

# NTGD3147F

## Power MOSFET and Schottky Diode

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

### Features

- Fast Switching
- Low Gate Change
- Low  $R_{DS(on)}$
- Low  $V_F$  Schottky Diode
- Independently Connected Devices to Provide Design Flexibility
- This is a Pb-Free Device

### Applications

- DC-DC Converters
- 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	$I_D$	$T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	-2.2 -1.6	A
	$t \leq 5$ s		$T_A = 25^\circ\text{C}$	-2.5	
Power Dissipation (Note 1)	Steady State	$P_D$	$T_A = 25^\circ\text{C}$	1.0	W
	$t \leq 5$ s			1.3	
Pulsed Drain Current		$I_{DM}$	-7.5	A	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-25 to 150	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	-0.8	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

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

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	A

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient - Steady-State (Note 1)	$R_{\theta JA}$	125	$^\circ\text{C}/\text{W}$
Junction-to-Ambient - $t \leq 5$ s (Note 1)	$R_{\theta JA}$	100	$^\circ\text{C}/\text{W}$
Junction-to-Ambient Steady-State (Note 2)	$R_{\theta JA}$	235	$^\circ\text{C}/\text{W}$

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).
2. Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 30 mm<sup>2</sup> [2 oz] including traces).



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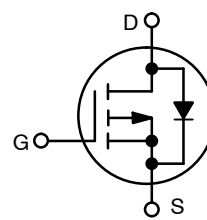
<http://onsemi.com>

### P-CHANNEL MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ Max	$I_D$ Max
-20 V	145 m $\Omega$ @ -4.5 V	-2.2 A
	200 m $\Omega$ @ -2.5 V	-1.6 A

### SCHOTTKY DIODE

$V_R$ Max	$V_F$ Max	$I_F$ Max
20 V	0.45 V	1.0 A



P-Channel MOSFET

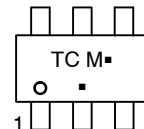


Schottky Diode



TSOP-6  
CASE 318G  
STYLE 15

### MARKING DIAGRAM



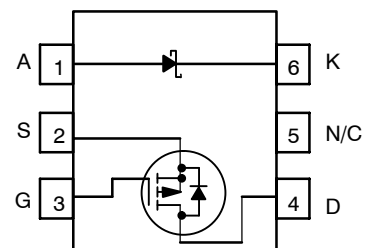
TC = Specific Device Code

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.

# NTGD3147F

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	-20			V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			14.2		mV/°C	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = -16\text{ V}$	$T_J = 25^\circ\text{C}$			-1.0	$\mu\text{A}$
			$T_J = 85^\circ\text{C}$			-10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA	

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.5	-0.95	-1.5	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			3.0		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -2.2\text{ A}$		90	145	mΩ
		$V_{GS} = -2.5\text{ V}, I_D = -1.6\text{ A}$		140	200	
Forward Transconductance	$g_{FS}$	$V_{DS} = -5.0\text{ V}, I_D = -2.2\text{ A}$		4.5		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -10\text{ V}$		400		pF
Output Capacitance	$C_{OSS}$			75		
Reverse Transfer Capacitance	$C_{RSS}$			40		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, I_D = -2.2\text{ A}$		3.8	5.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.5		
Gate-to-Source Charge	$Q_{GS}$			0.9		
Gate-to-Drain Charge	$Q_{GD}$			1.0		

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, I_D = -1.0\text{ A}, R_G = 6.0\ \Omega$		7.5		ns
Rise Time	$t_r$			6.2		
Turn-Off Delay Time	$t_{d(OFF)}$			14.5		
Fall Time	$t_f$			18.4		

### DRAIN-TO-SOURCE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_D = -0.8\text{ A}$	$T_J = 25^\circ\text{C}$		-0.8	1.2	V
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = -0.8\text{ A}$			12		ns
Charge Time	$T_a$				8.0		
Discharge Time	$T_b$				4.0		
Reverse Recovery Time	$Q_{RR}$				4.0		nC

