

# NTGF3123P

## Power MOSFET and Schottky Diode

### 20 V, 2.5 A, P-Channel with Schottky Barrier Diode, TSOP-6 Dual

#### Features

- FETKY® P-Channel and Schottky Diode
- Small Size (3 x 3 mm) Dual TSOP-6 Package
- Leading Edge Trench Technology for Low On Resistance
- Low  $V_F$  Schottky Diode
- Common Drain/Cathode for Ease of Board Layout
- This is a Pb-Free Device

#### Applications

- DC-DC Converters; Configured as Asynchronous Buck
- Portable Devices like PDA's, Cellular Phones, and Hard Drives

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	20	V
Gate-to-Source Voltage		$V_{GS}$	$\pm 12$	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	2.3	A
		$T_A = 85^\circ\text{C}$	1.6	
	$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$	2.5	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	1.1	W
		$t \leq 5 \text{ s}$	1.3	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	1.7	A
		$T_A = 85^\circ\text{C}$	1.2	
Power Dissipation (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	0.56	W
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	6.9	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-25 to 150	$^\circ\text{C}$
Source Current (Body Diode) (Note 2)		$I_S$	0.9	A
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 [2 oz] including traces). Both die on.
2. Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 0.0465 in sq [2 oz] including traces). Both die on.



ON Semiconductor®

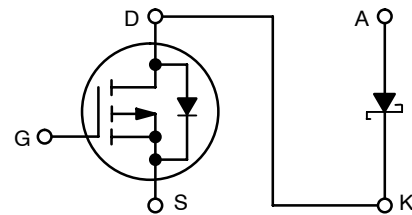
<http://onsemi.com>

#### MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
20 V	145 m $\Omega$ @ 4.5 V	2.5 A
	200 m $\Omega$ @ 2.5 V	

#### SCHOTTKY DIODE

$V_R$ MAX	$V_F$ TYP	$I_F$ MAX
20 V	0.40 V	1.0 A



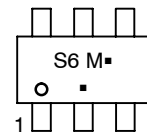
P-CHANNEL MOSFET

SCHOTTKY DIODE



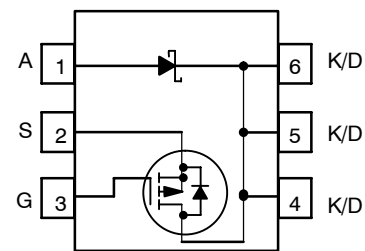
TSOP6  
CASE 318G

#### MARKING DIAGRAM



S6 = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### PIN CONNECTION



(Top View)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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

Parameter	Symbol	Value	Unit
Peak Repetitive Reverse Voltage	$V_{RRM}$	20	V
DC Blocking Voltage	$V_R$	20	V
Average Rectified Forward Current	$I_F$	1.0	A

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
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### BOTH DIE ON

Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	115	°C/W
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	95	
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	225	

### ONE DIE ON

Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	225	°C/W
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	125	
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	305	

- Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
- Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 30 mm sq [2 oz] including traces).

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu$ A	20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			14.4		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 16$ V, $V_{GS} = 0$ V	$T_J = 25^\circ\text{C}$		1.0	$\mu$ A
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 12$ V			100	nA

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = 250$ $\mu$ A	0.6	1.2	1.4	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			3.2		mV/°C
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 4.5$ V, $I_D = 2.0$ A		95	145	m $\Omega$
		$V_{GS} = 2.5$ V, $I_D = 1.7$ A		150	200	
Forward Transconductance	$g_{FS}$	$V_{DS} = -5.0$ V, $I_D = -2.5$ A		4.0		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = -10$ V		390		pF
Output Capacitance	$C_{OSS}$			75		
Reverse Transfer Capacitance	$C_{RSS}$			37		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5$ V, $V_{DS} = -10$ V, $I_D = -2.2$ A		3.7	5.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.7		
Gate-to-Source Charge	$Q_{GS}$			1.1		
Gate-to-Drain Charge	$Q_{GD}$			1.2		

- Pulse Test: Pulse Width  $\leq 300$   $\mu$ s, Duty Cycle  $\leq 2\%$ .

