

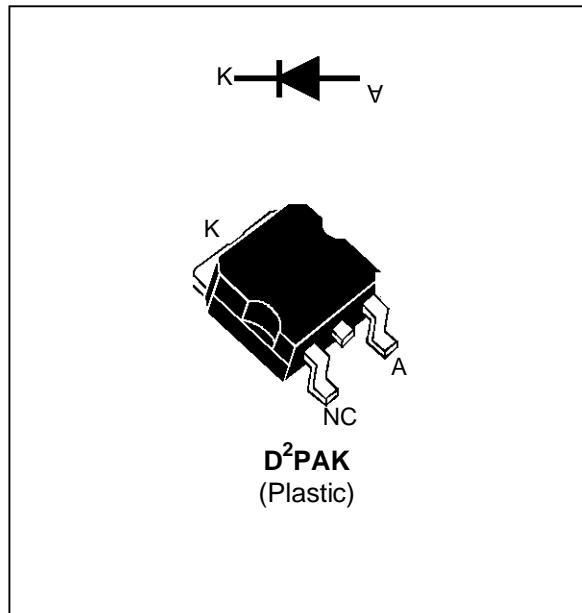
TURBOSWITCH™ "A". ULTRA-FAST HIGH VOLTAGE DIODE

MAIN PRODUCTS CHARACTERISTICS

I _{F(AV)}	12A
V _{RRM}	600V
t _{rr} (typ)	28ns
V _F (max)	1.5V

FEATURES AND BENEFITS

- SPECIFIC TO "FREEWHEEL MODE" OPERATIONS: Freewheel or Booster Diode.
- ULTRA-FAST RECOVERY.
- VERY LOW OVERALL POWER LOSSES IN BOTH THE DIODE AND THE COMPANION TRANSISTOR.
- HIGH FREQUENCY OPERATIONS.
- SMD PACKAGE.



DESCRIPTION

The TURBOSWITCH is a very high performance series of ultra-fast high voltage power diodes from 600V to 1200V.

TURBOSWITCH, A 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 in D²PAK, these 600V devices are particularly intended for use on 240V domestic mains.

ABSOLUTE MAXIMUM RATINGS

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	STTA1206G	30	A
I _{FRM}	Repetitive peak forward current (tp = 5 µs, f = 5kHz)	STTA1206G	140	A
T _j	Max operating junction temperature		-65 to 150	°C
T _{stg}	Storage temperature		-65 to 150	°C

TM : TURBOSWITCH is a trademark of **SGS-THOMSON MICROELECTRONICS**.

STTA1206G

THERMAL AND POWER DATA

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	Junction to case thermal resistance	STTA1206D	1.9	°C/W
P_1	Conduction power dissipation (see fig. 2)	$I_{F(AV)} = 12A \quad \delta = 0.5$ STTA1206D $T_c = 108^\circ C$	22	W
P_{max}	Total power dissipation $P_{max} = P_1 + P_3 \quad (P_3 = 10\% P_1)$	STTA1206D $T_c = 104^\circ C$	24	W

STATIC ELECTRICAL CHARACTERISTICS (see Fig.2)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_F *	Forward voltage drop	$I_F = 12A$	$T_j = 25^\circ C$ $T_j = 125^\circ C$			1.75 1.5	V V
I_R **	Reverse leakage current	$V_R = 0.8 \times V_{RRM}$	$T_j = 25^\circ C$ $T_j = 125^\circ C$			100 5	μA mA

Test pulses widths : * $t_p = 380 \mu s$, duty cycle < 2%

** $t_p = 5 ms$, duty cycle < 2%

DYNAMIC ELECTRICAL CHARACTERISTICS

TURN-OFF SWITCHING (see Fig.3)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	$T_j = 25^\circ C$ $I_F = 0.5 A \quad I_R = 1A \quad I_{rr} = 0.25A$ $I_F = 1 A \quad dI_F/dt = -50A/\mu s \quad V_R = 30V$		28	55	ns
I_{RM}	Maximum reverse recovery current	$T_j = 125^\circ C \quad V_R = 400V \quad I_F = 12A$ $dI_F/dt = -96 A/\mu s$ $dI_F/dt = -500 A/\mu s$		16	7.5	A
S factor	Softness factor	$T_j = 125^\circ C \quad V_R = 400V \quad I_F = 12A$ $dI_F/dt = -500 A/\mu s$		0.45	/	/