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

4. Switching characteristics are independent of operating junction temperatures.

# NTGD3147F

## 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	$V_F$	$I_F = 0.5 \text{ A}$		0.32	0.4	V
		$I_F = 1.0 \text{ A}$		0.36	0.45	
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 10 \text{ V}$		0.04	1.0	mA
		$V_R = 20 \text{ V}$		0.21	5.0	

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 75^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.5 \text{ A}$		0.27		V
		$I_F = 1.0 \text{ A}$		0.31		
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 10 \text{ V}$		0.77		mA
		$V_R = 20 \text{ V}$		2.65		

## SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 125^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	$V_F$	$I_F = 0.5 \text{ A}$		0.22		V
		$I_F = 1.0 \text{ A}$		0.27		
Maximum Instantaneous Reverse Current	$I_R$	$V_R = 10 \text{ V}$		8.75		mA
		$V_R = 20 \text{ V}$		37.37		

TYPICAL PERFORMANCE CHARACTERISTICS

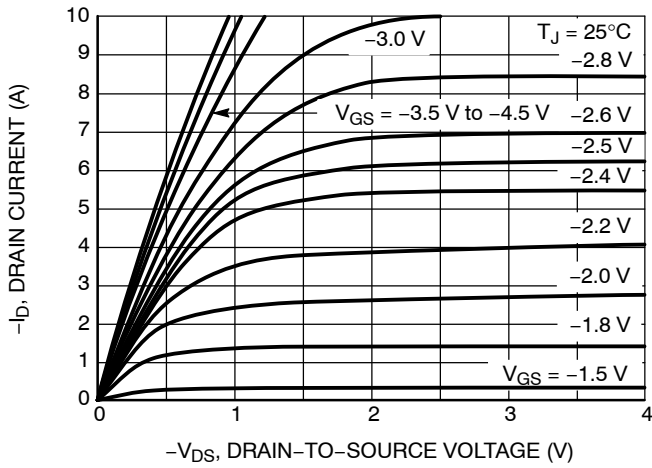


Figure 1. On-Region Characteristics

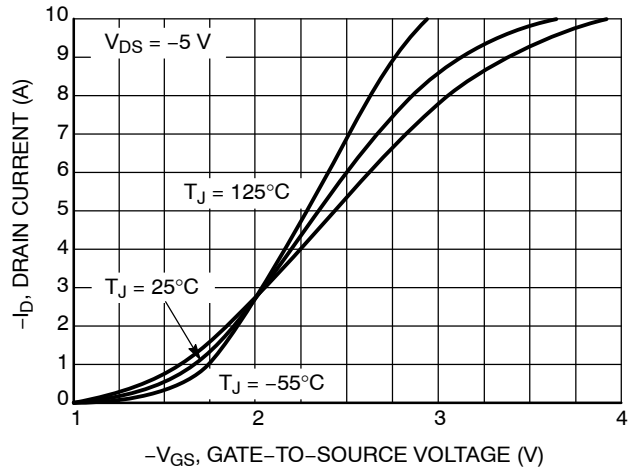


Figure 2. Transfer Characteristics

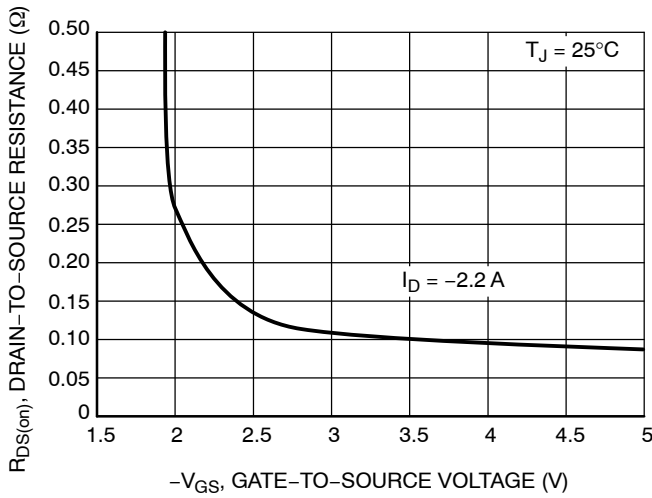


