

# NVTFS5124PL

## Power MOSFET

-60 V, -6 A, 260 mΩ, Single P-Channel



ON Semiconductor®

<http://onsemi.com>

### Features

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- NVTFS5124PLWF – Wettable Flanks Product
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	$V_{DS}$	-60	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\Psi J-mb}$ (Notes 1, 2, 3, 4)	Steady State	$T_{mb} = 25^\circ\text{C}$	$I_D$ -6.0	A
		$T_{mb} = 100^\circ\text{C}$	-4.0	
Power Dissipation $R_{\Psi J-mb}$ (Notes 1, 2, 3)	Steady State	$T_{mb} = 25^\circ\text{C}$	$P_D$ 18	W
		$T_{mb} = 100^\circ\text{C}$	9.0	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$ -2.4	A
		$T_A = 100^\circ\text{C}$	-1.7	
Power Dissipation $R_{\theta JA}$ (Notes 1, 3)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$ 3.0	W
		$T_A = 100^\circ\text{C}$	1.5	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$ -24	A	
Operating Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	-18	A	
Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}, V_{DD} = -50 \text{ V}, V_{GS} = -10 \text{ V}, I_{L(pk)} = -13 \text{ A}, L = 0.1 \text{ mH}, R_G = 25 \Omega$ )	$E_{AS}$	8.5	mJ	
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.

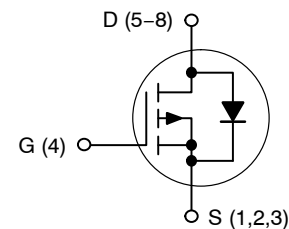
### THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Value	Unit
Junction-to-Mounting Board (top) – Steady State (Note 2 and 3)	$R_{\Psi J-mb}$	8.4	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	49.2	

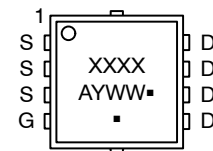
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Psi ( $\Psi$ ) is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to single case surface.
3. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
4. Continuous DC current rating. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
-60 V	260 mΩ @ -10 V	-6 A
	380 mΩ @ -4.5 V	

### P-Channel MOSFET



### MARKING DIAGRAM



- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NVTFS5124PL

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

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

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-60			V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -60 V	T <sub>J</sub> = 25°C		-1.0	μA
			T <sub>J</sub> = 125°C		-10	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = -250 μA	-1.5		-2.5	V
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -3 A		200	260	mΩ
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -3 A		290	380	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = -15 V, I <sub>D</sub> = -5 A	4			S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = -25 V		250		pF
Output Capacitance	C <sub>oss</sub>			27		
Reverse Transfer Capacitance	C <sub>rss</sub>			17		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -48 V, I <sub>D</sub> = -3 A		3.5		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.4		
Gate-to-Source Charge	Q <sub>GS</sub>			1.2		
Gate-to-Drain Charge	Q <sub>GD</sub>			1.9		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = -10 V, V <sub>DS</sub> = -48 V, I <sub>D</sub> = -3 A		6		

### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -48 V, I <sub>D</sub> = -3 A, R <sub>G</sub> = 2.5 Ω		7		ns
Rise Time	t <sub>r</sub>			14		
Turn-Off Delay Time	t <sub>d(off)</sub>			13		
Fall Time	t <sub>f</sub>			10		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -3 A	T <sub>J</sub> = 25°C		-0.87	-1.0	V
			T <sub>J</sub> = 125°C		-0.74		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = -3 A		17		ns	
Charge Time	t <sub>a</sub>			14			
Discharge Time	t <sub>b</sub>			3			
Reverse Recovery Charge	Q <sub>RR</sub>			19		nC	

