onsemi

MOSFET – Power, Single, N-Channel

40 V, 14 mΩ, 26 A

NVTFS5C478NL

V$_{(BR)DSS}$	R$_{DS(on)}$ MAX	I$_D$ MAX
40 V	14 mΩ @ 10 V	26 A
	25 mΩ @ 4.5 V	

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
- NVTFS5C478NLWF – Wettable Flanks Product
- AEC–Q101 Qualified and PPAP Capable
- These Devices are Pb–Free and are RoHS Compliant

N–Channel

D (5 – 8)

G (4)

S (1, 2, 3)

WDFN8 3.3x3.3, 0.65P
CASE 511AB

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

MARKING DIAGRAM

```
1
S        D
S  XXXX  D
S  AYWW■ D
G        D
```

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.

MAXIMUM RATINGS (T$_J$ = 25°C unless otherwise noted)

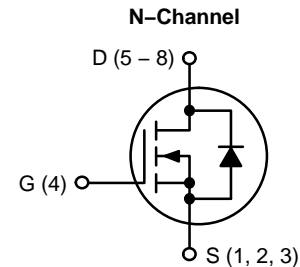| Parameter			Symbol	Value	Unit
Drain–to–Source Voltage			V$_{DSS}$	40	V
Gate–to–Source Voltage			V$_{GS}$	±20	V
Continuous Drain Current R$_{θJC}$ (Notes 1, 2, 3, 4)	Steady State	T$_C$ = 25°C	I$_D$	26	A
		T$_C$ = 100°C		18	
Power Dissipation R$_{θJC}$ (Notes 1, 2, 3)		T$_C$ = 25°C	P$_D$	20	W
		T$_C$ = 100°C		10	
Continuous Drain Current R$_{θJA}$ (Notes 1, 3, 4)	Steady State	T$_A$ = 25°C	I$_D$	10	A
		T$_A$ = 100°C		8.0	
Power Dissipation R$_{θJA}$ (Notes 1, 3)		T$_A$ = 25°C	P$_D$	3.0	W
		T$_A$ = 100°C		2.0	
Pulsed Drain Current	T$_A$ = 25°C, t$_p$ = 10 μs		I$_{DM}$	104	A
Operating Junction and Storage Temperature			T$_J$, T$_{stg}$	–55 to +175	°C
Source Current (Body Diode)			I$_S$	15	A
Single Pulse Drain–to–Source Avalanche Energy (I$_{L(pk)}$ = 1.4 A)			E$_{AS}$	43	mJ
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.
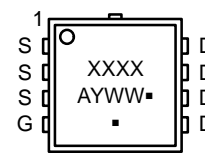
THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Value	Unit
Junction–to–Case – Steady State (Note 3)	R$_{θJC}$	8.2	°C/W
Junction–to–Ambient – Steady State (Note 3)	R$_{θJA}$	51	

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.

NVTFS5C478NL

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		40	–	–	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 40 V	T_J = 25°C	–	–	10	μA
			T_J = 125°C	–	–	250	
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 = 20 μA		1.2	–	2.2	V
Drain–to–Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 5 A		–	11.5	14	mΩ
		V_{GS} = 4.5 V, I_D = 5 A		–	20	25	
Forward Transconductance	g_{FS}	V_{DS} = 15 V, I_D = 15 A		–	25	–	S
CHARGES AND CAPACITANCES							
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 25 V		–	400	–	pF
Output Capacitance	C_{oss}			–	170	–	
Reverse Transfer Capacitance	C_{rss}			–	8.0	–	
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 32 V, I_D = 15 A		–	3.8	–	nC
Threshold Gate Charge	$Q_{G(TH)}$			–	1.0	–	nC
Gate–to–Source Charge	Q_{GS}			–	1.9	–	
Gate–to–Drain Charge	Q_{GD}			–	1.2	–	
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 32 V, I_D = 15 A		–	8.0	–	nC
SWITCHING CHARACTERISTICS (Note 6)							
Turn–On Delay Time	$t_{d(on)}$	V_{GS} = 4.5 V, V_{DS} = 32 V, I_D = 15 A, R_G = 2.5 Ω		–	7.0	–	ns
Rise Time	t_r			–	39	–	
Turn–Off Delay Time	$t_{d(off)}$			–	14	–	
Fall Time	t_f			–	5.0	–	
DRAIN–SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 10 A	T_J = 25°C	–	0.85	1.2	V
			T_J = 125°C	–	0.70	–	
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = 15 A		–	15	–	ns
Charge Time	t_a			–	7.0	–	
Discharge Time	t_b			–	8.0	–	
Reverse Recovery Charge	Q_{RR}			–	5.0	–	nC

