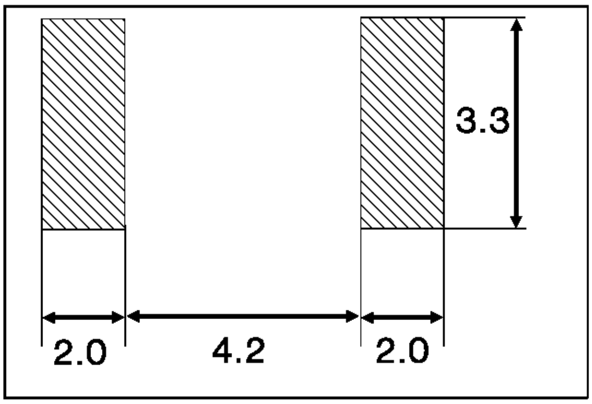
SOD15 Plastic




| REF. | DIMENSIONS | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A | 2.50 | 3.10 | 0.098 | 0.122 |
| a1 | 0.05 | 0.20 | 0.002 | 0.008 |
| B | 2.90 | 3.10 | 0.114 | 0.122 |
| b1 | 0.29 | 0.32 | 0.011 | 0.012 |
| C | 4.80 | 5.20 | 0.189 | 0.204 |
| D | 7.60 | 8.00 | 0.299 | 0.315 |
| E | 6.30 | 6.60 | 0.225 | 0.259 |
| F | 1.30 | 1.70 | 0.051 | 0.056 |

## FOOTPRINT DIMENSIONS

SOD15 Plastic




Marking : T53

Laser marking

Logo indicates cathode