NVTFS5124PL

Power MOSFET
−60 V, −6 A, 260 mΩ, Single P−Channel

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°C unless otherwise noted)

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

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	°C/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 (Ψ) 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^2, 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.

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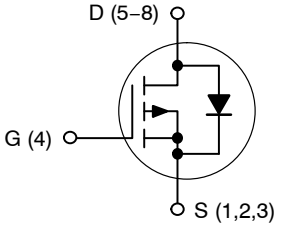
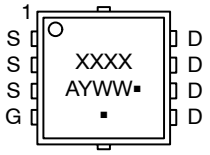
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
−60 V	260 mΩ @ −10 V	−6 A
	380 mΩ @ −4.5 V	

P−Channel MOSFET



MARKING DIAGRAM

WDFN8
(μ8FL)
CASE 511AB



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.

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = −250 μA		−60			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = −60 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} = ±20 V				±100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = −250 μA		−1.5		−2.5	V
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −10 V, I_D = −3 A			200	260	mΩ
		V_{GS} = −4.5 V, I_D = −3 A			290	380	
Forward Transconductance	g_{FS}	V_{DS} = −15 V, I_D = −5 A		4			S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = −25 V			250		pF
Output Capacitance	C_{oss}				27		
Reverse Transfer Capacitance	C_{rss}				17		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −4.5 V, V_{DS} = −48 V, I_D = −3 A			3.5		nC
Threshold Gate Charge	$Q_{G(TH)}$				0.4		
Gate−to−Source Charge	Q_{GS}				1.2		
Gate−to−Drain Charge	Q_{GD}				1.9		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −10 V, V_{DS} = −48 V, I_D = −3 A			6		
SWITCHING CHARACTERISTICS (Note 6)							
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = −4.5 V, V_{DS} = −48 V, I_D = −3 A, R_G = 2.5 Ω			7		ns
Rise Time	t_r				14		
Turn−Off Delay Time	$t_{d(off)}$				13		
Fall Time	t_f				10		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = −3 A	T_J = 25°C		−0.87	−1.0	V
			T_J = 125°C		−0.74		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = −3 A			17		ns
Charge Time	t_a				14		
Discharge Time	t_b				3		
Reverse Recovery Charge	Q_{RR}				19		nC

