

# NTS4101P

## Power MOSFET

–20 V, –1.37 A, Single P–Channel, SC–70

### Features

- Leading –20 V Trench for Low  $R_{DS(on)}$
- –2.5 V Rated for Low Voltage Gate Drive
- SC–70 Surface Mount for Small Footprint (2x2 mm)
- Pb–Free Package is Available

### Applications

- High Side Load Switch
- Charging Circuit
- Single Cell Battery Applications such as; Cell Phones, Digital Cameras, PDAs

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter			Symbol	Value	Units
Drain–to–Source Voltage			V <sub>DSS</sub>	–20	V
Gate–to–Source Voltage			V <sub>GS</sub>	±12	V
Continuous Drain Current (Note 1)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	–1.28	A
		T <sub>A</sub> = 70°C		–1.00	
	t ≤ 5 s	T <sub>A</sub> = 25°C	–1.37	A	
Power Dissipation (Note 1)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub>	0.29	W
	t ≤ 5 s			0.33	W
Pulsed Drain Current	t <sub>p</sub> = 10 μs		I <sub>DM</sub>	–4.0	A
Operating Junction and Storage Temperature			T <sub>J</sub> , T <sub>STG</sub>	–55 to 150	°C
Source Current (Body Diode), Continuous			I <sub>S</sub>	–0.5	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T <sub>L</sub>	260	°C

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Units
Junction–to–Ambient – Steady State (Note 1)	$R_{\theta JA}$	430	$^\circ\text{C/W}$
Junction–to–Ambient – $t \leq 5 \text{ s}$ (Note 1)	$R_{\theta JA}$	375	

1. Surface–mounted on FR4 board using 1" sq. pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface–mounted on FR4 board using the minimum recommended pad size (Cu area = TBD in sq).

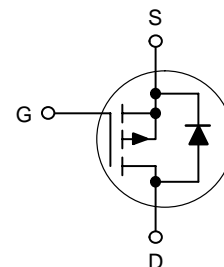


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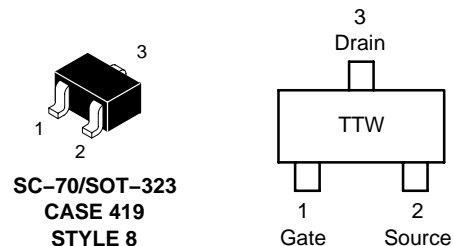
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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ Max
–20 V	83 m $\Omega$ @ –4.5 V	–1.37 A
	88 m $\Omega$ @ –3.6 V	
	104 m $\Omega$ @ –2.5 V	

### P–Channel MOSFET



### MARKING DIAGRAM & PIN ASSIGNMENT



SC–70/SOT–323  
CASE 419  
STYLE 8

TT = Device Code  
W = Work Week

### ORDERING INFORMATION

Device	Package	Shipping†
NTS4101PT1	SOT–323	3000/Tape & Reel
NTS4101PT1G	SOT–323 (Pb–Free)	3000/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# NTS4101P

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-20	-24.5		V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			-13.7		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -20 V	T <sub>J</sub> = 25°C		-1.0	μA
			T <sub>J</sub> = 70°C		-5.0	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±12 V			±100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA	-0.45	-0.64		V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			2.7		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -1.0 A		83	120	mΩ
		V <sub>GS</sub> = -3.6 V, I <sub>D</sub> = -0.7 A		88	130	
		V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.3 A		104	160	

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = -20 V		603		pF
Output Capacitance	C <sub>OSS</sub>			90		
Reverse Transfer Capacitance	C <sub>RSS</sub>			62		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -4.5 V, I <sub>D</sub> = -1.0 A		6.4		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.7		
Gate-to-Source Charge	Q <sub>GS</sub>			1.0		
Gate-to-Drain Charge	Q <sub>GD</sub>			1.5		

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = -4.5 V, V <sub>DD</sub> = -4.0 V, I <sub>D</sub> = -1.0 A, R <sub>G</sub> = 6.2 Ω		6.2		ns
Rise Time	t <sub>r</sub>			14.9		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			26		
Fall Time	t <sub>f</sub>			18		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -0.3 A	T <sub>J</sub> = 25°C		-0.61	-1.2	V
			T <sub>J</sub> = 125°C		-0.5		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>SD</sub> /dt = 100 A/μs, I <sub>S</sub> = -1.0 A			10.9		ns
Charge Time	T <sub>a</sub>				7.1		
Discharge Time	T <sub>b</sub>				3.8		
Reverse Recovery Charge	Q <sub>RR</sub>				4.25		nC

3. Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2%.

