



# STP4NB50 STP4NB50FP

N-CHANNEL 500V - 2.5Ω - 3.8A - TO-220/TO-220FP

PowerMesh™ MOSFET

PRELIMINARY DATA

TYPE	V <sub>DS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP4NB50	500 V	< 2.8 Ω	3.8 A
STP4NB50FP	500 V	< 2.8 Ω	2.5 A

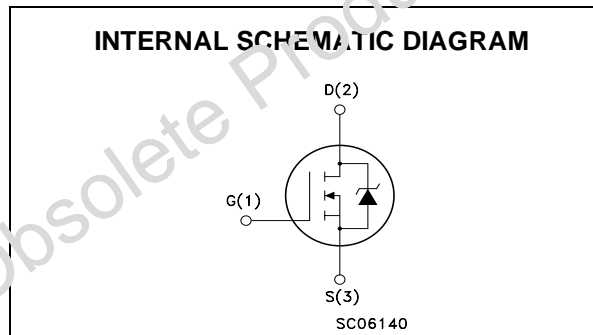
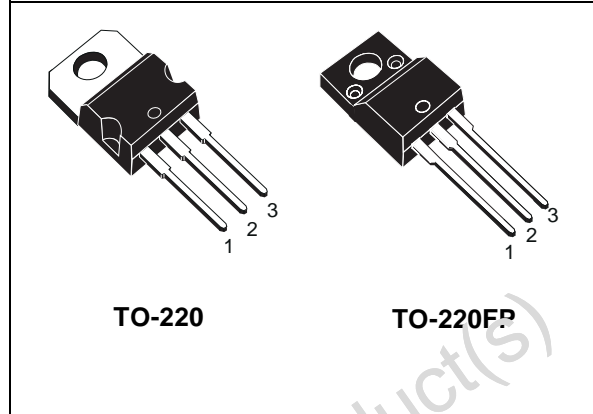
- TYPICAL R<sub>DS(on)</sub> = 2.5 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

## DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest R<sub>DS(on)</sub> per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

## APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP4NB50	STP4NB50FP	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500		V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	500		V
V <sub>GS</sub>	Gate-source Voltage	±30		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	3.8	2.5	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	2.4	1.6	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	15.2	15.2	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	80	35	W
	Derating Factor	0.64	0.28	W/°C
dv/dt	Peak Diode Recovery voltage slope	4.5		V/ns
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	-	2500	V
T <sub>stg</sub>	Storage Temperature	-65 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 4 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>

## STP4NB50 - STP4NB50FP

### THERMAL DATA

		TO-220	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	1.56	3.57	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose	300		°C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	3.8	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> = 50 V)	220	mJ

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED) OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	500			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			1 50	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±30V			±100	nA

### ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.9 A		2.5	2.8	Ω

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)</sub> max, I <sub>D</sub> = 1.9 A		2.3		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		400		pF
C <sub>oss</sub>	Output Capacitance			62		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			7.5		pF

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 250V, I_D = 1.9 A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 3)		11		ns
$t_r$	Rise Time			8		ns
$Q_g$	Total Gate Charge	$V_{DD} = 400V, I_D = 3.8 A,$ $V_{GS} = 10V$		15	21	nC
$Q_{gs}$	Gate-Source Charge			6.5		nC
$Q_{gd}$	Gate-Drain Charge			5		nC

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400V, I_D = 3.8 A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 5)		8		ns
$t_f$	Fall Time			5		ns
$t_c$	Cross-over Time			14		ns

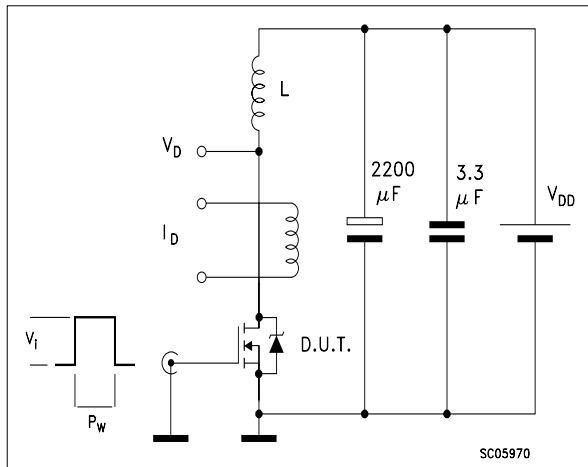
## SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				3.8	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				15.2	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 3.8 A, V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 3.8 A, di/dt = 100A/\mu s,$ $V_{DD} = 100V, T_j = 150^\circ C$ (see test circuit, Figure 5)		245		ns
$Q_{rr}$	Reverse Recovery Charge			980		nC
$I_{RRM}$	Reverse Recovery Current			9		A