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

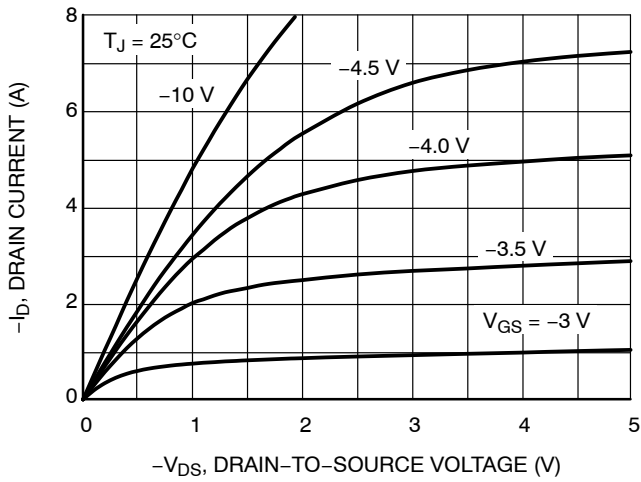


Figure 1. On-Region Characteristics

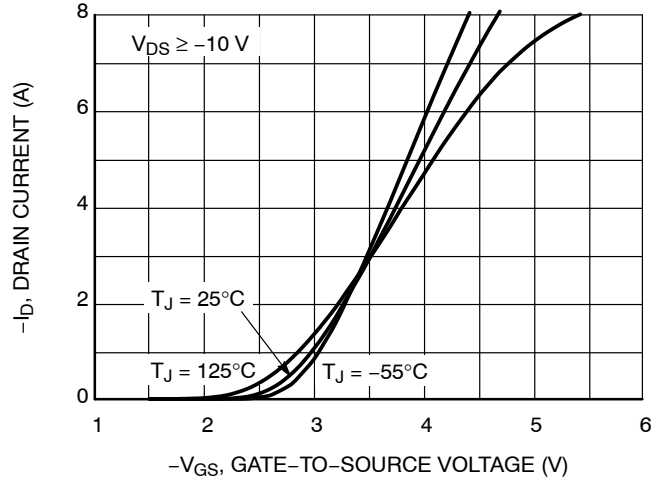


Figure 2. Transfer Characteristics

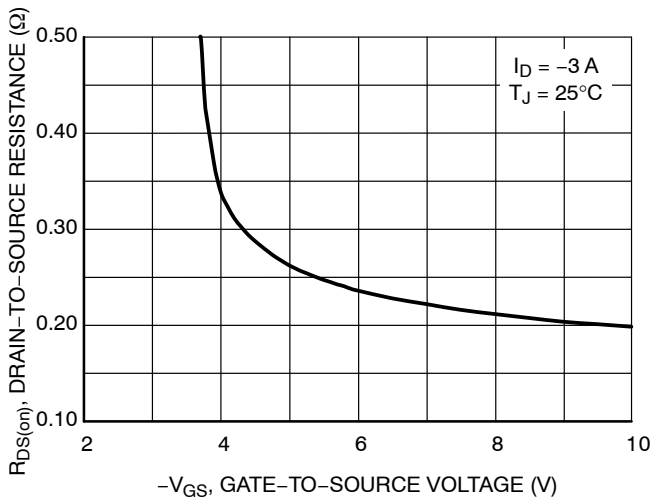


Figure 3. On-Resistance vs. Gate-to-Source Voltage

