STTA1212D

TURBOSWITCH ™ ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	12A
V_{RRM}	1200V
t_{rr} (typ)	50 ns
V_F (max)	2.0 V

FEATURES AND BENEFITS

- ULTRA-FAST, SOFT RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY AND/OR HIGH PULSED CURRENT OPERATION.
- HIGH REVERSE VOLTAGE CAPABILITY.
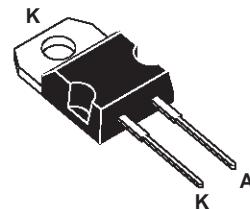
TO-220AC

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. They are also suitable for secondary of SMPS as high voltage rectifier diodes.

ABSOLUTE RATINGS (limiting values)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		1200	V
$I_{F(RMS)}$	RMS forward current		30	A
I_{FRM}	Repetitive peak forward current	$tp = 5\ \mu s$ F = 5kHz square	160	A
I_{FSM}	Surge non repetitive forward current	$tp = 10ms$ sinusoidal	100	A
T_{stg}	Storage temperature range		- 65 to + 150	℃
T_j	Maximum operating junction temperature		150	℃

THERMAL AND POWER DATA

Symbol	Parameter	Test conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance		1.9	°C/W
P_1	Conduction power dissipation	$I_{F(AV)} = 12A$ $\delta = 0.5$ Tc= 95°C	29.2	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	Tc= 89°C	32.1	W

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	$I_F = 12A$	Tj = 25°C Tj = 125°C		 1.35	2.2 2.0	V V
I_R **	Reverse leakage current	$V_R = 0.8$ x V_{RRM}	Tj = 25°C Tj = 125°C		 0.8	100 5.0	µA mA
Vto	Threshold voltage	$Ip < 3.I_{F(AV)}$	Tj = 125°C			1.57	V
Rd	Dynamic resistance					36	mΩ

Test pulses :   * tp = 380 µs, δ < 2%
                 ** tp = 5 ms , δ < 2%

To evaluate the maximum conduction losses use the following equation :
$P = V_{to} \times I_{F(AV)} + Rd \times I^2_{F(RMS)}$

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		50 	 100	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C VR = 600V I_F =12A dI_F/dt = -96 A/µs dI_F/dt = -500 A/µs		 30	 18	A
S factor	Softness factor	Tj = 125°C V_R = 600V I_F = 12A dI_F/dt = -500 A/µs		 1.2		/

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F =12 A, dI_F/dt = 96 A/µs measured at $1.1 \times$ VFmax			900	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =12A, dI_F/dt = 96 A/µs I_F =40A, dI_F/dt = 500 A/µs		 40	 30	V

Fig. 1: Conduction losses versus average current.

P1(W)
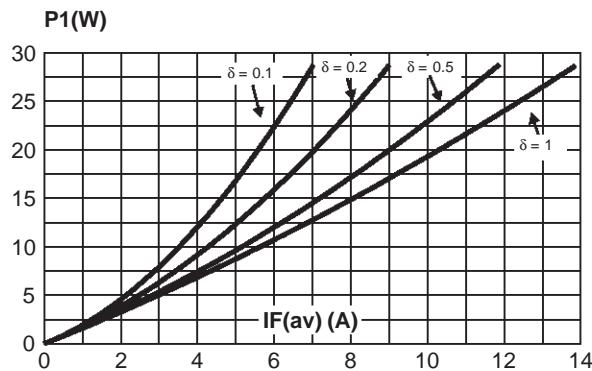
Fig. 2: Forward voltage drop versus forward current (maximum values).

IFM(A)
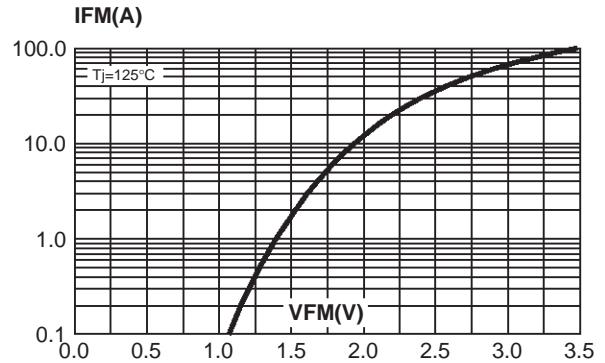
Fig. 3: Relative variation of thermal impedance junction to case versus pulse duration.

