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# MOSFET - Power, Single N-Channel, DUAL COOL™, DFN8 5x6.15

60 V, 1.9 mΩ, 199 A



ON Semiconductor®

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## NTMFSC1D9N06HL

### Features

- Advanced Dual-Side Cooled Packaging
- Ultra Low  $R_{DS(on)}$  to Minimize Conduction Losses
- MSL1 Robust Packaging Design
- Low  $Q_g$  and  $Q_{oss}$  to Minimize Charge Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- DC-DC Conversion
- Orring FET/Load Switching
- Synchronous Rectification

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ , Unless otherwise specified)

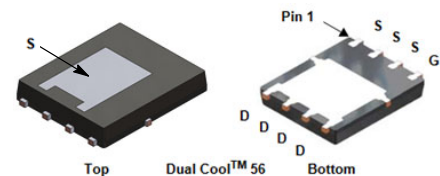
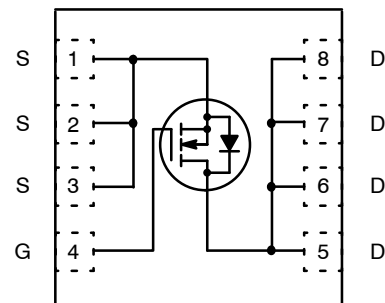
Parameter	Symbol	Value	Unit	
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	60	V	
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JC}$ (Note 2)	$I_D$	199	A	
Power Dissipation $R_{\theta JC}$ (Note 2)				$P_D$
Continuous Drain Current $R_{\theta JA}$ (Note 1, 2)	$I_D$	30	A	
Power Dissipation $R_{\theta JA}$ (Note 1, 2)				$P_D$
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 100 \mu\text{s}$	$I_{DM}$	820	A
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)	$I_S$	138	A	
Single Pulse Drain-to-Source Avalanche Energy ( $I_{AV} = 43 \text{ A}$ )	$E_{AS}$	277	mJ	
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)	$T_L$	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.

1. Surface-mounted on FR4 board using 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.

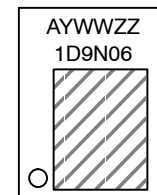
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
60 V	1.9 mΩ @ 10 V	199 A

### N-Channel MOSFET



DFN8 5x6.15  
CASE 506EG

### MARKING DIAGRAM



1D9N06 = Specific Device Code  
A = Assembly Plant Code  
YWW = Date Code (Year & Week)  
ZZ = Lot Code

### ORDERING INFORMATION

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

# NTMFSC1D9N06HL

## THERMAL CHARACTERISTICS

Symbol	Parameter	Max	Unit
$R_{\theta JC}$	Junction-to-Case – Steady State (Note 2)	0.9	°C/W
$R_{\theta JT}$	Junction-to-Top Source – Steady State (Note 2)	1.4	
$R_{\theta JA}$	Junction-to-Ambient – Steady State (Note 2)	39	

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS} / T_J$			38		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$		10	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		250	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.2		2.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)} / T_J$	$I_D = 250\ \mu\text{A}, \text{ref to } 25^\circ\text{C}$		-5.6		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		1.4	1.9	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 40\text{ A}$		1.9	2.6	
Forward Trans-conductance	$g_{FS}$	$V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		357		S
Gate-Resistance	$R_G$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1.4	2.6	$\Omega$

### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 30\text{ V}$		4910		pF
Output Capacitance	$C_{OSS}$			862		
Reverse Transfer Capacitance	$C_{RSS}$			12		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		64		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		29		
Threshold Gate Charge	$Q_{G(TH)}$			7.2		
Gate-to-Source Charge	$Q_{GS}$			13.2		nC
Gate-to-Drain Charge	$Q_{GD}$			5.7		
Output Charge	$Q_{OSS}$	$V_{DD} = 30\text{ V}, V_{GS} = 0\text{ V}$		92		nC

### SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}, R_G = 2.5\ \Omega$		25.4		ns
Rise Time	$t_r$			16.2		
Turn-Off Delay Time	$t_{d(OFF)}$			30.3		
Fall Time	$t_f$			10.1		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$	$T_J = 25^\circ\text{C}$		0.80	1.2	V
			$T_J = 150^\circ\text{C}$		0.63		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 50\text{ A}$			56		ns
Reverse Recovery Charge	$Q_{RR}$				67		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.

