

# MSU5N50

## 500V N-Channel MOSFET

### Description

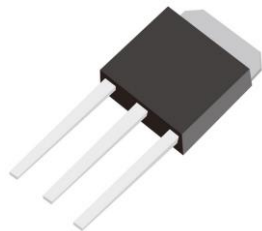
The MSU5N50 is a N-channel enhancement-mode MOSFET , providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-251 package is universally preferred for all commercial-industrial applications

### Features

- Originative New Design
- Rugged Gate Oxide Technology
- Extremely Low Intrinsic Capacitances
- Remarkable Switching Characteristics
- Unequalled Gate Charge : 2.5 nC (Typ.)
- Extended Safe Operating Area
- Lower RDS(ON) : 1.1 Ω (Typ.) @VGS=10V
- 100% Avalanche Tested
- RoHS compliant package

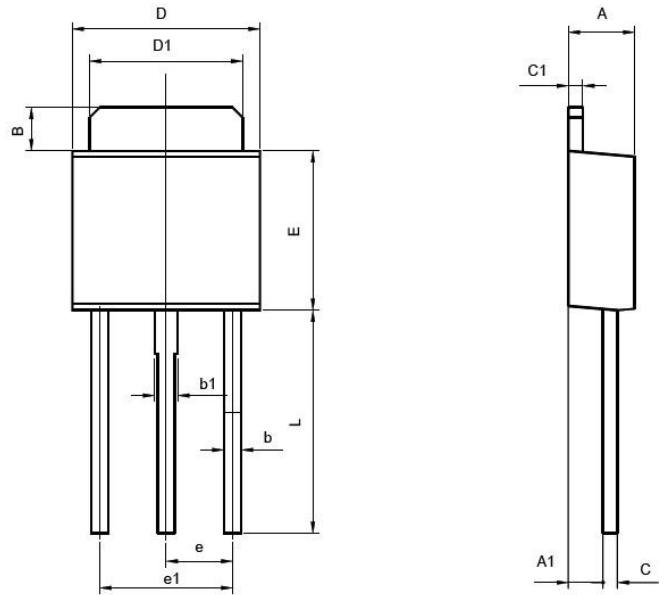
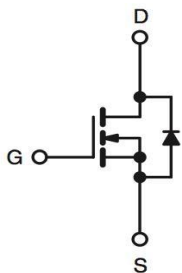
### Packing & Order Information

80/Tube ; 4,000/Box



**RoHS**  
COMPLIANT

### Graphic symbol



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	min	max	min	max
A	2.15	2.45	0.85	0.96
A1	1.00	1.40	0.39	0.55
B	1.25	1.75	0.49	0.69
b	0.45	0.75	0.18	0.3
b1	0.65	0.95	0.26	0.37
C	0.38	0.64	0.15	0.25
C1	0.38	0.64	0.15	0.25
D	6.30	6.70	2.48	2.64
D1	5.10	5.50	2.01	2.17
E	5.30	5.70	2.09	2.24
e	2.3 (typ.)		0.91 (typ.)	
e1	4.4	4.8	1.73	1.89
L	7.4	8.0	2.91	3.15

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#### MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

##### Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>DSS</sub>	Drain-Source Voltage	500	V
V <sub>GS</sub>	Gate-Source Voltage	±30	V
I <sub>D</sub>	Drain Current -Continuous (TC=25°C)	5	A
	Drain Current -Continuous (TC=100°C)	3	A
I <sub>DM</sub>	Drain Current Pulsed	20	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy	305	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy	7.6	mJ
dV/dt	Peak Diode Recovery dV/dt	4.5	V/ns
P <sub>D</sub>	Power Dissipation (TC = 25 °C)	40	W
	- Derate above 25°C	0.32	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	°C

- Drain current limited by maximum junction temperature

##### Thermal Resistance Characteristics

Symbol	Parameter	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	2.3	°C/W
R <sub>θJA</sub>	Junction-to-Ambient	110	

##### On Characteristics

Symbol	Test Conditions	Min	Typ.	Max.	Units
V <sub>GS</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0	--	4.0	V
*R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.25 A	--	2.0	1.5	Ω

##### Off Characteristics

Symbol	Test Conditions	Min	Typ.	Max.	Units
BV <sub>DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250μA	500	--	--	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> = 250μA, Referenced to 25°C	--	0.6	--	V/°C
I <sub>DSS</sub>	V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V	--	--	1	μA
	V <sub>DS</sub> = 400 V, V <sub>C</sub> = 125°C	--	--	10	
I <sub>GSSF</sub>	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V	--	--	100	nA
I <sub>GSSR</sub>	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V	--	--	-100	nA