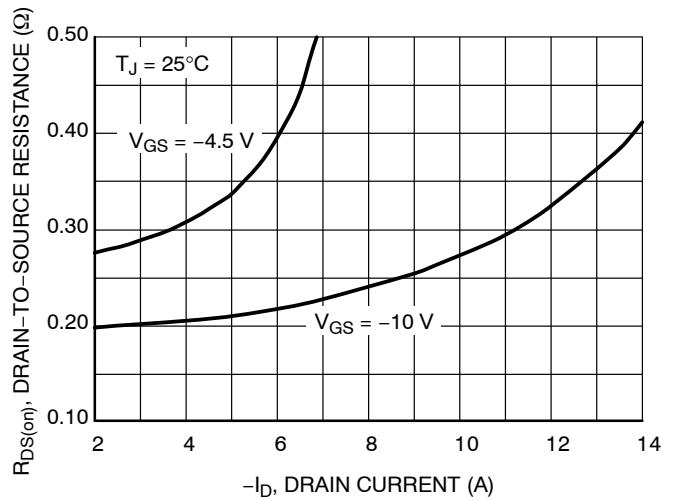


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

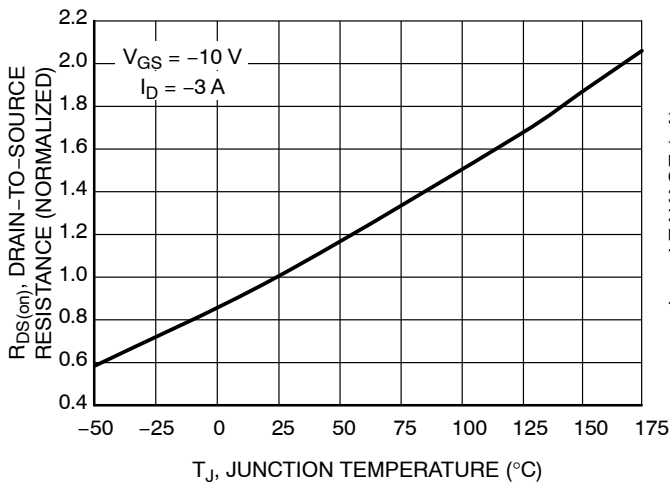


Figure 5. On-Resistance Variation with Temperature

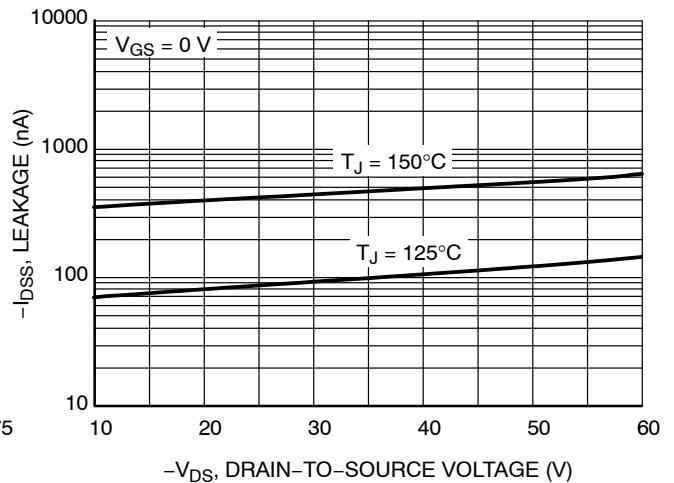


