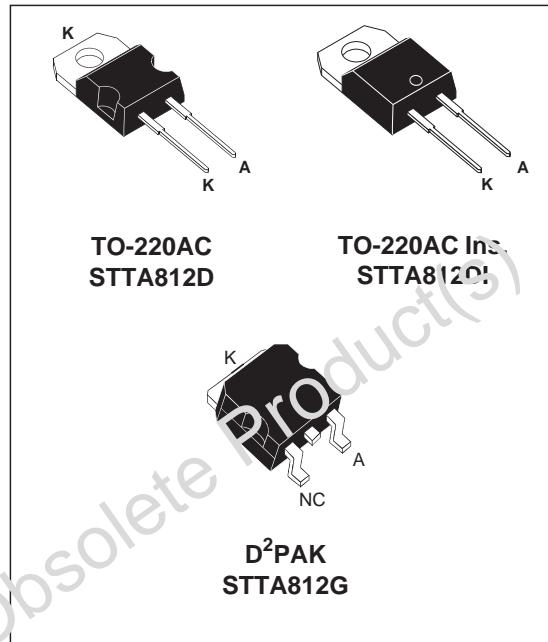


TURBOSWITCH ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCT CHARACTERISTICS

I_{F(AV)}	8A
V_{RRM}	1200V
t_{rr} (typ)	50ns
V_F (max)	2.0V



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
- INSULATED PACKAGE : TO-220AC Ins. Electrical insulation : 2500V_{RMS}. Capacitance : 7pF.

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.

ABSOLUTE RATINGS (limiting values)

Sym bol	Parameter	Value	Unit
V _{RKM}	Repetitive peak reverse voltage	1200	V
V _{RSM}	Non repetitive peak reverse voltage	1200	V
I _{F(RMS)}	RMS forward current	TO-220AC/ D ² PAK	A
		TO-220AC Ins.	A
I _{FRM}	Repetitive peak forward current	tp = 5 µs F = 5kHz square	A
I _{FSM}	Surge non repetitive forward current	tp = 10ms sinusoidal	A
T _{stg}	Storage temperature range	- 65 to + 150	°C
T _j	Maximum operating junction temperature	150	°C

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.

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THERMAL AND POWER DATA

Symbol	Parameter		Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	TO-220AC/D ² PAK TO-220AC Ins.		2.3 3.3	°C/W
P_1	Conduction power dissipation $I_{F(AV)} = 8A \quad \delta = 0.5$	TO-220AC/D ² PAK TO-220AC Ins.	$T_c = 105^\circ C$ $T_c = 85^\circ C$	19.5	W
P_{max}	Total power dissipation $P_{max} = P_1 + P_3 \quad (P_3 = 10\% P_1)$	TO-220AC/D ² PAK TO-220AC Ins.	$T_c = 100^\circ C$ $T_c = 79^\circ C$	21.5	W

STATIC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	$I_F = 8A$	$T_j = 25^\circ C$ $T_j = 125^\circ C$		1.35	2.2 2.0	V V
I_R **	Reverse leakage current	$V_R = 0.8 \times V_{RRM}$	$T_j = 25^\circ C$ $T_j = 125^\circ C$		0.6	100 4	μA mA
V_{to}	Threshold voltage	$I_p < 3.I_{AV}$	$T_j = 125^\circ C$			1.57	V
rd	Dynamic parameter					54	mΩ

Test pulses : * $t_p = 380 \mu s, \delta < 2\%$

** $t_p = 5 ms, \delta < 2\%$

To evaluate the maximum conduction losses use the following equation :

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

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A \quad I_R = 1A \quad Irr = 0.25A$ $I_F = 1 A \quad dI_F/dt = -50A/\mu s \quad V_R = 30V$		50	100	ns
I_{RM}	Maximum reverse recovery current	$T_j = 125^\circ C \quad VR = 600V \quad I_F = 8A$ $dI_F/dt = -64 A/\mu s$ $dI_F/dt = -500 A/\mu s$		25	12	A
S factor	Softness factor	$T_j = 125^\circ C \quad V_R = 600V \quad I_F = 8A$ $dI_F/dt = -500 A/\mu s$		1.2		-

TURN-ON SWITCHING

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	$T_j = 25^\circ C$ $I_F = 8 A, dI_F/dt = 64 A/\mu s$ measured at $1.1 \times V_{Fmax}$			900	ns
V_{Fp}	Peak forward voltage	$T_j = 25^\circ C$ $I_F = 8A, dI_F/dt = 64 A/\mu s$ $I_F = 40A, dI_F/dt = 500 A/\mu s$		45	35	V

Fig. 1: Conduction losses versus average current.

