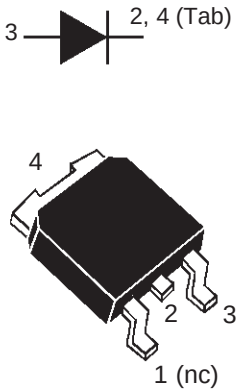
STTA312B(-TR)

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

MAIN PRODUCT CHARACTERISTICS

$I_{F(AV)}$	**3 A**
V_{RRM}	**1200 V**
V_F (max)	**1.7 V**
t_{rr} (typ)	**65 ns**



DPAK

FEATURES AND BENEFITS

- SPECIFIC TO THE FOLLOWING OPERATIONS: SNUBBING OR CLAMPING, DEMAGNETIZATION AND RECTIFICATION
- ULTRA-FAST, VERY SOFT AND NOISE-FREE RECOVERY
- VERY LOW OVERALL POWER LOSSES AND PARTICULARY LOW FORWARD VOLTAGE
- SURFACE MOUNT DEVICE
- TAPE AND REEL OPTION : -TR

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 primary of SMPS as snubber, clamping or demagnetizing diodes, and also in 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 surge reverse voltage		1200	V
$I_{F(RMS)}$	RMS forward current		8	A
I_{FRM}	Repetitive peak forward current	tp = 5 µs F = 1 KHz	50	A
I_{FSM}	Surge non repetitive forward current	tp = 10ms Sine	25	A
T_{stg}	Storage temperature range		- 65 to + 150	°C
Tj	Maximum junction temperature		125	°C

TURBOSWITCH is a trademark from STMicroelectronics.

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th\ (j-c)}$	Junction to case thermal resistance		6.5	°C/W
P_1	Conduction power dissipation	$I_{F(AV)}$ = 3A, δ = 0.5 Tc = 80°C	6.7	W
P_{max}	Total power dissipation $P_{max} = P_1 + P_3$ (P_3 = 10% P_1)	Tc = 76°C	7.5	W

STATIC ELECTRICAL CHARACTERISTICS (see figure 6)

Symbol	Tests Conditions	Tests Conditions		Min.	Typ.	Max.	Unit
I_R *	Reverse leakage current	V_R = 0.8 X V_{RRM}	Tj = 25°C			20	µA
			Tj = 125°C		150	400	µA
V_F **	Forward voltage drop	I_F = 3 A	Tj = 25°C			1.8	V
		I_F = 3 A	Tj = 125°C		1.15	1.7	
Vto	Threshold voltage		Tj = 125°C			1.15	V
rd	Dynamic resistance					185	mΩ

Pulse test : * tp = 5 ms, δ < 2 %
** tp = 380 µs, δ < 2%

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see figure 7)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
t_{rr}		Tj = 25°C	I_F= 0.5A I_R=1A I_{rr}= 0.25A I_F= 1A dI_F/dt= 50A/µs V_R= 30V		65	115	ns
I_{RM}	Maximum recovery current	Tj = 125°C	I_F= 3A V_R= 600V dI_F/dt = -16A/µs dI_F/dt = -50A/µs		6.0	3.6	A
S factor	Softness factor	Tj = 125°C	V_R= 600V I_F= 3A dI_F/dt = -50A/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=2A dI_F/dt = 16A/µs Measured at 1.1 x V_{Fmax}			900	ns
V_{FP}	Peak forward voltage					35	V

APPLICATION DATA

The 1200V TURBOSWITCH™ series has been designed to provide the lowest overall power losses in all frequency or high pulsed current operations.