# NTMFSC1D9N06HL

## TYPICAL CHARACTERISTICS

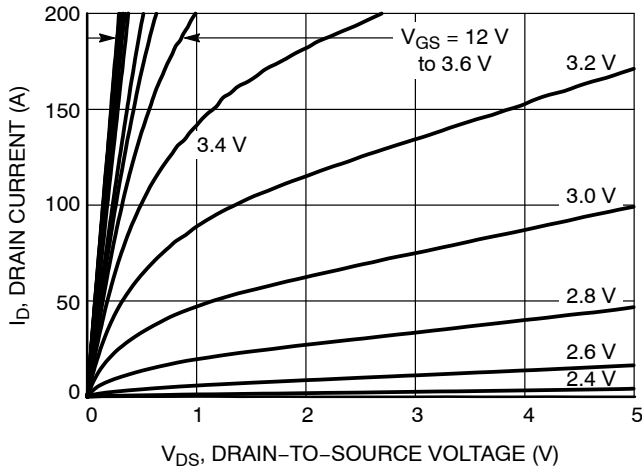


Figure 1. On-Region Characteristics

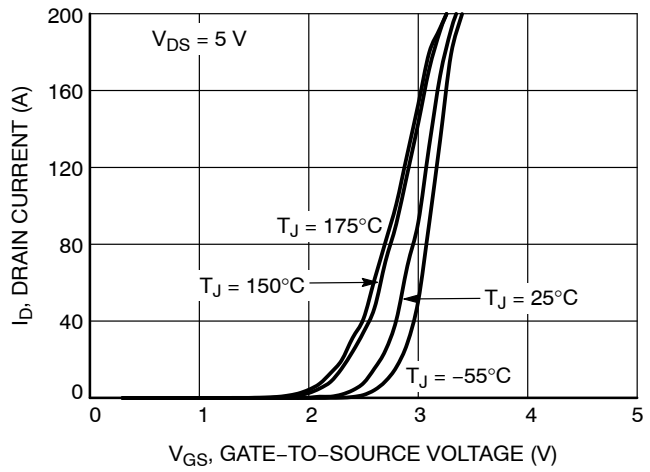


Figure 2. Transfer Characteristics

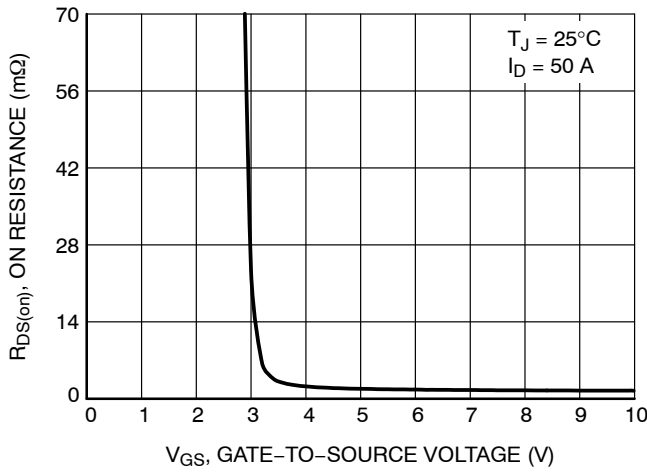


Figure 3. On-Resistance vs. Gate-to-Source Voltage

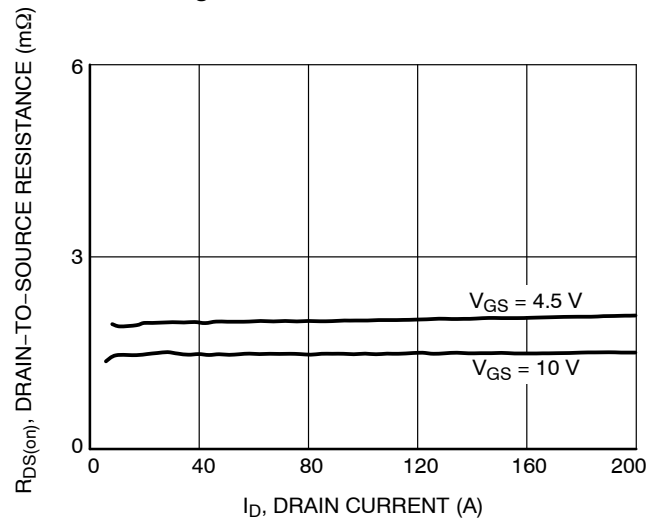


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

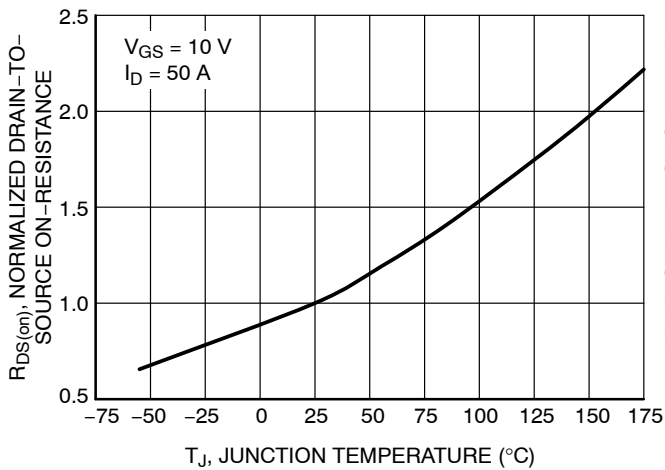


