

# NTK3139P

## Power MOSFET

-20 V, -780 mA, Single P-Channel with ESD Protection, SOT-723



ON Semiconductor®

<http://onsemi.com>

### Features

- P-channel Switch with Low  $R_{DS(on)}$
- 44% Smaller Footprint and 38% Thinner than SC-89
- Low Threshold Levels Allowing 1.5 V  $R_{DS(on)}$  Rating
- Operated at Low Logic Level Gate Drive
- These are Pb-Free Devices

### Applications

- Load/Power Switching
- Interfacing, Logic Switching
- Battery Management for Ultra Small Portable Electronics

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

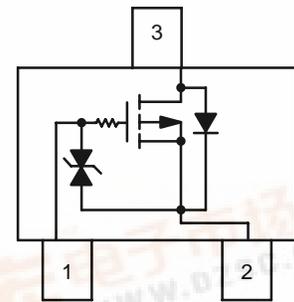
Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	$V_{DSS}$	-20	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 6$	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$ -780	mA
		$T_A = 85^\circ\text{C}$	-570	
	$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$	-870	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$ 450	mW
		$t \leq 5 \text{ s}$	550	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$ -660	mA
		$T_A = 85^\circ\text{C}$	-480	
Power Dissipation (Note 2)		$T_A = 25^\circ\text{C}$	$P_D$ 310	mW
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	-1.2	A
Operating Junction and Storage Temperature	$T_J, T_{STG}$	-55 to 150		$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260		$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Surface mounted on FR4 board using 1 in 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

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ Max
-20 V	0.38 $\Omega$ @ -4.5 V	-780 mA
	0.52 $\Omega$ @ -2.5 V	-660 mA
	0.70 $\Omega$ @ -1.8 V	-100 mA
	0.95 $\Omega$ @ -1.5 V	-100 mA

### SOT-723 (3-LEAD)



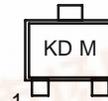
Top View

- 1 - Gate
- 2 - Source
- 3 - Drain



SOT-723  
CASE 631AA  
STYLE 5

### MARKING DIAGRAM



- KD = Specific Device Code
- M = Date Code

### ORDERING INFORMATION

Device	Package	Shipping†
NTK3139PT1G	SOT-723*	4000 / Tape & Reel
NTK3139PT5G	SOT-723*	8000 / 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.

\*These packages are inherently Pb-Free.



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## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	280	°C/W
Junction-to-Ambient – $t = 5$ s (Note 3)	$R_{\theta JA}$	228	
Junction-to-Ambient – Steady State Minimum Pad (Note 4)	$R_{\theta JA}$	400	

3. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)

4. Surface mounted on FR4 board using the minimum recommended pad size

## MOSFET ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = -250$ $\mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = -250$ $\mu\text{A}$ , Reference to $25^\circ\text{C}$		-16.5		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = -16$ V	$T_J = 25^\circ\text{C}$		-1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		-2.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 4.5$ V			$\pm 2.0$	$\mu\text{A}$

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = -250$ $\mu\text{A}$	-0.45		-1.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			2.4		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -780$ mA		0.38	0.48	$\Omega$
		$V_{GS} = -2.5$ V, $I_D = -660$ mA		0.52	0.67	
		$V_{GS} = -1.8$ V, $I_D = -100$ mA		0.70	0.95	
		$V_{GS} = -1.5$ V, $I_D = -100$ mA		0.95	2.20	
Forward Transconductance	$g_{FS}$	$V_{DS} = -10$ V, $I_D = -540$ mA		1.2		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = -16$ V		113	170	pF
Output Capacitance	$C_{OSS}$			15	25	
Reverse Transfer Capacitance	$C_{RSS}$			9.0	15	

### SWITCHING CHARACTERISTICS, $V_{GS} = 4.5$ V (Note 6)

Turn On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5$ V, $V_{DS} = -10$ V, $I_D = -200$ mA, $R_G = 10$ $\Omega$		9.0		ns
Rise Time	$t_r$			5.8		
TurnOff Delay Time	$t_{d(OFF)}$			32.7		
Fall Time	$t_f$			20.3		

