

## **STFV4N150**

# N-CHANNEL 1500V - 5Ω - 4A TO-220FH Very High Voltage PowerMESH™ MOSFET

**Table 1: General Features** 

TYPE	V <sub>DSS</sub>	V <sub>DSS</sub> R <sub>DS(on)</sub>		Pw
STFV4N150	1500 V	< 7 Ω	4 A	40 W

- TYPICAL  $R_{DS}(on) = 5 \Omega$
- AVALANCHE RUGGEDNESS
- GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES
- HIGH SPEED SWITCHING
- FULLY PLASTIC TO-220 PACKAGE
- CREEPAGE DISTANCE PATH IS > 4mm

#### **DESCRIPTION**

Using the well consolidated high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of Power MOSFETs with outstanding performances. The strengthened layout coupled with the Company's proprietary edge termination structure, gives the lowest RDS(on) per area, unrivalled gate charge and switching characteristics. The creepage path is what makes this package unique from TO-220FP. The creepage distance path between each lead and between the leads and the heatsink has been increased to >4.0mm, making this package met all stringent safety norms in high voltage applications.

#### **APPLICATIONS**

■ SWITCH MODE POWER SUPPLIES

Figure 1: Package

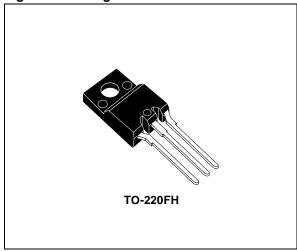
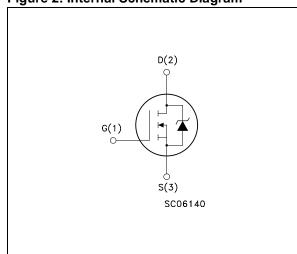


Figure 2: Internal Schematic Diagram



**Table 2: Order Codes** 

SALES TYPE	MARKING	PACKAGE	PACKAGING
STFV4N150	FV4N150	TO-220FH	TUBE

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**Table 3: Absolute Maximum ratings** 

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	1500	V
V <sub>DGR</sub>	Drain-gate Voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	1500	V
V <sub>GS</sub>	Gate- source Voltage	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	4	Α
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	2.5	А
I <sub>DM</sub> (•)	Drain Current (pulsed)	12	А
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	40	W
	Derating Factor	0.32	W/°C
T <sub>j</sub> T <sub>stg</sub>	Operating Junction Temperature Storage Temperature	-55 to 150	°C

### **Table 4: Thermal Data**

Rthj-case	Thermal Resistance Junction-case Max	3.12	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W

#### **Table 5: Avalanche Characteristics**

Symbol Parameter		Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)	4	Α
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting $T_j = 25$ °C, $I_D = I_{AR}$ , $V_{DD} = 50$ V)	350	mJ

## **ELECTRICAL CHARACTERISTICS** (T<sub>CASE</sub> =25°C UNLESS OTHERWISE SPECIFIED)

#### Table 6: On /Off

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	1500			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			10 500	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 V			± 100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	3	4	5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2 A		5	7	Ω

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<sup>(•)</sup> Pulse width limited by safe operating area (\*) Limited only by maximum temperature allowed

## **ELECTRICAL CHARACTERISTICS** (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	$V_{DS} = 30 \text{ V}$ , $I_D = 2 \text{ A}$		3.5		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0		1300 120 12		pF pF pF
$\begin{array}{c} t_{d(on)} \\ t_{r} \\ t_{d(off)} \\ t_{f} \end{array}$	Turn-on Delay Time Rise Time Turn-off-Delay Time Fall Time	$V_{DD} = 750 \text{ V}, I_{D} = 2 \text{ A},$ $R_{G} = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see Figure 17)		35 30 45 45		ns ns ns ns
Q <sub>g</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 600 \text{ V}, I_{D} = 4 \text{ A},$ $V_{GS} = 10 \text{ V}$ (see Figure 20)		30 10 9	50	nC nC nC

## **Table 8: Source Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
I <sub>SD</sub> I <sub>SDM</sub> (2)	Source-drain Current Source-drain Current (pulsed)				4 12	A A
V <sub>SD</sub> (1)	Forward On Voltage	I <sub>SD</sub> = 4 A, V <sub>GS</sub> = 0			2	V
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I <sub>SD</sub> = 4 A, di/dt = 100 A/μs V <sub>DD</sub> = 45V (see Figure 18)		510 3 12		ns µC A
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I <sub>SD</sub> = 4 A, di/dt = 100 A/μs V <sub>DD</sub> = 45V, T <sub>j</sub> = 150°C (see Figure 18)		650 4 12.6		ns µC A

<sup>(1)</sup> Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %.(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area

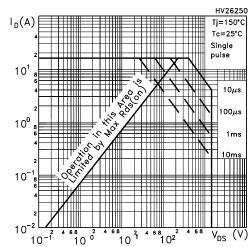


Figure 4: Output Characteristics

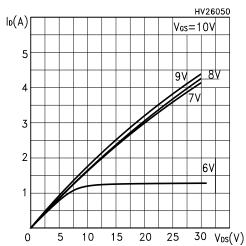


Figure 5: Transconductance

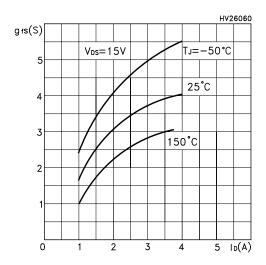
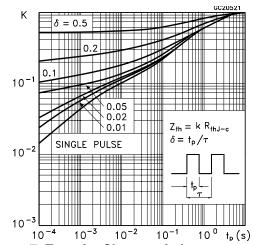


