MOSFET – Power, P-Channel, Schottky Diode, µCool 2x2 mm

-20 V, -4.1 A, 2.0 A

NTLJF3117P

ON Semiconductor®

Features

- FETKY™ Configuration with MOSFET plus Low Vf Schottky Diode
- µCOOL™ Package Provides Exposed Drain Pad for Excellent Thermal Conduction
- 2x2 mm Footprint Same as SC−88 Package Design
- Independent Pinout Provides Circuit Design Flexibility
- Low Profile (< 0.8 mm) for Easy Fit in Thin Environment
- High Current Schottky Diode: 2 A Current Rating
- This is a Pb−Free Device

Applications

- Optimized for Portable Applications like Cell Phones, Digital Cameras, Media Players, etc.
- DC−DC Buck Circuit
- Li−Ion Battery Applications
- Color Display and Camera Flash Regulators

MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX (Note 1)
−20 V	100 mΩ @ −4.5 V	−4.1 A
	135 mΩ @ −2.5 V	
	200 mΩ @ −1.8 V	

SCHOTTKY DIODE

V_R MAX	V_F TYP	I_F MAX
30 V	0.47 V	2.0 A
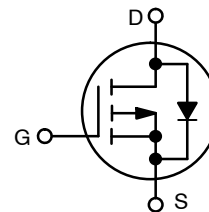
P−CHANNEL MOSFET   **SCHOTTKY DIODE**

MARKING DIAGRAM

WDFN6
CASE 506AN

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1 ●      6
2  JHM■  5
3      ● 4
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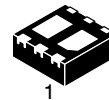
JH = Specific Device Code
M = Date Code
■ = Pb−Free Package
(Note: Microdot may be in either location)

PIN CONNECTIONS

```
A  1          K       6  K
N/C 2                 5  G
D  3          D       4  S
```

(Top View)

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}	±8.0	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−3.3	A
		T_A = 85°C		−2.4	
	t ≤ 5 s	T_A = 25°C		−4.1	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.5	W
	t ≤ 5 s			2.3	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	−2.3	A
		T_A = 85°C		−1.6	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.71	W
Pulsed Drain Current	t_p = 10 µs		I_{DM}	−20	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode) (Note 2)			I_S	−1.9	A
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
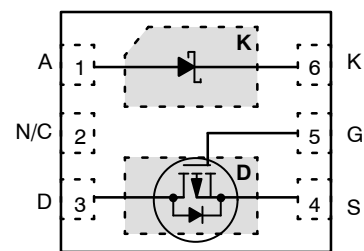
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm^2, 2 oz Cu.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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

Parameter	Symbol	Value	Unit
Peak Repetitive Reverse Voltage	V_{RRM}	30	V
DC Blocking Voltage	V_R	30	V
Average Rectified Forward Current	I_F	2.0	A

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 3)	$R_{\theta JA}$	83	
Junction−to−Ambient − t ≤ 5 s (Note 3)	$R_{\theta JA}$	54	°C/W
Junction−to−Ambient − Steady State Min Pad (Note 4)	$R_{\theta JA}$	177	

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 of 30 mm^2, 2 oz Cu.

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	$V_{(BR)DSS}/T_J$	I_D = −250 μA, Ref to 25°C			9.95		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 = 85°C			−10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±8.0 V				±100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = −250 μA		−0.4	−0.7	−1.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				2.44		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = −4.5, I_D = −2.0 A			75	100	mΩ
		V_{GS} = −2.5, I_D = −2.0 A			101	135	
		V_{GS} = −1.8, I_D = −1.6 A			150	200	
Forward Transconductance	g_{FS}	V_{DS} = −5.0 V, I_D = −2.0 A			3.1		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = −10 V			531		pF
Output Capacitance	C_{OSS}				91		
Reverse Transfer Capacitance	C_{RSS}				56		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −2.0 A			5.5	6.2	nC
Threshold Gate Charge	$Q_{G(TH)}$				0.7		
Gate−to−Source Charge	Q_{GS}				1.0		
Gate−to−Drain Charge	Q_{GD}				1.4		
Gate Resistance	R_G				8.8		Ω
SWITCHING CHARACTERISTICS (Note 6)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −4.5 V, V_{DD} = −5.0 V, I_D = −1.0 A, R_G = 6.0 Ω			5.2		ns
Rise Time	t_r				13.2		
Turn−Off Delay Time	$t_{d(OFF)}$				13.7		
Fall Time	t_f				19.1		

