

# MOSFET - Power, Single N-Channel, Source-Down 30 V, 1.0 mΩ, 294 A

## NTMFSS0D9N03P8

### Features

- Advance 5x6 mm Package with Source Down and Center Gate Design to Improve Power Density, Efficiency, and Thermal Performance
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen-Free / BFR Free and are RoHS Compliant

### Typical Applications

- ORing
- Motor Drives
- Power Load Switch
- DC-DC

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

Parameter	Symbol	Value	Unit	
Drain-to-Source Voltage	V <sub>DSS</sub>	30	V	
Gate-to-Source Voltage	V <sub>GS</sub>	±20	V	
Continuous Drain Current R <sub>θJC</sub> (Note 2)	T <sub>C</sub> = 25°C	I <sub>D</sub>	A	
		294		
Power Dissipation R <sub>θJC</sub> (Note 2)	T <sub>C</sub> = 85°C		A	
		212		
Continuous Drain Current R <sub>θJA</sub> (Notes 1, 2)	T <sub>A</sub> = 25°C	P <sub>D</sub>	W	
		125		
Power Dissipation R <sub>θJA</sub> (Notes 1, 2)	T <sub>A</sub> = 85°C		W	
		65		
Pulsed Drain Current	T <sub>A</sub> = 25°C, t <sub>p</sub> = 10 µs	I <sub>DM</sub>	A	
		TBD		
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +150 °C	
Single Pulse Drain-to-Source Avalanche Energy (I <sub>L(pk)</sub> = 45 A, L = 0.3 mH)		E <sub>AS</sub>	304 mJ	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T <sub>L</sub>	260 °C	

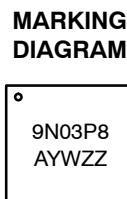
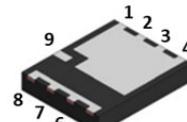
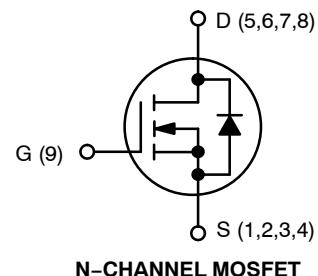
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Note 2)	R <sub>θJC</sub>	1.0	°C/W
Junction-to-Ambient - Steady State (Note 2)	R <sub>θJA</sub>	41	

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 1 in<sup>2</sup> pad size, 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>
30 V	1.0 mΩ @ 10 V	294 A
	1.2 mΩ @ 4.5 V	



TDFN9 5x6  
CASE 520AE

A = Assembly Location  
Y = Year Code  
W = Work Week Code  
ZZ = Assembly Lot Code

### ORDERING INFORMATION

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

# NTMFSS0D9N03P8

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

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

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}$ , $I_D = 500 \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(\text{BR})\text{DSS}}/T_J$	$I_D = 500 \mu\text{A}$ , ref to $25^\circ\text{C}$		-37		$\text{mV}/^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}$ , $V_{\text{DS}} = 24 \text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	$I_{\text{GSS}}$	$V_{\text{DS}} = 0 \text{ V}$ , $V_{\text{GS}} = 20 \text{ V}$			100	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{\text{GS}(\text{TH})}$	$V_{\text{GS}} = V_{\text{DS}}$ , $I_D = 500 \mu\text{A}$	1.0		3.0	V
Threshold Temperature Coefficient	$V_{\text{GS}(\text{TH})}/T_J$	$I_D = 500 \mu\text{A}$ , ref to $25^\circ\text{C}$		12		$\text{mV}/^\circ\text{C}$
Drain-to-Source On Resistance	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}$ , $I_D = 30 \text{ A}$		0.62	1.0	$\text{m}\Omega$
		$V_{\text{GS}} = 4.5 \text{ V}$ , $I_D = 30 \text{ A}$		0.86	1.2	
Forward Transconductance	$g_{\text{FS}}$	$V_{\text{DS}} = 5 \text{ V}$ , $I_D = 30 \text{ A}$		175		S
Gate Resistance	$R_G$	$T_A = 25^\circ\text{C}$		1		$\Omega$

