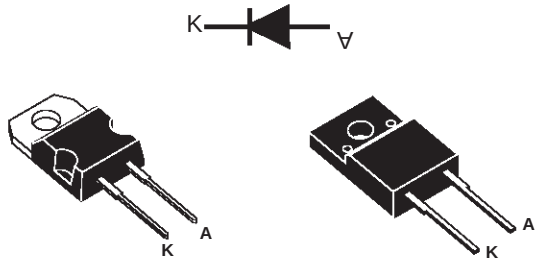
STTA512D/F/B

TURBOSWITCH ™ "A". ULTRA-FAST HIGH VOLTAGE DIODE

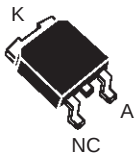
MAIN PRODUCTS CHARACTERISTICS

$I_{F(AV)}$	**5A**
V_{RRM}	**1200V**
t_{rr} (typ)	**45ns**
V_F (max)	**2.0V**



TO-220AC
STTA512D

ISOWATT220AC
STTA512F



DPAK
STTA512B

FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGNETIZATION AND RECTIFICATION
- ULTRA-FAST, SOFT AND NOISE-FREE RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY AND/OR HIGH PULSED CURRENT OPERATIONS.
- CECC APPROVED.

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, and also at the secondary of SMPS as high voltage rectifier diodes.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		1200	V
V_{RSM}	Non repetitive peak reverse voltage		1200	V
$I_{F(RMS)}$	RMS forward current		20	A
I_{FRM}	Repetitive peak forward current	tp = 5 µs F = 5kHz	75	A
I_{FSM}	Surge non repetitive forward current	tp = 10ms Sine	45	A
T_j	Maximum operating junction temperature		150	°C
T_{stg}	Storage temperature		-65 to 150	°C

TURBOSWITCH is a trademark of STMicroelectronics.

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	STTA512D/B STTA512F	4.0 5.5	°C/W
P_1	Conduction power dissipation (see fig. 6)	$I_{F(AV)}$ = 5A δ =0.5 STTA512D/B Tc= 102°C STTA512F Tc=84°C	12	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	STTA512D/B Tc= 98°C STTA512F Tc=78°C	13	W

STATIC ELECTRICAL CHARACTERISTICS (see figure 6)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	I_F =5A	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		 0.3	100 2.0	µA mA
Vto	Threshold voltage		Tj = 125°C			1.57	V
Rd	Dynamic resistance					0.086	mΩ

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

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see figure 7)

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		45	 95	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C VR = 600V I_F =5A dI_F/dt = -40 A/µs dI_F/dt = -500 A/µs		 20	7.5	A
S factor	Softness factor	Tj = 125°C V_R = 600V I_F =5A dI_F/dt = -500 A/µs		1.2		/

TURN-ON SWITCHING (see figure 8)

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			900	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =5A, dI_F/dt = 40 A/µs I_F =40A, dI_F/dt = 500 A/µs		 50	35	V

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 1 to 5),the way of calculating the power losses is given below:

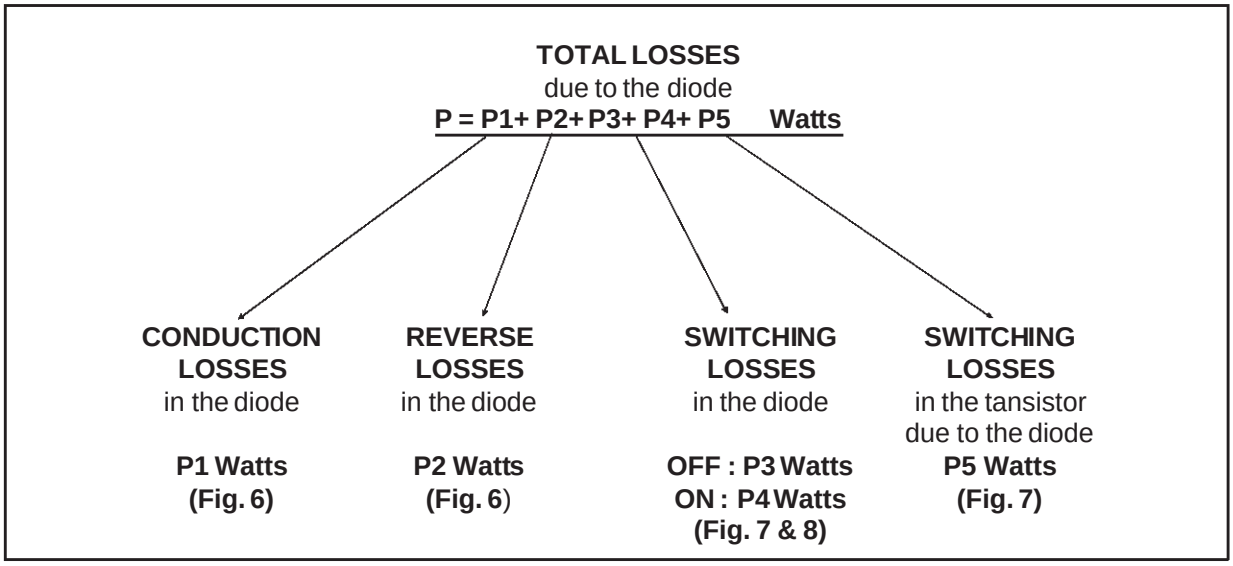


Fig. 1 : "FREEWHEEL" MODE.

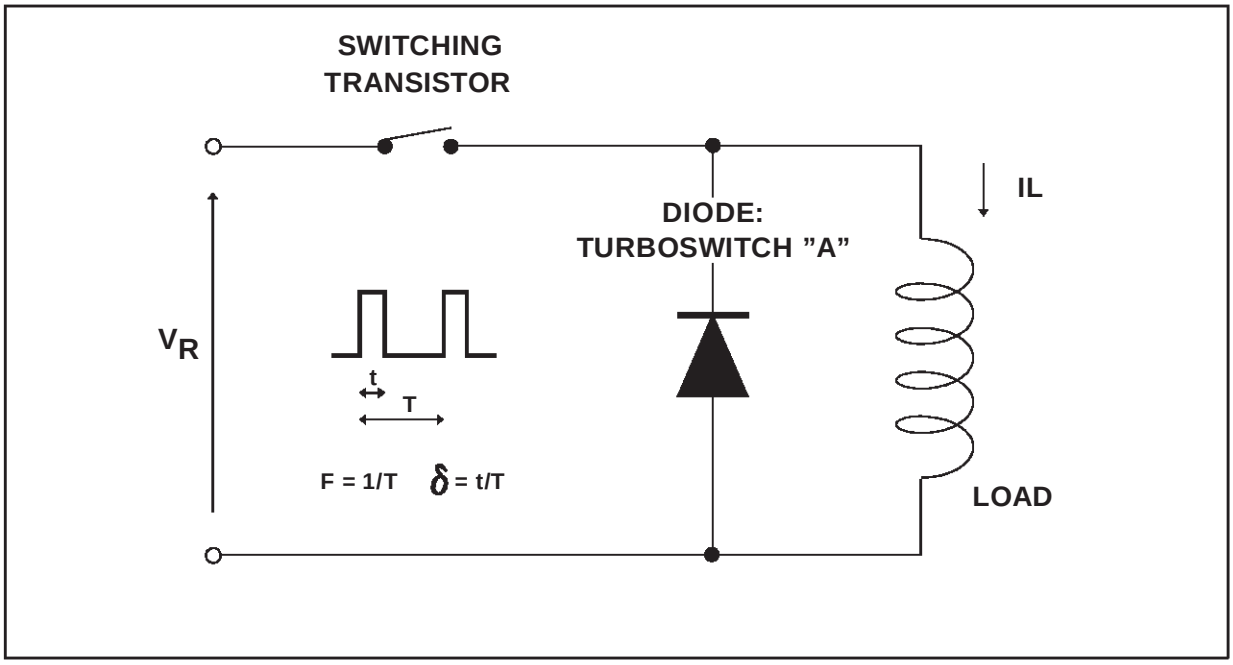


Fig. 2 : SNUBBER DIODE.