TURN-ON SWITCHING (see Fig.4)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	$T_j = 25^\circ C$ $I_F = 12 A, dI_F/dt = 96 A/\mu s$ measured at, $1.1 \times V_{Fmax}$			500	ns
V_{Fp}	Peak forward voltage	$T_j = 25^\circ C$ $I_F = 12A, dI_F/dt = 96 A/\mu s$			10	V

APPLICATION DATA

The TURBOSWITCH "A" is especially designed to provide the lowest overall power losses in any "FREEWHEEL Mode" application (Fig.1) 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:

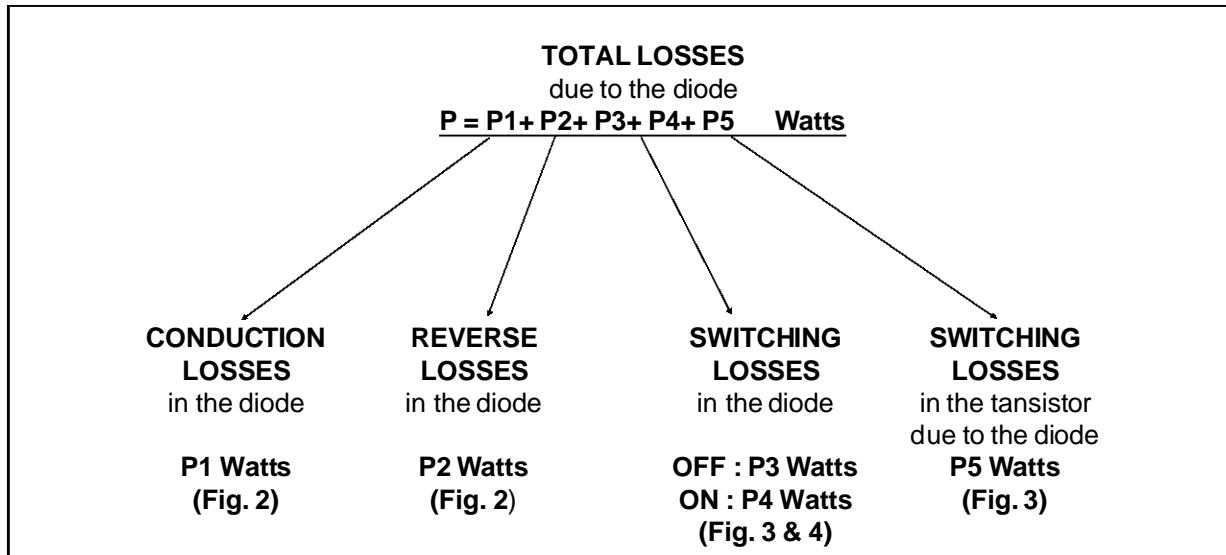
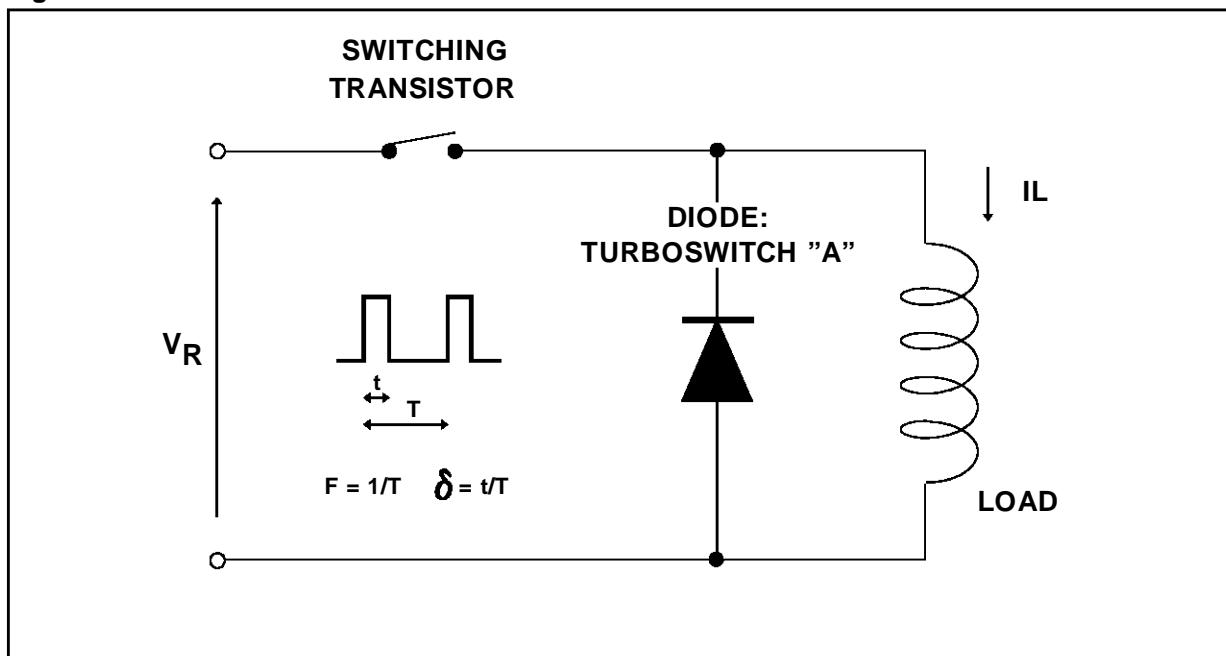


