STB20NF06L - STF20NF06L STP20NF06L

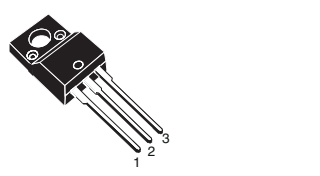
N-channel 60V - 0.06Ω - 20A - D²PAK/TO-220/TO-220FP STripFET™ II Power MOSFET

General features

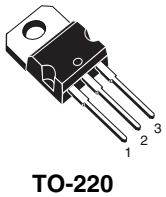
Type	V_{DSS}	$R_{DS(on)}$	I_D
STB20NF06L	60V	<0.07Ω	20A
STF20NF06L	60V	<0.07Ω	20A (1)
STP20NF06L	60V	<0.07Ω	20A

1. Refer to SOA for the max allowable current value on FP-type due to Rth value

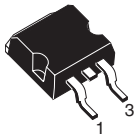
- Avalanche rugged technology
- 100% avalanche tested
- 175°C operating temperature
- High dv/dt capability
- application oriented characterization



TO-220FP



TO-220

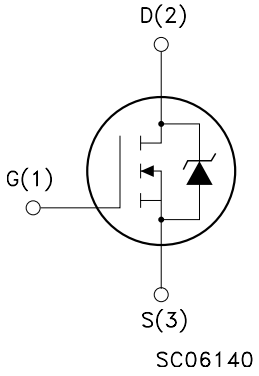


D²PAK

Description

This Power MOSFET is the latest development of STMicroelectronics unique “single feature size”™ strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

Internal schematic diagram



Applications

- Switching application

Order codes

Part number	Marking	Package	Packaging
STB20NF06LT4	B20NF06L	D²PAK	Tape & reel
STF20NF06L	F20NF06L	TO-220FP	Tube
STP20NF06L	P20NF06L	TO-220	Tube

Contents

1 Electrical ratings 3

2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

3 Test circuit 9

4 Package mechanical data 10

5 Packing mechanical data 14

6 Revision history 15

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/D²PAK	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	60		V
V_{GS}	Gate- source voltage	± 18		V
I_D	Drain current (continuous) at T_C = 25°C	20	20 (1)	A
I_D	Drain current (continuous) at T_C = 100°C	14	14 (1)	A
I_{DM} (2)	Drain current (pulsed)	80	80 (1)	A
P_{tot}	Total dissipation at T_C = 25°C	60	28	W
	Derating Factor	0.4	0.18	W/°C
dv/dt (3)	Peak diode recovery voltage slope	9		V/ns
E_{AS} (4)	Single pulse avalanche energy	120		mJ
T_{stg}	Storage temperature	-55 to 175		°C
T_j	Max. operating junction temperature			

1. Refer to SOA for the max allowable current value on FP-type due to Rth value
2. Pulse width limited by safe operating area.
3. $I_{SD} \leq 20A$, di/dt ≤200A/µs, $V_{DD} \leq V_{(BR)DSS}$, $Tj \leq T_{JMAX}$
4. Starting Tj = 25 °C, I_D = 10A, V_{DD} = 30V

Table 2. Thermal data

Symbol	Parameter	TO-220/D²PAK	TO-220FP	Unit
Rthj-case	Thermal resistance junction-case max	2.5	5.35	°C/W
Rthj-amb	Thermal resistance junction-ambient max	62.5		°C/W
T_l	Maximum lead temperature for soldering purpose (for 10sec. 1.6mm from case)	300		°C/W

2 Electrical characteristics

(T_{CASE}=25°C unless otherwise specified)

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250µA, V_{GS} =0	60			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = Max rating V_{DS} = Max rating, @125°C				1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 18V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10V, I_D = 10A V_{GS} = 5V, I_D = 10A		0.060 0.075	0.070 0.085	Ω Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS}= 15V, I_D = 8A		10		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25V, f = 1MHz, V_{GS} = 0		400 100 40		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 30V, I_D = 20A, V_{GS} = 10V (see *Figure 16*)		7.5 2.5 4.2		nC nC nC

1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 30V, I_D = 10A R_G = 4.7Ω V_{GS} = 10V (see *Figure 15*)		12 30 20 6		ns ns ns ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)				20 80	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 20A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 20A, di/dt = 100A/µs, V_{DD} = 20V, T_j = 150°C (see *Figure 17*)		50 65 3		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220/ D²PAK