### DRAIN SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0$ V, $I_S = -350$ mA	$T_J = 25^\circ\text{C}$		-0.8	-1.2	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0$ V, $dI_{SD}/dt = 100$ A/ $\mu\text{s}$ , $I_S = -1.0$ A, $V_{DD} = -20$ V			13.2		ns
Charge Time	$t_a$				11.8		
Discharge Time	$t_b$				1.4		
Reverse Recovery Charge	$Q_{RR}$				5.0		

5. Pulse Test: pulse width = 300  $\mu\text{s}$ , duty cycle = 2%

6. Switching characteristics are independent of operating junction temperatures

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## TYPICAL CHARACTERISTICS

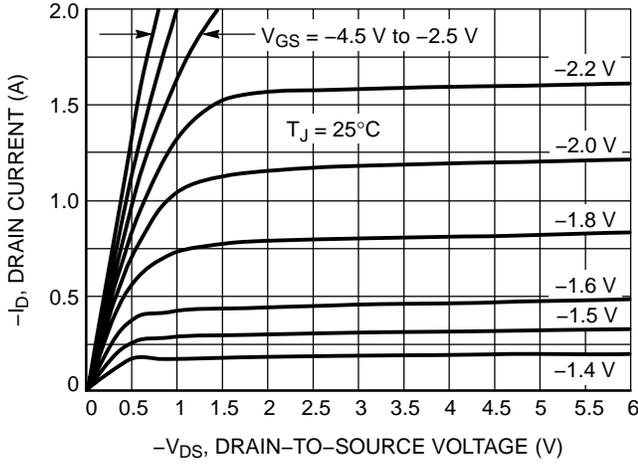


Figure 1. On-Region Characteristics

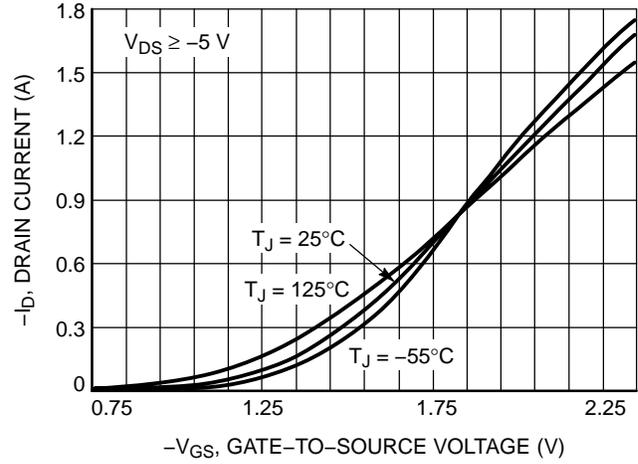


Figure 2. Transfer Characteristics

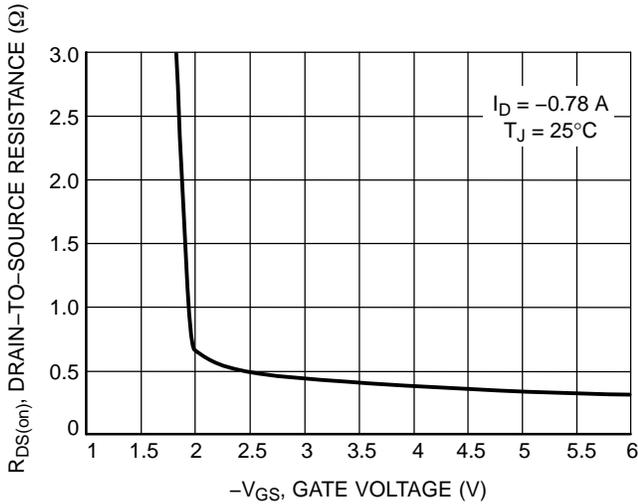


Figure 3. On-Resistance vs. Gate-to-Source Voltage

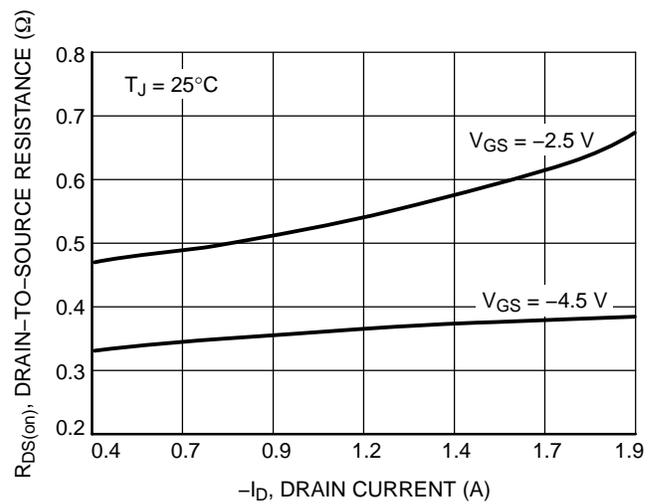


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

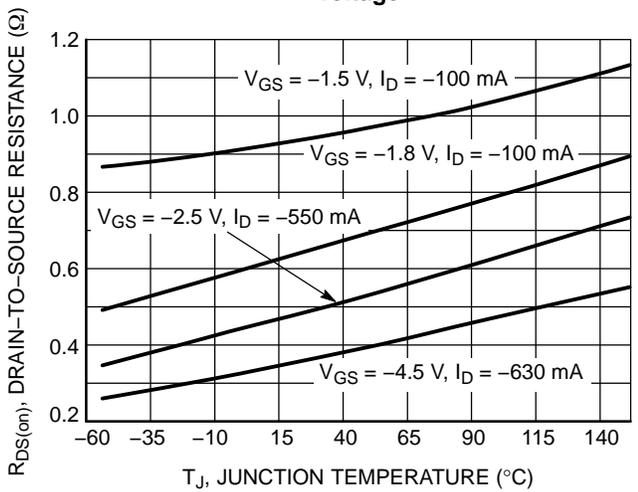


Figure 5. On-Resistance Variation with Temperature

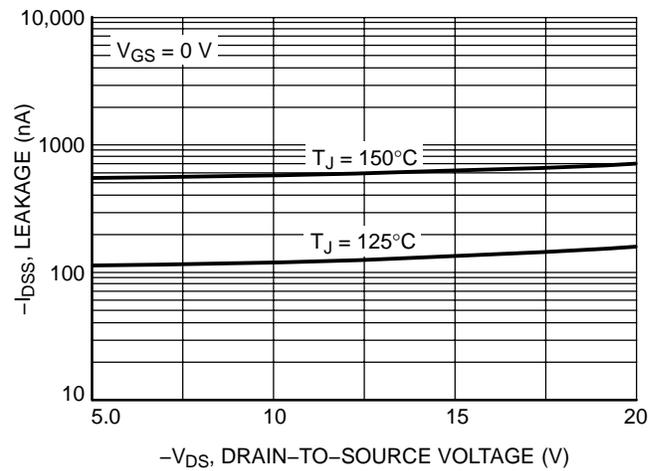


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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## TYPICAL CHARACTERISTICS

