

# MOSFET - Power, Single N-Channel 40 V, 0.8 mΩ, 353 A

## NVMFS5C406N

### Features

- Small Footprint (5x6 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- NVMFS5C406NWF – Wettable Flank Option for Enhanced Optical Inspection
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		V <sub>DSS</sub>	40	V
Gate-to-Source Voltage		V <sub>GS</sub>	±20	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	T <sub>C</sub> = 25°C	I <sub>D</sub>	353
		T <sub>C</sub> = 100°C		249
Power Dissipation $R_{\theta JC}$ (Note 1)		T <sub>C</sub> = 25°C	P <sub>D</sub>	179
		T <sub>C</sub> = 100°C		90
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub>	52
		T <sub>A</sub> = 100°C		37
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)		T <sub>A</sub> = 25°C	P <sub>D</sub>	3.9
		T <sub>A</sub> = 100°C		1.9
Pulsed Drain Current	T <sub>A</sub> = 25°C, t <sub>p</sub> = 10 µs	I <sub>DM</sub>	900	A
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Source Current (Body Diode)		I <sub>S</sub>	149	A
Single Pulse Drain-to-Source Avalanche Energy (I <sub>L(pk)</sub> = 32.5 A)		E <sub>AS</sub>	439	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T <sub>L</sub>	260	°C

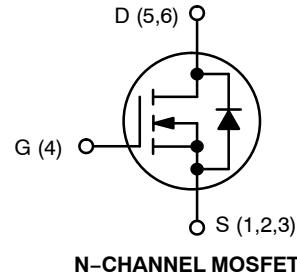
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	R <sub>θJC</sub>	0.84	°C/W
Junction-to-Ambient – Steady State (Note 2)	R <sub>θJA</sub>	38.7	

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. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

V <sub>(BR)DSS</sub>	R <sub>DS(ON) MAX</sub>	I <sub>D MAX</sub>
40 V	0.8 mΩ @ 10 V	353 A



### ORDERING INFORMATION

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

# NVMFS5C406N

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>							
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		40	—	—	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>			—	16.7	—	mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V	T <sub>J</sub> = 25 °C	—	—	10	μA
			T <sub>J</sub> = 125°C	—	—	250	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V		—	—	100	nA
<b>ON CHARACTERISTICS (Note 4)</b>							
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 280 μA		2.0	—	4.0	V
Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			—	-8.0	—	mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 50 A	—	0.64	0.8	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 50 A		—	190	—	S
<b>CHARGES, CAPACITANCES &amp; GATE RESISTANCE</b>							
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 20 V		—	7288	—	pF
Output Capacitance	C <sub>OSS</sub>			—	4530	—	
Reverse Transfer Capacitance	C <sub>rss</sub>			—	150	—	
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V; I <sub>D</sub> = 50 A		—	110	—	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V; I <sub>D</sub> = 50 A		—	21	—	
Gate-to-Source Charge	Q <sub>GS</sub>			—	33	—	
Gate-to-Drain Charge	Q <sub>GD</sub>			—	20	—	
Plateau Voltage	V <sub>GP</sub>			—	4.7	—	V
<b>SWITCHING CHARACTERISTICS (Note 5)</b>							
Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 32 V, I <sub>D</sub> = 50 A, R <sub>G</sub> = 2.5 Ω		—	48	—	ns
Rise Time	t <sub>r</sub>			—	116	—	
Turn-Off Delay Time	t <sub>d(OFF)</sub>			—	133	—	
Fall Time	t <sub>f</sub>			—	52	—	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>							
Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 50 A	T <sub>J</sub> = 25°C	—	0.78	1.2	V
			T <sub>J</sub> = 125°C	—	0.64	—	
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> = 50 A		—	82	—	ns
Charge Time	t <sub>a</sub>			—	39	—	
Discharge Time	t <sub>b</sub>			—	43	—	
Reverse Recovery Charge	Q <sub>RR</sub>			—	120	—	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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

