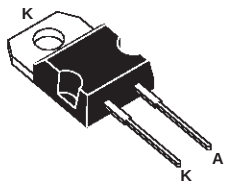
STTA506D/F/B

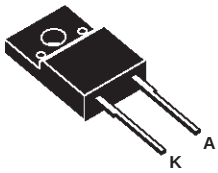
TURBOSWITCH ™ ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCTS CHARACTERISTICS

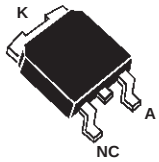
$I_{F(AV)}$	5A
V_{RRM}	600V
t_{rr} (typ)	20ns
V_F (max)	1.5V



TO-220AC
STTA506D



ISOWATT220AC
STTA506F



DPAK
STTA506B

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: ISOWATT220AC
  Electrical insulation : 2000VDC
  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 TO-220AC, ISOWATT220AC or in DPAK, 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
V_{RSM}	Non repetitive peak reverse voltage		600	V
$I_{F(RMS)}$	RMS forward current	TO-220AC ISOWATT220AC	20	A
		DPAK	10	A
I_{FRM}	Repetitive peak forward current	tp=5µs F=5kHz square	65	A
I_{FSM}	Surge non repetitive forward current	tp=10 ms sinusoidal	55	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	TO-220AC/ DPAK ISOWATT220AC		3.5 6.0	°C/W
P_1	Conduction power dissipation • $I_{F(AV)}$ = 5A δ =0.5	TO-220AC/ DPAK ISOWATT220AC	Tc= 118°C Tc= 96°C	9	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	TO-220AC/ DPAK ISOWATT220AC	Tc= 115°C Tc= 90°C	10	W

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =5A	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		 0.75	100 2	µA mA
V_{to}	Threshold voltage	Ip < 3.I_{AV}	Tj = 125°C			1.15	V
rd	Dynamic resistance					70	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 reverse recovery current	Tj = 125°C VR = 400V I_F =5A dI_F/dt = -40 A/µs dI_F/dt = -500 A/µs		 11	3.0	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F =5A dI_F/dt = -500 A/µs		0.55		-

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F =5 A, dI_F/dt = 40 A/µs measured at 1.1 × $V_F$max			500	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =5A, dI_F/dt = 40 A/µs			10	V

Fig. 1: Switching OFF losses versus dI/dt.

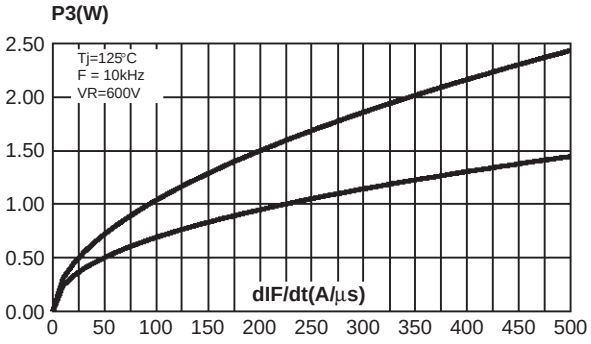


Fig. 2: Forward voltage drop versus forward current.

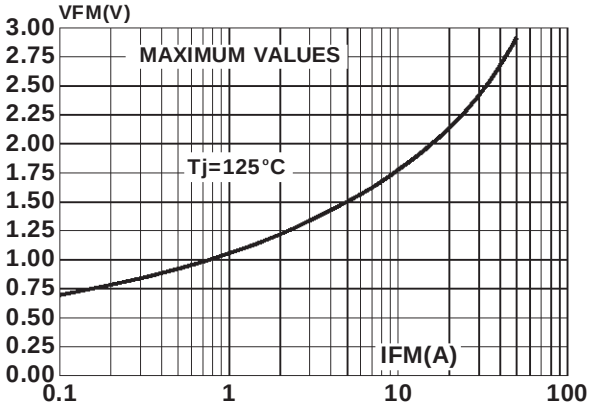


Fig. 3: Peak reverse recovery current versus dI_F/dt.

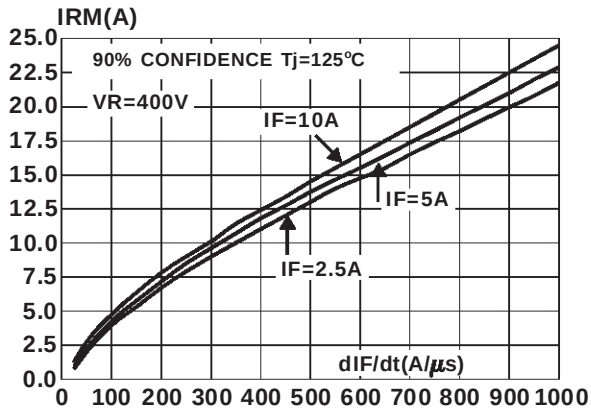


Fig. 4: Reverse recovery time versus dI_F/dt.

