



# STB19NF20 - STF19NF20 STP19NF20

N-channel 200V - 0.15Ω - 15A - TO-220 - D<sup>2</sup>PAK - TO-220FP  
MESH OVERLAY™ Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>w</sub>
STB19NF20	200V	<0.16Ω	15A	90W
STF19NF20	200V	<0.16Ω	15A	25W
STP19NF20	200V	<0.16Ω	15A	90W

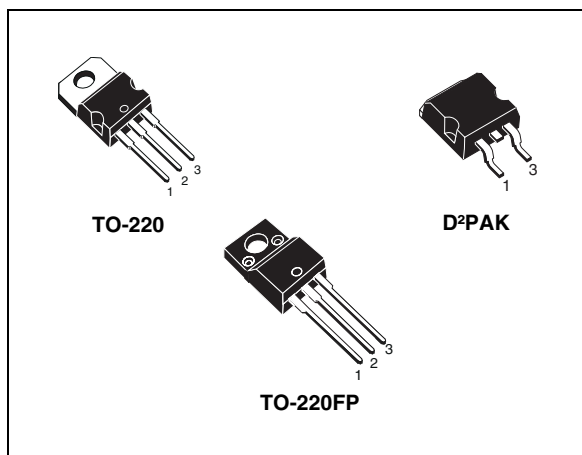
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitances

## Description

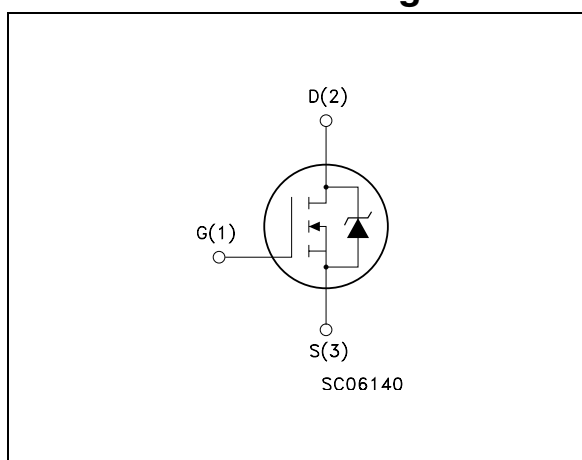
This Power MOSFET is designed using the company's consolidated strip layout-based MESH OVERLAY™ process. This technology matches and improves the performances compared with standard parts from various sources.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STB19NF20	19NF20	D <sup>2</sup> PAK	Tape & reel
STF19NF20	19NF20	TO-220FP	Tube
STP19NF20	19NF20	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220 / D <sup>2</sup> PAK	TO-220FP	
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> = 0)	200		V
V <sub>GS</sub>	Gate-source voltage	± 20		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25°C	15	15 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> =100°C	9.45	9.45 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	60	60 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	90	25	W
	Derating factor	0.72	0.2	W/°C
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1s;T <sub>C</sub> =25°C)	--	2500	V
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	15		V/ns
T <sub>J</sub> T <sub>stg</sub>	Operating junction temperature Storage temperature	-55 to 150		°C

- Limited by package
- Pulse width limited by safe operating area
- I<sub>SD</sub> ≤ 15A, di/dt ≤ 300A/μs, V<sub>DD</sub> = 80%V<sub>(BR)DSS</sub>

**Table 2. Thermal data**

Symbol	Parameter	Value			Unit
		TO-220	D <sup>2</sup> PAK	TO-220FP	
R <sub>thj-case</sub>	Thermal resistance junction-case max	1.39		5	°C/W
R <sub>thj-pcb</sub>	Thermal resistance junction-pcb max	--	50	--	
R <sub>thj-a</sub>	Thermal resistance junction-ambient max	62.5			°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purpose	300			°C

**Table 3. Avalanche data**

Symbol	Parameter	Value	Unit
I <sub>AR</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>J</sub> Max)	15	A
E <sub>AS</sub>	Single pulse avalanche energy (starting T <sub>J</sub> =25°C, I <sub>d</sub> =I <sub>ar</sub> , V <sub>dd</sub> =50V)	110	mJ