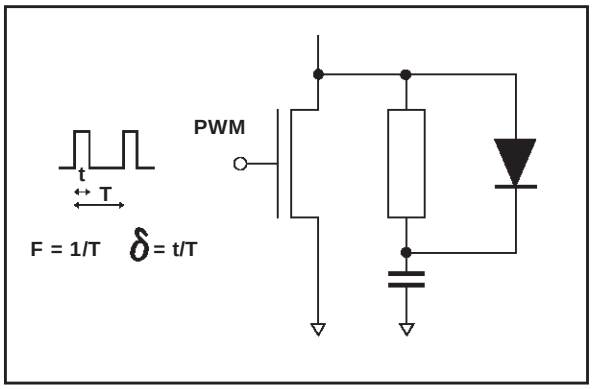


Fig. 3 : CLAMPING DIODE.

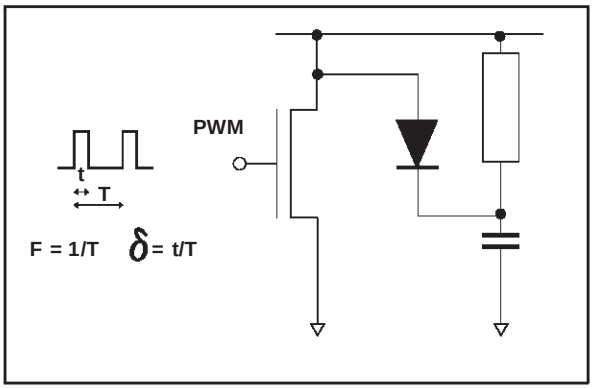


Fig. 4 : DEMAGNETIZING DIODE.

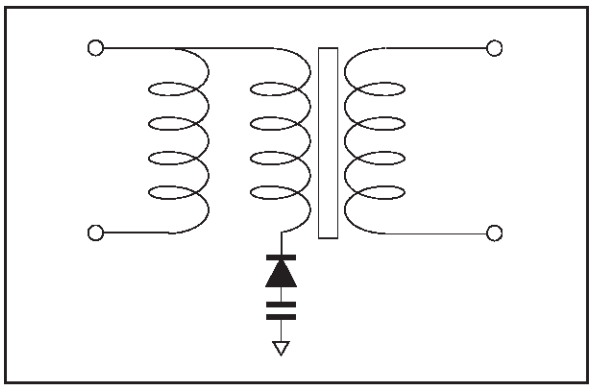
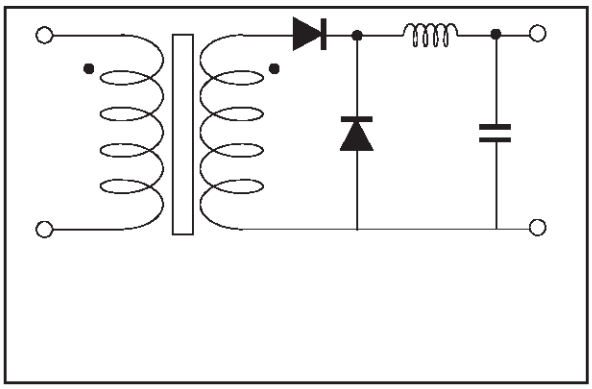
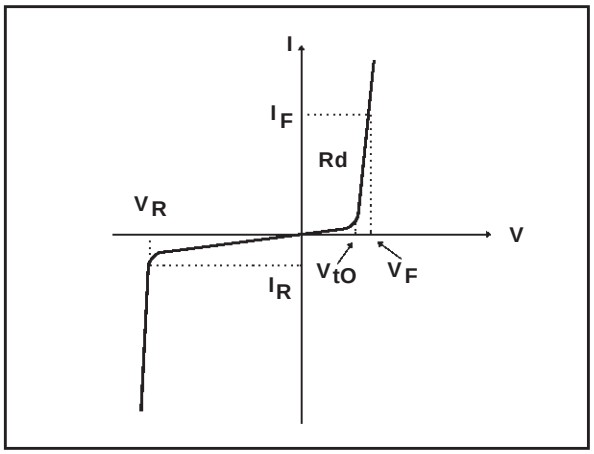


Fig. 5 : RECTIFIER DIODE.