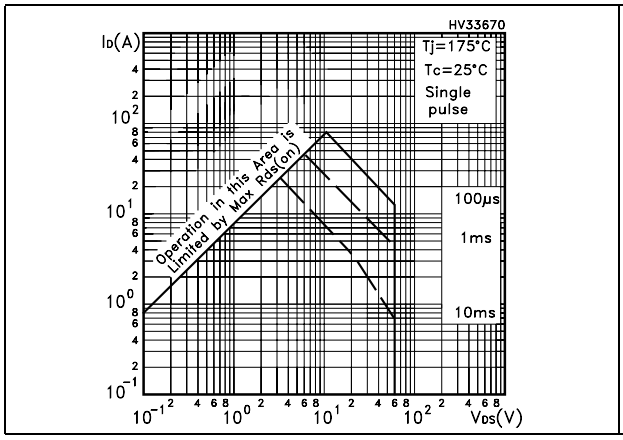


Figure 2. Thermal impedance for TO-220/ D²PAK

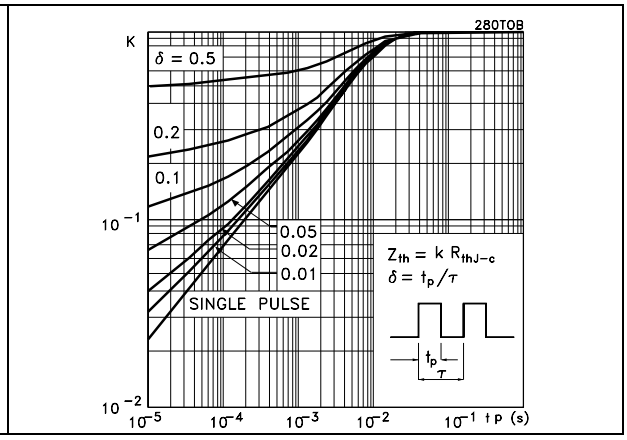


Figure 3. Safe operating area for TO-220FP

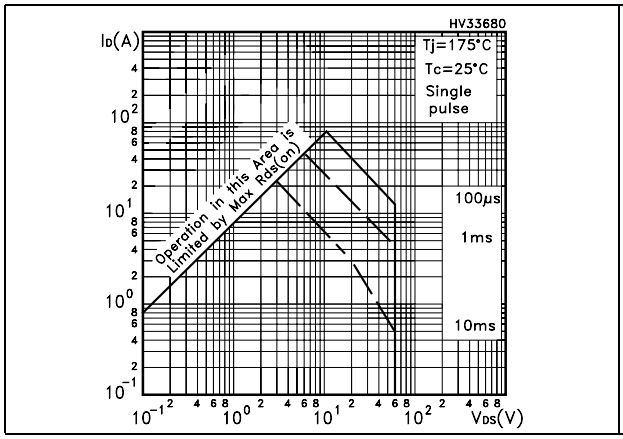


Figure 4. Thermal impedance for TO-220FP

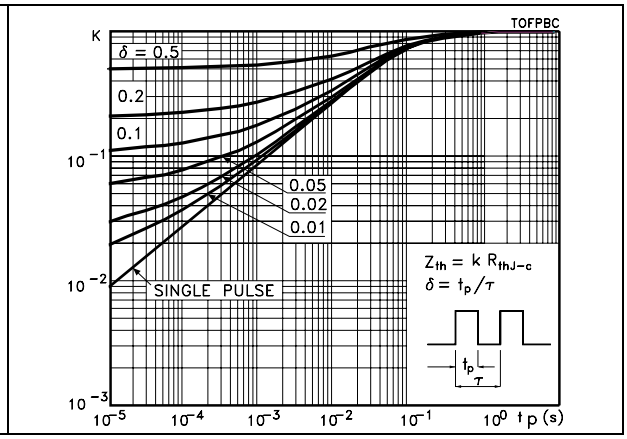


Figure 5. Output characterisics

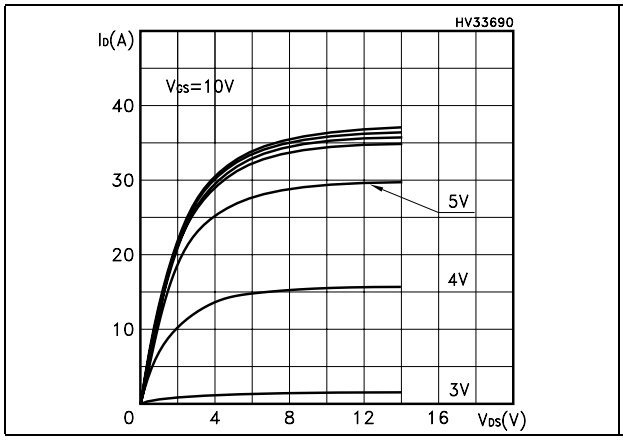


