

MOSFET – Power, P-Channel, Schottky Diode, μCool 2x2 mm -20 V, -4.1 A, 2.0 A



ON Semiconductor®

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NTLJF3117P

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

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	I _D	T _A = 25°C	-3.3	A
			T _A = 85°C	-2.4	
	t ≤ 5 s	T _A = 25°C	-4.1		
Power Dissipation (Note 1)	Steady State	P _D	T _A = 25°C	1.5	W
			t ≤ 5 s	2.3	
Continuous Drain Current (Note 2)	Steady State	I _D	T _A = 25°C	-2.3	A
			T _A = 85°C	-1.6	
			T _A = 25°C	0.71	
Power Dissipation (Note 2)		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.

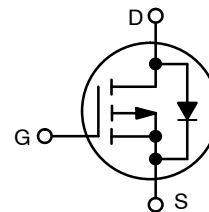
1. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size of 30 mm², 2 oz Cu.

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

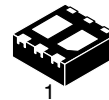


P-CHANNEL MOSFET

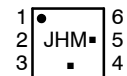


SCHOTTKY DIODE

MARKING DIAGRAM

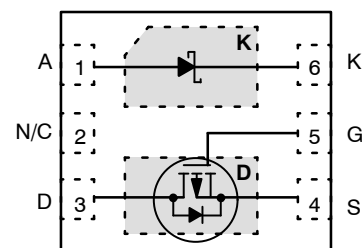


WDFN6
CASE 506AN



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

PIN CONNECTIONS



(Top View)

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 ($T_J = 25^\circ\text{C}$ 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	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – $t \leq 5$ s (Note 3)	$R_{\theta JA}$	54	
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 mm², 2 oz Cu.

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, $I_D = -250$ 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		$\text{mV}/^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -16$ V, $V_{GS} = 0$ V	$T_J = 25^\circ\text{C}$		-1.0	μA
			$T_J = 85^\circ\text{C}$		-10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ 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		$\text{mV}/^\circ\text{C}$
Drain-to-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -2.0$ A		75	100	$\text{m}\Omega$
		$V_{GS} = -2.5$ V, $I_D = -2.0$ A		101	135	
		$V_{GS} = -1.8$ V, $I_D = -1.6$ 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		

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 $\leq 2\%$.
 6. Switching characteristics are independent of operating junction temperatures.

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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	$t_{d(ON)}$	$V_{GS} = -4.5\text{ V}, V_{DD} = -10\text{ V},$ $I_D = -2.0\text{ A}, R_G = 2.0\ \Omega$		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}	$V_{GS} = 0\text{ V}, I_S = -1.0\text{ A}$	$T_J = 25^\circ\text{C}$		-0.75	-1.0	V
			$T_J = 125^\circ\text{C}$		-0.64		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, d_{ISD}/d_t = 100\text{ A}/\mu\text{s},$ $I_S = -1.0\text{ A}$			16.2		ns
Charge Time	t_a				10.6		
Discharge Time	t_b				5.6		
Reverse Recovery Time	Q_{RR}				5.7		

5. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

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	$I_F = 0.1\text{ A}$		0.34	0.39	V
		$I_F = 1.0\text{ A}$		0.47	0.53	
Maximum Instantaneous Reverse Current	I_R	$V_R = 30\text{ V}$		17	20	μA
		$V_R = 20\text{ V}$		3.0	8.0	
		$V_R = 10\text{ V}$		2.0	4.5	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ($T_J = 85^\circ\text{C}$ unless otherwise noted)

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

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	$I_F = 0.1\text{ A}$		0.2	0.29	V
		$I_F = 1.0\text{ A}$		0.4	0.47	
Maximum Instantaneous Reverse Current	I_R	$V_R = 30\text{ V}$		2.0	20	mA
		$V_R = 20\text{ V}$		1.1	10.9	
		$V_R = 10\text{ V}$		0.63	8.4	

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Capacitance	C	$V_R = 5.0\text{ V}, f = 1.0\text{ MHz}$		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 mm², 2 oz cu.

