



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 R_{th} value

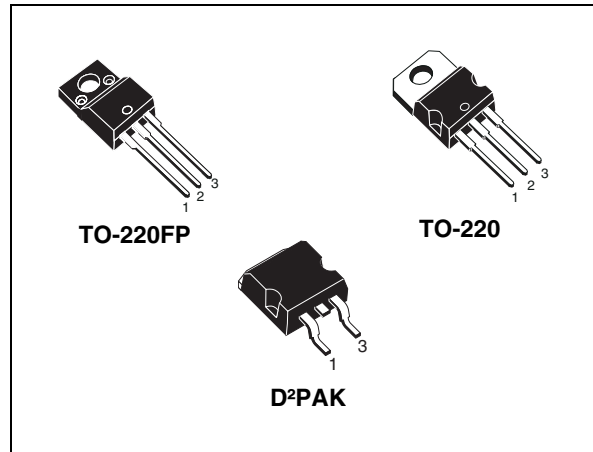
- Avalanche rugged technology
- 100% avalanche tested
- 175°C operating temperature
- High dv/dt capability
- application oriented characterization

Description

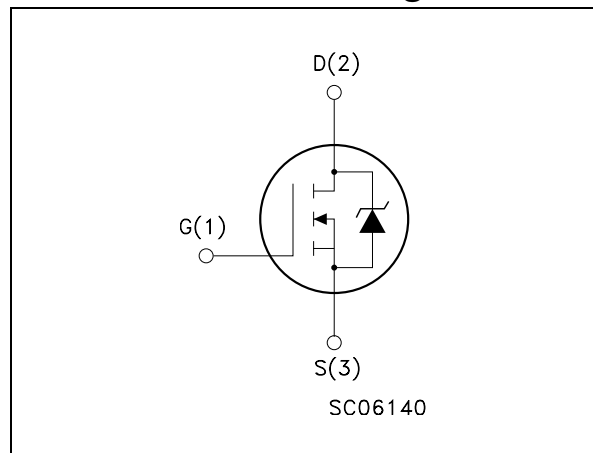
This Power MOSFET is the latest development of STMicroelectronics unique “single feature size”™ strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

Applications

- Switching application



Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STB20NF06LT4	B20NF06L	D ² PAK	Tape & reel
STF20NF06L	F20NF06L	TO-220FP	Tube
STP20NF06L	P20NF06L	TO-220	Tube

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1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/D ² PAK	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 $T_C = 25^\circ\text{C}$	20	20 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	14	14 ⁽¹⁾	A
$I_{DM}^{(2)}$	Drain current (pulsed)	80	80 ⁽¹⁾	A
P_{tot}	Total dissipation at $T_C = 25^\circ\text{C}$	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 R_{th} value

2. Pulse width limited by safe operating area.

3. $I_{SD} \leq 20\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

4. Starting $T_j = 25^\circ\text{C}$, $I_D = 10\text{A}$, $V_{DD} = 30\text{V}$

Table 2. Thermal data

Symbol	Parameter	TO-220/D ² PAK	TO-220FP	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.5	5.35	°C/W
$R_{thj-amb}$	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

($T_{CASE}=25^{\circ}\text{C}$ unless otherwise specified)

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0$	60			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating, @ } 125^{\circ}\text{C}$			1 10	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 18\text{V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{V}$, $I_D = 10\text{A}$ $V_{GS} = 5\text{V}$, $I_D = 10\text{A}$		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	$V_{DS} = 15\text{V}$, $I_D = 8\text{A}$		10		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GS} = 0$		400 100 40		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 30\text{V}$, $I_D = 20\text{A}$, $V_{GS} = 10\text{V}$ (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
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30V, I_D = 10A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 15)		12		ns
t_r	Rise time			30		ns
$t_{d(off)}$	Turn-off delay time			20		ns
t_f	Fall time			6		ns