In such application (fig. 1 to 5), the way of calculating the power losses is given below :

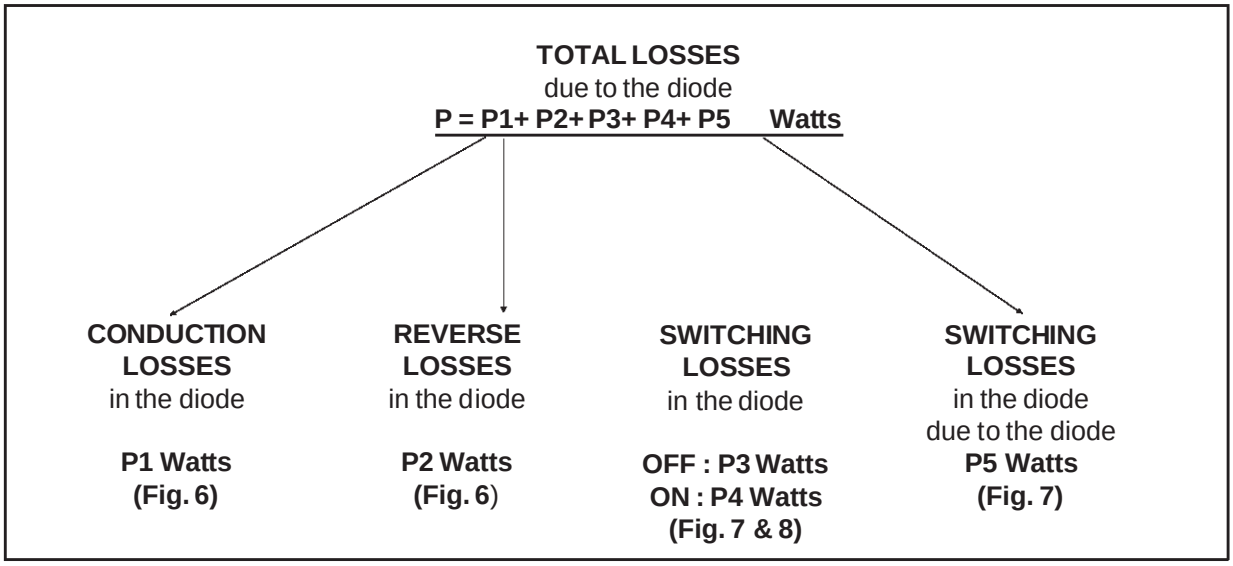
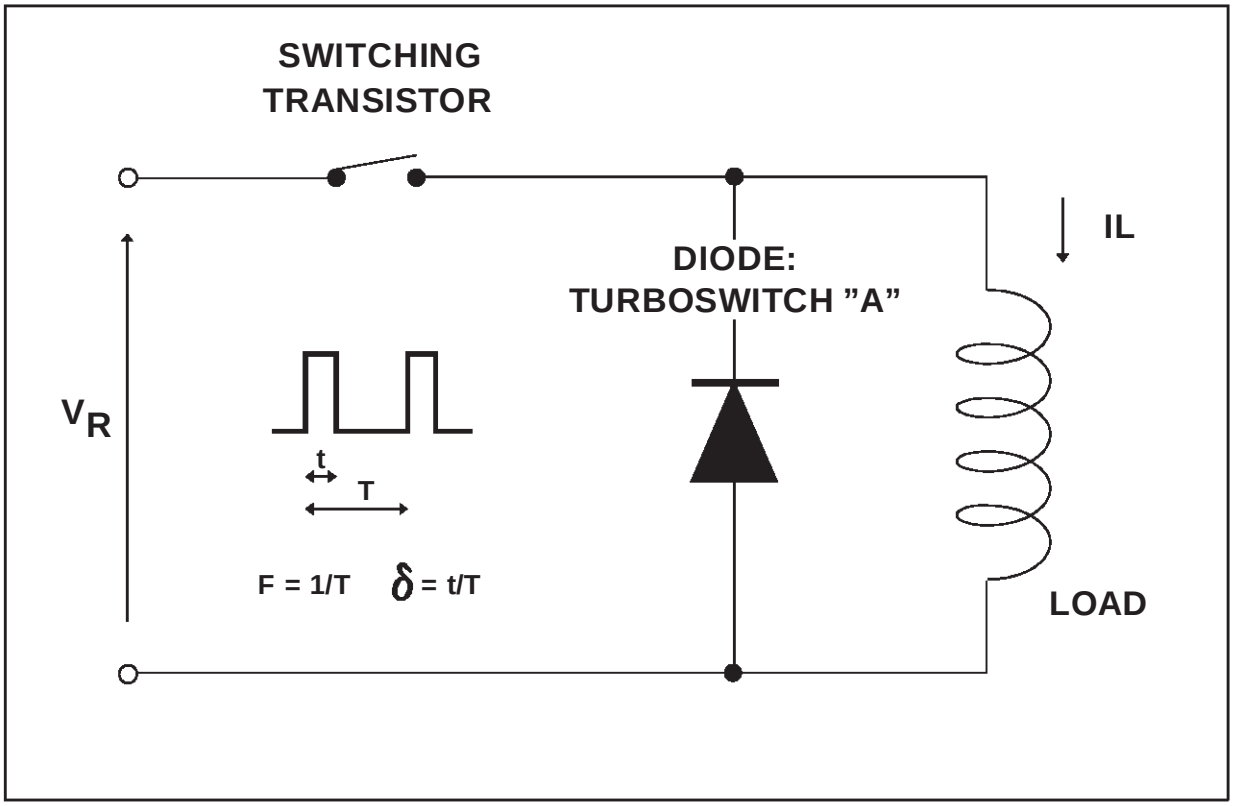


