

# MOSFET - Power, Single N-Channel, Source Down 33, WDFN9

25 V, 0.58 mΩ, 310 A

## NTTFSSH0D7N02X

### Features

- Advanced Source–Down Package Technology (3.3 x 3.3 mm) with Excellent Thermal Conduction
- Ultra Low  $R_{DS(on)}$  to Improve System Efficiency
- Low  $Q_G$  and Capacitance to Minimize Driving and Switching Losses
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- High Switching Frequency DC–DC Conversion
- Synchronous Rectifier

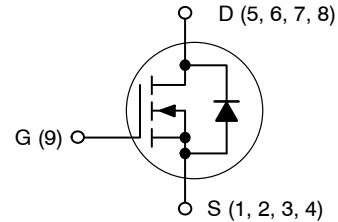
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain–to–Source Voltage	$V_{DSS}$	25	V
Gate–to–Source Voltage	$V_{GS}$	-12/+16	V
Continuous Drain Current (Notes 1, 2)	$T_C = 25^\circ\text{C}$	$I_D$	310 A
	$T_C = 100^\circ\text{C}$		196
Power Dissipation (Note 1)	$T_C = 25^\circ\text{C}$	$P_D$	87 W
Pulsed Drain Current	$T_C = 25^\circ\text{C}$ , $t_p = 100 \mu\text{s}$	$I_{DM}$	1342 A
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	146	A
Single Pulse Avalanche Energy (Note 3) ( $I_{PK} = 62 \text{ A}$ )	$E_{AS}$	192	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	$^\circ\text{C}$

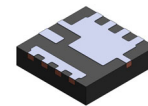
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are valid for the particular conditions noted.
2. Surface–mounted on FR4 board using a 1 in<sup>2</sup> pad size, 1 oz Cu pad.
3.  $E_{AS}$  of 192 mJ is based on started  $T_J = 25^\circ\text{C}$ ,  $I_{AS} = 62 \text{ A}$ ,  $V_{GS} = 10 \text{ V}$ , 100% avalanche tested.

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
25 V	0.58 mΩ @ $V_{GS} = 10 \text{ V}$	310 A
	0.80 mΩ @ $V_{GS} = 4.5 \text{ V}$	

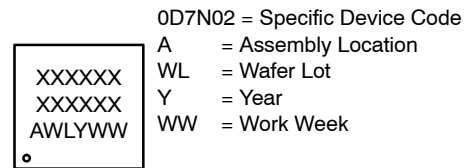


N-CHANNEL MOSFET



WDFN9  
CASE 511EB

### MARKING DIAGRAM



### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# NTTFSSH0D7N02X

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.4	°C/W
Thermal Resistance, Junction-to-Ambient (Note 4)	$R_{\theta JA}$	60	

4. Surface-mounted on FR4 board using a 1 in<sup>2</sup> pad size, 1 oz Cu pad.

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	25			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 1\text{ mA}$ , Referenced to 25 °C		21		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 25\text{ V}$			10	μA
		$V_{DS} = 25\text{ V}, T_J = 125\text{ }^\circ\text{C}$			100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = +16\text{ V}$			100	nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 24\text{ A}$		0.51	0.58	mΩ
		$V_{GS} = 6\text{ V}, I_D = 19\text{ A}$		0.56	0.65	
		$V_{GS} = 4.5\text{ V}, I_D = 19\text{ A}$		0.66	0.80	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 484\text{ } \mu\text{A}$	1.1		2.0	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 484\text{ } \mu\text{A}$		-3		mV/°C
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 24\text{ A}$		190		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 12\text{ V}, f = 1\text{ MHz}$		3980		pF
Output Capacitance	$C_{OSS}$			1160		
Reverse Transfer Capacitance	$C_{RSS}$			124		
Output Charge	$Q_{OSS}$			22		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 12\text{ V}; I_D = 24\text{ A}$		25		
		$V_{GS} = 6\text{ V}, V_{DD} = 12\text{ V}; I_D = 24\text{ A}$		33		
		$V_{GS} = 10\text{ V}, V_{DD} = 12\text{ V}; I_D = 24\text{ A}$		55		
Threshold Gate Charge	$Q_{G(TH)}$			5.7		
Gate-to-Source Charge	$Q_{GS}$			9.7		
Gate-to-Drain Charge	$Q_{GD}$			4.1		
Gate Plateau Voltage	$V_{GP}$			2.5		V
Gate Resistance	$R_G$	$f = 1\text{ MHz}$		0.4		Ω

