

TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

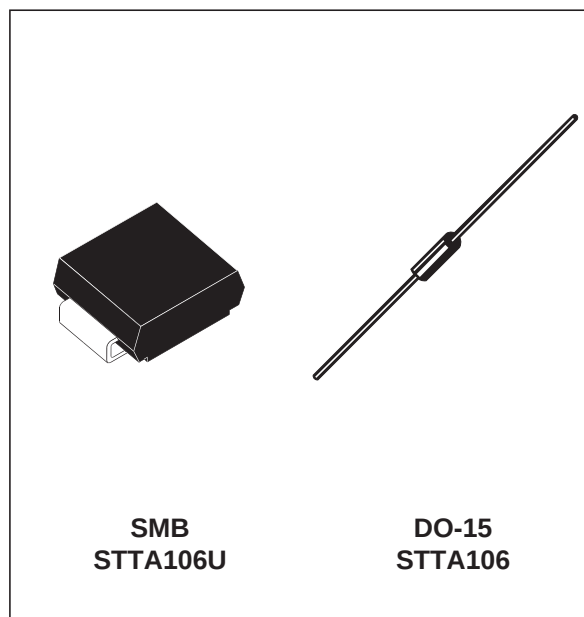
$I_{F(AV)}$	1A
V_{RRM}	600V
t_{rr} (typ)	20ns
V_F (max)	1.5V

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

DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes. TURBOSWITCH family drastically cuts losses in both the diode and the associated switching IGBT and MOSFET in all freewheel mode operations and is particularly suitable and efficient in motor



control freewheel applications and in booster diode applications in power factor control circuitries.

Available either in SMB or DO-15 axial package, these 600V devices are particularly intended for use on 240V domestic mains.

ABSOLUTE RATINGS (limiting values)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		600	V
$I_{F(RMS)}$	RMS forward current		6	A
I_{FRM}	Repetitive peak forward current	$t_p = 5 \mu s$ $F = 5 kHz$ square	10	A
I_{FSM}	Surge non repetitive forward current	$t_p = 10 ms$ sinusoidal	25	A
T_j	Maximum operating junction temperature		125	°C
T_{stg}	Storage temperature range		- 65 to + 150	°C

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THERMAL AND POWER DATA

Symbol	Parameter	Test conditions		Value	Unit
R _{th(j-l)}	Junction to lead		SMB	23	°C/W
	Junction to lead L=5mm		DO-15	45	°C/W
P ₁	Conduction power dissipation	I _{F(AV)} = 0.8A δ = 0.5 Tlead= 93°C	SMB	1.4	W
		I _{F(AV)} = 0.8A δ = 0.5 Tlead= 60°C	DO-15	1.4	W
P _{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tlead= 90°C	SMB	1.5	W
		Tlead= 60°C	DO-15	1.5	W

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_F^*	Forward voltage drop	$I_F = 1A$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		1.1	1.75 1.5	V
I_R^{**}	Reverse leakage current	$V_R = 0.8 \times V_{RRM}$ $T_j = 25^\circ C$ $T_j = 125^\circ C$		250	10 750	μA
V_{to}	Threshold voltage	$I_p < 3 \cdot I_{F(AV)}$ $T_j = 125^\circ C$			1.15	V
R_d	Dynamic resistance				350	m Ω

Test pulse : * $t_p = 380 \mu s$, $\delta < 2\%$ ** $t_p = 5 ms$, $\delta < 2\%$

To evaluate the maximum conduction losses use the following equation :

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

DYNAMIC ELECTRICAL CHARACTERISTICS
TURN-OFF SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A$ $I_R = 1A$ $I_{rr} = 0.25A$ $I_F = 1 A$ $di_F/dt = -50A/\mu s$ $V_R = 30V$		20	50	ns
I_{RM}	Maximum recovery current	$T_j = 125^\circ C$ $V_R = 400V$ $I_F = 1A$ $di_F/dt = -8 A/\mu s$ $di_F/dt = -50 A/\mu s$		1.6	0.6	A
S factor	Softness factor	$T_j = 125^\circ C$ $V_R = 400V$ $I_F = 1A$ $di_F/dt = -50 A/\mu s$		1.1		/