### CHARGES & CAPACITANCES

Input Capacitance	$C_{\text{iss}}$	$V_{\text{GS}} = 0 \text{ V}$ , $f = 1 \text{ MHz}$ , $V_{\text{DS}} = 15 \text{ V}$		9000		pF
Output Capacitance	$C_{\text{oss}}$			3010		
Reverse Transfer Capacitance	$C_{\text{RSS}}$			275		
Threshold Gate Charge	$Q_{\text{G}(\text{TH})}$	$V_{\text{GS}} = 4.5 \text{ V}$ , $V_{\text{DS}} = 15 \text{ V}$ ; $I_D = 30 \text{ A}$		15		
Gate-to-Source Charge	$Q_{\text{GS}}$			24		
Gate-to-Drain Charge	$Q_{\text{GD}}$			12		
Total Gate Charge	$Q_{\text{G}(\text{TOT})}$		$V_{\text{GS}} = 10 \text{ V}$ , $V_{\text{DS}} = 15 \text{ V}$ ; $I_D = 30 \text{ A}$	127		nC

### SWITCHING CHARACTERISTICS, $V_{\text{GS}} = 10 \text{ V}$ (Note 5)

Turn-On Delay Time	$t_{\text{d}(\text{ON})}$	$V_{\text{GS}} = 10 \text{ V}$ , $V_{\text{DS}} = 15 \text{ V}$ , $I_D = 30 \text{ A}$ , $R_G = 6 \Omega$		20.4		ns
Rise Time	$t_r$			19.3		
Turn-Off Delay Time	$t_{\text{d}(\text{OFF})}$			125.4		
Fall Time	$t_f$			49.5		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{\text{SD}}$	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 30 \text{ A}$	$T_J = 25^\circ\text{C}$		0.75	1.2	V
			$T_J = 125^\circ\text{C}$		0.58		
Reverse Recovery Time	$t_{\text{RR}}$	$V_{\text{GS}} = 0 \text{ V}$ , $dI_S/dt = 100 \text{ A}/\mu\text{s}$ , $I_S = 30 \text{ A}$			68.4		ns
Charge Time	$t_a$				35.2		
Discharge Time	$t_b$				33.2		
Reverse Recovery Charge	$Q_{\text{RR}}$				92		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  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

5. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS

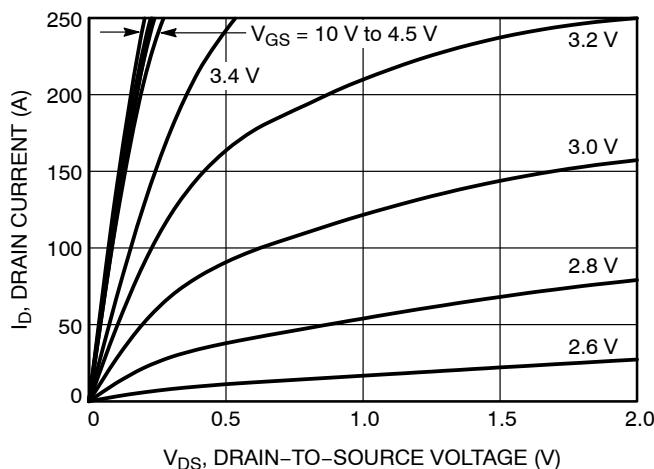


Figure 1. On-Region Characteristics

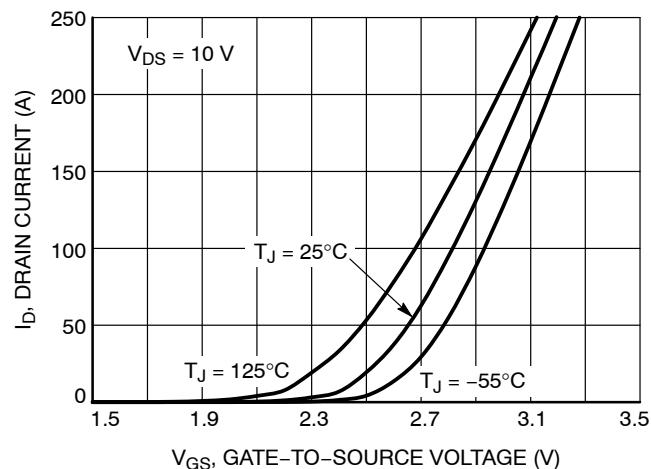


Figure 2. Transfer Characteristics

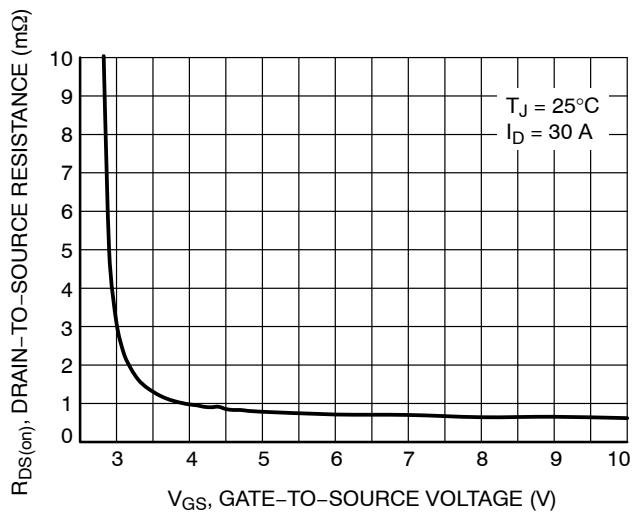


Figure 3. On-Resistance vs. Gate-to-Source Voltage

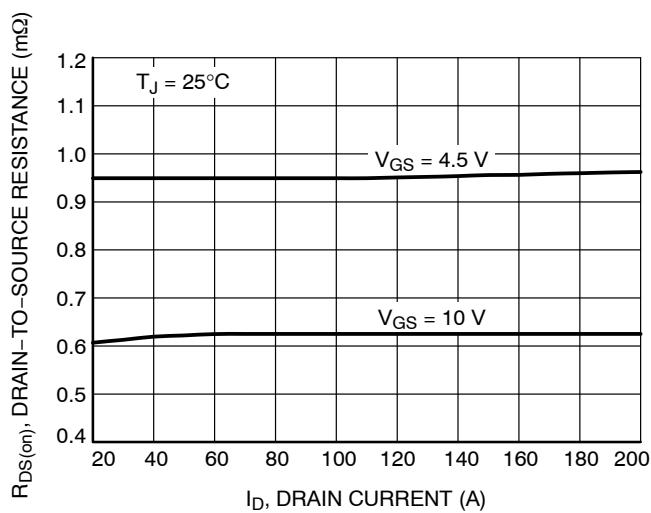


