NTLGF3501N

Power MOSFET and Schottky Diode

20 V, 4.6 A FETKY®, N−Channel, 2.0 A Schottky Barrier Diode, DFN6

Features

- Flat Lead 6 Terminal Package 3x3x1 mm
- Reduced Gate Charge to Improve Switching Response
- Enhanced Thermal Characteristics
- This is a Pb−Free Device

Applications

- Buck Converter, Inverting Buck/Boost
- High Side DC−DC Conversion Circuits
- Power Management in Portable, HDD and Computing

MOSFET MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	20	V
Gate−to−Source Voltage			V_{GS}	±12	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	3.4	A
		T_A = 85°C		2.5	
	t ≤ 10 s	T_A = 25°C		4.6	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.74	W
	t ≤ 10 s			3.13	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	2.8	A
		T_A = 85°C		2.0	
Power Dissipation (Note 2)		T_A = 25°C	P_D	1.14	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	13.8	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	1.7	A
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 (Cu area = 0.5 in sq).

ON Semiconductor®

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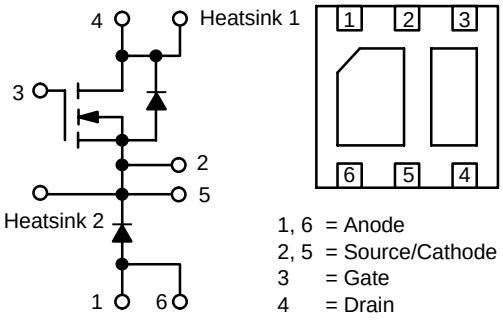
MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D TYP
20 V	70 mΩ @ 4.5 V	4.6 A

SCHOTTKY DIODE

V_R MAX	V_F TYP	I_F MAX
20 V	0.36 V	2.0 A



1, 6 = Anode
2, 5 = Source/Cathode
3 = Gate
4 = Drain

MARKING DIAGRAMS

DFN6
CASE 506AG

3501 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NTLGF3501NT1G	DFN6 (Pb−free)	3000 / Tape & Reel
NTLGF3501NT2G	DFN6 (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.

SCHOTTKY DIODE MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Max	Unit
Peak Repetitive Reverse Voltage	V_{RRM}	20	V
DC Blocking Voltage	V_R	20	V
Average Rectified Forward Current	I_F	2.0	A

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient – Steady State (Note 2)	$R_{\theta JA}$	110	°C/W
Junction−to−Ambient – t ≤ 10 s (Note 2)	$R_{\theta JA}$	56	°C/W
Junction−to−Ambient – Steady State (Note 3)	$R_{\theta JA}$	72	°C/W
Junction−to−Ambient – t ≤ 10 s (Note 3)	$R_{\theta JA}$	40	°C/W

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

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		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	$V_{(BR)DSS}/T_J$				22		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 16 V, V_{GS} = 0 V	T_J = 25°C			1.0	μA
			T_J = 125°C			10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±12 V				100	nA
ON CHARACTERISTICS (Note 4)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		0.6		2.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				−2.8		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = 4.5, I_D = 3.4 A			70	90	mΩ
		V_{GS} = 2.5, I_D = 1.7 A			95	120	
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 3.4 A			6.7		S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 10 V			144	275	pF
Output Capacitance	C_{OSS}				67	125	
Reverse Transfer Capacitance	C_{RSS}				22	40	
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 10 V, I_D = 3.4 A			2.1	10	nC
Threshold Gate Charge	$Q_{G(TH)}$				0.11		
Gate−to−Source Charge	Q_{GS}				0.42		
Gate−to−Drain Charge	Q_{GD}				0.7		
SWITCHING CHARACTERISTICS (Note 5)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DD} = 16 V, I_D = 3.4 A, R_G = 2.5 Ω			4.8	10	ns
Rise Time	t_r				13.6	25	
Turn−Off Delay Time	$t_{d(OFF)}$				9.0	20	
Fall Time	t_f				1.9	5.0	

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperatures.

