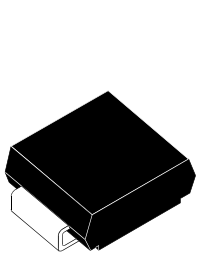
STTA106/U

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



SMB
STTA106U

F126
STTA106

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 particulary suitable and efficient in motor control freewheel applications and in booster diode applications in power factor control circuitries.

Available either in SMB or F126 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	tp = 5 µs F = 5kHz square	10	A
I_{FSM}	Surge non repetitive forward current	tp = 10 ms sinusoidal	25	A
T_j	Maximum operating junction temperature		125	°C
T_{stg}	Storage temperature range		- 65 to + 150	°C

TM : TURBOSWITCH is a trademark of STMicroelectronics

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		F126	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	F126	1.4	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tlead= 90°C	SMB	1.5	W
		Tlead= 60°C	F126	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 Tj = 125°C		 1.1	1.75 1.5	V
I_R **	Reverse leakage current	V_R = 0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 250	10 750	µA
V_{to}	Threshold voltage	Ip < 3.$I_{F(AV)}$	Tj = 125°C			1.15	V
Rd	Dynamic resistance					350	mΩ

Test pulse : * tp = 380 µs, δ < 2%
** tp = 5 ms, δ < 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 I_F = 0.5 A I_R = 1A Irr = 0.25A I_F = 1 A dI_F/dt =-50A/µs V_R = 30V		20	 50	ns
I_{RM}	Maximum recovery current	Tj = 125°C VR = 400V I_F = 1A dI_F/dt = -8 A/µs dI_F/dt = -50 A/µs		 1.6	0.6	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F =1A dI_F/dt = -50 A/µs		1.1		/

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F = 1 A, dI_F/dt = 8 A/µs measured at 1.1 × V_F max			500	ns
V_{Fp}	Peak forward voltage				10	V

Fig. 1: Conduction losses versus average current.

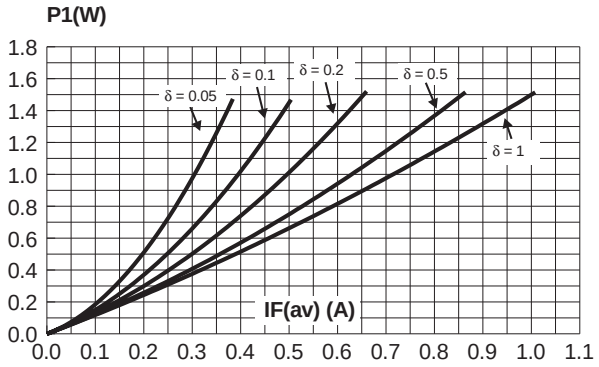


Fig. 2: Forward voltage drop versus forward current (maximum values).

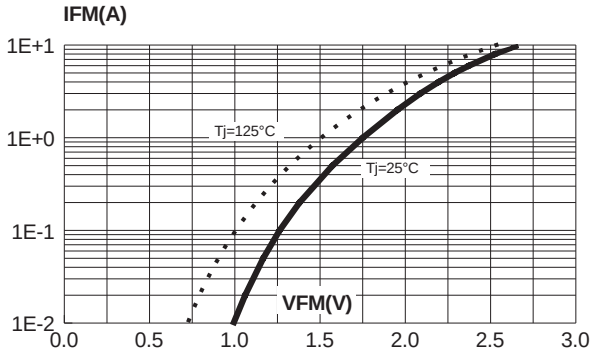


Fig. 3: Peak reverse recovery current versus dI_F/dt (90% confidence).

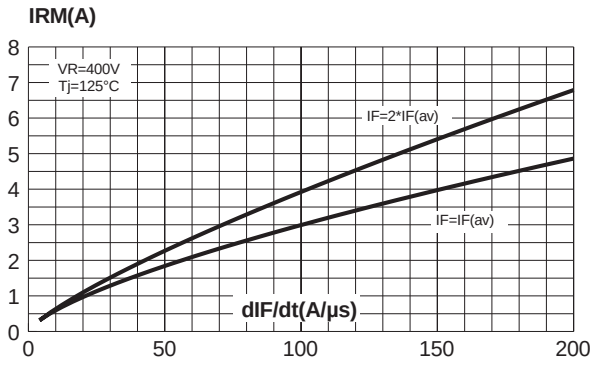


Fig. 4: Reverse recovery time versus dI_F/dt (90% confidence).