Zth(j-c)/Rth(j-c)
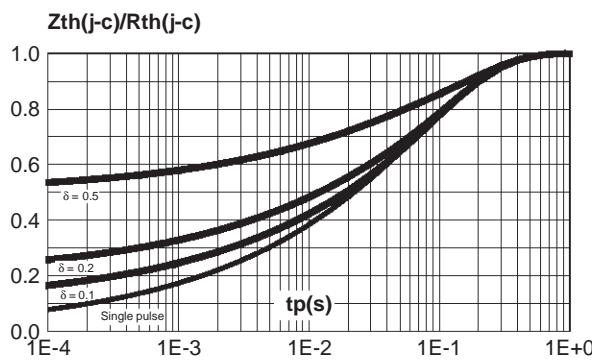
Fig. 4: Peak reverse recovery current versus dI$_F$/dt (90% confidence).

IRM(A)
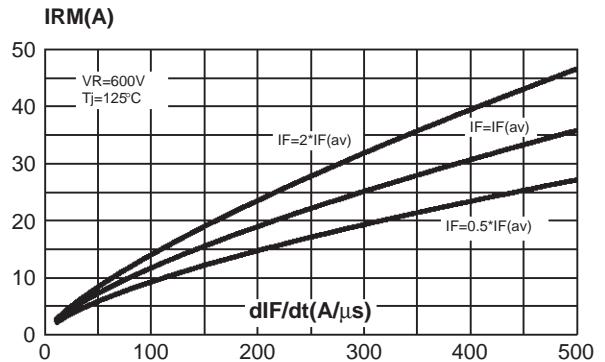
**Fig. 5:** Reverse recovery time versus dI$_F$/dt (90% confidence).

trr(ns)
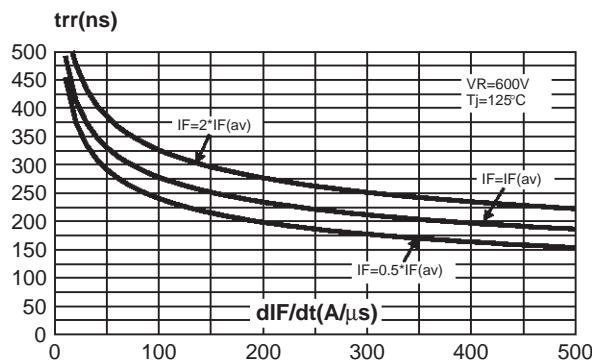
Fig. 6: Softness factor (tb/ta) versus dI$_F$/dt (typical values).