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

10. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

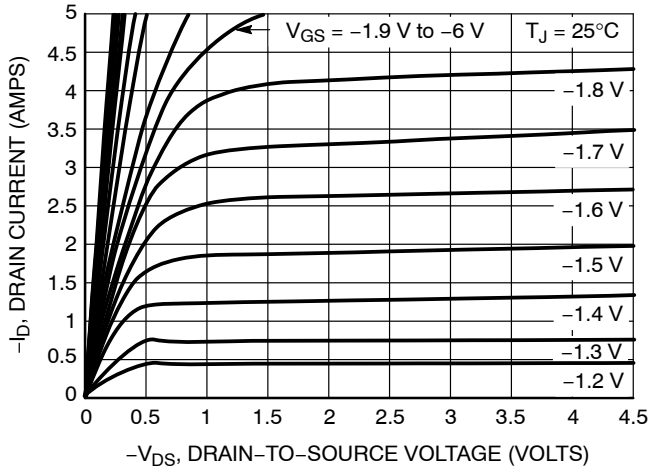


Figure 1. On-Region Characteristics

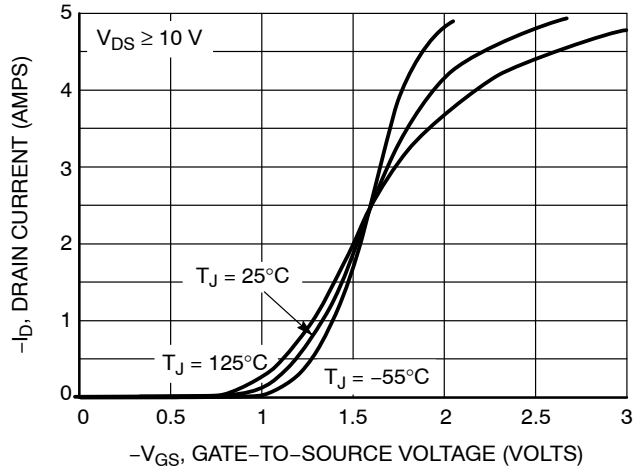


Figure 2. Transfer Characteristics

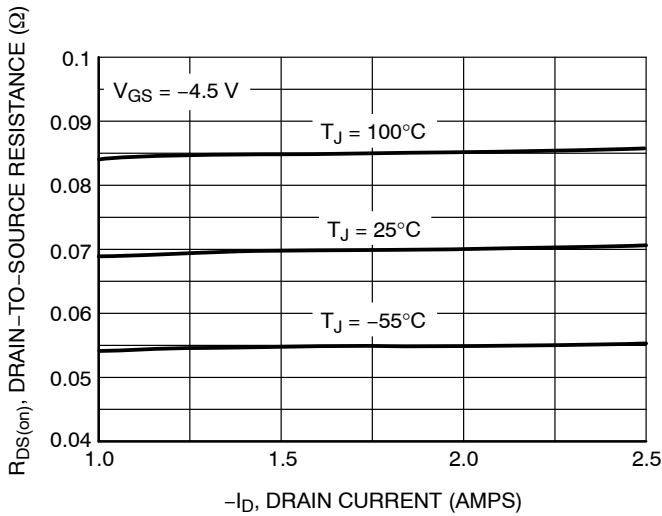


Figure 3. On-Resistance versus Drain Current

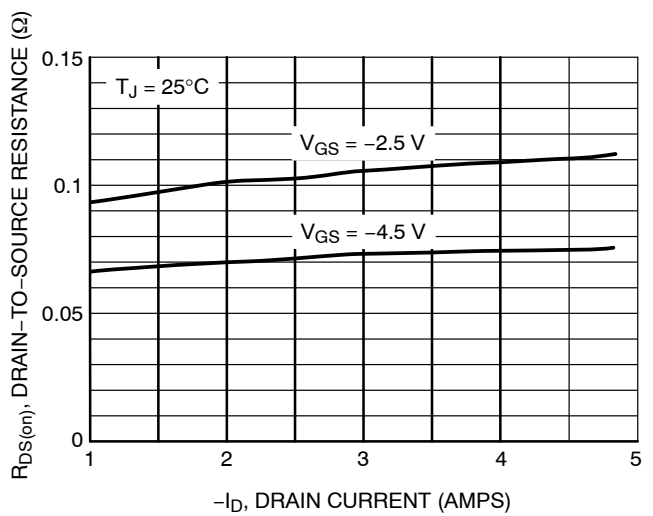


Figure 4. On-Resistance versus Drain Current and Gate Voltage

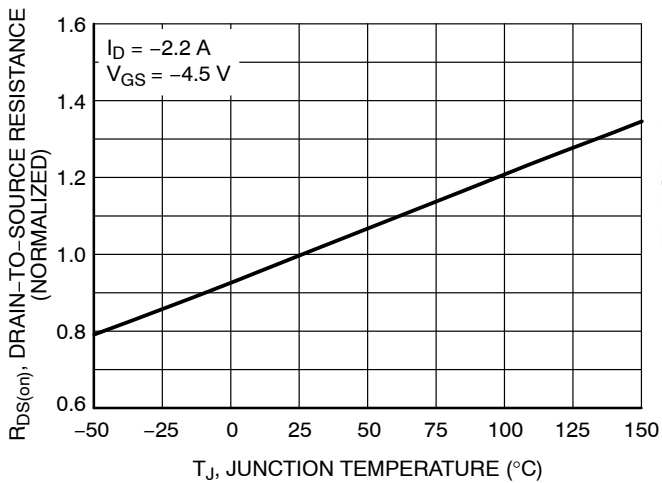


Figure 5. On-Resistance Variation with Temperature

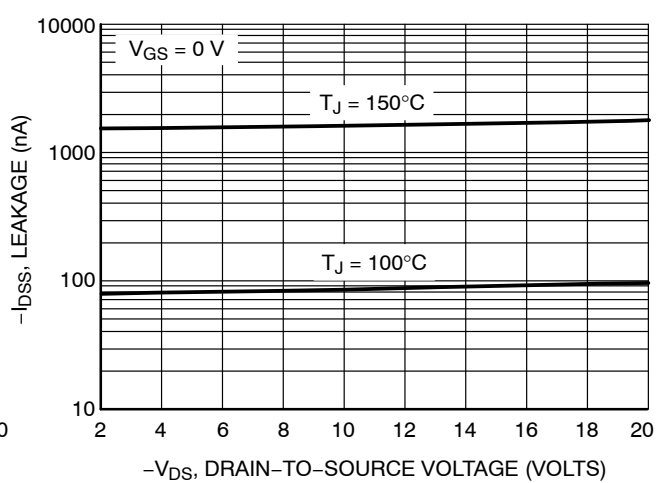


Figure 6. Drain-to-Source Leakage Current versus Voltage

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TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