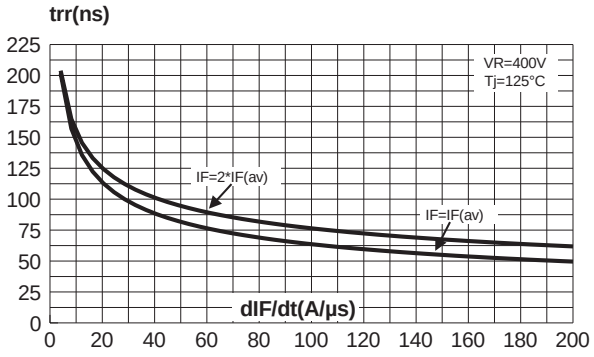


Fig. 5: Softness factor (tb/ta) versus dI_F/dt (typical values).

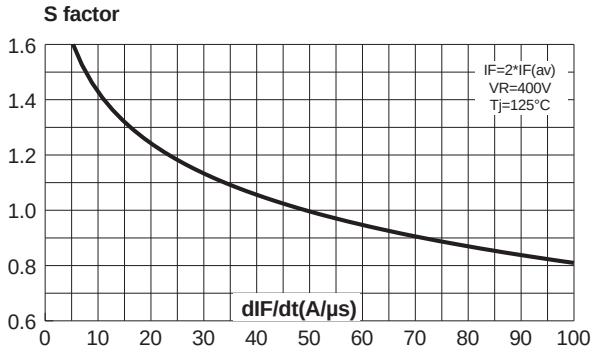


Fig. 6: Relative variation of dynamic parameters versus junction temperature (reference Tj = 125°C).

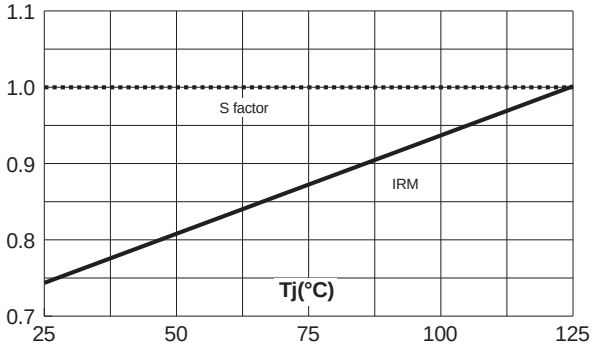


Fig. 7: Transient peak forward voltage versus dI_F/dt (90% confidence).

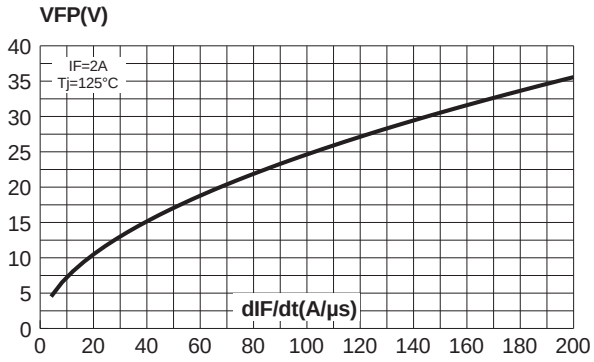


Fig. 8: Forward recovery time versus dI_F/dt (90% confidence).

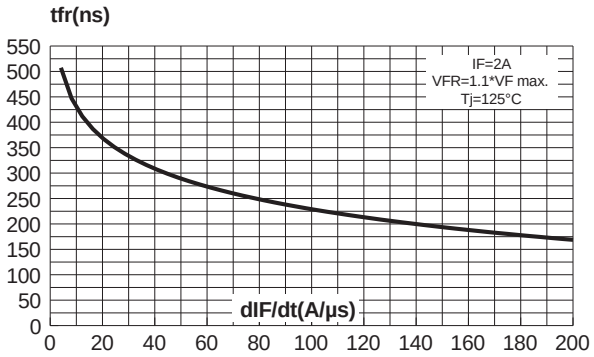
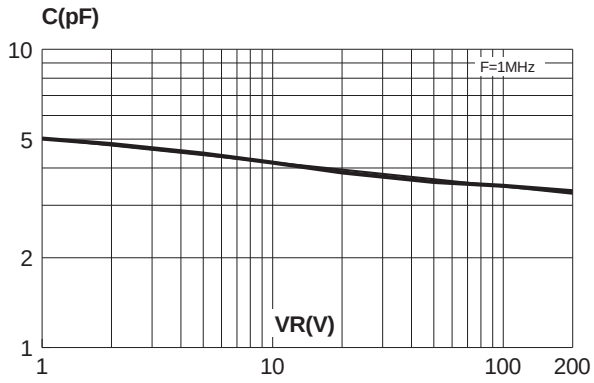


Fig. 9: Junction capacitance versus reverse voltage applied (typical values).