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. 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
SWITCHING CHARACTERISTICS (Note 6)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −4.5 V, V_{DD} = −10 V, I_D = −2.0 A, R_G = 2.0 Ω			5.5		ns
Rise Time	t_r				15		
Turn−Off Delay Time	$t_{d(OFF)}$				19.8		
Fall Time	t_f				21.6		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Recovery Voltage	V_{SD}	V_{GS} = 0 V, IS = −1.0 A	T_J = 25°C		−0.75	−1.0	V
			T_J = 125°C		−0.64		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, d_{ISD}/d_t = 100 A/μs, I_S = −1.0 A			16.2		ns
Charge Time	t_a				10.6		
Discharge Time	t_b				5.6		
Reverse Recovery Time	Q_{RR}				5.7		nC

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

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		0.34	0.39	V
		I_F = 1.0 A		0.47	0.53	
Maximum Instantaneous Reverse Current	I_R	V_R = 30 V		17	20	μA
		V_R = 20 V		3.0	8.0	
		V_R = 10 V		2.0	4.5	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 85°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V_F	I_F = 0.1 A		0.22	0.35	V
		I_F = 1.0 A		0.40	0.50	
Maximum Instantaneous Reverse Current	I_R	V_R = 30 V		0.22	2.5	mA
		V_R = 20 V		0.11	1.6	
		V_R = 10 V		0.06	1.2	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS (T_J = 125°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V_F	I_F = 0.1 A		0.2	0.29	V
		I_F = 1.0 A		0.4	0.47	
Maximum Instantaneous Reverse Current	I_R	V_R = 30 V		2.0	20	mA
		V_R = 20 V		1.1	10.9	
		V_R = 10 V		0.63	8.4	

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Capacitance	C	V_R = 5.0 V, f = 1.0 MHz		38		pF

7. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).
8. Surface−mounted on FR4 board using the minimum recommended pad size of 30 mm^2, 2 oz cu.
9. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤2%.
10. Switching characteristics are independent of operating junction temperatures.

NTLJF3117P

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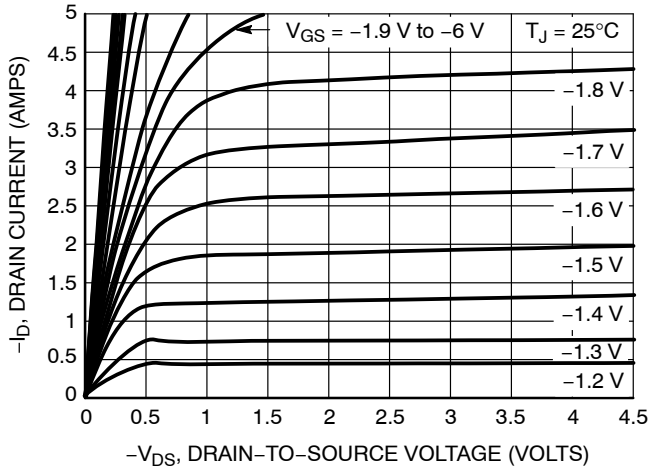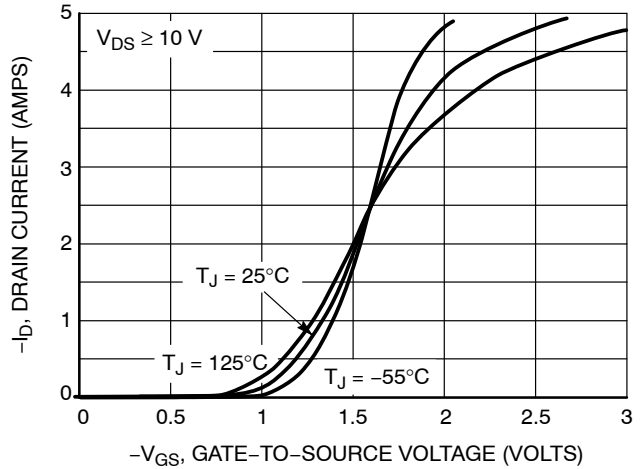