Fig. 1 : "FREEWHEEL MODE".



APPLICATION DATA (Cont'd)

Fig. 2 : SNUBBER DIODE.

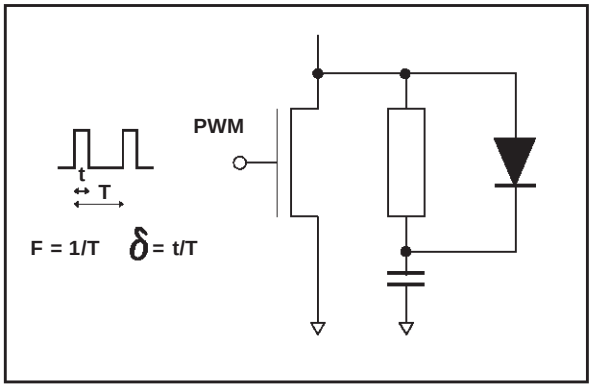


Fig. 3 : CLAMPING DIODE.

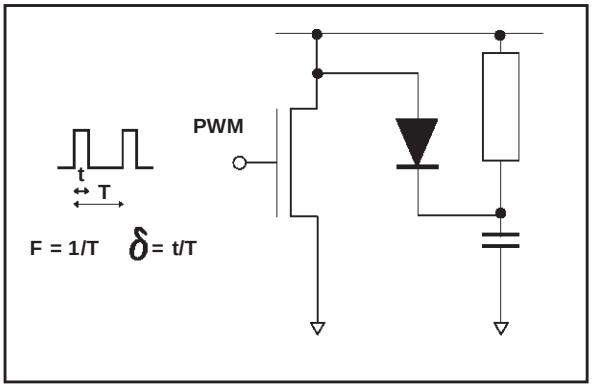


Fig. 4 : DEMAGNETIZING DIODE.

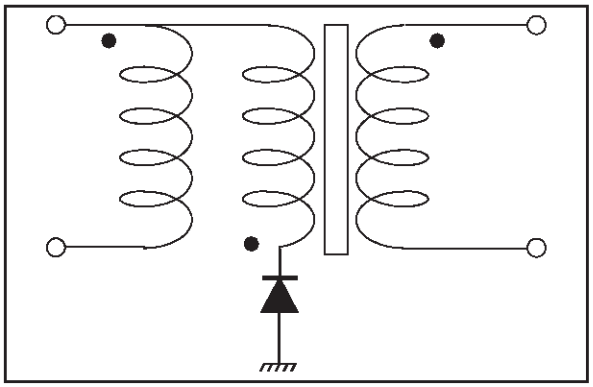


Fig. 5 : RECTIFIER DIODE.