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	200			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 7.5A$		0.15	0.16	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 8V, I_D = 7.5A$		12		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V, f = 1 \text{ MHz},$ $V_{GS} = 0$		800		pF
$C_{oss}$	Output capacitance			165		pF
$C_{rss}$	Reverse transfer capacitance			26		pF
$Q_g$	Total gate charge	$V_{DD} = 160V, I_D = 15A$		24		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		4.4		nC
$Q_{gd}$	Gate-drain charge	(see Figure 16)		11.6		nC

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	$V_{DD}=100\text{ V}$ , $I_D=7.5\text{ A}$ , $R_G=4.7\Omega$ , $V_{GS}=10\text{ V}$ (see Figure 15)		11.5 22		ns ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	$V_{DD}=100\text{ V}$ , $I_D=7.5\text{ A}$ , $R_G=4.7\Omega$ , $V_{GS}=10\text{ V}$ (see Figure 15)		19 11		ns ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				15	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				60	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=15\text{ A}$ , $V_{GS}=0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=15\text{ A}$ , $V_{DD}=50\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , (see Figure 20)		125 0.55 8.8		ns $\mu\text{C}$ A
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=15\text{ A}$ , $V_{DD}=50\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , $T_j=150^\circ\text{C}$ (see Figure 20)		148 0.73 9.9		ns $\mu\text{C}$ A

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration = 300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220 / D<sup>2</sup>PAK

