

# MOSFET - Power, DUAL COOL<sup>®</sup> N-Channel, DFN8 5x6 40 V, 0.85 mΩ, 316 A NVMFSC0D9N04CL

## Features

- Advanced Dual-sided Cooled Packaging
- Small Footprint (5x6 mm) for Compact Design
- Ultra Low R<sub>DS(on)</sub> to Minimize Conduction Losses
- Low Q<sub>G</sub> and Capacitance to Minimize Driver Losses
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant
- MSL1 Robust Packaging Design

## 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 <sub>θJC</sub> (Note 2)	Steady State	T <sub>C</sub> = 25°C	I <sub>D</sub> 316 A
		T <sub>C</sub> = 100°C	I <sub>D</sub> 224 A
Power Dissipation R <sub>θJC</sub> (Note 2)	Steady State	T <sub>C</sub> = 25°C	P <sub>D</sub> 166 W
		T <sub>C</sub> = 100°C	P <sub>D</sub> 83 W
Continuous Drain Current R <sub>θJA</sub> (Notes 1, 2)	Steady State	T <sub>A</sub> = 25°C	I <sub>D</sub> 50 A
		T <sub>A</sub> = 100°C	I <sub>D</sub> 35 A
Power Dissipation R <sub>θJA</sub> (Notes 1, 2)	Steady State	T <sub>A</sub> = 25°C	P <sub>D</sub> 4.1 W
		T <sub>A</sub> = 100°C	P <sub>D</sub> 2.0 W
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>	138	A
Single Pulse Drain-to-Source Avalanche Energy (I <sub>L(pk)</sub> = 29 A)	E <sub>AS</sub>	706	mJ
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)	T <sub>L</sub>	300	°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.

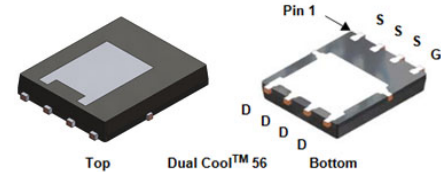
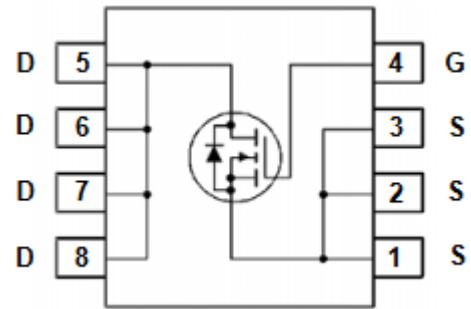
## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Bottom) - Steady State (Note 2)	R <sub>θJC</sub>	0.9	°C/W
Junction-to-Case (Top) - Steady State (Note 2)	R <sub>θJC</sub>	1.4	
Junction-to-Ambient - Steady State (Note 2)	R <sub>θJA</sub>	37	

1. Surface-mounted on FR4 board using a 1 in<sup>2</sup> pad size, 1 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

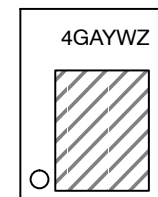
V <sub>(BR)DSS</sub>	R <sub>DS(ON) MAX</sub>	I <sub>D MAX</sub>
40 V	0.85 mΩ @ 10 V	316 A
	1.3 mΩ @ 4.5 V	

## N-Channel MOSFET



DFN8/DFN8 (SO8FL)  
CASES 506EG & 507BC

## MARKING DIAGRAM



- 4G = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- Z = Assembly Lot Code

## ORDERING INFORMATION

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

# NVMFSC0D9N04CL

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

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

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>	I <sub>D</sub> = 250 μA, ref to 25°C		5		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		100	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = +20 V			100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.2		2.0	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA, ref to 25°C		-8.6		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 50 A	0.69	0.85	mΩ
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 50 A	1.0	1.3	

### CHARGES & CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 25 V		8860		pF
Output Capacitance	C <sub>OSS</sub>			3400		
Reverse Transfer Capacitance	C <sub>RSS</sub>			90		
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		135		nC
Gate-to-Source Charge	Q <sub>GS</sub>			23		
Gate-to-Drain Charge	Q <sub>GD</sub>			17		
Plateau Voltage	V <sub>GP</sub>			2.9		

### SWITCHING CHARACTERISTICS (Note 3)

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		54		ns
Rise Time	t <sub>r</sub>			160		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			220		
Fall Time	t <sub>f</sub>			170		

### DRAIN-SOURCE DIODE CHARACTERISTICS

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		0.8	1.2	V
			T <sub>J</sub> = 125°C		0.65		
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		91		ns	
Charge Time	t <sub>a</sub>			42			
Discharge Time	t <sub>b</sub>			49			
Reverse Recovery Charge	Q <sub>RR</sub>			159			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.