APPLICATION DATA

The TURBOSWITCH™ is especially designed to provide the lowest overall power losses in any "Freewhell 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 :

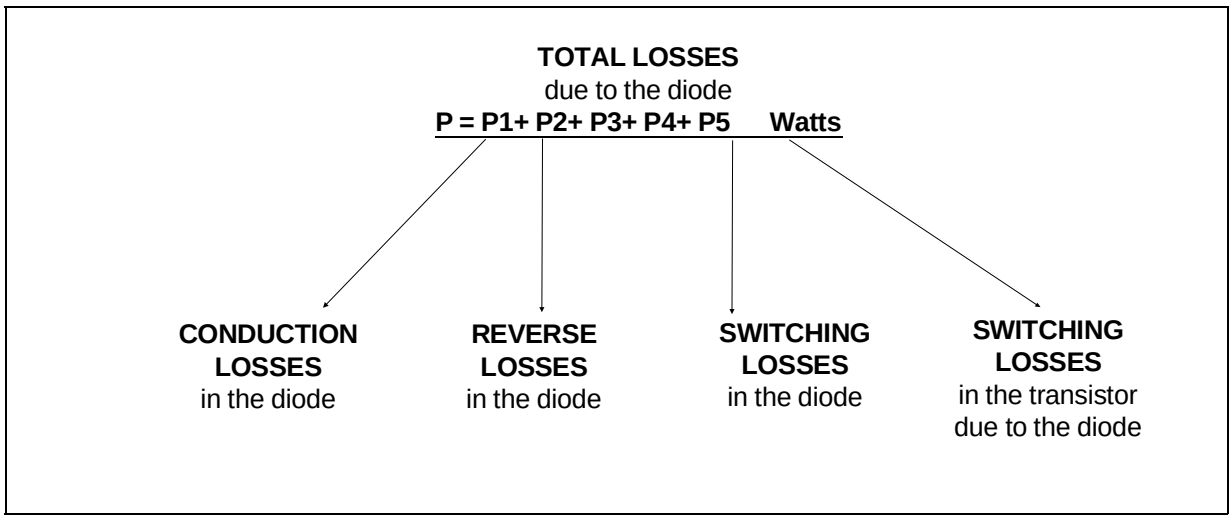
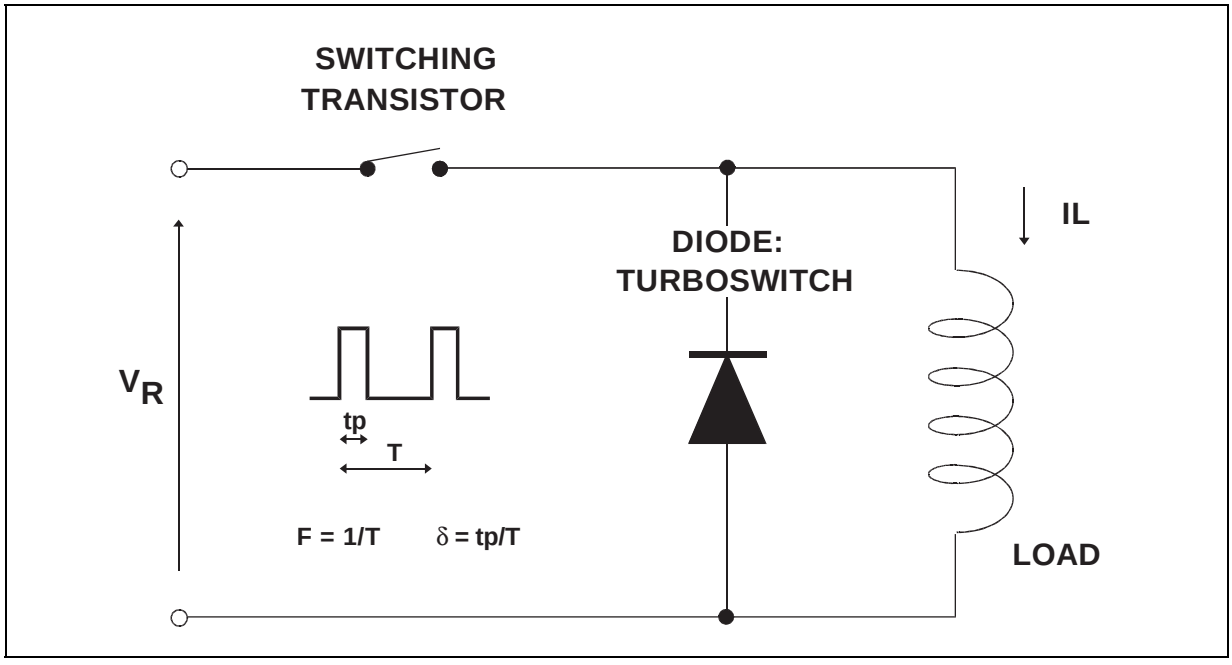
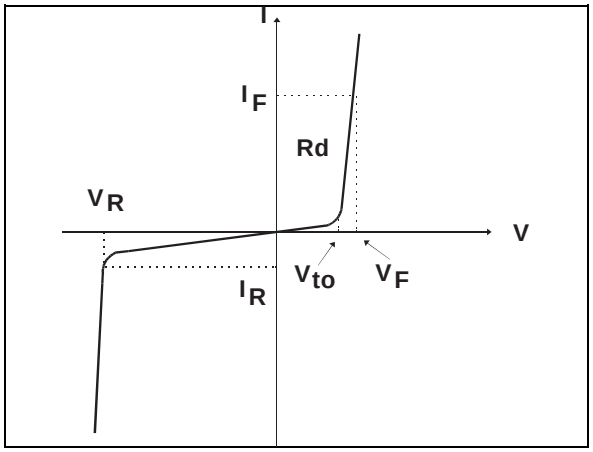


