

MOSFET – Power, Single N-Channel

80 V, 20 mΩ, 30 A

NVTFS6H860NL

Features

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- NVTFS6H860NLWF – 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)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-to-Source Voltage	80	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D	Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3, 4)	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	30 21 A
P_D	Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3)	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	42 21 W
I_D	Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4)	$T_A = 25^\circ\text{C}$ $T_A = 100^\circ\text{C}$	8.1 5.7 A
P_D	Power Dissipation $R_{\theta JA}$ (Notes 1, 3)	$T_A = 25^\circ\text{C}$ $T_A = 100^\circ\text{C}$	3.1 1.6 W
I_{DM}	Pulsed Drain Current $T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$	122	A
T_J , T_{stg}	Operating Junction and Storage Temperature Range	-55 to $+175$	$^\circ\text{C}$
I_S	Source Current (Body Diode)	35	A
E_{AS}	Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 1.5 \text{ A}$)	121	mJ
T_L	Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	260	$^\circ\text{C}$

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.

THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

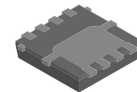
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State (Note 3)	3.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 3)	48	

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 mm², 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.

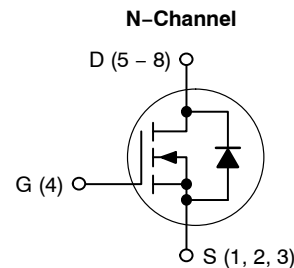
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
80 V	20 mΩ @ 10 V 26 mΩ @ 4.5 V	30 A



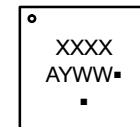
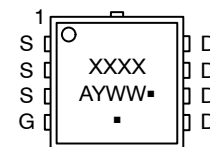
WDFN8
($\mu 8\text{FL}$)
CASE 511AB



WDFNW8
(Full-Cut $\mu 8\text{FL}$)
CASE 515AN



MARKING DIAGRAMS



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.

NVTFS6H860NL

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

V _{(BR)DSS}	Drain-to-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	80			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{GS} = 0 V, V _{DS} = 80 V	T _J = 25°C T _J = 125°C		10 100	μA
I _{GSS}	Gate-to-Source Leakage Current	V _{DS} = 0 V, V _{GS} = 20 V			100	nA

ON CHARACTERISTICS (Note 5)

V _{GS(TH)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 30 μA	1.2		2.0	V
V _{GS(TH)/T_J}	Threshold Temperature Coefficient			-5.1		mV/°C
R _{DS(on)}	Drain-to-Source On Resistance	V _{GS} = 10 V, I _D = 5 A V _{GS} = 4.5 V, I _D = 5 A		16.5 20.5	20 26	mΩ
g _{FS}	Forward Transconductance	V _{DS} = 8 V, I _D = 15 A		45		S

CHARGES, CAPACITANCES & GATE RESISTANCE

C _{ISS}	Input Capacitance	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 40 V		610		pF
C _{OSS}	Output Capacitance			83		
C _{RSS}	Reverse Transfer Capacitance			5		
Q _{G(TOT)}	Total Gate Charge	V _{GS} = 10 V, V _{DS} = 40 V; I _D = 15 A		12		nC
Q _{G(TH)}	Threshold Gate Charge	V _{GS} = 4.5 V, V _{DS} = 40 V; I _D = 15 A		1		
Q _{GS}	Gate-to-Source Charge			2		
Q _{GD}	Gate-to-Drain Charge			2		
V _{GP}	Plateau Voltage			3		V
Q _{G(TOT)}	Total Gate Charge			6		nC

SWITCHING CHARACTERISTICS (Note 6)

t _{d(ON)}	Turn-On Delay Time	V _{GS} = 4.5 V, V _{DS} = 64 V, I _D = 15 A, R _G = 2.5 Ω		8		ns
t _r	Rise Time			32		
t _{d(OFF)}	Turn-Off Delay Time			14		
t _f	Fall Time			5		

DRAIN-SOURCE DIODE CHARACTERISTICS

V _{SD}	Forward Diode Voltage	V _{GS} = 0 V, I _S = 5 A	T _J = 25°C T _J = 125°C		0.80 0.66	1.2	V
t _{RR}	Reverse Recovery Time	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 15 A			29		ns
t _a	Charge Time				18		
t _b	Discharge Time				11		
Q _{RR}	Reverse Recovery Charge				21		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