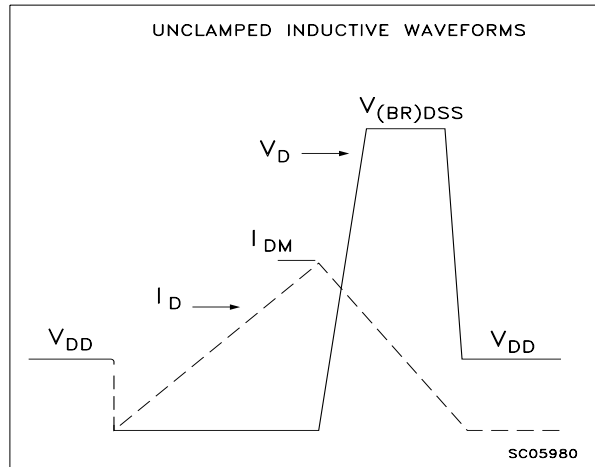
Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

# STP4NB50 - STP4NB50FP

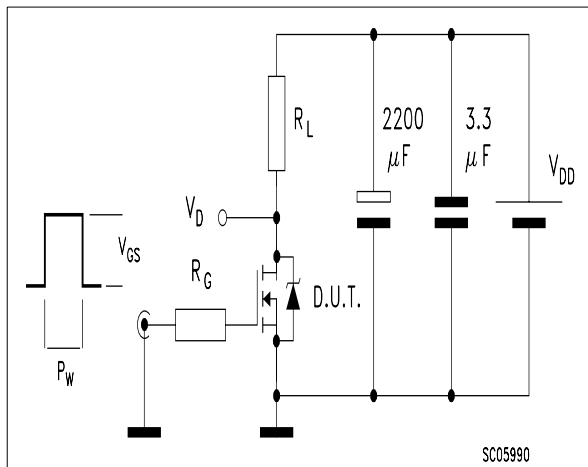
**Fig. 1: Unclamped Inductive Load Test Circuit**



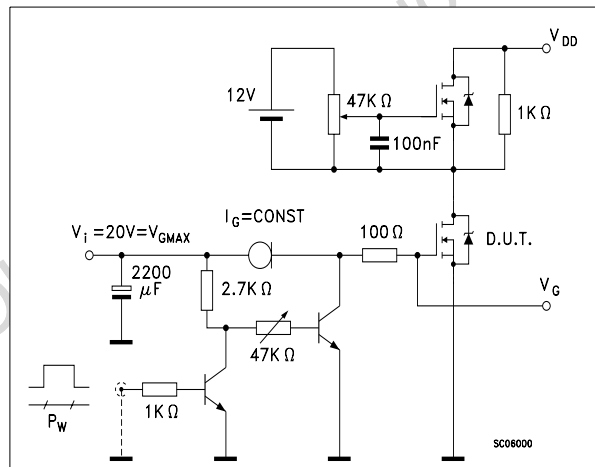
**Fig. 2: Unclamped Inductive Waveform**



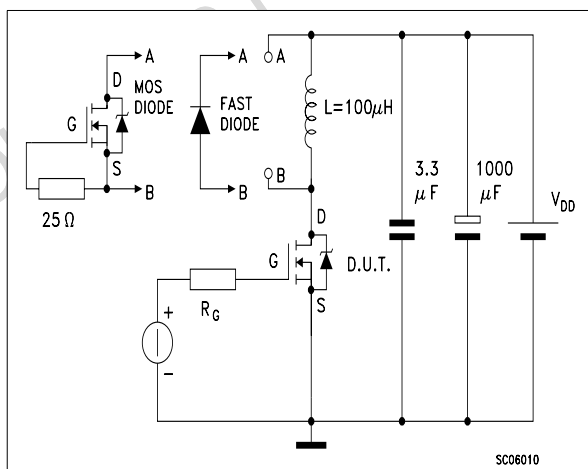
**Fig. 3: Switching Times Test Circuit For Resistive Load**