Figure 6: Thermal Impedance



**Figure 7: Transfer Characteristics** 

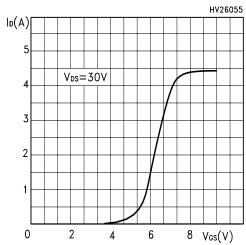
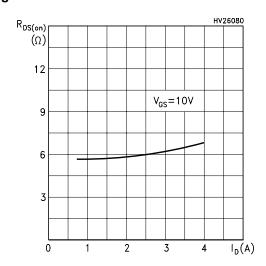


Figure 8: Static Drain-source On Resistance



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Figure 9: Gate Charge vs Gate-source Voltage

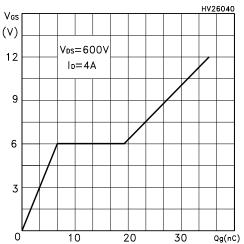


Figure 10: Normalized Gate Thereshold Voltage vs Temperature

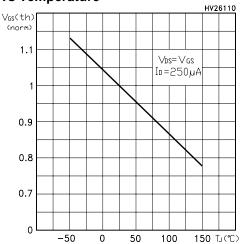


Figure 11: Source-Drain Diode Forward Characteristics

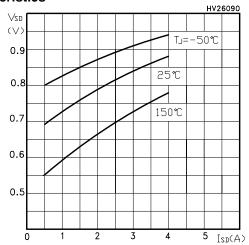


Figure 12: Capacitance Variations

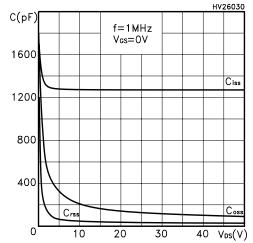


Figure 13: Normalized On Resistance vs Temperature

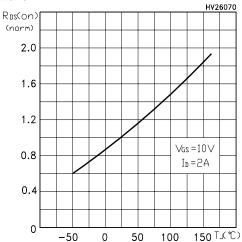


Figure 14: Normalized BVdss vs Temperature

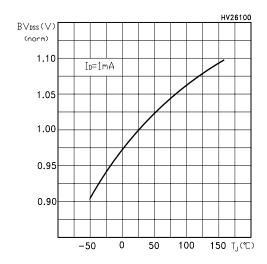


Figure 15: Maximum Avalanche Energy vs Temperature

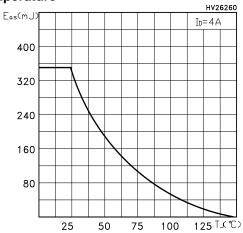


Figure 16: Unclamped Inductive Load Test Circuit

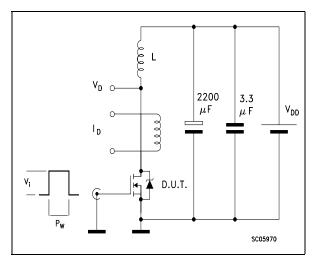


Figure 17: Switching Times Test Circuit For Resistive Load

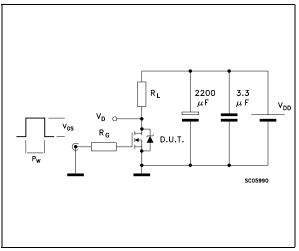


Figure 18: Test Circuit For Inductive Load Switching and Diode Recovery Times

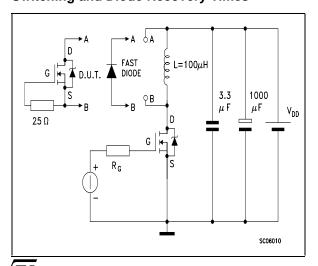


Figure 19: Unclamped Inductive Waveform

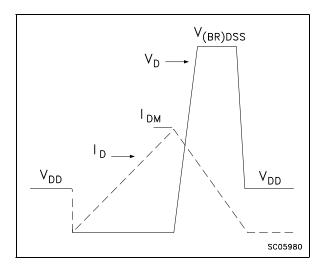
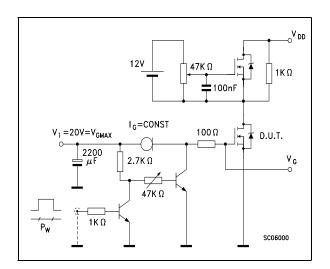
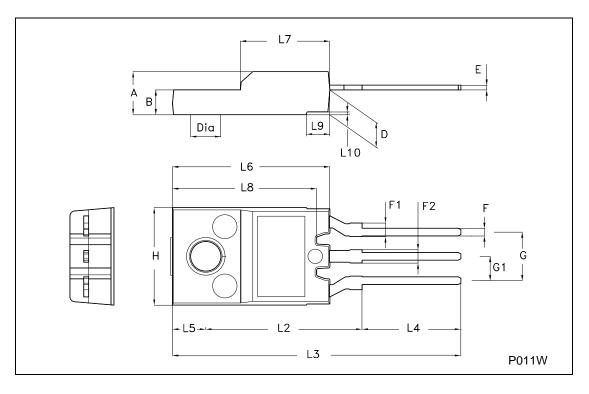


Figure 20: Gate Charge Test Circuit



## TO-220FH (Fully plastic High voltage) MECHANICAL DATA

DIM.		mm			inch	
DIIVI.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
Α	4.4		4.6	0.173		0.181
В	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
Е	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.3		1.8	0.051		0.070
F2	1.3		1.8	0.051		0.070
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
Н	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	0.385		0.417
L5		3.4			0.134	
L6	15.9		16.4	0.626	· ·	0.645
L7	9		9.3	0.354		0.366
L8	14.5		15	0.570		0.590
L9		2.4			0.094	



## **Table 9: Revision History**

Ī	Date	Revision	Description of Changes
	07-Jul-2005	1	First release.

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