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

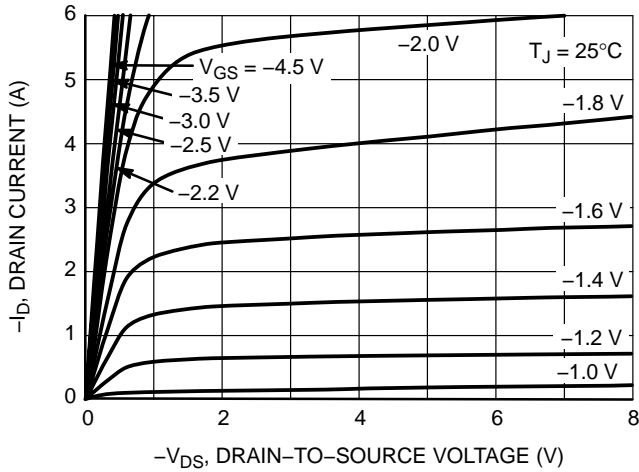


Figure 1. On-Region Characteristics

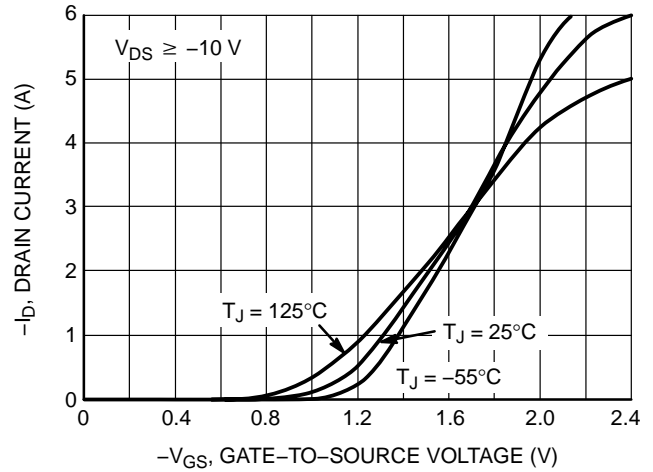


Figure 2. Transfer Characteristics

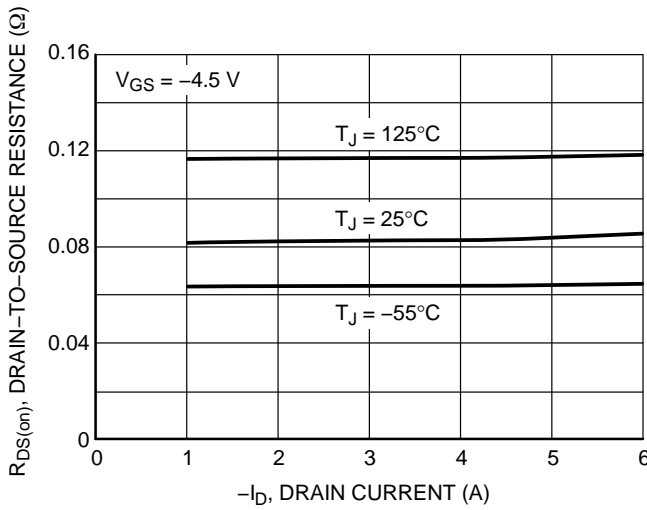


Figure 3. On-Resistance versus Drain Current and Temperature

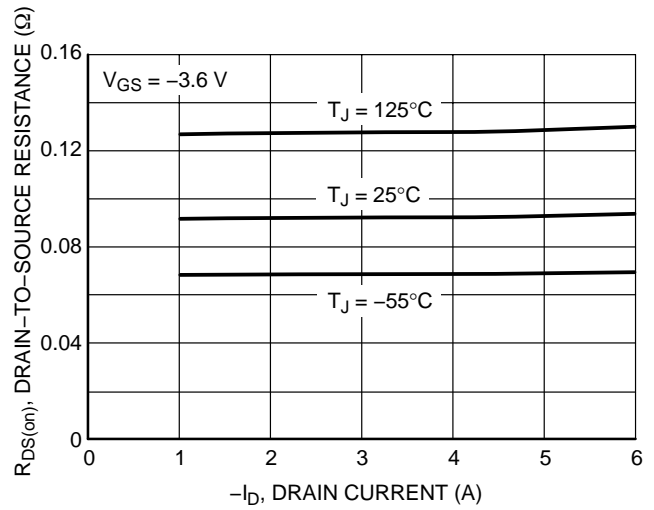


Figure 4. On-Resistance versus Drain Current and Temperature

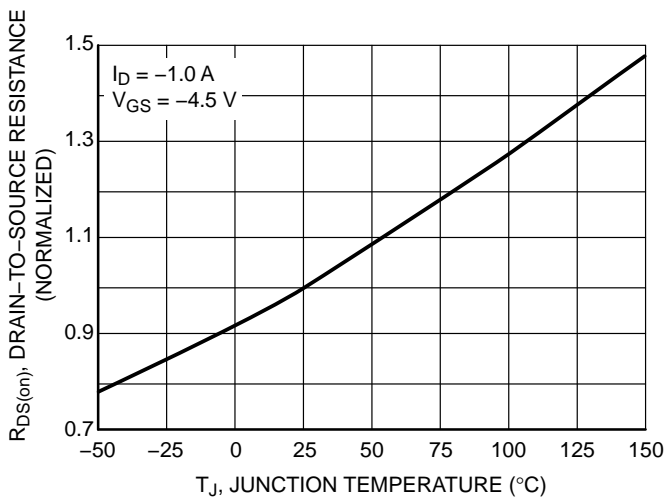


Figure 5. On-Resistance Variation with Temperature

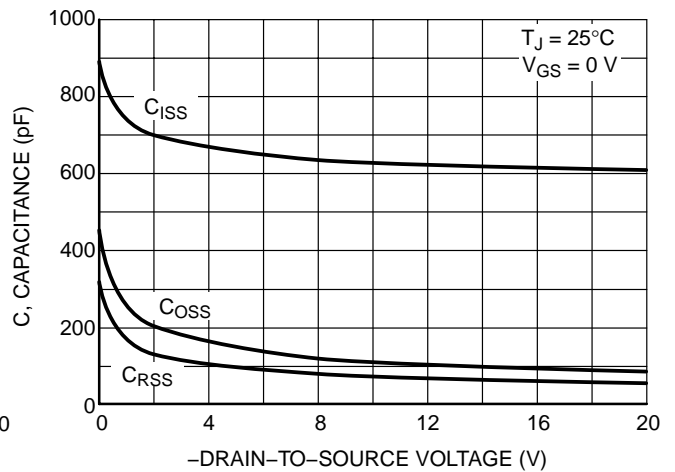


Figure 6. Capacitance Variation

TYPICAL CHARACTERISTICS

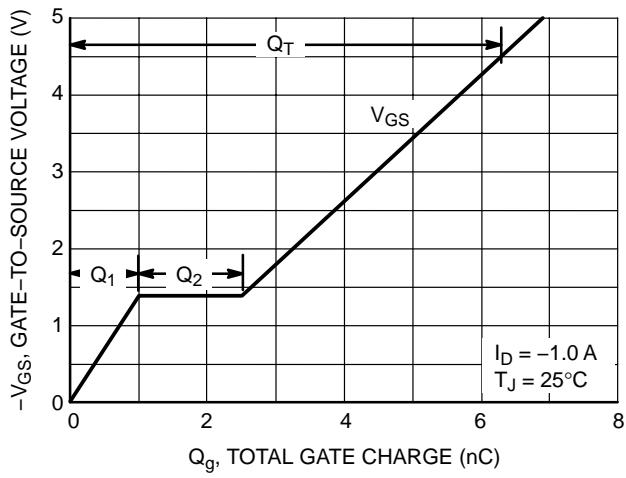