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	$T_j = 25^\circ C$ $I_F = 1 A$, $di_F/dt = 8 A/\mu s$ measured at $1.1 \times V_F \text{ max}$			500	ns
V_{Fp}	Peak forward voltage				10	V

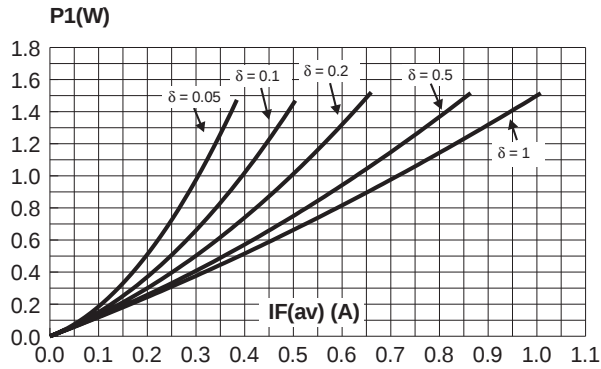
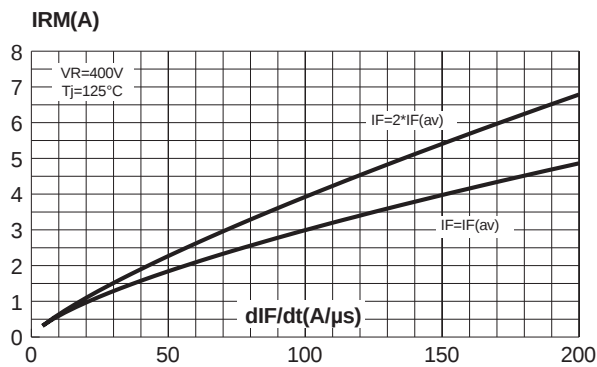
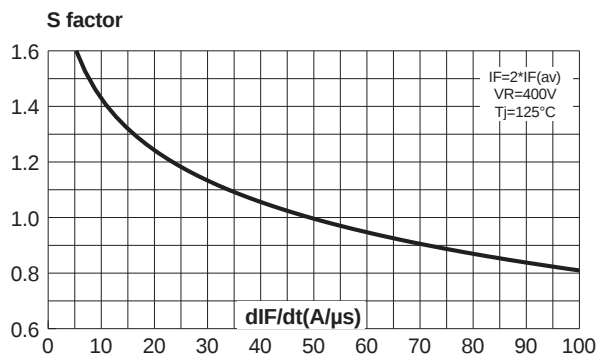
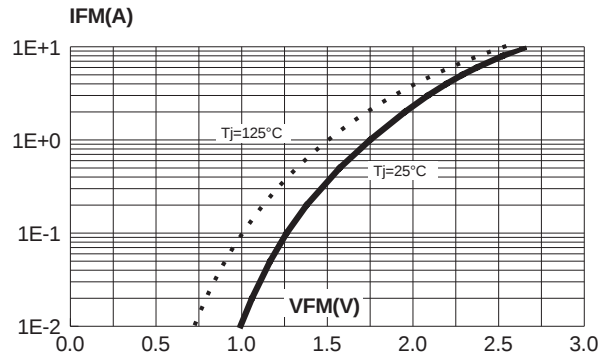
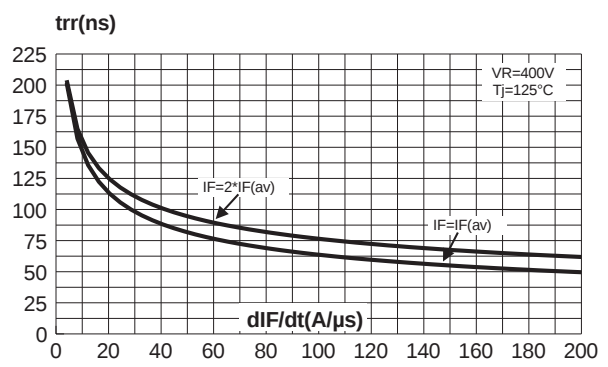
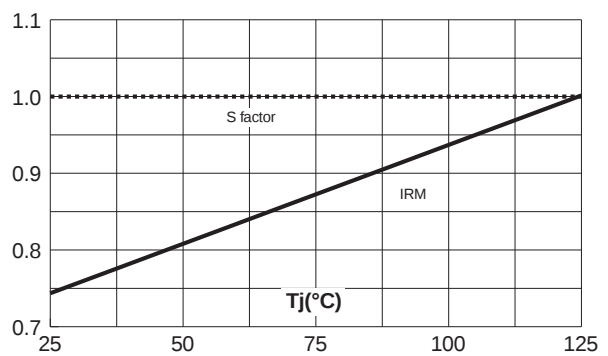
Fig. 1: Conduction losses versus average current.**Fig. 3:** Peak reverse recovery current versus dI_F/dt (90% confidence).**Fig. 5:** Softness factor (t_b/t_a) versus dI_F/dt (typical values).**Fig. 2:** Forward voltage drop versus forward current (maximum values).**Fig. 4:** Reverse recovery time versus dI_F/dt (90% confidence).**Fig. 6:** Relative variation of dynamic parameters versus junction temperature (reference $T_j = 125^\circ\text{C}$). (Reference: $T_j = 125^\circ\text{C}$)