**Fig. 4: Gate Charge test Circuit**

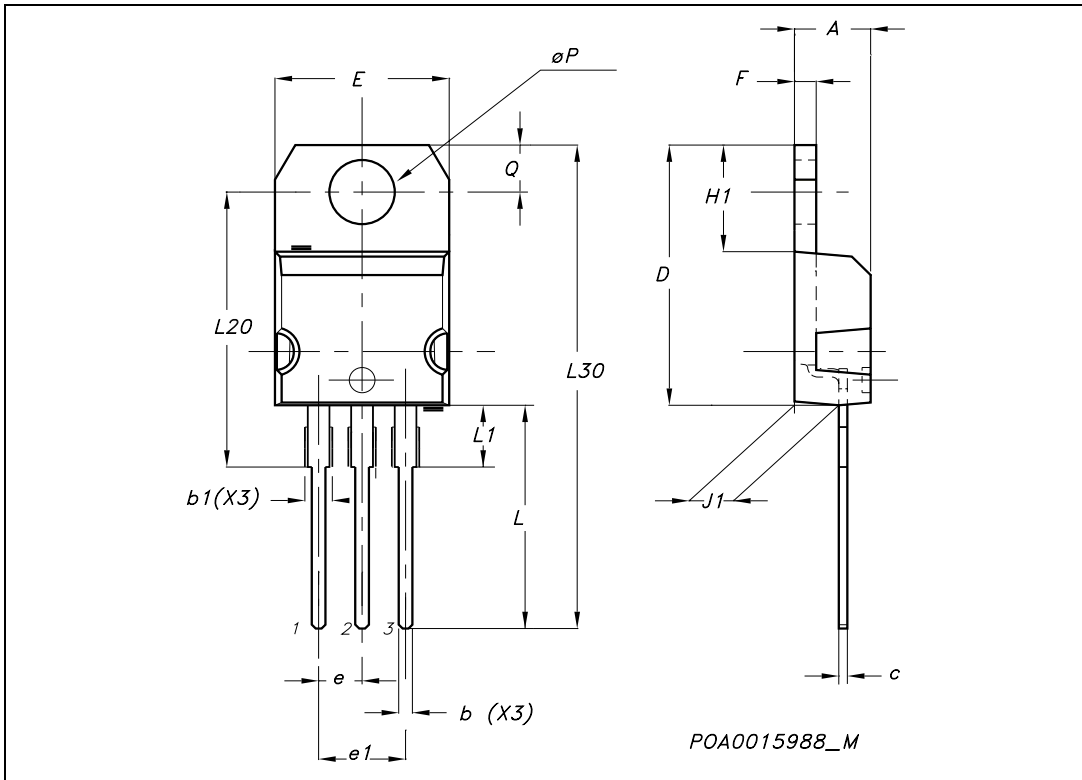


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



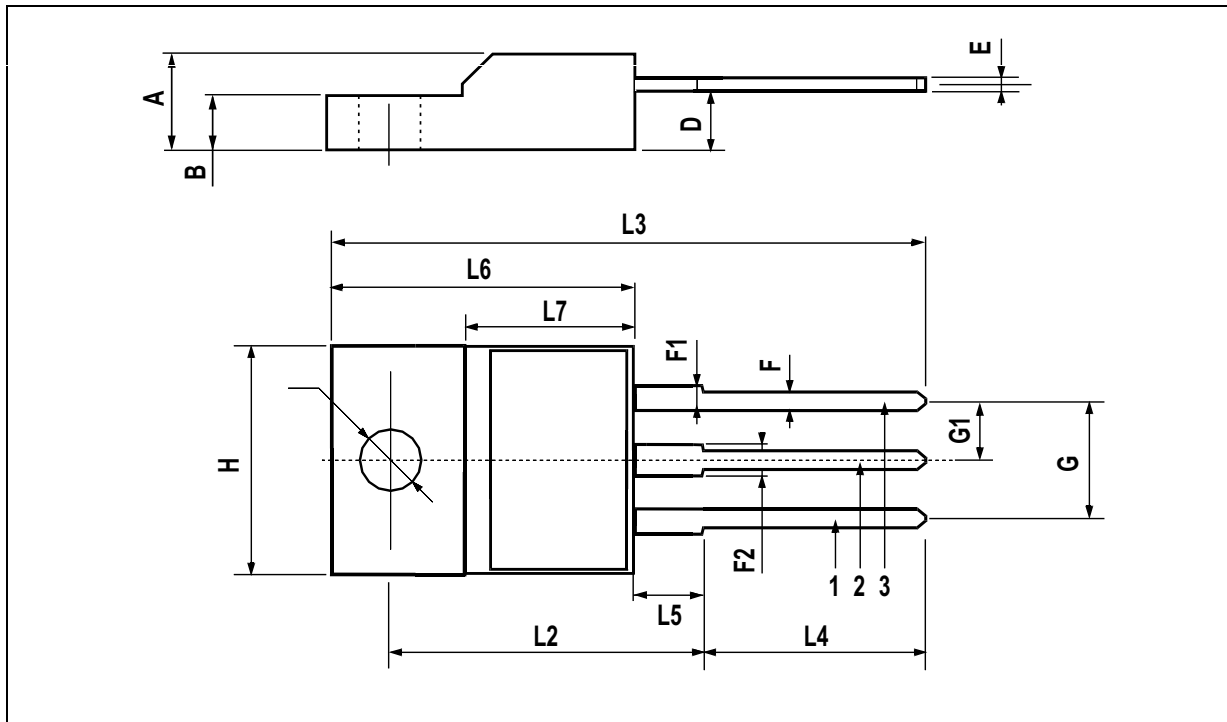
**TO-220 MECHANICAL DATA**

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
∅	3		3.2	0.118		0.126



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