Figure 3. On-Resistance versus Gate-to-Source Voltage

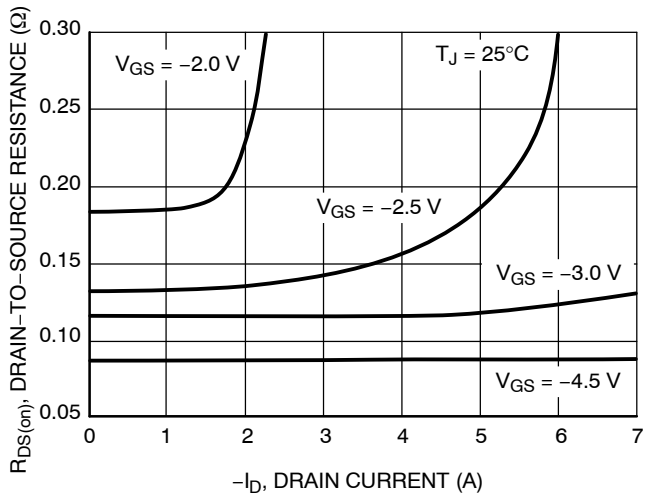


Figure 4. On-Resistance versus Drain Current and Gate Voltage

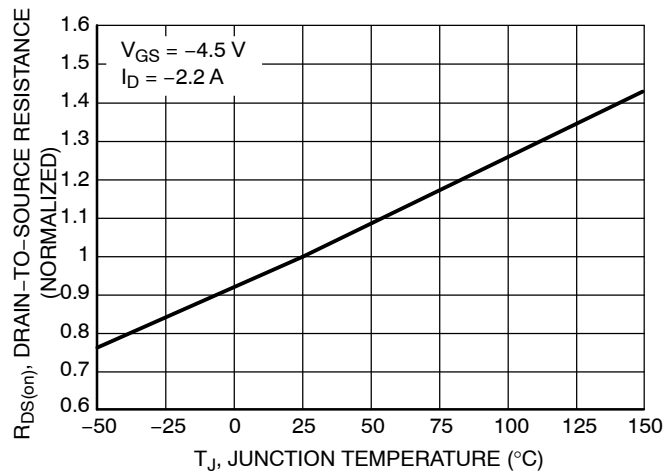


Figure 5. On-Resistance Variation with Temperature

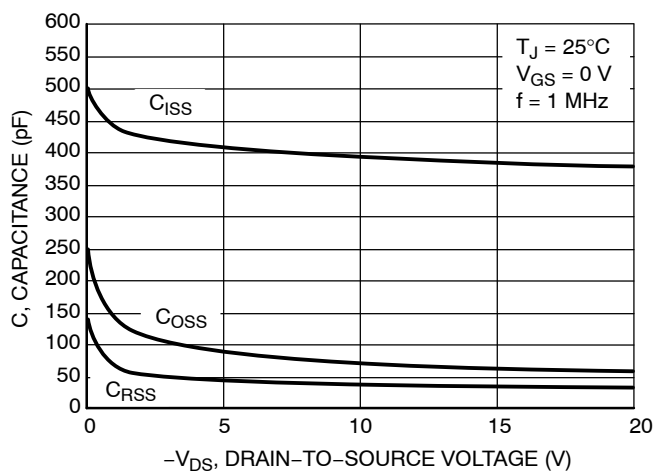


Figure 6. Capacitance Variation

TYPICAL PERFORMANCE CHARACTERISTICS

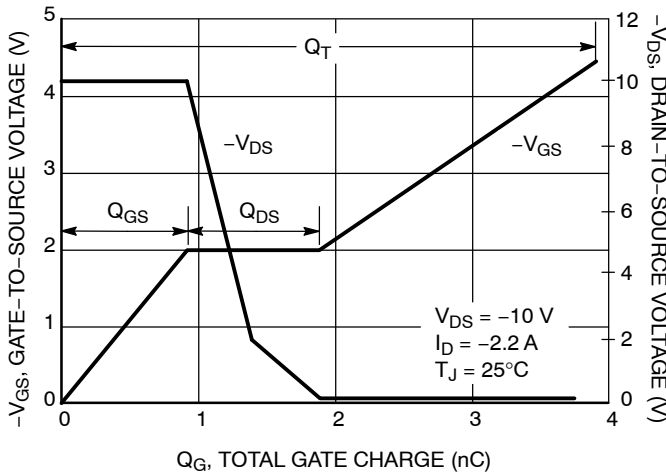


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

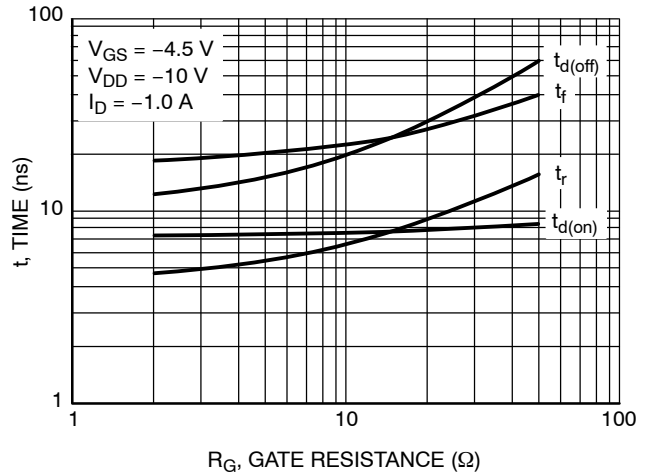


Figure 8. Resistive Switching Time Variation versus Gate Resistance

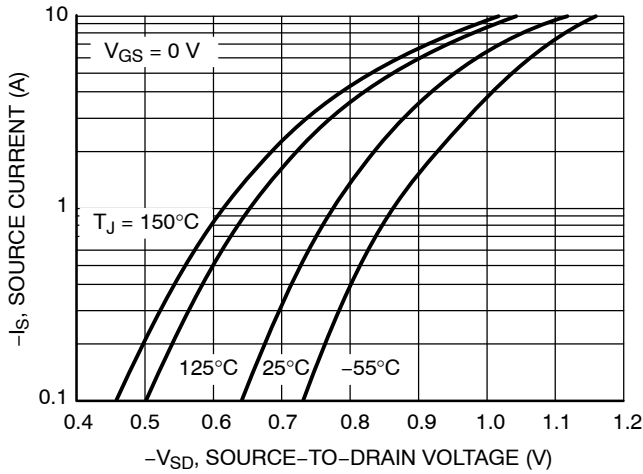


