NTK3139P

Power MOSFET

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

ON Semiconductor®

http://onsemi.com

Features

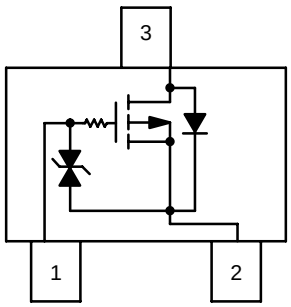
- P−channel Switch with Low $R_{DS(on)}$
- 44% Smaller Footprint and 38% Thinner than SC−89
- Low Threshold Levels Allowing 1.5 V $R_{DS(on)}$ Rating
- Operated at Low Logic Level Gate Drive
- These are Pb−Free Devices

Applications

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

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

SOT−723 (3−LEAD)



Top View

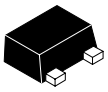
1 − Gate
2 − Source
3 − Drain

MAXIMUM RATINGS (T_J = 25°C unless otherwise stated)

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

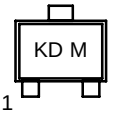
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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



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.

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°C unless otherwise specified)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = −250 μA		−20			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	I_D = −250 μA, Reference to 25°C			−16.5		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = −16V	T_J = 25°C			−1.0	μA
			T_J = 125°C			−2.0	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±4.5 V				±2.0	μA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = −250 μA		−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	Ω
		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 Ω			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°C		−0.8	−1.2	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, d_{ISD}/d_t = 100 A/μs, 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		nC

5. Pulse Test: pulse width = 300 μs, duty cycle = 2%
6. Switching characteristics are independent of operating junction temperatures