STATIC & DYNAMIC CHARACTERISTICS . POWER LOSSES .

Fig. 6: STATIC CHARACTERISTICS



Conduction losses :

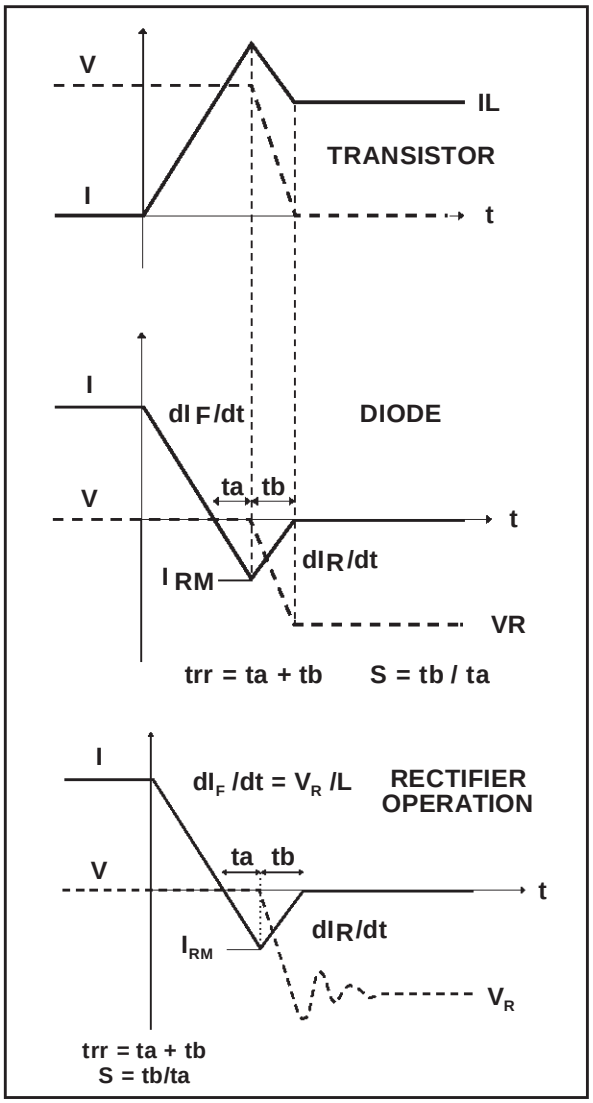
$P1 = V_{t0} . I_{F(AV)} + R_d . I_F^2{}_{(RMS)}$

Reverse losses :

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

APPLICATION DATA (Cont'd)

Fig. 7: 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) :

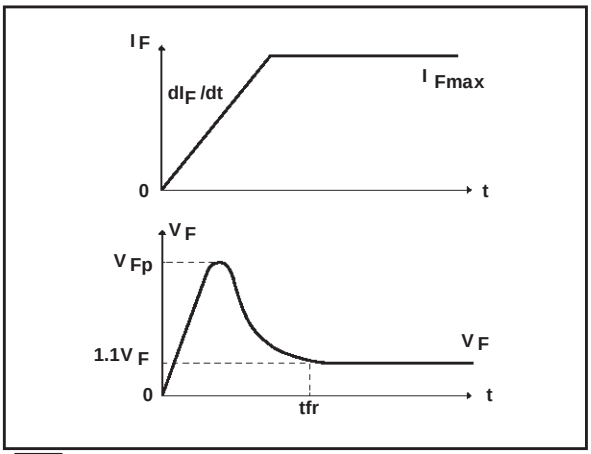
$$P3 = \frac{V_R \times I_{RM}^2 \times S \times F}{6 \; x \; dI_F/dt}$$

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. 8: TURN-ON CHARACTERISTICS



Turn-on losses :

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

Fig. 9: Conduction losses versus average current.