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

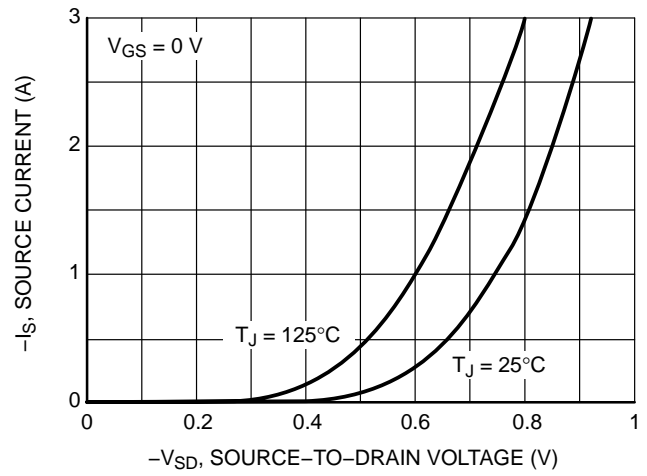
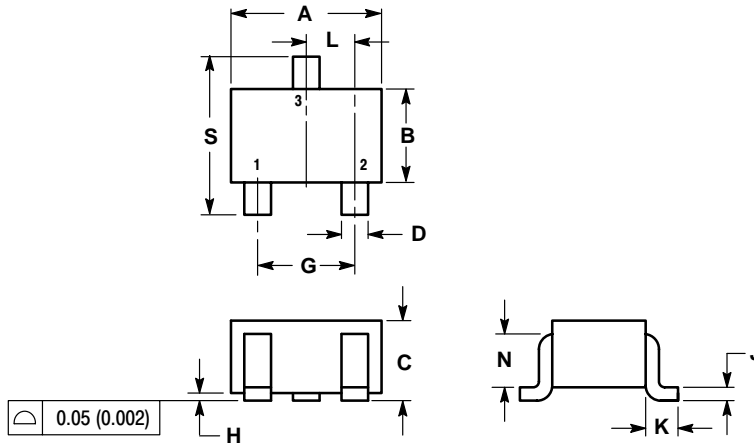


Figure 8. Diode Forward Voltage versus Current

# NTS4101P

## PACKAGE DIMENSIONS

SC-70 (SOT-323)  
CASE 419-04  
ISSUE L



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.032	0.040	0.80	1.00
D	0.012	0.016	0.30	0.40
G	0.047	0.055	1.20	1.40
H	0.000	0.004	0.00	0.10
J	0.004	0.010	0.10	0.25
K	0.017 REF		0.425 REF	
L	0.026 BSC		0.650 BSC	
N	0.028 REF		0.700 REF	
S	0.079	0.095	2.00	2.40

STYLE 8:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

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