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 1.7 A	T_J = 25°C		0.8	1.15	V
			T_J = 150°C		0.63		V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, I_S = 1.0 A , dI_S/dt = 100 A/μs			12		ns
Charge Time	t_a				8.0		
Discharge Time	t_b				4.0		
Reverse Recovery Charge	Q_{RR}				5.0		nC

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V_F	I_F = 0.1 A		0.32	0.34	V
		I_F = 1.0 A		0.36	0.39	
Maximum Instantaneous Reverse Current	I_R	V_R = 5.0 V			100	μA
		V_R = 5 V, T_J = 100°C			12	mA
		V_R = 10 V		70		μA
		V_R = 20 V		255		

6. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

TYPICAL N−CHANNEL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

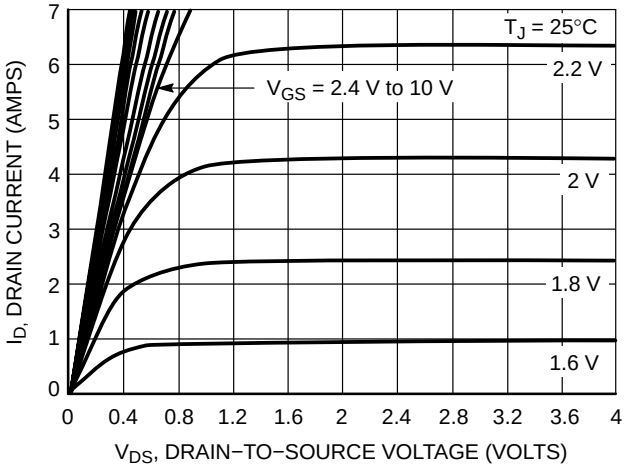


Figure 1. On−Region Characteristics

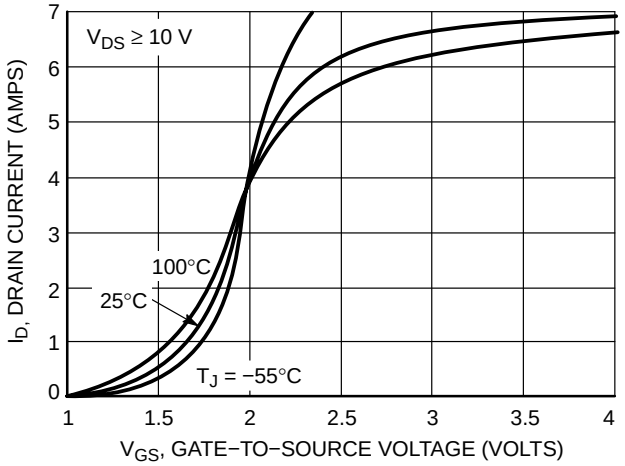


Figure 2. Transfer Characteristics

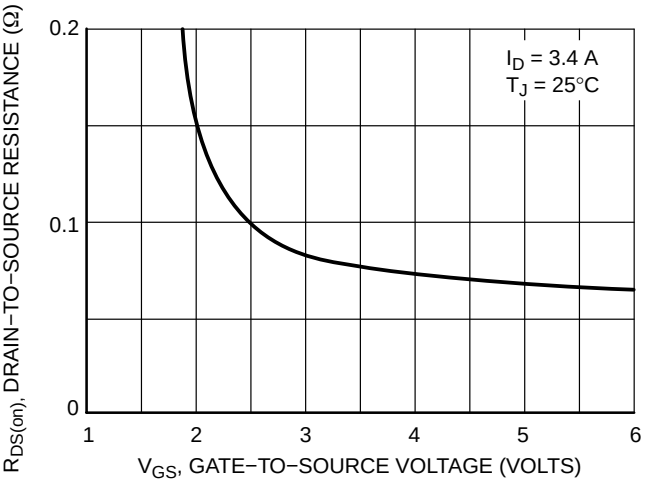


Figure 3. On−Resistance vs. Gate−to−Source Voltage

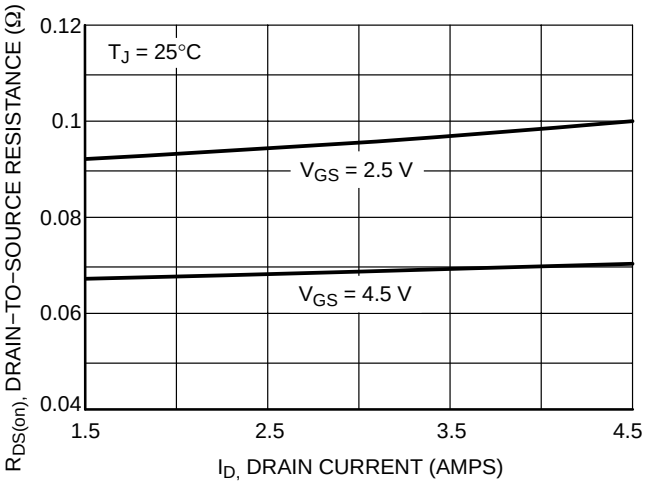


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

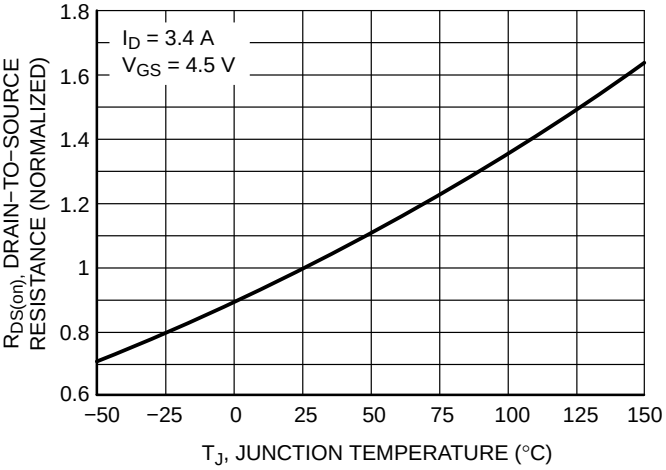


Figure 5. On−Resistance Variation with Temperature

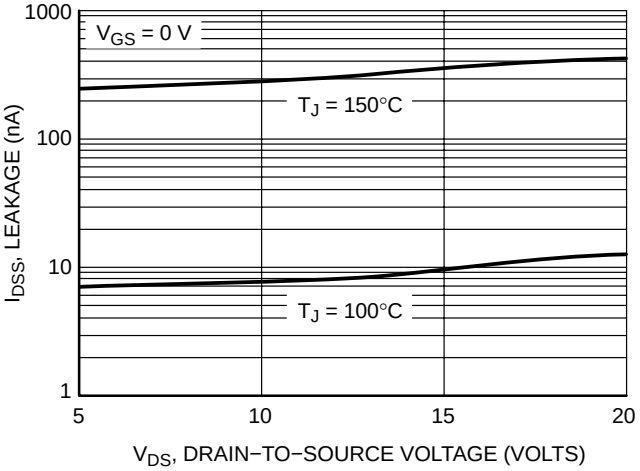


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL N−CHANNEL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