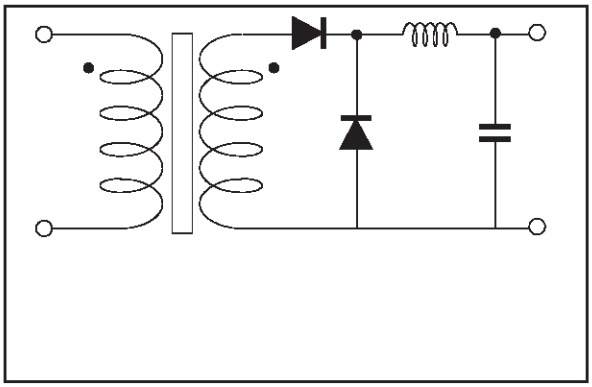
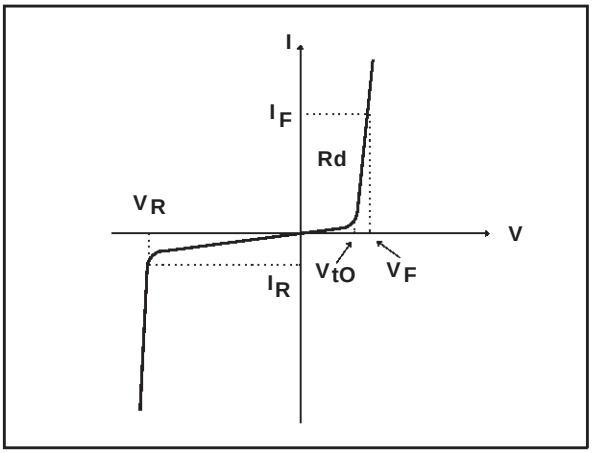


Fig. 6 : STATIC CHARACTERISTICS.



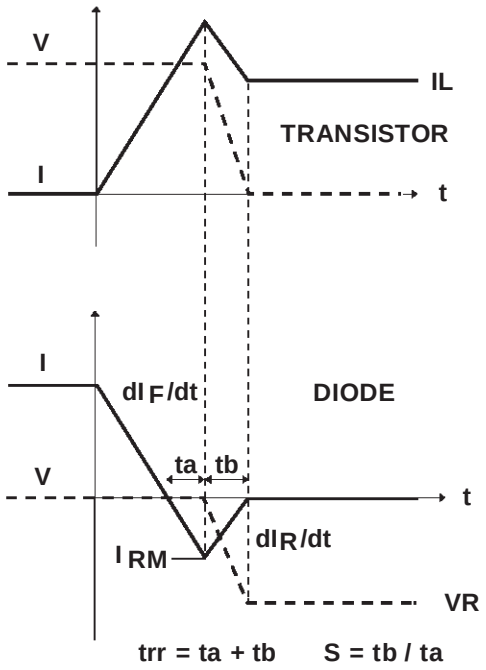
Conduction losses :

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

Reverse losses :

$P2 = V_R \times I_{R \times (1 - \delta)}$

APPLICATION DATA (Cont'd)



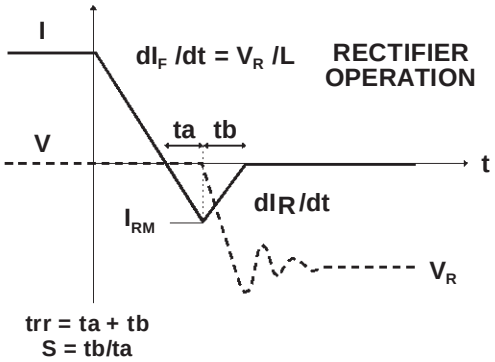
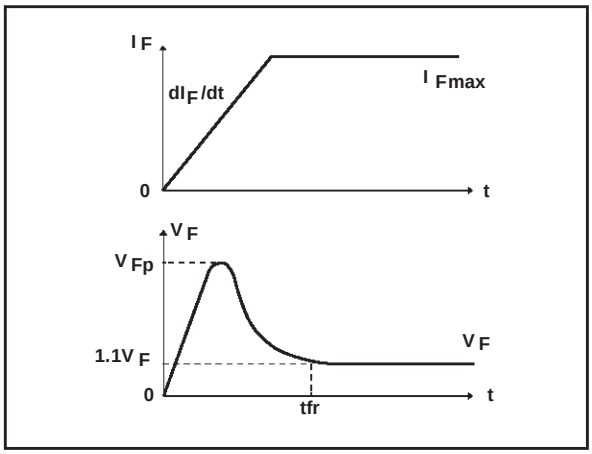


Fig. 8 : TURN-ON CHARACTERISTICS.