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

TYPICAL CHARACTERISTICS

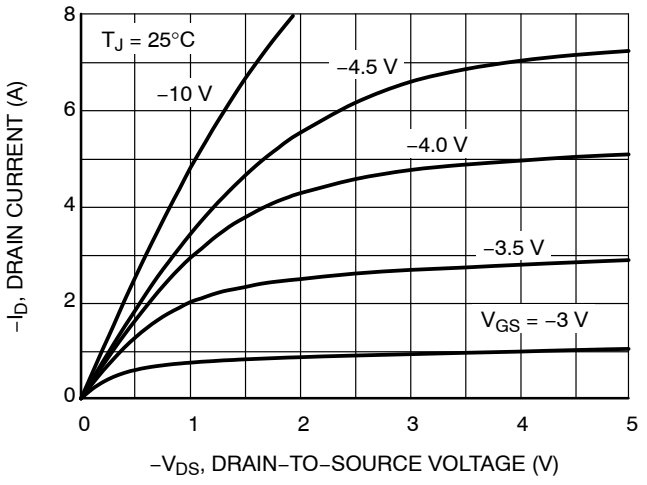


Figure 1. On−Region Characteristics

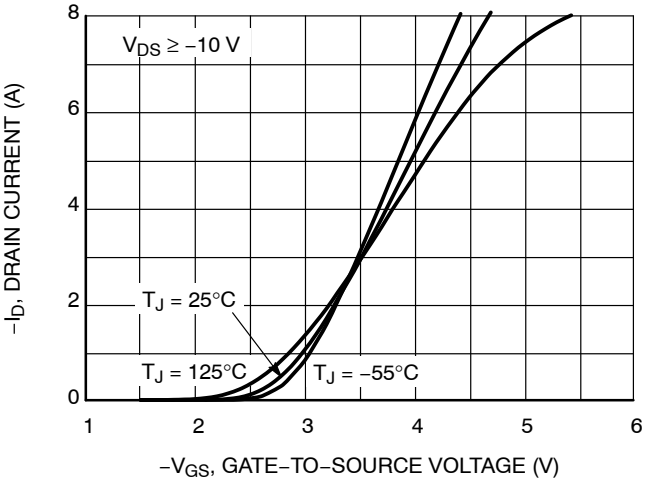


Figure 2. Transfer Characteristics

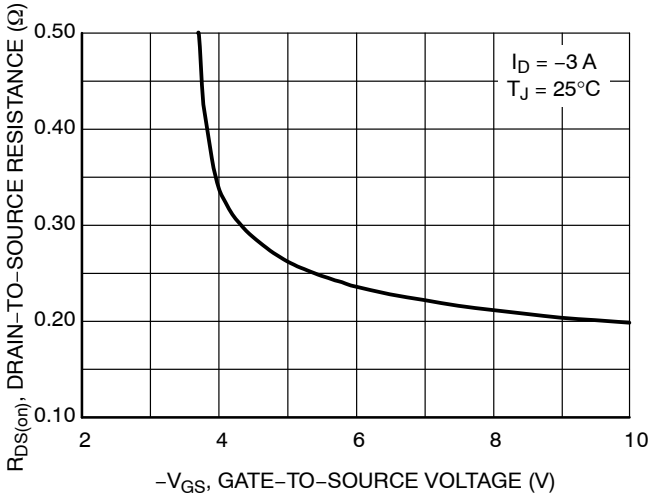


Figure 3. On−Resistance vs. Gate−to−Source Voltage

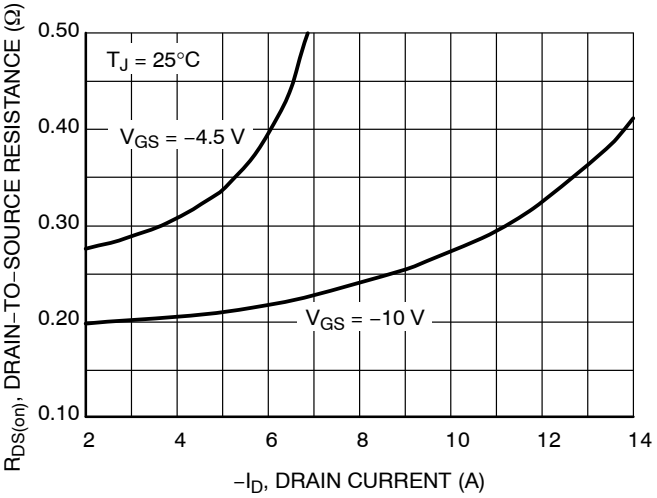


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

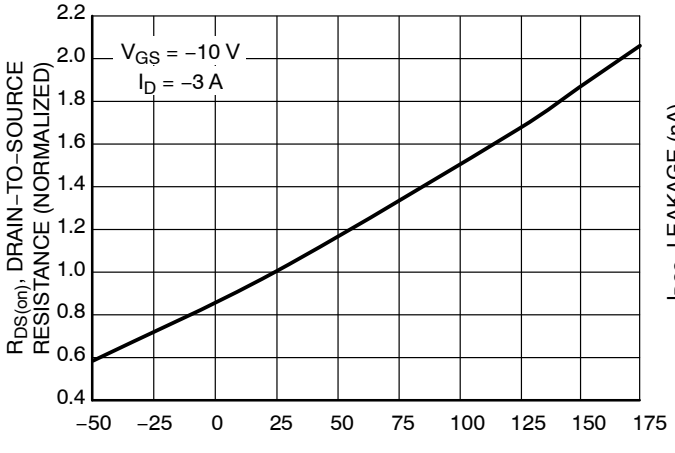