Figure 6. Transfer characteristics

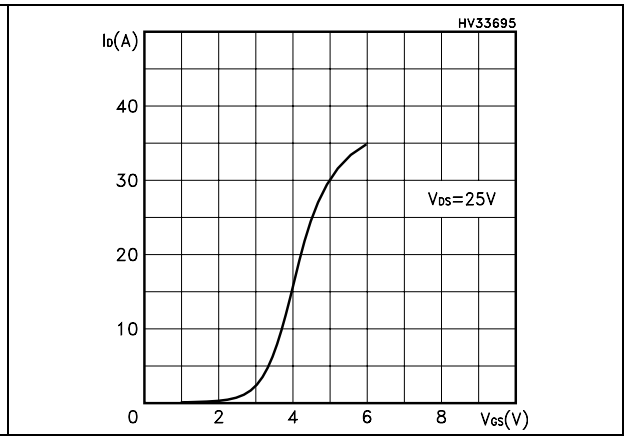


Figure 7. Transconductance

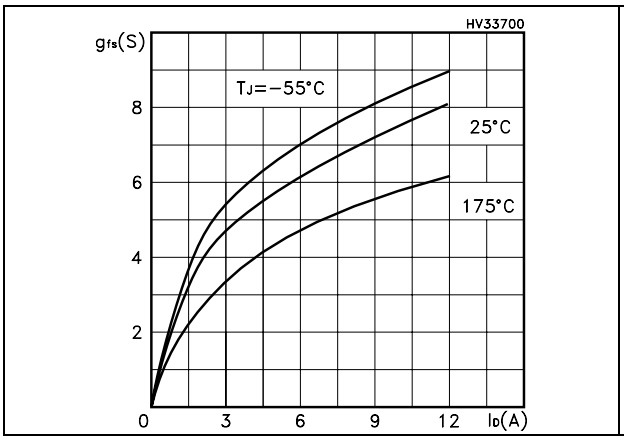


Figure 8. Static drain-source on resistance

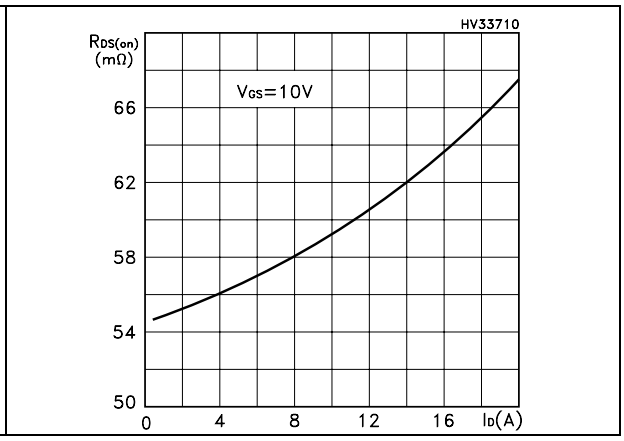


Figure 9. Gate charge vs gate-source voltage

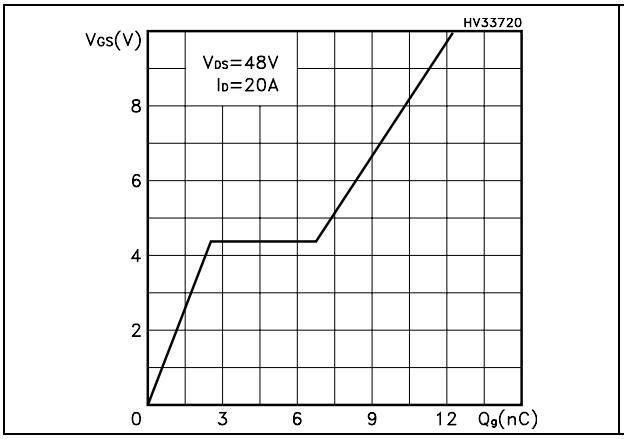


Figure 10. Capacitance variations

