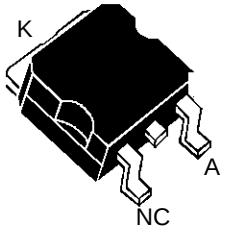
SGS-THOMSON MICROELECTRONICS

STTA1206G

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**



D^2PAK
(Plastic)

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 D^2PAK, 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.**

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 δ =0.5 STTA1206D Tc= 108°C	22	W
P_{max}	Total power dissipation Pmax = P1 + P3 (P3 = 10% P1)	STTA1206D Tc= 104°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	Tj = 25°C Tj = 125°C			1.75 1.5	V V
I_R **	Reverse leakage current	V_R =0.8 x V_{RRM}	Tj = 25°C Tj = 125°C			100 5	µA mA

Test pulses widths : * tp = 380 µs, duty cycle < 2%
** tp = 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	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		28	55	ns
I_{RM}	Maximum reverse recovery current	Tj = 125°C VR = 400V I_F =12A dI_F/dt = -96 A/µs dI_F/dt = -500 A/µs		16	7.5	A
S factor	Softness factor	Tj = 125°C V_R = 400V I_F =12A dI_F/dt = -500 A/µs		0.45		/

TURN-ON SWITCHING (see Fig.4)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{fr}	Forward recovery time	Tj = 25°C I_F =12 A, dI_F/dt = 96 A/µs measured at, 1.1 × $V_F$max			500	ns
V_{Fp}	Peak forward voltage	Tj = 25°C I_F =12A, dI_F/dt = 96 A/µs			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:

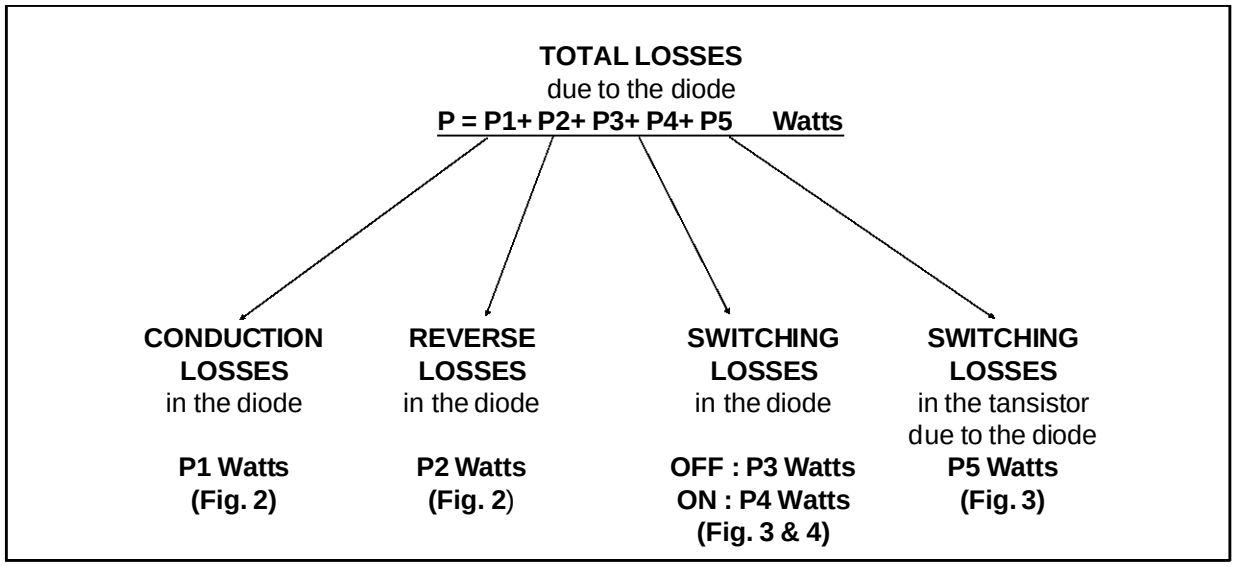
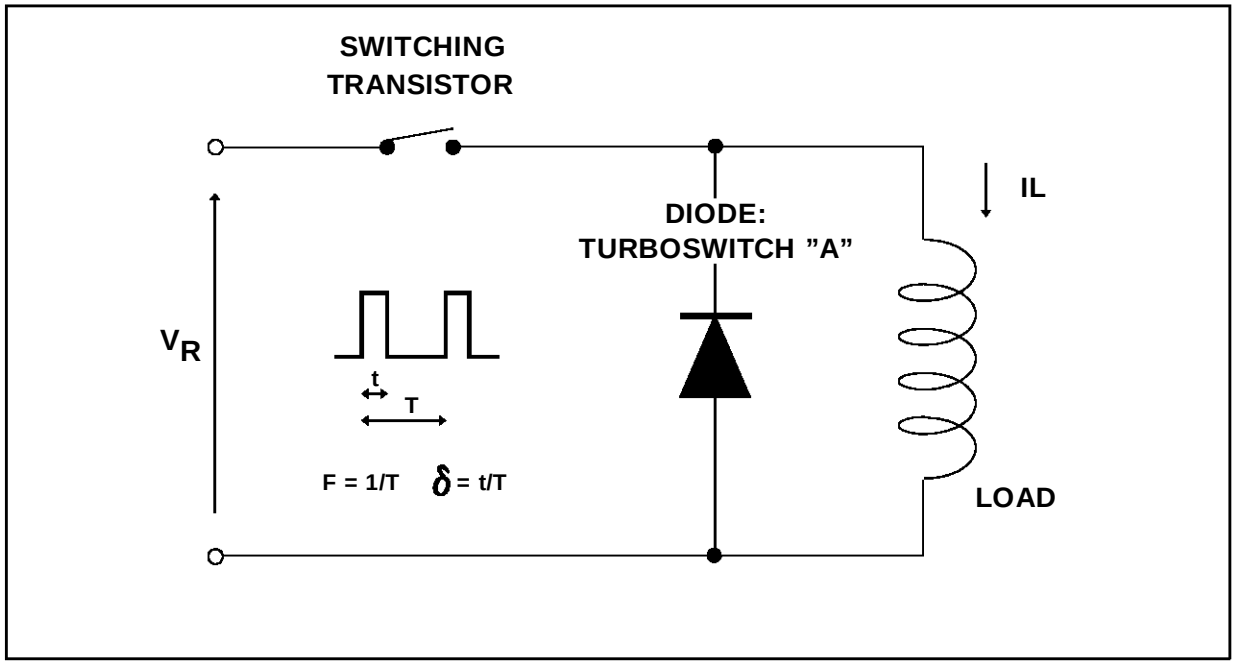
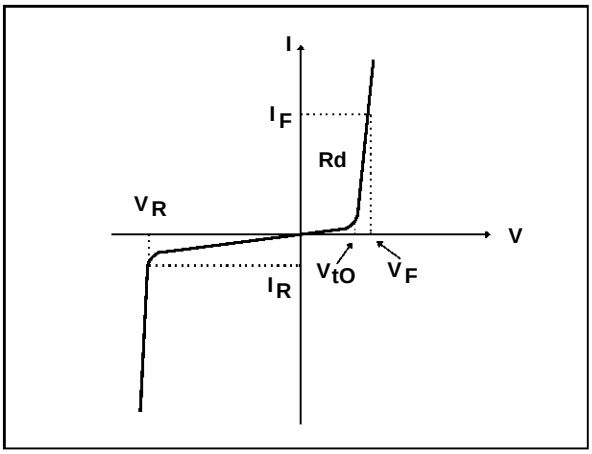


Fig. 1 : "FREEWHEEL" MODE.



APPLICATION DATA (Cont'd)

Fig. 2 : STATIC CHARACTERISTICS



Conduction losses :

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

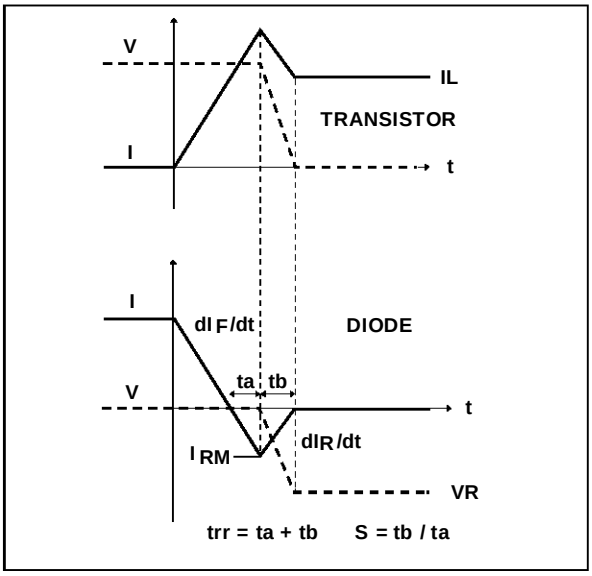
with

V_{t0} = 1.15 V
R_d = 0.029 Ohm
(Max values at 125°C)