Figure 9. Diode Forward Voltage versus Current

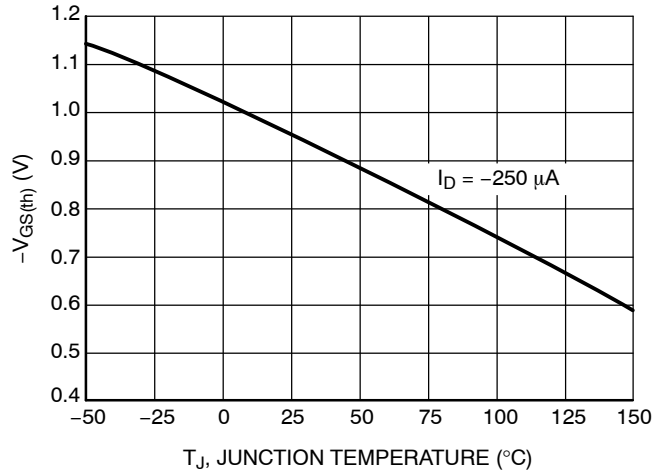


Figure 10. Threshold Voltage

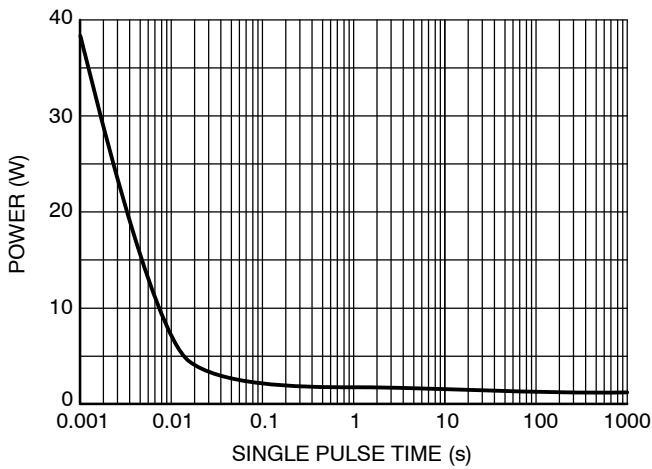


Figure 11. Single Pulse Maximum Power Dissipation

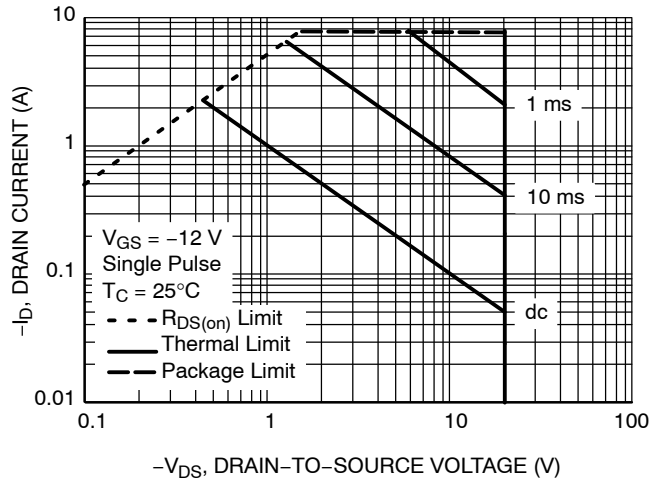


Figure 12. Maximum Rated Forward Biased Safe Operating Area

# NTGD3147F

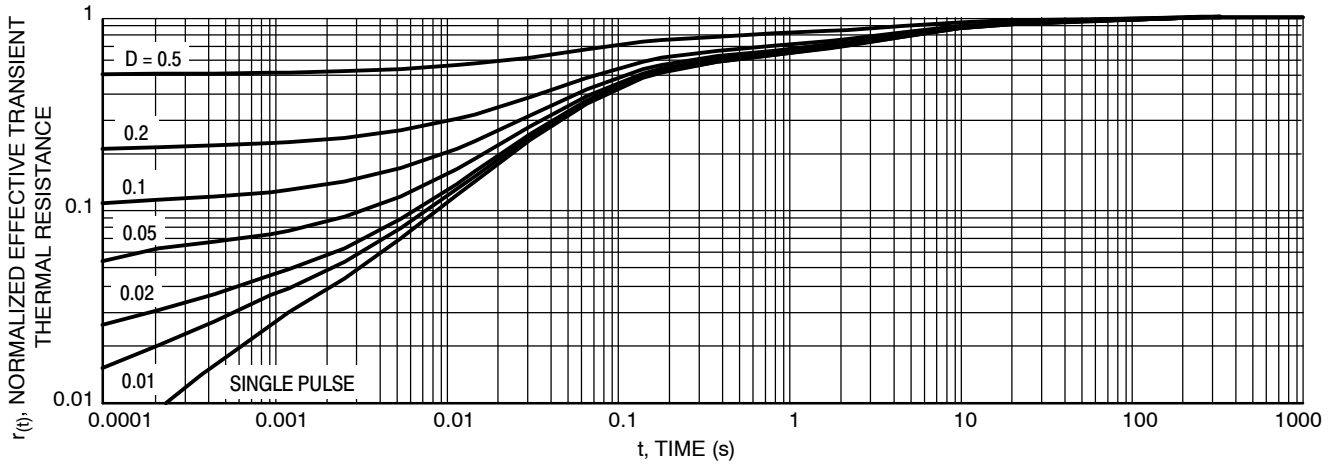


Figure 13. Thermal Response

## TYPICAL SCHOTTKY CHARACTERISTICS

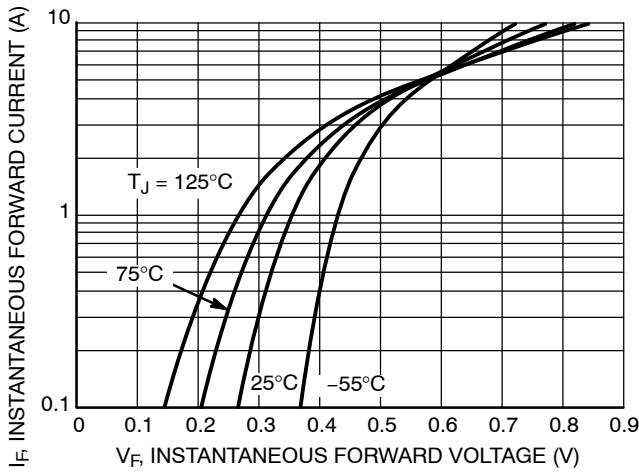


Figure 14. Typical Forward Voltage

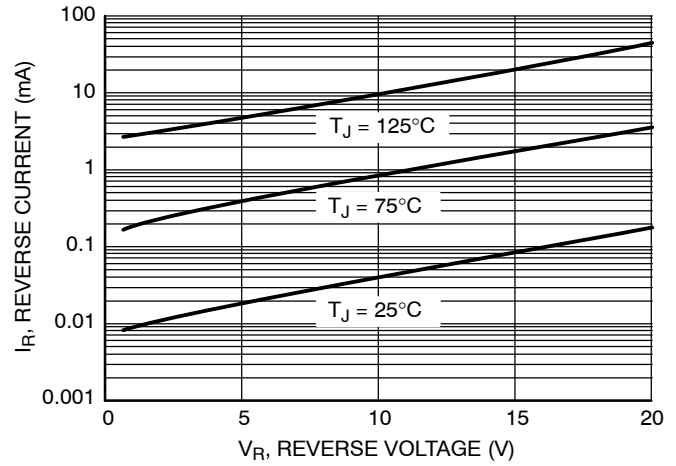


Figure 15. Typical Reverse Current