TYPICAL CHARACTERISTICS

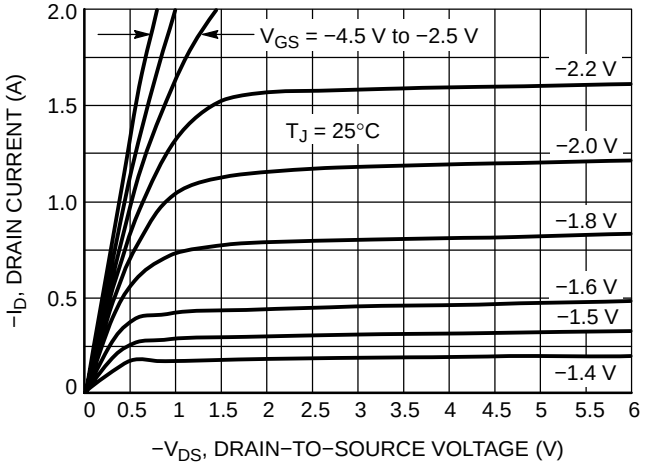


Figure 1. On−Region Characteristics

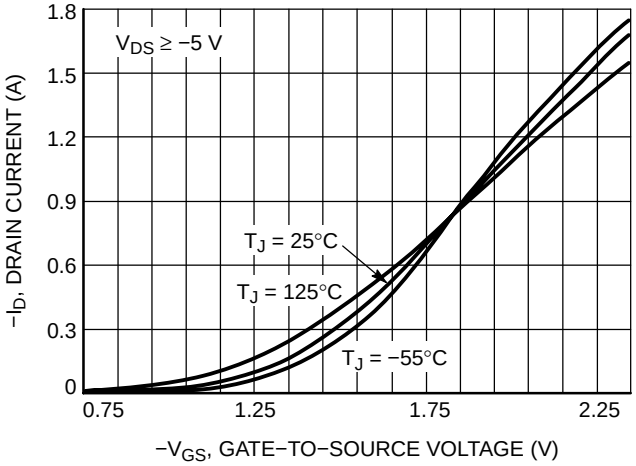


Figure 2. Transfer Characteristics

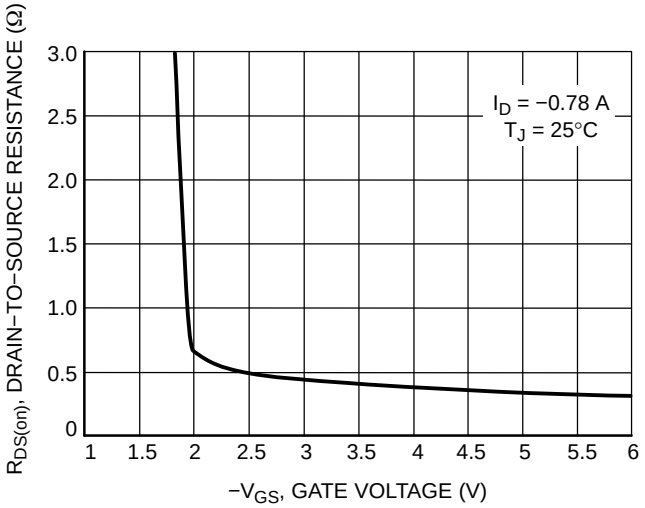


Figure 3. On−Resistance vs. Gate−to−Source Voltage

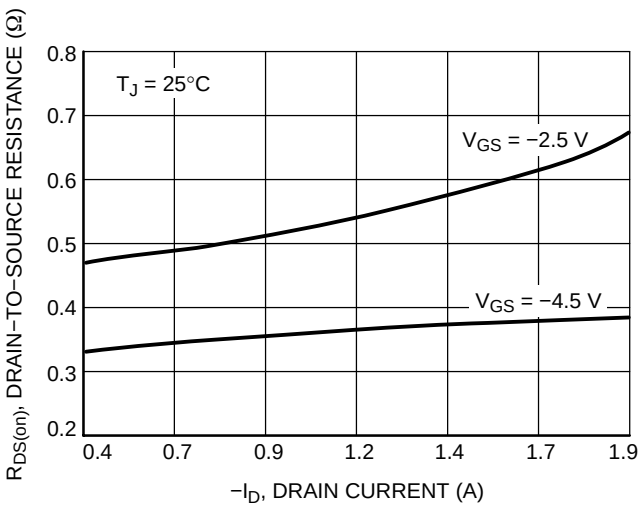


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

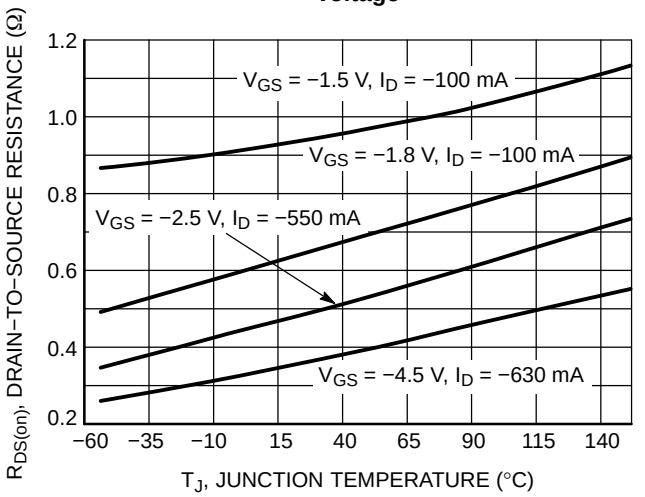


Figure 5. On−Resistance Variation with Temperature

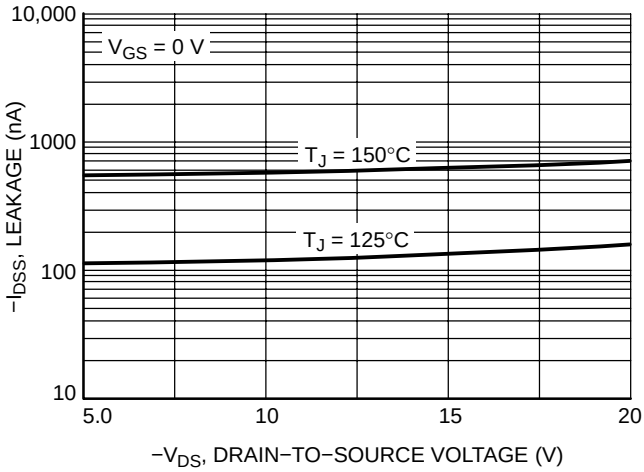


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

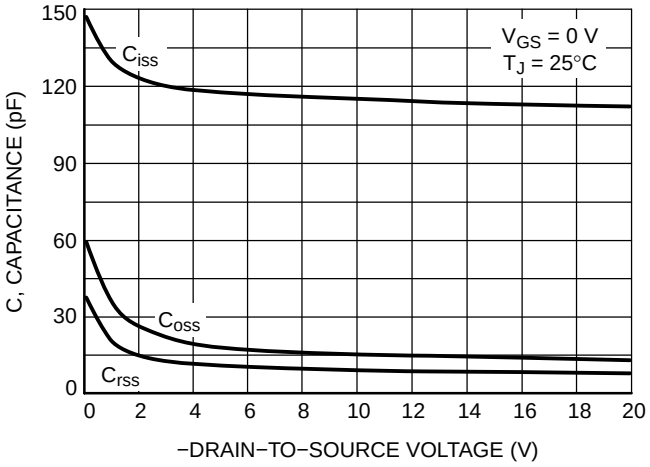


Figure 7. Capacitance Variation