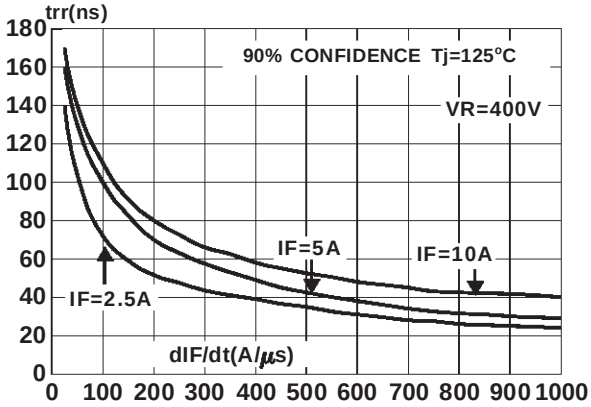


Fig. 5: Softness factor (tb/ta) versus dI_F/dt.

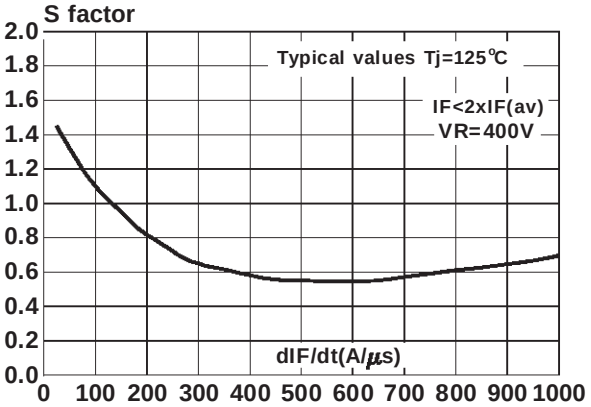


Fig. 6: Relative variation of dynamic parameters versus junction temperature (reference Tj = 125°C).

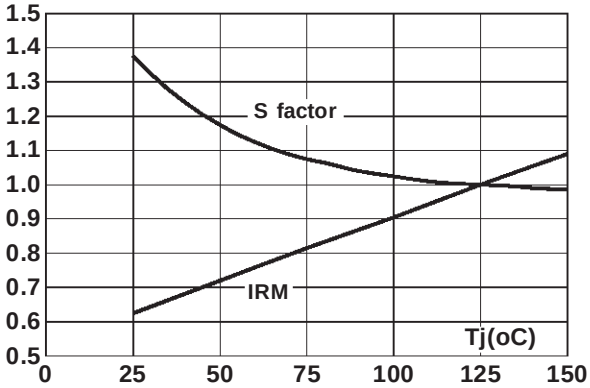


Fig. 7: Transient peak forward voltage versus dI_F/ft.

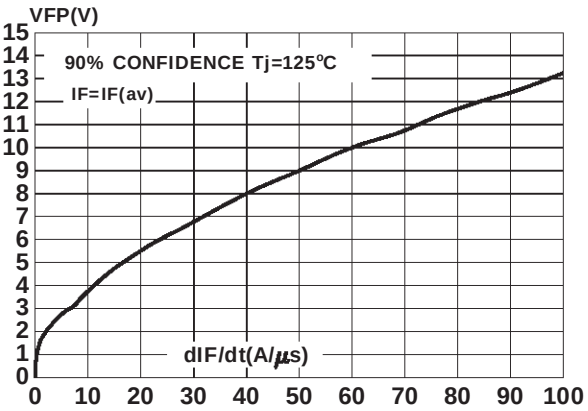


Fig. 8: Forward recovery time versus dI_F/dt.

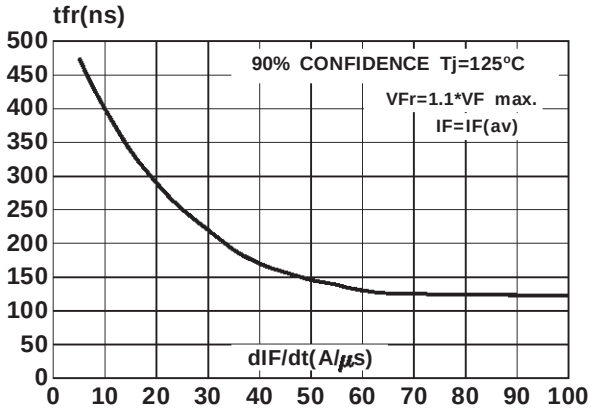


Fig. 9: Relative cariation of thermal transient impedance junction to case versus pulse duration (TO-220AC and DPAK).