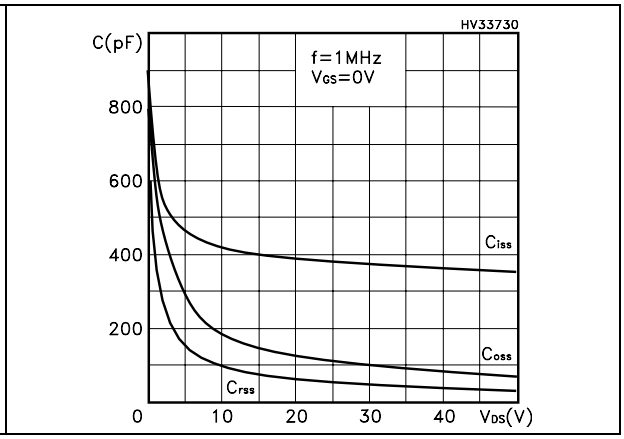


Figure 11. Normalized gate threshold voltage vs temperature

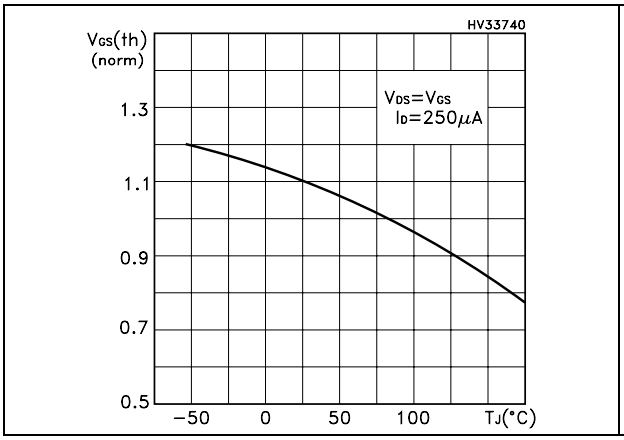


Figure 12. Normalized on resistance vs temperature

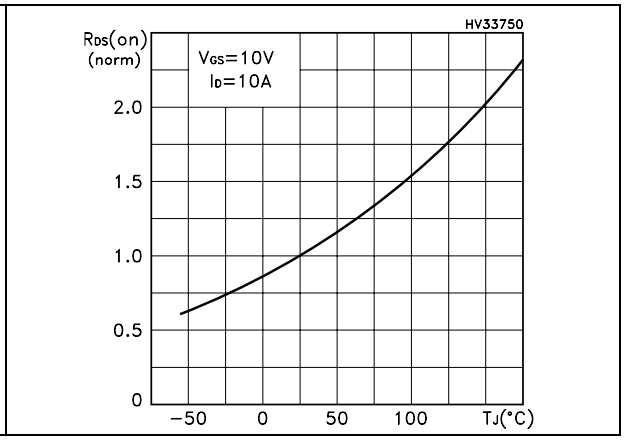


Figure 13. Source-drain diode forward characteristics

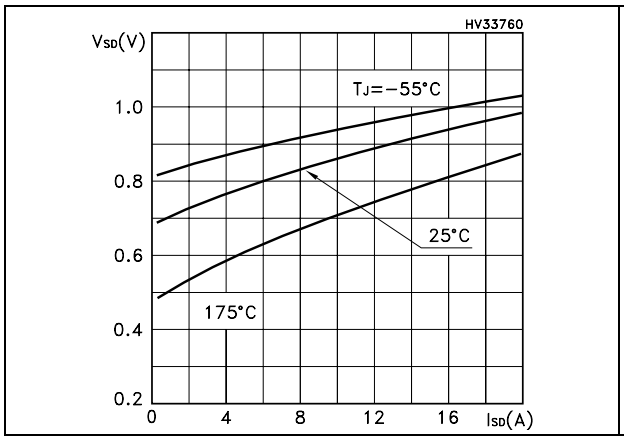
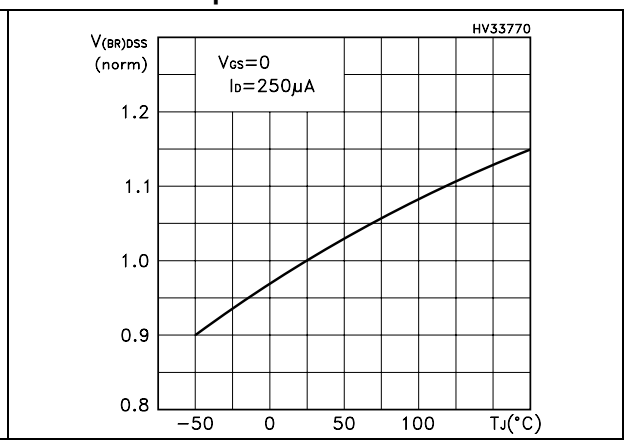