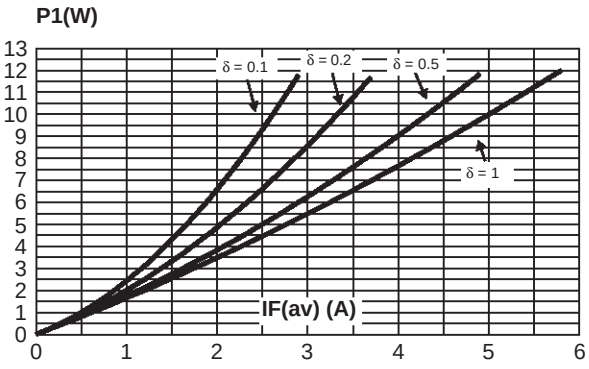


Fig. 10: Switching OFF losses versus dI_F/dt.

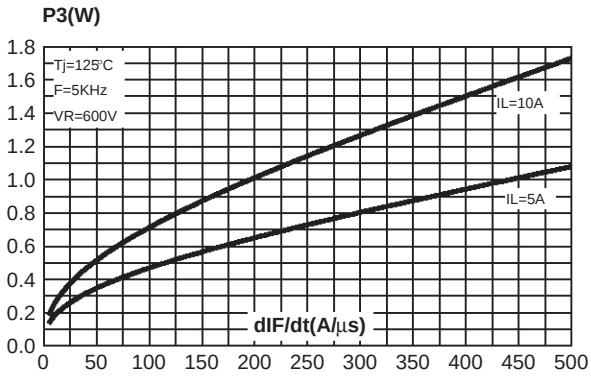


Fig. 11: Switching ON losses versus dI_F/dt

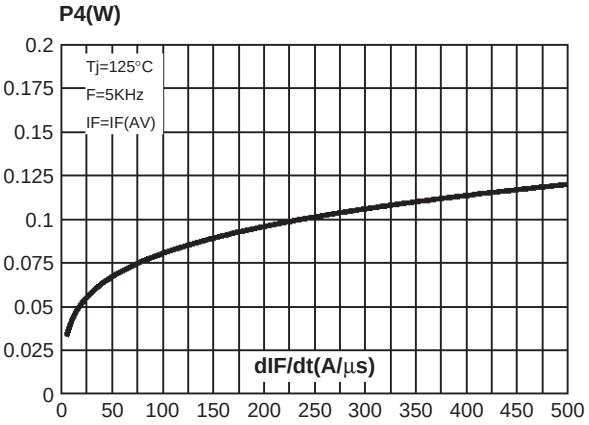


Fig. 12: Switching losses in transistor due to the diode.

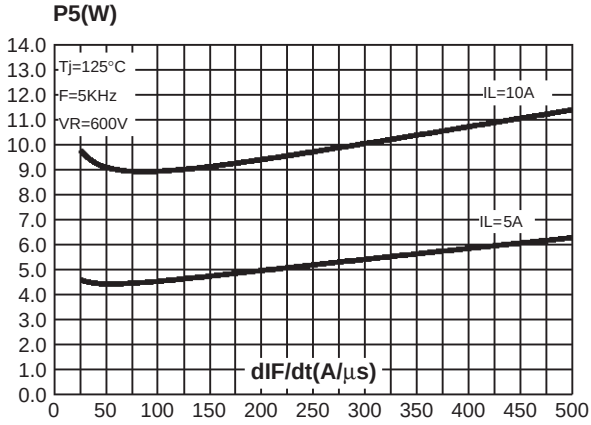


Fig. 13: Forward voltage drop versus forward current (maximum values).