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

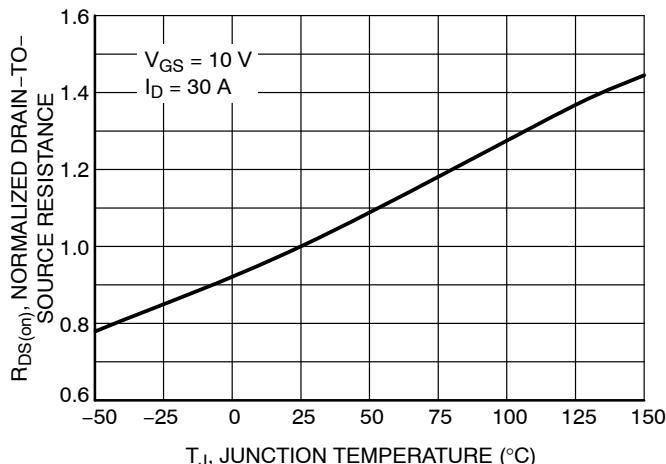


Figure 5. On-Resistance Variation with Temperature

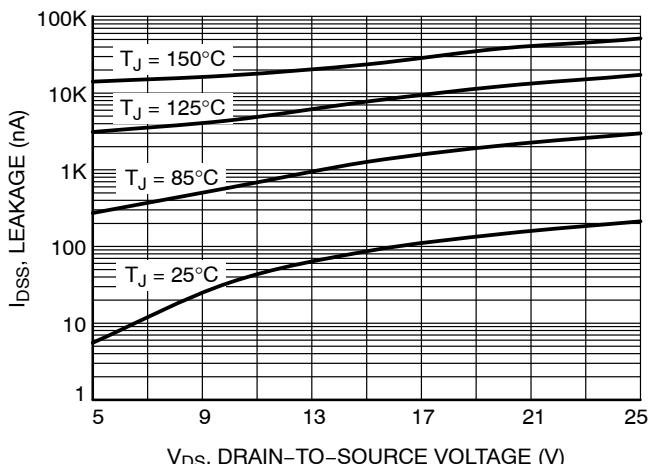


Figure 6. Drain-to-Source Leakage Current vs. Voltage

## TYPICAL CHARACTERISTICS

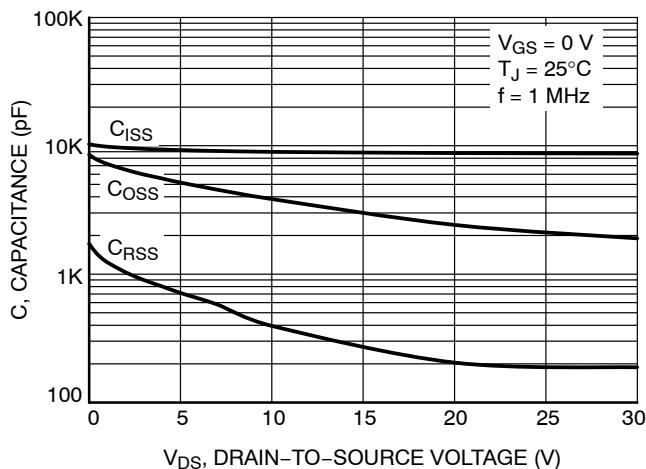


Figure 7. Capacitance Variation