Fig. 7: Transient peak forward voltage versus dI_F/dt (90% confidence).

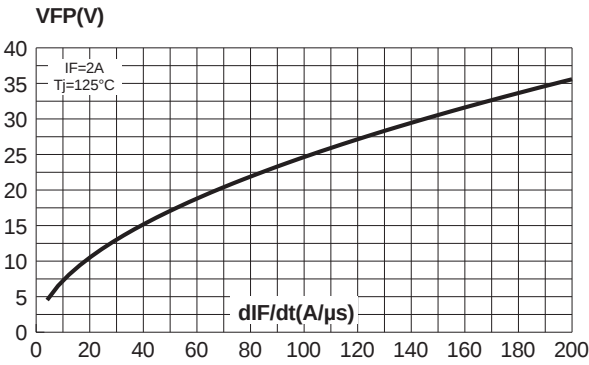


Fig. 8: Forward recovery time versus dI_F/dt (90% confidence).

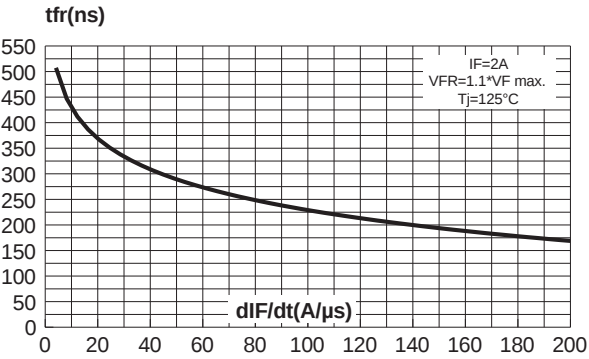
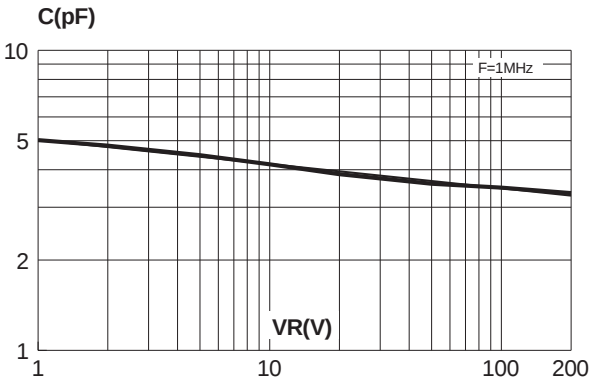


Fig. 9: Junction capacitance versus reverse voltage applied (typical values).



APPLICATION DATA

The TURBOSWITCH™ is especially designed to provide the lowest overall power losses in any “Freewheel Mode” application (see fig. A) considering both diode and companion transistor, thus optimizing the overall performance in the end application.

