

# MOSFET – Power, Single N-Channel

40 V, 378 A, 0.7 mΩ

NVMFS5C404N

## 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
- NVMFS5C404NWF – Wettable Flank Option for Enhanced Optical Inspection
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-to-Source Voltage	40	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	378 267 A
$P_D$	Power Dissipation $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	200 100 W
$I_D$	Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	$T_A = 25^\circ\text{C}$ $T_A = 100^\circ\text{C}$	53 37 A
$P_D$	Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	$T_A = 25^\circ\text{C}$ $T_A = 100^\circ\text{C}$	3.9 1.9 W
$I_{DM}$	Pulsed Drain Current $T_A = 25^\circ\text{C}$ , $t_p = 10 \mu\text{s}$	900	A
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$I_S$	Source Current (Body Diode)	191	A
$E_{AS}$	Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 38 \text{ A}$ )	907	mJ
$T_L$	Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	260	$^\circ\text{C}$

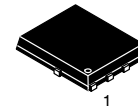
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## THERMAL RESISTANCE MAXIMUM RATINGS

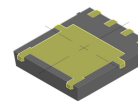
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State	0.75	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 2)	39	

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.

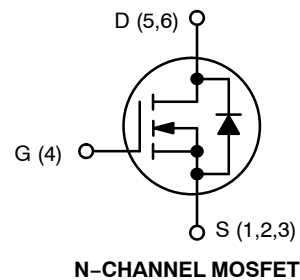
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	0.7 mΩ @ 10 V	378 A



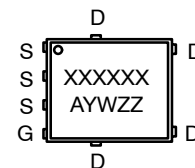
DFN5  
CASE 506EZ



DFNW5  
CASE 507BA



## MARKING DIAGRAMS



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

## ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 5.

# NVMFS5C404N

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

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

V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
V <sub>(BR)DSS</sub> /T <sub>J</sub>	Drain-to-Source Breakdown Voltage Temperature Coefficient			19.7		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	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	
I <sub>GSS</sub>	Gate-to-Source Leakage Current	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V			100	nA

### ON CHARACTERISTICS (Note 4)

V <sub>GS(TH)</sub>	Gate Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0		4.0	V
V <sub>GS(TH)</sub> /T <sub>J</sub>	Threshold Temperature Coefficient			-6.2		mV/°C
R <sub>DS(on)</sub>	Drain-to-Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		0.57	0.7	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 50 A		210		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

C <sub>ISS</sub>	Input Capacitance	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 25 V		8400		pF
C <sub>OSS</sub>	Output Capacitance			4600		
C <sub>RSS</sub>	Reverse Transfer Capacitance			120		
Q <sub>G(TOT)</sub>	Total Gate Charge	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V; I <sub>D</sub> = 50 A		128		nC
Q <sub>G(TH)</sub>	Threshold Gate Charge	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V; I <sub>D</sub> = 50 A		22		
Q <sub>GS</sub>	Gate-to-Source Charge			35		
Q <sub>GD</sub>	Gate-to-Drain Charge			26		
V <sub>GP</sub>	Plateau Voltage			4.3		V

### SWITCHING CHARACTERISTICS (Note 5)

t <sub>d(ON)</sub>	Turn-On Delay Time	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V, I <sub>D</sub> = 50 A, R <sub>G</sub> = 2.5 Ω		16		ns
t <sub>r</sub>	Rise Time			113		
t <sub>d(OFF)</sub>	Turn-Off Delay Time			77		
t <sub>f</sub>	Fall Time			109		

### DRAIN-SOURCE DIODE CHARACTERISTICS

V <sub>SD</sub>	Forward Diode Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 50 A	T <sub>J</sub> = 25°C		0.76	1.2	V
			T <sub>J</sub> = 125°C		0.63		
t <sub>RR</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 50 A			96		ns
t <sub>a</sub>	Charge Time				49		
t <sub>b</sub>	Discharge Time				47		
Q <sub>RR</sub>	Reverse Recovery Charge				189		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