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10\text{ V}, V_{DD} = 12\text{ V},$ $I_D = 24\text{ A}, R_G = 2.5\text{ } \Omega$		4		ns
Rise Time	$t_r$			6		
Turn-Off Delay Time	$t_{d(OFF)}$			26		
Fall Time	$t_f$			57		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 24\text{ A}, T_J = 25\text{ }^\circ\text{C}$		0.76	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 24\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.63		

# NTTFSSH0D7N02X

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>SOURCE-TO-DRAIN DIODE CHARACTERISTICS</b>						
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}$ , $I_S = 24\text{ A}$ , $di/dt = 700\text{ A}/\mu\text{s}$ , $V_{DD} = 12\text{ V}$		17		ns
Charge Time	$t_a$			10		
Discharge Time	$t_b$			7		
Reverse Recovery Charge	$Q_{RR}$			58		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.

# NTTFSSH0D7N02X

## TYPICAL CHARACTERISTICS

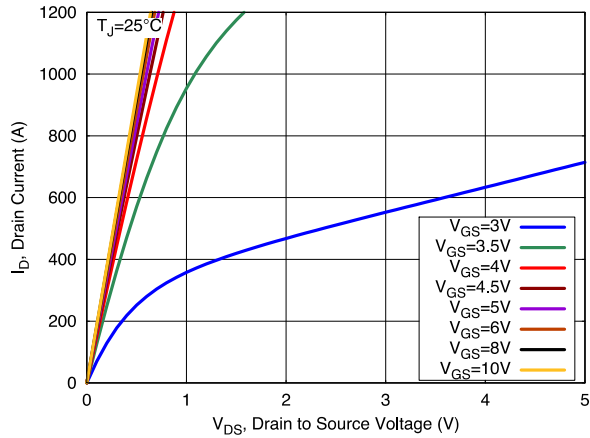


Figure 1. On-Region Characteristics

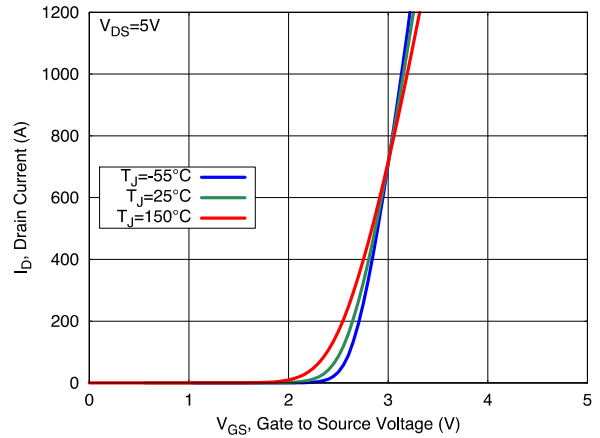


Figure 2. Transfer Characteristics

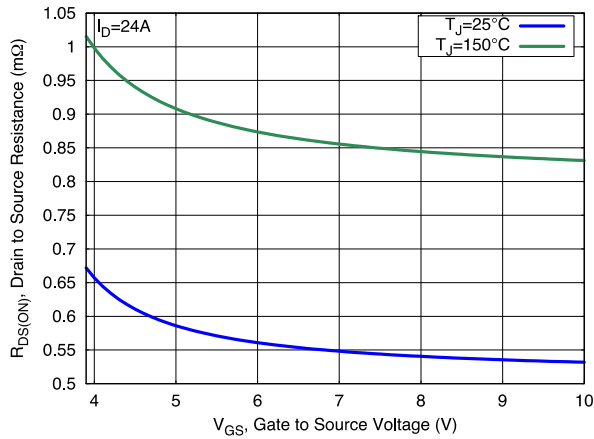


Figure 3. On-Resistance vs. Gate Voltage

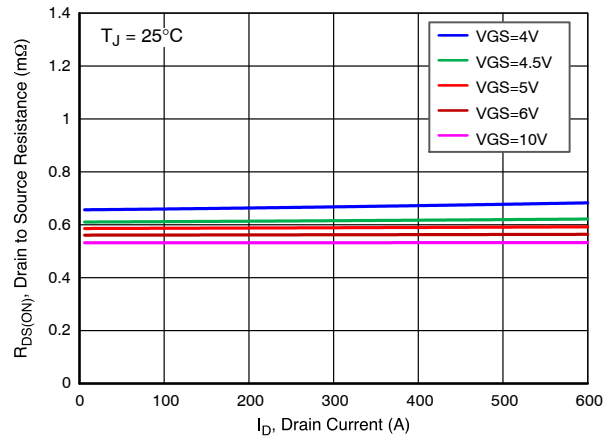


Figure 4. On-Resistance vs. Drain Current

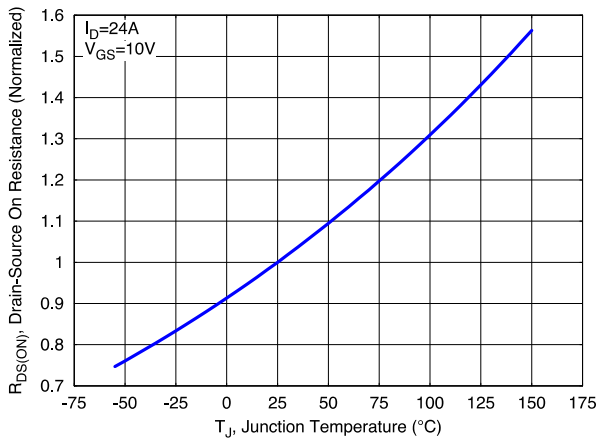