Table 6. Source drain diode

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

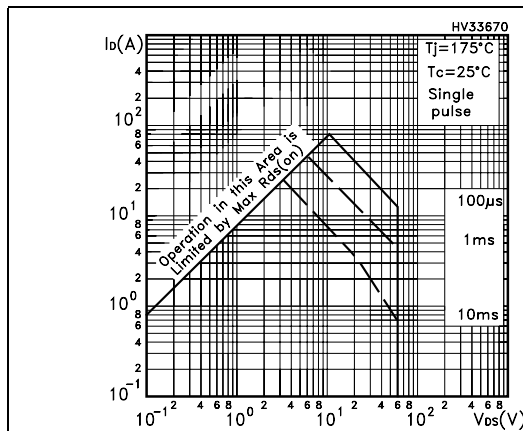


Figure 2. Thermal impedance for TO-220/D²PAK

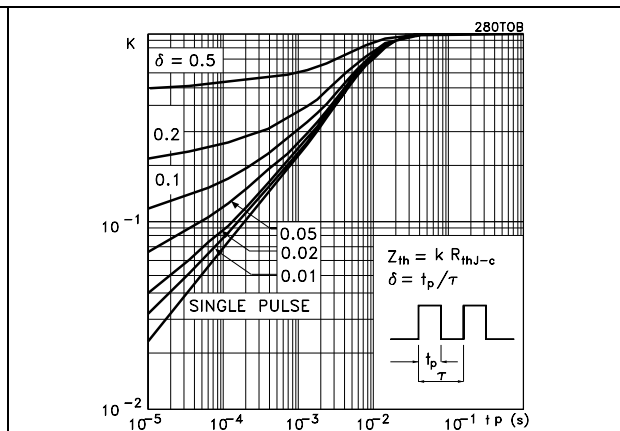


Figure 3. Safe operating area for TO-220FP

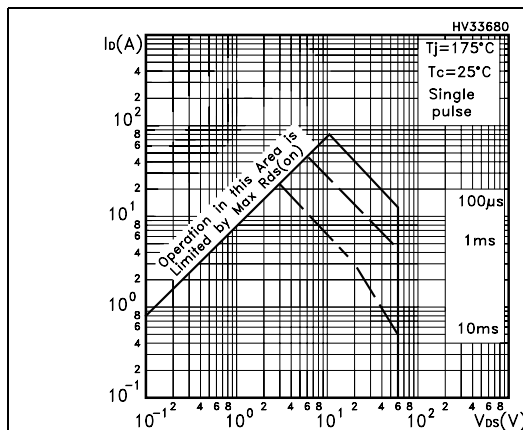


Figure 4. Thermal impedance for TO-220FP

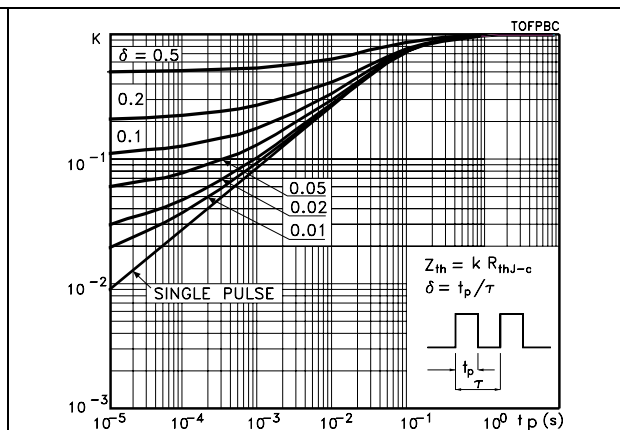