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#### Switching Characteristics

Symbol	Test Conditions	Min	Typ.	Max.	Units
$t_{d(on)}$	$V_{DS} = 250\text{ V}, I_D = 5\text{ A},$ $R_G = 25\ \Omega$	--	10	--	ns
$t_r$		--	50	--	ns
$t_{d(off)}$		--	50	--	ns
$t_f$		--	50	--	ns
$Q_g$	$V_{DS} = 400\text{ V}, I_D = 5\text{ A},$ $V_{GS} = 10\text{ V}$	--	20	--	nC
$Q_{gs}$		--	2.5	--	nC
$Q_{gd}$		--	10	--	nC
$C_{ISS}$	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $F = 1.0\text{ MHz}$	--	520	670	pF
$C_{OSS}$		--	80	104	pF
$C_{RSS}$		--	15	20	pF

#### Source-Drain Diode Maximum Ratings and Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
$I_S$			--	--	5	A
$I_{SM}$			20			
$V_{SD}$	$I_S = 5\text{ A}, V_{GS} = 0\text{ V}$		--	--	1.4	V
$t_{rr}$	$I_S = 5\text{ A}, V_{GS} = 0\text{ V}$		--	260	--	ns
$Q_{rr}$			$diF/dt = 100\text{ A}/\mu\text{s}$	--	2.1	--

#### Notes;

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $L = 22\text{ mH}, I_{AS} = 5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega,$  Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 5\text{ A}, di/dt \leq 100\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS},$  Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s},$  Duty Cycle  $\leq 2\%$
5. Essentially Independent of Operating Temperature

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#### ■ Characteristics Curve