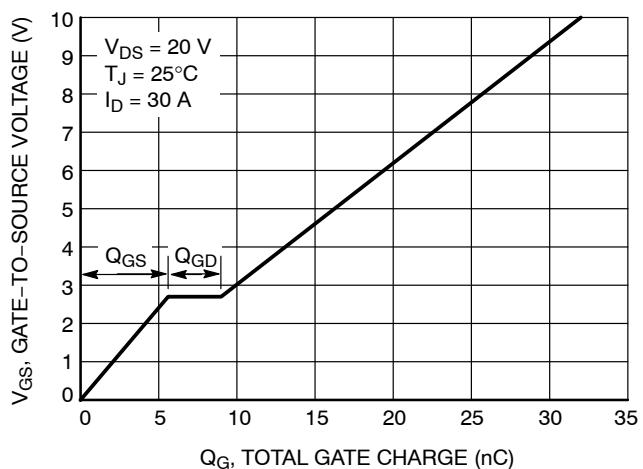


Figure 8. Gate-to-Source vs. Total Charge

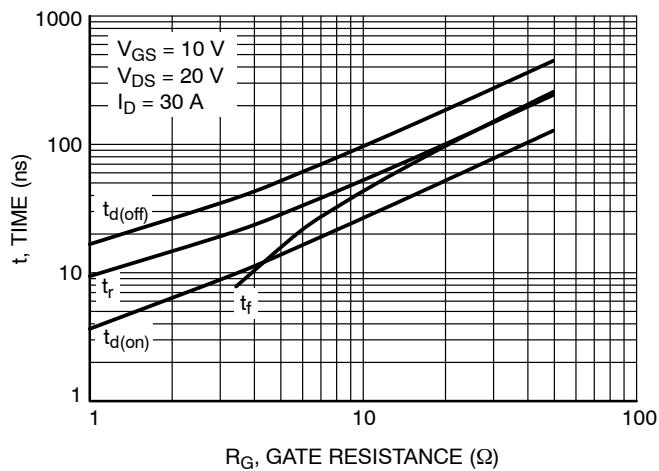


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

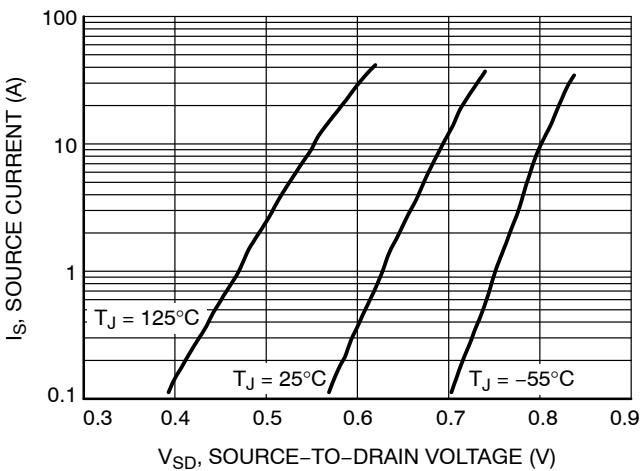


Figure 10. Diode Forward Voltage vs. Current

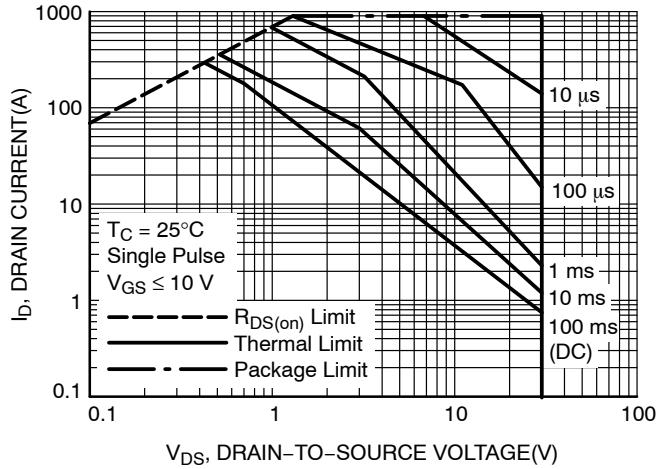
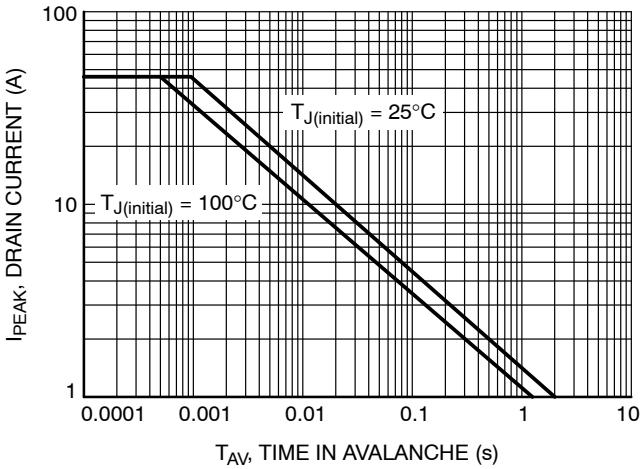