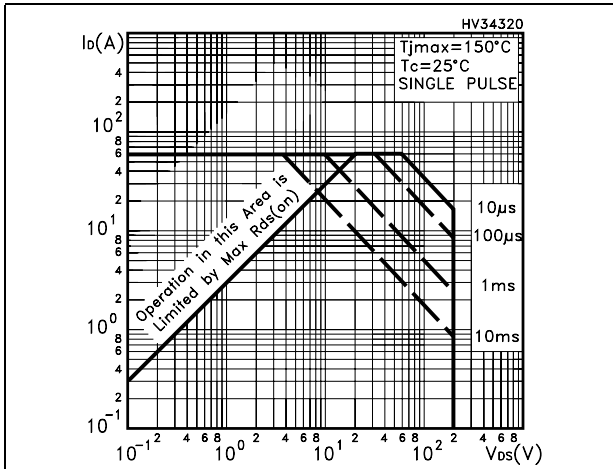


Figure 2. Thermal impedance for TO-220 / D<sup>2</sup>PAK

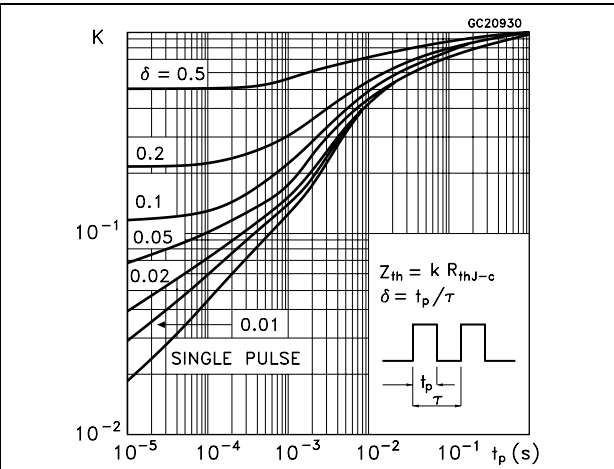


Figure 3. Safe operating area for TO-220FP

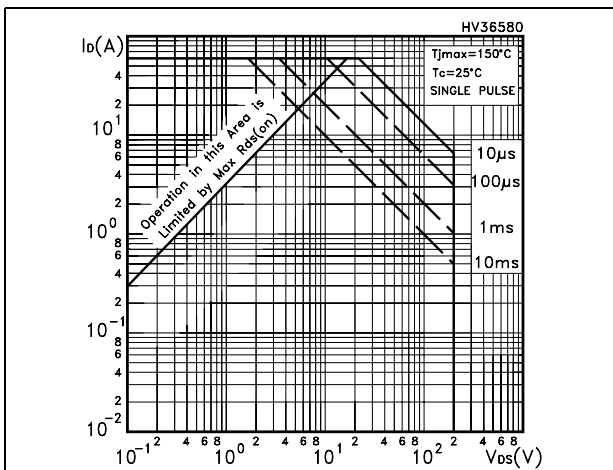


Figure 4. Thermal impedance for TO-220FP

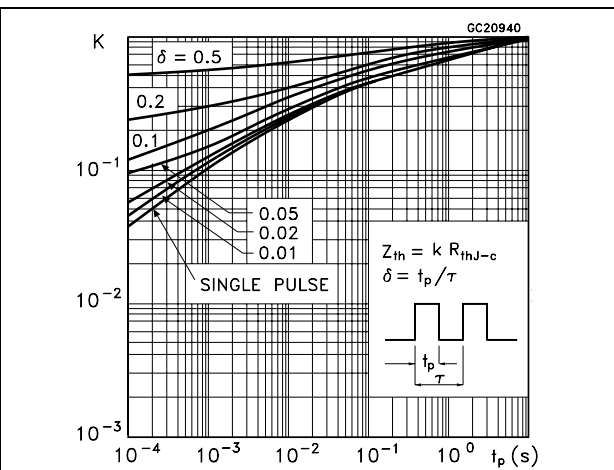


Figure 5. Output characteristics

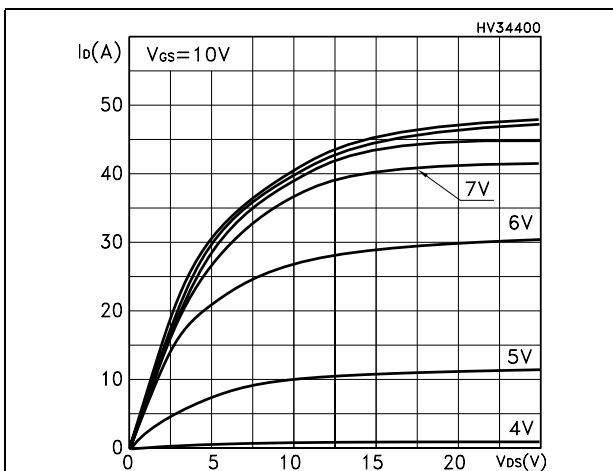