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.
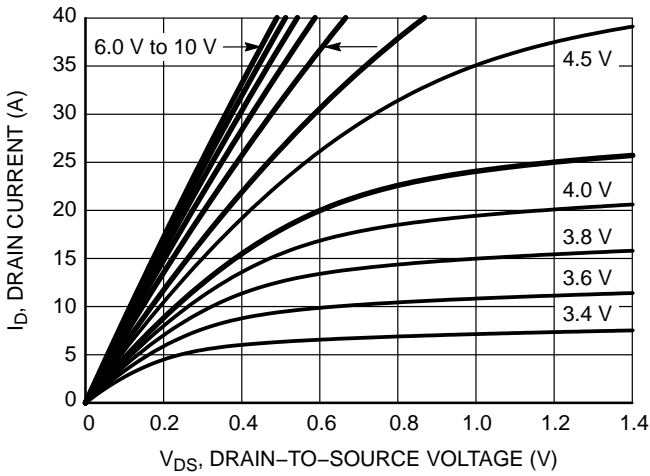
NVTFS5C478NL

TYPICAL CHARACTERISTICS

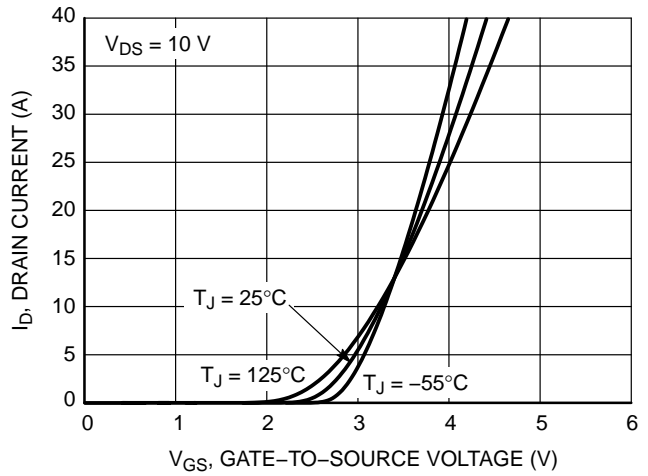Figure 1. On–Region Characteristics

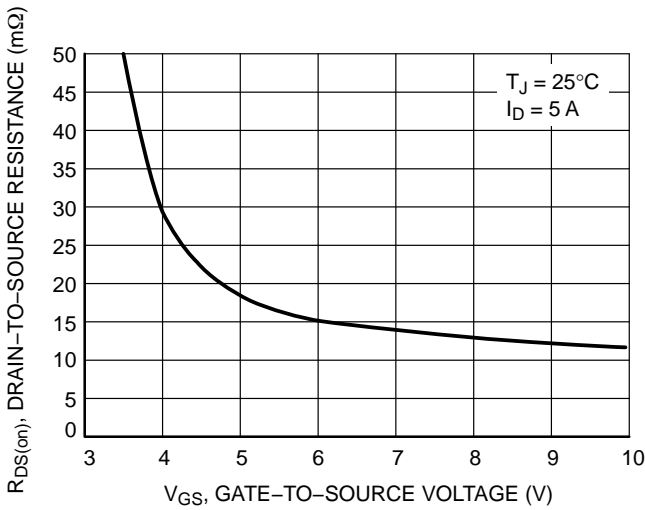Figure 2. Transfer Characteristics