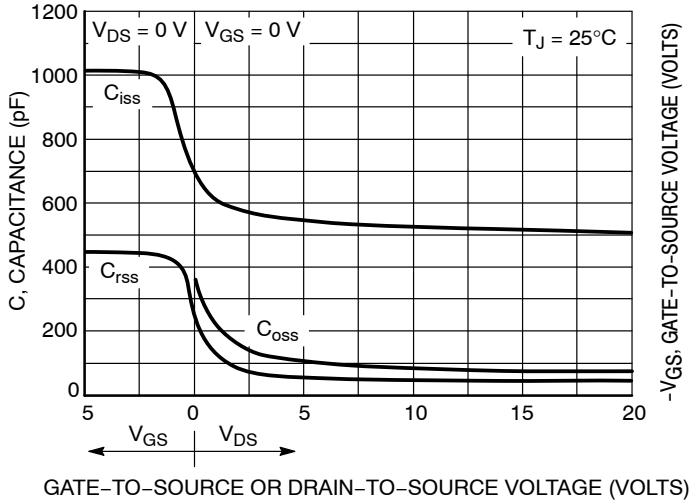


Figure 7. Capacitance Variation

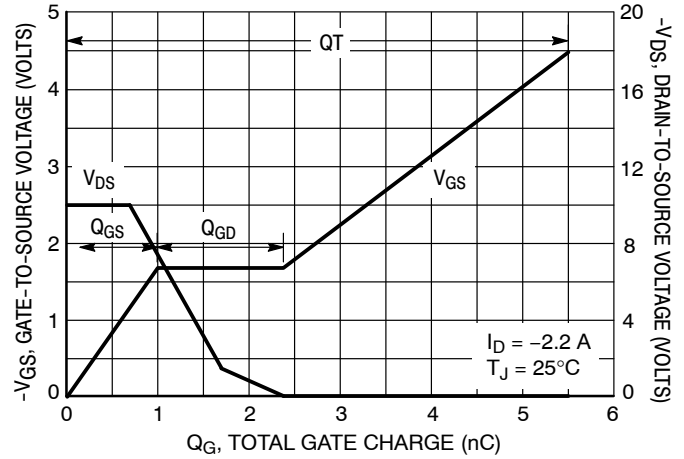


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

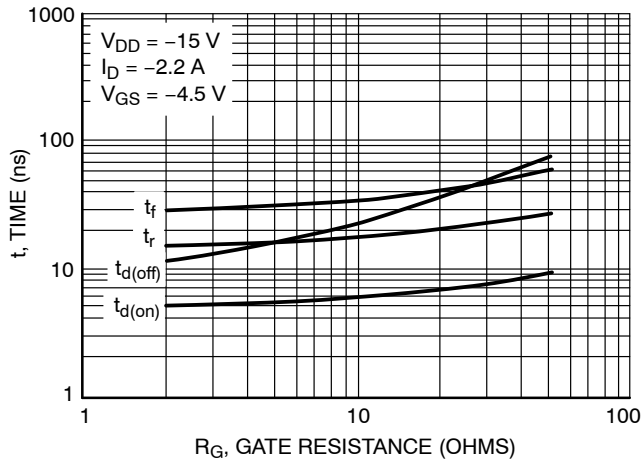


Figure 9. Resistive Switching Time Variation versus Gate Resistance

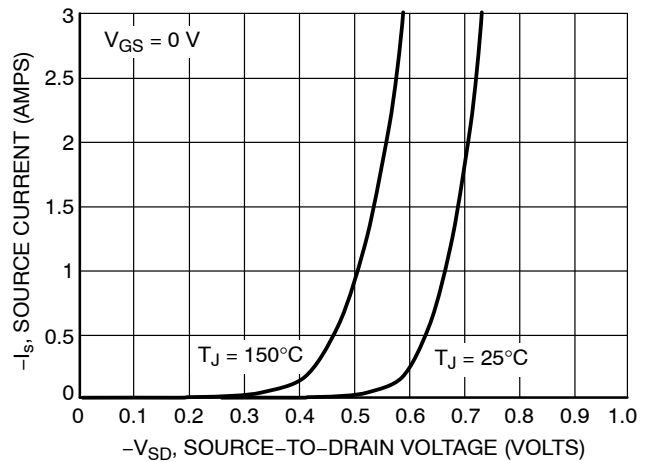


Figure 10. Diode Forward Voltage versus Current

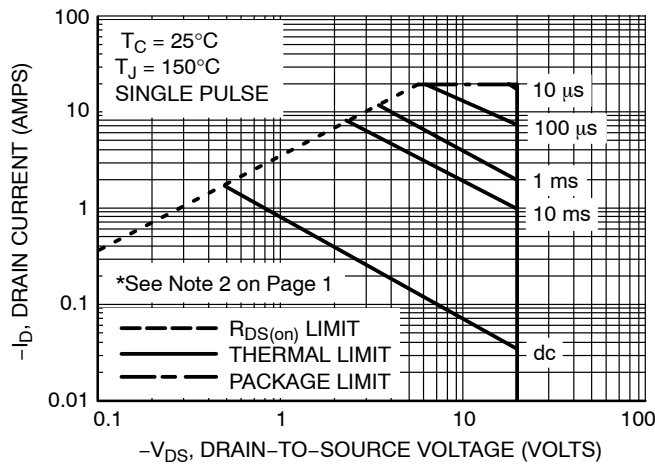


Figure 11. Maximum Rated Forward Biased Safe Operating Area

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TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