Figure 6. Transfer characteristics

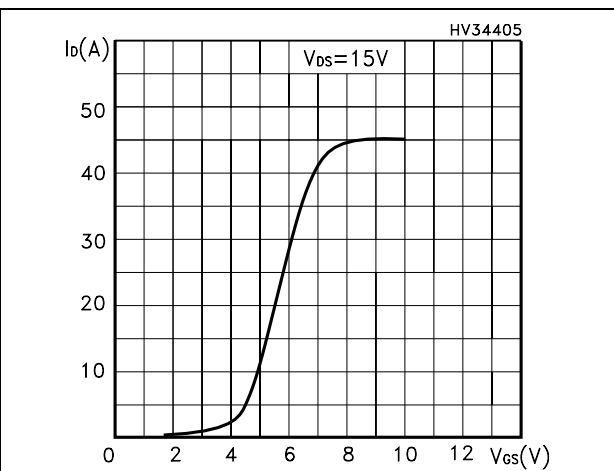


Figure 7. Static drain-source on resistance

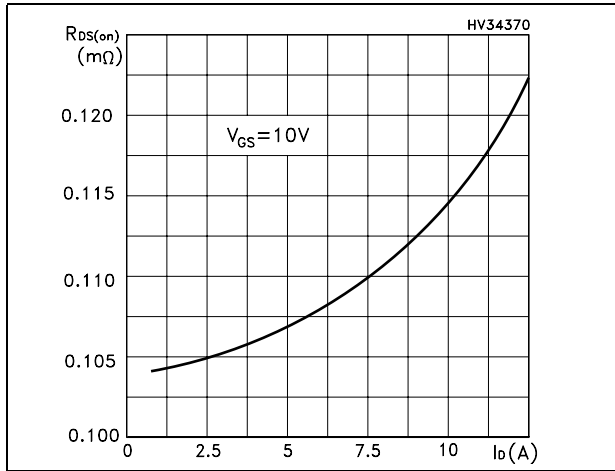


Figure 8. Normalized  $BV_{DSS}$  vs temperature

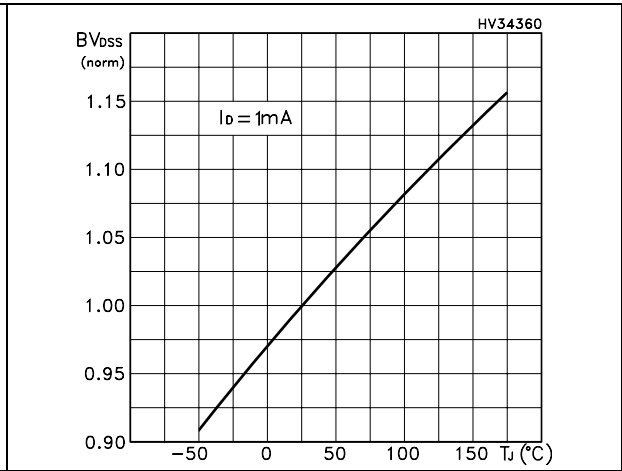


Figure 9. Gate charge vs gate-source voltage

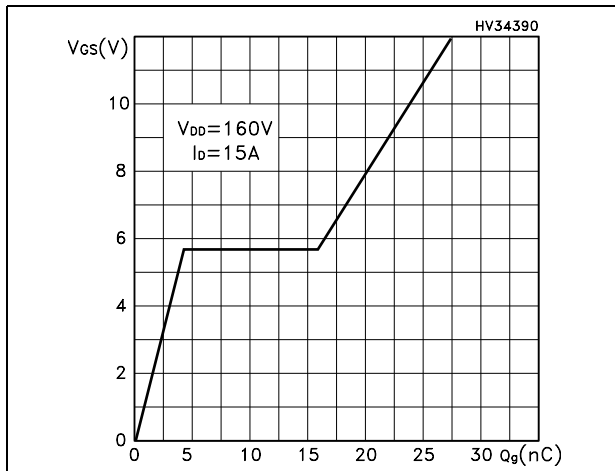


Figure 10. Capacitance variations

