



STTA1512P/PI

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

MAIN PRODUCTS CHARACTERISTICS

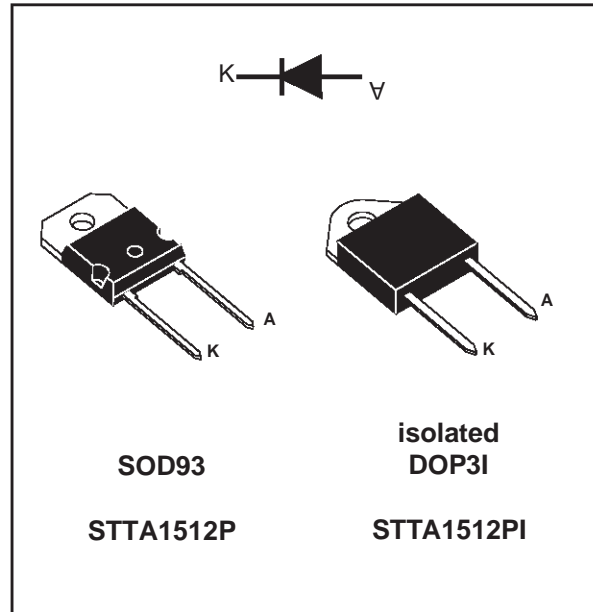
$I_{F(AV)}$	15A
V_{RRM}	1200V
t_{rr} (typ)	55ns
V_F (max)	1.9V

FEATURES AND BENEFITS

- ULTRA-FAST, SOFT AND NOISE-FREE RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY AND/OR HIGH PULSED CURRENT OPERATIONS.
- CECC APPROVED.

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 the primary of SMPS as snubber, clamping or demagnetizing diodes, and also 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 peak reverse voltage	1200	V
$I_{F(RMS)}$	RMS forward current	50	A
I_{FRM}	Repetitive peak forward current ($t_p = 5 \mu s$, $F = 5kHz$)	300	A
T_j	Maximum operating junction temperature	150	°C
T_{stg}	Storage temperature	-65 to 150	°C

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STTA1512P/PI

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	STTA1512P STTA1512PI	1.6 2.1	°C/W
P_1	Conduction power dissipation (see fig. 6)	$I_{F(AV)} = 15A$ $\delta = 0.5$ STTA1512P $T_C = 95^\circ C$ STTA1512PI $T_C = 78^\circ C$	34	W
P_{max}	Total power dissipation $P_{max} = P_1 + P_3$ ($P_3 = 10\% P_1$)	STTA1512P $T_C = 89^\circ C$ STTA1512PI $T_C = 70^\circ C$	38	W

STATIC ELECTRICAL CHARACTERISTICS (see Fig.6)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_F *	Forward voltage drop	$I_F = 15A$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.3	2.1 1.9	V V
I_R **	Reverse leakage current	$V_R = 0.8$ $\times V_{RRM}$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.3	100 6.0	μA mA
V_{to}	Threshold voltage	$T_j = 125^\circ C$			1.48	V
r_d	Dynamic resistance	$T_j = 125^\circ C$			25	m Ω

Test pulses widths : * $t_p = 380 \mu s$, $\delta < 2\%$

** $t_p = 5 ms$, $\delta < 2\%$

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see Fig.7)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$ $I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$		55	105	ns
I_{RM}	Maximum reverse recovery current	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 15A$ $di_F/dt = -120 A/\mu s$ $di_F/dt = -500 A/\mu s$		33	20	A
S_{factor}	Softness factor	$T_j = 125^\circ C$ $V_R = 600V$ $I_F = 15A$ $di_F/dt = -500 A/\mu s$		1.2		/

TURN-ON SWITCHING (see Fig.8)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	$T_j = 25^\circ C$ $I_F = 15 A$, $di_F/dt = 120 A/\mu s$ measured at $1.1 \times V_{Fmax}$			900	ns
V_{Fp}	Peak forward voltage	$T_j = 25^\circ C$ $I_F = 15A$, $di_F/dt = 120 A/\mu s$ $I_F = 40A$, $di_F/dt = 500 A/\mu s$		40	30	V

APPLICATION DATA

The 1200V TURBOSWITCH series has been designed to provide the lowest overall power losses in 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 :

