

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_{DS}	20	V
Gate-to-Source Voltage		V_{GS}	± 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	
	$t \leq 5$ s	$T_A = 25^\circ\text{C}$	2.5	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	1.1	W
		$t \leq 5$ 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	$t_p = 10$ μs	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®

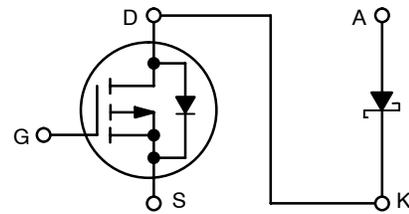
<http://onsemi.com>

MOSFET

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

SCHOTTKY DIODE

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



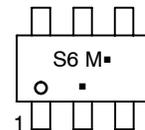
P-CHANNEL MOSFET

SCHOTTKY DIODE



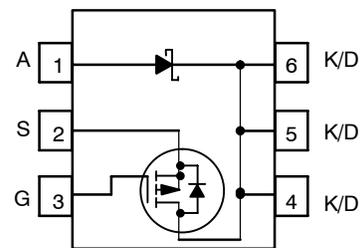
TSOP6
CASE 318G

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	

3. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).

4. 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, $I_D = 250$ μ 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	μ 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	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, $I_D = 250$ μ 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 Ω
		$V_{GS} = 2.5$ 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		

5. Pulse Test: Pulse Width ≤ 300 μ 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
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	μA
		$V_R = 20\text{ V}$		29.6	400	