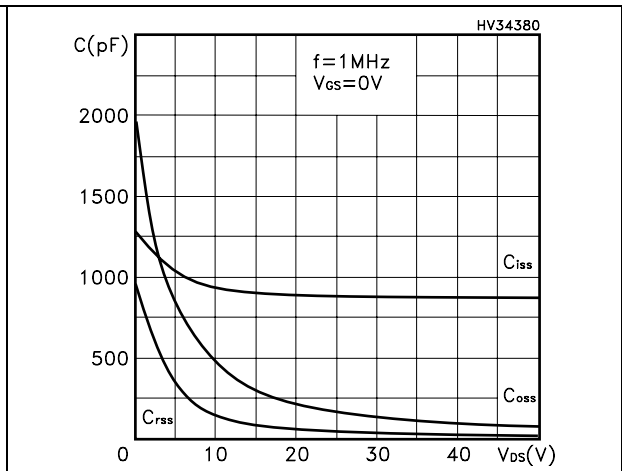


Figure 11. Normalized gate threshold voltage vs temperature

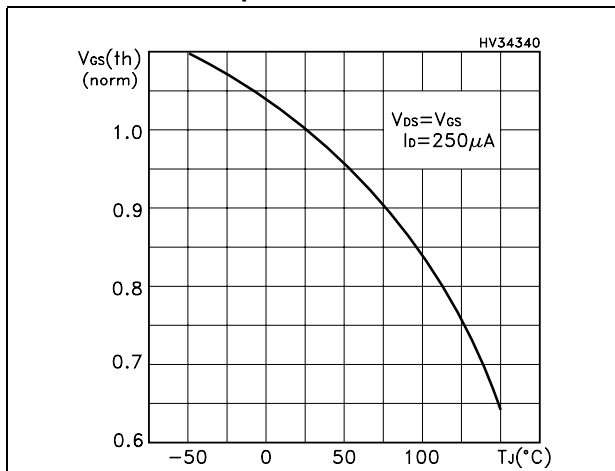


Figure 12. Normalized on resistance vs temperature

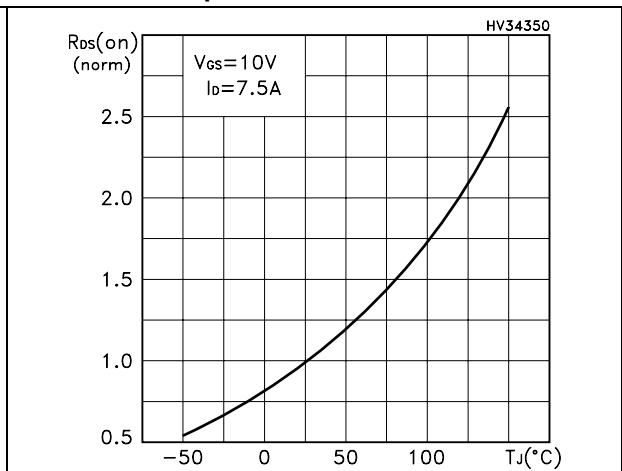


Figure 13. Source-drain forward characteristics

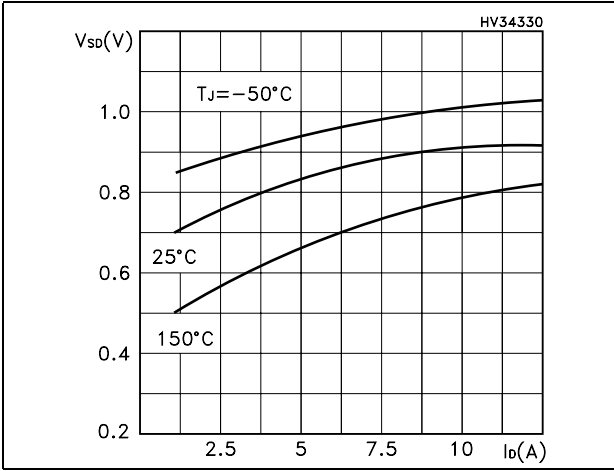
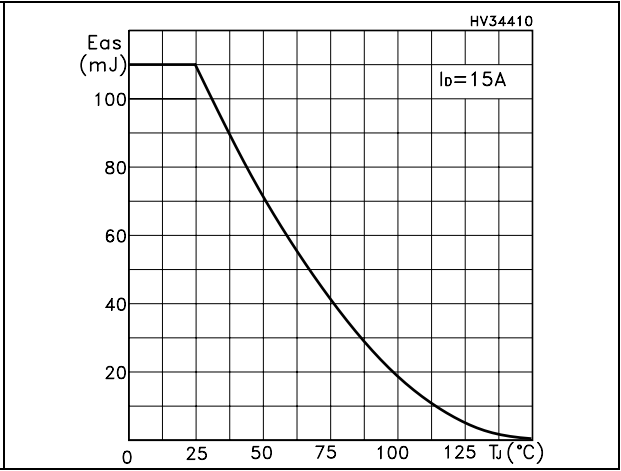