Fig. A : "FREEWHEEL" MODE



APPLICATION DATA (Cont'd)

Fig. B : STATIC CHARACTERISTICS



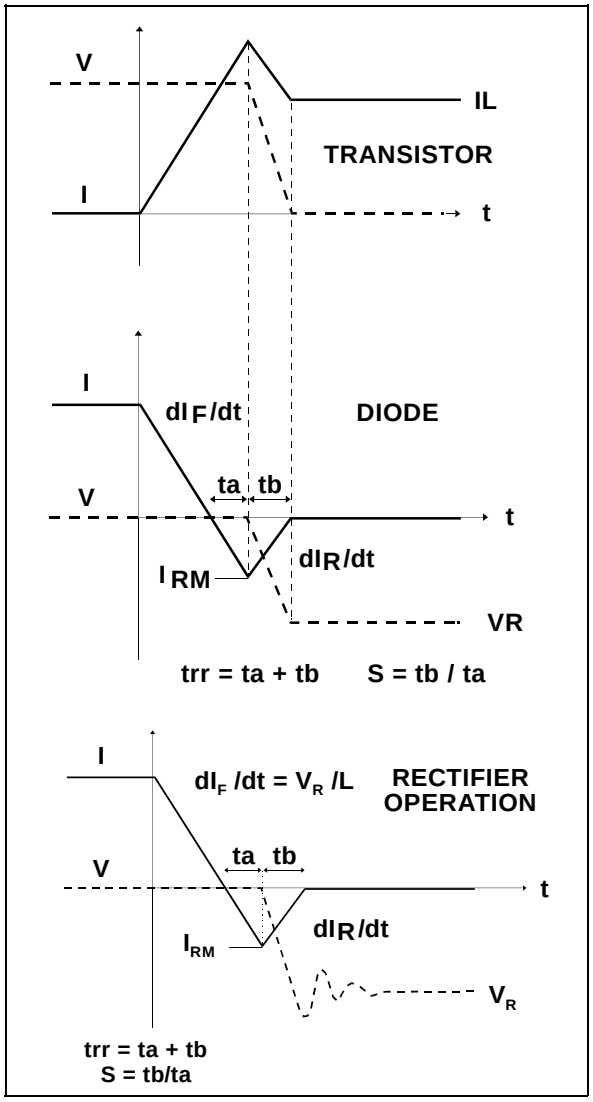
Conduction losses :

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

Reverse losses :