Ratings and characteristics curves are ON GOING.

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

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

Turn-off losses :

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

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

Turn-on losses :

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

Fig. 9: Conduction losses versus average current.

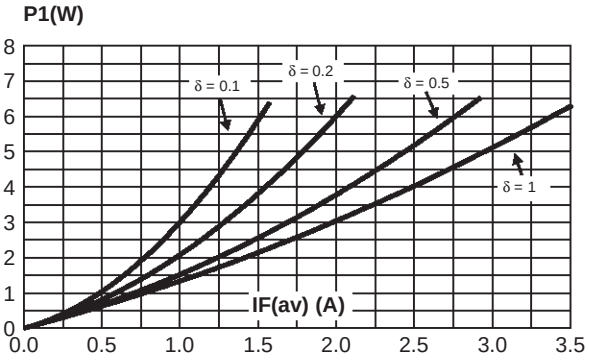


Fig. 10: Switching OFF losses versus dI_F/dt.

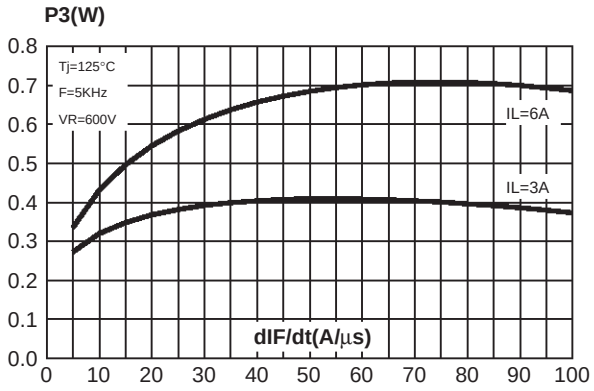


Fig. 11: Switching ON losses versus dI_F/dt.

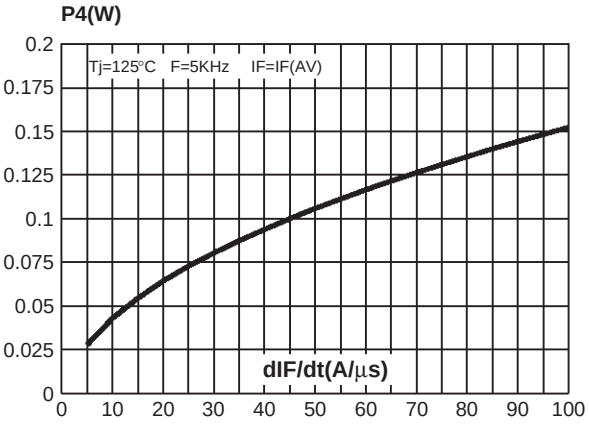


Fig. 12: Switching losses in transistor due to the diode.

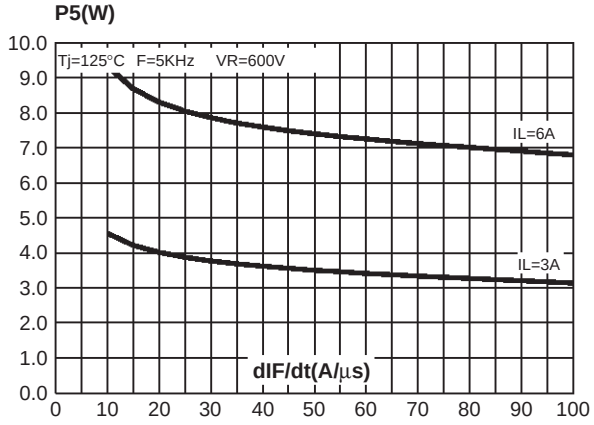


Fig. 13: Forward voltage drop versus forward current (maximum values).