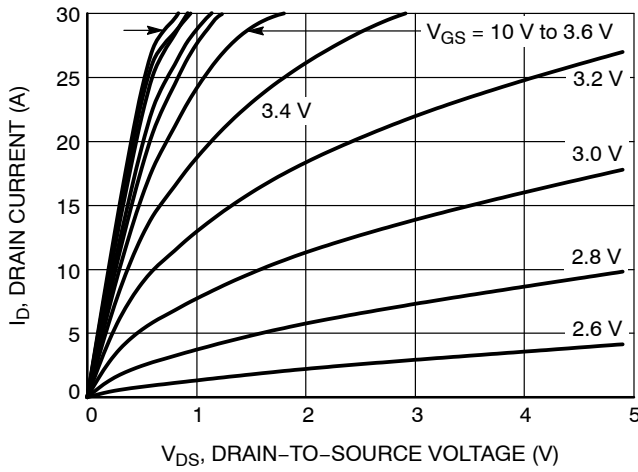


Figure 1. On-Region Characteristics

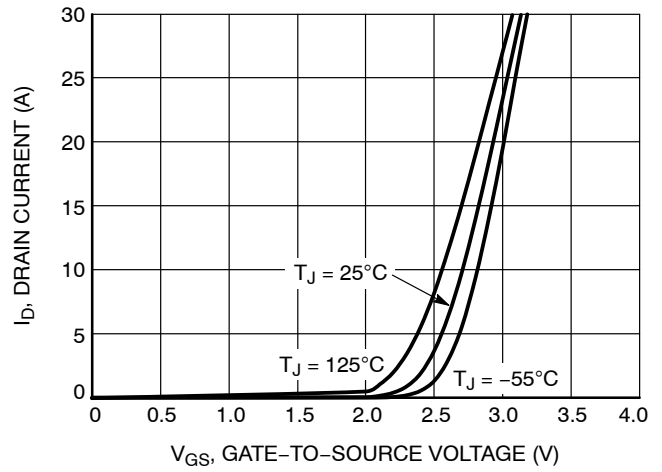


Figure 2. Transfer Characteristics

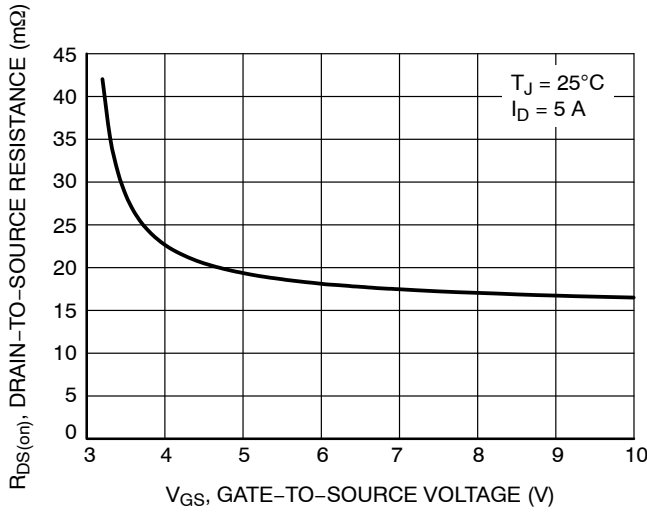


Figure 3. On-Resistance vs. Gate-to-Source Voltage

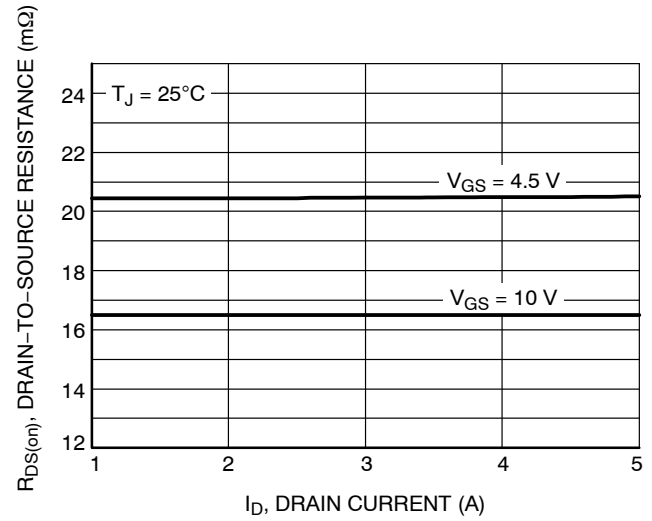