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

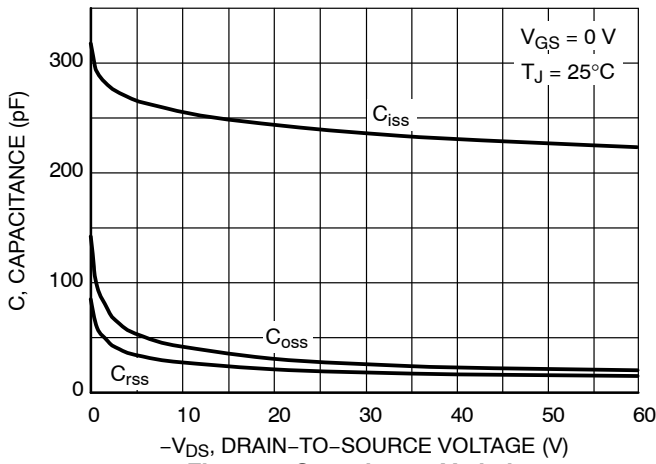


Figure 7. Capacitance Variation

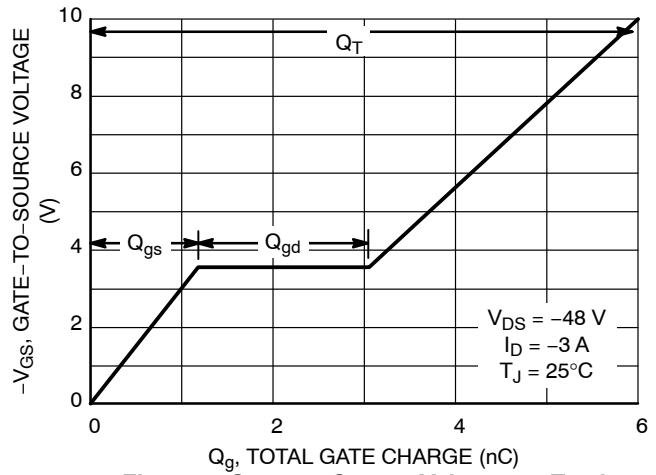


Figure 8. Gate-to-Source Voltage vs. Total Charge

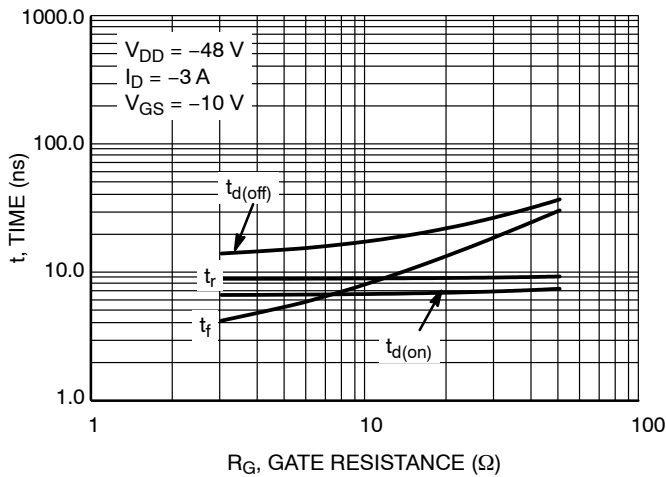


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