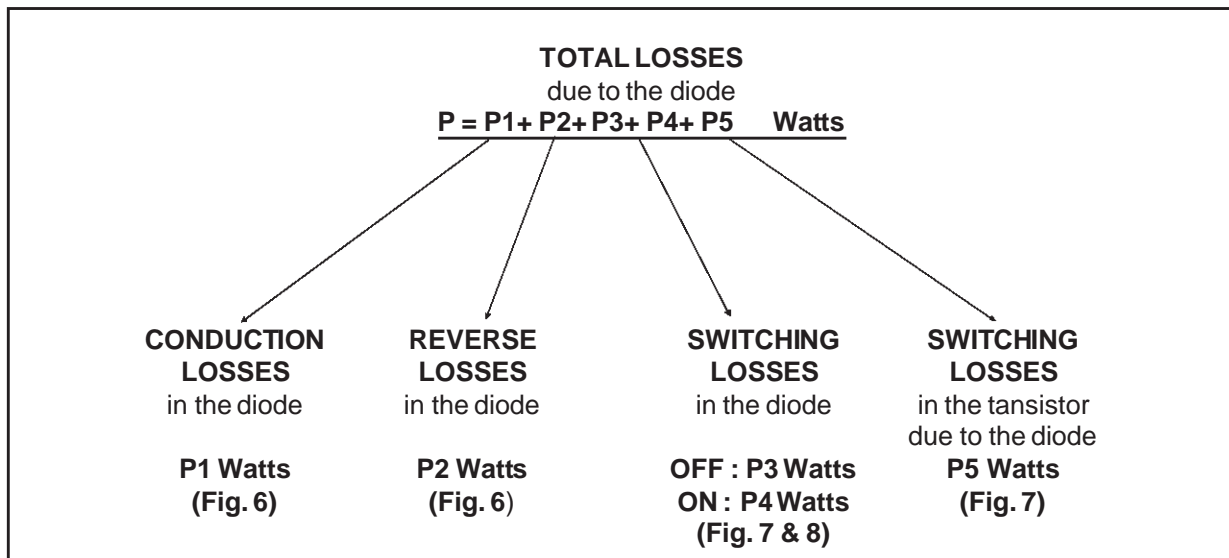


Fig. 1 : "FREEWHEEL" MODE.