Figure 14. Normalized breakdown voltage temperature



3 Test circuit

Figure 15. Switching times test circuit for resistive load

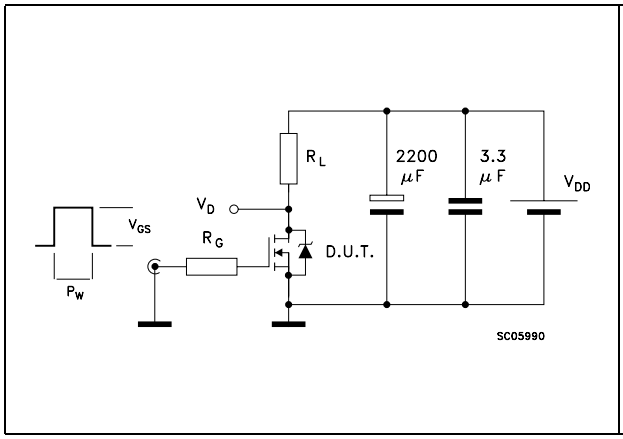


Figure 16. Gate charge test circuit

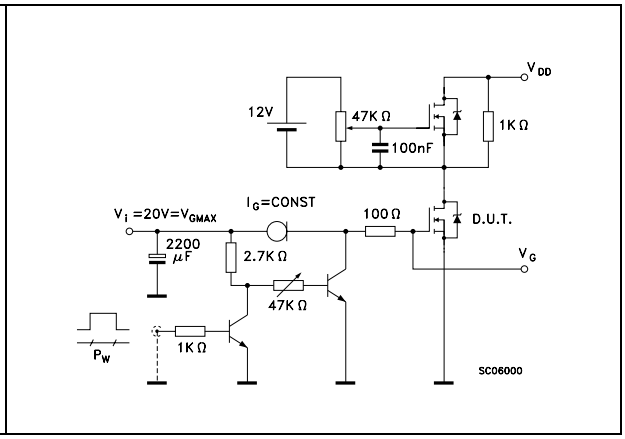


Figure 17. Test circuit for inductive load switching and diode recovery times

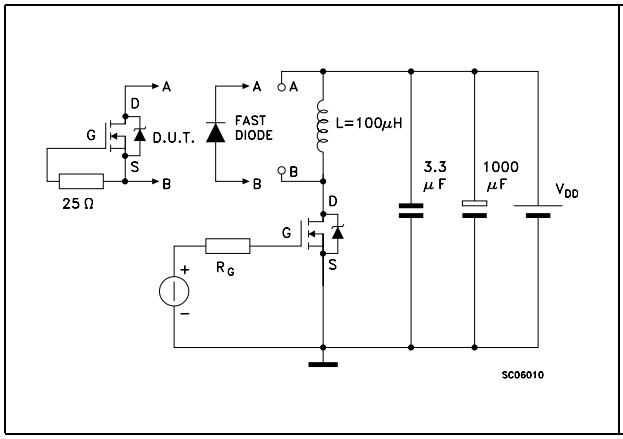


Figure 18. Unclamped Inductive load test circuit