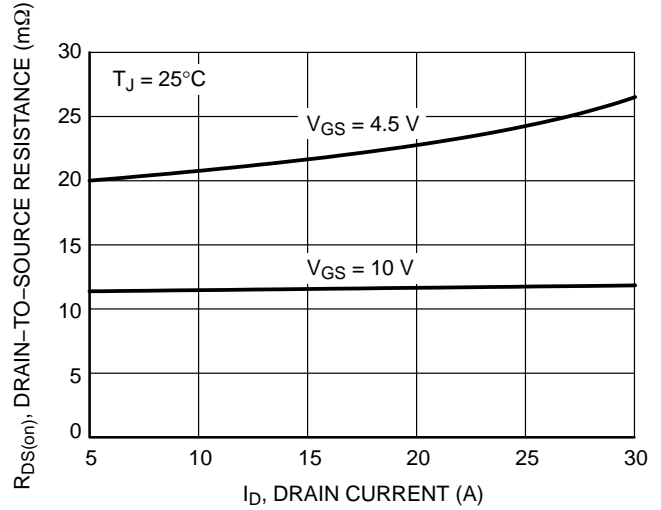Figure 3. On–Resistance vs. Gate–to–Source Voltage

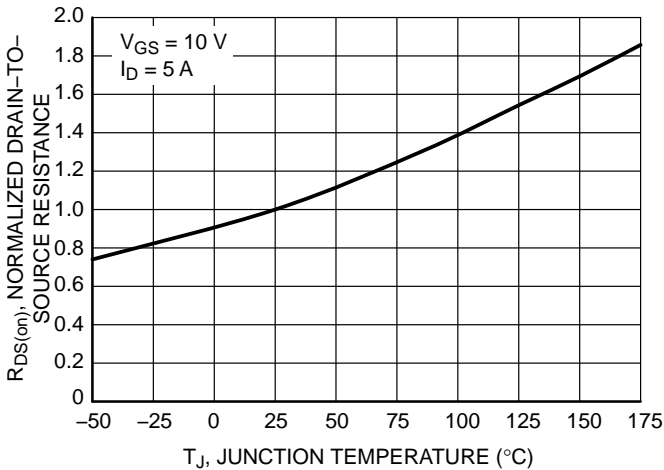
Figure 4. On–Resistance vs. Drain Current and Gate Voltage
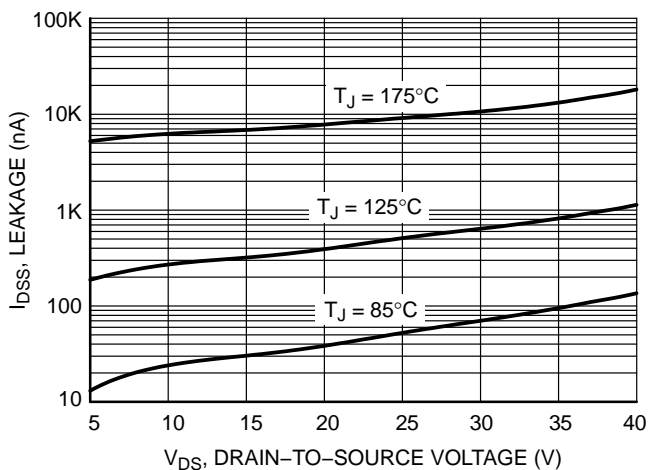