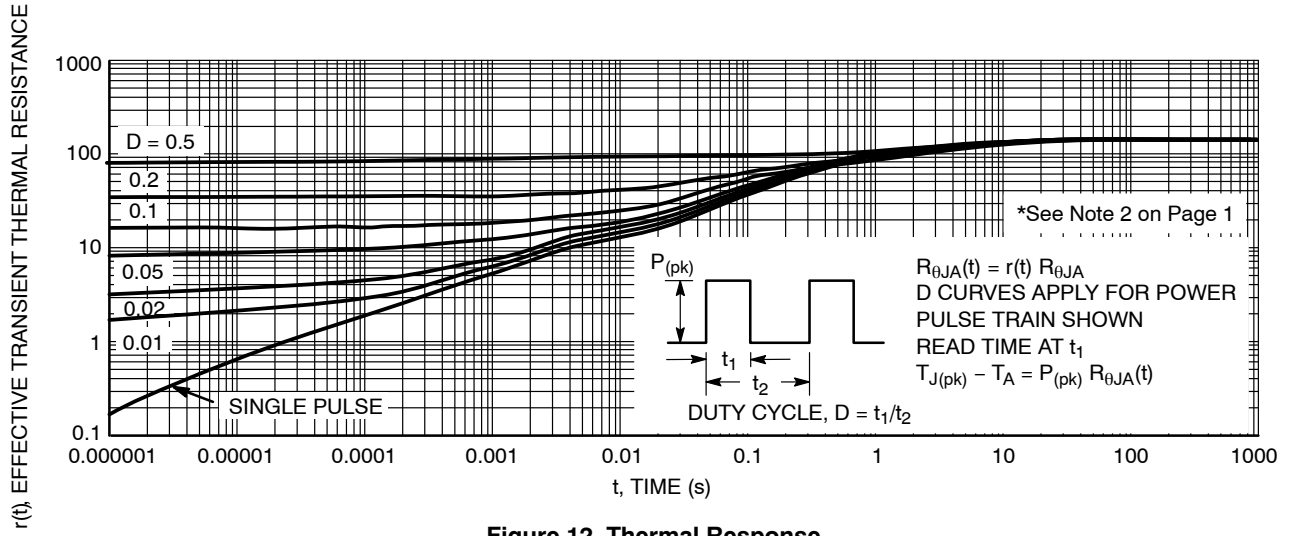


Figure 12. Thermal Response

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TYPICAL SCHOTTKY PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