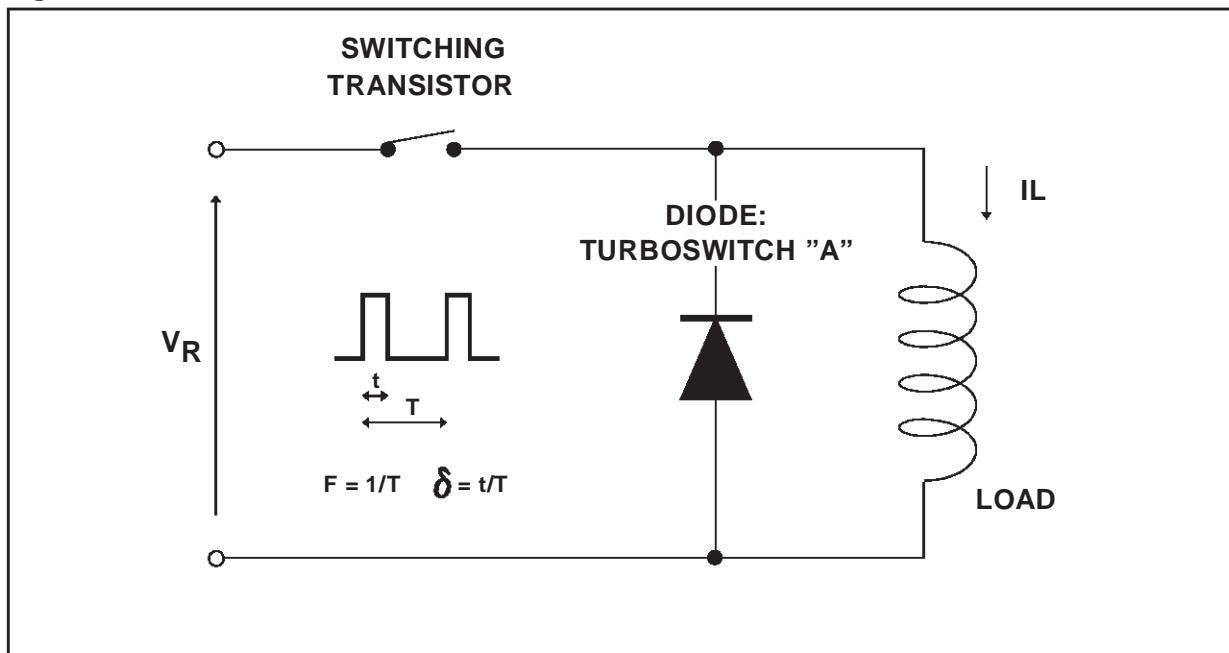


Fig. 2 : SNUBBER DIODE.

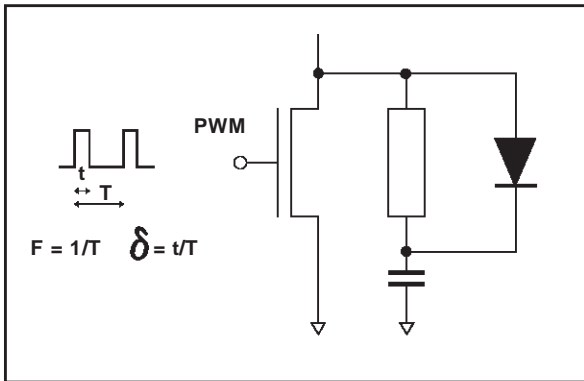


Fig. 3 : CLAMPING DIODE.

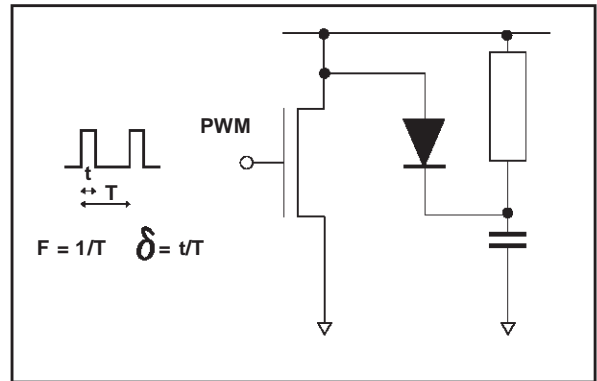


Fig. 4 : DEMAGNETIZING DIODE.

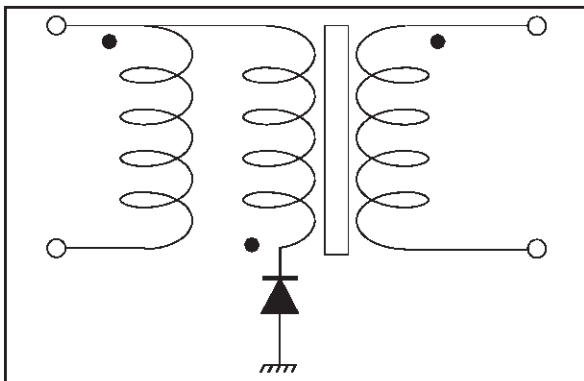
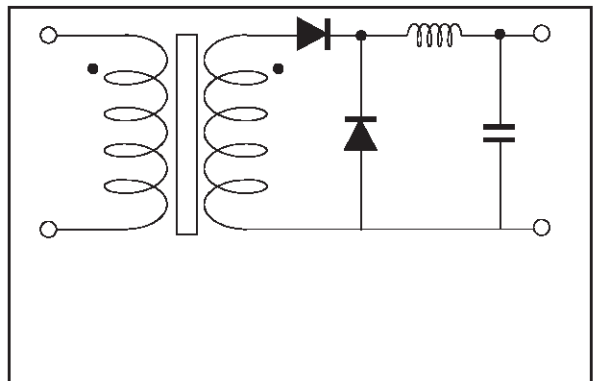
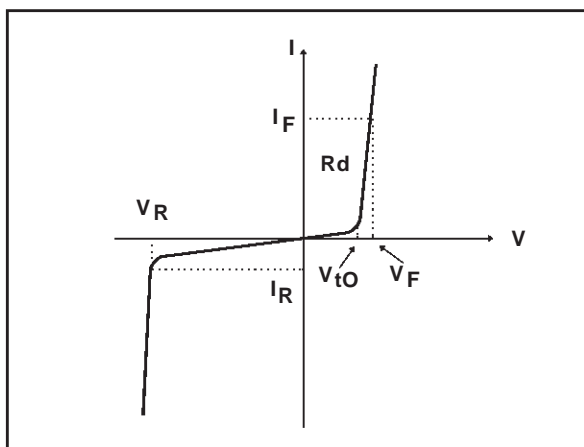