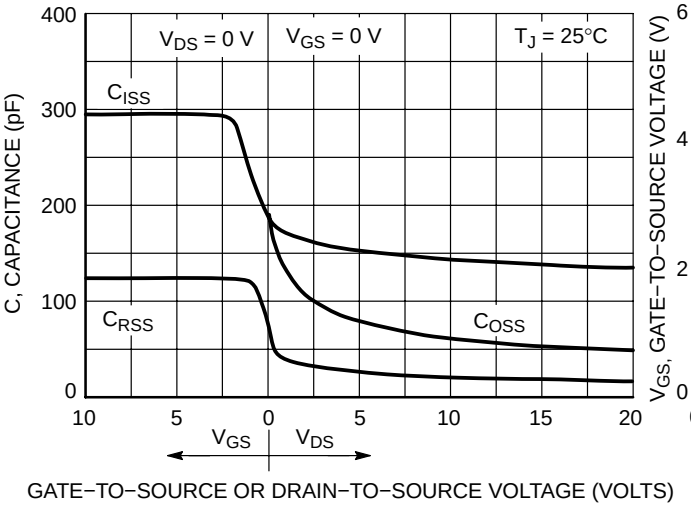


Figure 7. Capacitance Variation

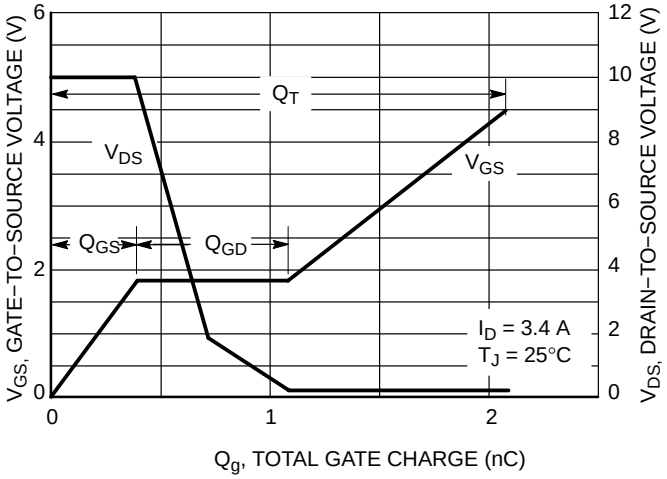


Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

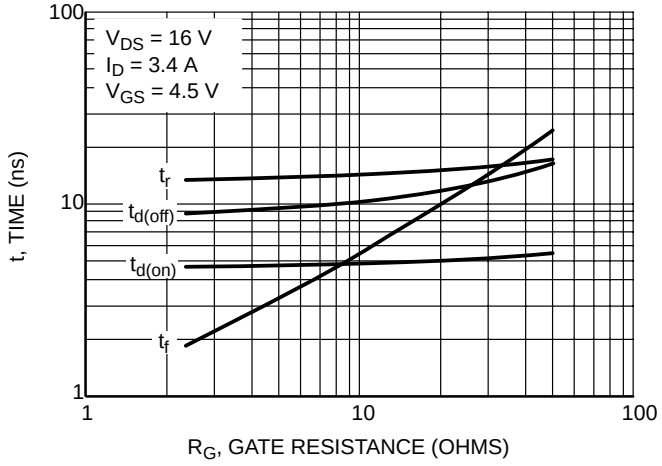


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

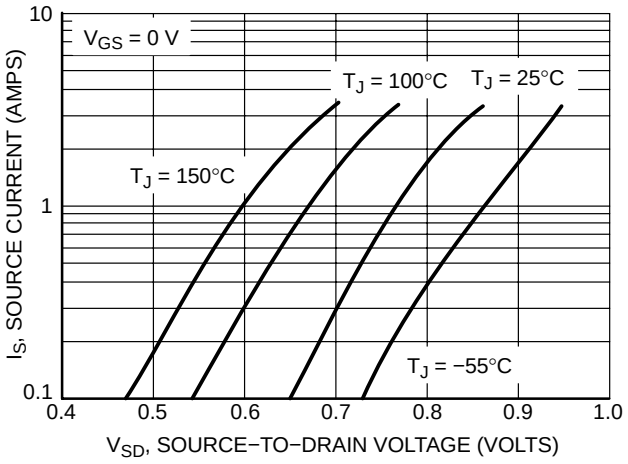


Figure 10. Diode Forward Voltage vs. Current

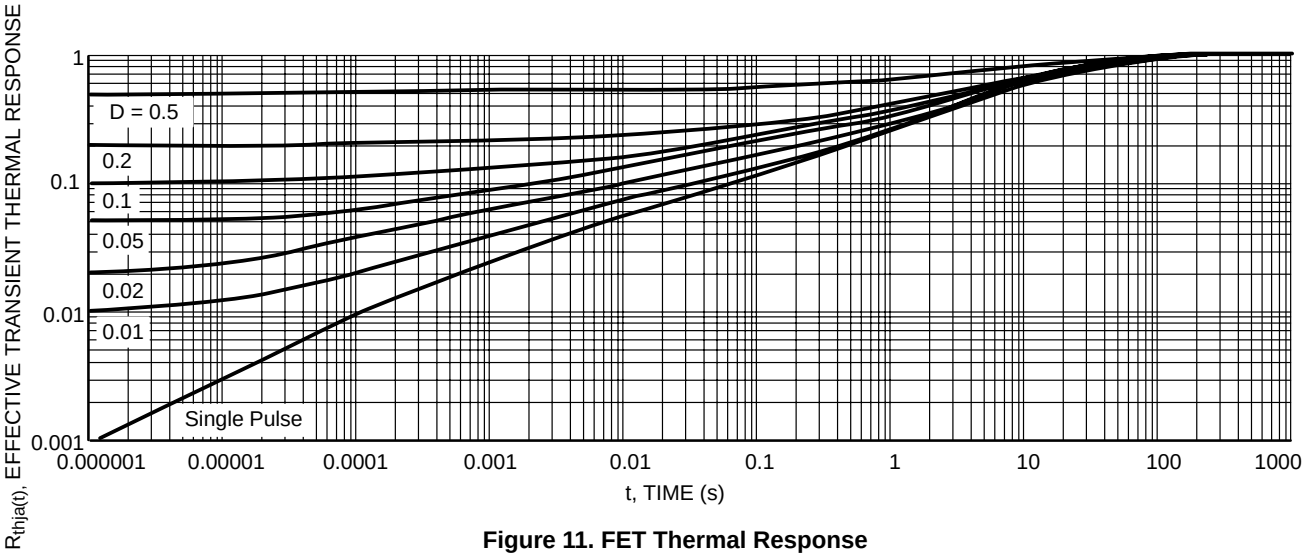


Figure 11. FET Thermal Response