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

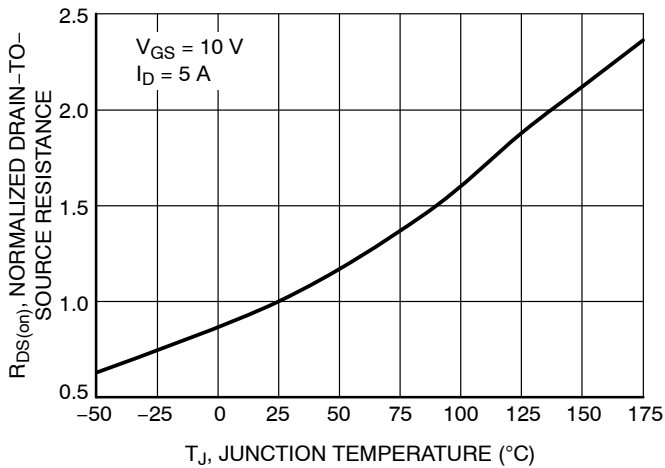


Figure 5. On-Resistance Variation with Temperature

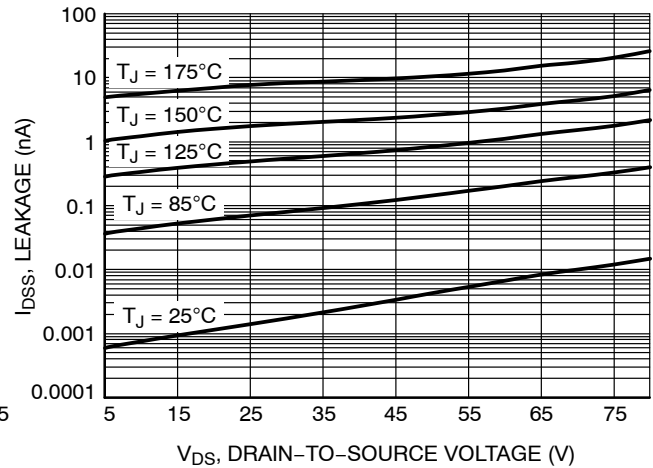


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS (continued)

