



# STP4NB50 STP4NB50FP

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

PowerMesh™ MOSFET

PRELIMINARY DATA

TYPE	V <sub>DSS</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

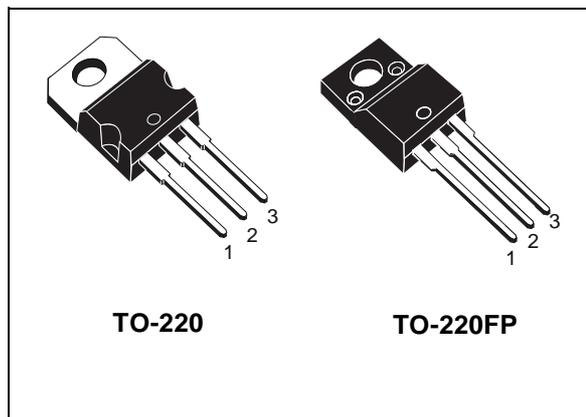
- TYPICAL R<sub>DS(on)</sub> = 2.5 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

## 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 RDS(on) per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

## APPLICATIONS

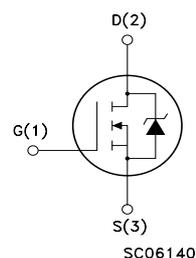
- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



TO-220

TO-220FP

## INTERNAL SCHEMATIC DIAGRAM



## 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 ≤ 200A/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.