Figure 11. Safe Operating Area

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

## TYPICAL CHARACTERISTICS

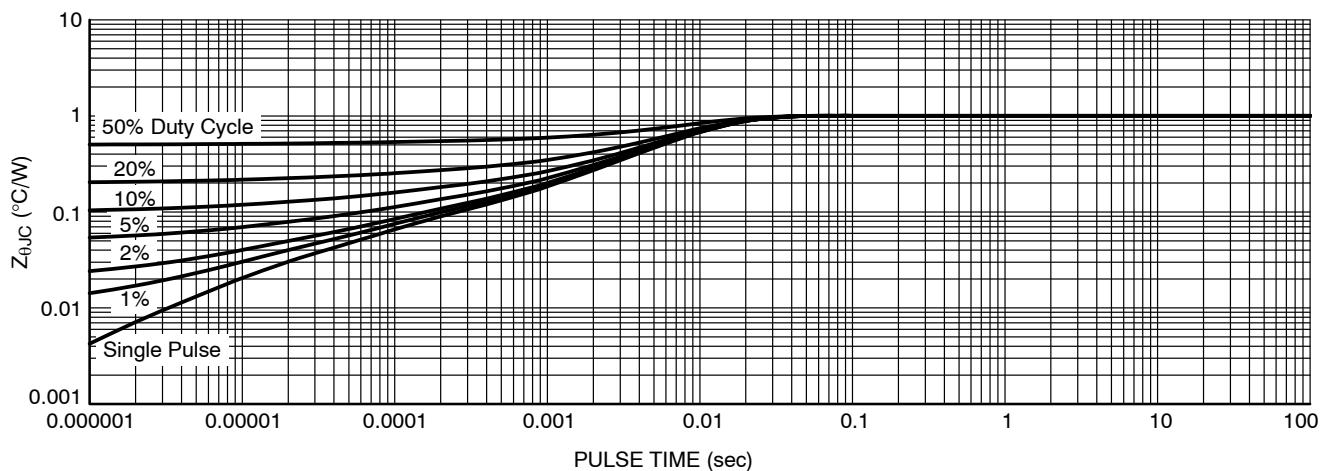
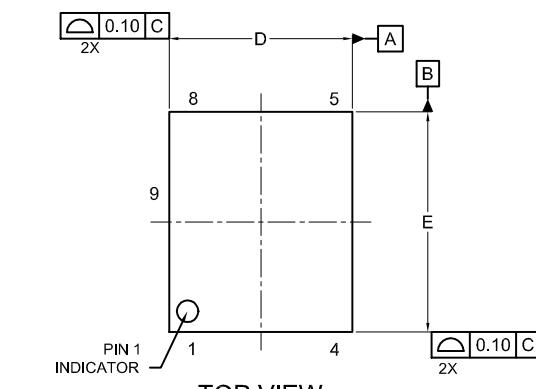
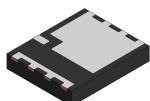


Figure 13. Thermal Characteristics

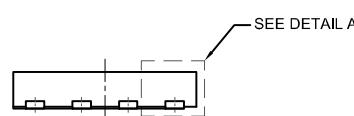
## DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTMFSS0D9N03P8	9N03P8	TDFN9 (Pb-Free)	3000 / Tape & Reel

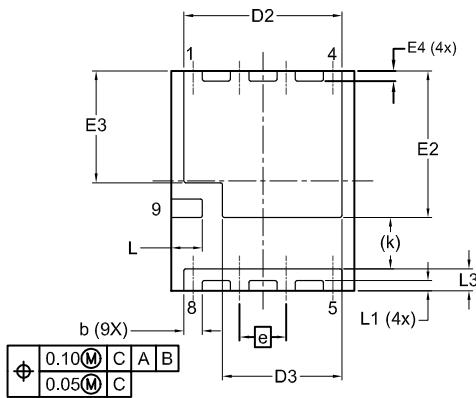
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



TOP VIEW



FRONT VIEW



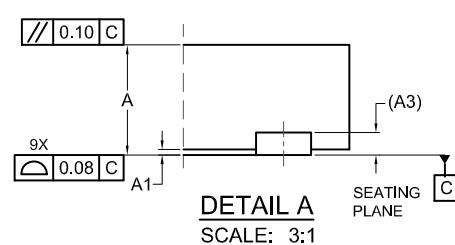
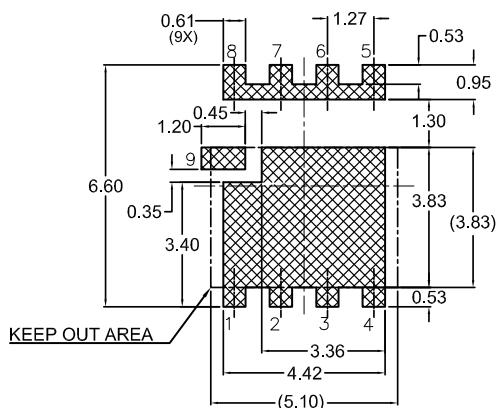
BOTTOM VIEW

**TDFN9 5x6, 1.27P**  
CASE 520AE  
ISSUE B

DATE 24 NOV 2022

## 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, D2, E1 AND E2 DO NOT INCLUDE MOLD FLASH.
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.

DETAIL A  
SCALE: 3:1LAND PATTERN  
RECOMMENDATION

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

**GENERIC  
MARKING DIAGRAM\***


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

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