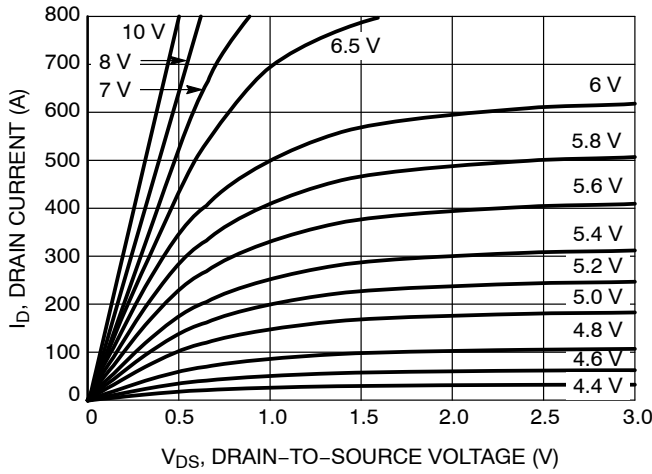


Figure 1. On-Region Characteristics

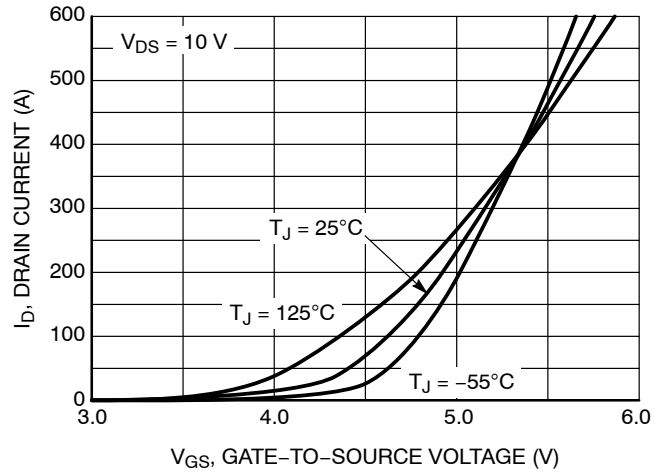


Figure 2. Transfer Characteristics

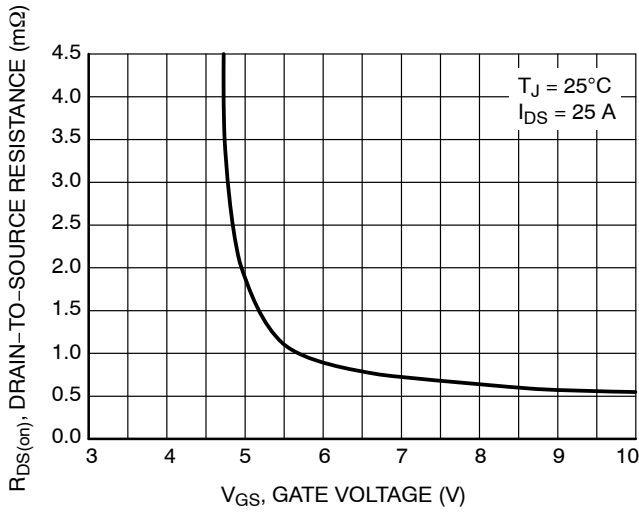


Figure 3. On-Resistance vs. Gate-to-Source Voltage

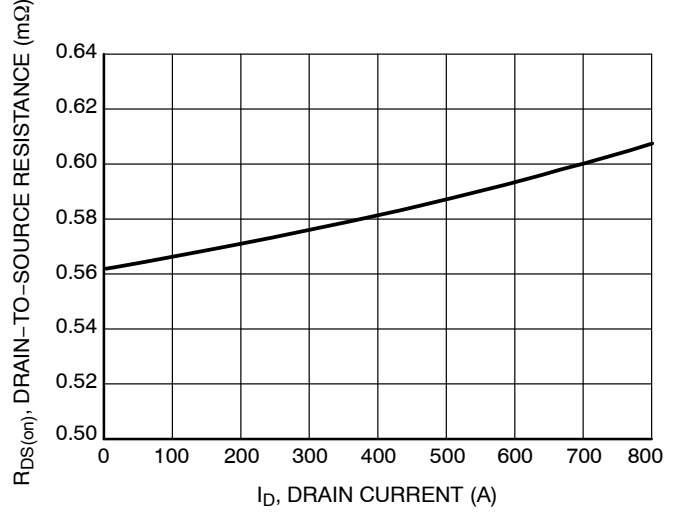


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

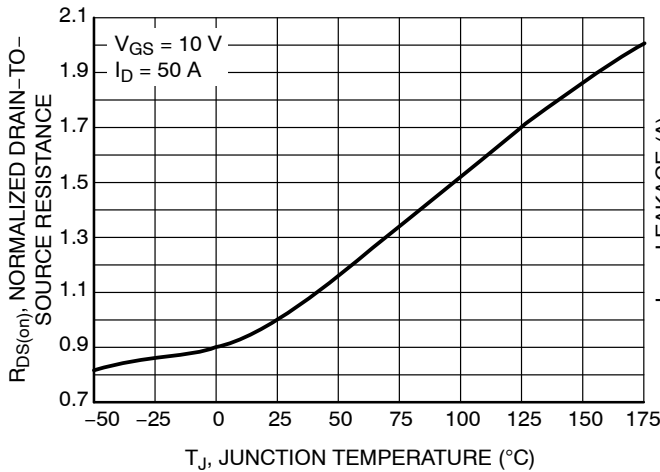


Figure 5. On-Resistance Variation with Temperature

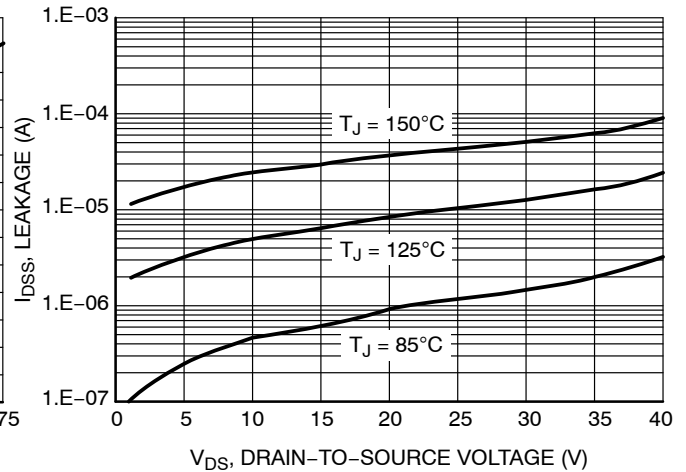