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P-CHANNEL

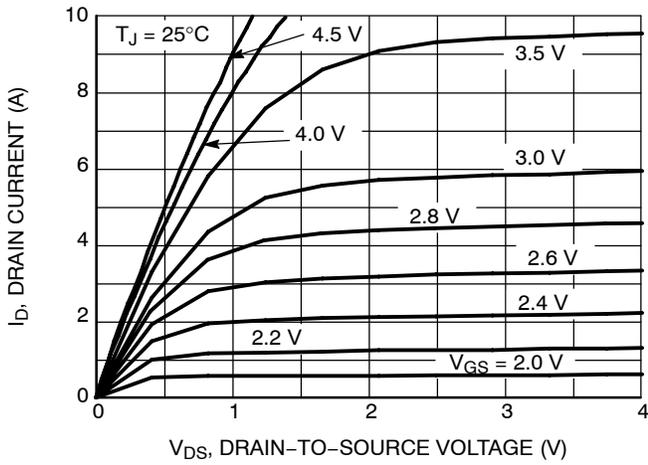


Figure 1. On-Region Characteristics

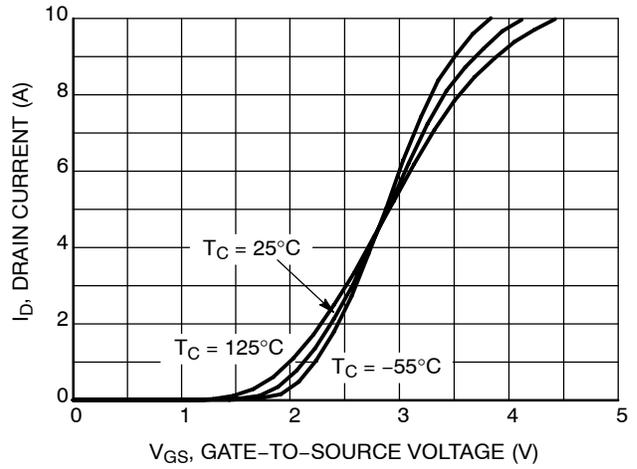


Figure 2. Transfer Characteristics

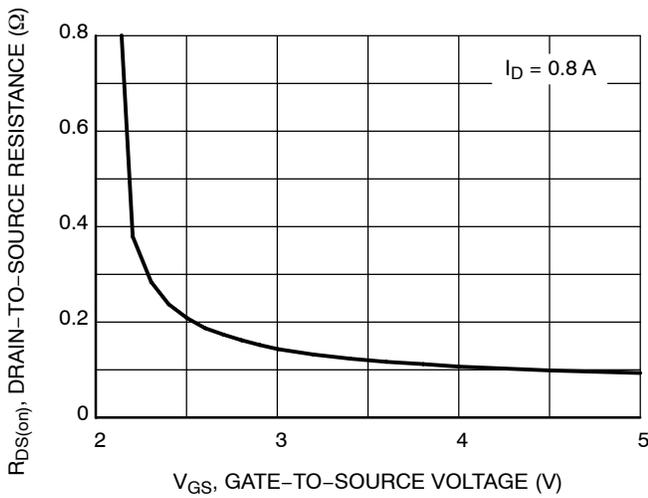


Figure 3. On-Resistance versus Gate-to-Source Voltage

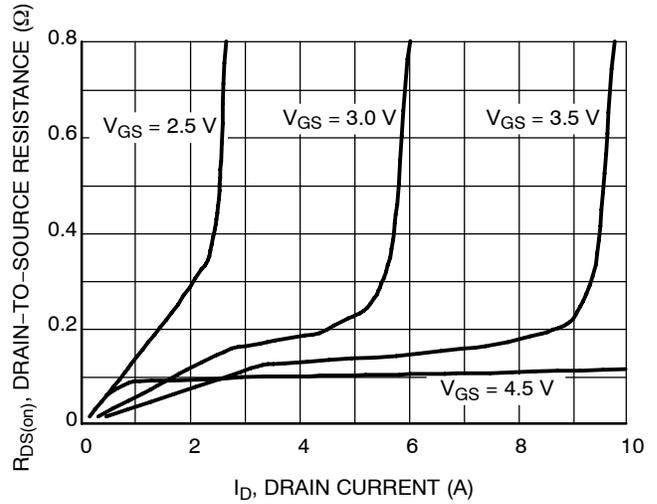


Figure 4. On-Resistance versus Drain Current and Gate Voltage

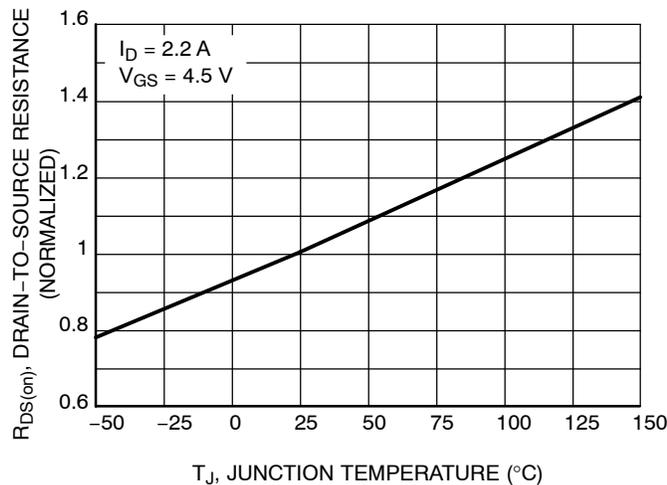


Figure 5. On-Resistance Variation with Temperature

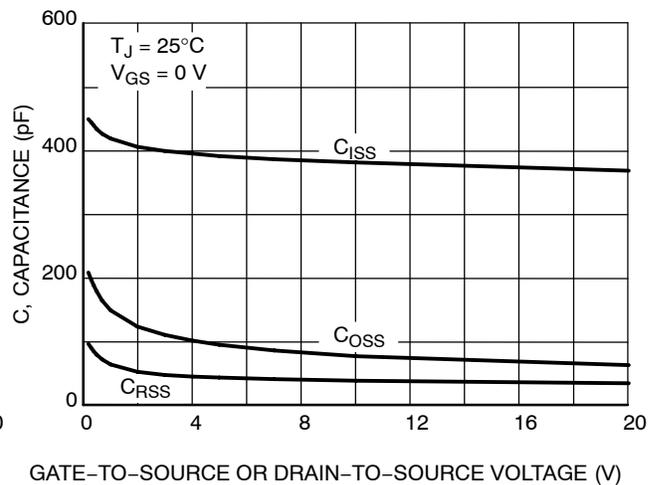