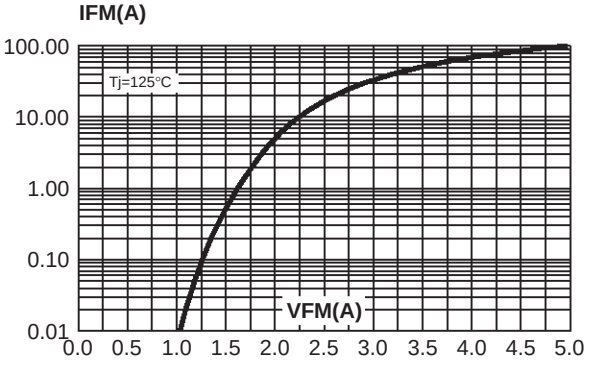


Fig. 14: Peak reverse recovery current versus dI_F/dt (90% confidence).

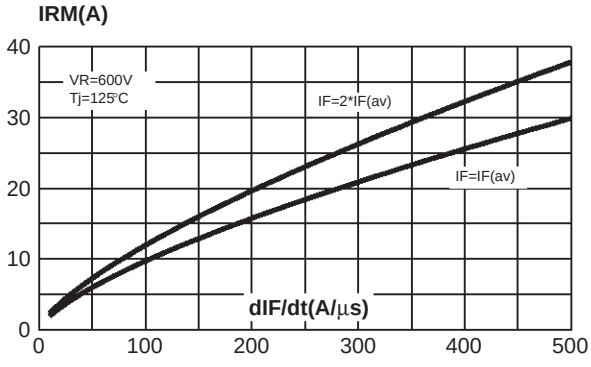


Fig. 15: Relative variation of thermal impedance junction to case versus pulse duration (TO-220AC and DPAK).

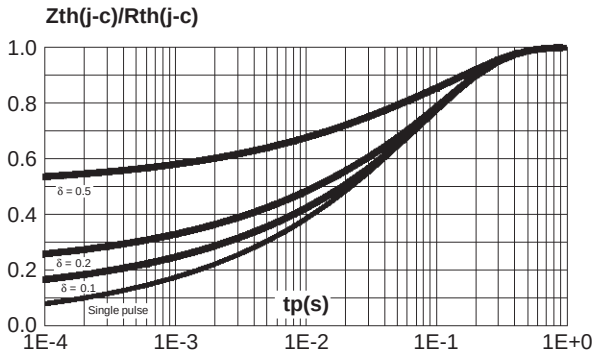


Fig. 16: Relative variation of thermal impedance junction to case versus pulse duration (ISOWATT220AC).

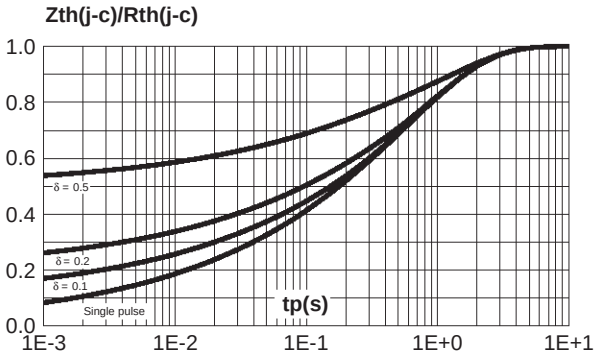


Fig. 17: Reverse recovery time versus dI_F/dt (90% confidence).

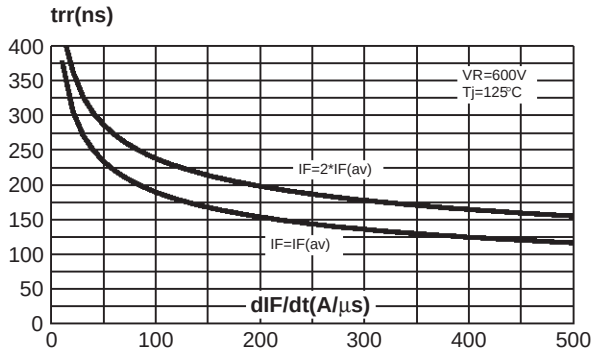


Fig. 18: Softness factor (tb/ta) versus dI_F/dt (typical values).

