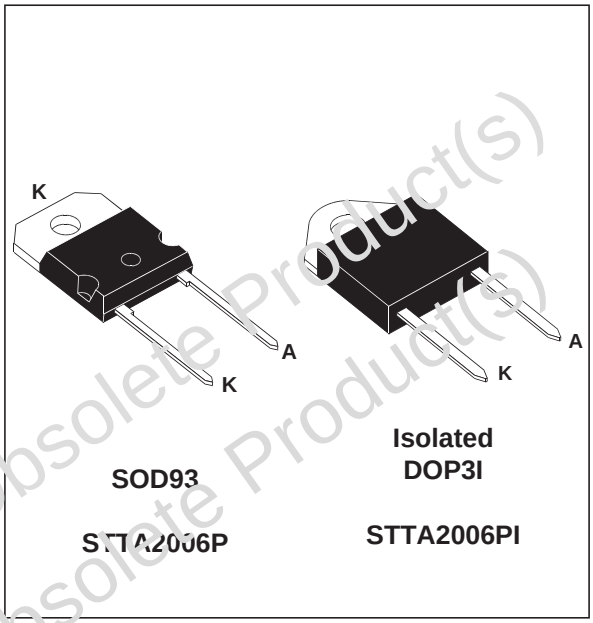
STTA2006P/PI

TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	20A
V_{RRM}	600V
t_{rr} (typ)	30ns
V_F (max)	1.5V



SOD93

STTA2006P

Isolated
DOP3I

STTA2006PI

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.
- INSULATED PACKAGE : DOP3I
  Electrical insulation : 2500V_{RMS}
  Capacitance < 12 pF

DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.
TURBOSWITCH family, drastically cuts losses in both the diode and the associated switching IGBT or 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.
Packaged either in SOD93 or in DOP3I, these

ABSOLUTE RATINGS (limiting values)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		600	V
V_{RSM}	Non repetitive peak reverse voltage		600	V
$I_{F(RMS)}$	RMS forward current		50	A
I_{FRM}	Repetitive peak forward current	tp = 5 µs F = 5kHz square	270	A
I_{FSM}	Surge non repetitive forward current	tp=10 ms sinusoidal	180	A
T_j	Maximum operating junction temperature		150	°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
$R_{th(j-c)}$	Junction to case thermal resistance	SOD93 DOP3I		1.5 2.1	°C/W
P_1	Conduction power dissipation $I_{F(AV)}$ = 20A δ =0.5	SOD93 DOP3I	Tc= 96°C Tc= 74°C	36	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	SOD93 DOP3I	Tc= 90°C Tc= 66°C	40	W

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =20A	Tj = 25°C Tj = 125°C		 1.25	1.75 1.5	V V
I_R **	Reverse leakage current	V_R =0.8 x V_{RRM}	Tj = 25°C Tj = 125°C		 2.5	100 6	µA mA
V_{to}	Threshold voltage	Ip < 3.I_{AV}	Tj = 125°C			1.15	V
rd	Dynamic resistance					17	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 = 1A dI_F/dt =-50A/µs V_R =30V		30	 60	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C VR = 400V I_F =20A dI_F/dt = -160 A/µs dI_F/dt = -500 A/µs		 17.5	12.5	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F =20A dI_F/dt = -500 A/µs		0.42		/

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F = 20A, dI_F/dt = 160 A/µs measured at, 1.1 × $V_F$max			600	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =20A, dI_F/dt = 160 A/µs			12	V

Fig. 1: Conduction losses versus average current.

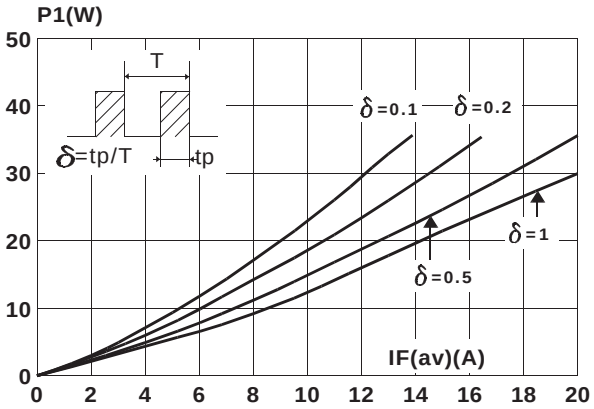


Fig. 2: Forward voltage drop versus forward current.