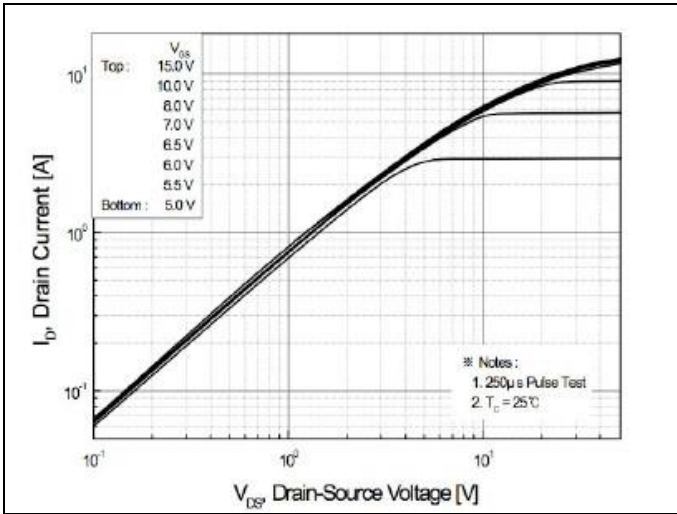


FIG.1-ON REGION CHARACTERISTICS

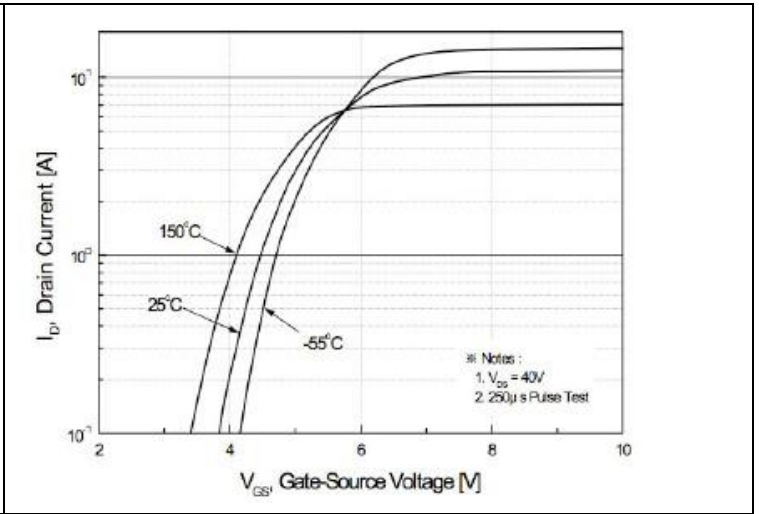


FIG.2-TRANSFER CHARACTERISTICS

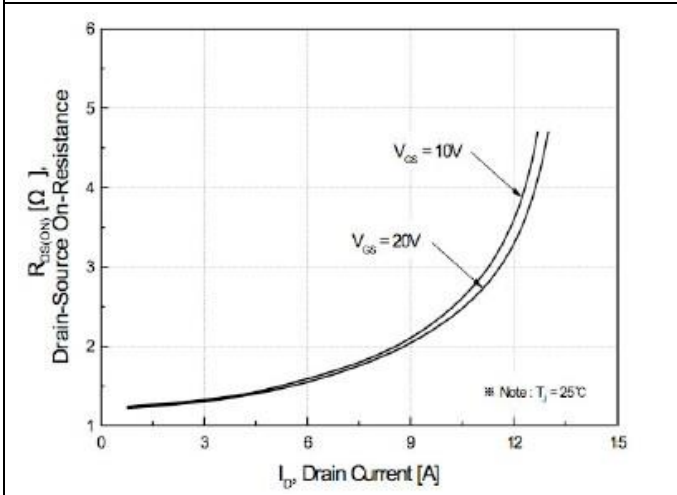


FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE

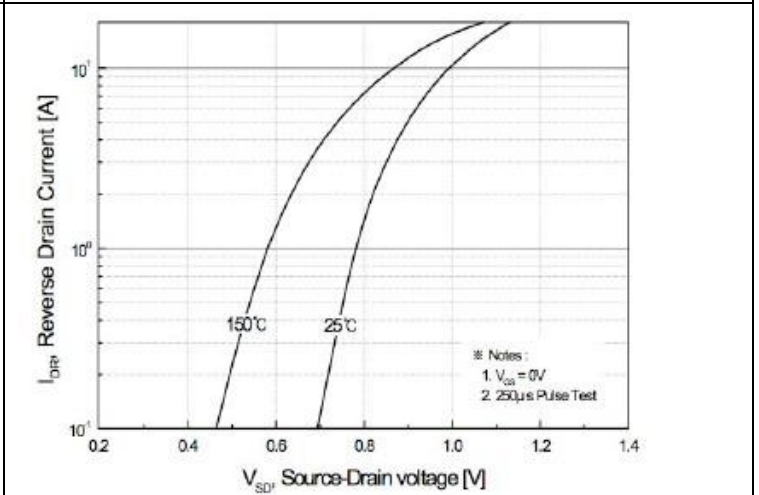


FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE

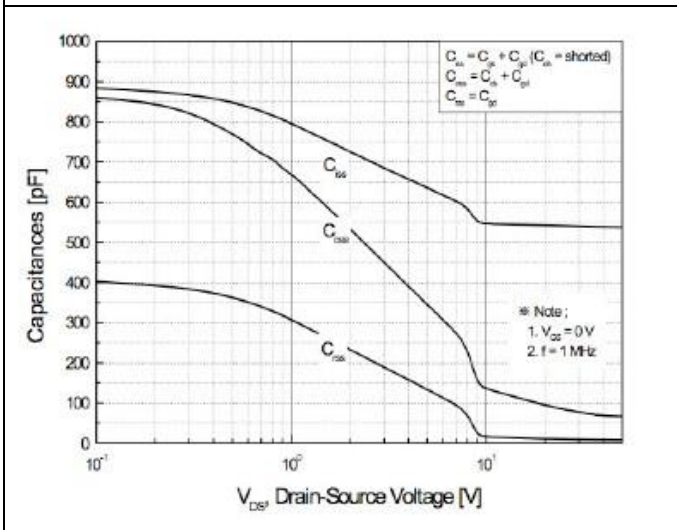


FIG.5-CAPACITANCE CHARACTERISTICS

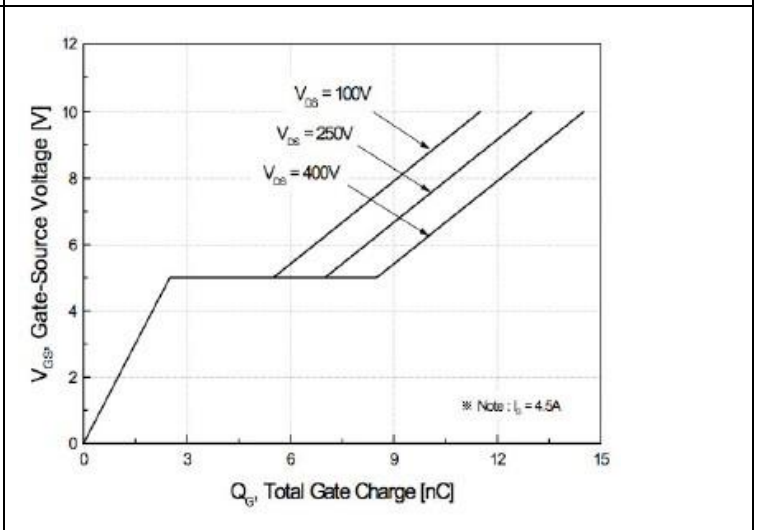


FIG.6-GATE CHARGE CHARACTERISTICS

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#### ■ Characteristics Curve