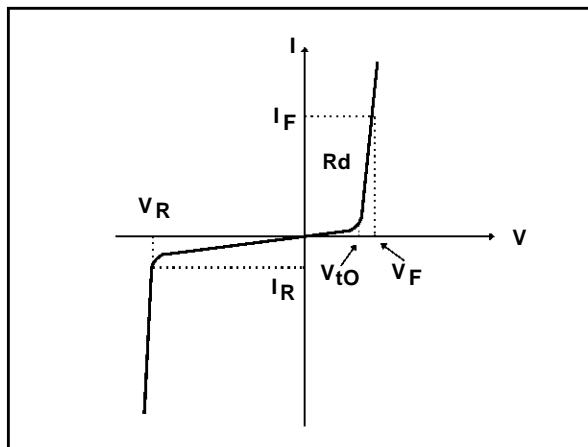
Fig. 1 : "FREEWHEEL" MODE.



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APPLICATION DATA (Cont'd)

Fig. 2 : STATIC CHARACTERISTICS



Conduction losses :

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

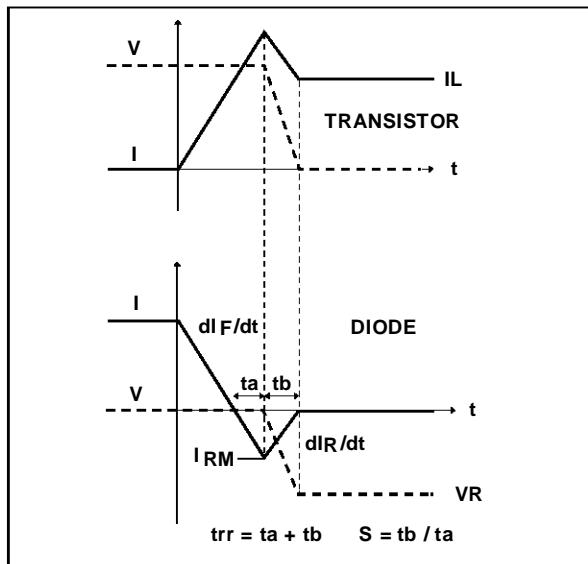
with

$$\begin{aligned} V_{t0} &= 1.15 \text{ V} \\ R_d &= 0.029 \text{ Ohm} \\ (\text{Max values at } 125^\circ\text{C}) \end{aligned}$$

Reverse losses :