Figure 14. Maximum avalanche energy vs temperature





### 3 Test circuit

Figure 15. Switching times test circuit for resistive load

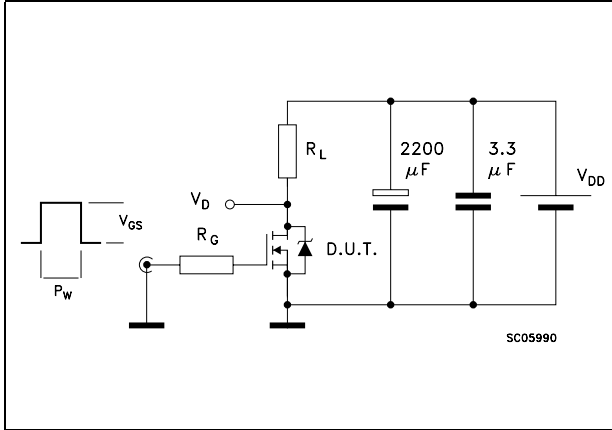


Figure 16. Gate charge test circuit

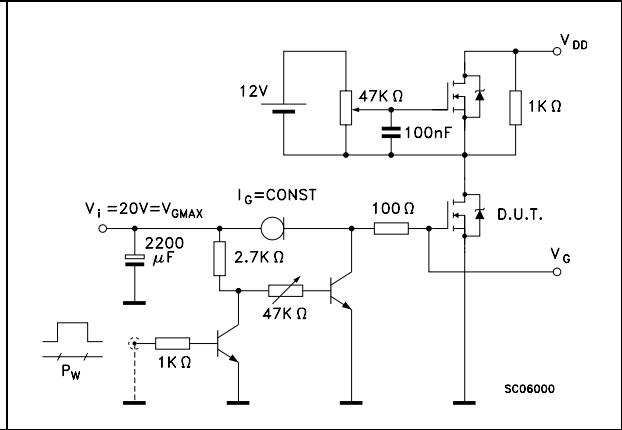


Figure 17. Test circuit for inductive load switching and diode recovery times

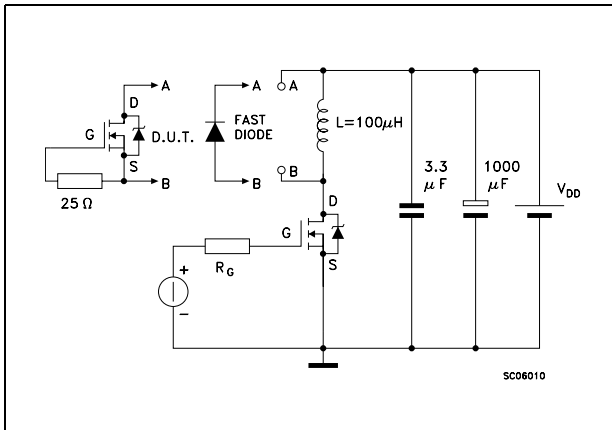