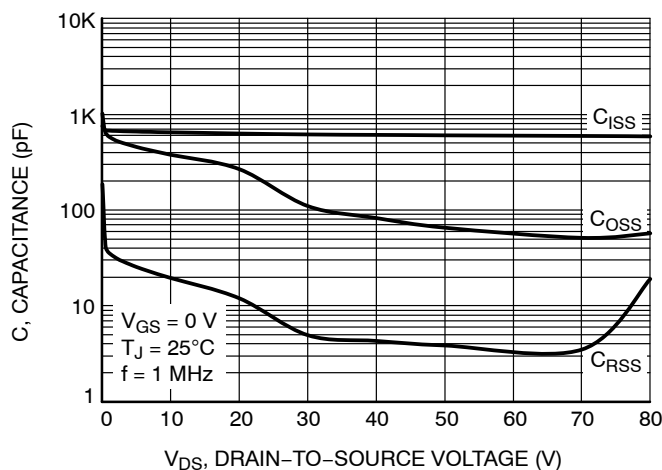


Figure 7. Capacitance Variation

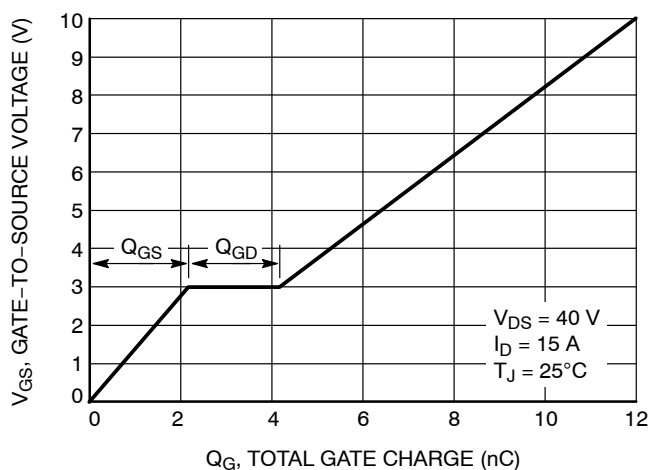


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

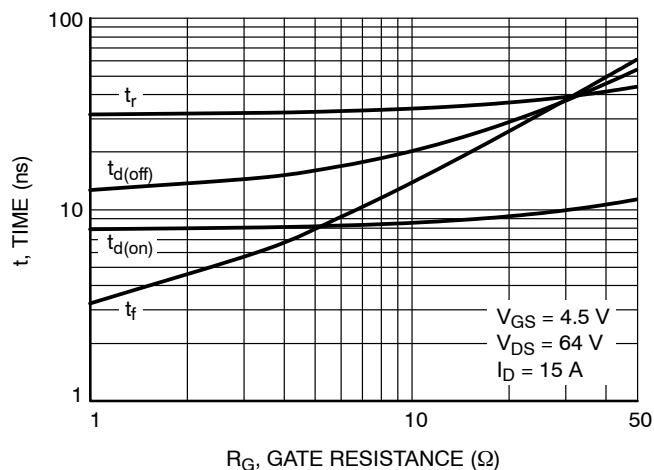


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

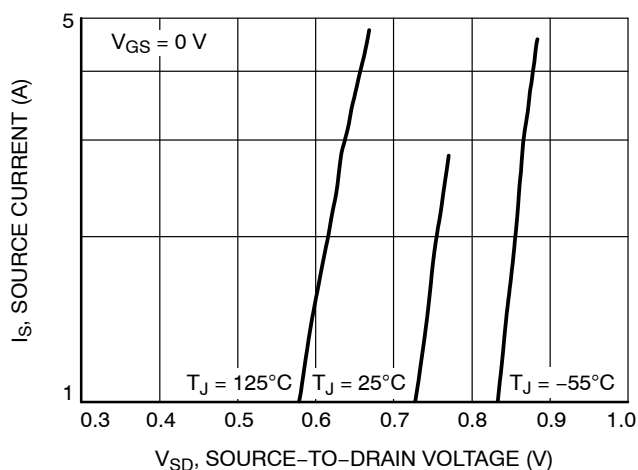


Figure 10. Diode Forward Voltage vs. Current

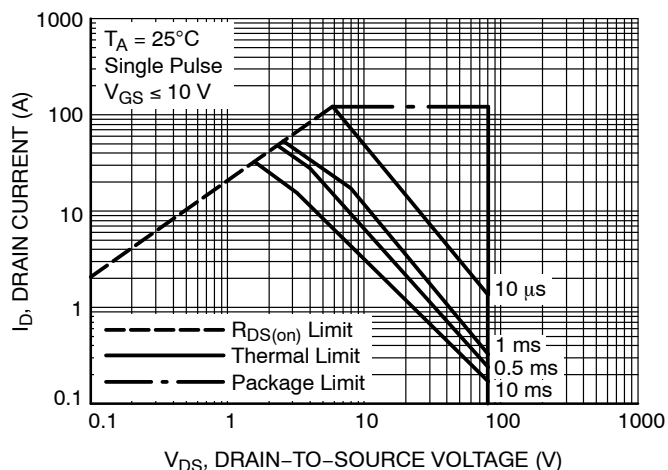


Figure 11. Safe Operating Area

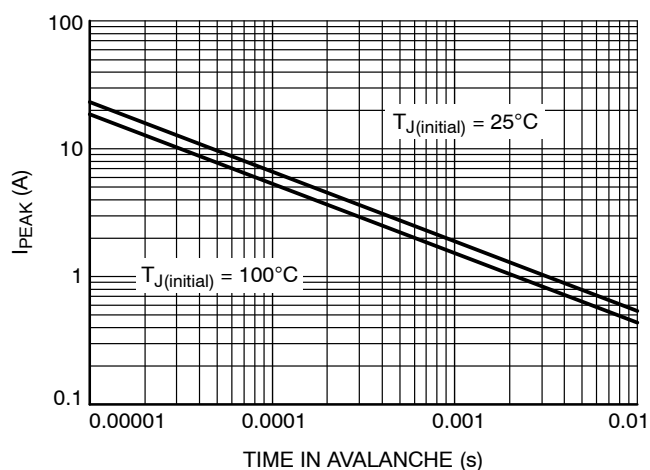


Figure 12. Maximum Drain Current vs. Time in Avalanche

NVTFS6H860NL

TYPICAL CHARACTERISTICS (continued)