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

Fig. 3 : TURN-OFF CHARACTERISTICS



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

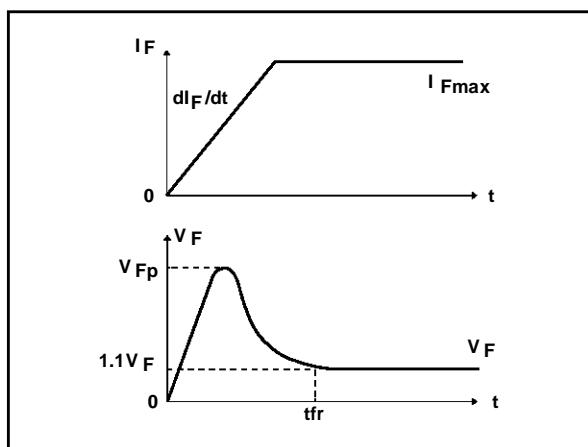
$$\begin{aligned} P5 = & \frac{V_R \times I_{RM}^2 \times (3 + 2 \times S) \times F}{6 \times dl_F/dt} \\ & + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \times dI_F/dt} \end{aligned}$$

Turn-off losses (in the diode) :

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

P3 and P5 are suitable for power MOSFET and IGBT

Fig. 4 : TURN-ON CHARACTERISTICS



Turn-on losses :