3. 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

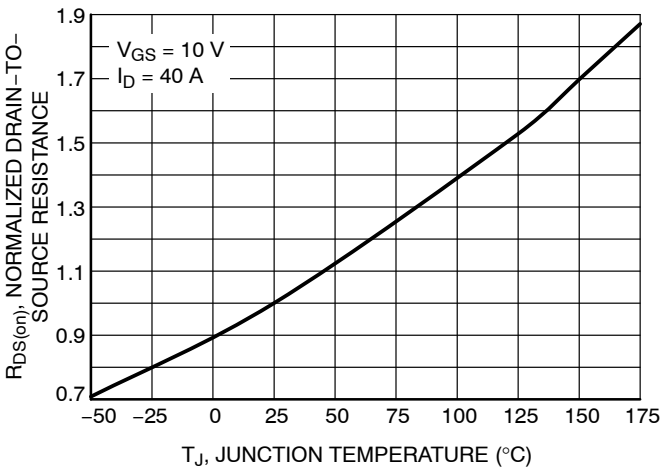


Figure 5. On-Resistance Variation with Temperature

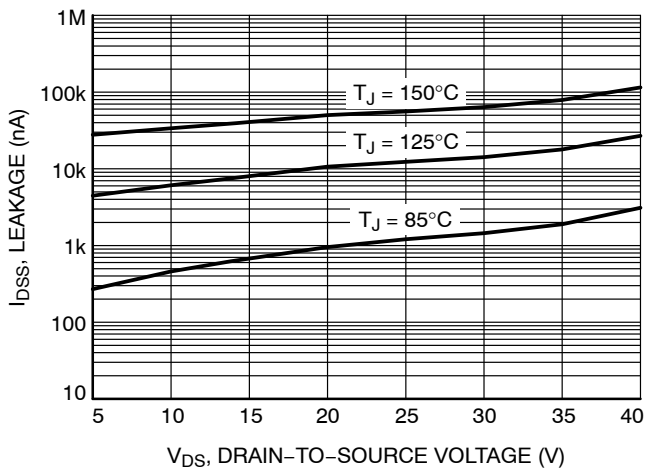


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NVMFSC0D9N04CL

## TYPICAL CHARACTERISTICS



Figure 7. Capacitance Variation

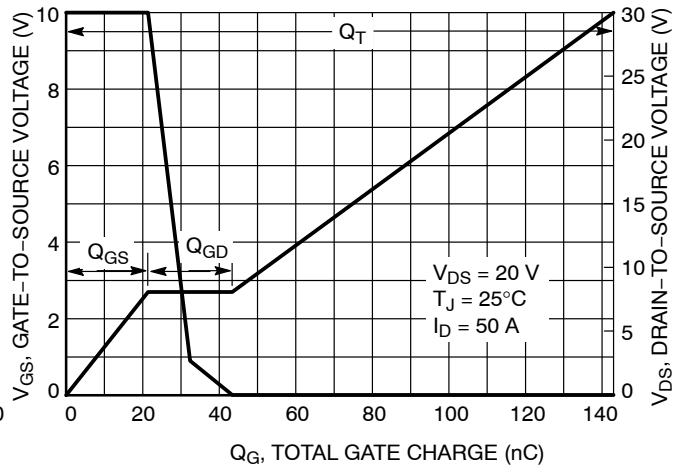


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