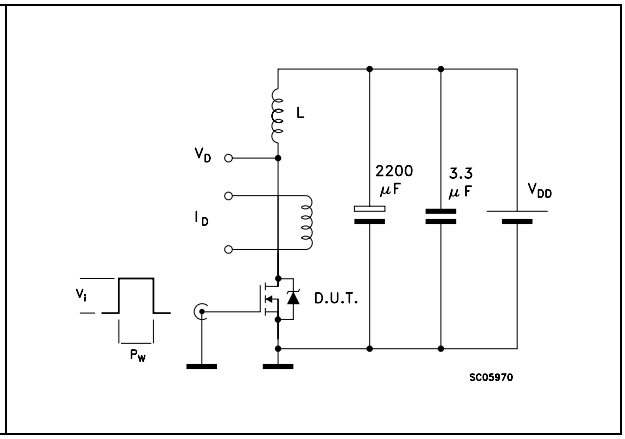


Figure 19. Unclamped inductive waveform

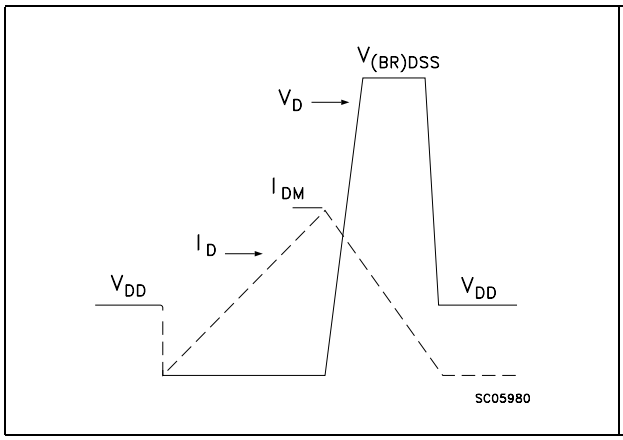
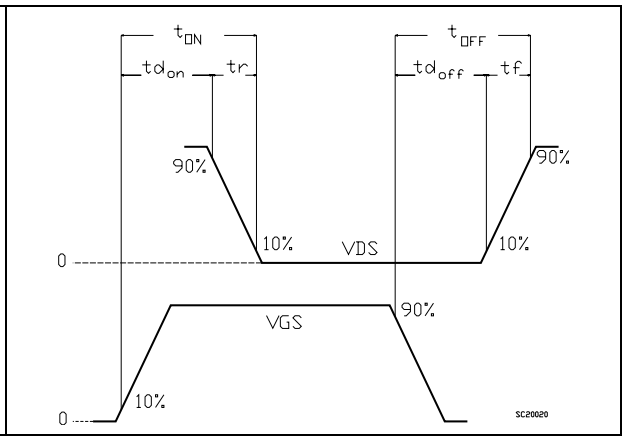


Figure 20. Switching time waveform

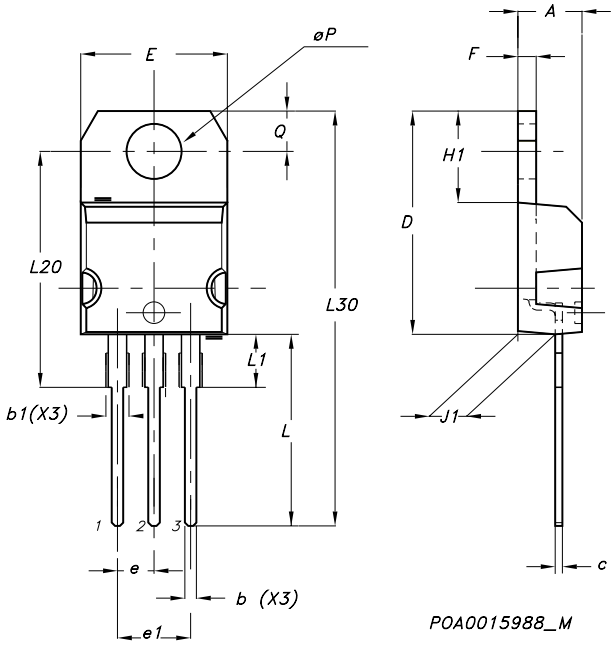


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at : *www.st.com*

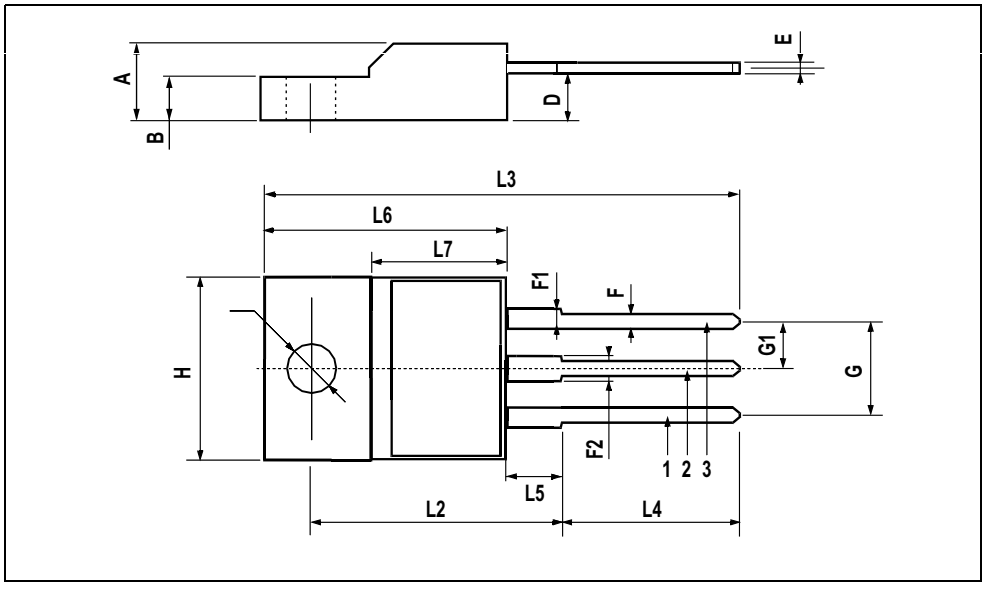
TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