Fig. 5 : RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. 6: STATIC CHARACTERISTICS



Conduction losses :

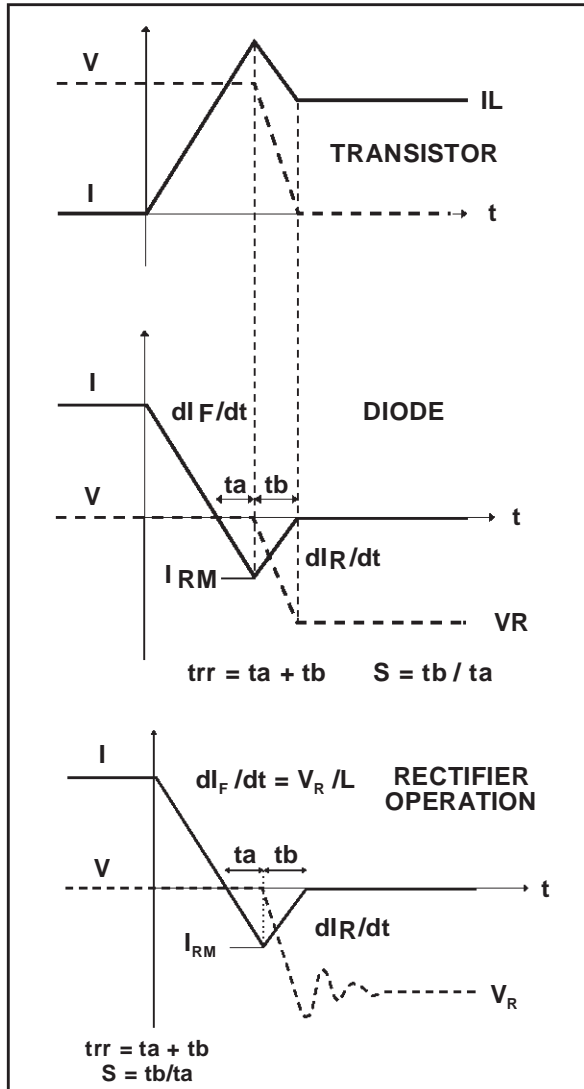
$$P1 = V_{t0} \cdot I_{F(AV)} + R_d \cdot I_{F(RMS)}^2$$

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. 7: TURN-OFF CHARACTERISTICS



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

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

Turn-off losses (in the diode):

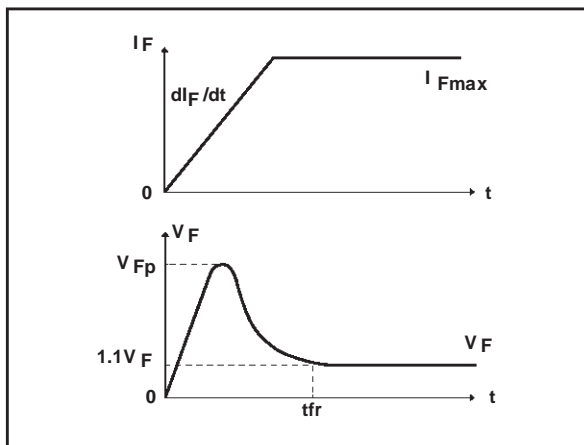
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

Turn-off losses:
(with non negligible serial inductance)

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

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

Fig. 8: TURN-ON CHARACTERISTICS



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

Fig. 9: Conduction losses versus average current.