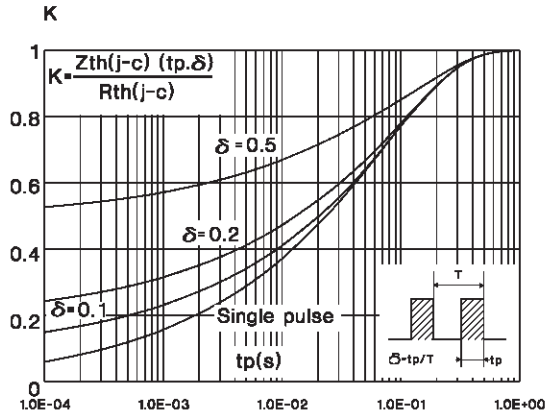
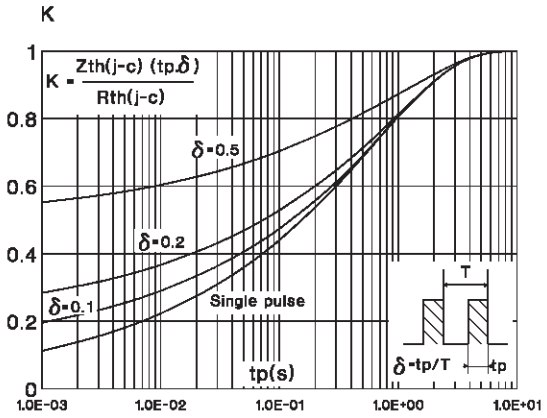


Fig. 10: Relative cariation of thermal transient impedance junction to case versus pulse duration (ISOWATT220AC).



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:

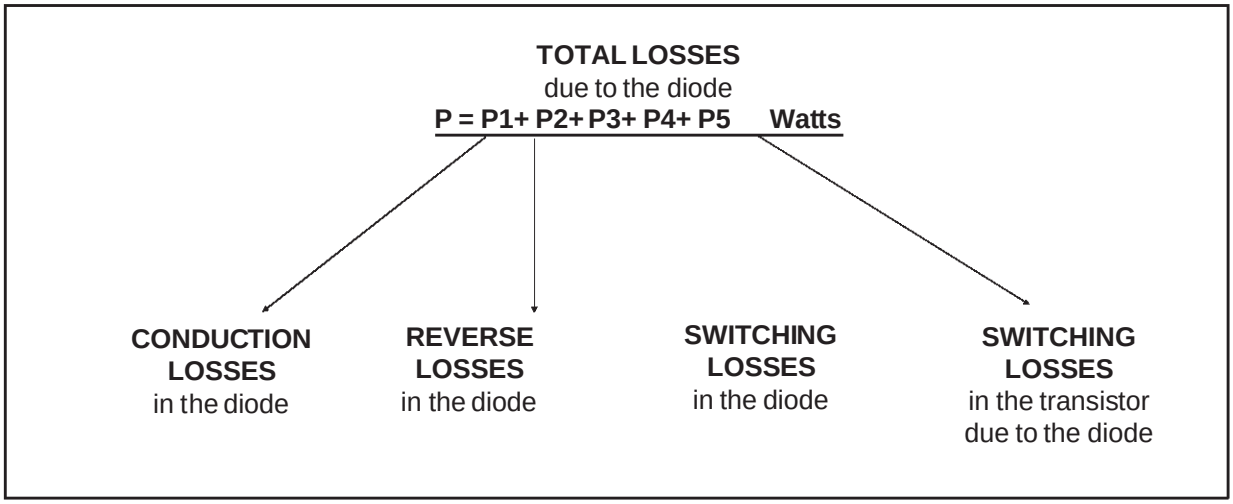
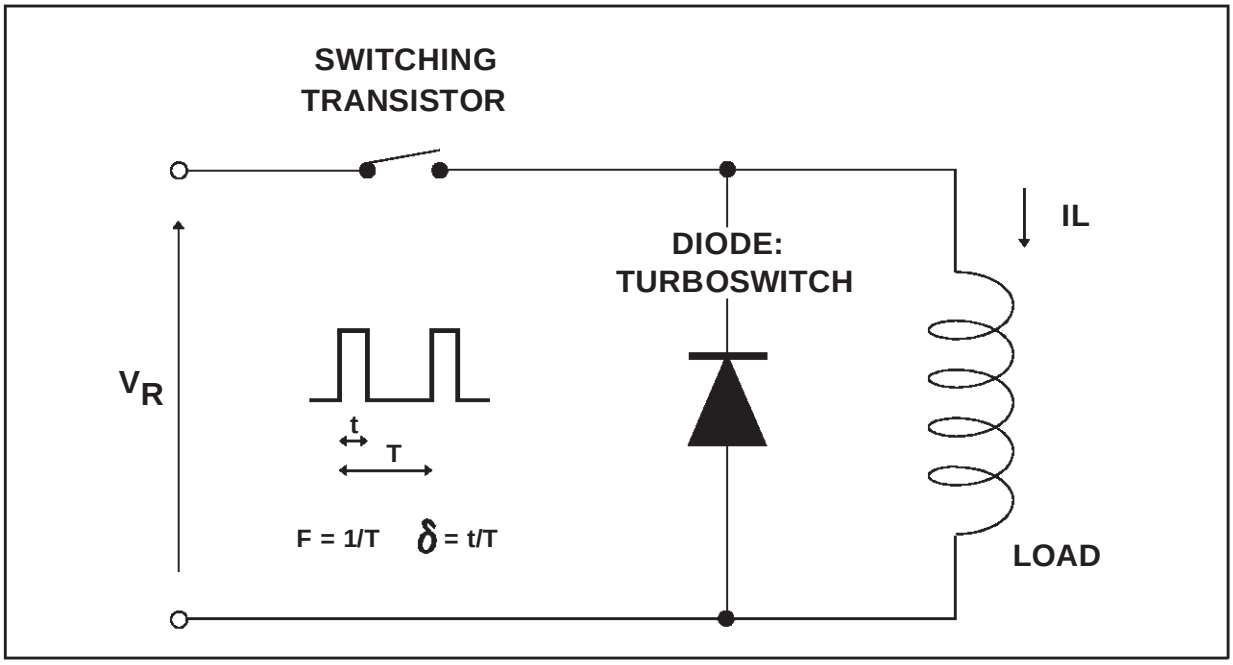
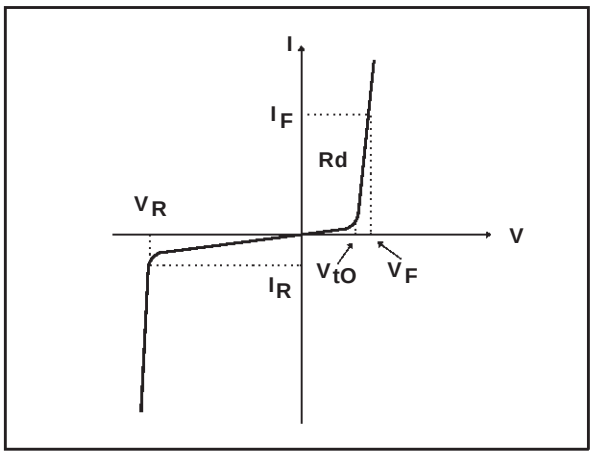


Fig. A : "FREEWHEEL" MODE



APPLICATION DATA (Cont'd)