Figure 5. On−Resistance Variation with Temperature

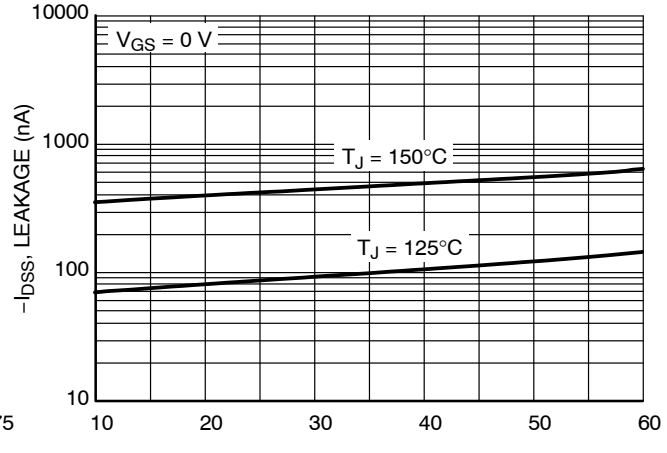


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

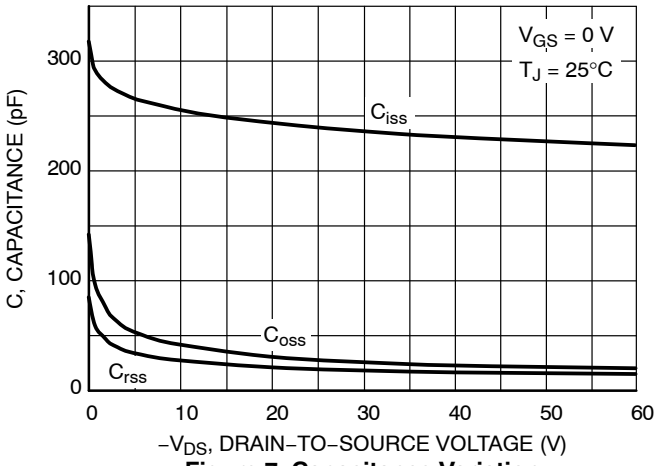


Figure 7. Capacitance Variation

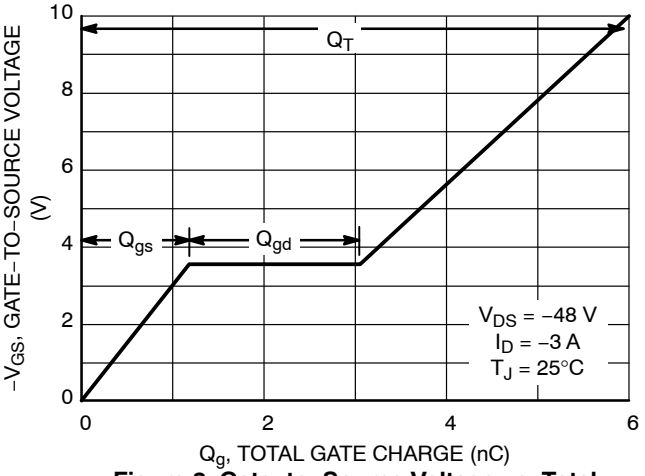


Figure 8. Gate−to−Source Voltage vs. Total Charge

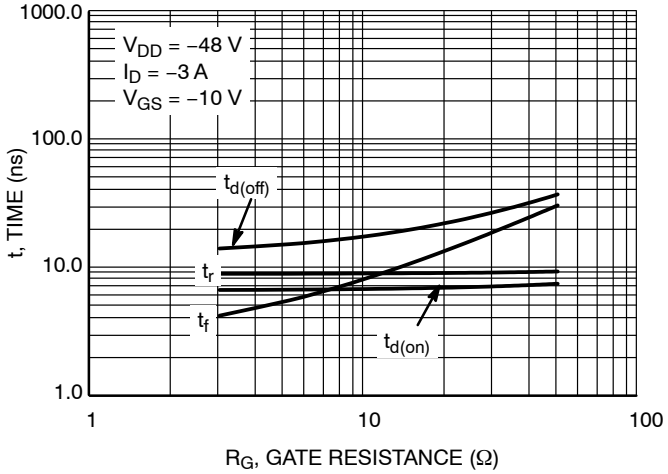


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

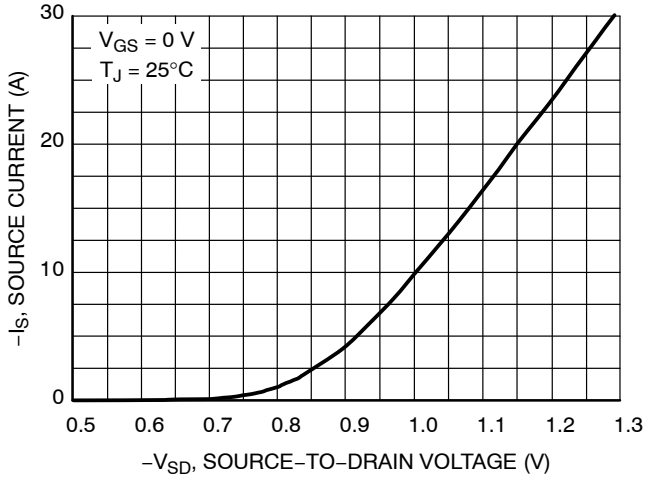