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V},$ $I_D = 1.0\text{ A}, R_G = 6.0\ \Omega$		6.7		ns
Rise Time	$t_r$			12.7		
Turn-Off Delay Time	$t_{d(OFF)}$			13.2		
Fall Time	$t_f$			11		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Recovery Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -0.8\text{ A}$	$T_J = 25^\circ\text{C}$		-0.8	-1.2	V
			$T_J = 125^\circ\text{C}$		-0.6		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, d_{ISD}/d_t = 100\text{ A}/\mu\text{s},$ $I_S = -1.0\text{ A}$		7.4		ns	
Charge Time	$t_a$			4.8			
Discharge Time	$t_b$			2.6			
Reverse Recovery Time	$Q_{RR}$			2.4			nC

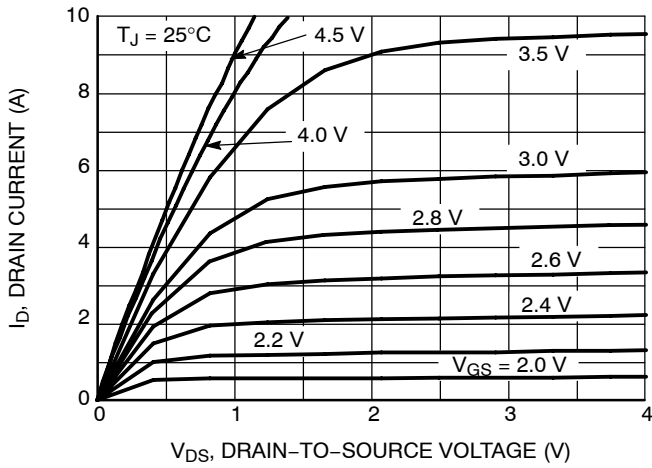
6. Switching characteristics are independent of operating junction temperatures.

### SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

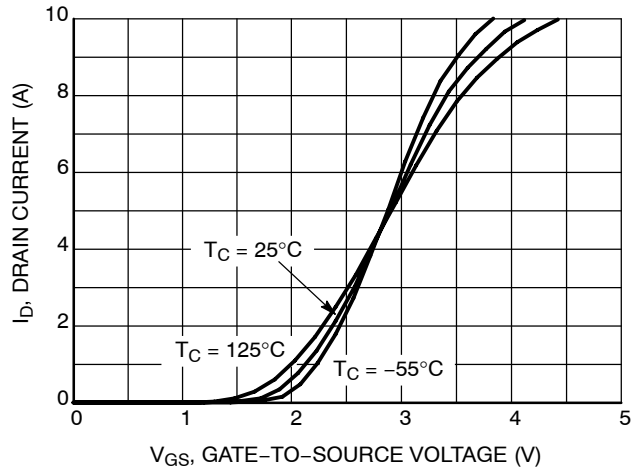
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.5\text{ A}$		0.35	0.4	V
		$I_F = 1.0\text{ A}$		0.4	0.45	
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 10\text{ V}$		15.7	200	$\mu\text{A}$
		$V_R = 20\text{ V}$		29.6	400	