Figure 5. On–Resistance Variation with Temperature

Figure 6. Drain–to–Source Leakage Current vs. Voltage
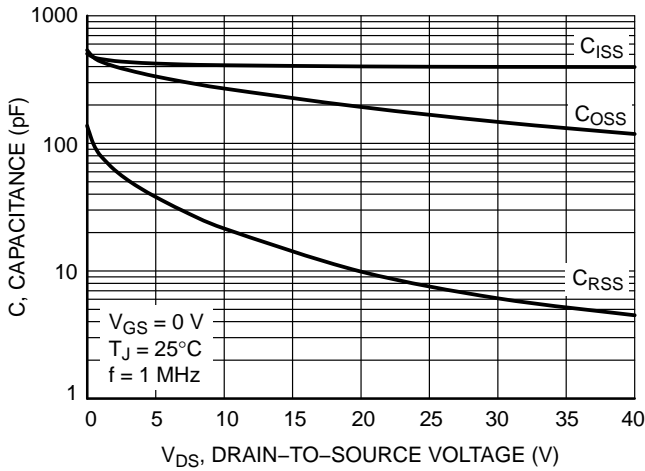
NVTFS5C478NL

TYPICAL CHARACTERISTICS
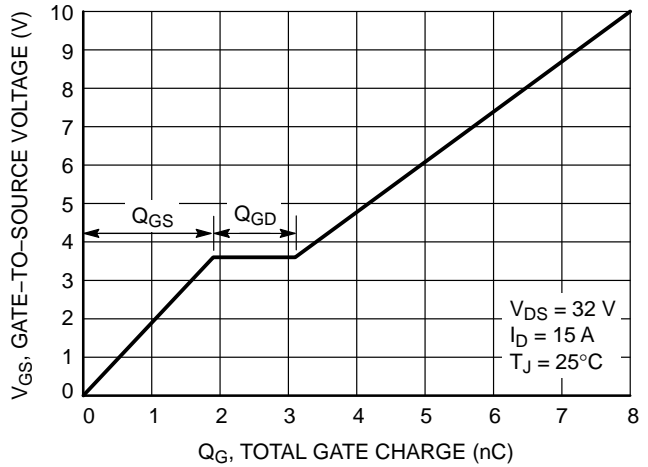

Figure 7. Capacitance Variation
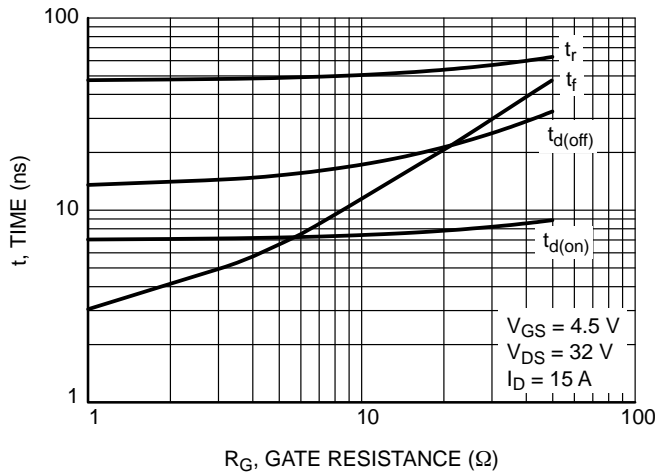

Figure 8. Gate−to−Source Voltage vs. Total Charge

Figure 9. Resistive Switching Time Variation vs. Gate Resistance
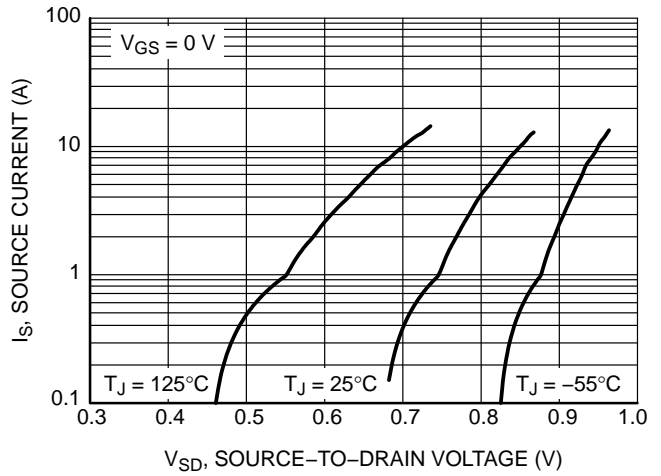
Figure 10. Diode Forward Voltage vs. Current