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

Fig. C : TURN-OFF CHARACTERISTICS



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

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

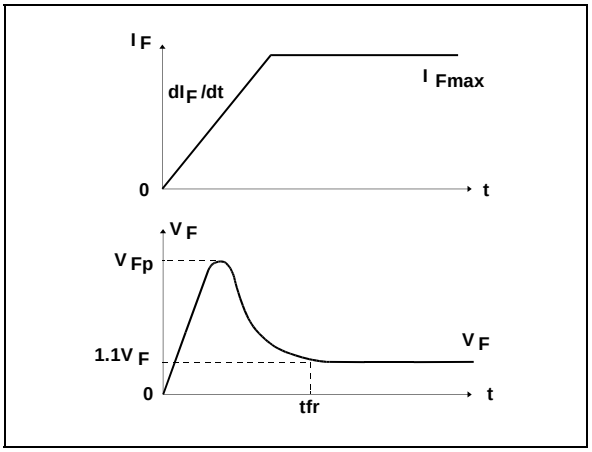
Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

APPLICATION DATA (Cont'd)

Fig. D : TURN-ON CHARACTERISTICS

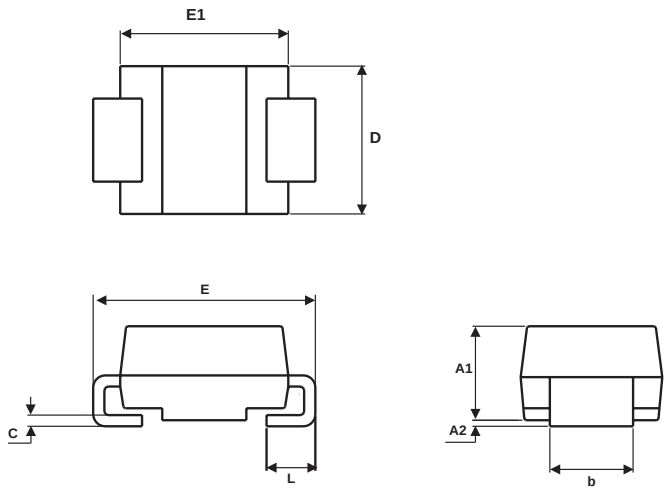


Turn-on losses :

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

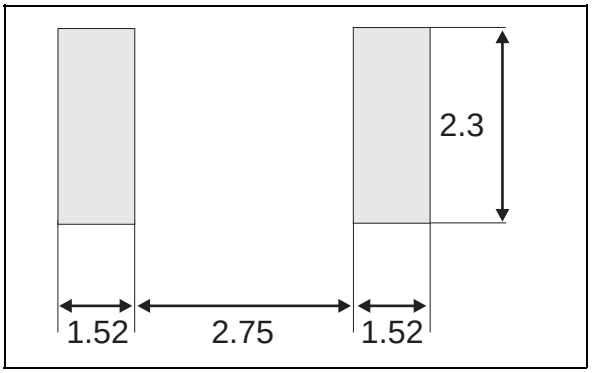
PACKAGE MECHANICAL DATA

SMB



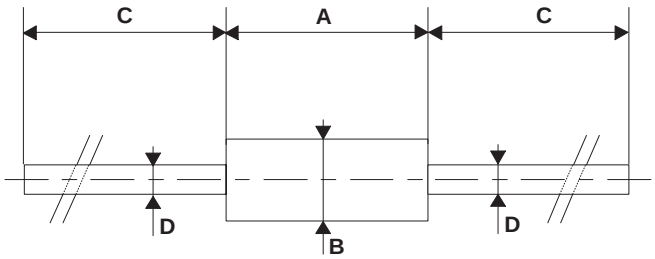
REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.41	0.006	0.016
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
D	3.30	3.95	0.130	0.156
L	0.75	1.60	0.030	0.063

FOOTPRINT DIMENSIONS (in millimeters)



PACKAGE MECHANICAL DATA

F126



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.05	6.20	6.35	0.238	0.244	0.250
B	2.95	3.00	3.05	0.116	0.118	0.120
C	26		31	1.024		1.220
D	0.76	0.81	0.86	0.030	0.032	0.034

MARKING

Type	Marking	Package	Weight	Base Qty	Delivery mode
STTA106U	T01	SMB	0.11g	2500	tape & reel
STTA106	STTA106	F126	0.39g	1000	box
STTA106RL	STTA106	F126	0.39g	6000	tape & reel

- Band indicates cathode
- Epoxy meets UL94,V0

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