Figure 18. Unclamped Inductive load test circuit

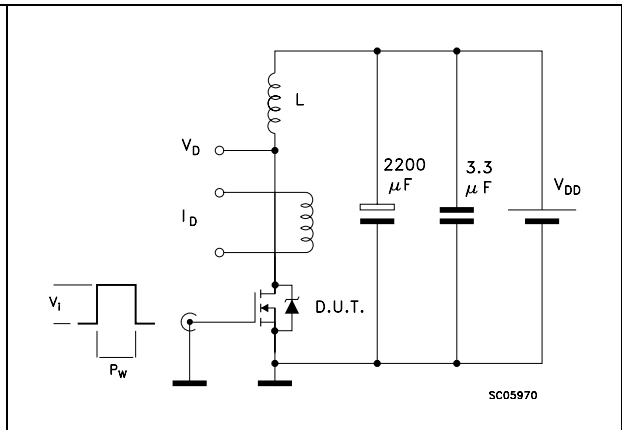


Figure 19. Unclamped inductive waveform

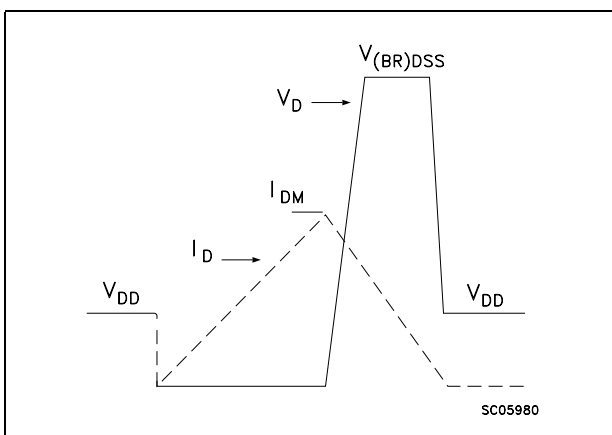
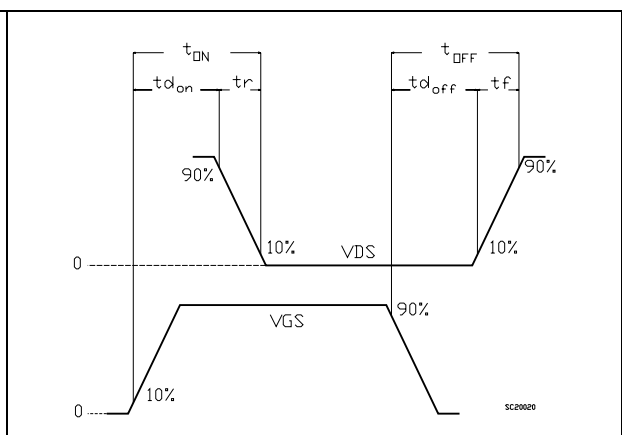


Figure 20. Switching time waveform

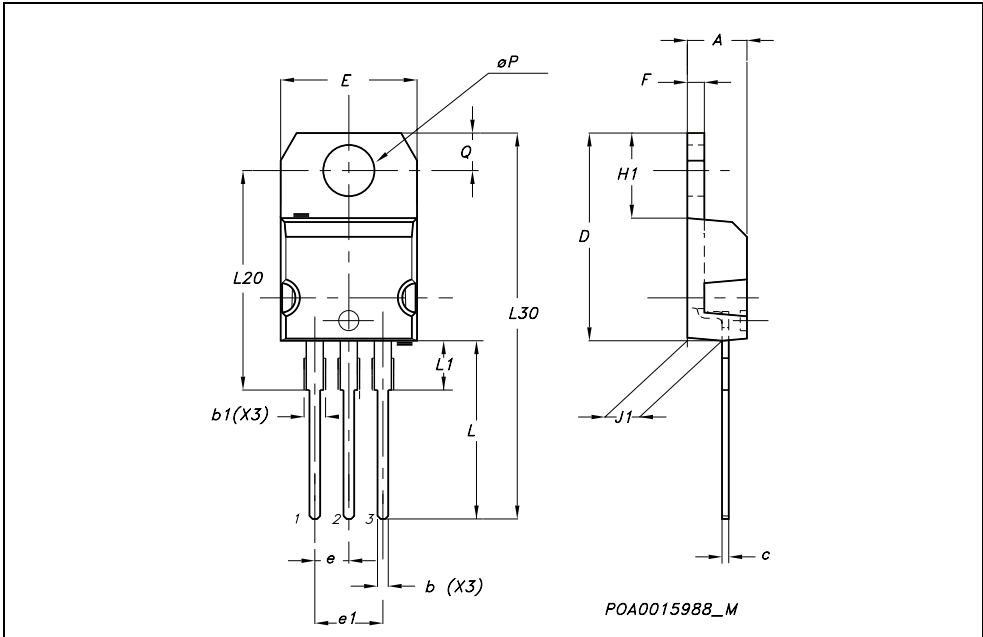


## 4 Package mechanical data

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](http://www.st.com)