Fig. B : STATIC CHARACTERISTICS



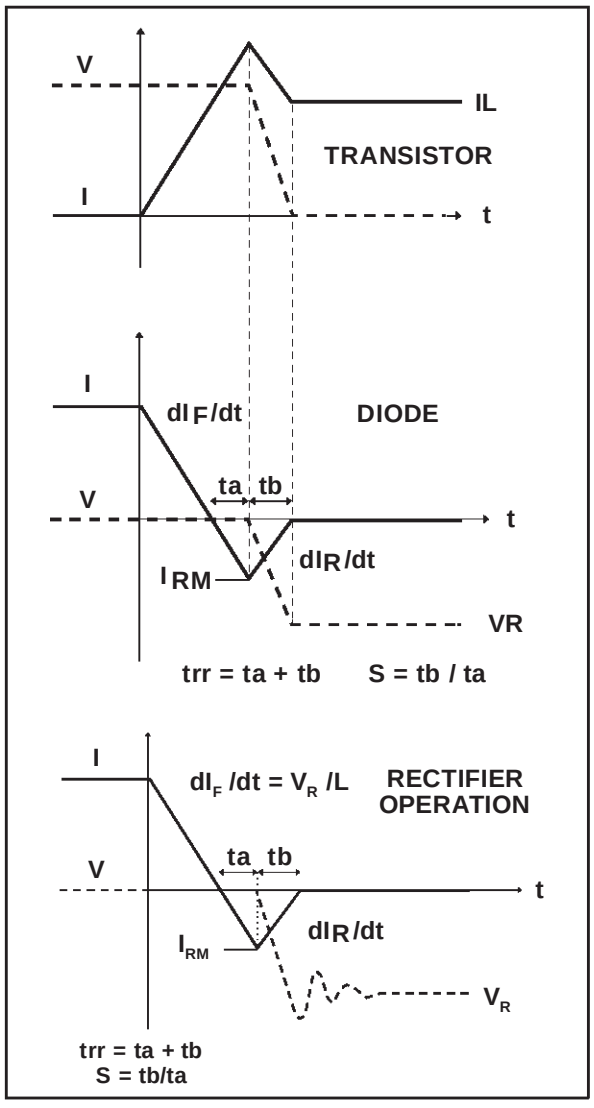
Conduction losses :

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

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)

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

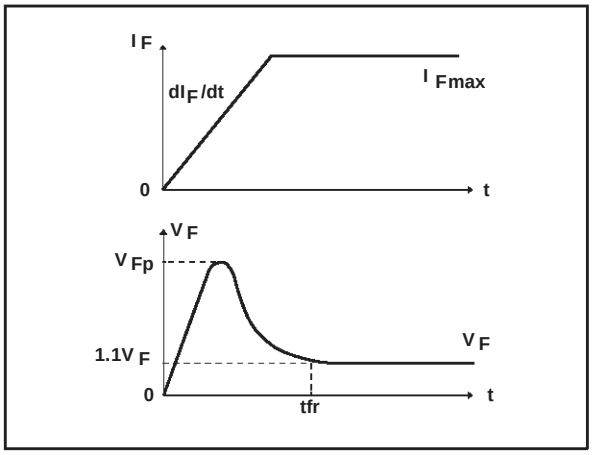
Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

APPLICATION DATA (Cont'd)

Fig. D : TURN-ON CHARACTERISTICS

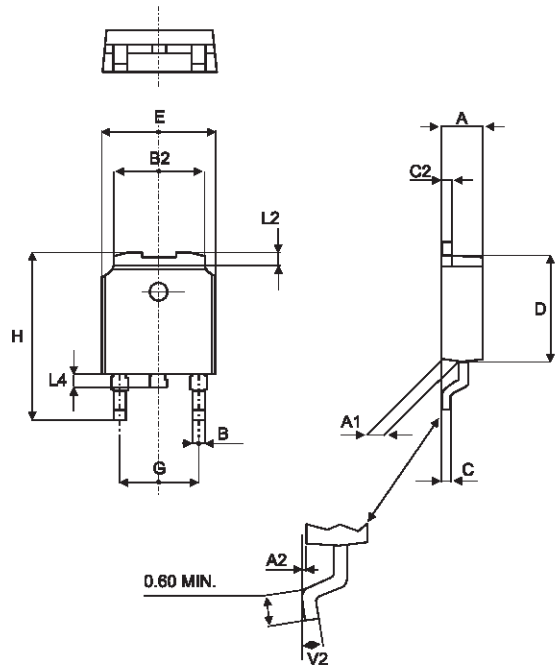


Turn-on losses :