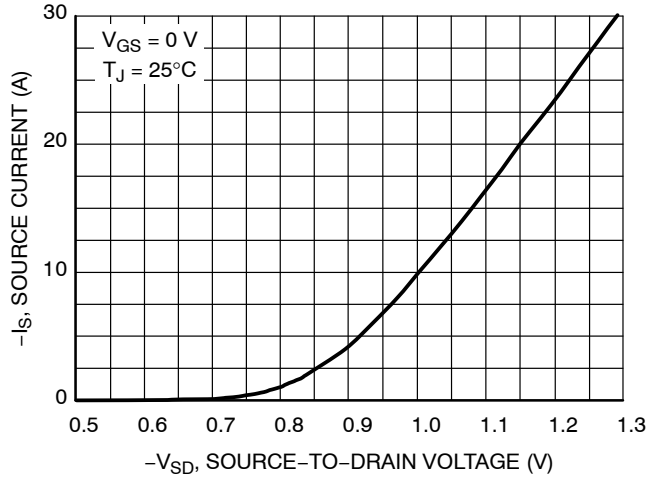


Figure 11. Diode Forward Voltage vs. Current

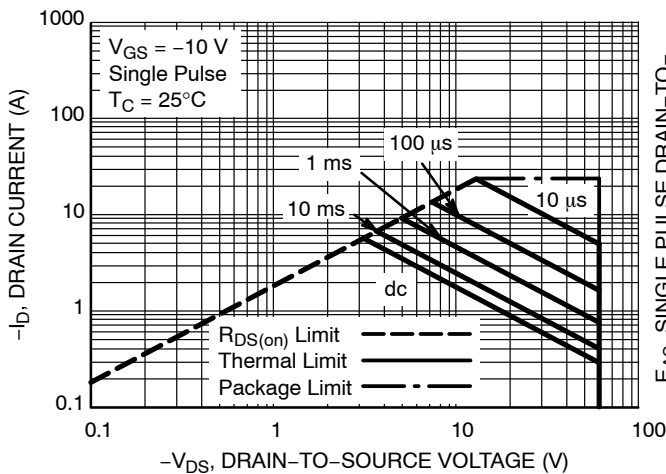


Figure 10. Maximum Rated Forward Biased Safe Operating Area

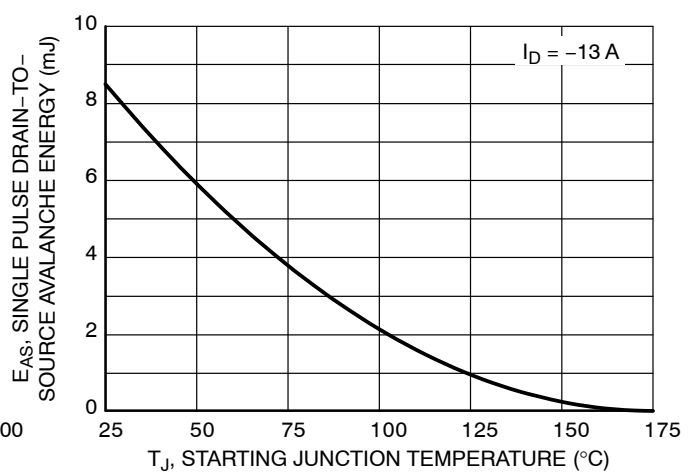
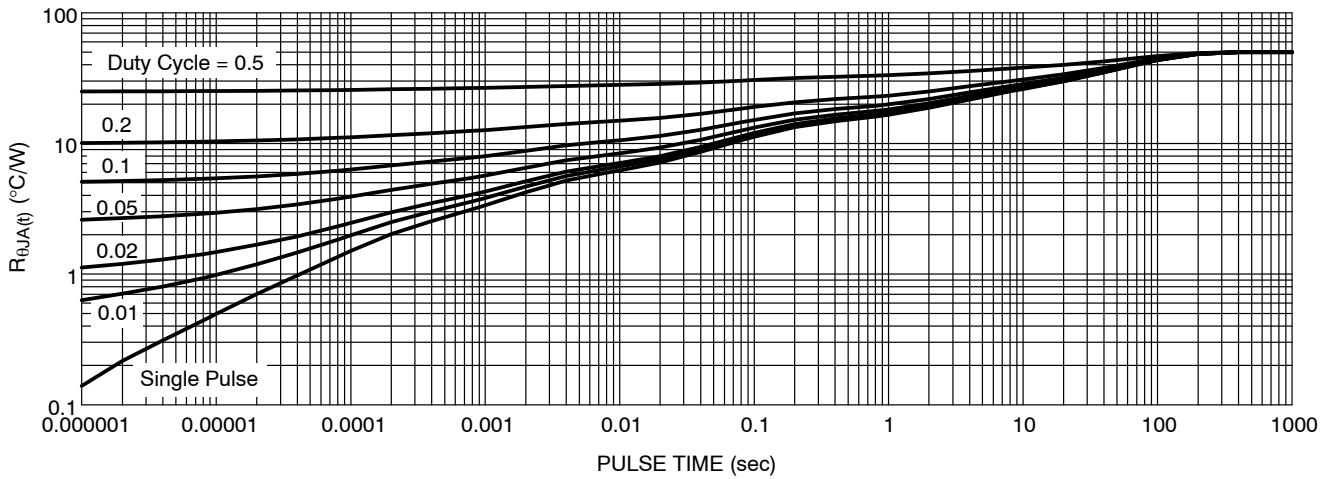