Figure 5. Output characteristics

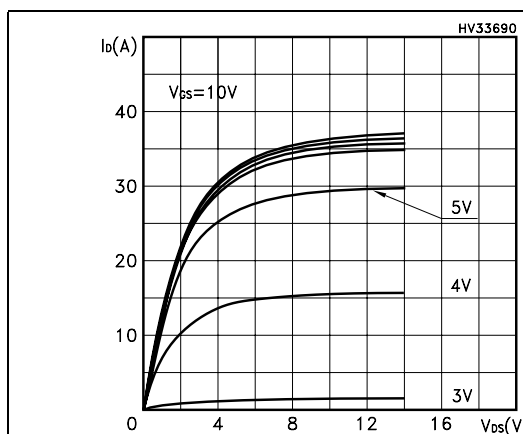


Figure 6. Transfer characteristics

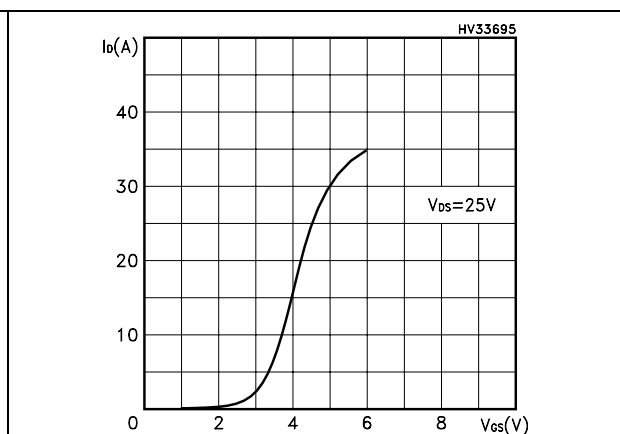


Figure 7. Transconductance

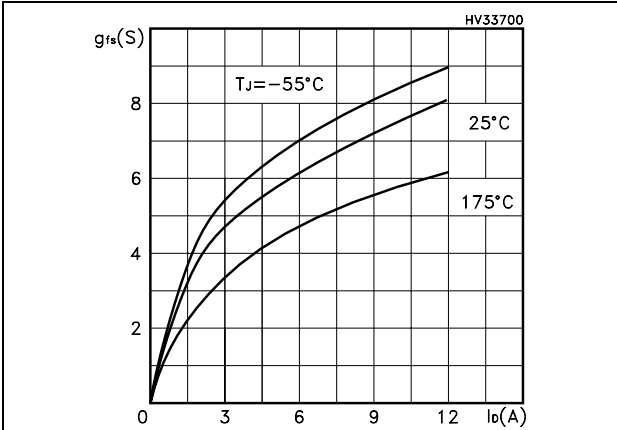


Figure 8. Static drain-source on resistance

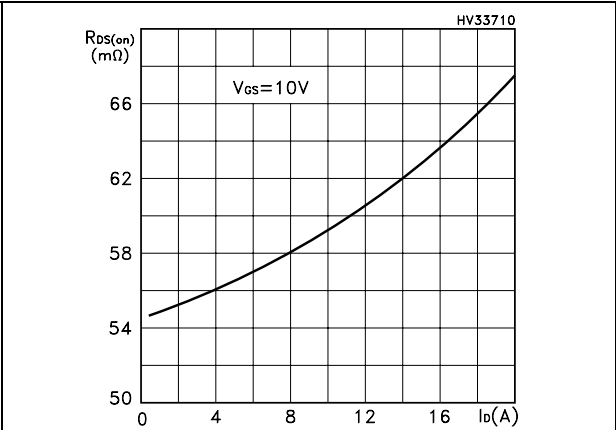


Figure 9. Gate charge vs gate-source voltage

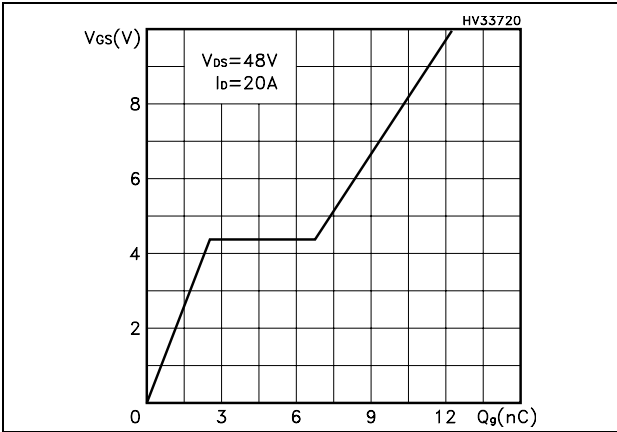