S factor
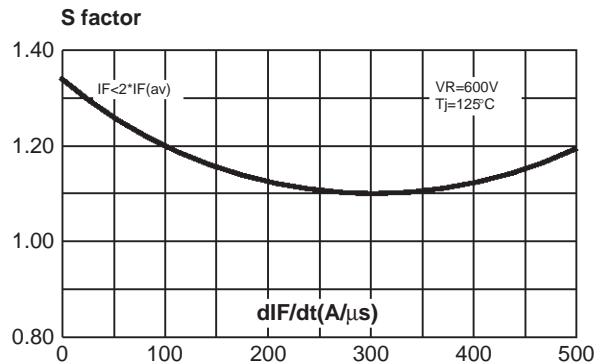
Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).
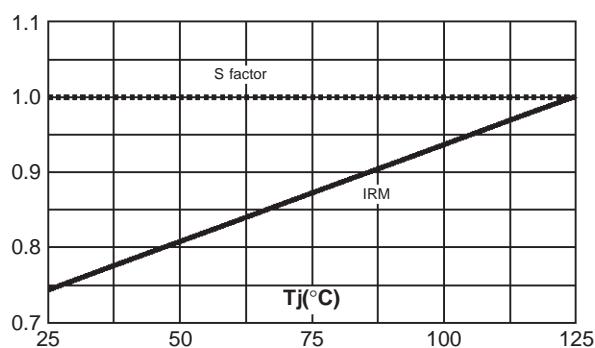
**Fig. 8:** Transient peak forward voltage versus dI$_F$/dt (90% confidence).
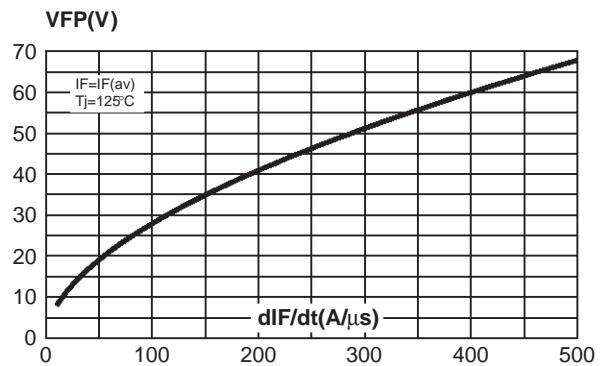
Fig. 9: Forward recovery time versus dI$_F$/dt (90% confidence).
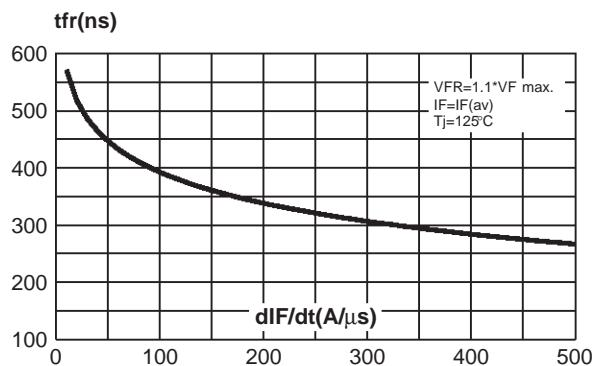
APPLICATION DATA