Figure 5. Normalized ON Resistance vs. Junction Temperature

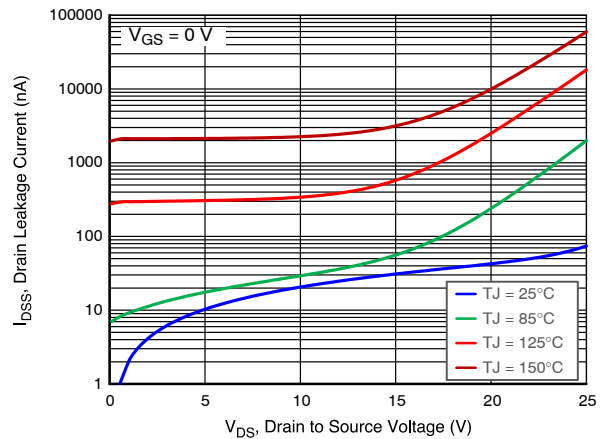


Figure 6. Drain Leakage Current vs. Drain Voltage

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## TYPICAL CHARACTERISTICS

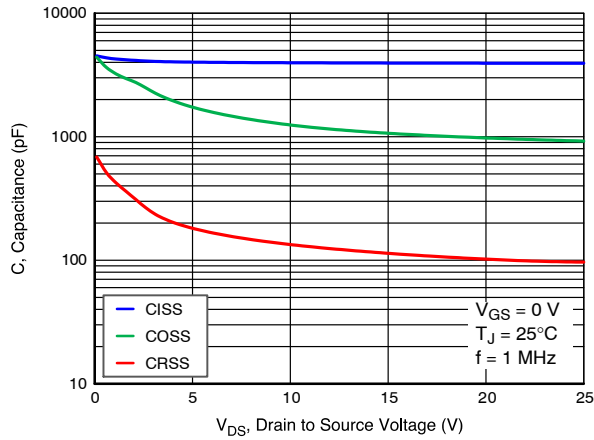


Figure 7. Capacitance Characteristics

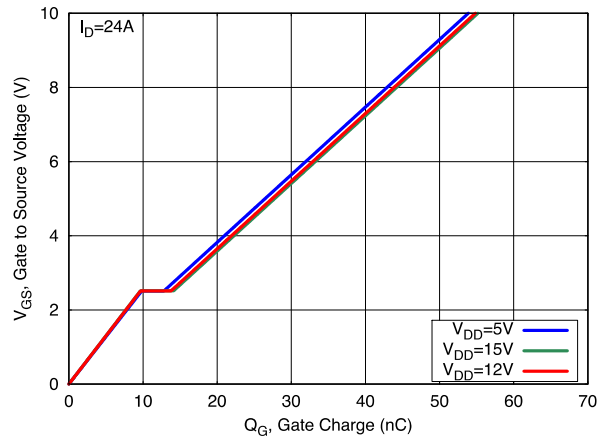


Figure 8. Gate Charge Characteristics

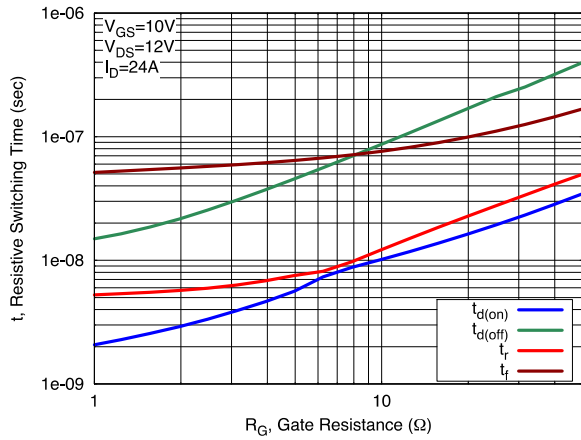


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

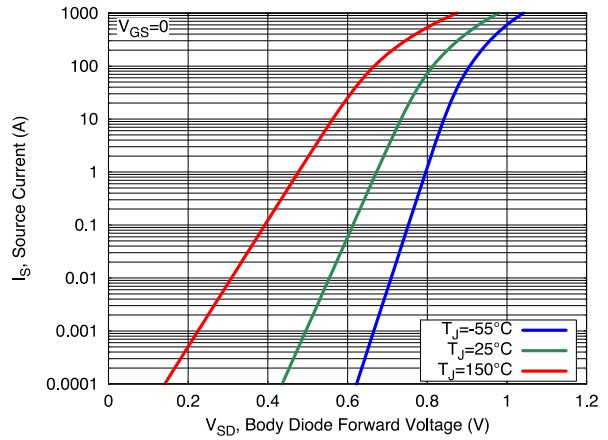


Figure 10. Diode Forward Characteristics

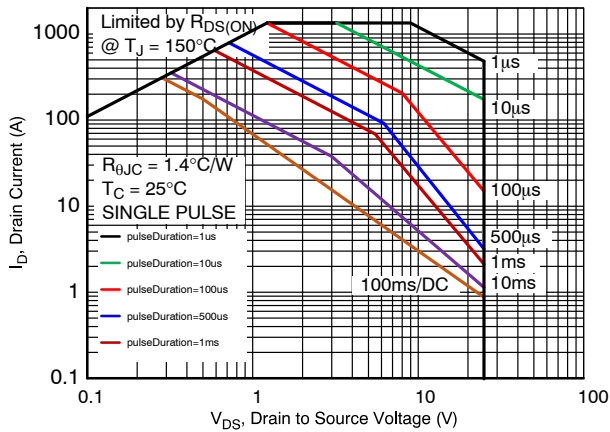


Figure 11. Safe Operating Area (SOA)