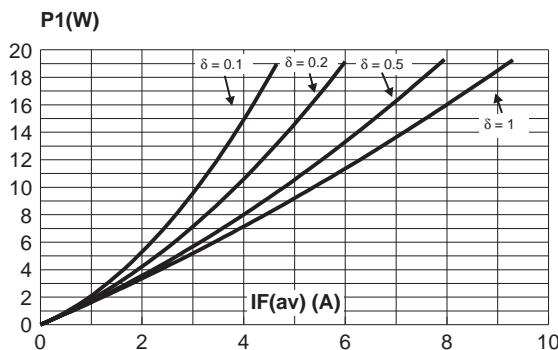


Fig. 2: Forward voltage drop versus forward current (maximum values).

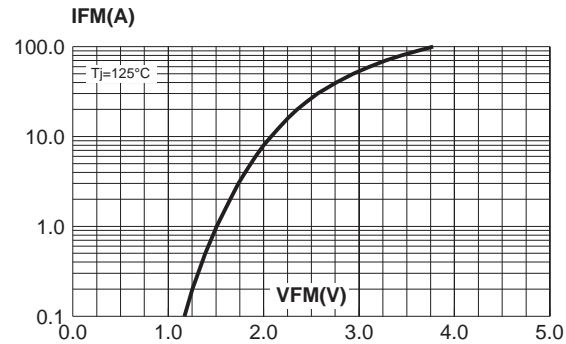


Fig. 3: Relative variation of thermal impedance junction to case versus pulse duration.

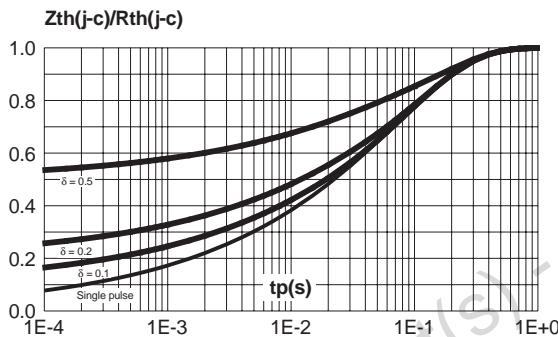


Fig. 4: Peak reverse recovery current versus dI_F/dt (90% confidence).

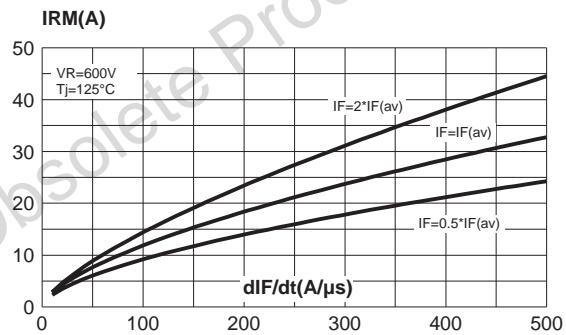


Fig. 5: Reverse recovery time versus dI_F/dt (90% confidence).

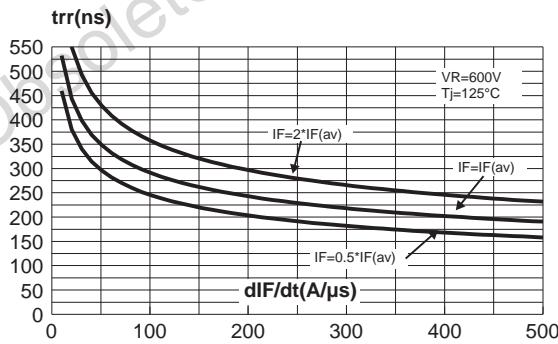
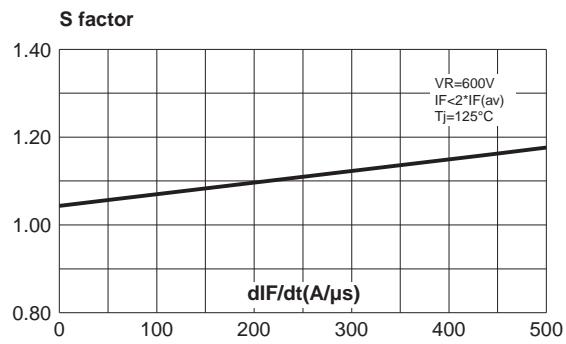


Fig. 6: Softness factor (tb/ta) versus dI_F/dt (typical values).