Figure 10. Capacitance variations

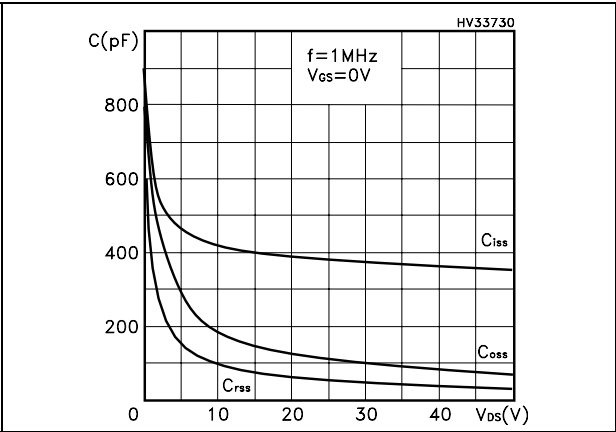


Figure 11. Normalized gate threshold voltage vs temperature

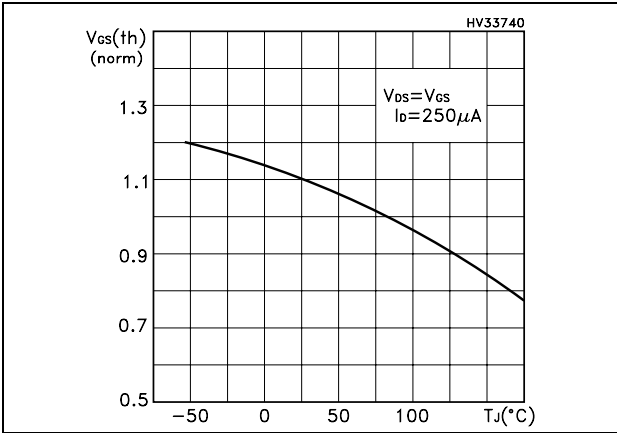


Figure 12. Normalized on resistance vs temperature

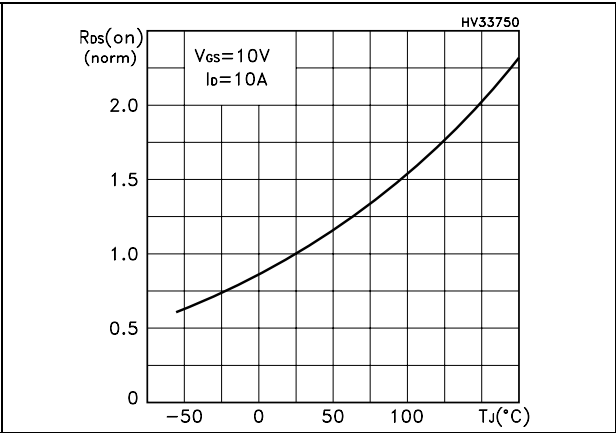


Figure 13. Source-drain diode forward characteristics

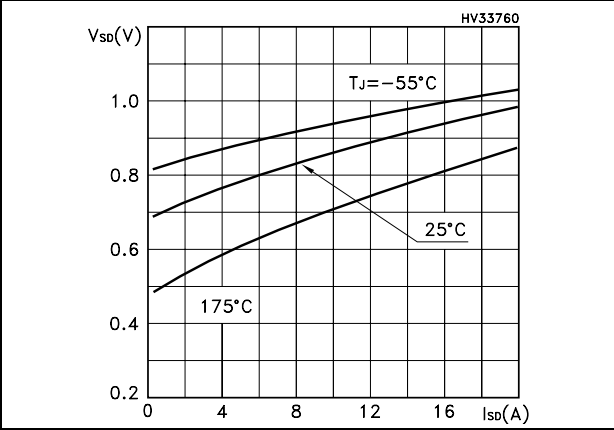
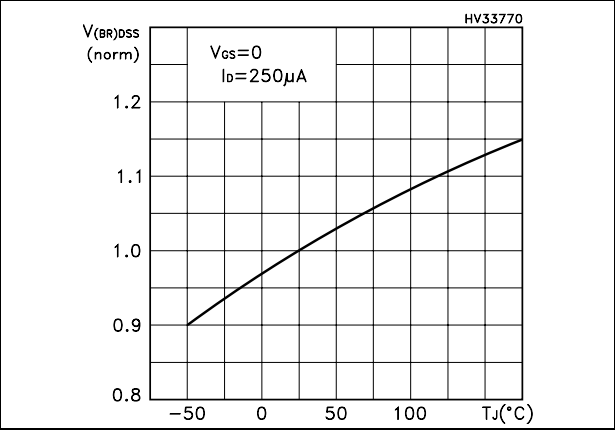