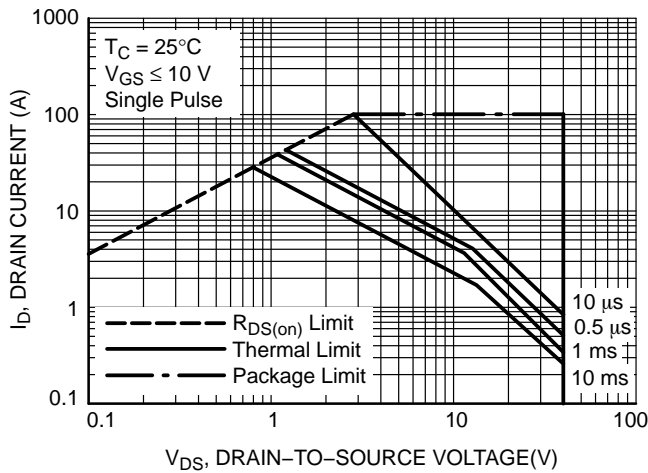
Figure 11. Maximum Rated Forward Biased Safe Operating Area
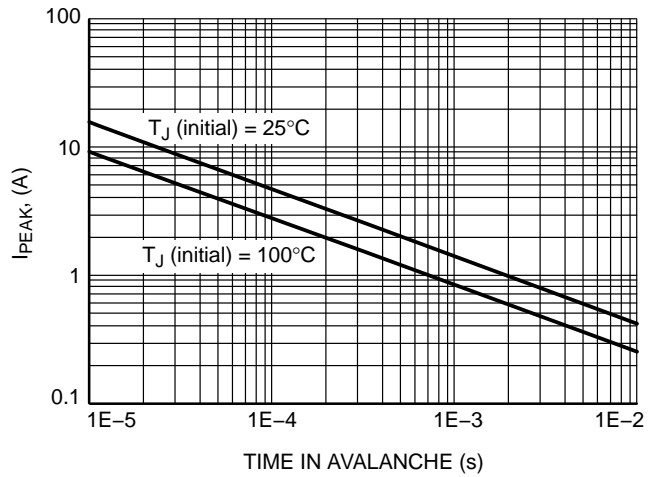
Figure 12. I_{PEAK} vs. Time in Avalanche

NVTFS5C478NL

TYPICAL CHARACTERISTICS
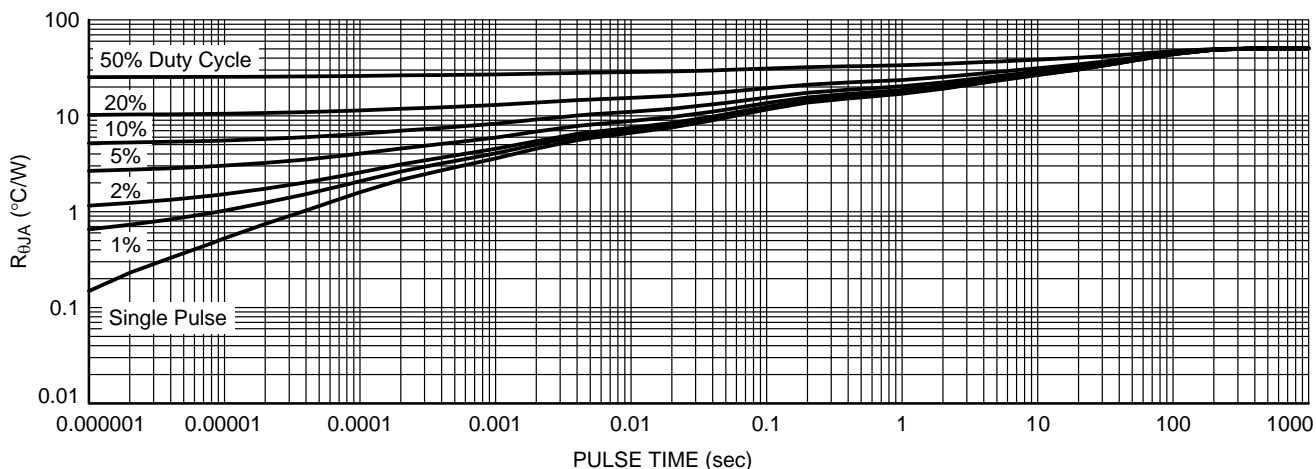
Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping†
NVTFS5C478NLTAG	478L	WDFN8 3.3x3.3, 0.65P (Pb–Free)	1500 / Tape & Reel
NVTFS5C478NLWFTAG	78LW	WDFNW8 3.3x3.3, 0.65P (Full–Cut μ8FL WF) (Pb–Free)	1500 / 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.