Reverse losses :

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

Fig. 3 : TURN-OFF CHARACTERISTICS



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

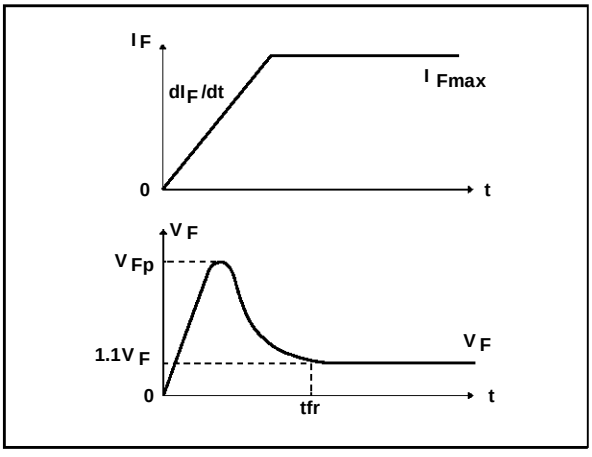
$$P5 = \frac{V_R \times I_{RM}{}^2 \times (3 + 2 \times S) \times F}{6 \; x \; dI_F/dt} + \frac{V_R \times I_{RM} \times I_L \times (S + 2) \times F}{2 \; x \; dI_F/dt}$$

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

Fig. 4 : TURN-ON CHARACTERISTICS



Turn-on losses :