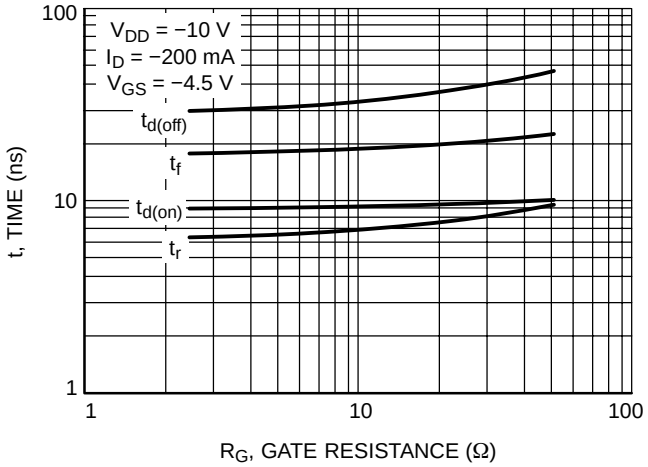


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

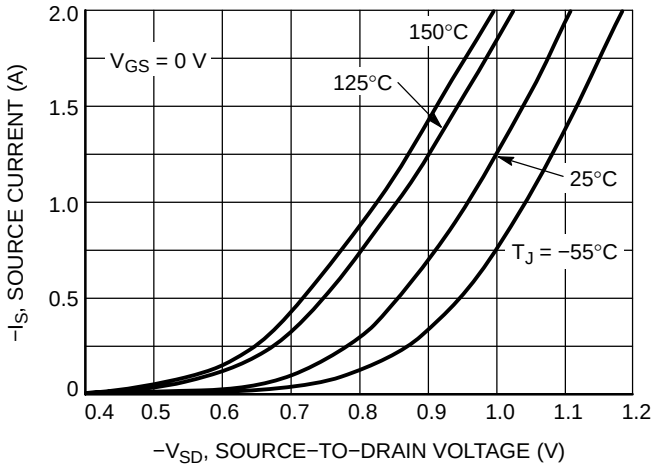
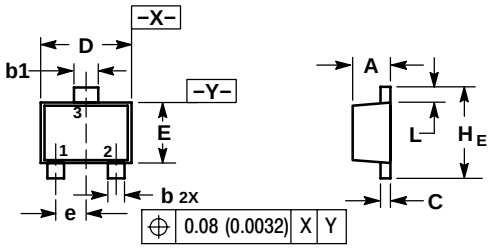


Figure 9. Diode Forward Voltage vs. Current

PACKAGE DIMENSIONS

SOT−723
CASE 631AA−01
ISSUE C

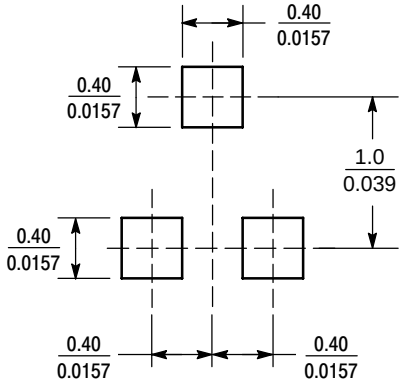


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

	MILLIMETERS			INCHES		
DIM	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_E	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:
PIN 1. GATE
2. SOURCE
3. DRAIN

SOLDERING FOOTPRINT*



SCALE 20:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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