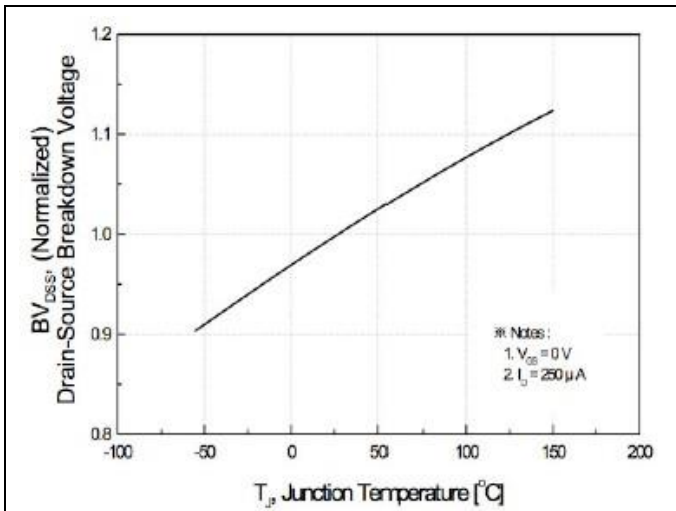


FIG.7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE

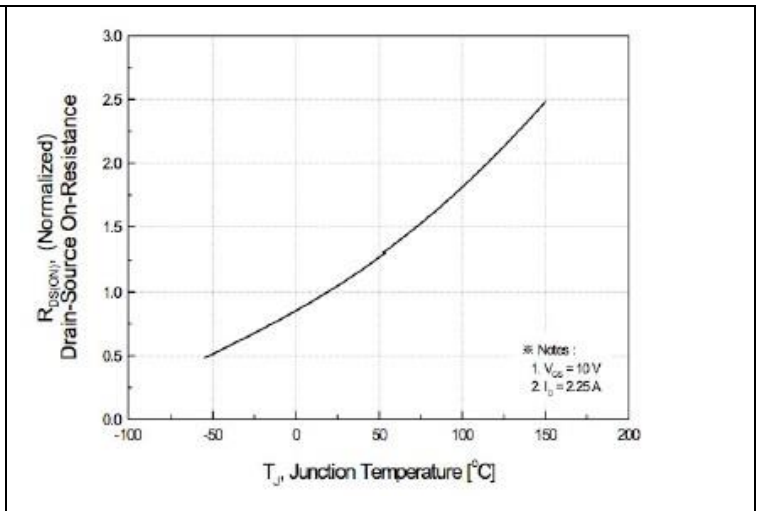


FIG.8-ON-RESISTANCE VARIATION VS TEMPERATURE

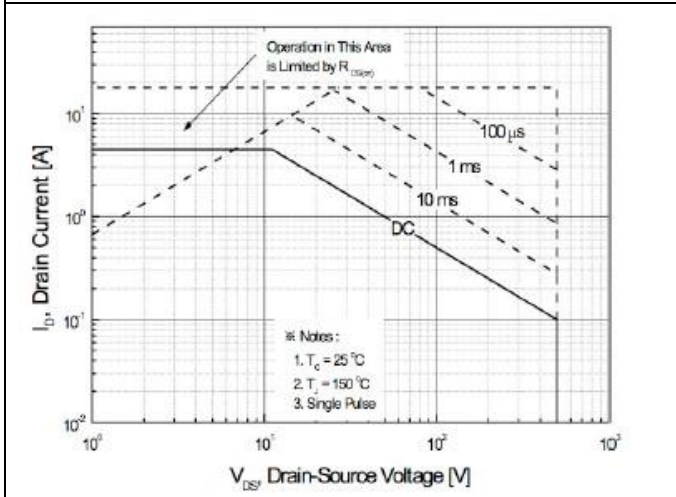