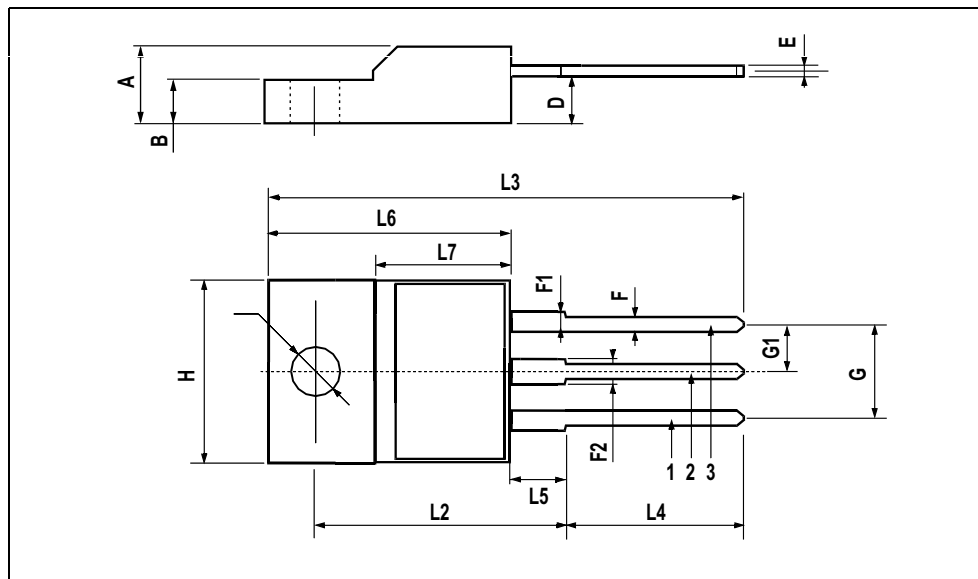
**TO-220 MECHANICAL DATA**

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



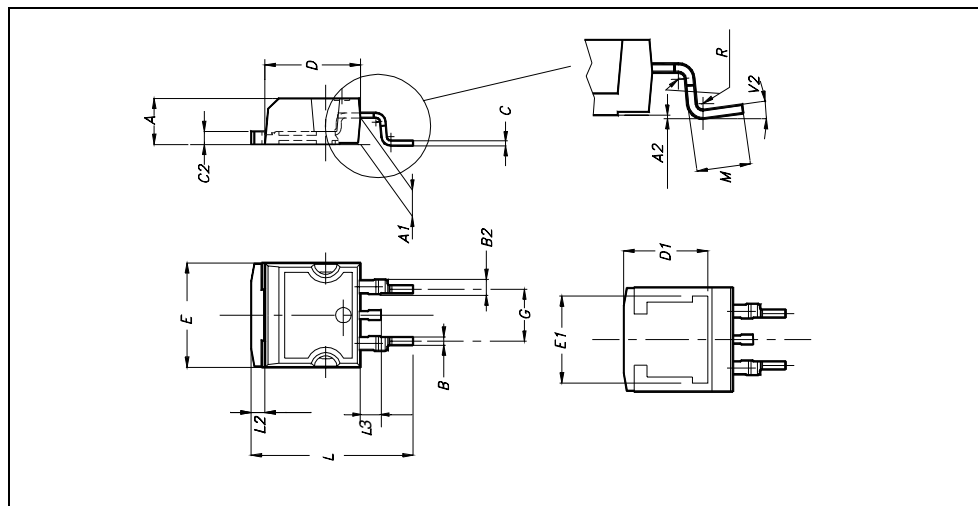
**TO-220FP MECHANICAL DATA**

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



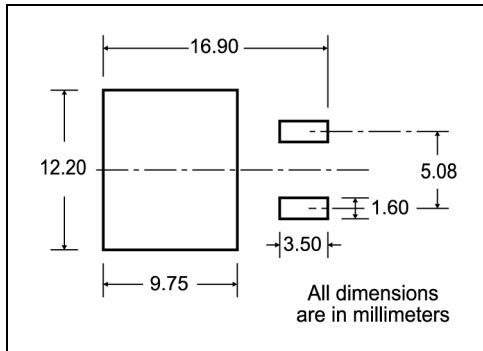
**D<sup>2</sup>PAK MECHANICAL DATA**

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 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT

**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

**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		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

**TRL**

\* on sales type

## 6 Revision history

**Table 8. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
13-Oct-2006	1	First release
17-Nov-2006	2	Part number has been modified
02-Feb-2007	3	Preliminary version
16-Feb-2007	4	TO-220FP package has been added

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