Figure 14. Normalized breakdown voltage temperature



3 Test circuit

Figure 15. Switching times test circuit for resistive load



Figure 16. Gate charge test circuit

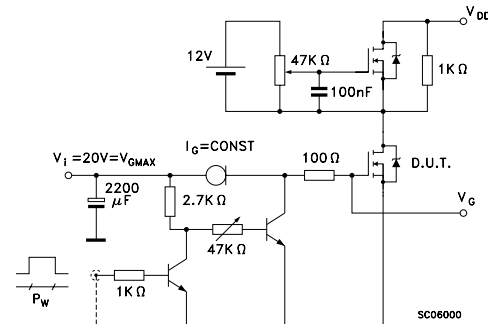


Figure 17. Test circuit for inductive load switching and diode recovery times

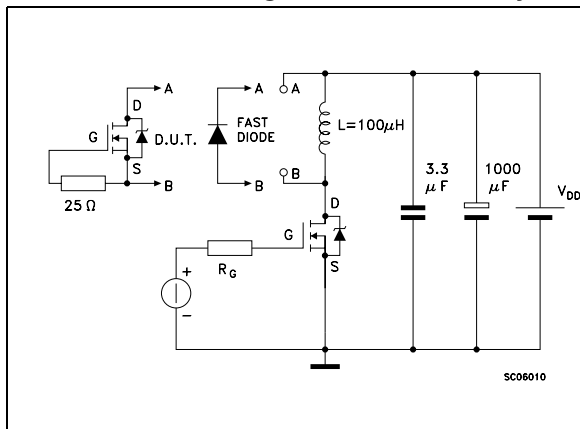


Figure 18. Unclamped Inductive load test circuit

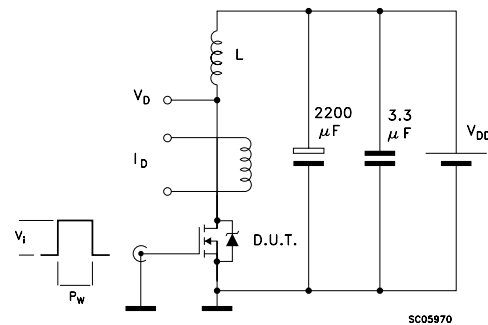
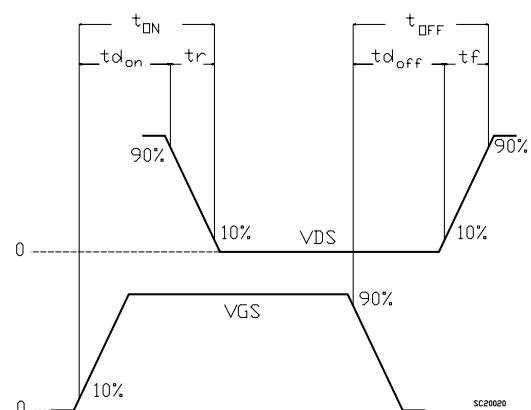