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

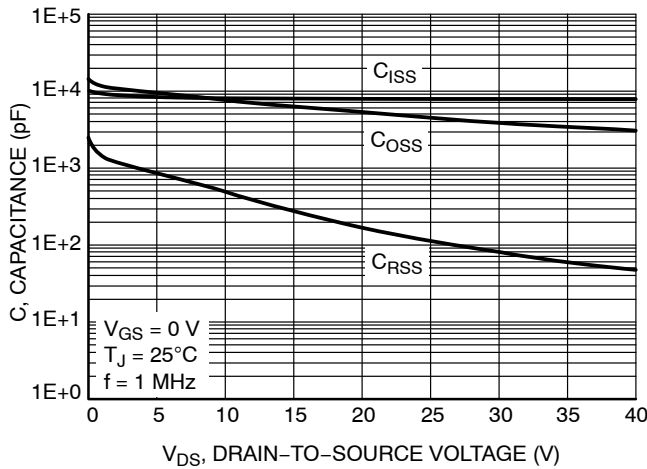


Figure 7. Capacitance Variation

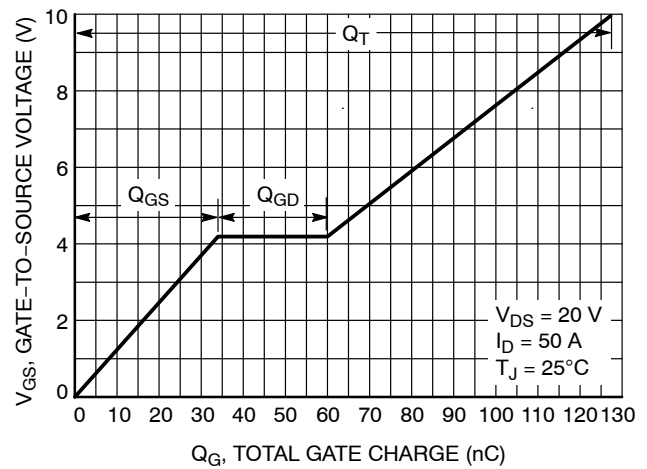


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

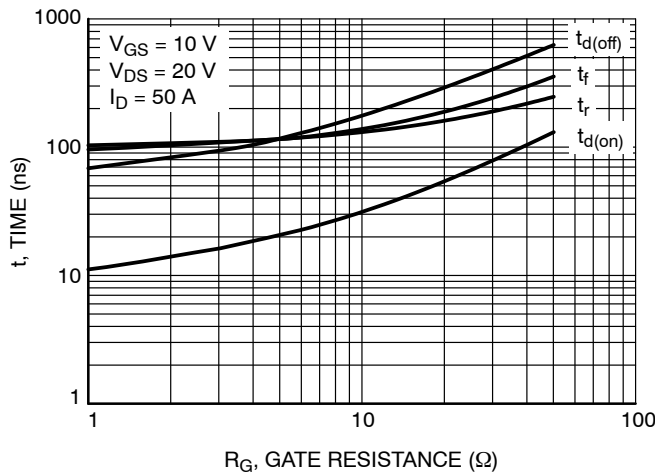


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

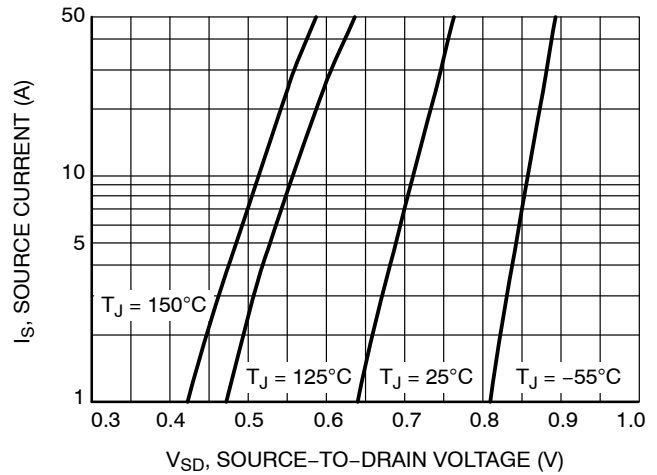


Figure 10. Diode Forward Voltage vs. Current

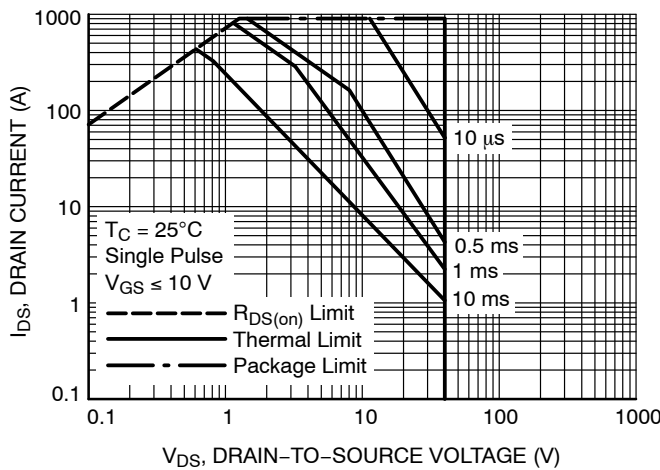