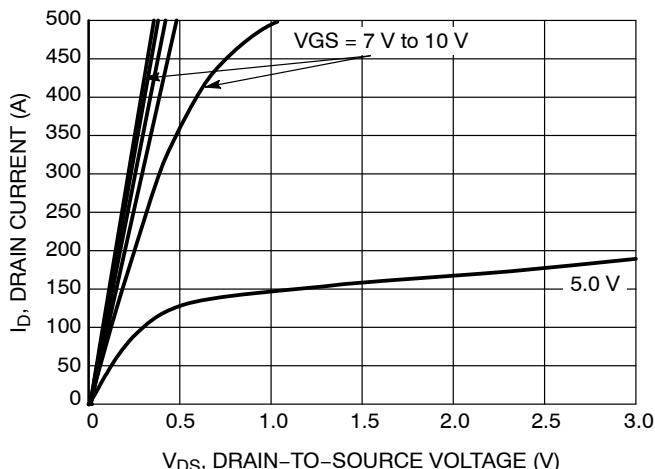


Figure 1. On-Region Characteristics

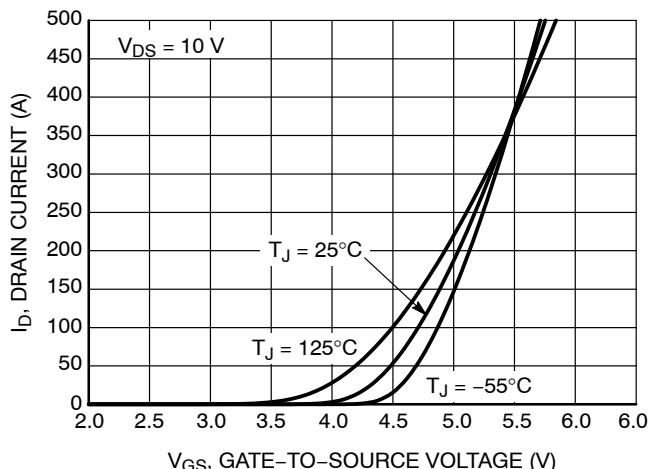


Figure 2. Transfer Characteristics

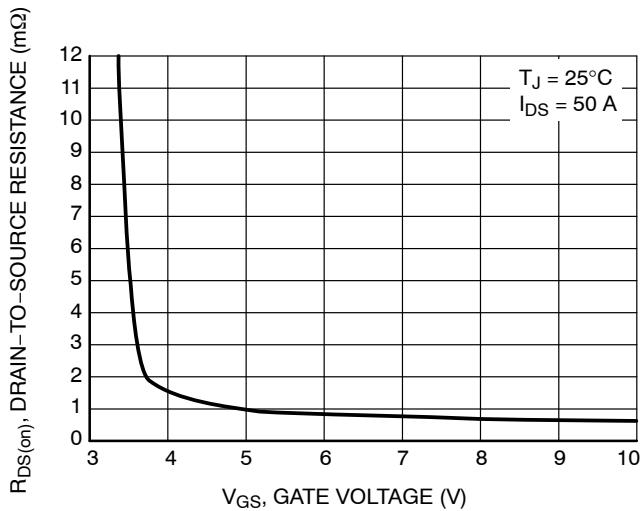


Figure 3. On-Resistance vs. Gate-to-Source Voltage

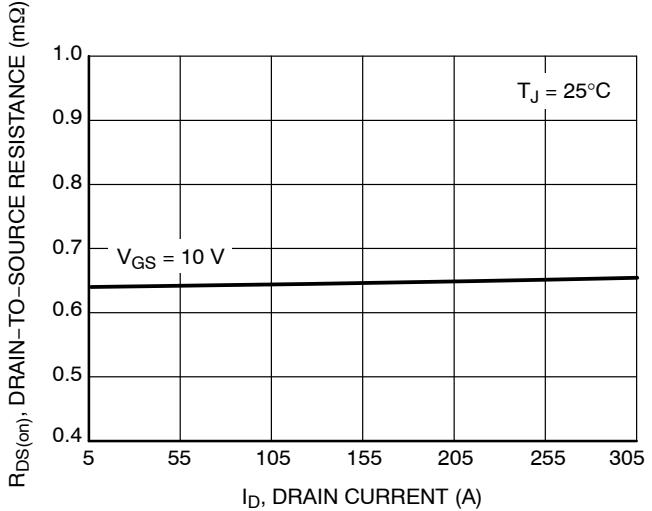


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

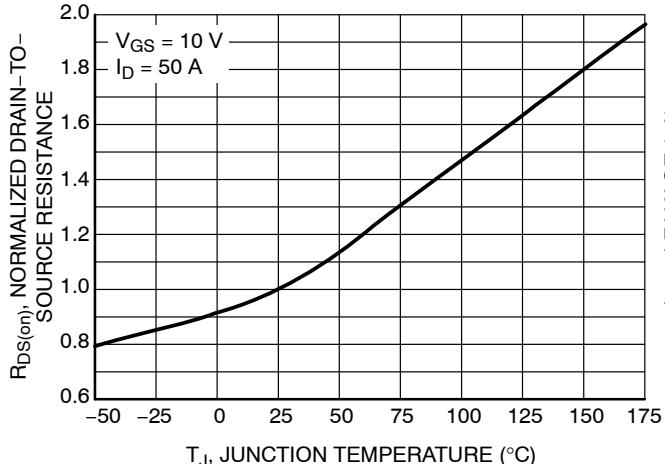


Figure 5. On-Resistance Variation with Temperature

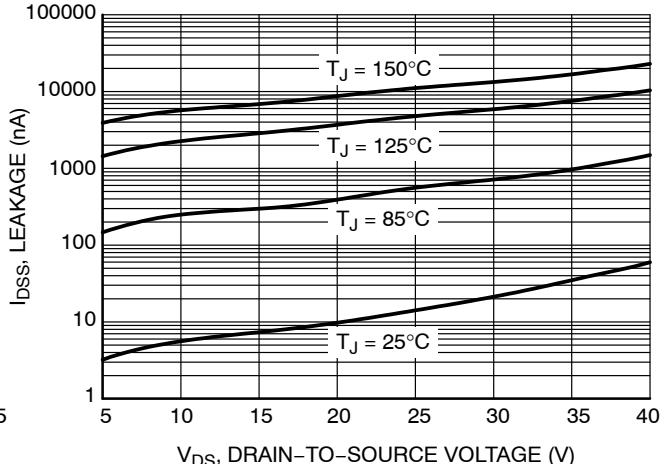


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