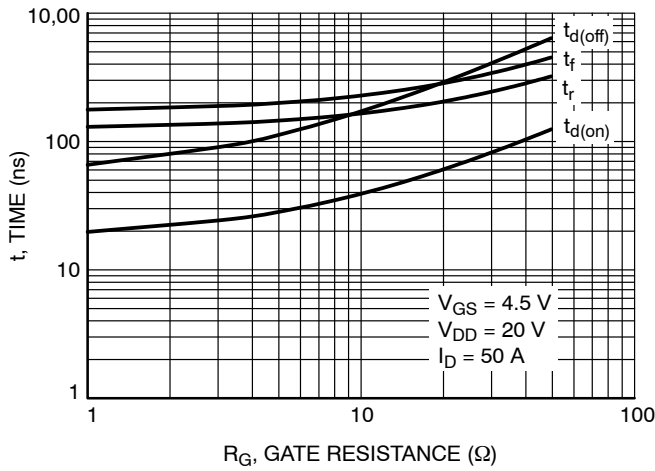


Figure 9. Resistive Switching Time Variation vs. Gate Resistance



Figure 10. Diode Forward Voltage vs. Current

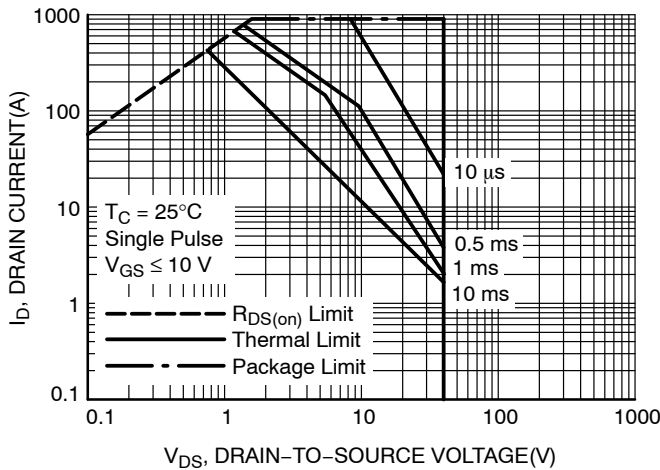


Figure 11. Safe Operating Area

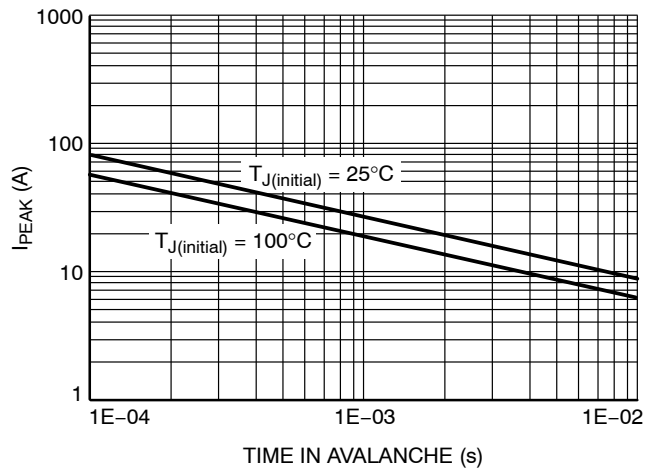


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

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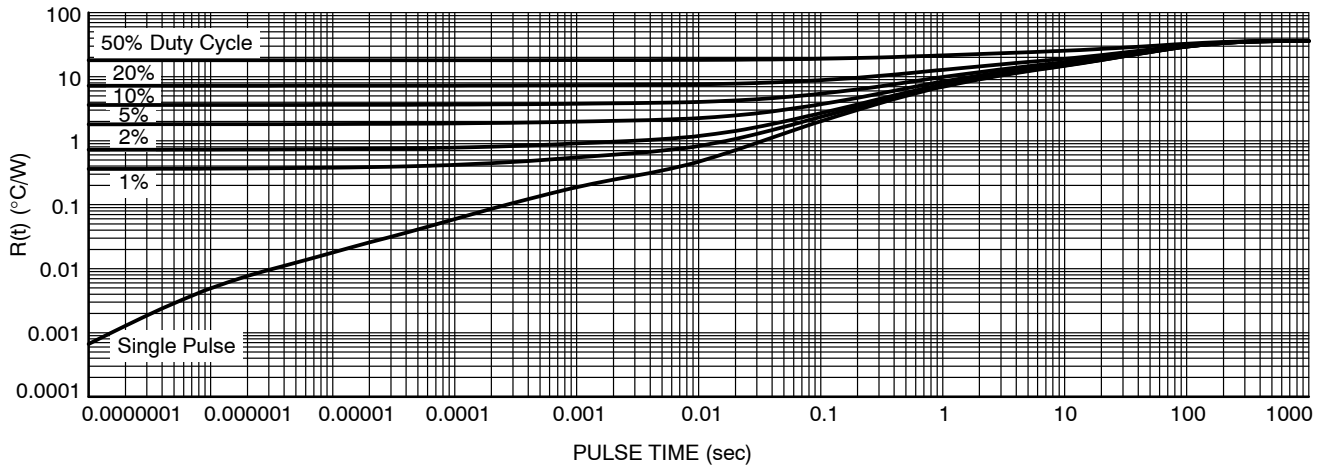