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

SCALE 2:1

DATE 23 APR 2012
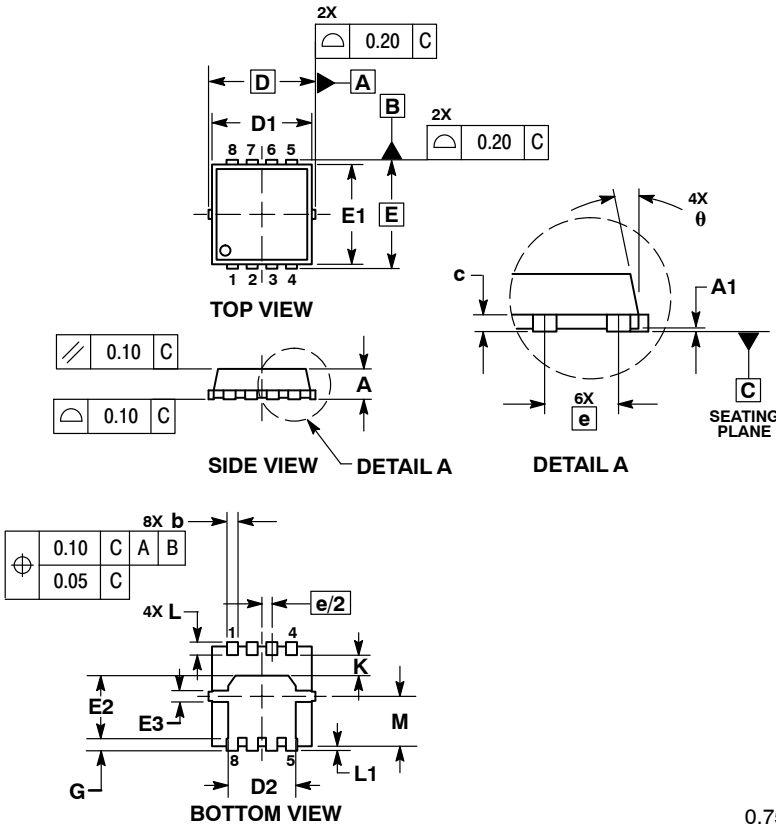
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

TOP VIEW

SIDE VIEW — **DETAIL A**

DETAIL A

SEATING PLANE

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 °

BOTTOM VIEW

GENERIC MARKING DIAGRAM*

1
XXXXX
AYWW■
■

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.

SOLDERING FOOTPRINT*

PACKAGE OUTLINE

8X
0.42

0.65 PITCH

4X
0.66

3.60

2.30

0.75
0.57

0.47

2.37

3.46
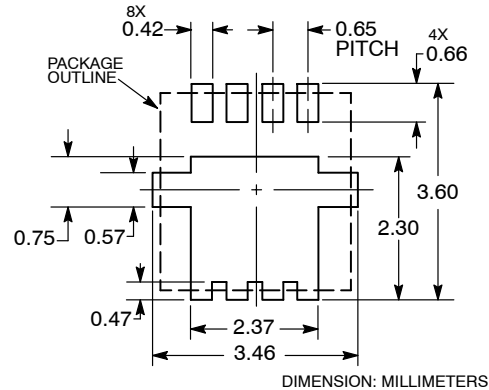
DIMENSION: MILLIMETERS

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

DOCUMENT NUMBER:	98AON30561E	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	WDFN8 3.3X3.3, 0.65P		PAGE 1 OF 1