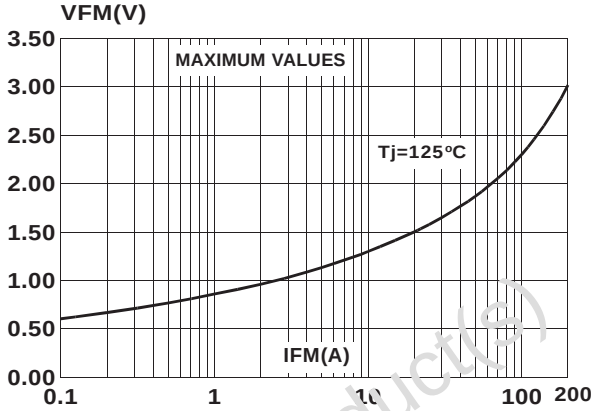


Fig. 3: Relative variation of thermal transient impedance junction to case versus pulse duration.

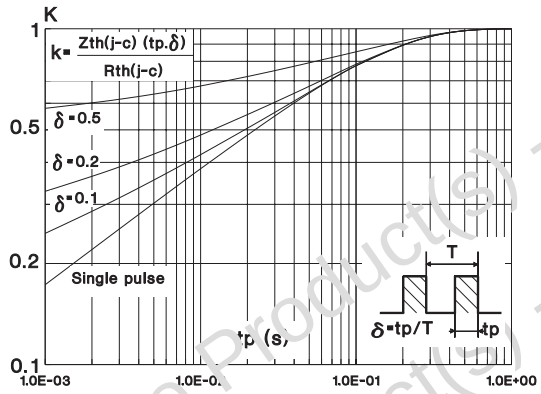


Fig. 4: Peak reverse recovery current versus dI_F/dt.

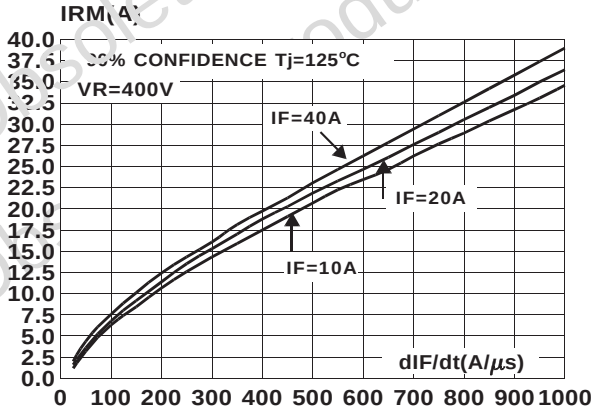


Fig. 5: Reverse recovery time versus dI_F/dt.

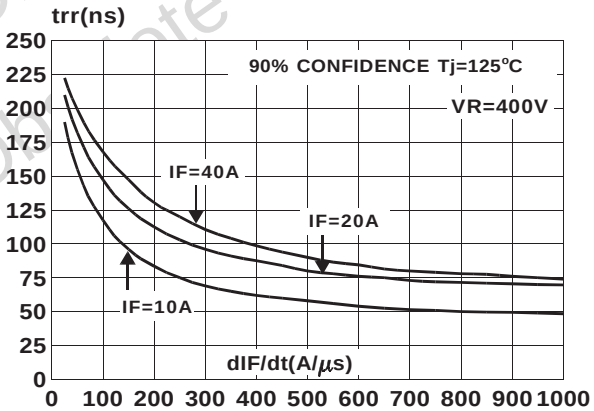


Fig. 6: Softness factor (tb/ta) versus dI_F/dt.