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

Fig. 5 : Conduction losses versus average current

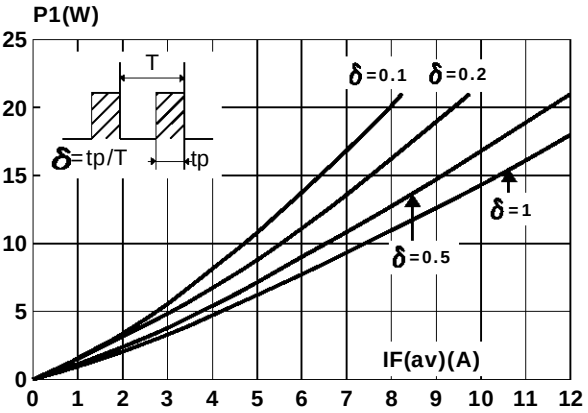


Fig. 6 : Switching OFF losses versus dIF/dt

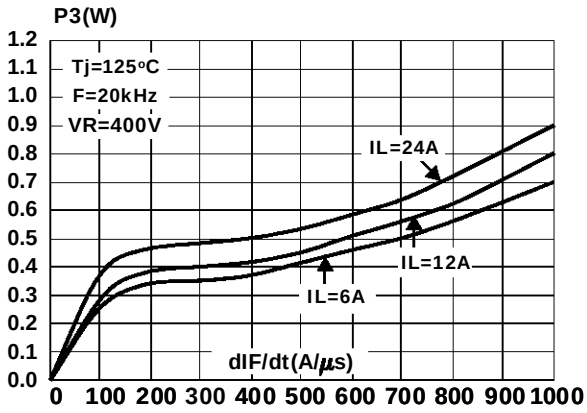


Fig. 7 : Switching ON losses versus dIF/dt

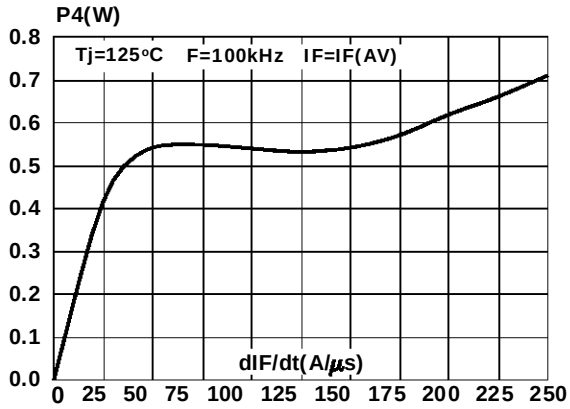


Fig. 8 : Switching losses in transistor due to the diode

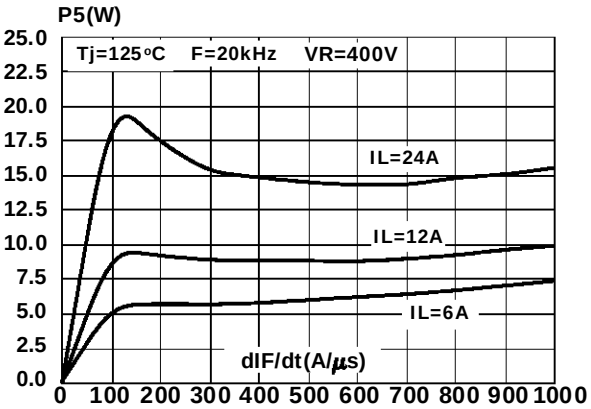


Fig. 9 : Forward voltage drop versus forward current

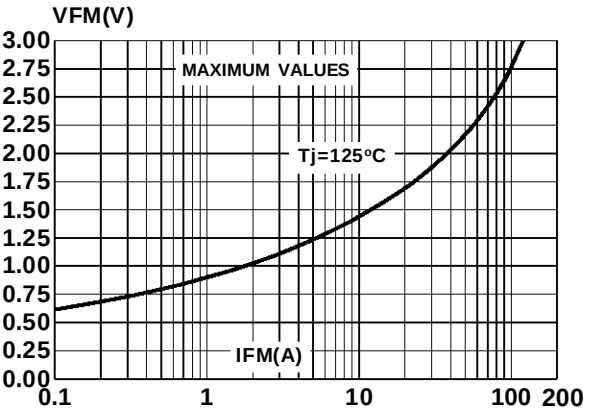


Fig. 10 : Relative variation of thermal transient impedance junction to case versus pulse duration