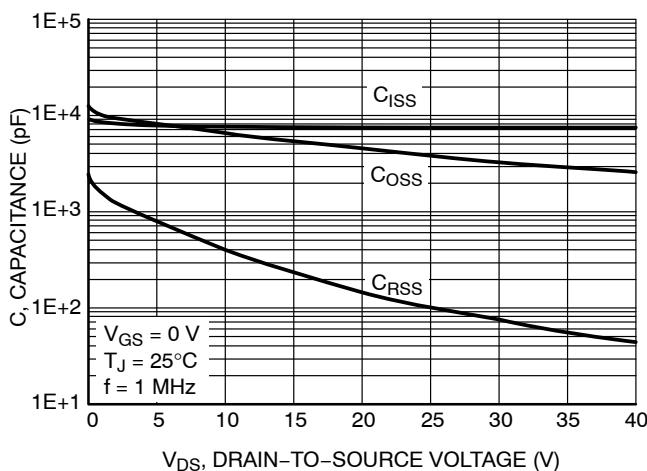


Figure 7. Capacitance Variation

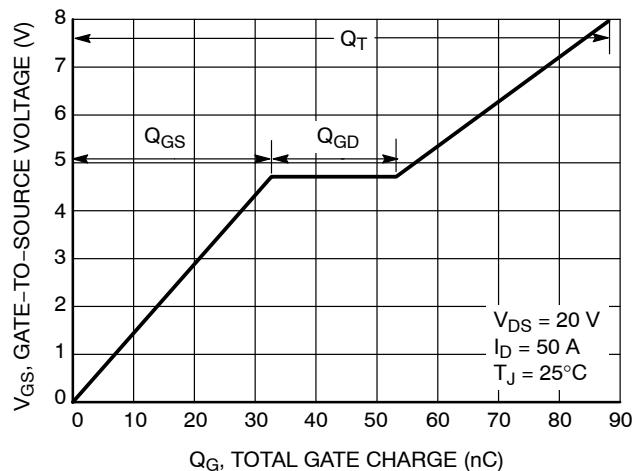


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

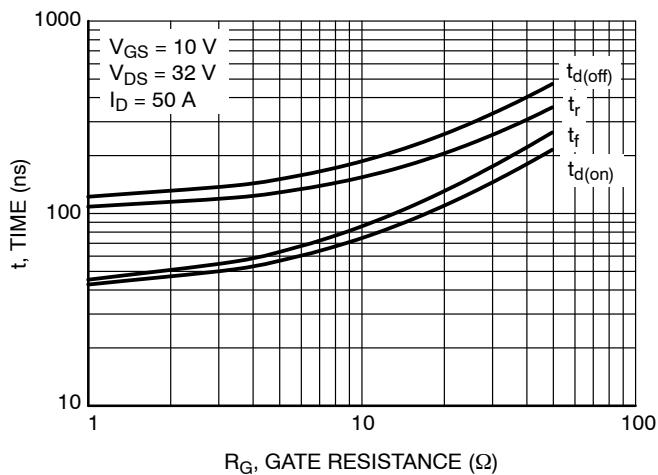


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

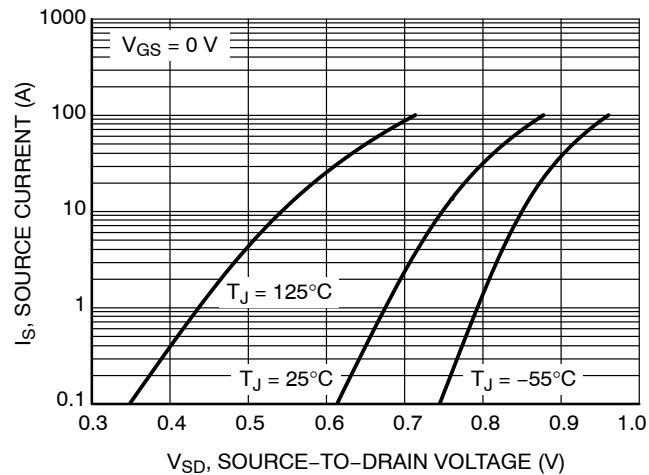


Figure 10. Diode Forward Voltage vs. Current

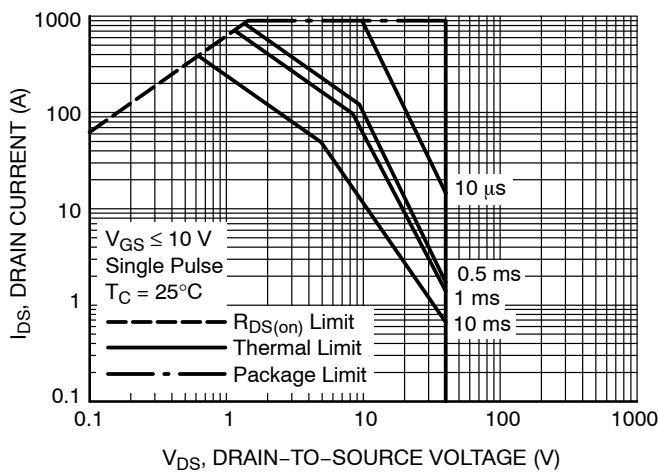


Figure 11. Maximum Rated Forward Biased Safe Operating Area

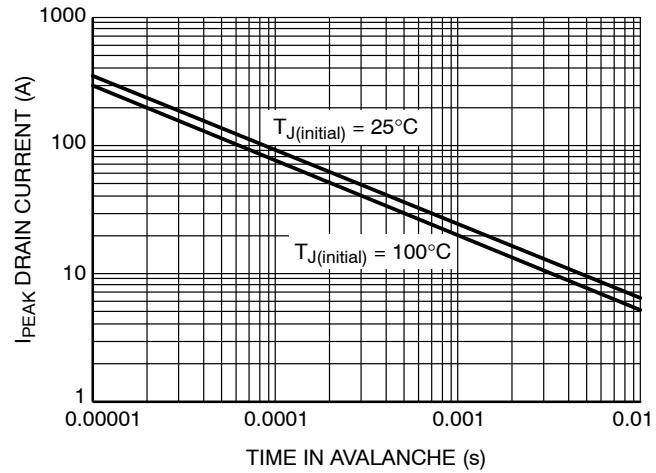


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NVMFS5C406N