The way of calculating the power losses is given below :

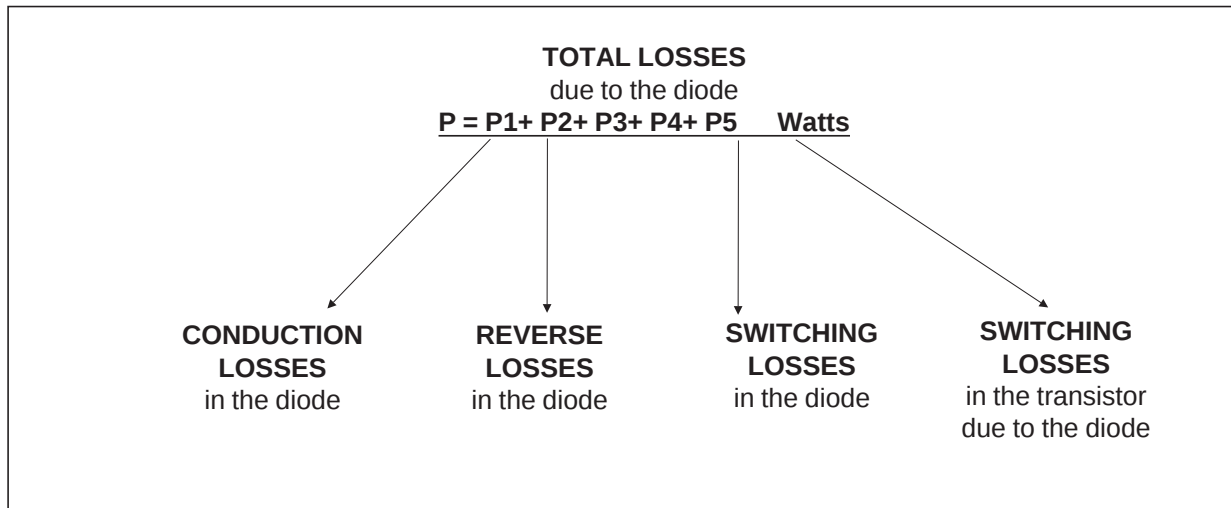
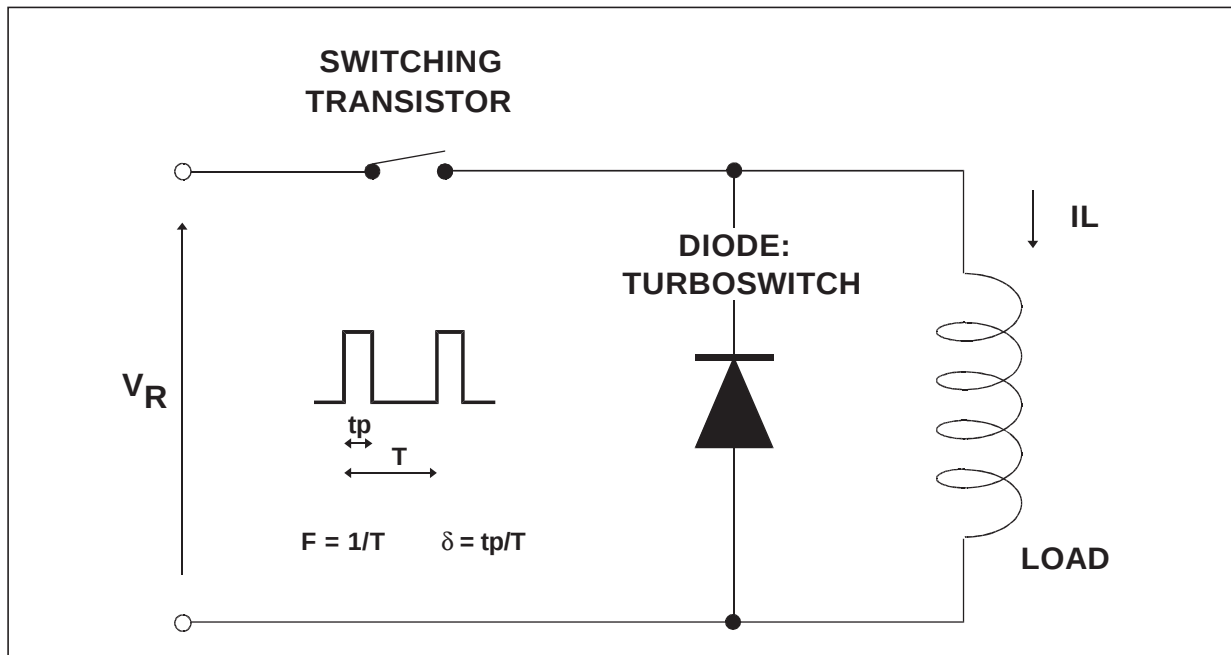
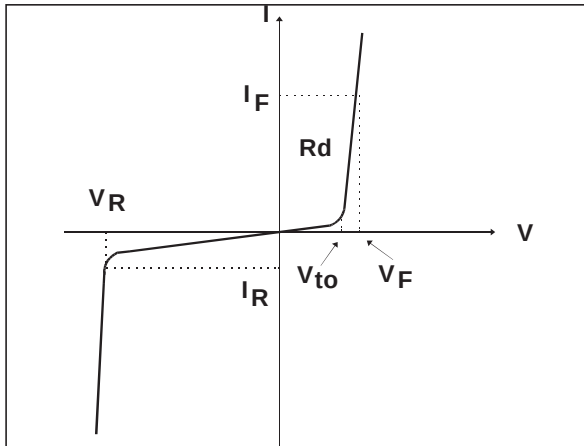