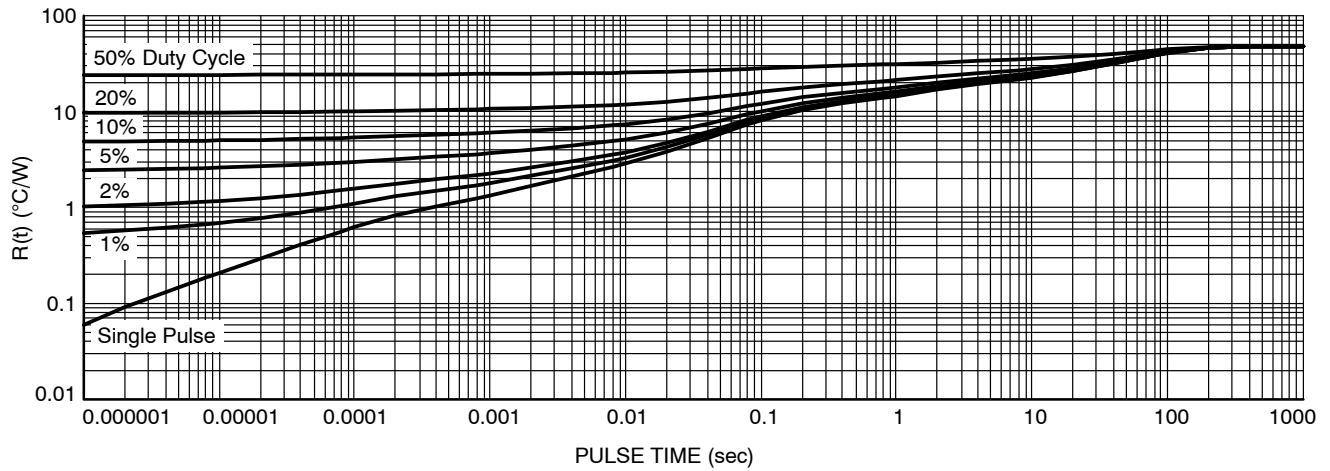


Figure 13. Thermal Response

DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
NVTFS6H860NLTAG	860L	WDFN8 (Pb-Free)	1,500 / Tape & Reel
NVTFS6H860NLWFTAG	60LW	WDFN8 (Pb-Free, Wettable Flanks)	1,500 / Tape & Reel

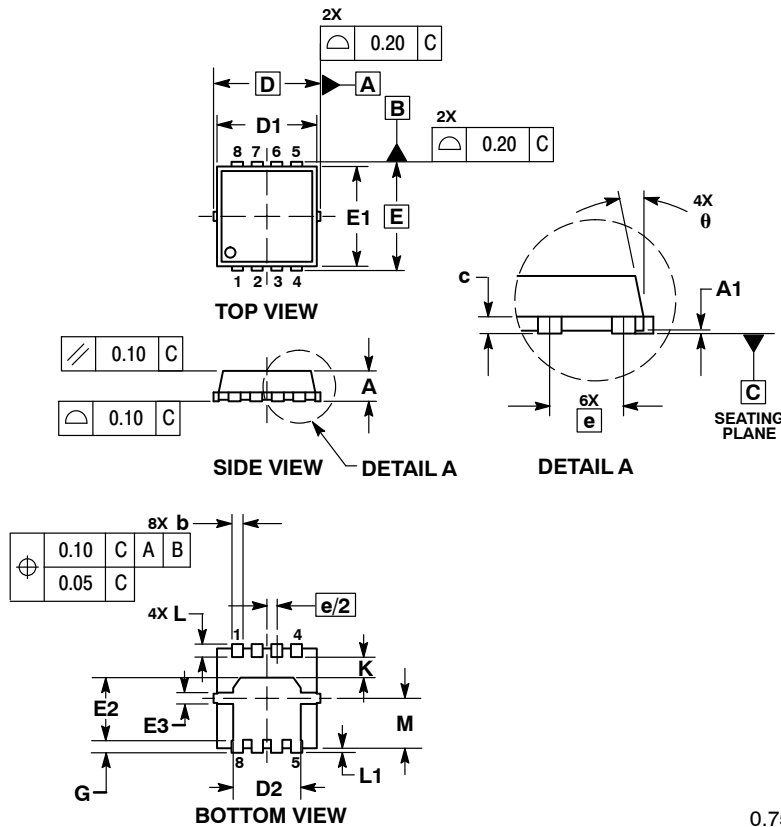
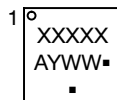
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).



SCALE 2:1

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

DATE 23 APR 2012


GENERIC MARKING DIAGRAM*


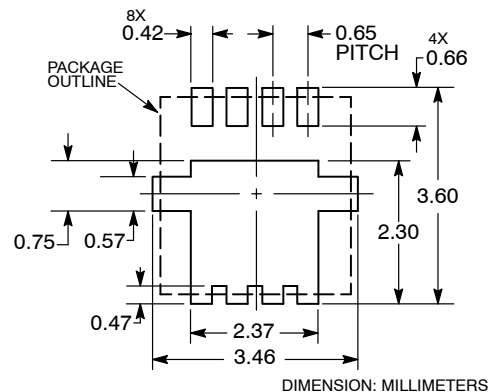
XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

*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.