## TYPICAL CHARACTERISTICS

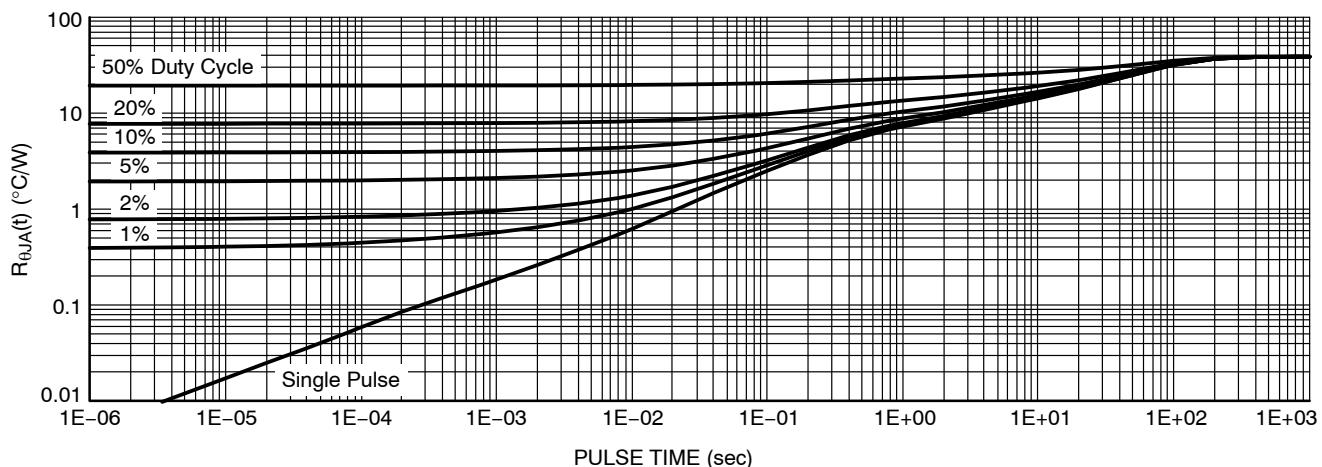
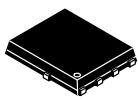


Figure 13. Thermal Characteristics

## DEVICE ORDERING INFORMATION

Device	Case	Marking	Package	Shipping <sup>†</sup>
NVMFS5C406NT1G	506EZ	5C406N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C406NWFT1G	507BA	406NWF	DFNW5 (Pb-Free, Wettable Flanks)	1500 / 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](#).



SCALE 2:1

DFN5, 4.90 x 5.90 x 1.00, 1.27P

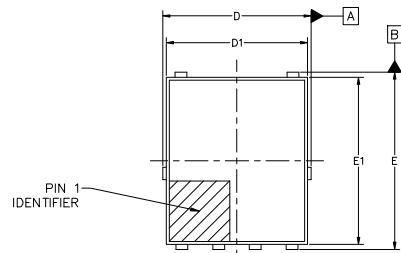