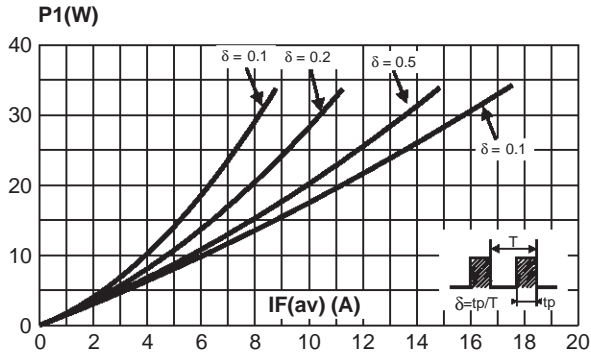


Fig. 11: Switching ON losses versus dI_F/dt .

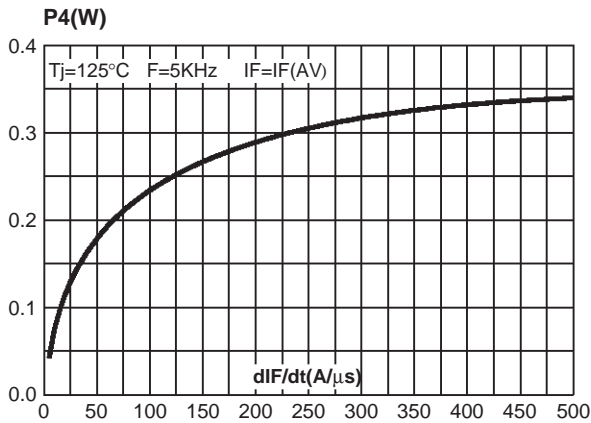


Fig. 13: Forward voltage drop versus forward current (maximum values).

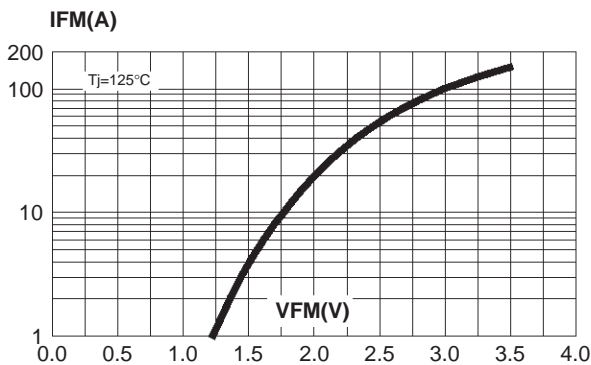


Fig. 10: Switching OFF losses versus dI_F/dt .

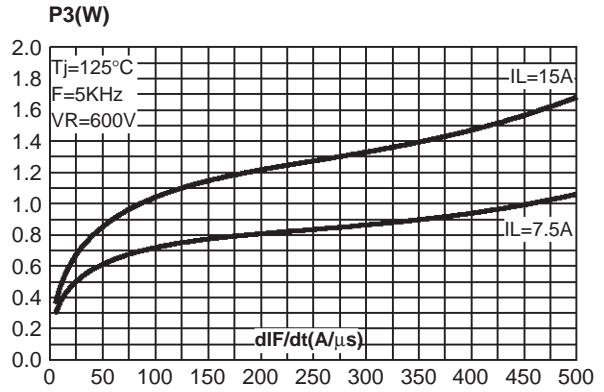


Fig. 12: Switching losses in transistor due to the diode.

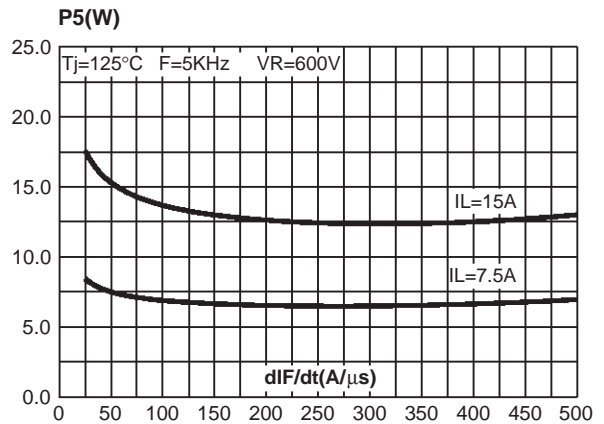


Fig. 14: Relative variation of thermal impedance junction to case versus pulse duration.