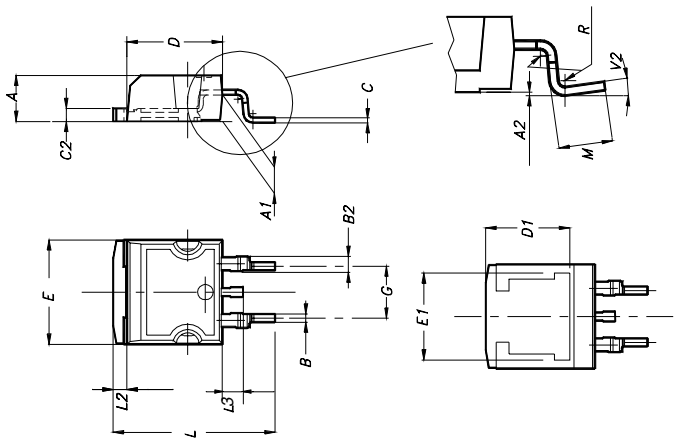
TO-220FP MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



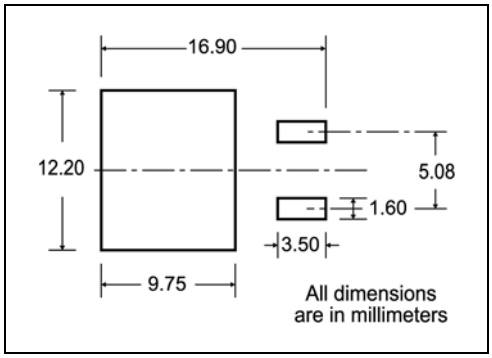
D^2PAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0º		4º			

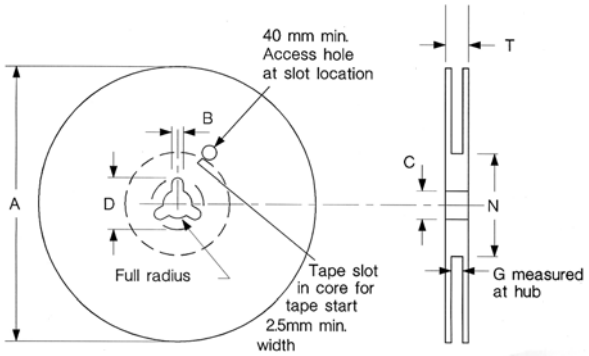


5 Packing mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



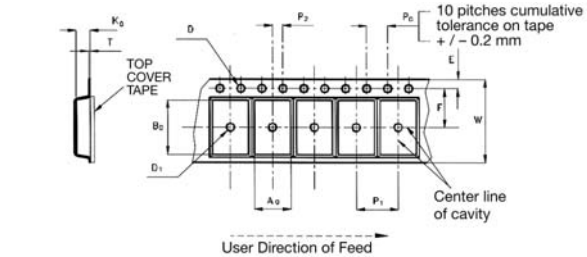
REEL MECHANICAL DATA

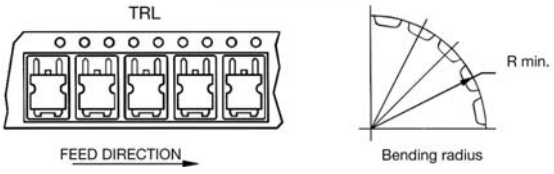
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956





* on sales type

6 Revision history

Table 7. Revision history

Date	Revision	Changes
09-Dec-2004	1	First release
27-Jul-2006	2	New template, inserted D²PAK

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