Figure 1. On−Region Characteristics

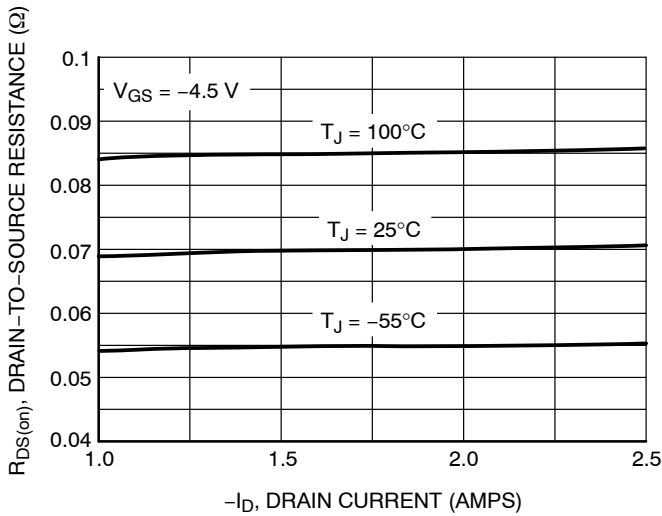Figure 2. Transfer Characteristics

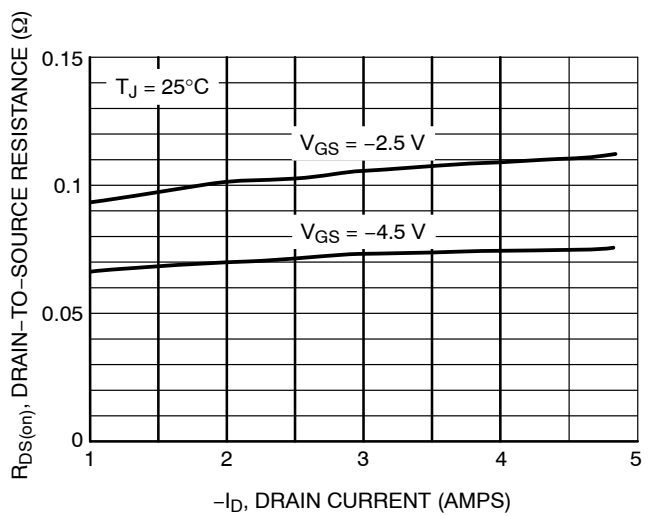Figure 3. On−Resistance versus Drain Current

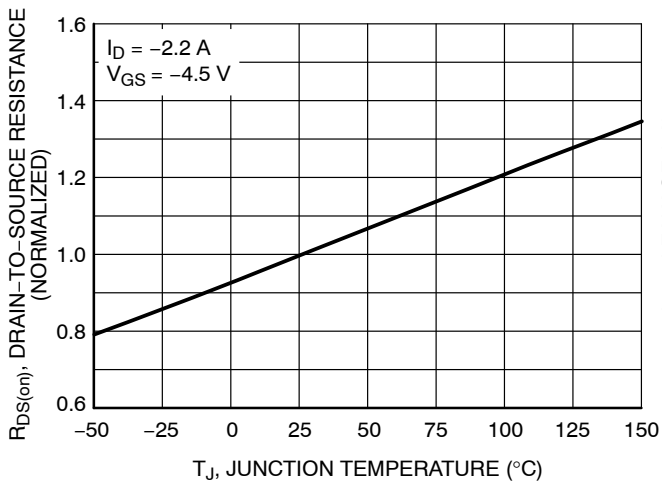Figure 4. On−Resistance versus Drain Current and Gate Voltage

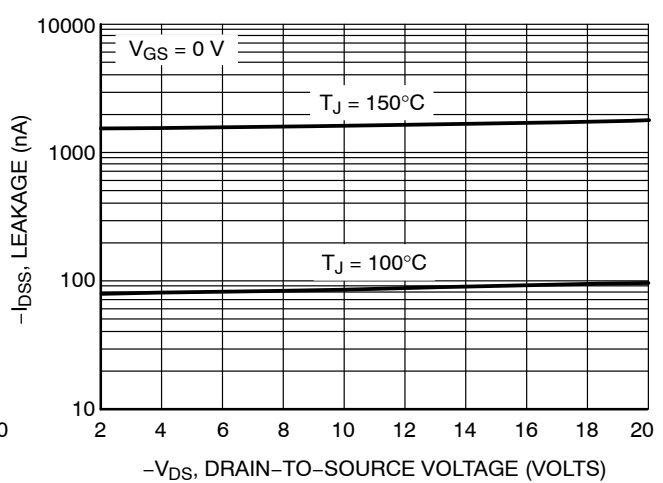Figure 5. On−Resistance Variation with Temperature