### ORDERING INFORMATION

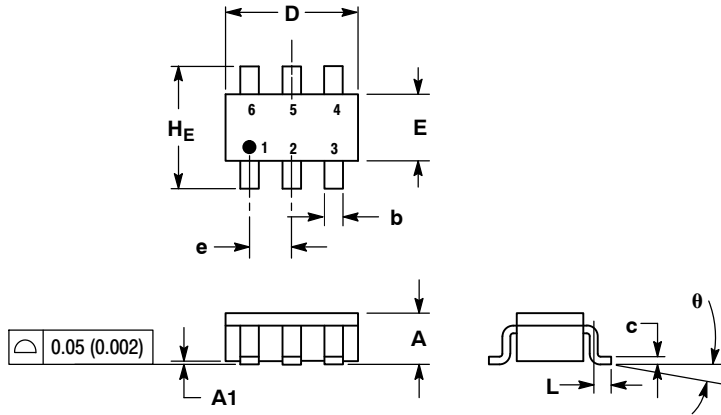
Device	Package	Shipping <sup>†</sup>
NTGD3147FT1G	TSOP-6 (Pb-Free)	3000 / Tape & Reel

<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.

# NTGD3147F

## PACKAGE DIMENSIONS

TSOP-6  
CASE 318G-02  
ISSUE S



### NOTES:

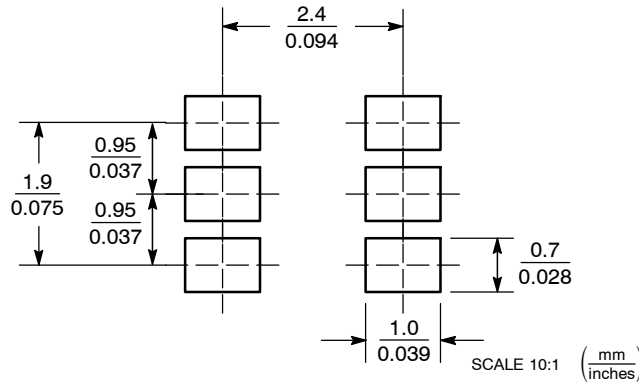
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

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°

### STYLE 15:

- PIN 1: ANODE  
2: SOURCE  
3: GATE  
4: DRAIN  
5: N/C  
6: CATHODE

### 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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