Figure 13. Thermal Characteristics

## ORDERING INFORMATION

Device	Device Marking	Package	Shipping†
NVMFSC0D9N04CL	4G	DFN8 5x6 (Pb-Free/Halogen Free)	3000 / Tape & Reel
NVMFWSC0D9N04CL	410LWC	DFNW8 5x6 (Pb-Free/Halogen Free, Wettable Flank)	3000 / Tape & Reel

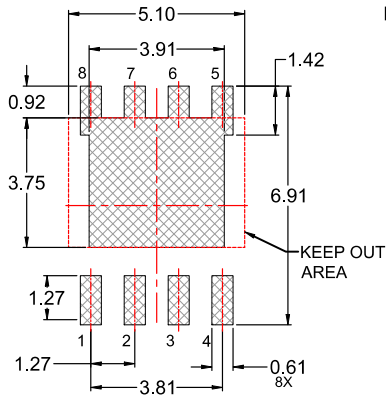
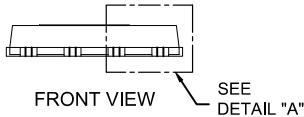
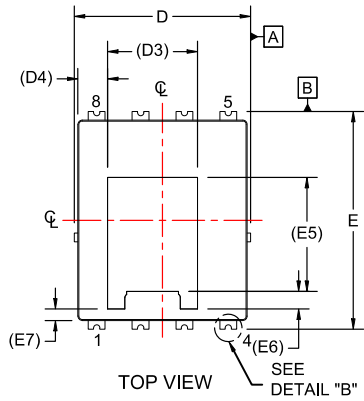
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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# NVMFSC0D9N04CL