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

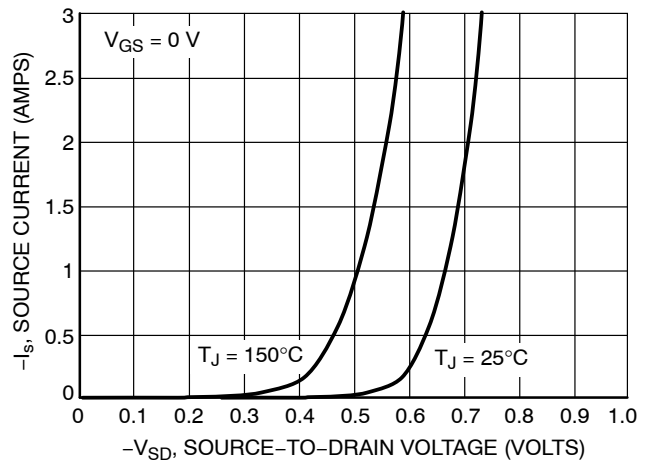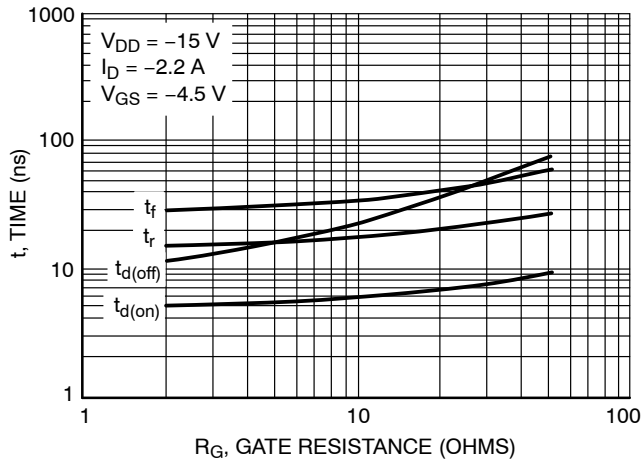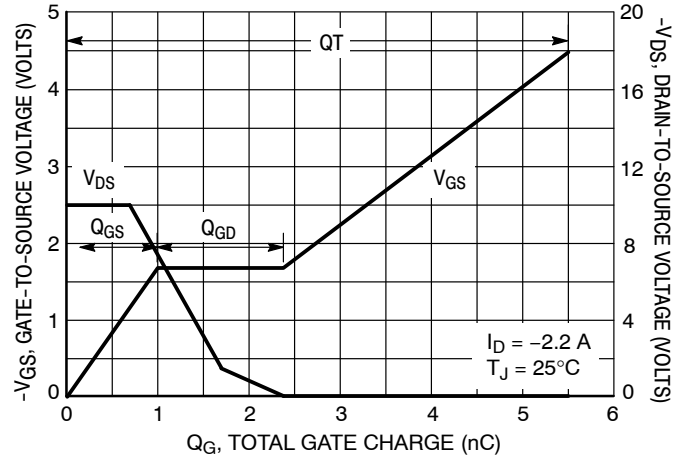## TYPICAL PERFORMANCE CURVES (T$_J$ = 25°C unless otherwise noted)

Figure 7. Capacitance Variation

Figure 8. Gate–To–Source and Drain–To–Source Voltage versus Total Charge

Figure 9. Resistive Switching Time Variation versus Gate Resistance

Figure 10. Diode Forward Voltage versus Current

Figure 11. Maximum Rated Forward Biased Safe Operating Area

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

Figure 12. Thermal Response

Axis labels and annotations on the figure:

r(t), EFFECTIVE TRANSIENT THERMAL RESISTANCE (vertical axis)

t, TIME (s) (horizontal axis)

