

## N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP5NA50	500 V	< 1.6 Ω	5 A
STP5NA50FI	500 V	< 1.6 Ω	3 A

- TYPICAL R<sub>DS(on)</sub> = 1.2 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD

### DESCRIPTION

This series of POWER MOSFETS represents the most advanced high voltage technology. The optimized cell layout coupled with a new proprietary edge termination concur to give the device low R<sub>DS(on)</sub> and gate charge, unequalled ruggedness and superior switching performance.

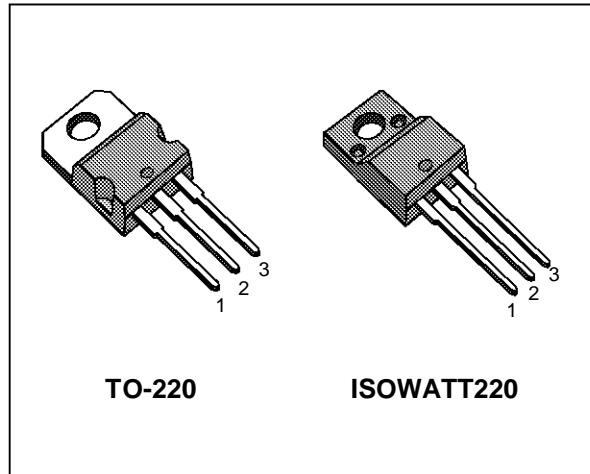
### APPLICATIONS

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

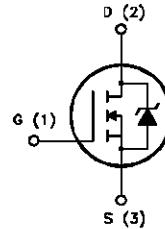
### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP5NA50	STP5NA50FI	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500	500	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	500	500	V
V <sub>GS</sub>	Gate-source Voltage	± 30	± 30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	5	3	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	3.3	2	A
I <sub>DM(•)</sub>	Drain Current (pulsed)	20	20	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	100	40	W
	Derating Factor	0.8	0.32	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	—	2000	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



INTERNAL SCHEMATIC DIAGRAM



# STP5NA50/FI

## THERMAL DATA

			TO-220	ISOWATT220	
R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.25	3.12	°C/W
R <sub>thj-amb</sub> R <sub>thc-sink</sub> T <sub>1</sub>	Thermal Resistance Junction-ambient Thermal Resistance Case-sink Maximum Lead Temperature For Soldering Purpose	Max Typ	62.5 0.5 300		°C/W °C/W °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, δ < 1%)	5	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)	280	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy (pulse width limited by T <sub>j</sub> max, δ < 1%)	7.4	mJ
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (T <sub>c</sub> = 100 °C, pulse width limited by T <sub>j</sub> max, δ < 1%)	3.3	A

## ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 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 x 0.8 T <sub>c</sub> = 125 °C			25 250	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 V			± 100	nA

### ON (\*)

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> = 250 μA	2.25	3	3.75	V
R <sub>D(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V I <sub>D</sub> = 2.5 A		1.3	1.6	Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>D(on)max</sub> V <sub>GS</sub> = 10 V	5			A

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>D(on)max</sub> I <sub>D</sub> = 2.5 A	2.7	4		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		700 115 30	930 155 45	pF pF pF

## ELECTRICAL CHARACTERISTICS (continued)

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$V_{DD} = 250 \text{ V}$ $I_D = 2.5 \text{ A}$ $R_G = 15 \Omega$ $V_{GS} = 10 \text{ V}$ (see test circuit, figure 3)		17 30	25 40	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 400 \text{ V}$ $I_D = 5 \text{ A}$ $R_G = 15 \Omega$ $V_{GS} = 10 \text{ V}$ (see test circuit, figure 5)		450		$\text{A}/\mu\text{s}$
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400 \text{ V}$ $I_D = 5 \text{ A}$ $V_{GS} = 10 \text{ V}$		32 7 14	45	nC nC nC

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ $t_f$ $t_c$	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 400 \text{ V}$ $I_D = 5 \text{ A}$ $R_G = 15 \Omega$ $V_{GS} = 10 \text{ V}$ (see test circuit, figure 5)		18 12 30	25 18 42	ns ns ns

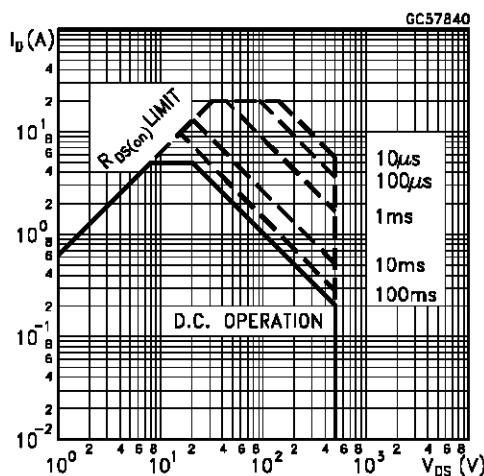
## SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				5 20	A A
$V_{SD} (\ast)$	Forward On Voltage	$I_{SD} = 5 \text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 5 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 50 \text{ V}$ $T_j = 150^\circ\text{C}$		380		ns
$Q_{rr}$	Reverse Recovery Charge	(see test circuit, figure 5)		3.8		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			20		A

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(\*) Pulse width limited by safe operating area

## Safe Operating Areas for TO-220



## Safe Operating Areas for ISOWATT220