Figure 5. On-Resistance Variation with Temperature

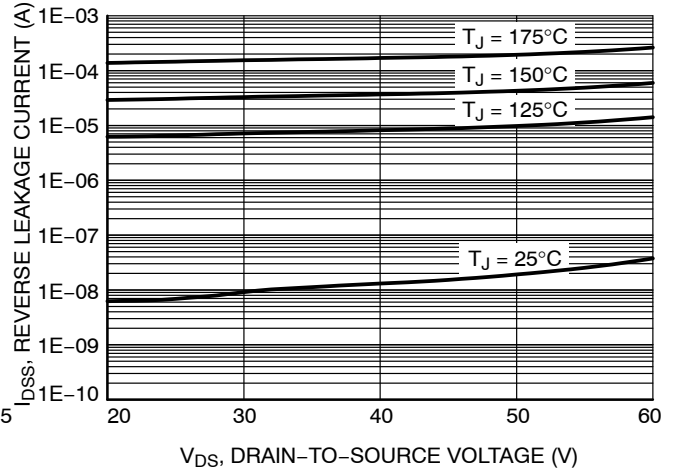


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTMFSC1D9N06HL

## TYPICAL CHARACTERISTICS

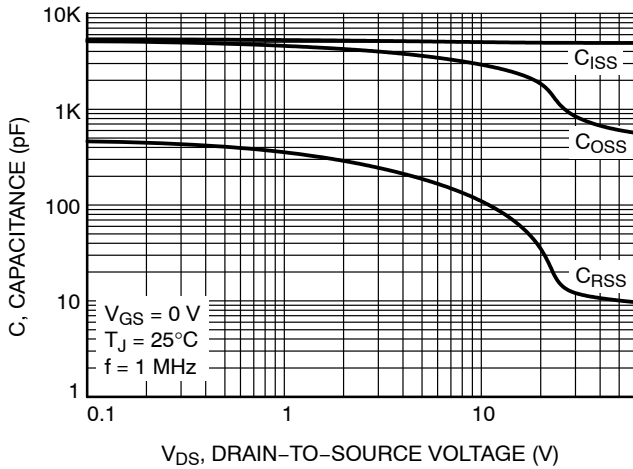


Figure 7. Capacitance Variation

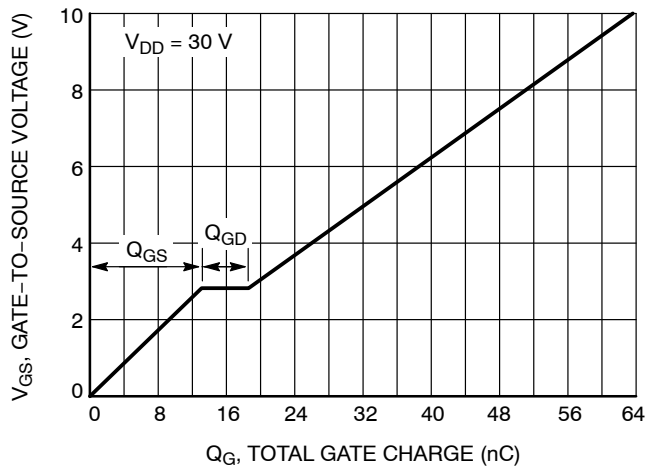


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

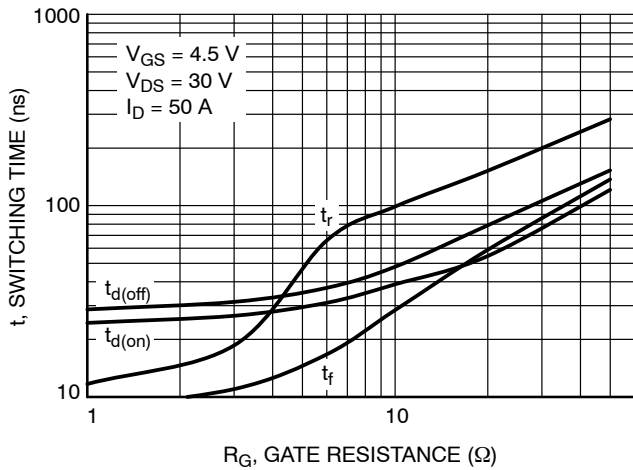


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