TYPICAL SCHOTTKY PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

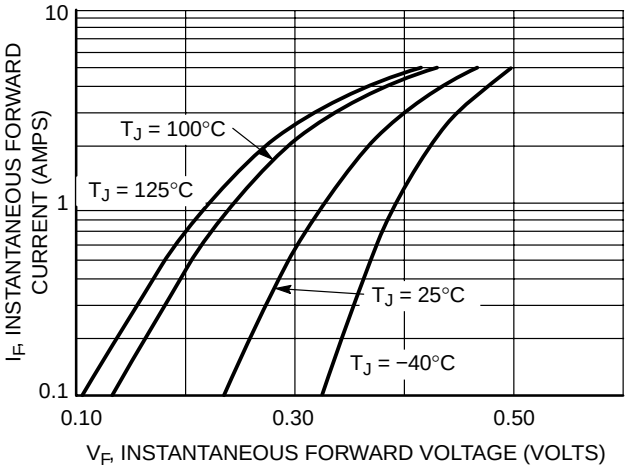


Figure 12. Typical Forward Voltage

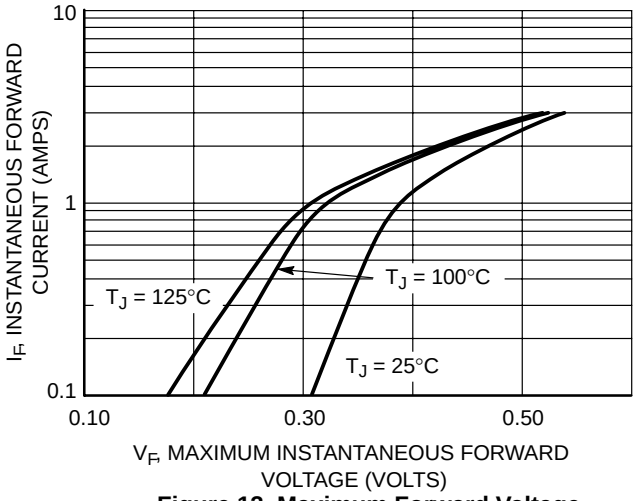


Figure 13. Maximum Forward Voltage

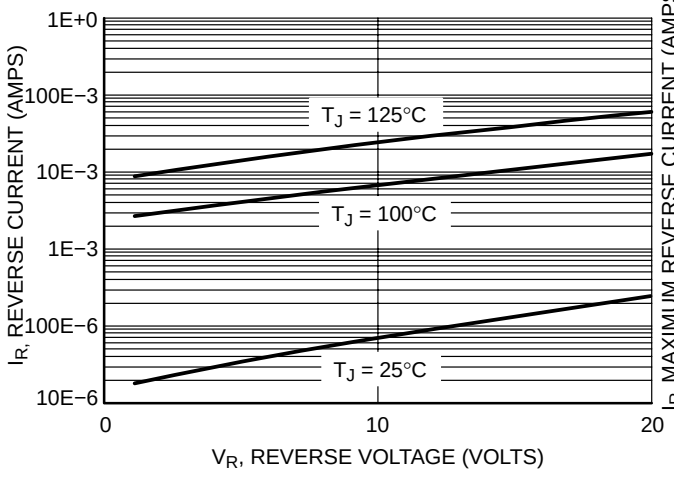


Figure 14. Typical Reverse Current

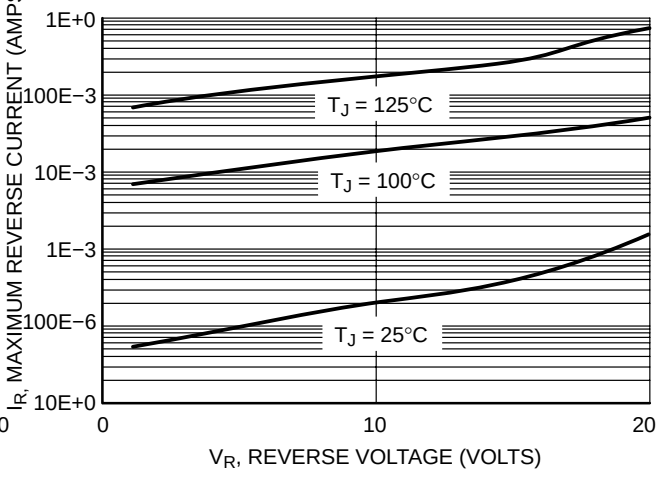


Figure 15. Maximum Reverse Current

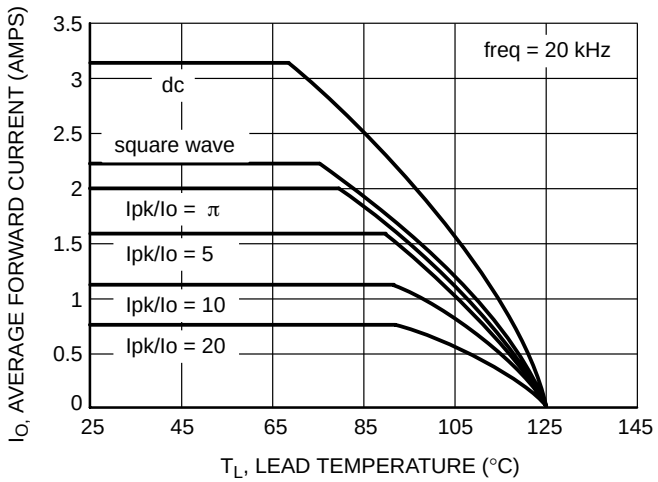


Figure 16. Current Derating