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Fig. 7: Relative variation of dynamic parameters versus junction temperature (reference $T_j=125^\circ\text{C}$).

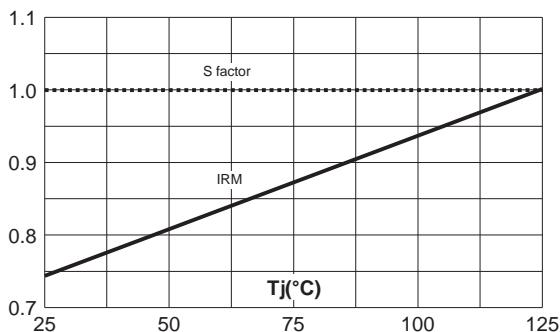


Fig.8: Transient peak forward voltage versus $\text{d}I_F/\text{dt}$ (90% confidence).

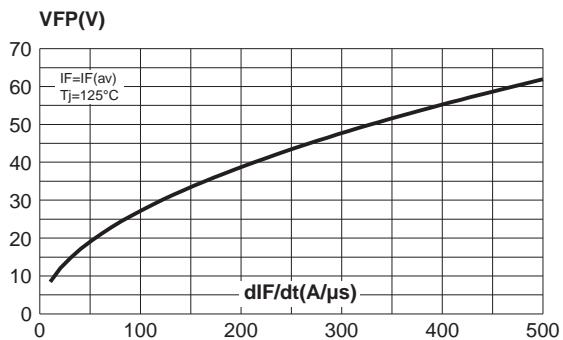
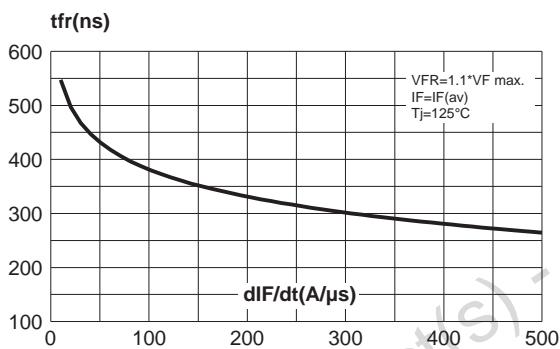


Fig. 9: Forward recovery time versus $\text{d}I_F/\text{dt}$ (90% confidence).



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 :