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

# NVTFS5124PL

## TYPICAL CHARACTERISTICS



### DEVICE ORDERING INFORMATION

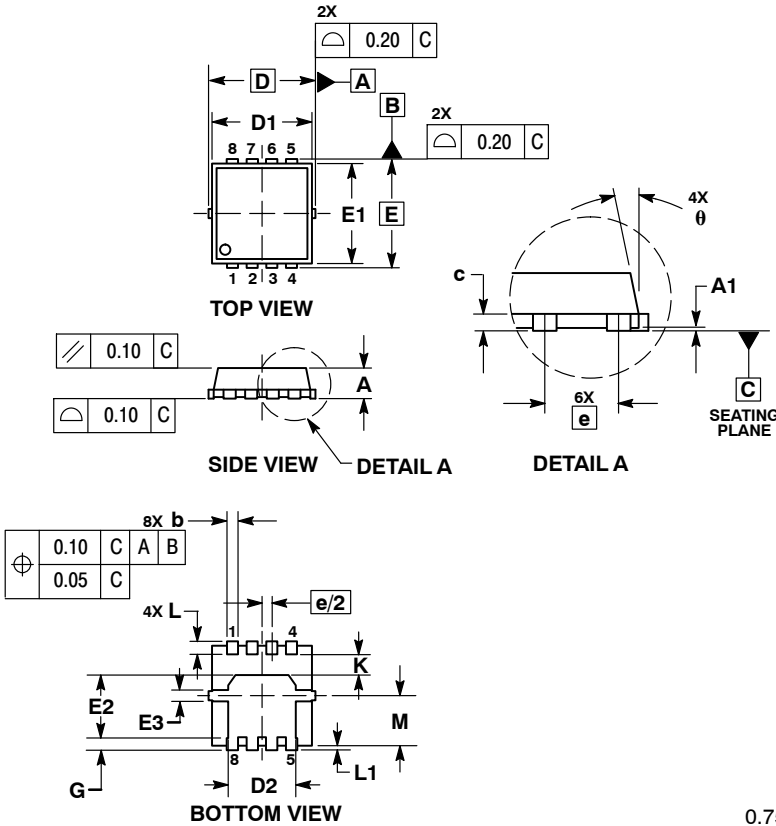
Device	Marking	Package	Shipping <sup>†</sup>
NVTFS5124PLTAG	5124	WDFN8 (Pb-Free)	1500 / Tape & Reel
NVTFS5124PLWFTAG	24LW	WDFN8 (Pb-Free)	1500 / Tape & Reel
NVTFS5124PLTWG	5124	WDFN8 (Pb-Free)	5000 / Tape & Reel
NVTFS5124PLWFTWG	24LW	WDFN8 (Pb-Free)	5000 / Tape & Reel

<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.

# NVTF5124PL

## PACKAGE DIMENSIONS

WDFN8 3.3x3.3, 0.65P  
CASE 511AB  
ISSUE D

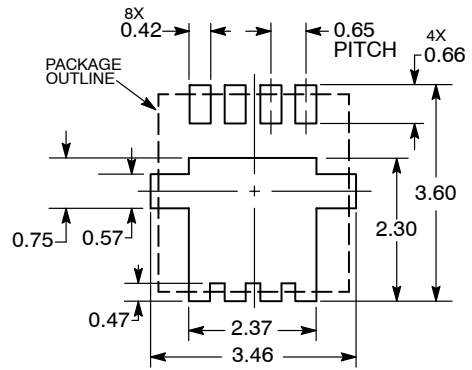


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	---	0.05	0.000	---	0.002
b	0.23	0.30	0.40	0.009	0.012	0.016
c	0.15	0.20	0.25	0.006	0.008	0.010
D	3.30 BSC			0.130 BSC		
D1	2.95	3.05	3.15	0.116	0.120	0.124
D2	1.98	2.11	2.24	0.078	0.083	0.088
E	3.30 BSC			0.130 BSC		
E1	2.95	3.05	3.15	0.116	0.120	0.124
E2	1.47	1.60	1.73	0.058	0.063	0.068
E3	0.23	0.30	0.40	0.009	0.012	0.016
e	0.65 BSC			0.026 BSC		
G	0.30	0.41	0.51	0.012	0.016	0.020
K	0.65	0.80	0.95	0.026	0.032	0.037
L	0.30	0.43	0.56	0.012	0.017	0.022
L1	0.06	0.13	0.20	0.002	0.005	0.008
M	1.40	1.50	1.60	0.055	0.059	0.063
θ	0°	---	12°	0°	---	12°

**SOLDERING FOOTPRINT\***



DIMENSION: MILLIMETERS

\*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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