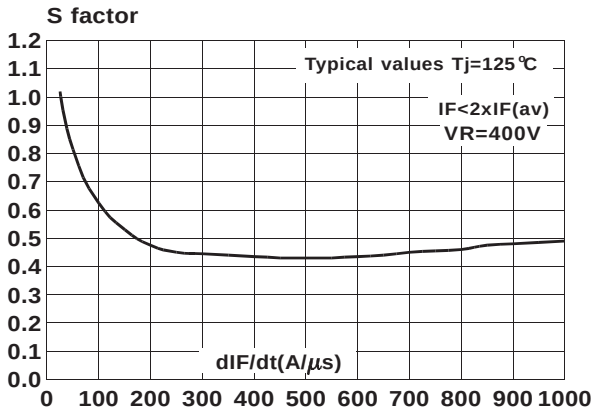


Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

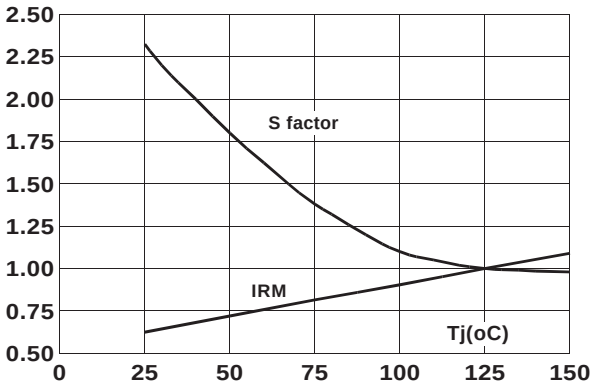


Fig. 9: Transcient peak forward voltage versus dI_F/dt.

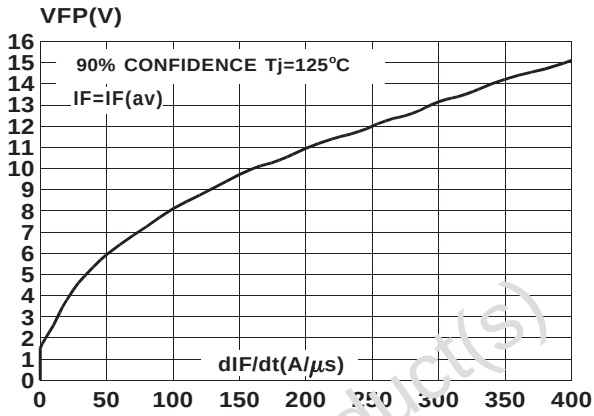
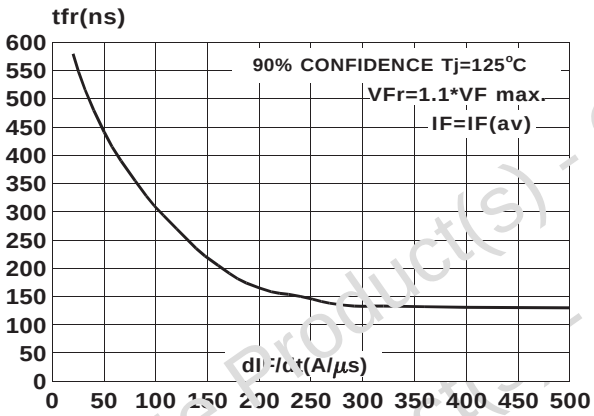


Fig. 9: Forward recovery time versus dI_F/dt.



APPLICATION DATA

The TURBOSWITCH is especially designed to provide the lowest overall power losses in any "FREEWHEEL Mode" application (Fig.A) considering both the diode and the companion transistor, thus optimizing the overall performance in the end application.
The way of calculating the power losses is given below:

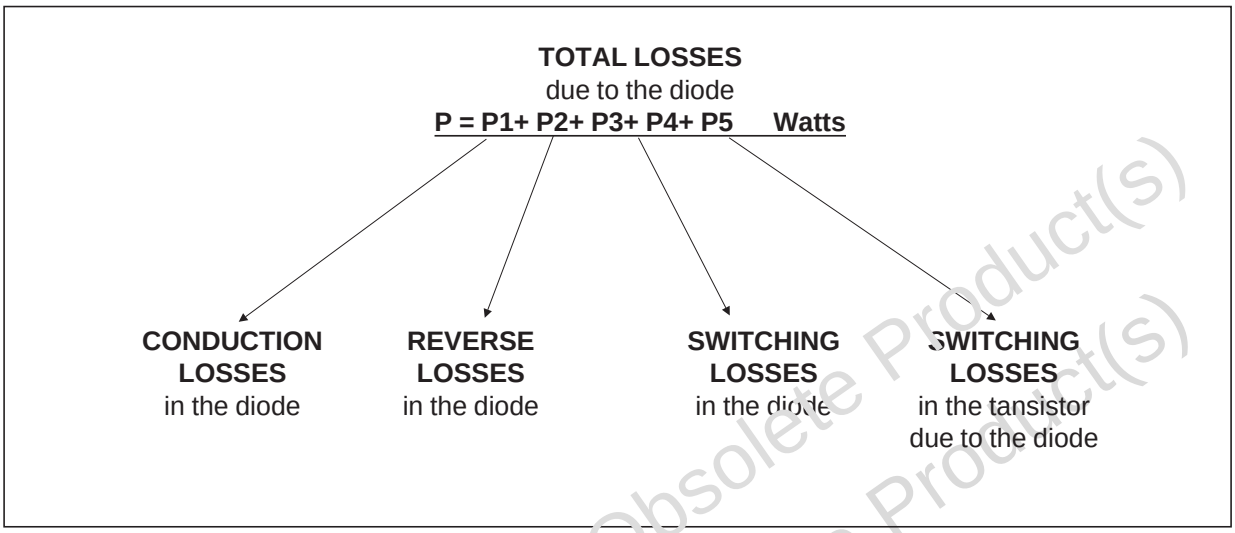
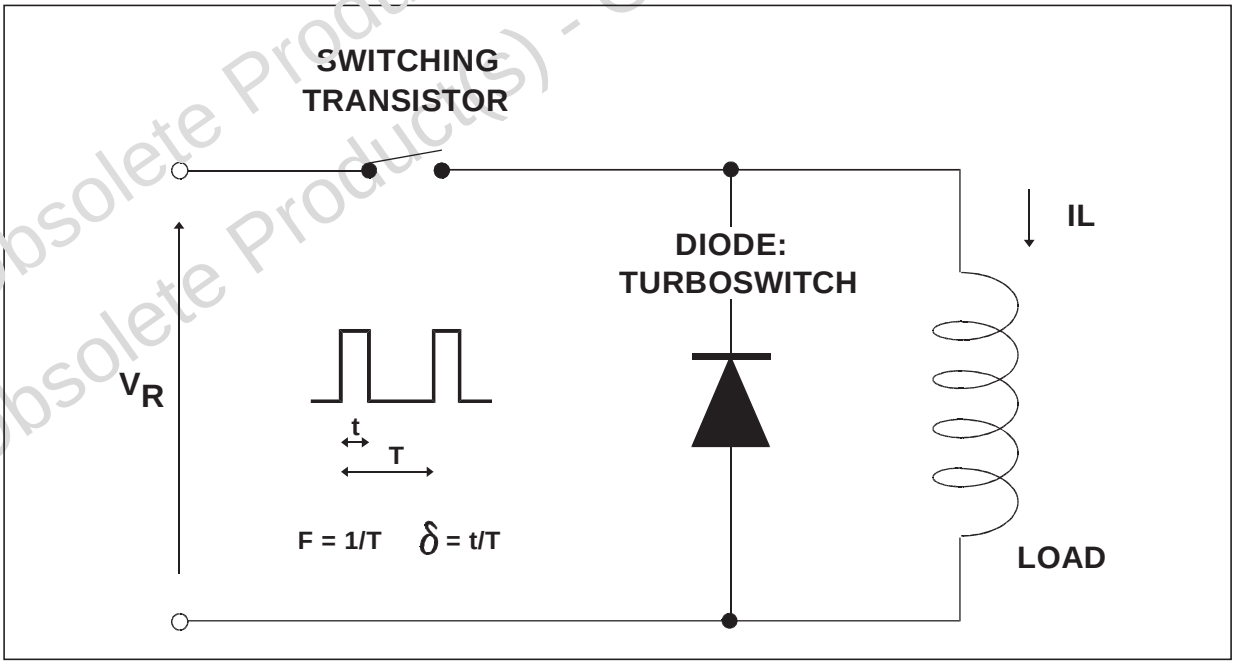
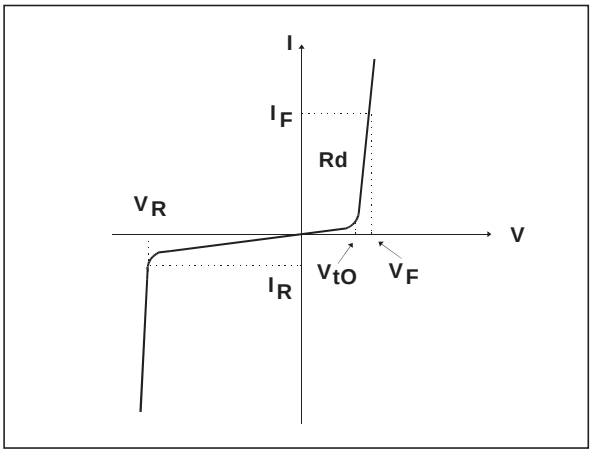