D = 0.5
0.2
0.1
0.05
0.02
0.01
SINGLE PULSE

*See Note 2 on Page 1

$P_{(pk)}$

$R_{\theta JA}(t) = r(t)\, R_{\theta JA}$
D CURVES APPLY FOR POWER
PULSE TRAIN SHOWN
READ TIME AT t_1
$T_{J(pk)} - T_A = P_{(pk)}\, R_{\theta JA}(t)$

t_1
t_2

DUTY CYCLE, D = t_1/t_2

TYPICAL SCHOTTKY PERFORMANCE CURVES (T$_J$ = 25°C unless otherwise noted)
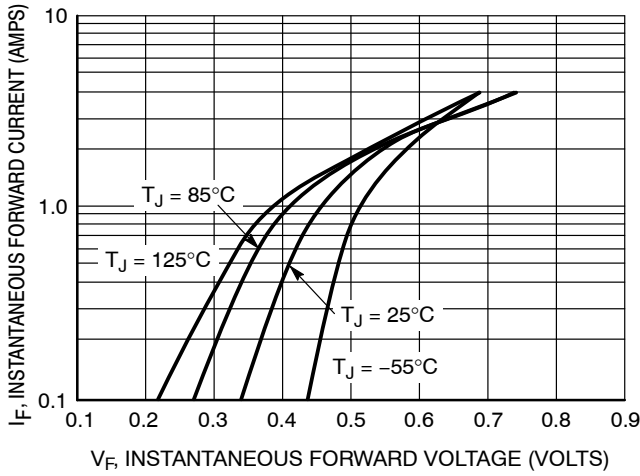
Figure 13. Typical Forward Voltage
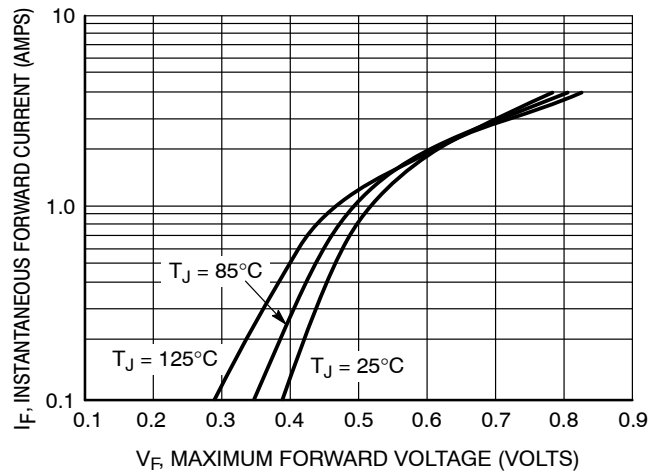
Figure 14. Maximum Forward Voltage
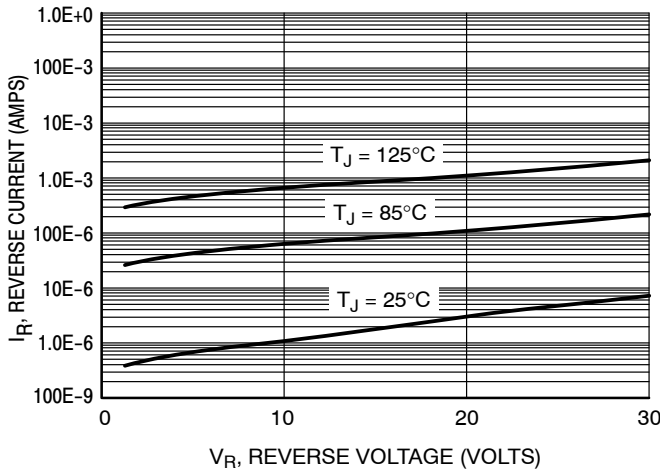
Figure 15. Typical Reverse Current
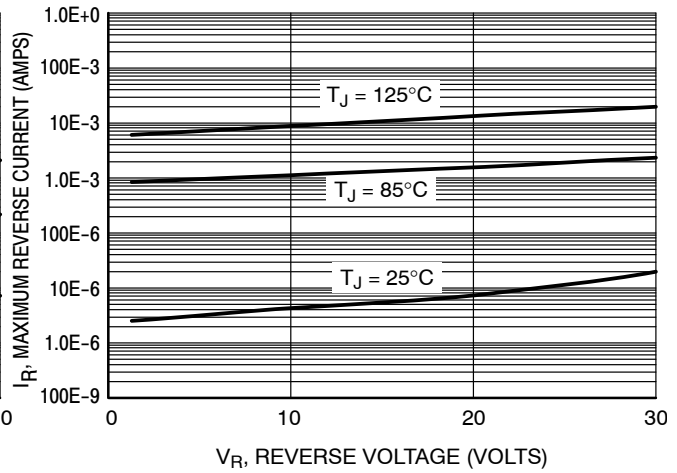
Figure 16. Maximum Reverse Current