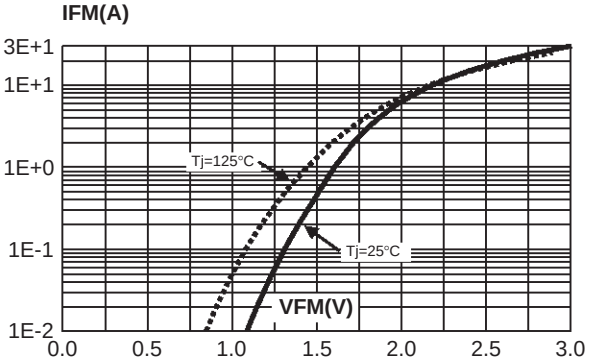


Fig. 14: Relative variation of thermal impedance junction to case versus pulse duration.

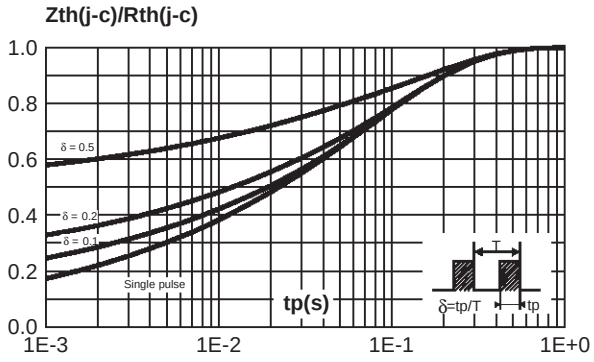


Fig. 15: Peak reverse recovery current versus dI_F/dt (90% confidence).

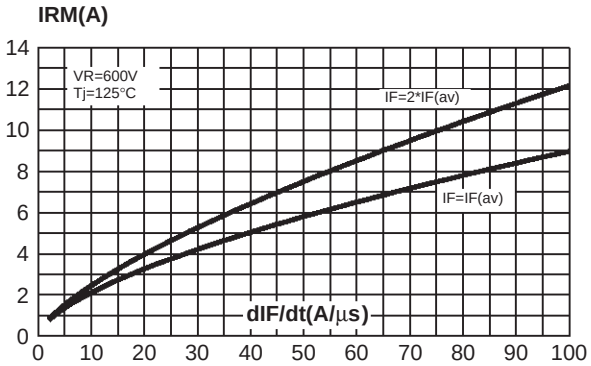


Fig. 16: Reverse recovery time versus dI_F/dt (90% confidence).

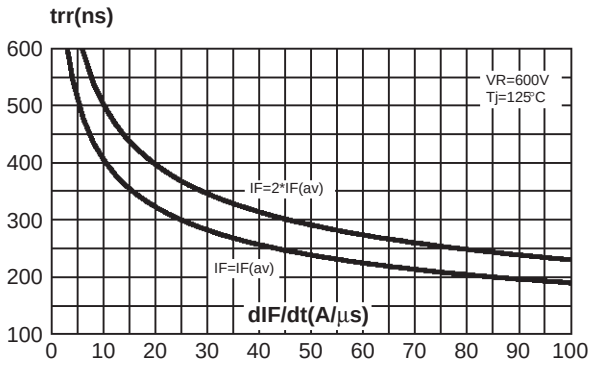


Fig. 17: Softness factor tb/ta versus dI_F/dt (typical values).

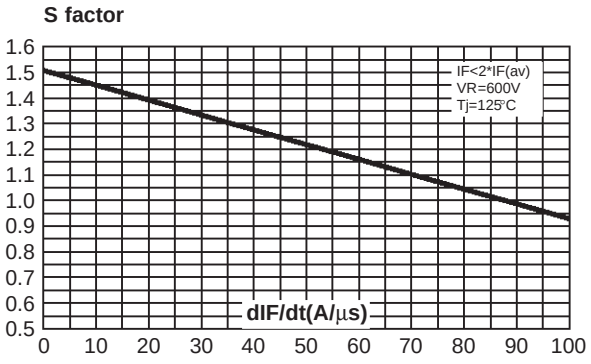


Fig. 18: Relative variation of dynamic parameters versus junction temperature (reference: Tj=125°C).