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 °

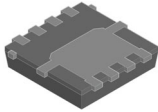
SOLDERING FOOTPRINT*


DIMENSION: MILLIMETERS

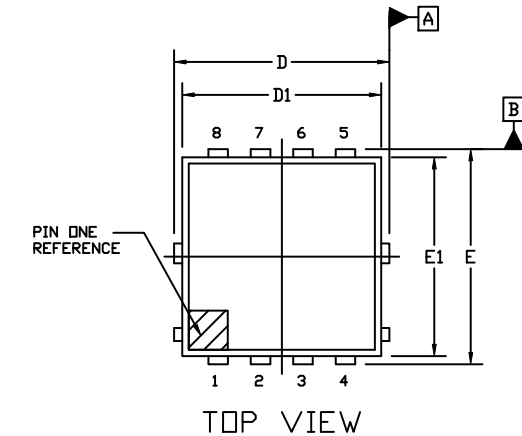
*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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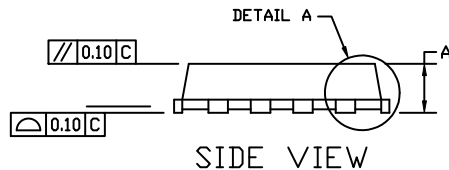
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WDFNW8 3.3x3.3, 0.65P (Full-Cut μ8FL WF)
CASE 515AN
ISSUE O

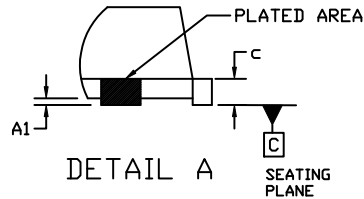
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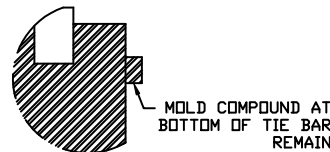
TOP VIEW



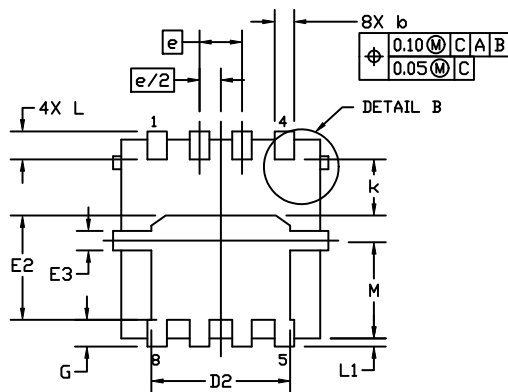
SIDE VIEW



DETAIL A

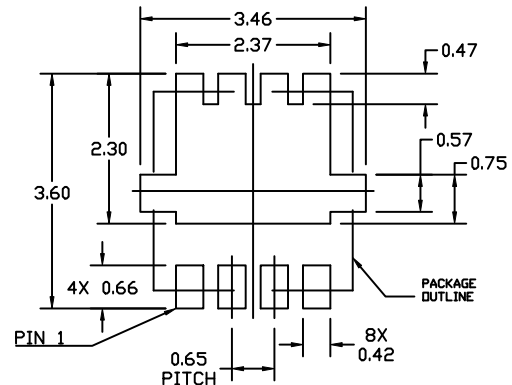


DETAIL B

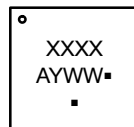


BOTTOM VIEW

DIM	MILLIMETERS		
	MIN.	NDM.	MAX.
A	0.70	0.75	0.80
A1	0.00	----	0.05
b	0.23	0.30	0.40
c	0.15	0.20	0.25
D	3.05	3.30	3.55
D1	2.95	3.05	3.15
D2	1.98	2.11	2.24
E	3.05	3.30	3.55
E1	2.95	3.05	3.15
E2	1.47	1.60	1.73
E3	0.23	0.30	0.40
e	0.65 BSC		
G	0.30	0.41	0.51
K	0.65	0.80	0.95
L	0.30	0.43	0.59
L1	0.06	0.13	0.20
M	1.40	1.50	1.60


RECOMMENDED
MOUNTING FOOTPRINT

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

**GENERIC
MARKING DIAGRAM***


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

(Note: Microdot may be in either location)

*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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