# NTGF3123P

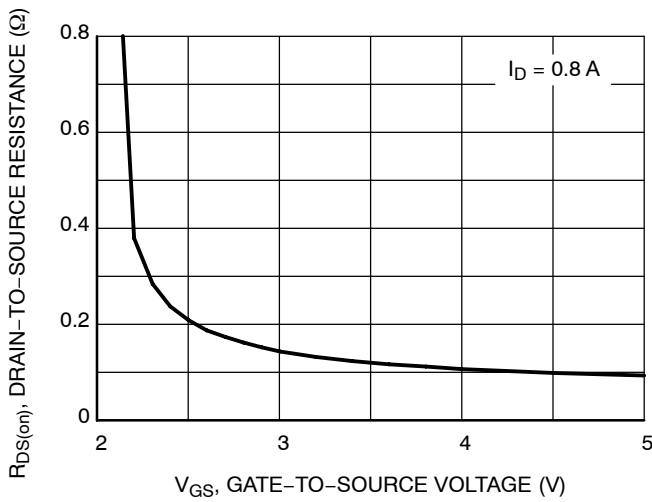
## P-CHANNEL



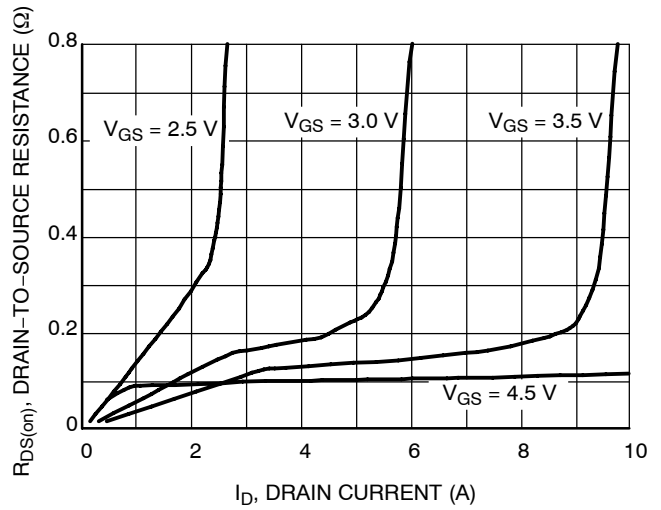
**Figure 1. On-Region Characteristics**



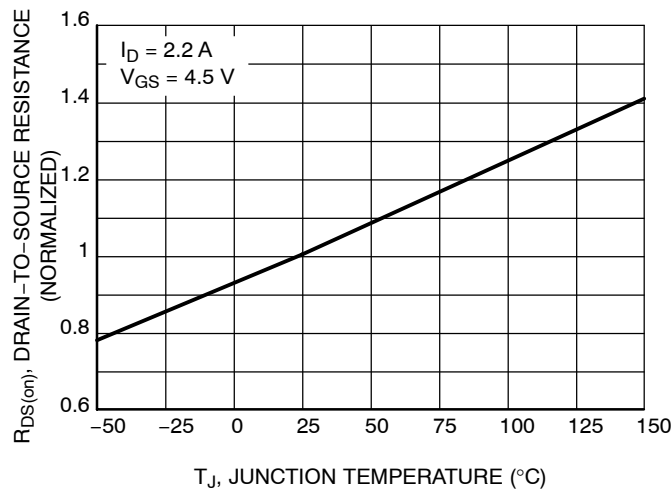
**Figure 2. Transfer Characteristics**



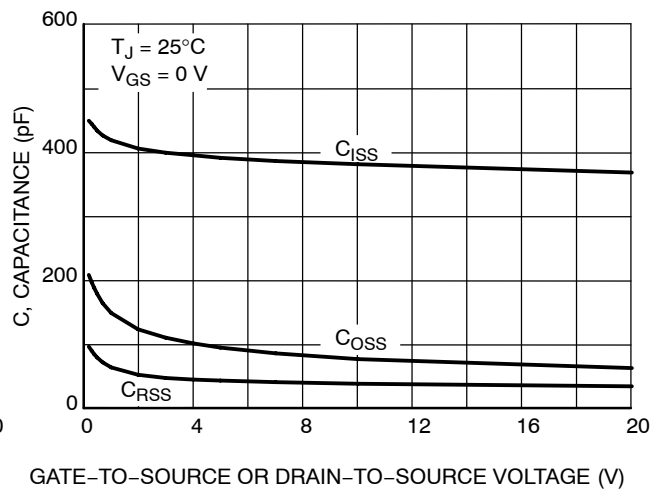
**Figure 3. On-Resistance versus Gate-to-Source Voltage**



**Figure 4. On-Resistance versus Drain Current and Gate Voltage**



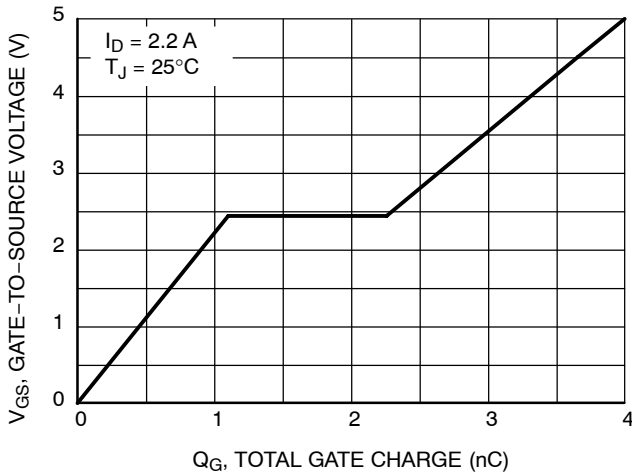
**Figure 5. On-Resistance Variation with Temperature**