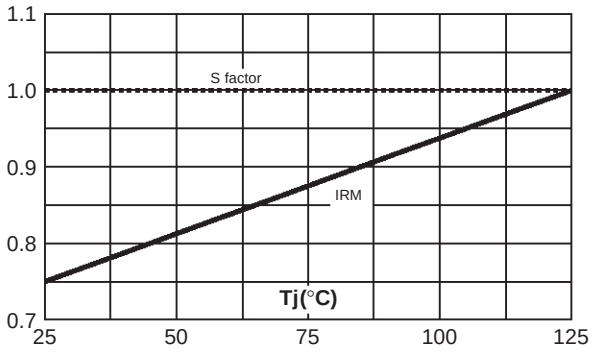


Fig. 19: Transient peak forward voltage versus dI_F/dt (90% confidence).

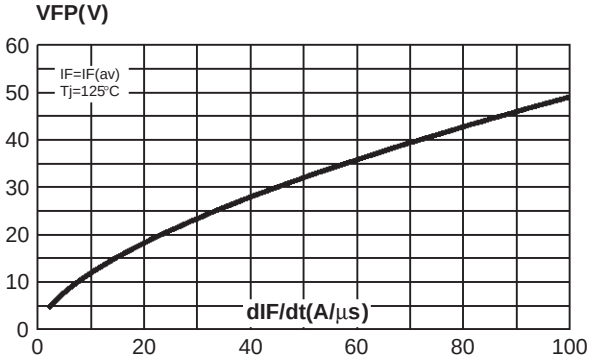
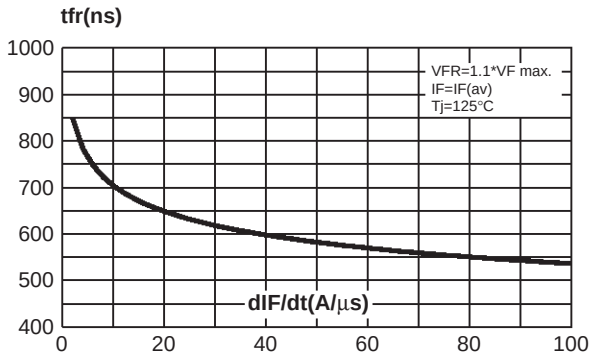
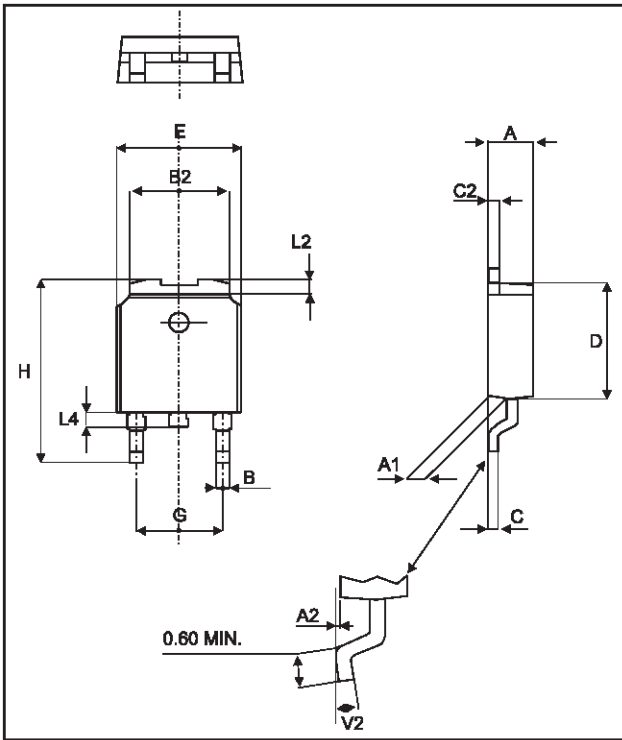


Fig. 20: Forward recovery time versus dI_F/dt (90% confidence).



PACKAGE MECHANICAL 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)

DPAK