Fig. A : “FREEWHEEL” MODE



APPLICATION DATA (Cont'd)

Fig. B : STATIC CHARACTERISTICS



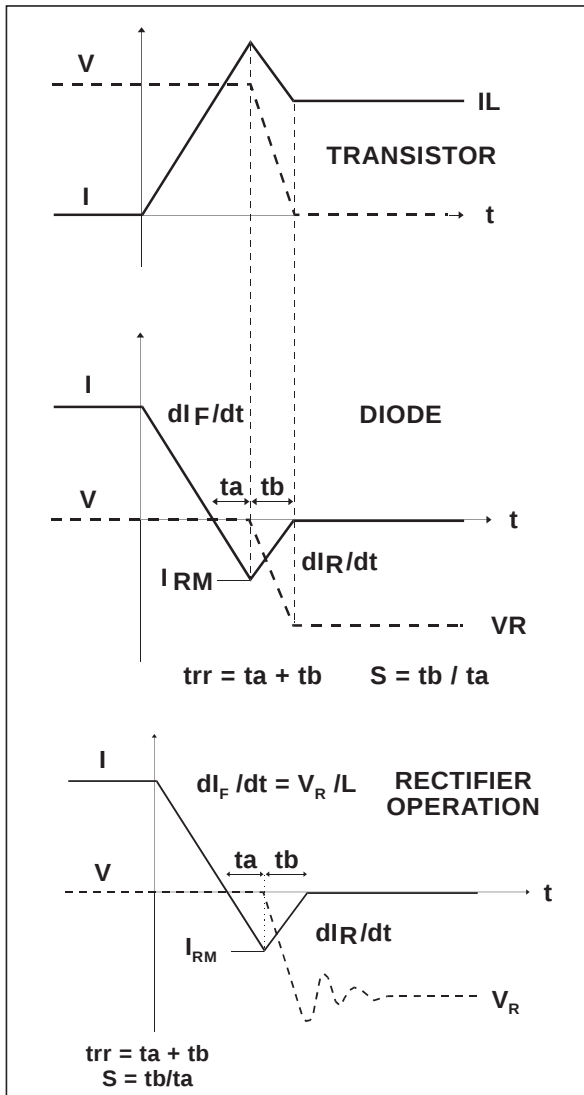
Conduction losses :

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

Reverse losses :

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

Fig. C : TURN-OFF CHARACTERISTICS



Turn-on losses :

(in the transistor, due to the diode)