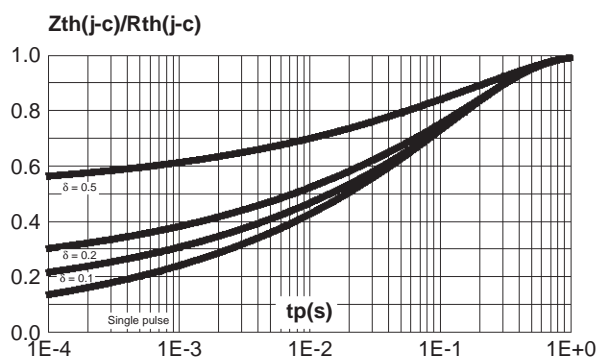


Fig. 15: Peak reverse recovery current versus di_F/dt (90% confidence).

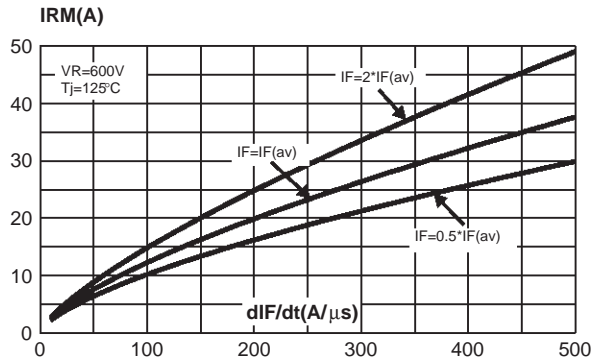


Fig. 16: Reverse recovery time versus di_F/dt (90% confidence).

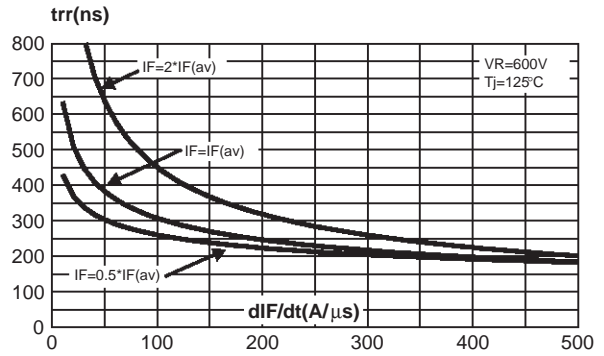


Fig. 17: Softness factor (t_b/t_a) versus di_F/dt (typical values).

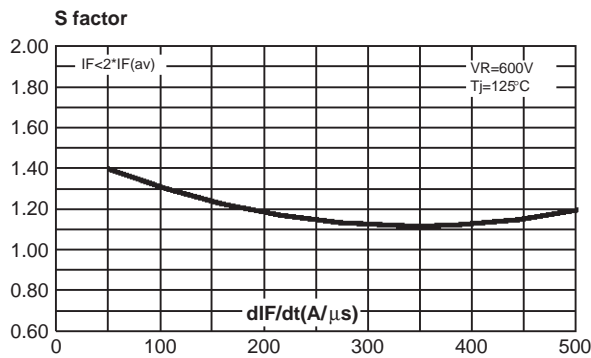


Fig. 18: Relative variation of dynamic parameters versus junction temperature.

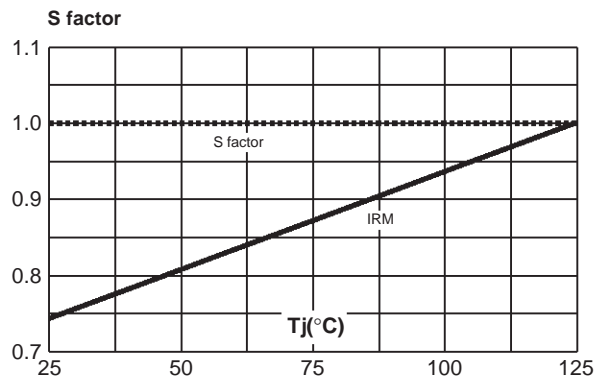


Fig. 19: Transient peak forward voltage versus di_F/dt (90% confidence).