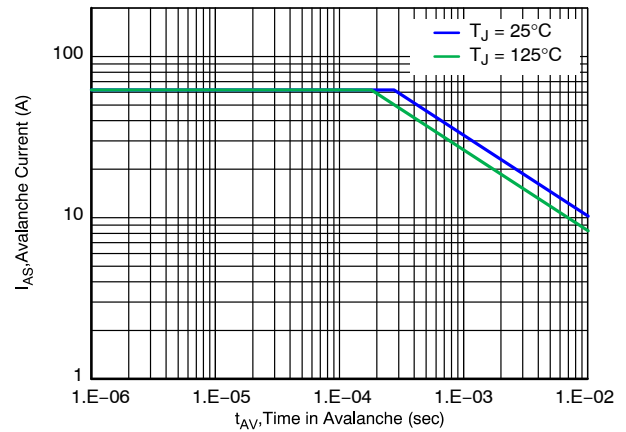


Figure 12. Avalanche Current vs Pulse Time (UIS)

# NTTFSSH0D7N02X

## TYPICAL CHARACTERISTICS

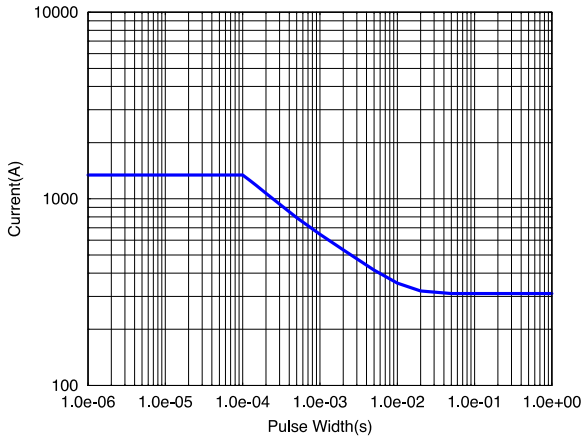


Figure 13. IDM vs Pulse Width

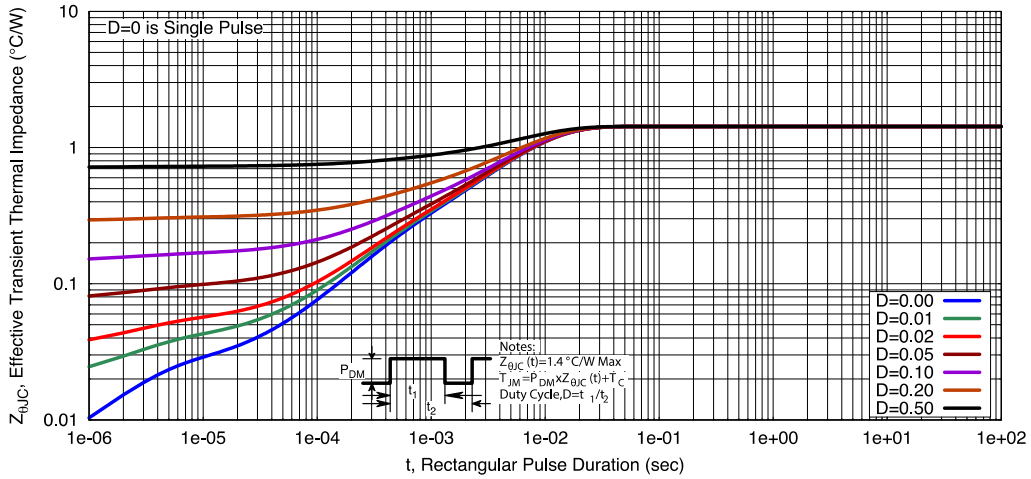
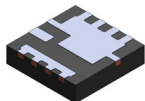