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 A to D),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 tansistor due to the diode |
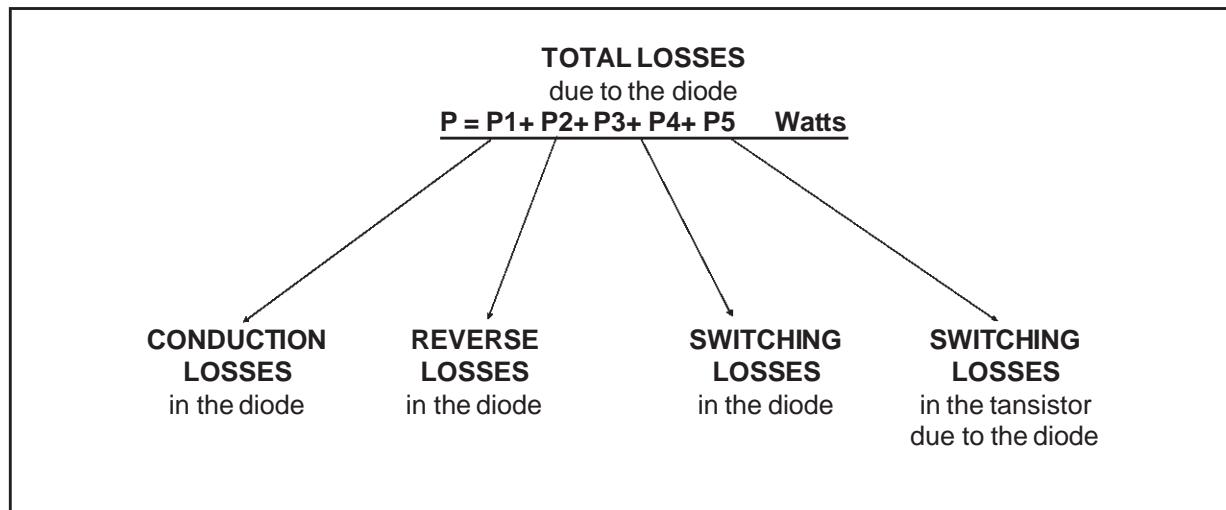
**Fig. A :** "FREEWHEEL" MODE.
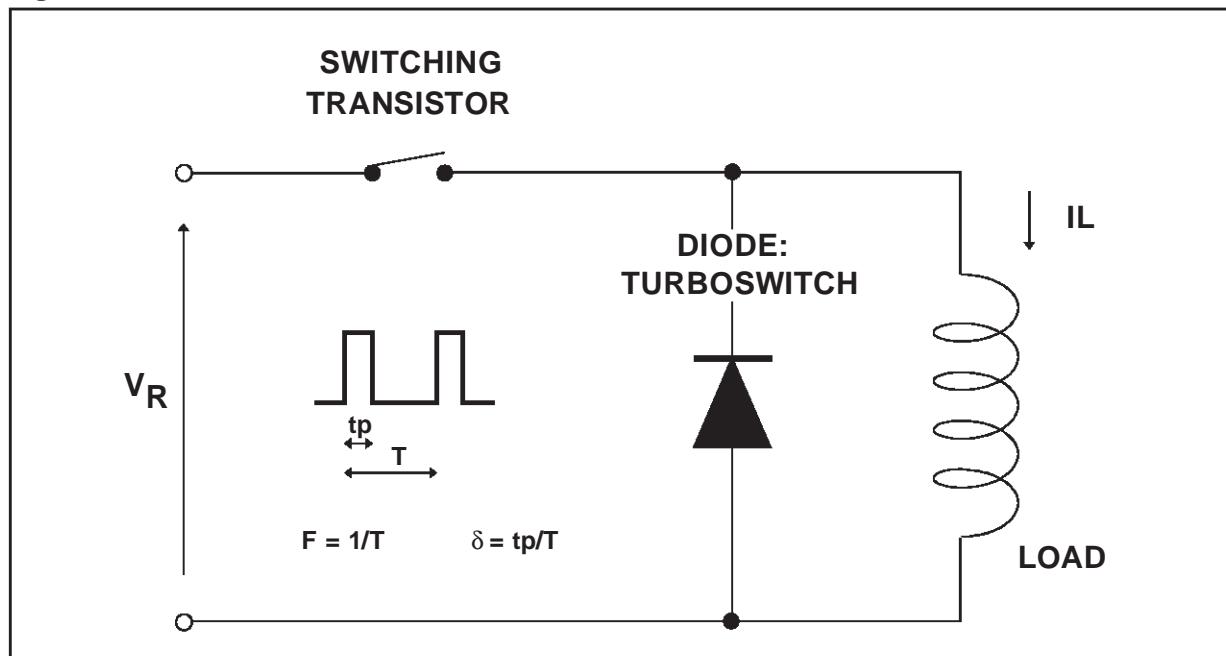
Fig. B : SNUBBER DIODE.
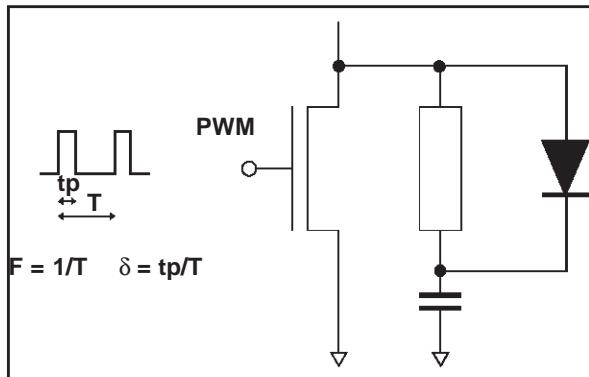