CASE 506EZ

ISSUE B

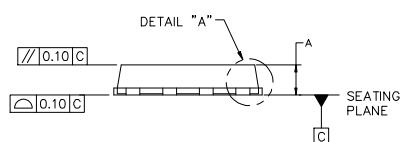
DATE 16 SEP 2024

## NOTES:

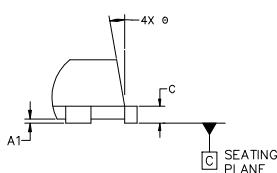
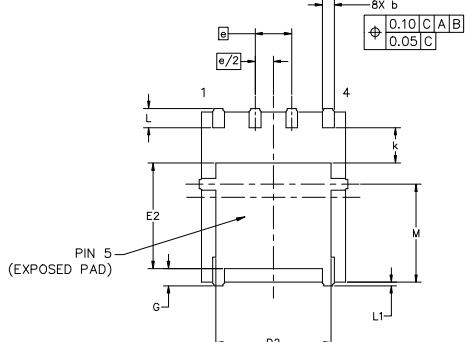
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.



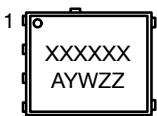
TOP VIEW



SIDE VIEW

DETAIL "A"  
SCALED 2:1

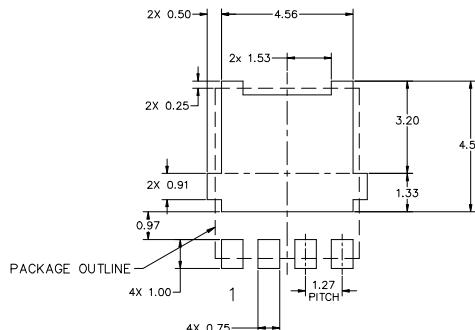
BOTTOM VIEW

GENERIC  
MARKING DIAGRAM\*

XXXXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ZZ = Lot Traceability

\*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.