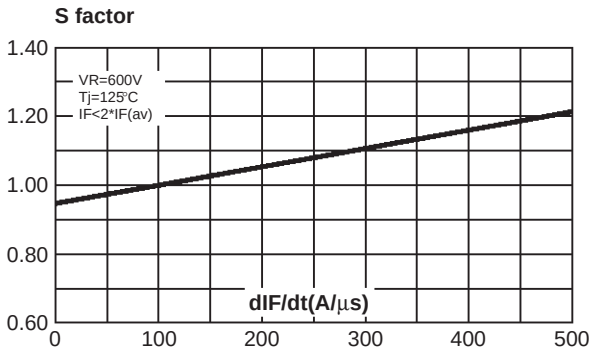


Fig. 19: Relative variation of dynamic parameters versus junction temperature (reference Tj=125°C).

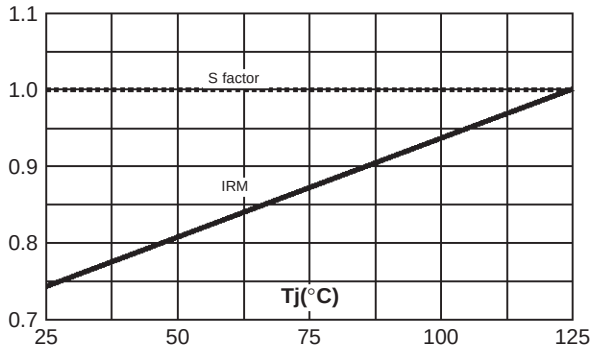


Fig. 20: Transient peak forward voltage versus dI_F/dt (90% confidence).

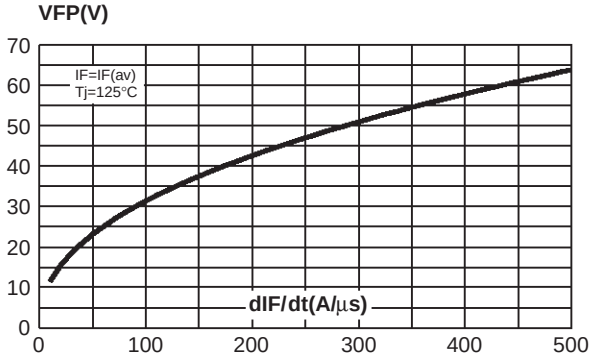
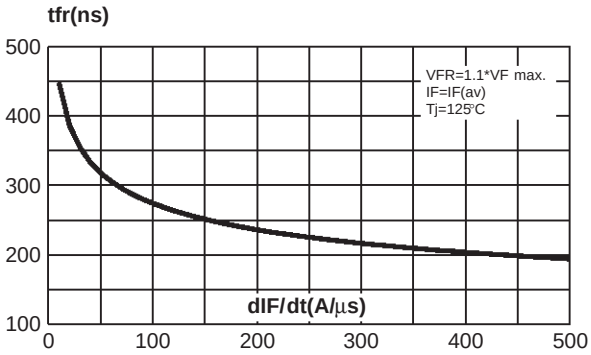
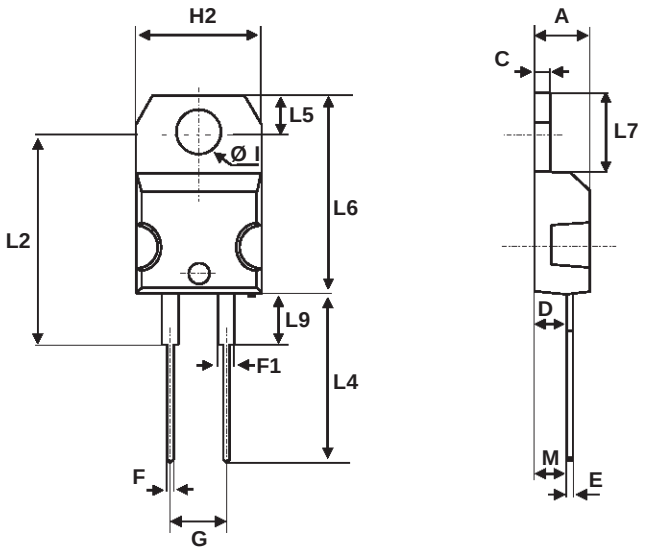


Fig. 21: Forward recovery time versus dI_F/dt (90% confidence).