Figure 11. Diode Forward Voltage vs. Current

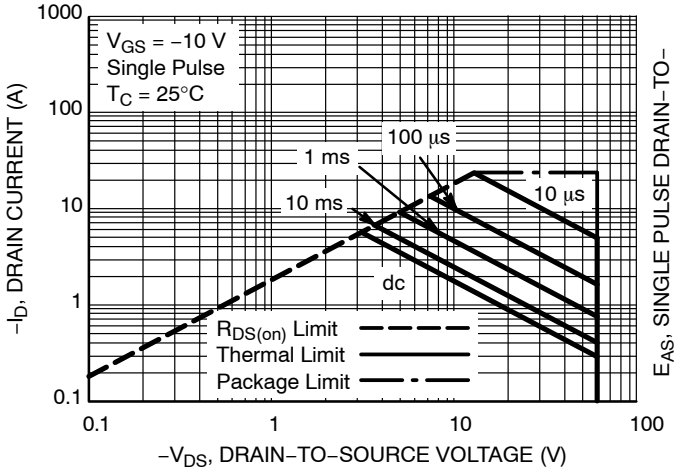


Figure 10. Maximum Rated Forward Biased Safe Operating Area

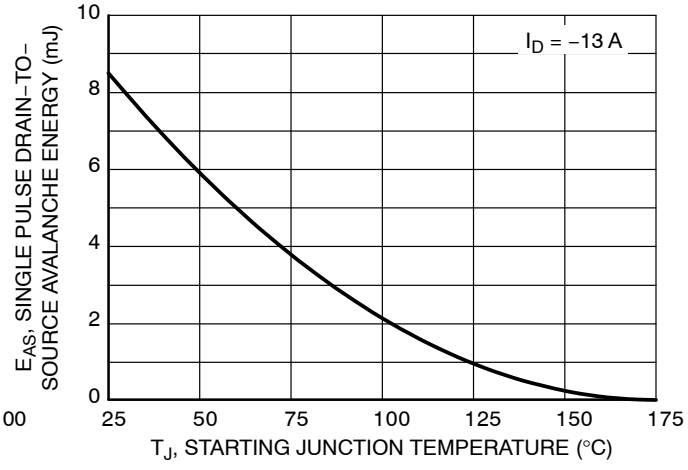


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL CHARACTERISTICS

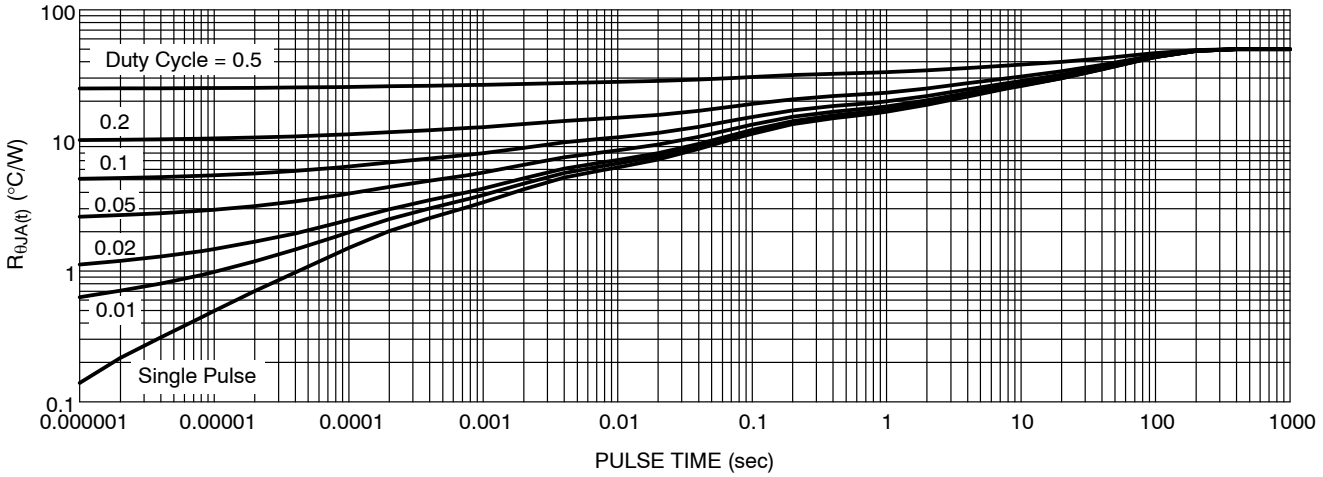


Figure 13. Thermal Response

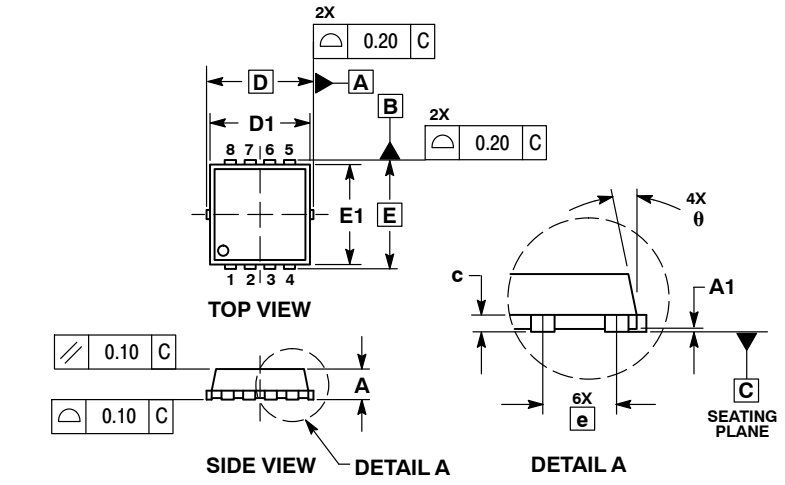
DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping†
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

†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.

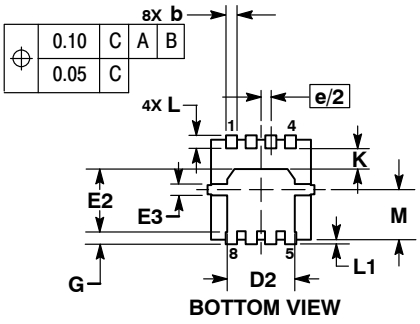
PACKAGE DIMENSIONS

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

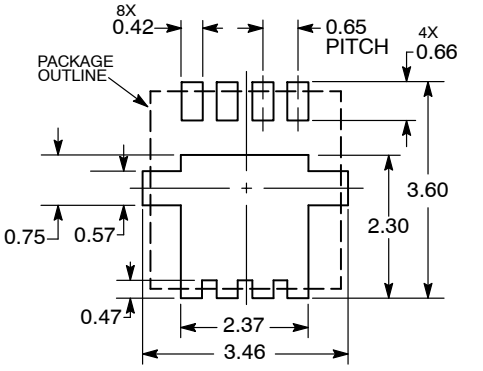


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

	MILLIMETERS			INCHES		
DIM	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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
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