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.80	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
k	1.10	1.20	1.40
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
Θ	0°	---	12°

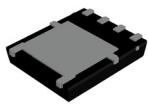


## RECOMMENDED MOUNTING FOOTPRINT

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

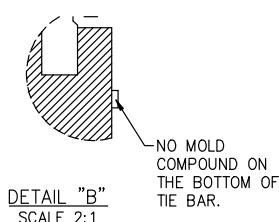
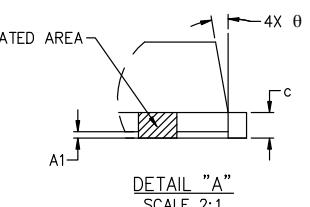
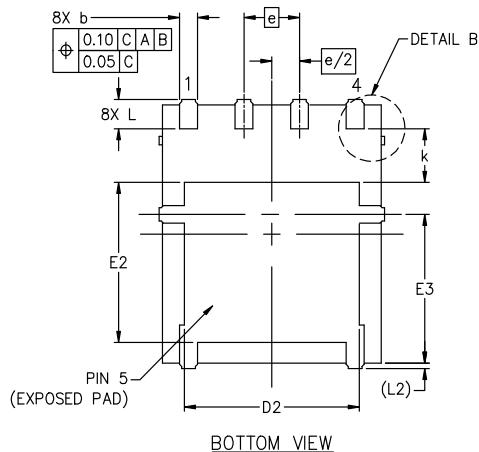
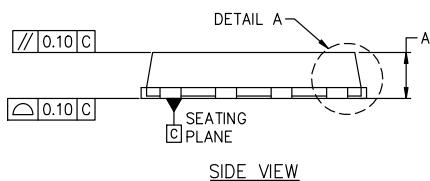
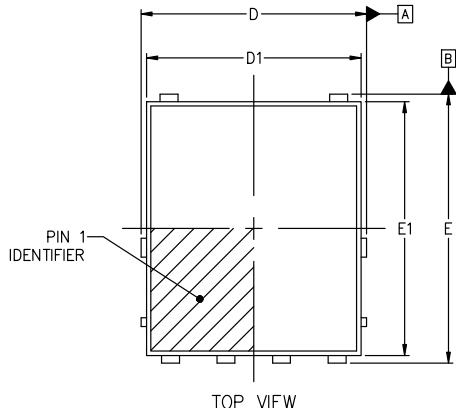
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**DFNW5 4.90x5.90x1.00, 1.27P**  
**CASE 507BA**  
**ISSUE C**

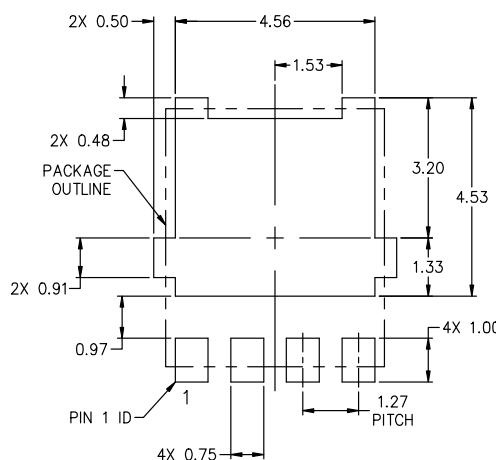
DATE 19 SEP 2024



NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5M-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
4. THIS PACKAGE CONTAINS WETTABLE FLANK DESIGN FEATURES TO AID IN FILLET FORMATION ON THE LEADS DURING MOUNTING.

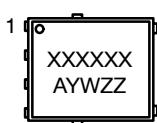
DIM	MILLIMETERS		
	MIN	NOM	MAX
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D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
E3	3.00	3.40	3.80
e		1.27 BSC	
k	1.20	1.35	1.50
L	0.51	0.57	0.71
L2		0.15 REF.	
θ	0°	6°	12°



RECOMMENDED MOUNTING FOOTPRINT\*

\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

**GENERIC  
MARKING DIAGRAM\***



XXXXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ZZ = Lot Traceability

\*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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