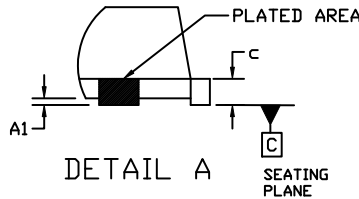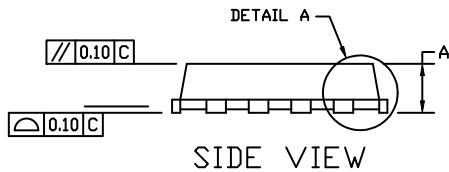**WDFNW8 3.3x3.3, 0.65P (Full−Cut µ8FL WF)**
CASE 515AN
ISSUE O

DATE 25 AUG 2020
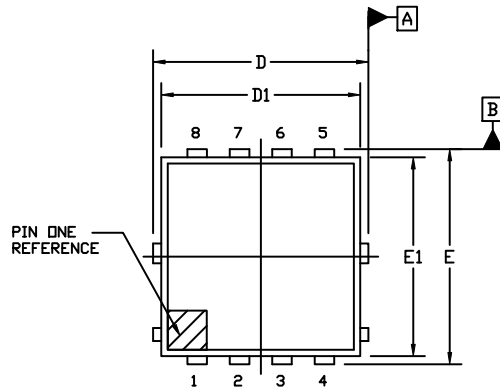
NOTES:

1. DIMENSIONING AND TOLERANCING PER.ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

TOP VIEW

DETAIL A

SIDE VIEW

DETAIL B

BOTTOM VIEW

DIM	MILLIMETERS		
	MIN.	NOM.	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
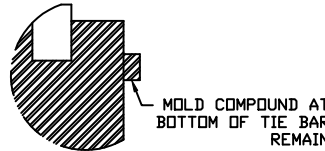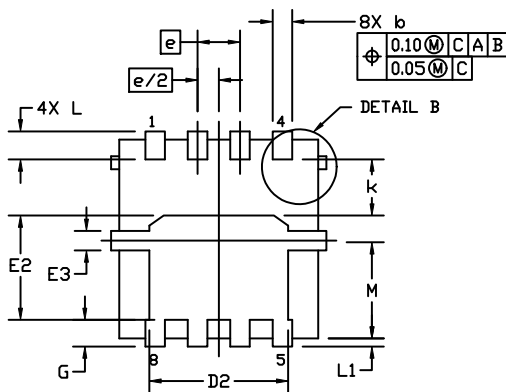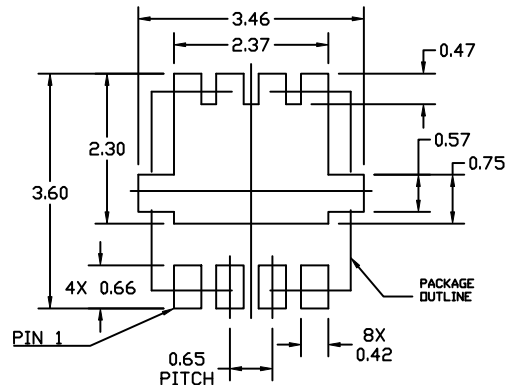
RECOMMENDED
MOUNTING FOOTPRINT

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

**GENERIC
MARKING DIAGRAM***
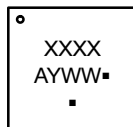
XXXX
AYWW▪

XXXX = 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.

(Note: Microdot may be in either location)

DOCUMENT NUMBER:	98AON24556H		
DESCRIPTION:	WDFNW8 3.3x3.3, 0.65P (Full−Cut µ8FL WF)		PAGE 1 OF 1

ADDITIONAL INFORMATION

◊