Figure 19. Unclamped inductive waveform



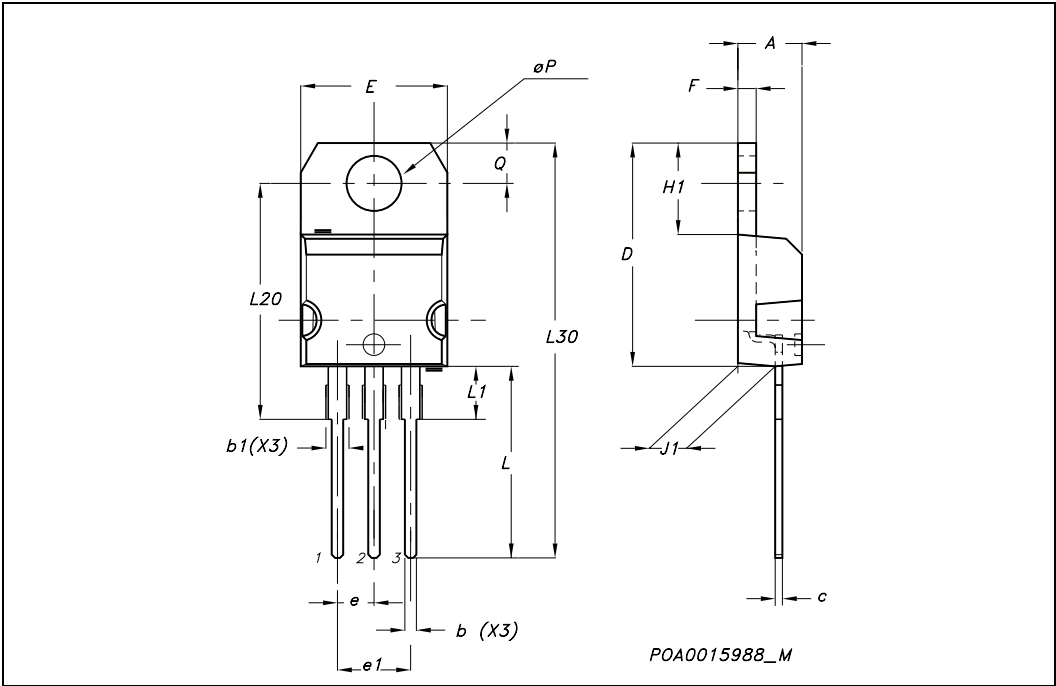
Figure 20. Switching time waveform



4 Package mechanical data

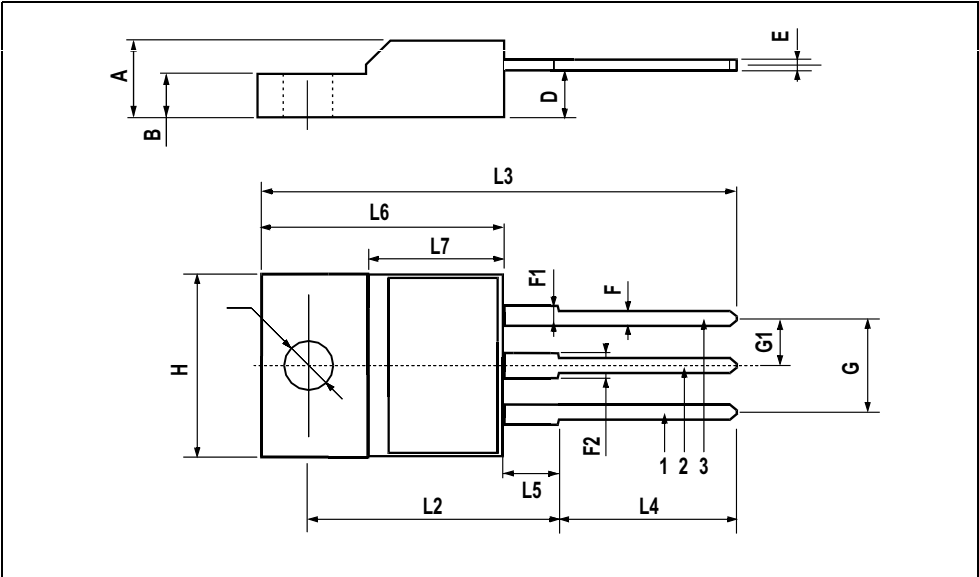
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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