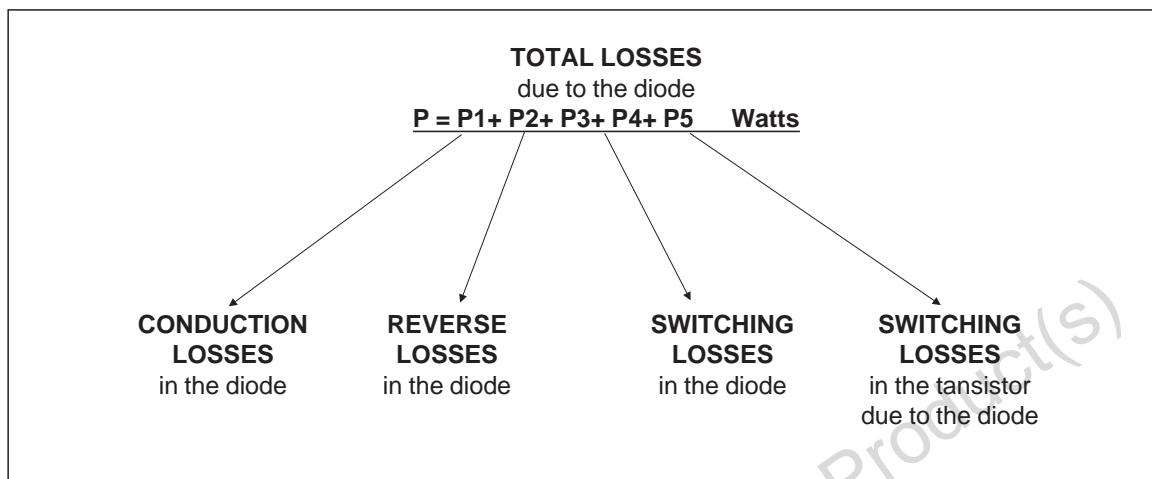
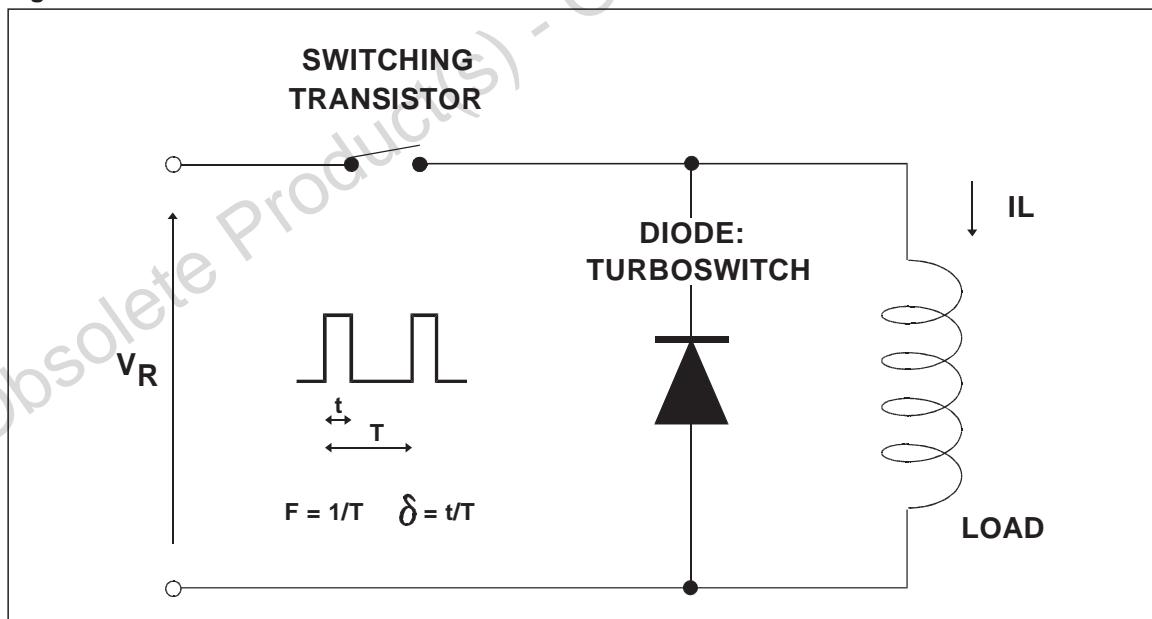


Fig. A: "FREEWHEEL" MODE.



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Fig. B: SNUBBER DIODE.

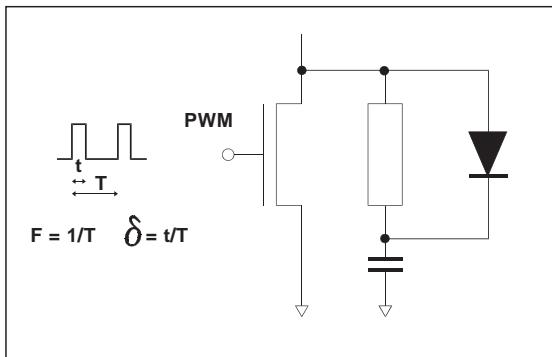


Fig. C: DEMAGNETIZING DIODE.