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

Fig. 5 : Conduction losses versus average current

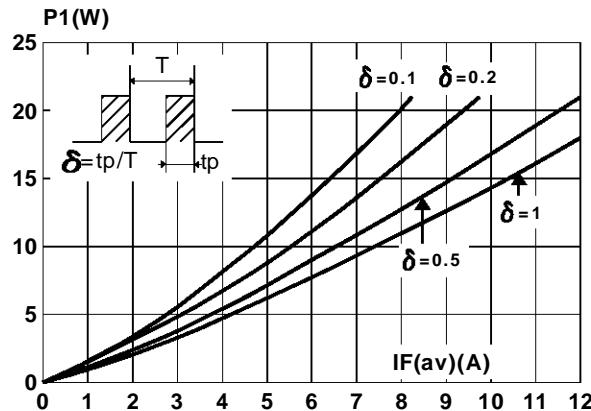


Fig. 6 : Switching OFF losses versus dIF/dt

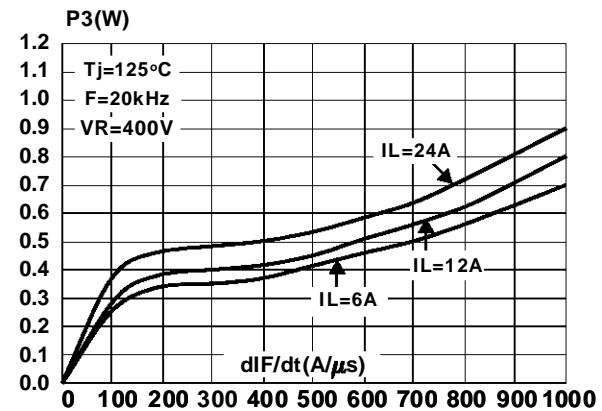


Fig. 7 : Switching ON losses versus dIF/dt

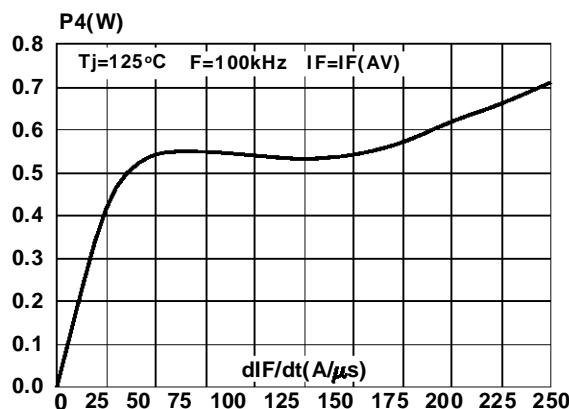


Fig. 8 : Switching losses in transistor due to the diode

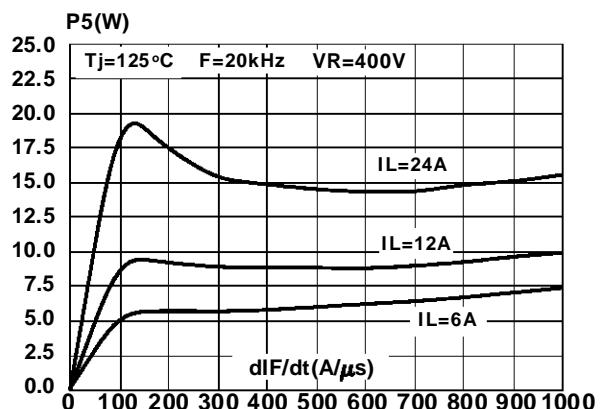


Fig. 9 : Forward voltage drop versus forward current

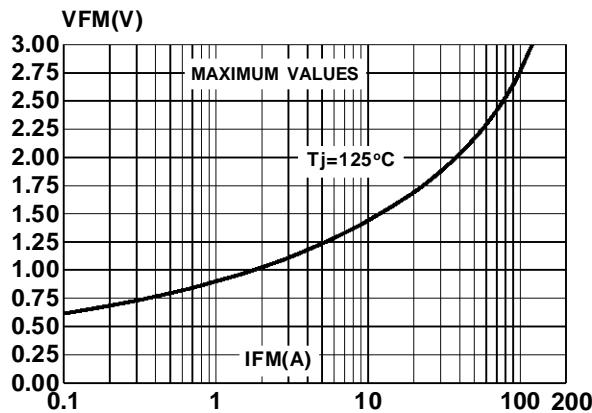
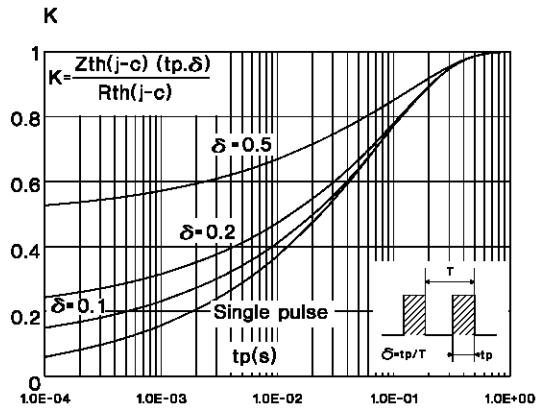


Fig. 10 : Relative variation of thermal transient impedance junction to case versus pulse duration



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Fig. 11 : Peak reverse recovery current versus dI/dt