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

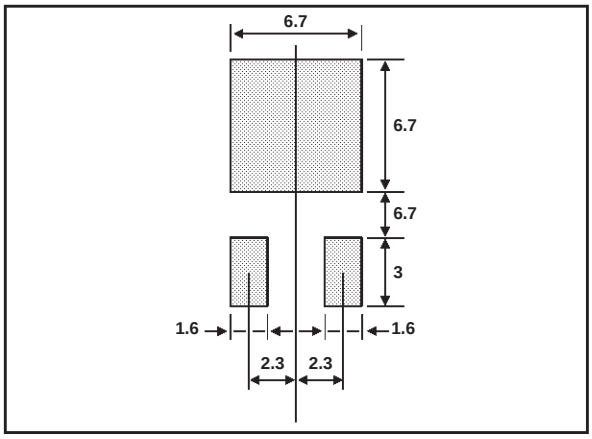
PACKAGE MECHANICAL DATA

DPAK



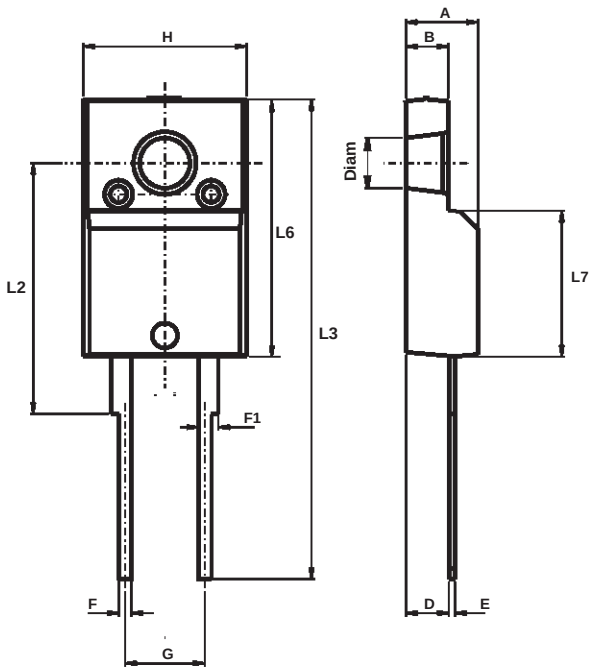
REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max	Min.	Max.
A	2.20	2.40	0.086	0.094
A1	0.90	1.10	0.035	0.043
A2	0.03	0.23	0.001	0.009
B	0.64	0.90	0.025	0.035
B2	5.20	5.40	0.204	0.212
C	0.45	0.60	0.017	0.023
C2	0.48	0.60	0.018	0.023
D	6.00	6.20	0.236	0.244
E	6.40	6.60	0.251	0.259
G	4.40	4.60	0.173	0.181
H	9.35	10.10	0.368	0.397
L2	0.80 typ.		0.031 typ.	
L4	0.60	1.00	0.023	0.039
V2	0°	8°	0°	8°

FOOTPRINT DIMENSIONS (in millimeters)



- Cooling method : by conduction (C)

PACKAGE MECHANICAL DATA
ISOWATT220AC

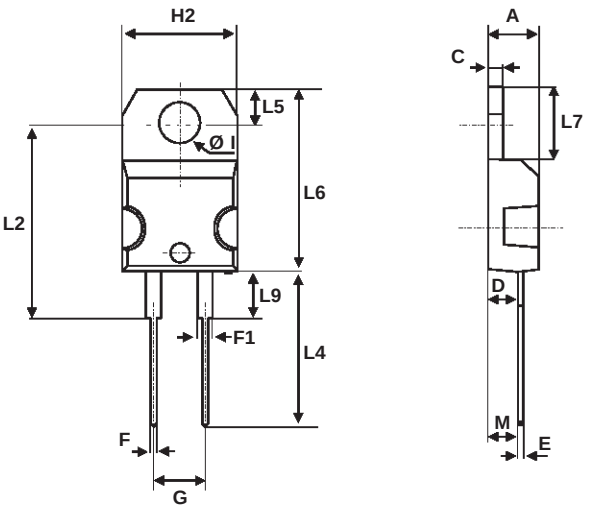


REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	2.50	2.70	0.098	0.106
D	2.40	2.75	0.094	0.108
E	0.40	0.70	0.016	0.028
F	0.75	1.00	0.030	0.039
F1	1.15	1.70	0.045	0.067
G	4.95	5.20	0.195	0.205
H	10.00	10.40	0.394	0.409
L2	16.00 typ.		0.630 typ.	
L3	28.60	30.60	1.125	1.205
L6	15.90	16.40	0.626	0.646
L7	9.00	9.30	0.354	0.366
Diam	3.00	3.20	0.118	0.0126

- Cooling method : by conduction (C)
- Recommanded torque value : 0.55m.N
- Maximum torque value : 0.7m.N

PACKAGE MECHANICAL DATA

TO-220AC



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

- Cooling method : by conduction (C)
- Recommanded torque value : 0.55m.N
- Maximum torque value : 0.7m.N

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA506D	STTA506D	TO-220AC	1.86g	50	Tube
STTA506F	STTA506F	ISOWATT220AC	2g	50	Tube
STTA506B	STTA506B	DPAK	0.3g	75	Tube
STTA506B-TR	STTA506B	DPAK	0.3g	2500	Tape & reel

- Epoxy meets UL94,V0