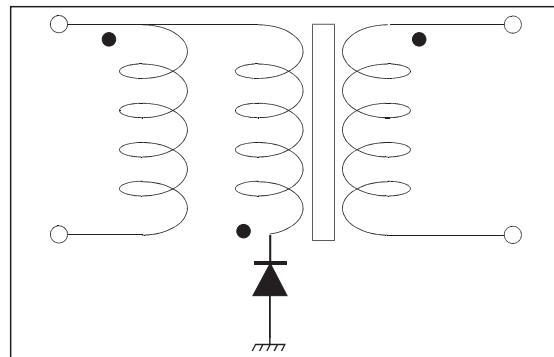
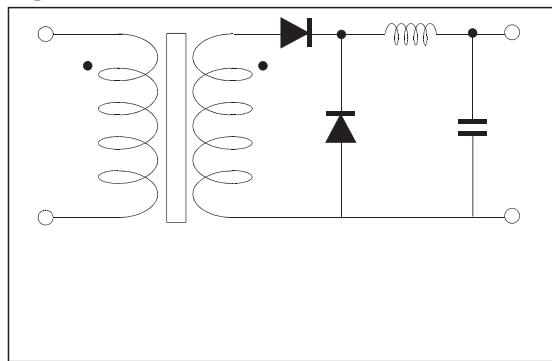
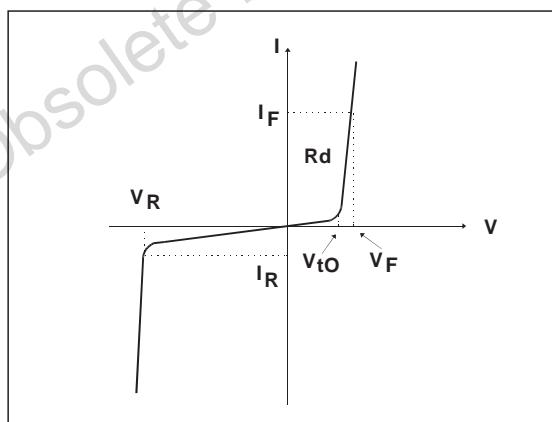


Fig. D: RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. E: STATIC CHARACTERISTICS



Conduction losses :

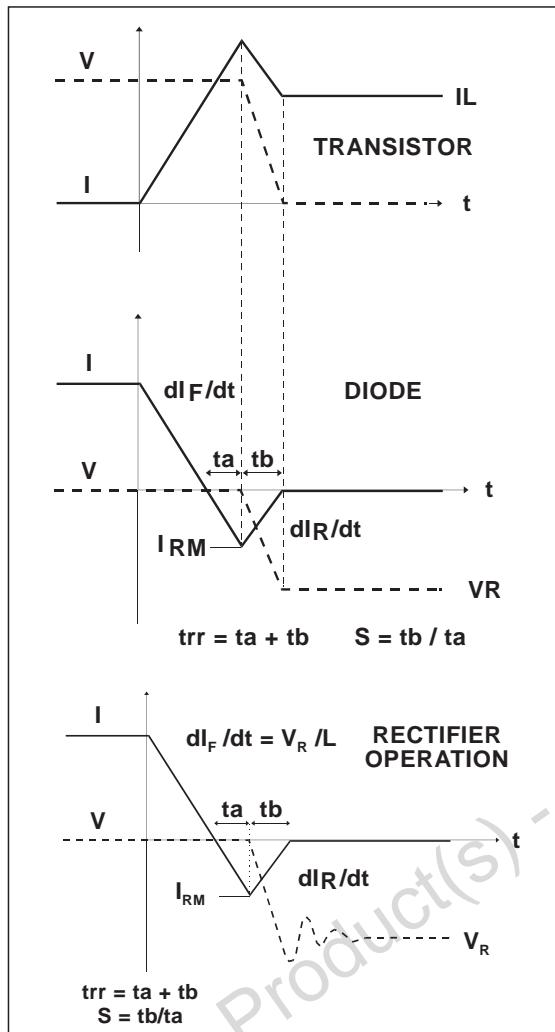
$$P1 = V_{t0} \cdot I_F(AV) + R_d \cdot I_F^2(RMS)$$

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. F: TURN-OFF CHARACTERISTICS



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

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

Turn-off losses (in the diode) :