Figure 14. Transient Thermal Response

### ORDERING INFORMATION

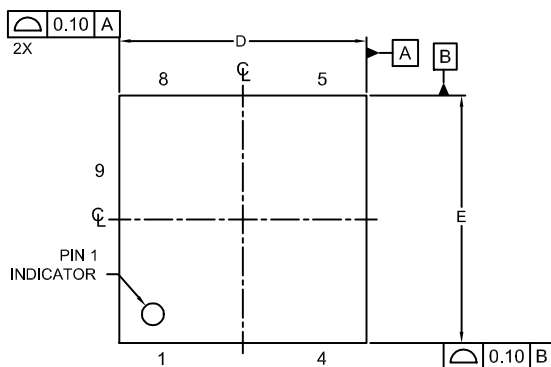
Device	Marking	Package	Shipping†
NTTFSSH0D7N02X	0D7N02	WDFN9 (Pb-Free)	3000 / Tape & Reel

†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.

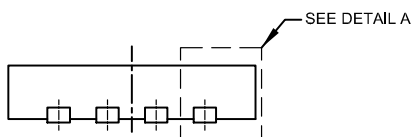


**WDFN9 3.3x3.3, 0.65P**  
**CASE 511EB**  
**ISSUE B**

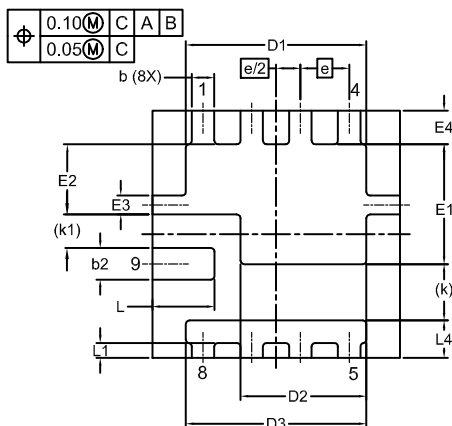
DATE 21 JUL 2021



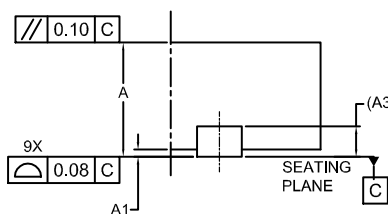
TOP VIEW



FRONT VIEW

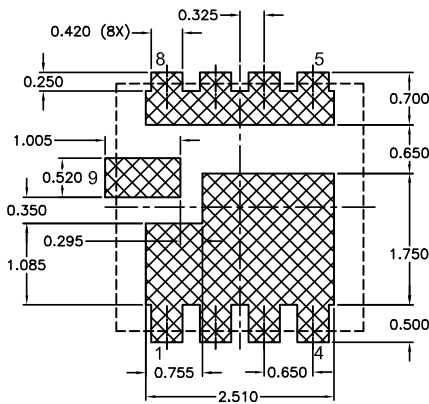


BOTTOM VIEW



DETAIL A

SCALE: 2:1



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. CONTROLLING DIMENSION: MILLIMETERS
2. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
3. DIMENSIONS D1, D2, E1 AND E2 DO NOT INCLUDE MOLD FLASH.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.

UNIT IN MILLIMETER			
DIM	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.25	0.30	0.35
b2	0.37	0.42	0.47
D	3.20	3.30	3.40
D1	2.31	2.41	2.51
D2	1.58	1.68	1.78
D3	2.31	2.41	2.51
E	3.20	3.30	3.40
E1	1.50	1.60	1.70
E2	0.84	0.94	1.04
E3	0.20	0.25	0.30
E4	0.35	0.45	0.55
e	0.650 BSC		
e/2	0.325 BSC		
k	0.75 REF		
k1	0.45 REF		
L	0.73	0.83	0.93
L1	0.10	0.20	0.30
L4	0.40	0.50	0.60

**GENERIC MARKING DIAGRAM\***



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

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "μ", may or may not be present. Some products may not follow the Generic Marking.

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