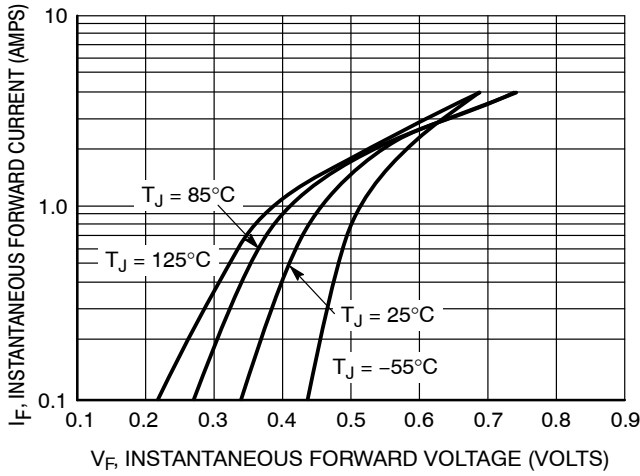


Figure 13. Typical Forward Voltage

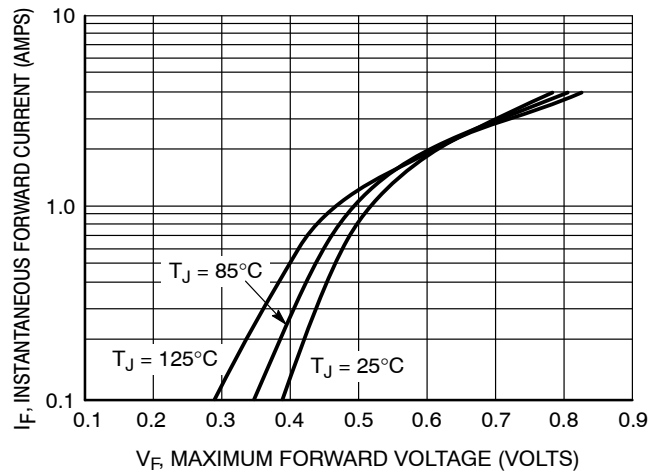


Figure 14. Maximum Forward Voltage

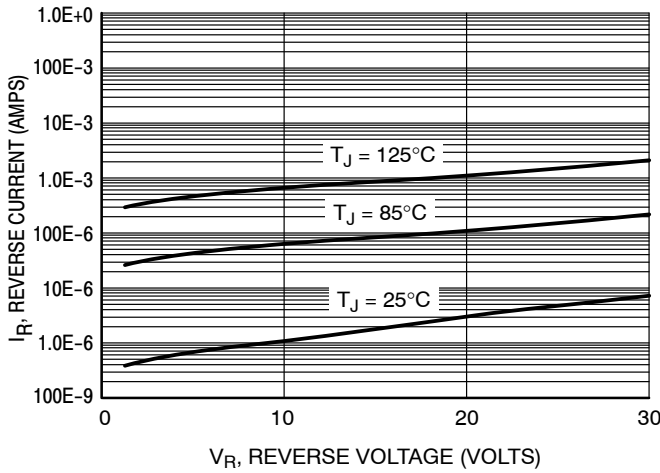


Figure 15. Typical Reverse Current

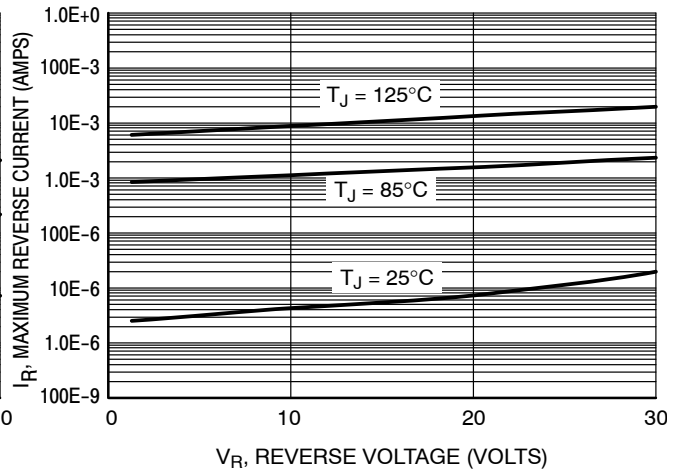


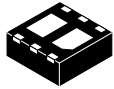
Figure 16. Maximum Reverse Current

ORDERING INFORMATION

Device	Package	Shipping [†]
NTLJF3117PT1G	WDFN6 (Pb-Free)	3000 / Tape & Reel

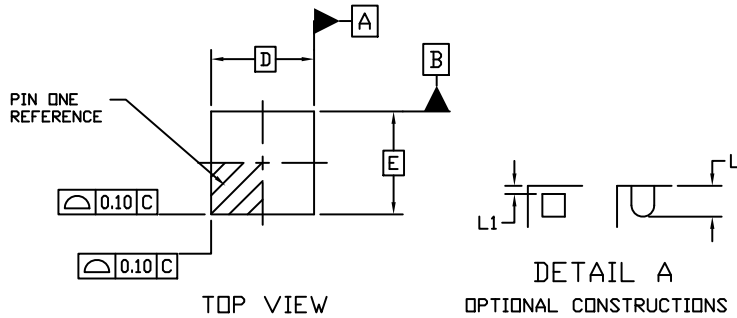
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