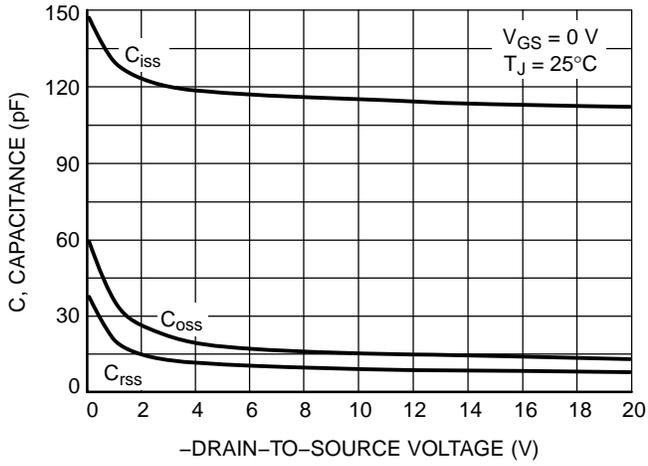


Figure 7. Capacitance Variation

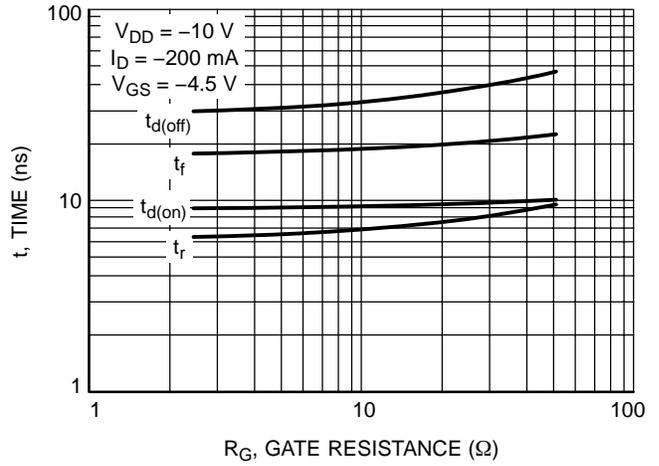


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

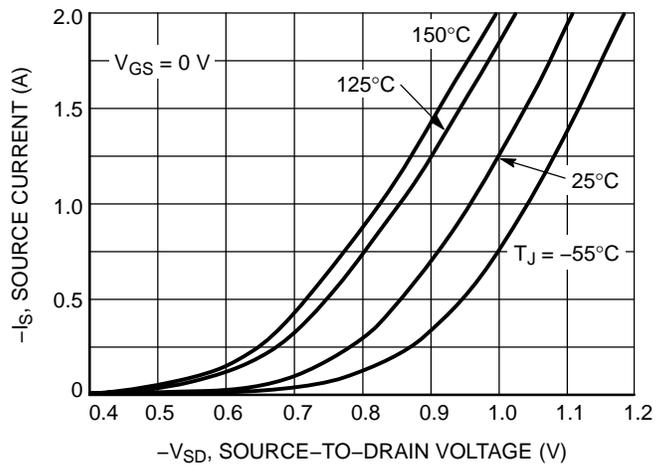
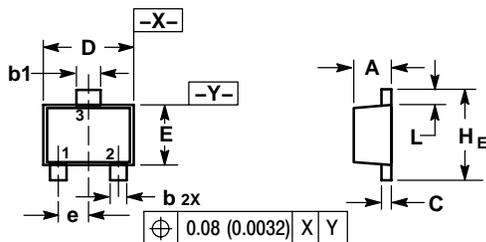


Figure 9. Diode Forward Voltage vs. Current

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## PACKAGE DIMENSIONS

**SOT-723**  
CASE 631AA-01  
ISSUE C



**NOTES:**

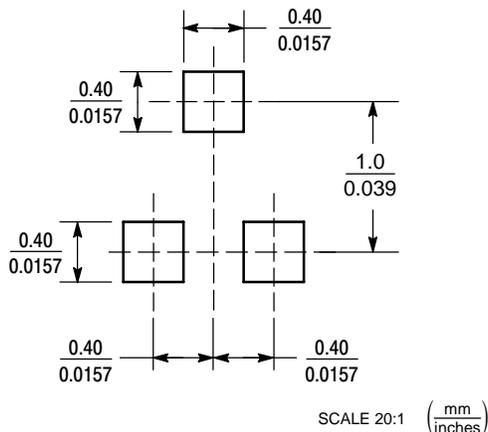
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.45	0.50	0.55	0.018	0.020	0.022
b	0.15	0.21	0.27	0.0059	0.0083	0.0106
b1	0.25	0.31	0.37	0.010	0.012	0.015
C	0.07	0.12	0.17	0.0028	0.0047	0.0067
D	1.15	1.20	1.25	0.045	0.047	0.049
E	0.75	0.80	0.85	0.03	0.032	0.034
e	0.40 BSC			0.016 BSC		
H <sub>E</sub>	1.15	1.20	1.25	0.045	0.047	0.049
L	0.15	0.20	0.25	0.0059	0.0079	0.0098

**STYLE 5:**

1. GATE
2. SOURCE
3. DRAIN

### SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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