FIG.9-MAXIMUM SAFE OPERATING AREA

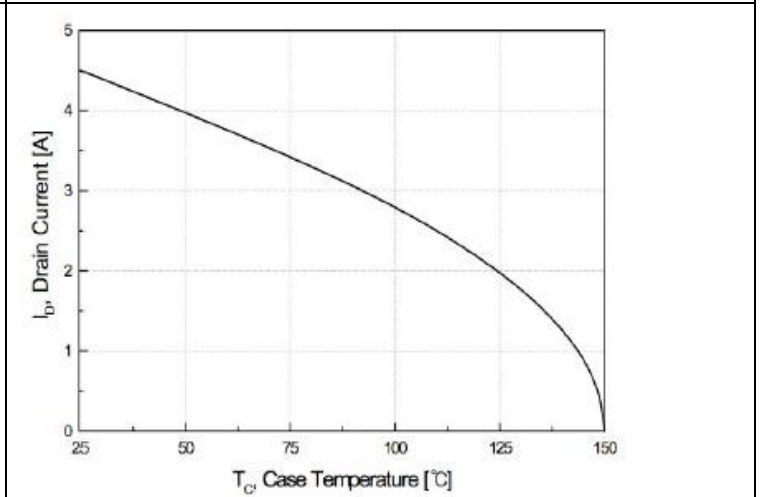


FIG.10-MAXIMUM DRAIN CURRENT VS CASE TEMPERATURE

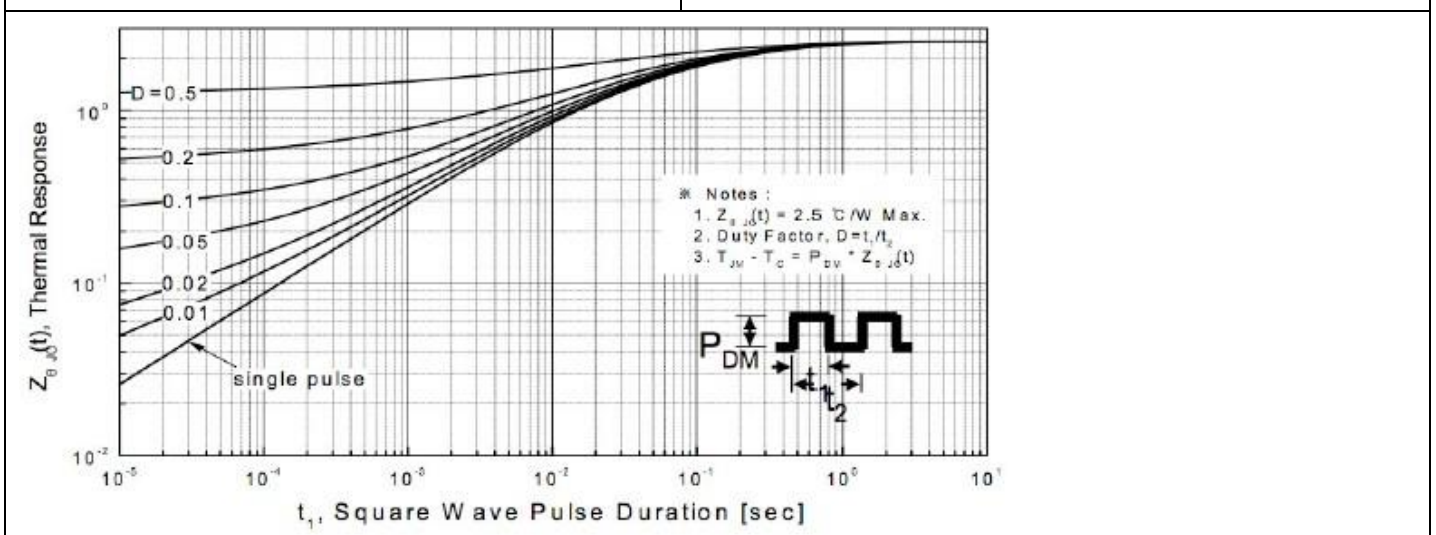


FIG.11-TRANSIENT THERMAL RESPONSE CURVE

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