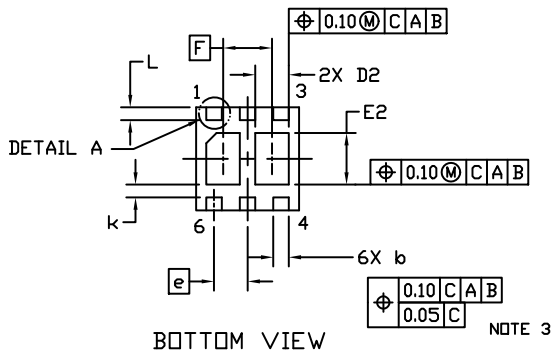
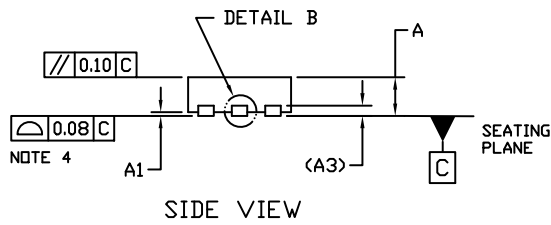
WDFN6 2x2, 0.65P
CASE 506AN
ISSUE H

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.



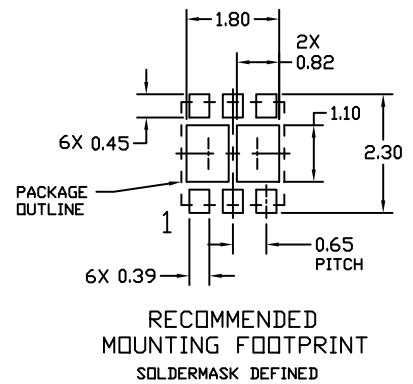
DIM	MILLIMETERS	
	MIN.	MAX.
A	0.70	0.80
A1	0.00	0.05
A3	0.20 REF	
<i>b</i>	0.25	0.35
D	2.00 BSC	
D2	0.57	0.77
E	2.00 BSC	
E2	0.90	1.10
<i>e</i>	0.65 BSC	
F	0.95 BSC	
<i>k</i>	0.25 REF	
L	0.20	0.30
L1	---	0.10

GENERIC MARKING DIAGRAM*



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.



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