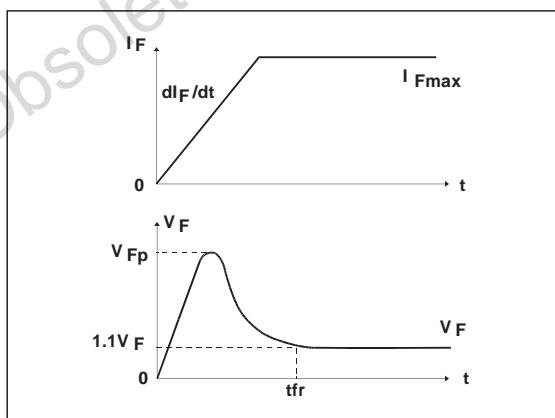
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \times dI_F/dt}$$

Turn-off losses :
(with non negligible serial inductance)

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

P3, P3' and P5 are suitable for power MOSFET and IGBT

Fig. G: TURN-ON CHARACTERISTICS

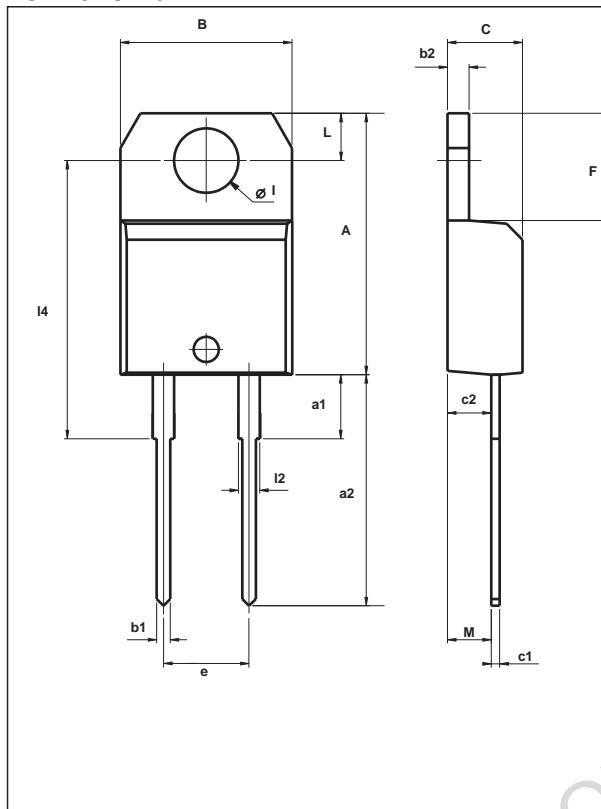


Turn-on losses :

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

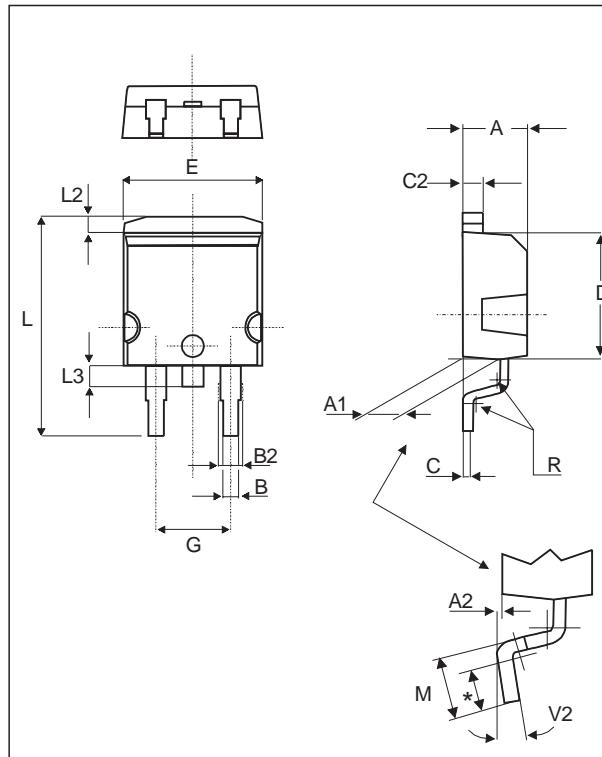
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PACKAGE DATA TO-220AC Ins.