Fig. A : "FREEWHEEL" MODE



APPLICATION DATA (Cont'd)

Fig. B: STATIC CHARACTERISTICS



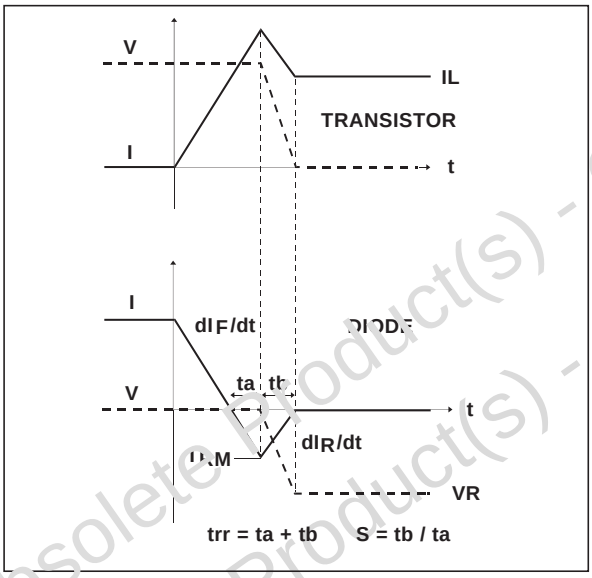
Conduction losses :

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

Reverse losses :

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

Fig. C: TURN-OFF CHARACTERISTICS



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

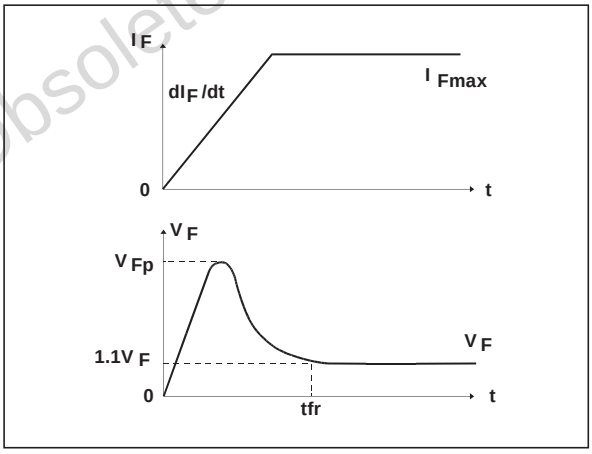
$$P5 = \frac{V_R \times I_{RM}{}^2 \times (3 + 2 \times S) \times F}{6 \; x \; dI_F / dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \; x \; dI_F / dt}$$

Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

Fig. D: TURN-ON CHARACTERISTICS

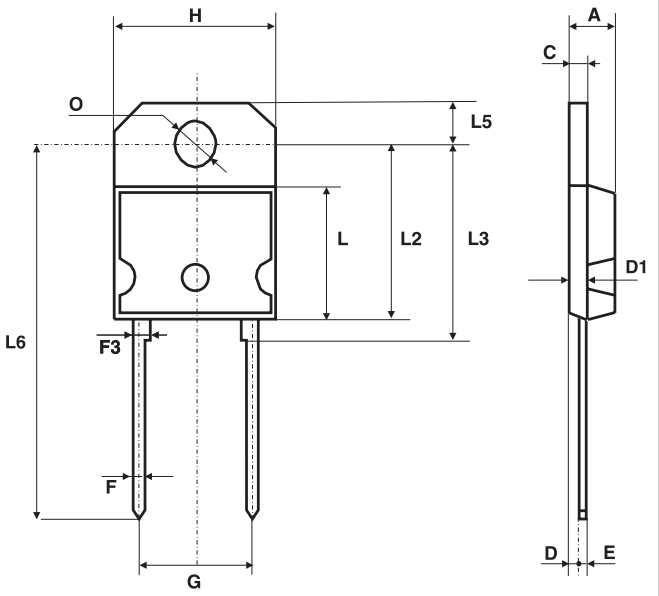


Turn-on losses :

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

PACKAGE MECHANICAL DATA

SOD93

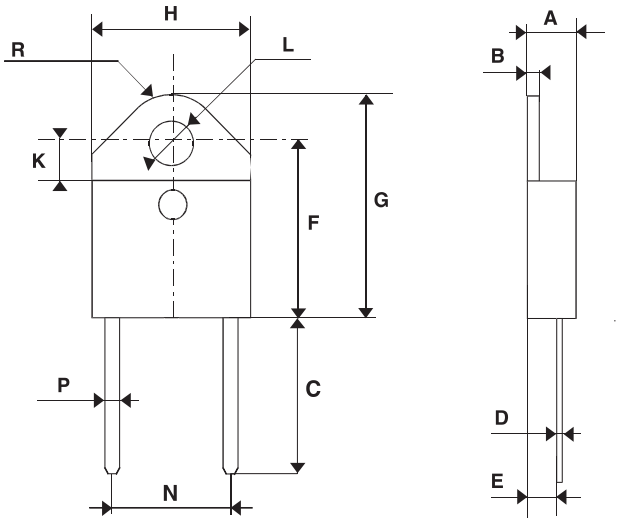


REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.70		4.90	0.185		0.193
C	1.17		1.37	0.046		0.054
D		2.50			0.098	
D1		1.27			0.050	
E	0.50		0.78	0.020		0.031
F	1.10		1.30	0.043		0.051
F3		1.75			0.069	
G	10.80		11.10	0.425		0.437
H	14.70		15.20	0.578		0.598
L			12.20			0.480
L2			16.20			0.638
L3		18.0			0.709	
L5	3.95		4.15	0.156		0.163
L6		31.00			1.220	
O	4.00		4.10	0.157		0.161

- Cooling method : by conduction (C)
- Recommended torque value : 0.8 m.N
- Maximum torque value : 1.0 m.N

PACKAGE DATA

DOP3I ISOLATED



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.4		4.6	0.173		0.181
B	1.45		1.55	0.057		0.061
C	14.35		15.60	0.565		0.614
D	0.5		0.7	0.020		0.028
E	2.7		2.9	0.106		0.114
F	15.8		16.5	0.622		0.650
G	20.4		21.1	0.815		0.831
H	15.1		15.5	0.594		0.610
K	3.4		3.65	0.134		0.144
L	4.08		4.17	0.161		0.164
N	10.8		11.3	0.425		0.444
P	1.20		1.40	0.047		0.055
?		4.60			0.181	

- Cooling method : by conduction (C)
- Recommended torque value : 0.8 m.N.
- Maximum torque value : 1.0 m.N.

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA2006P	STTA2006P	SOD93	3.79g	30	Tube
STTA2006PI	STTA2006PI	DOP3I	4.52g	120	Bulk

- Epoxy meets UL94,V0