Fig. C : DEMAGNETIZING DIODE.
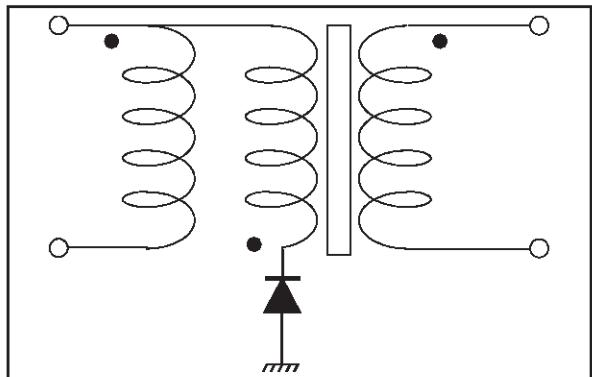
Fig. D : RECTIFIER DIODE.
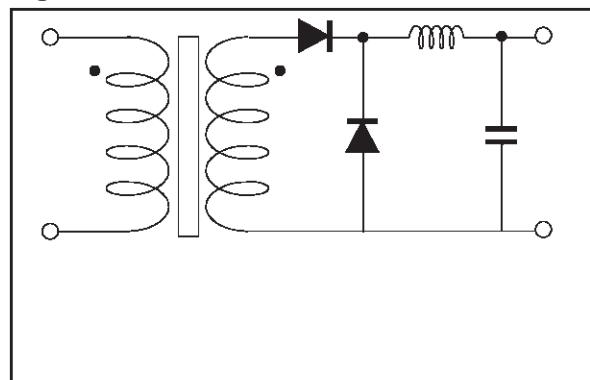
STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

**Fig. E:** STATIC CHARACTERISTICS
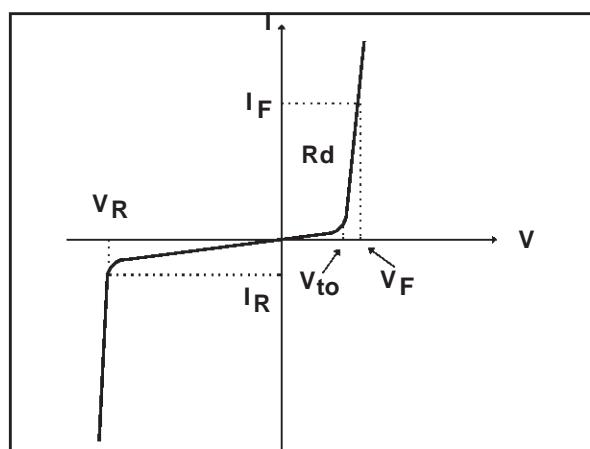
Conduction losses :

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

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. F: TURN-OFF CHARACTERISTICS
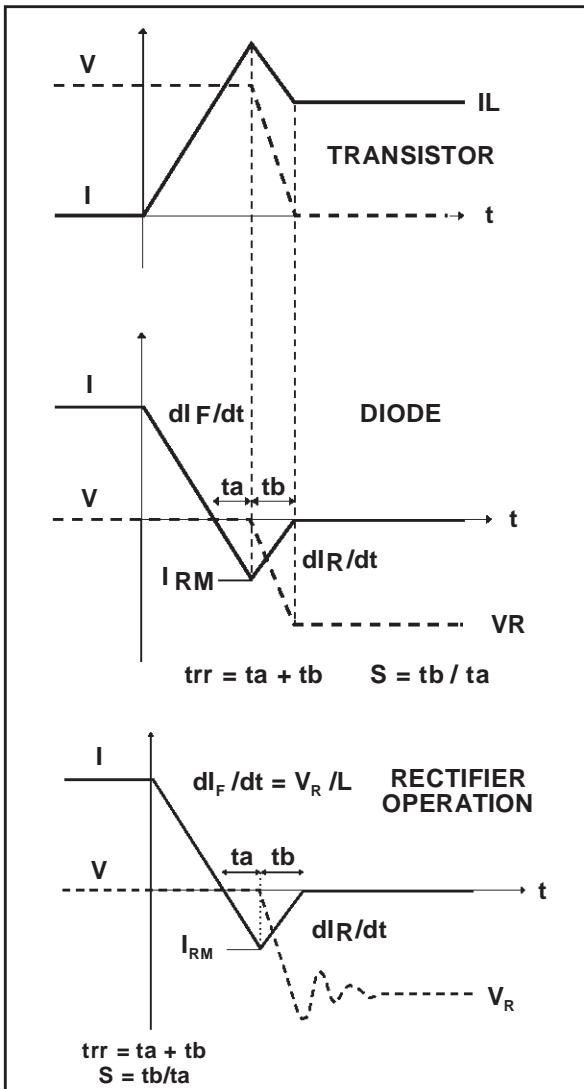
Turn-on losses :
(in the transistor, due to the diode)