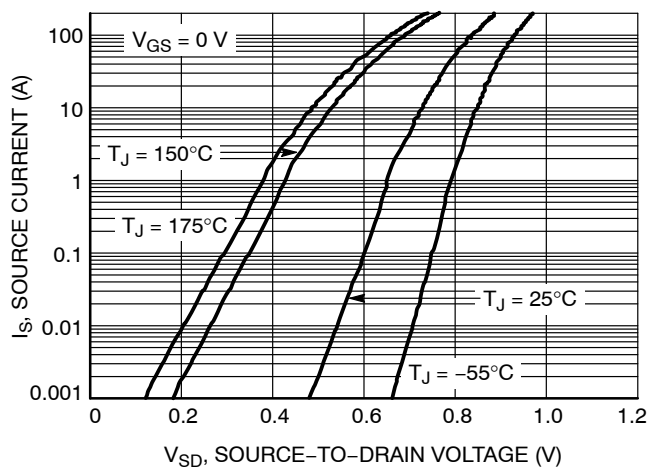


Figure 10. Diode Forward Voltage vs. Current

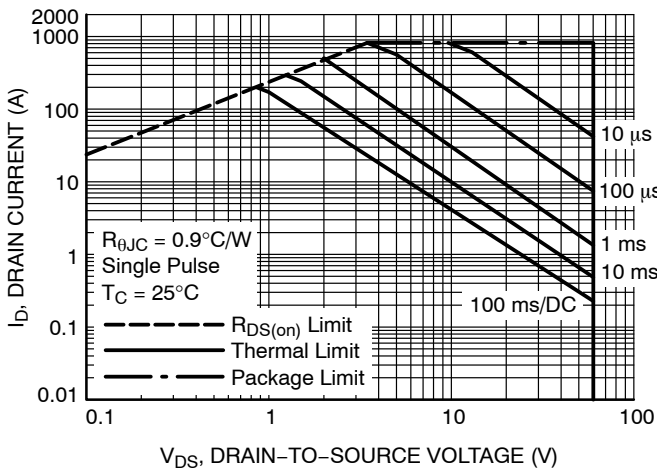


Figure 11. Forward Bias Safe Operating Area

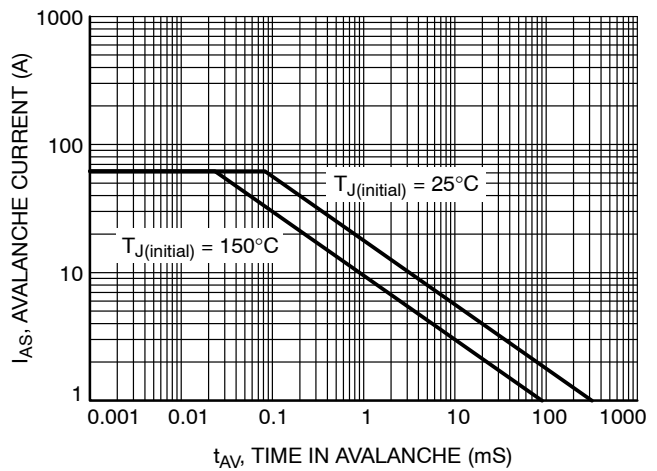


Figure 12. Unclamped Inductive Switching Capability

# NTMFSC1D9N06HL

## TYPICAL CHARACTERISTICS

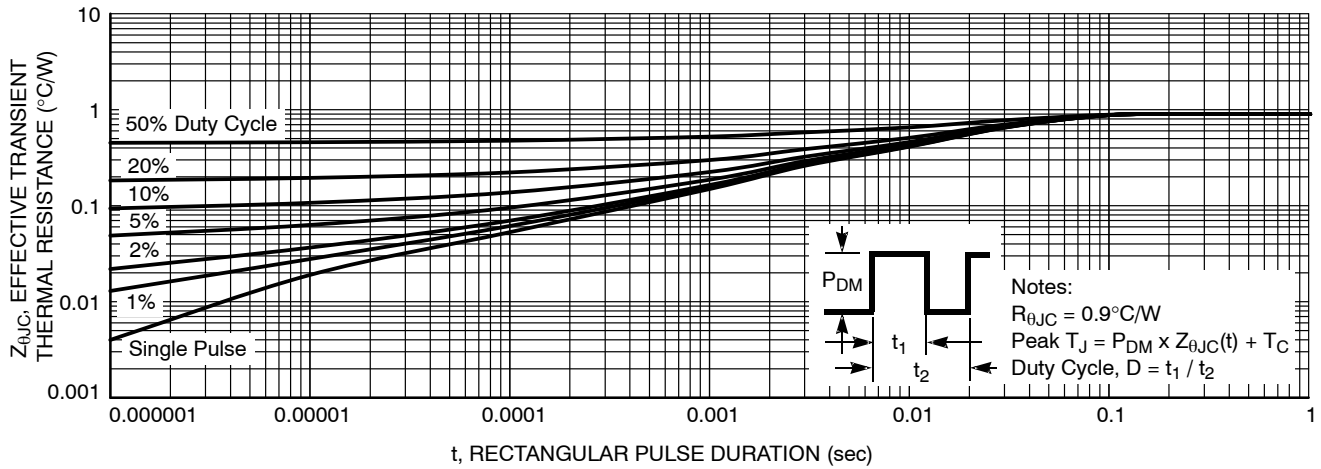


Figure 13. Transient Thermal Impedance