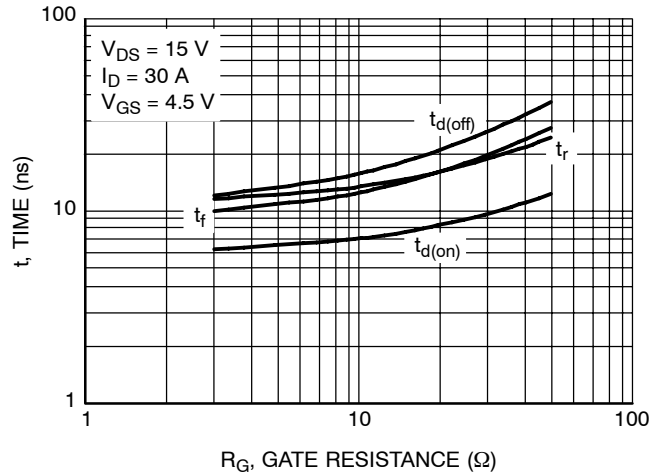
**Figure 6. Capacitance Variation**

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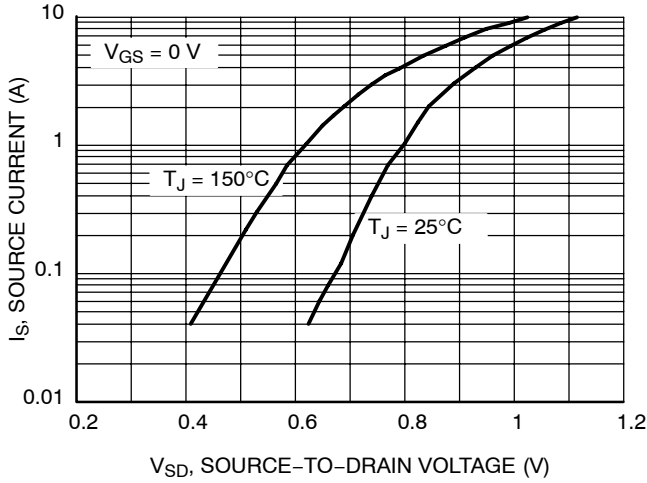
## P-CHANNEL



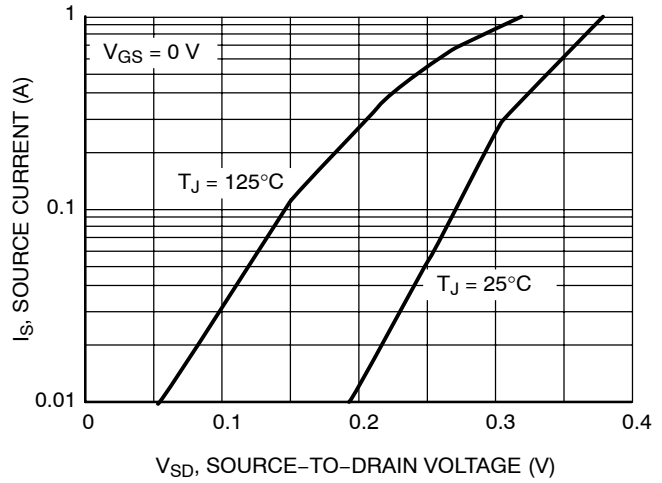
**Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge**



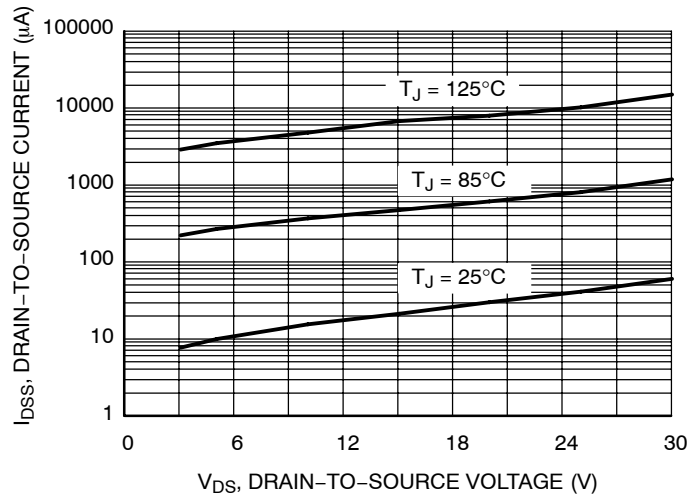
**Figure 8. Resistive Switching Time Variation versus Gate Resistance**