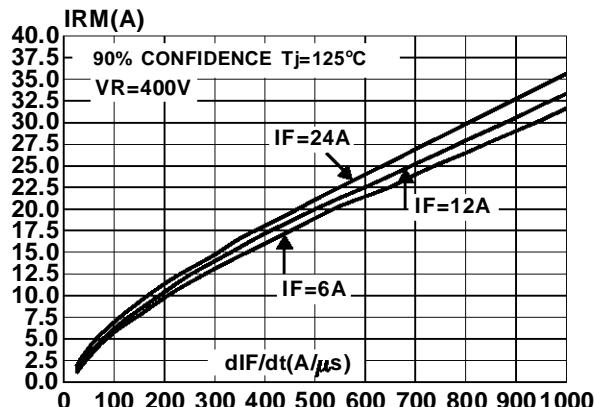


Fig. 12 : Reverse recovery time versus dI/dt

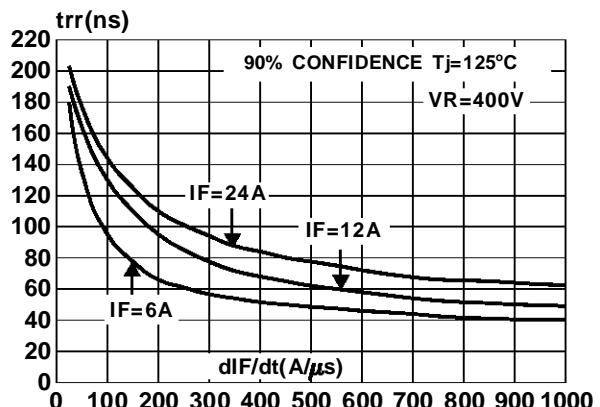


Fig. 13 : Softness factor (tb/ta) versus dI/dt

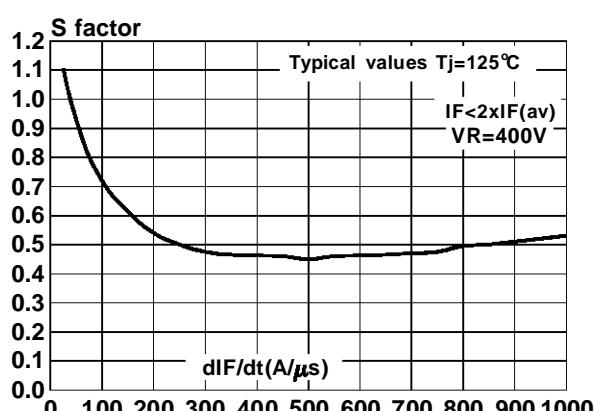


Fig. 14 : Relative variation of dynamic parameters versus junction temperature (Reference $T_j=125^\circ C$)

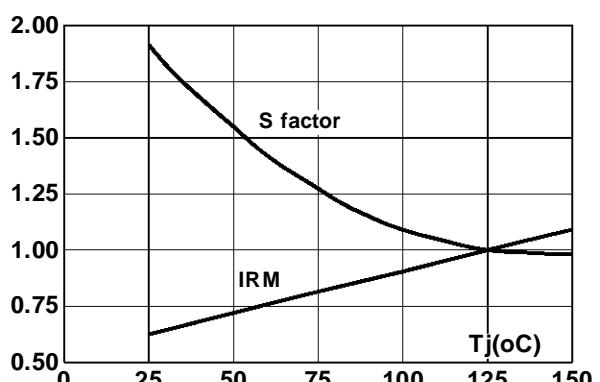


Fig. 15 : Transient peak forward voltage versus dI/dt

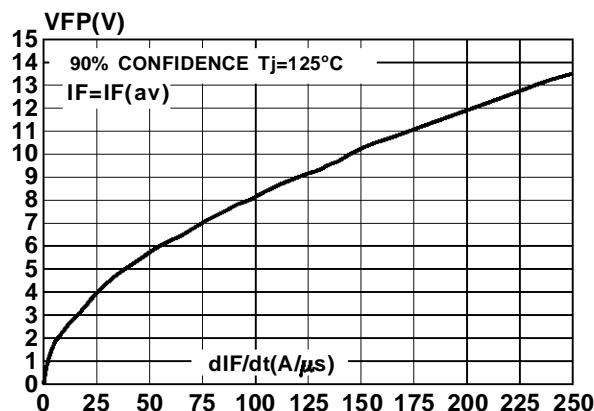
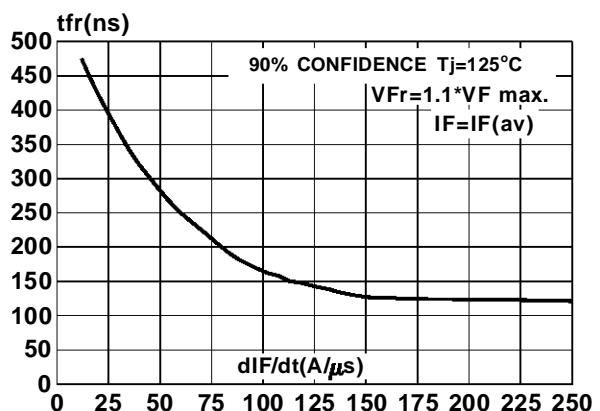


Fig. 16 : Forward recovery time versus dI/dt



PACKAGE DATA
D²PAK (Plastic)

REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.30		4.60	0.169		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	1.25		1.40	0.049		0.055
C	0.45		0.60	0.017		0.024
C2	1.21		1.36	0.047		0.054
D	9.00		9.35	0.354		0.368
E	10.00		10.28	0.393		0.405
G	4.88		5.28	0.192		0.208
L	15.00		15.85	0.590		0.624
L2	1.27		1.37	0.050		0.054
L3	1.40		1.75	0.055		0.069

Cooling method : C.

Marking : Type number.

Weight : 1.8 g.

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