### ORDERING INFORMATION

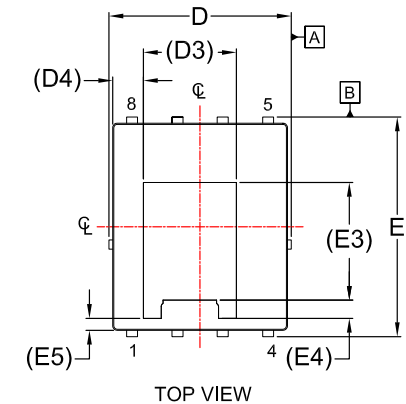
Device	Device Marking	Package	Shipping <sup>†</sup>
NTMFSC1D9N06HL	1D9N06	DFN8 (Pb-Free/Halogen Free)	3000 / Tape & Reel

<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.

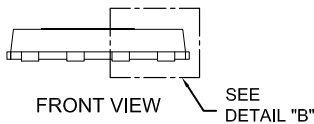
# NTMFSC1D9N06HL

## PACKAGE DIMENSIONS

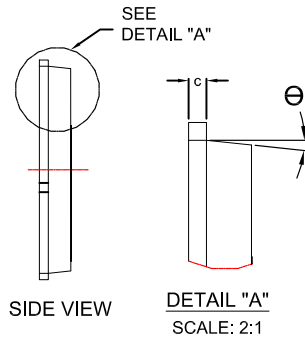
### DFN8 5x6.15, 1.27P, DUAL COOL CASE 506EG ISSUE D



TOP VIEW