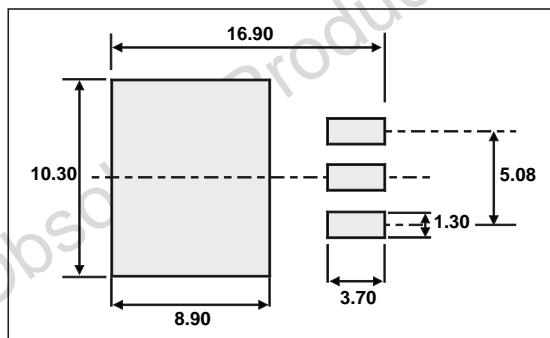
REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.598		0.625
a1		3.75			0.147	
a2	13.00		14.00	0.511		0.551
B	10.00		10.40	0.393		0.409
b1	0.61		0.88	0.024		0.034
b2	1.23		1.32	0.048		0.051
C	4.40		4.60	0.173		0.181
c1	0.49		0.70	0.019		0.027
c2	2.40		2.72	0.094		0.107
e	4.80		5.40	0.189		0.212
F	6.20		6.60	0.244		0.259
I	3.75		3.85	0.147		0.151
I4	15.80	16.40	16.80	0.622	0.646	0.661
L	2.65		2.95	0.104		0.116
I2	1.14		1.70	0.044		0.066
M		2.60			0.102	

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

PACKAGE DATA
D²PAK


The diagram illustrates the 3D structure of a D²PAK package. It includes a top view showing lead spacing (E), lead height (L), lead thickness (L2), lead width (L3), and body width (G). A side view shows lead height (A), lead thickness (C2), lead width (B), body height (D), and lead pitch (R). A bottom view shows lead pitch (A1), lead thickness (C), lead width (M), and lead angle (V2). A note at the bottom states: * FLAT ZONE NO LESS THAN 2mm.

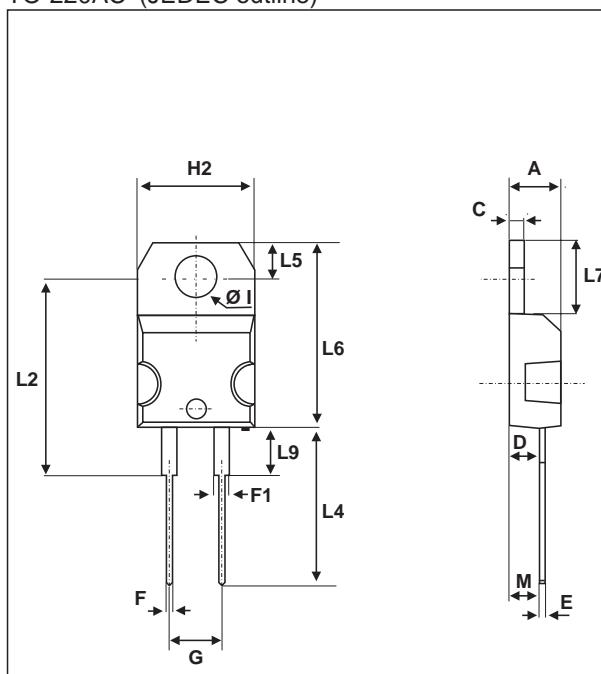
REF.	DIMENSIONS			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
A1	2.49	2.69	0.098	0.106
A2	0.03	0.23	0.001	0.009
B	0.70	0.93	0.027	0.037
B2	1.14	1.70	0.045	0.067
C	0.45	0.60	0.017	0.024
C2	1.23	1.36	0.048	0.054
D	8.95	9.35	0.352	0.368
E	10.00	10.40	0.393	0.409
G	4.88	5.28	0.192	0.208
L	15.00	15.85	0.590	0.624
L2	1.27	1.40	0.050	0.055
L3	1.40	1.75	0.055	0.069
M	2.40	3.20	0.094	0.126
R	0.40 typ.		0.016 typ.	
V2	0°	8°	0°	8°

FOOTPRINT DIMENSIONS (in millimeters)


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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

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

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
STTA812D	STTA812D	TO-220AC	1.86g	50	Tube
STTA812DI	STTA812DI	TO-220AC Ins.	1.86g	250	Bulk
STTA812G	STTA812G	D ² PAK	1.48g	50	Tube
STTA812G-TR	STTA812G	D ² PAK	1.48g	500	Tape & reel

- Epoxy meets UL94,V0

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