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

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

Fig. G: TURN-ON CHARACTERISTICS
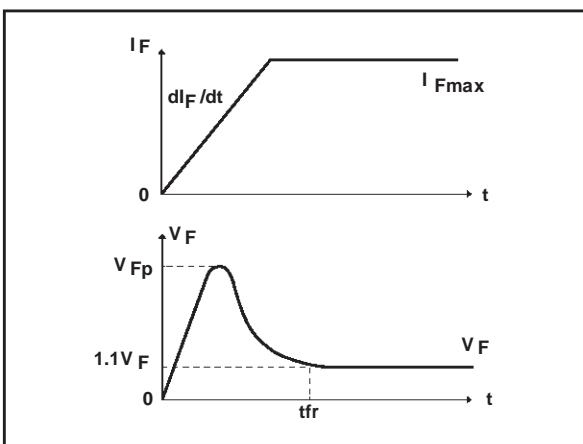
Turn-on losses :
P4 = 0.4 (V$_{FP}$ - V$_F$) . I$_{Fmax}$. t$_{fr}$. F

STTA1212D

PACKAGE DATA
TO-220AC (JEDEC outline)
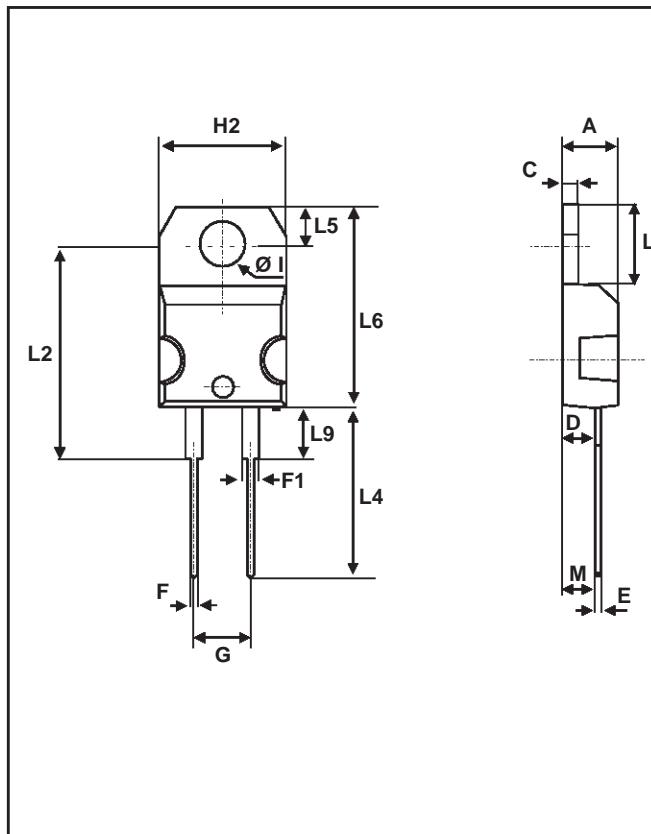
REF.	DIMENSIONS			
	Millimeters		**Inches**	
	Min.	**Max.**	**Min.**	**Max.**
A	4.40	4.60	0.173	0.181
C	1.23	1.32	0.048	0.051
D	2.40	2.72	0.094	0.107
E	0.49	0.70	0.019	0.027
F	0.61	0.88	0.024	0.034
F1	1.14	1.70	0.044	0.066
G	4.95	5.15	0.194	0.202
H2	10.00	10.40	0.393	0.409
L2	16.40 typ.		0.645 typ.	
L4	13.00	14.00	0.511	0.551
L5	2.65	2.95	0.104	0.116
L6	15.25	15.75	0.600	0.620
L7	6.20	6.60	0.244	0.259
L9	3.50	3.93	0.137	0.154
M	2.6 typ.		0.102 typ.	
Diam. I	3.75	3.85	0.147	0.151

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA1212D	STTA1212D	TO-220AC	1.86g	50	Tube

- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N.m.
- Maximum torque value: 0.70 N.m.
- Epoxy meets UL94,V0