Figure 11. Maximum Rated Forward Biased Safe Operating Area

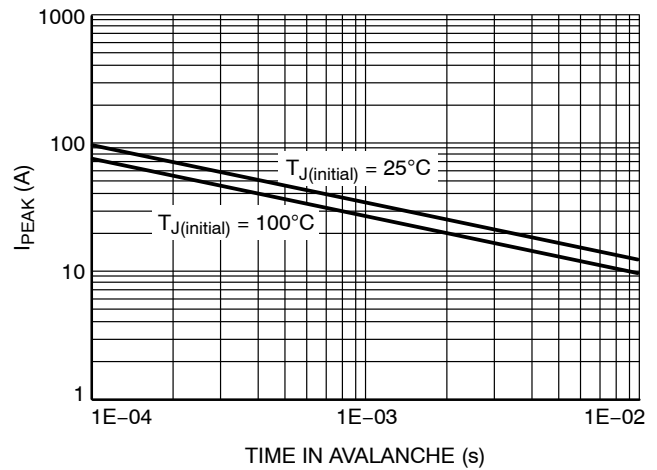


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NVMFS5C404N

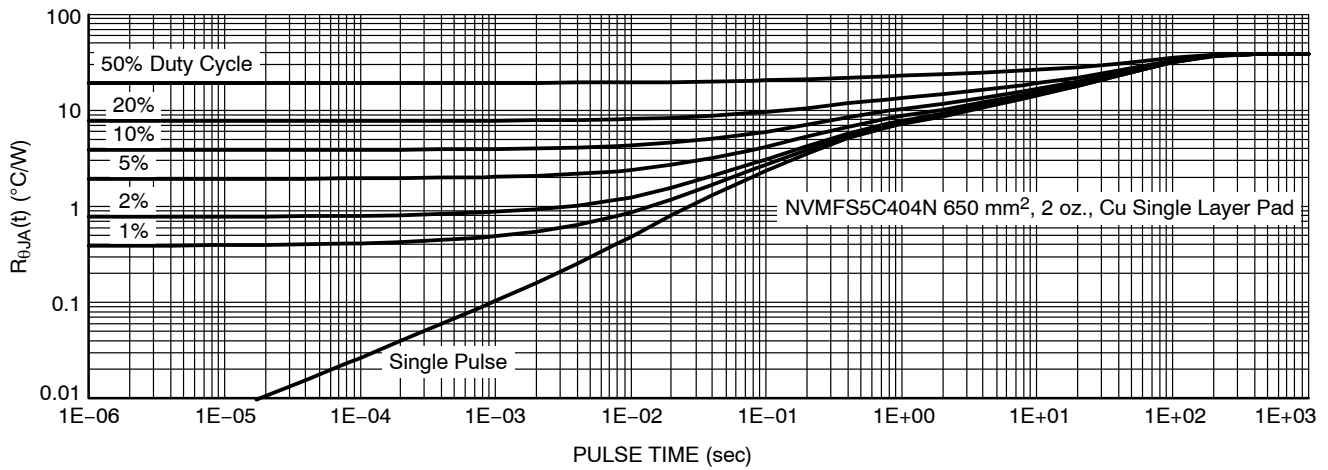


Figure 13. Thermal Characteristics

## DEVICE ORDERING INFORMATION

Device	Case	Marking	Package	Shipping†
NVMFS5C404NT1G	506EZ	5C404N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NET1G	506EZ	5C404N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NAFT1G	506EZ	5C404N	DFN5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFAT1G	507BA	404NWF	DFNW5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFET1G	507BA	404NWF	DFNW5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFET3G	507BA	404NWF	DFNW5 (Pb-Free)	5000 / Tape & Reel

## DISCONTINUED (Note 6)

NVMFS5C404NT3G	506EZ	5C404N	DFN5 (Pb-Free)	5000 / Tape & Reel
NVMFS5C404NWFT1G	507BA	404NWF	DFNW5 (Pb-Free)	1500 / Tape & Reel
NVMFS5C404NWFT3G	507BA	404NWF	DFNW5 (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](#).

6. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on [www.onsemi.com](http://www.onsemi.com).



DFN5, 4.90 x 5.90 x 1.00, 1.27P  
CASE 506EZ  
ISSUE B

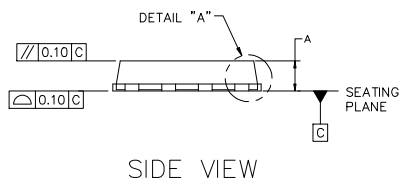
DATE 16 SEP 2024

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

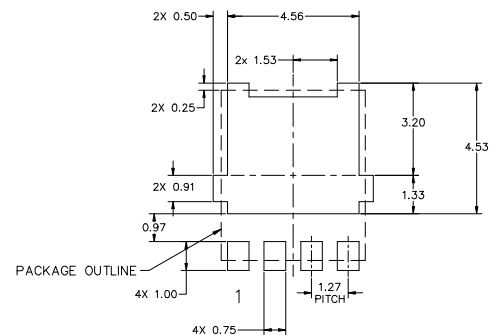
GENERIC  
MARKING DIAGRAM\*



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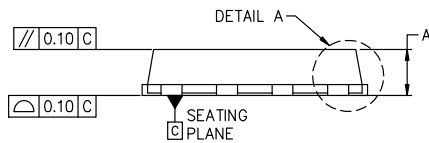
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**DFNW5 4.90x5.90x1.00, 1.27P**  
**CASE 507BA**  
**ISSUE C**

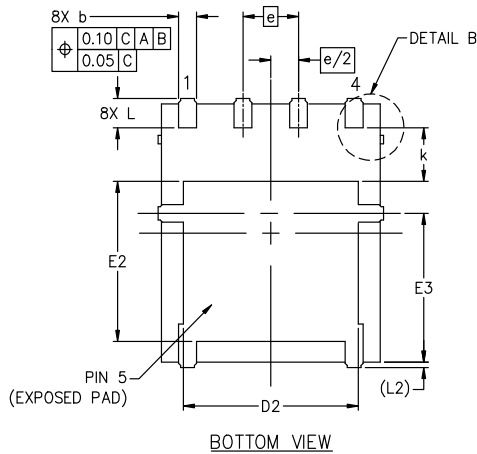
DATE 19 SEP 2024



TOP VIEW



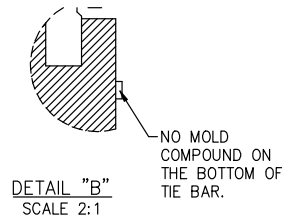
SIDE VIEW



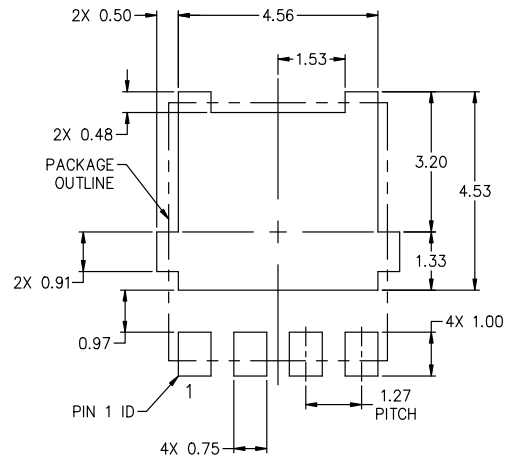
BOTTOM VIEW

## 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.

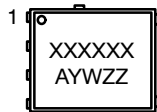


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
E3	3.00	3.40	3.80
e	1.27 BSC		
k	1.20	1.35	1.50
L	0.51	0.57	0.71
L2	0.15 REF.		
θ	0°	6°	12°



## RECOMMENDED MOUNTING FOOTPRINT\*

\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/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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<b>DESCRIPTION:</b>	<b>DFNW5 4.90x5.90x1.00, 1.27P</b>	<b>PAGE 1 OF 1</b>

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