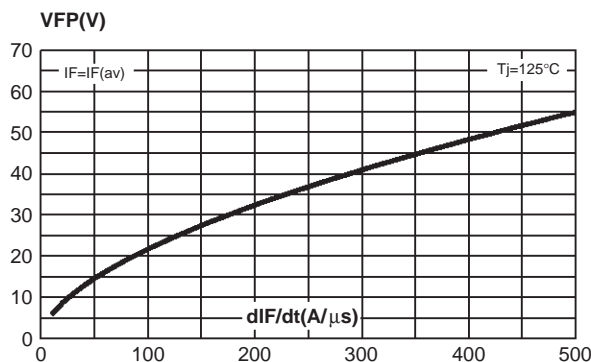
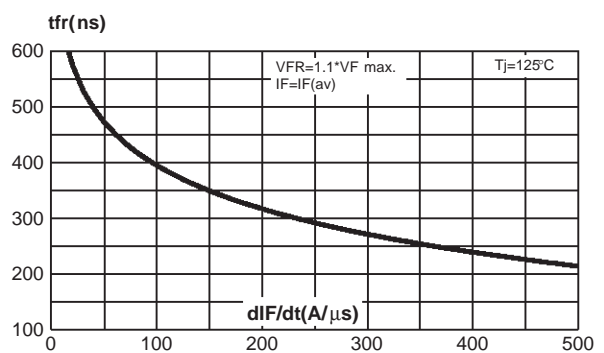
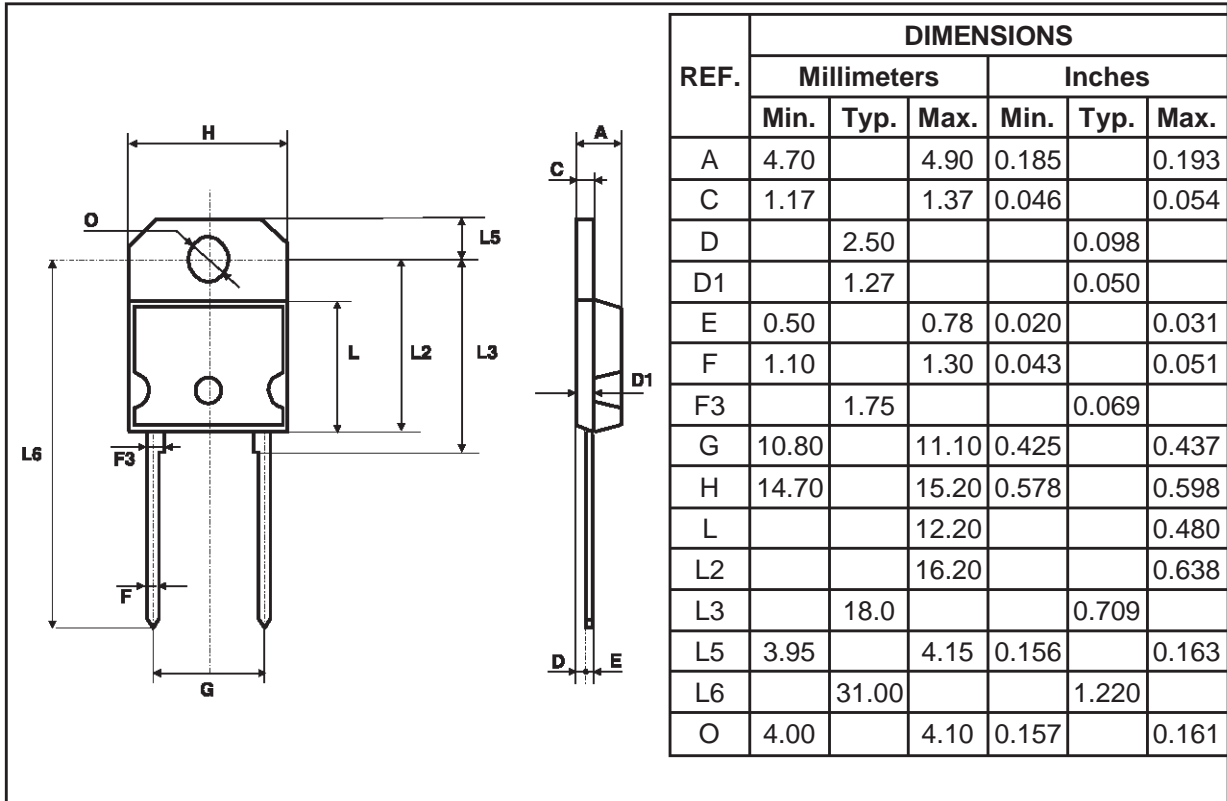


Fig. 20: Forward recovery time versus di_F/dt (90% confidence).