ORDERING INFORMATION

Device	Package	Shipping[†]
NTLJF3117PT1G	WDFN6 (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.
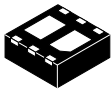
WDFN6 2x2, 0.65P
CASE 506AN
ISSUE H

DATE 25 JAN 2022
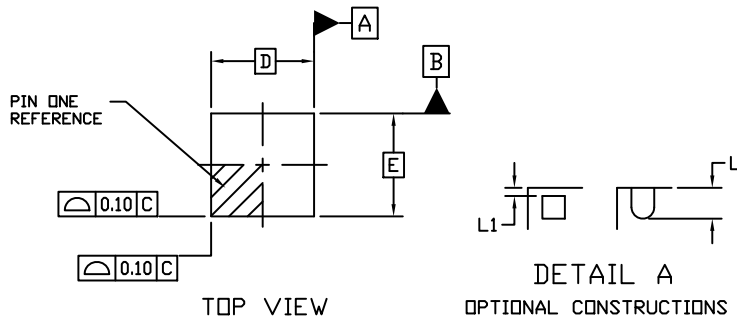
NOTES:

1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 1994.

2. CONTROLLING DIMENSION: MILLIMETERS

3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.

4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.

PIN ONE REFERENCE

TOP VIEW

DETAIL A
OPTIONAL CONSTRUCTIONS

SIDE VIEW

NOTE 4

SEATING PLANE

DETAIL B
OPTIONAL CONSTRUCTIONS

EXPOSED COPPER
MOLD COMPOUND
PLATING

DETAIL A

BOTTOM VIEW

NOTE 3
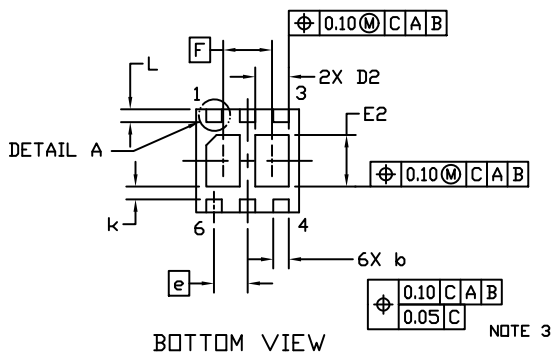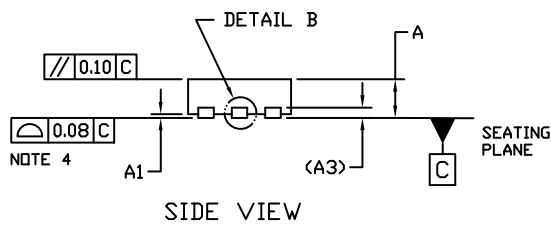
DIM	MILLIMETERS	
	MIN.	MAX.
A	0.70	0.80
A1	0.00	0.05
A3	0.20 REF	
b	0.25	0.35
D	2.00 BSC	
D2	0.57	0.77
E	2.00 BSC	
E2	0.90	1.10
e	0.65 BSC	
F	0.95 BSC	
k	0.25 REF	
L	0.20	0.30
L1	---	0.10

GENERIC MARKING DIAGRAM*

1
XX M

XX = Specific Device Code
M = Date Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb–Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

RECOMMENDED MOUNTING FOOTPRINT
SOLDERMASK DEFINED

1.80
2X 0.82
6X 0.45
1.10
2.30
PACKAGE OUTLINE
1
6X 0.39
0.65 PITCH
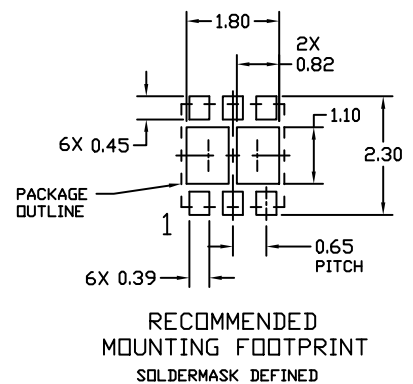
DOCUMENT NUMBER:	98AON20861D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	WDFN6 2x2, 0.65P		PAGE 1 OF 1

ADDITIONAL INFORMATION

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