**Figure 9. Diode Forward Voltage versus Current**



**Figure 10. Schottky Diode Forward Voltage versus Current**



**Figure 11. Schottky Diode Reverse Current**

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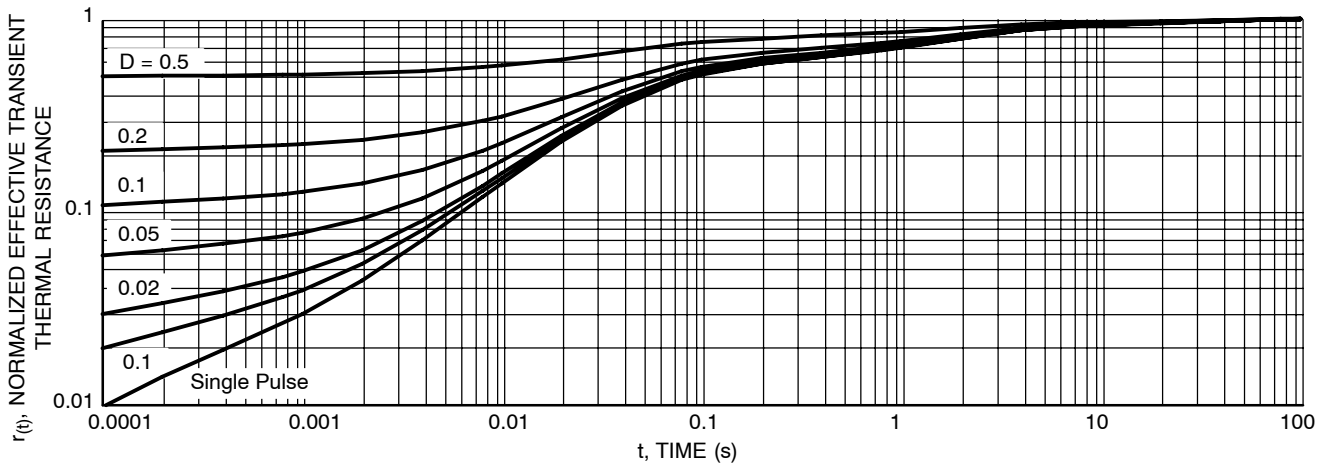


Figure 12. Thermal Response

## ORDERING INFORMATION

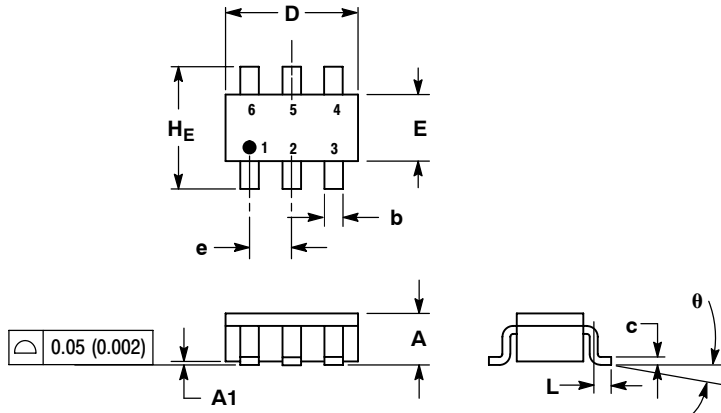
Device	Package	Shipping <sup>†</sup>
NTGF3123PT1G	TSOP6 (Pb-Free)	3000 / Tape & Reel

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

# NTGF3123P

## PACKAGE DIMENSIONS

### TSOP-6 CASE 318G-02 ISSUE S

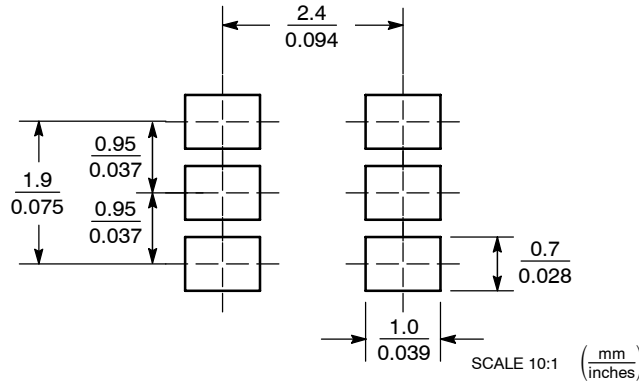


#### NOTES:

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

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.38	0.50	0.010	0.014	0.020
c	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
e	0.85	0.95	1.05	0.034	0.037	0.041
L	0.20	0.40	0.60	0.008	0.016	0.024
HE	2.50	2.75	3.00	0.099	0.108	0.118
θ	0°	-	10°	0°	-	10°

### 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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