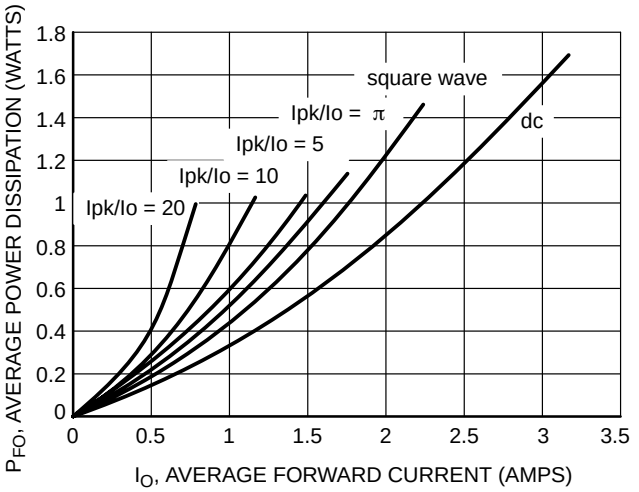


Figure 17. Forward Power Dissipation

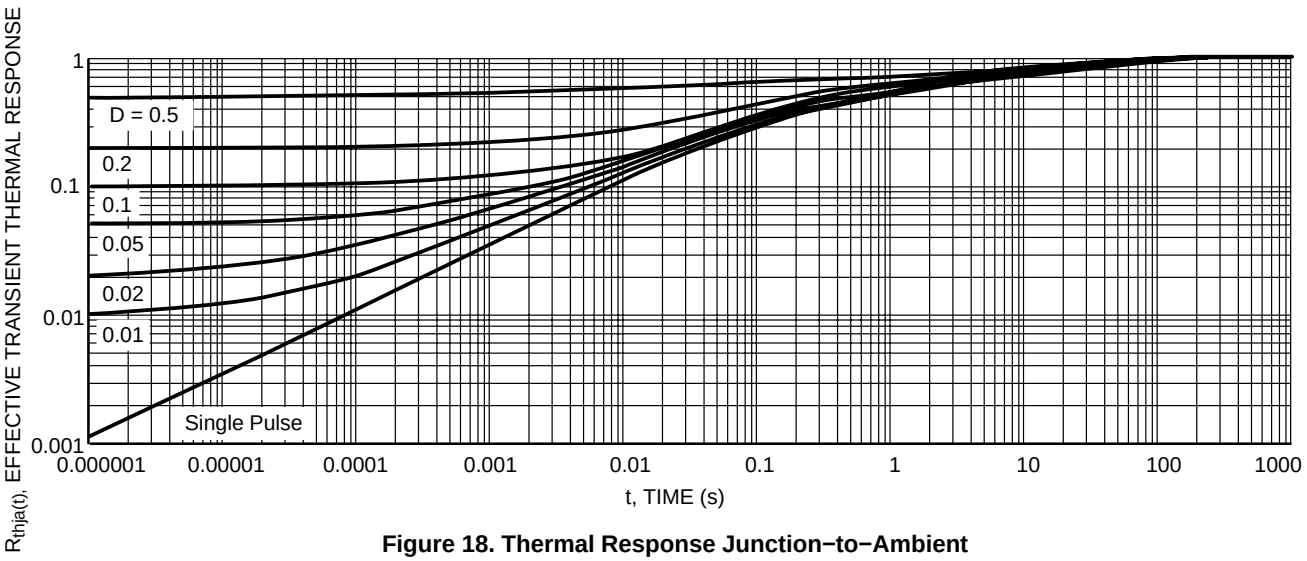
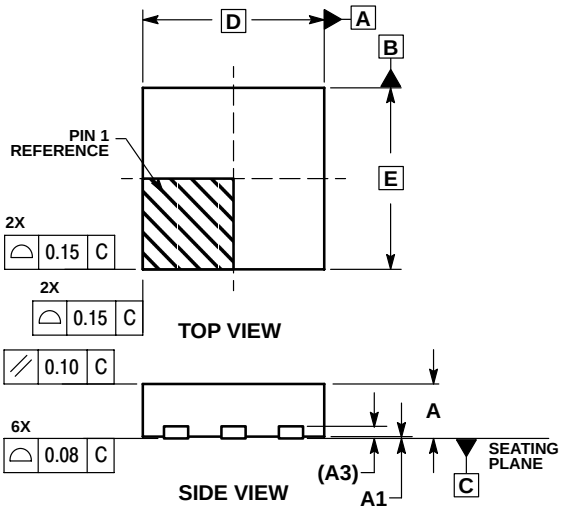


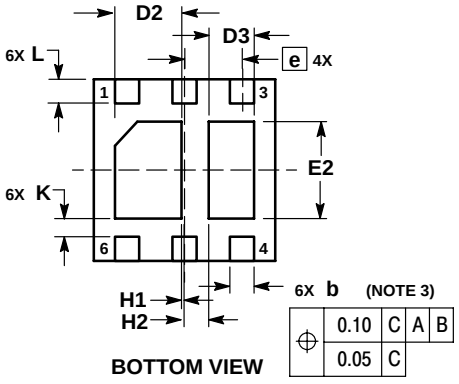
Figure 18. Thermal Response Junction−to−Ambient

NTLGF3501N

PACKAGE DIMENSIONS

DFN6 3*3 MM, 0.95 PITCH
CASE 506AG−01
ISSUE O

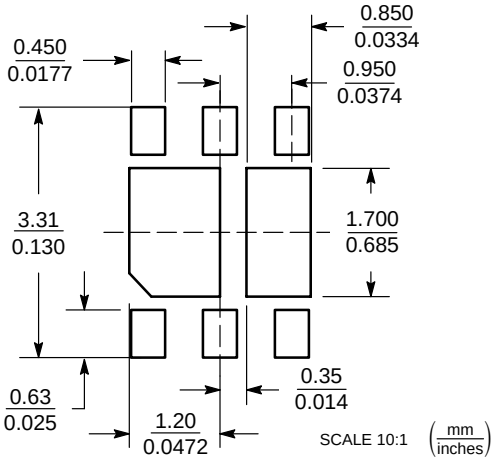




NOTES:
1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMESNION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0.00	0.03	0.05
A3		0.20 REF	
b	0.35	0.40	0.45
D		3.00 BSC	
D2	1.00	1.10	1.20
D3	0.65	0.75	0.85
E		3.00 BSC	
E2	1.50	1.60	1.70
e		0.95 BSC	
K	0.21	−−−	−−−
L	0.30	0.40	0.50
H1		0.05 REF	
H2		0.40 REF	

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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PUBLICATION ORDERING INFORMATION

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