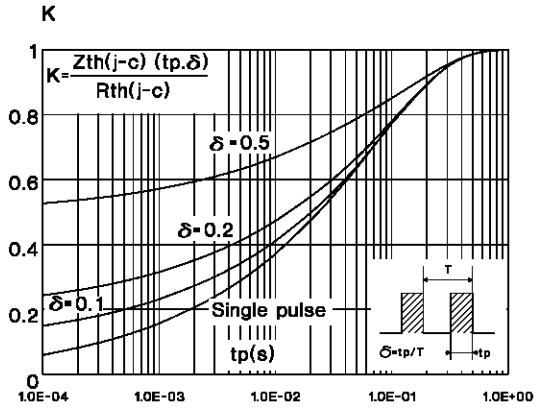


Fig. 11 : Peak reverse recovery current versus dI_F/dt

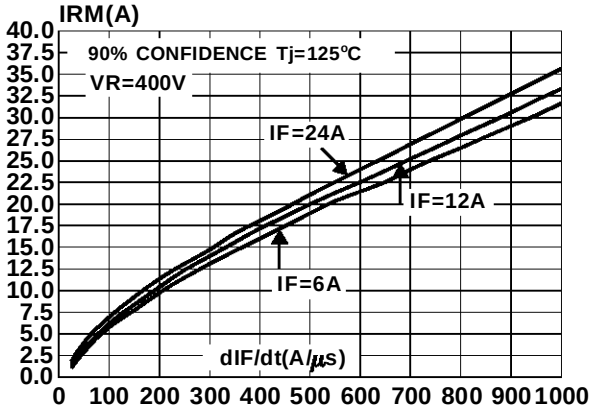


Fig. 12 : Reverse recovery time versus dI_F/dt

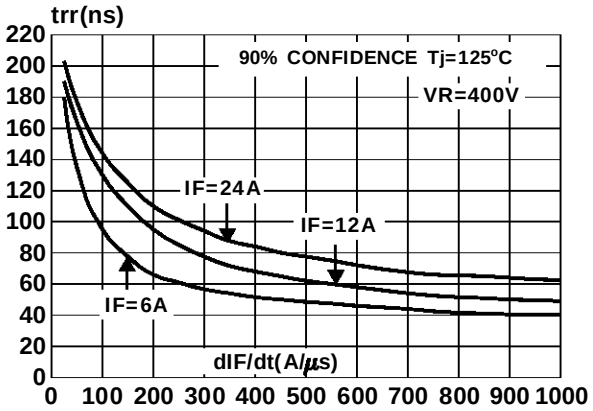


Fig. 13 : Softness factor (tb/ta) versus dI_F/dt

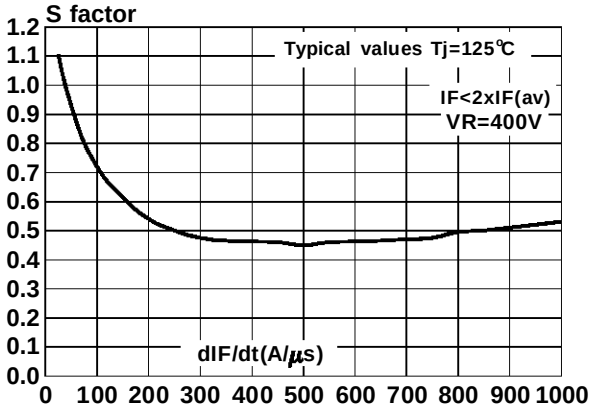


Fig. 14 : Relative variation of dynamic parameters versus junction temperature (Reference Tj=125°C)

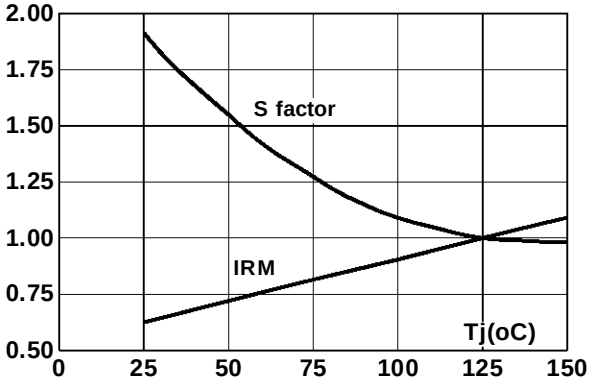


Fig. 15 : Transient peak forward voltage versus dI_F/dt

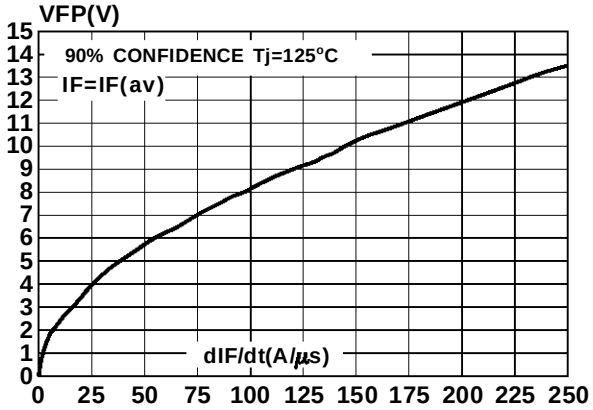
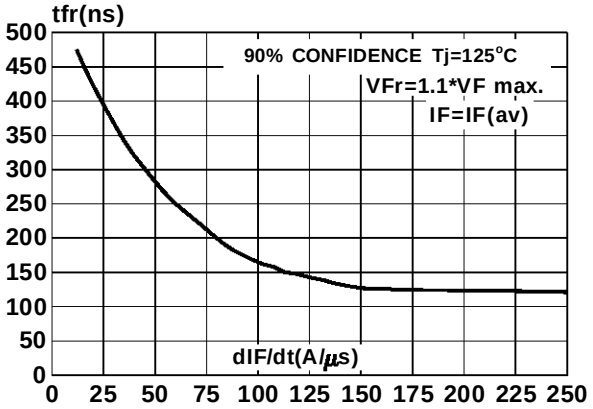
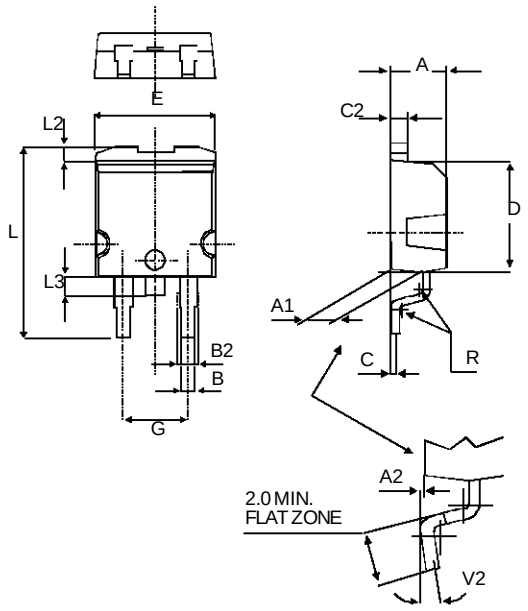


Fig. 16 : Forward recovery time versus dI_F/dt



PACKAGE DATA
D^2PAK (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.