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

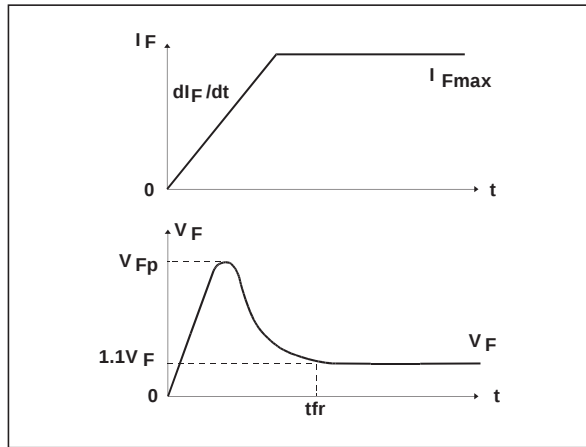
Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

APPLICATION DATA (Cont'd)

Fig. D : TURN-ON CHARACTERISTICS



Turn-on losses :

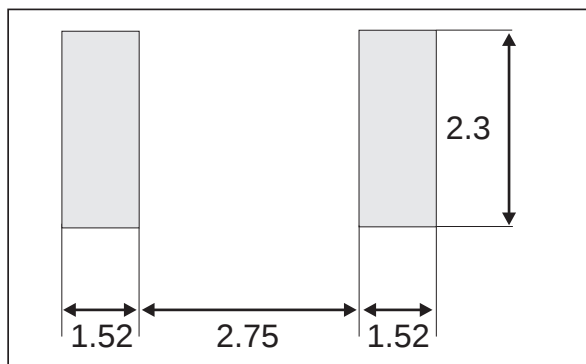
$$P_4 = 0.4 (V_{FP} - V_F) \times I_{Fmax} \times t_{fr} \times F$$

PACKAGE MECHANICAL DATA

SMB

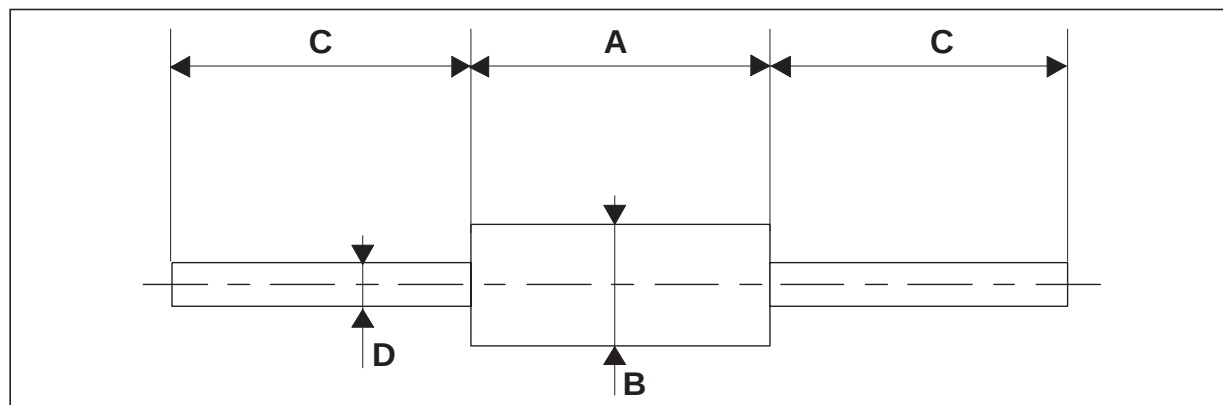
REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.41	0.006	0.016
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
D	3.30	3.95	0.130	0.156
L	0.75	1.60	0.030	0.063

FOOTPRINT DIMENSIONS (in millimeters)



PACKAGE MECHANICAL DATA

DO-15



REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	6.05	6.75	0.238	0.266
B	2.95	3.53	0.116	0.139
C	26	31	1.024	1.220
D	0.71	0.88	0.028	0.035

MARKING

Type	Marking	Package	Weight	Base Qty	Delivery mode
STTA106U	T01	SMB	0.1 g	2500	tape & reel
STTA106	STTA106	DO-15	0.4 g	1000	Ammopack
STTA106RL	STTA106	DO-15	0.4 g	6000	tape & reel

- Band indicates cathode
- Epoxy meets UL94,V0

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