Figure 6. Capacitance Variation

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P-CHANNEL

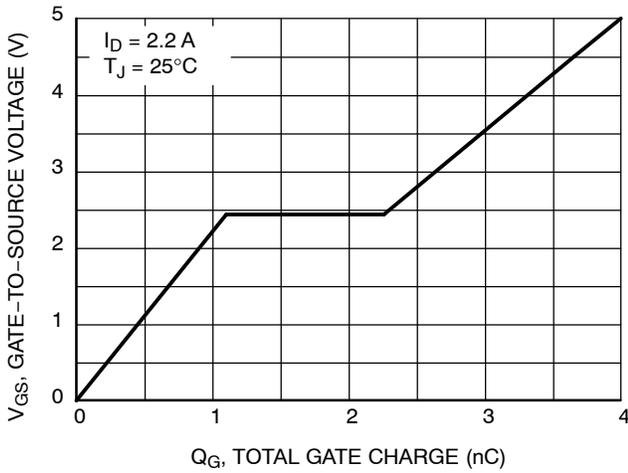


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

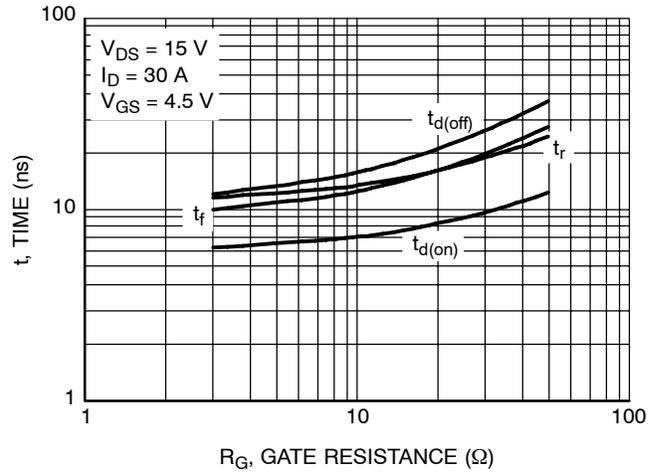


Figure 8. Resistive Switching Time Variation versus Gate Resistance

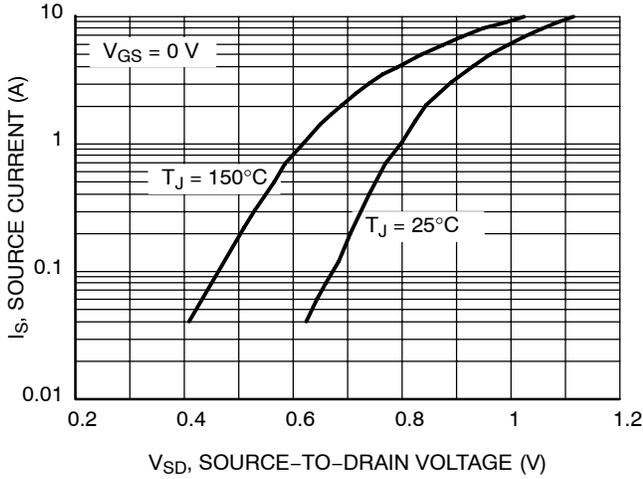


Figure 9. Diode Forward Voltage versus Current

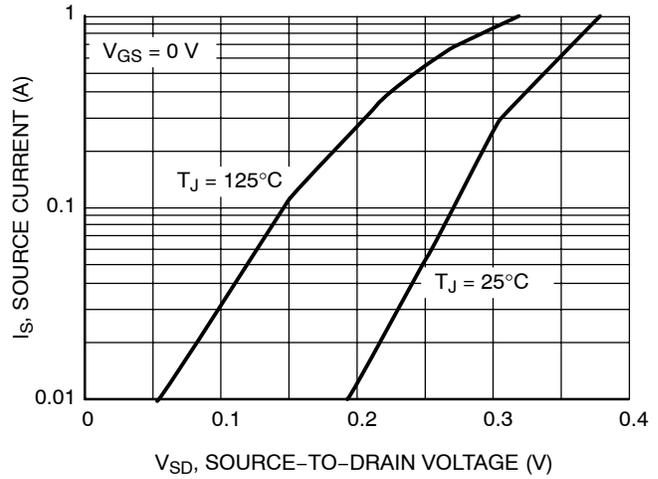


Figure 10. Schottky Diode Forward Voltage versus Current

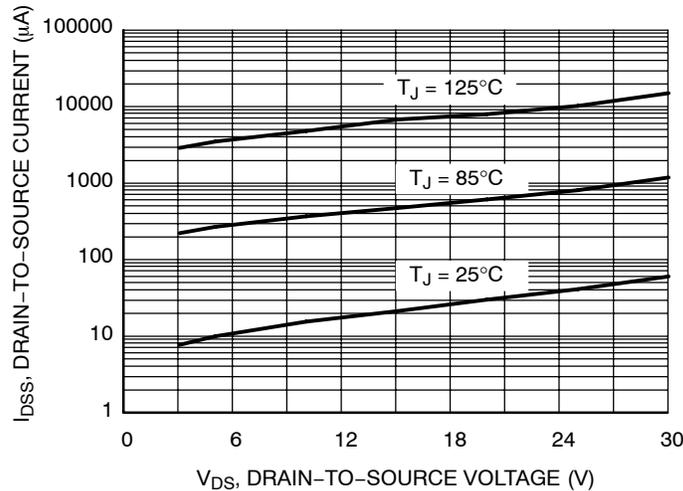


Figure 11. Schottky Diode Reverse Current