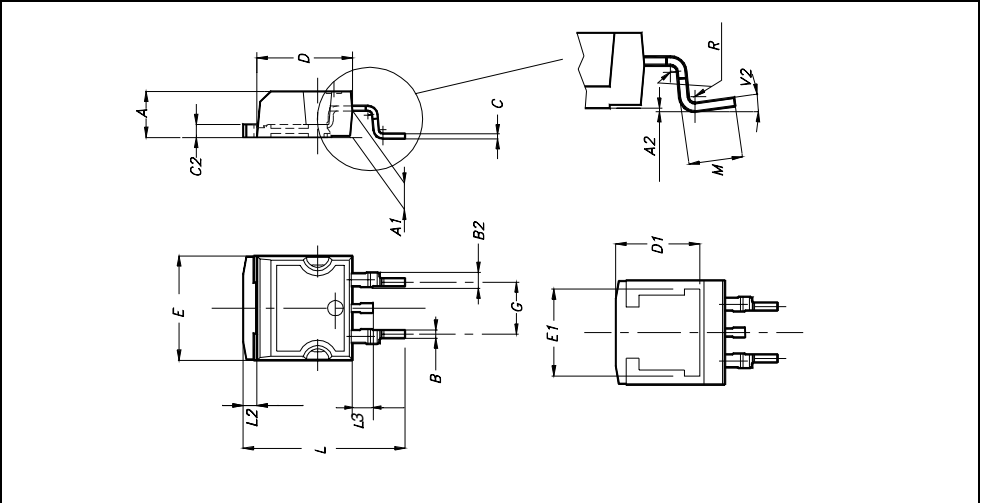
TO-220FP MECHANICAL DATA

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



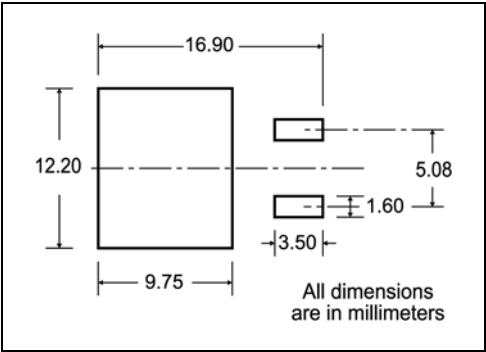
D²PAK MECHANICAL DATA

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	0°		4°			

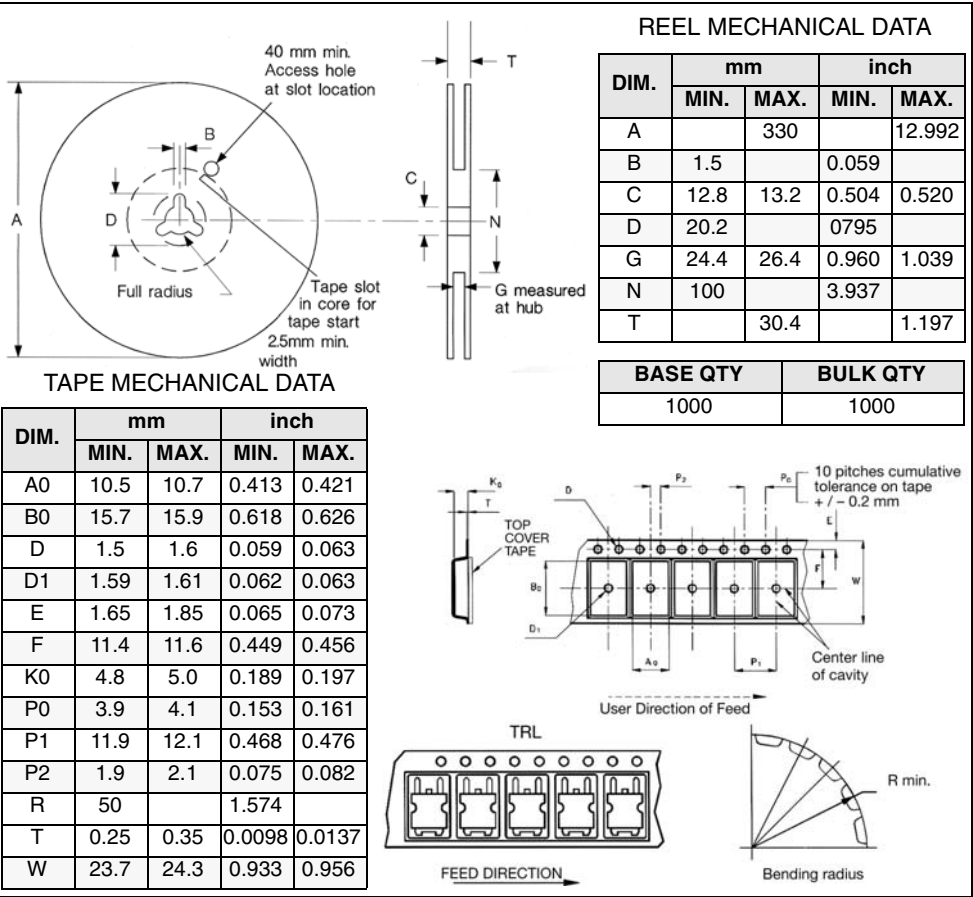


5 Packing mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



* 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 D ² PAK

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