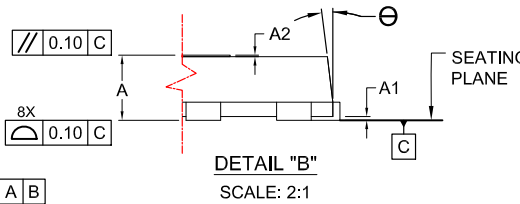


FRONT VIEW

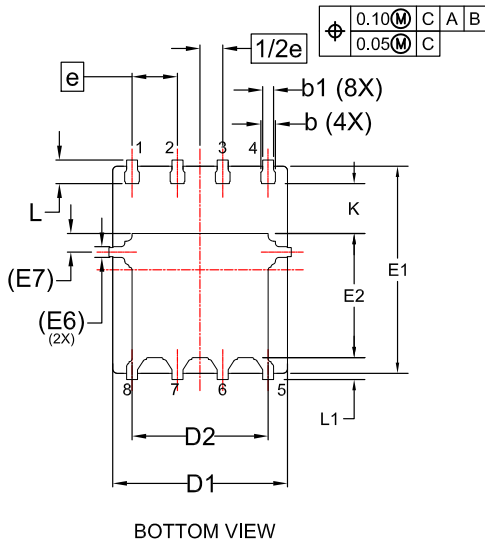


SIDE VIEW

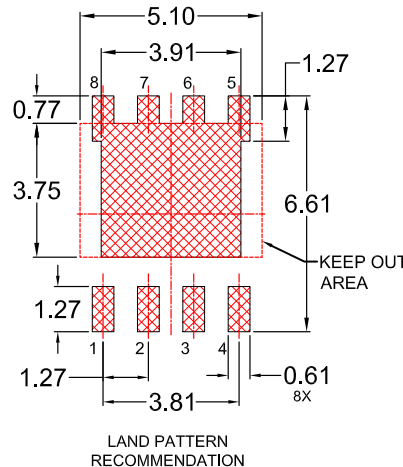
DETAIL "A"  
SCALE: 2:1



DETAIL "B"  
SCALE: 2:1



BOTTOM VIEW



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, SOLDERMWD.

#### 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	0.85	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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