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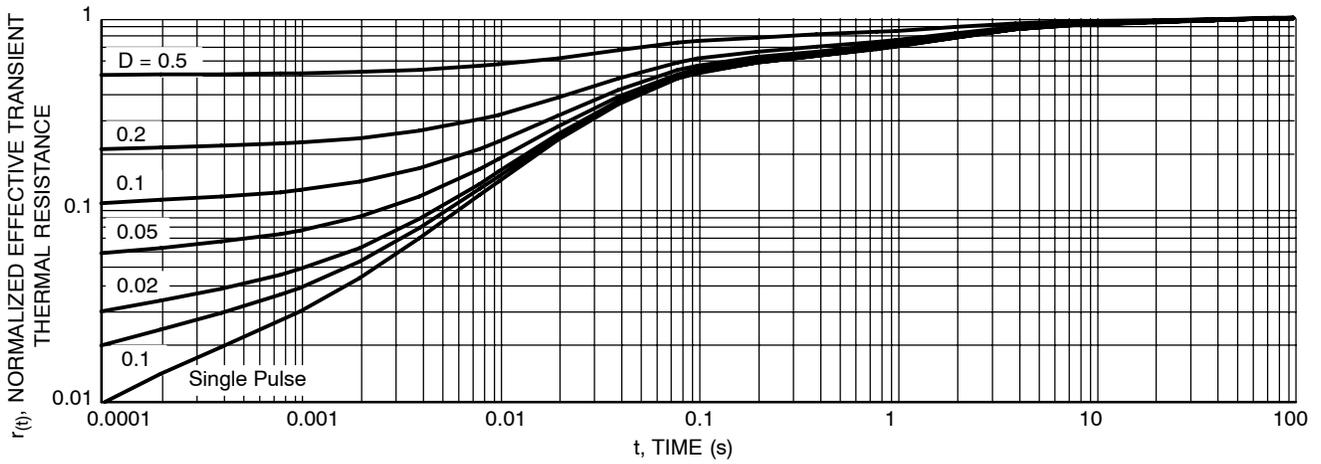


Figure 12. Thermal Response

ORDERING INFORMATION

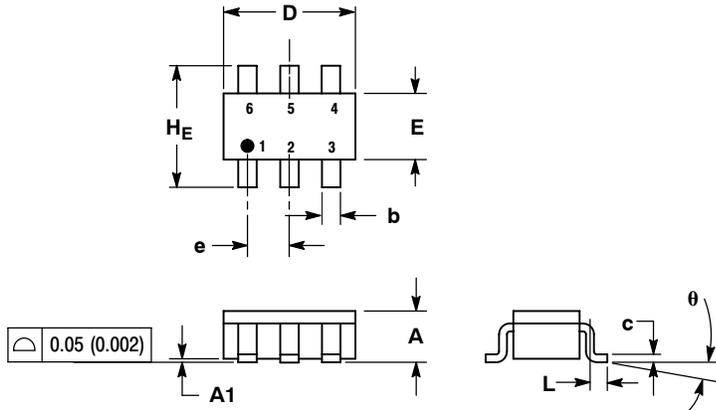
Device	Package	Shipping [†]
NTGF3123PT1G	TSOP6 (Pb-Free)	3000 / Tape & Reel

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

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PACKAGE DIMENSIONS

TSOP-6
CASE 318G-02
ISSUE S

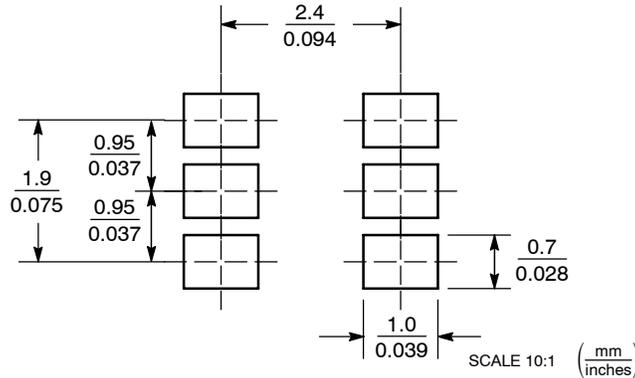


NOTES:

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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