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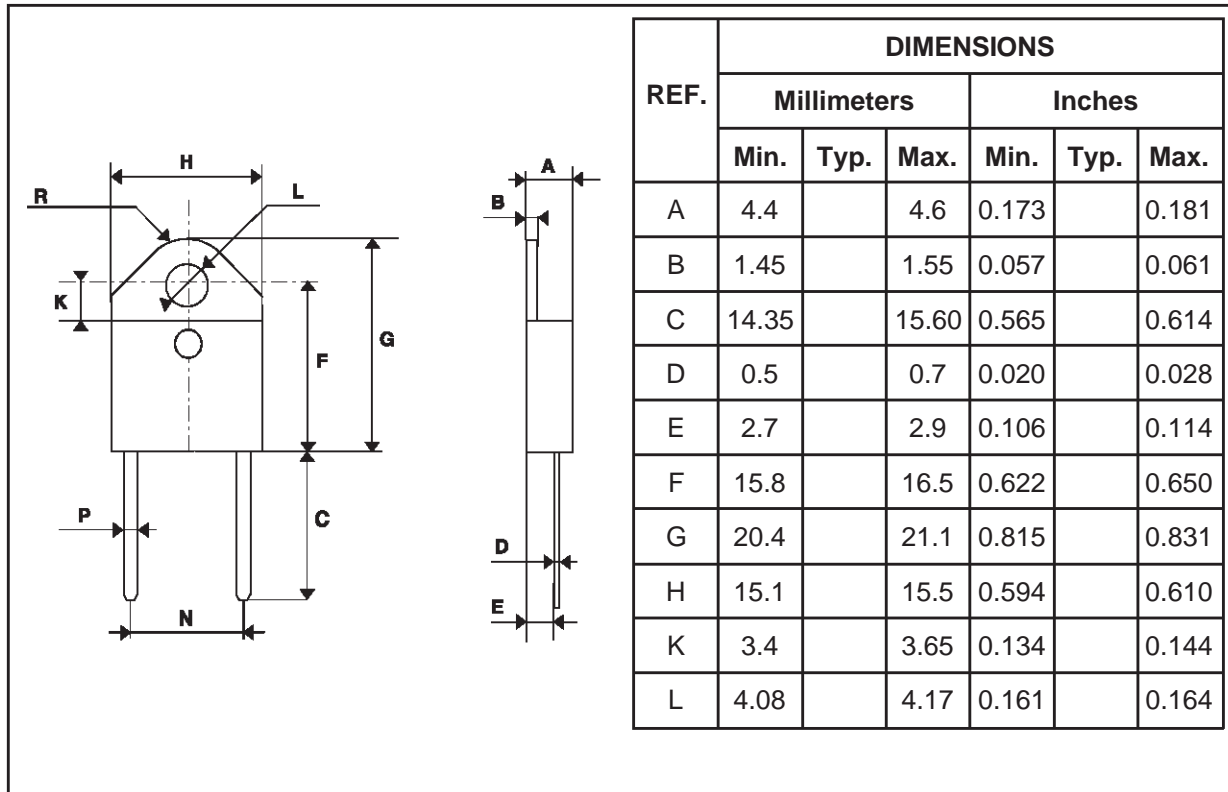
PACKAGE MECHANICAL DATA
SOD93



- **Marking:** Type number
- **Cooling method:** C
- **Weight:** 5.2 g
- **Recommended torque value:** 0.8 m.N
- **Maximum torque value:** 1.0 m.N

PACKAGE MECHANICAL DATA

DOP3I (isolated)



- **Marking:** Type number
- **Cooling method:** C
- **Weight:** 4.6 g
- **Recommended torque value:** 0.8 m.N
- **Maximum torque value:** 1.0 m.N

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