PACKAGE DATA

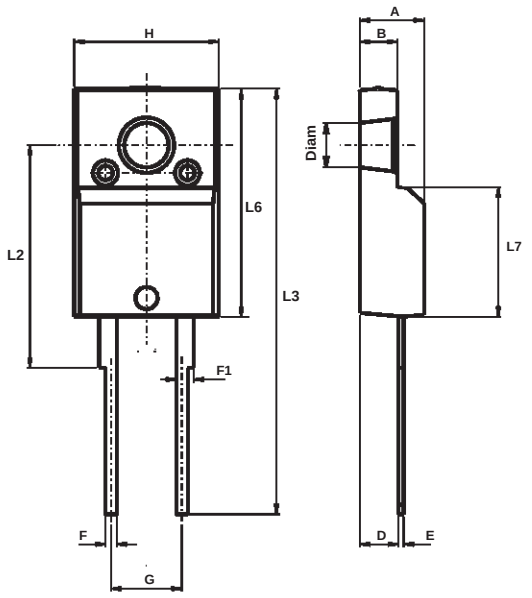
TO-220AC (JEDEC outline)



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

- **Marking:** Type number.
- Cooling method: C.
- Weight: 1.9 g.
- Torque value: 0.55 m.N typ (0.70 m.N max).

PACKAGE DATA
ISOWATT220AC

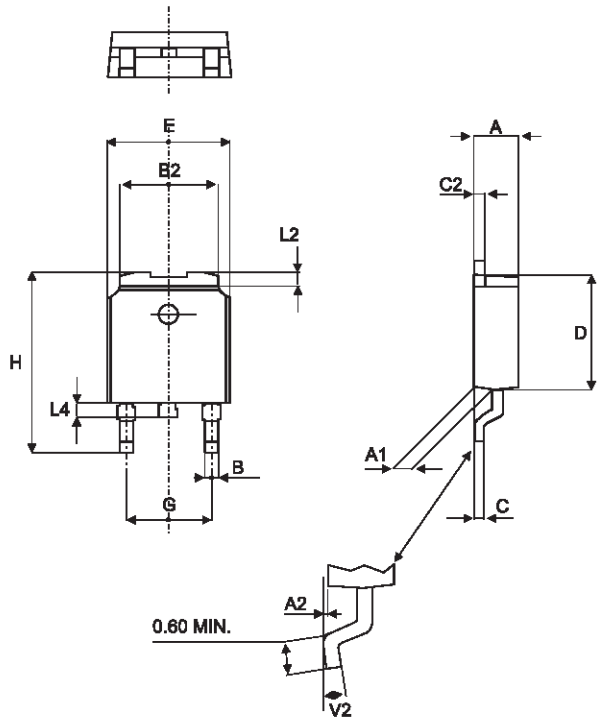


REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	2.50		2.70	0.098		0.106
D	2.40		2.75	0.094		0.108
E	0.40		0.70	0.016		0.028
F	0.75		1.00	0.030		0.039
F1	1.15		1.70	0.045		0.067
G	4.95		5.20	0.195		0.205
H	10.00		10.40	0.394		0.409
L2		16.00			0.630	
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

- **Marking:** Type number.
- Cooling method: C.
- Weight: 2.0 g.
- Torque value: 0.55 m.N typ (0.70 m.N max).
- Electrical isolation: 2000V DC
- Capacitance: 12 pF

PACKAGE DATA

DPAK



REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max	Min.	Typ.	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			0.031	
L4	0.60		1.00	0.023		0.039
V2	0°		8°	0°		8°

FOOTPRINT DIMENSIONS (in millimeters)