## PACKAGE DIMENSIONS

### DFNW8 (SO8FL) 5.0x6.3, 1.27P CASE 507BC ISSUE O



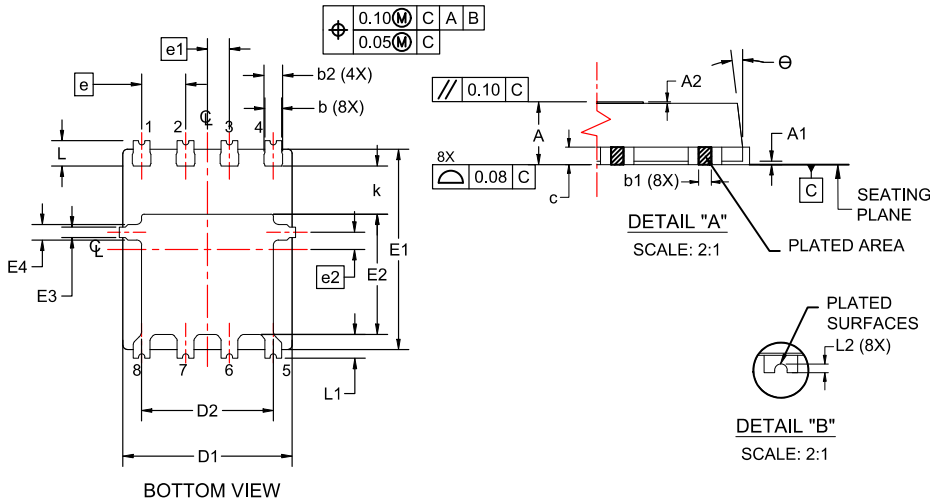
#### LAND PATTERN RECOMMENDATION

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

#### NOTES:

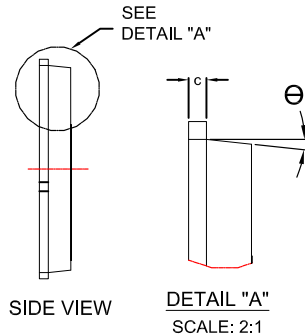
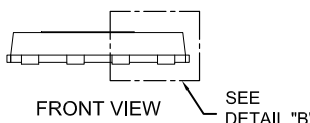
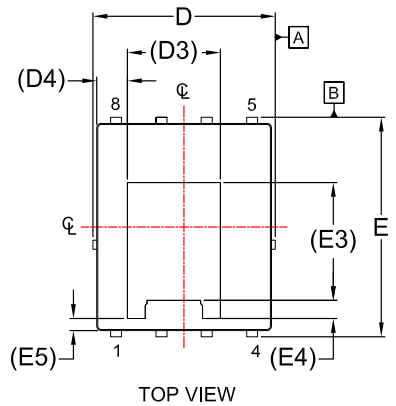
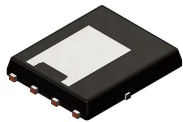
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.90	1.00
A1	0.00	-	0.05
A2	0.00	-	0.05
b	0.45	0.50	0.55
b1	0.13	0.18	0.23
b2	0.50	0.55	0.60
c	0.22	0.27	0.32
D	4.90	5.00	5.10
D1	4.80	4.90	5.00
D2	3.67	3.82	3.97
D3	2.60 REF		
D4	0.86 REF		
E	6.20	6.30	6.40
E1	5.70	5.80	5.90
E2	3.38	3.48	3.58
E3	0.25	0.30	0.35
E4	0.45	0.50	0.55
E5	3.30 REF		
E6	0.50 REF		
E7	0.34 REF		
e	1.27 BSC		
e1	0.635 BSC		
e2	0.52 BSC		
k	1.30	1.40	1.50
L	0.64	0.74	0.84
L1	0.59	0.69	0.79
L2	0.08	0.13	0.18
θ	0°	--	12°



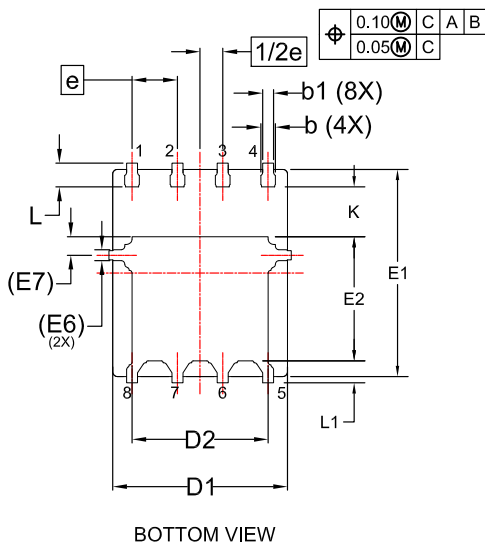
DFN8 5x6.15, 1.27P, DUAL COOL  
CASE 506EG  
ISSUE D

DATE 25 AUG 2020

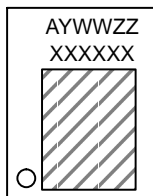


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

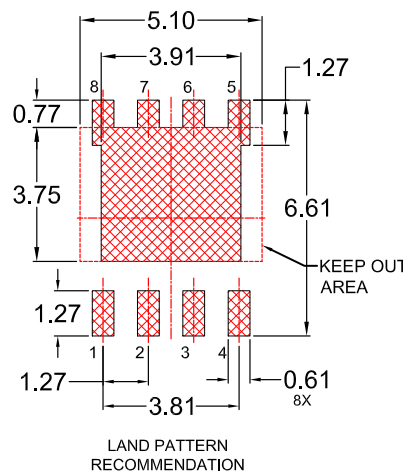
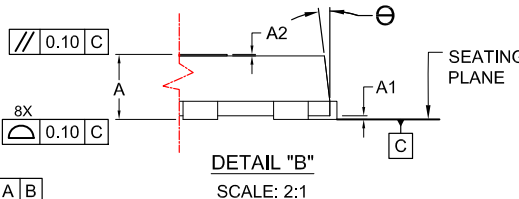


GENERIC MARKING DIAGRAM\*



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

\*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.



LAND PATTERN RECOMMENDATION  
\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.85	0.90	0.95
A1	-	-	0.05
A2	-	-	0.05
b	0.31	0.41	0.51
b1	0.21	0.31	0.41
c	0.20	0.25	0.30
D	4.90	5.00	5.10
D1	4.80	4.90	5.00
D2	3.67	3.82	3.97
D3	2.60 REF		
D4	0.86 REF		
E	6.05	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.58
E3	3.30 REF		
E4	0.50 REF		
E5	0.34 REF		
E6	0.30 REF		
E7	0.52 REF		
e	1.27 BSC		
1/2e	0.635 BSC		
K	1.30	1.40	1.50
L	0.56	0.66	0.76
L1	0.52	0.62	0.72
Θ	0°	---	12°

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