

MOSFET - Power, Single N-Channel, Source-Down TDFN9

60 V, 1.3 mΩ, 243 A

NTMFSS1D3N06CL

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
- These Devices are Pb-Free, Halogen-Free / BFR Free and are RoHS Compliant

Typical Applications

- DC-DC Converters
- Power Load Switch
- Notebook Battery Management
- Synchronous Rectifier

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		V _{DSS}	60	V	
Gate-to-Source Voltage		V _{GS}	±20	V	
Continuous Drain Current R _{θJC}	Steady State	T _C = 25°C	I _D	243	A
		T _C = 100°C		153	
Power Dissipation R _{θJC}	Steady State	T _C = 25°C	P _D	153	W
		T _C = 100°C		61	
Continuous Drain Current R _{θJA} (Notes 1, 2)	Steady State	T _A = 25°C	I _D	31	A
		T _C = 100°C		19	
Power Dissipation R _{θJA} (Notes 1, 2)	Steady State	T _A = 25°C	P _D	2.5	W
		T _C = 100°C		1	
Pulsed Drain Current	T _A = 25°C, t _p = 10 μs	I _{DM}	1758	A	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	-55 to +150	°C	
Single Pulse Drain-to-Source Avalanche Energy (I _{L(pk)} = 79 A)		E _{AS}	234	mJ	
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)		T _L	260	°C	

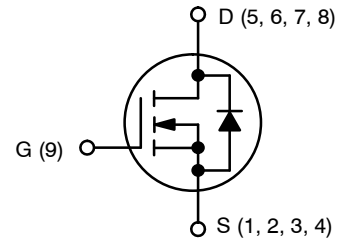
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

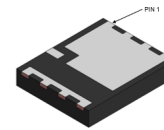
Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State	R _{θJC}	0.81	°C/W
Junction-to-Ambient - Steady State (Note 2)	R _{θJA}	50	

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 in² pad size, 2 oz. Cu pad.

V _{(BR)DSS}	R _{DS(ON) MAX}	I _{D MAX}
60 V	1.3 mΩ @ 10 V	243 A
	2.0 mΩ @ 4.5 V	

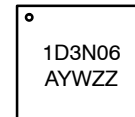


N-CHANNEL MOSFET



TDFN9 5x6
CASE 520AE

MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping [†]
NTMFSS1D3N06CL	TDFN9 (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 Specification Brochure, BRD8011/D.

NTMFSS1D3N06CL

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
-----------	--------	----------------	-----	-----	-----	------

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	$V_{(BR)DSS}/T_J$	$I_D = 250\ \mu\text{A}$, ref to 25°C		24		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$ $T_J = 25^\circ\text{C}$			10	μA
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.2		2.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	$I_D = 250\ \mu\text{A}$, ref to 25°C		-5.9		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		1.0	1.3	m Ω
		$V_{GS} = 4.5\text{ V}, I_D = 50\text{ A}$		1.3	2.0	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		180		S
Gate Resistance	R_G	$T_A = 25^\circ\text{C}$		0.6		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 30\text{ V}$		8190		pF	
Output Capacitance	C_{OSS}			3950			
Reverse Capacitance	C_{RSS}			25			
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		117		nC	
Total Gate Charge	$Q_{G(TOT)}$		$V_{GS} = 4.5\text{ V}, V_{DS} = 30\text{ V}, I_D = 50\text{ A}$		53		
Gate-to-Drain Charge	Q_{GD}				10		
Gate-to-Source Charge	Q_{GS}				22.4		
Plateau Voltage	V_{GP}				2.8		

SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 30\text{ V}, I_D = 50\text{ A}, R_G = 2.5\ \Omega$		19.6		ns
Rise Time	t_r			9.2		
Turn-Off Delay Time	$t_{d(OFF)}$			55		
Fall Time	t_f			14		

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 50\text{ A}$	$T_J = 25^\circ\text{C}$		0.79	1.2	V
			$T_J = 125^\circ\text{C}$		0.65		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, di/dt = 100\text{ A}/\mu\text{s}, I_S = 50\text{ A}$		84		ns	
Charge Time	t_a			43			
Discharge Time	t_b			41			
Reverse Recovery Charge	Q_{RR}			153			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.

NTMFSS1D3N06CL

TYPICAL CHARACTERISTICS

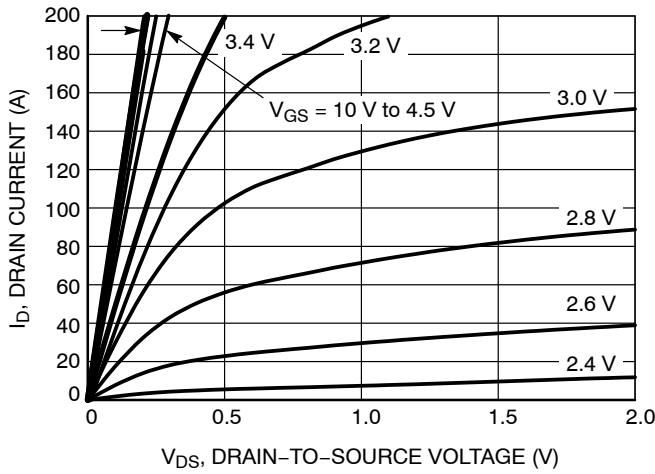


Figure 1. On-Region Characteristics

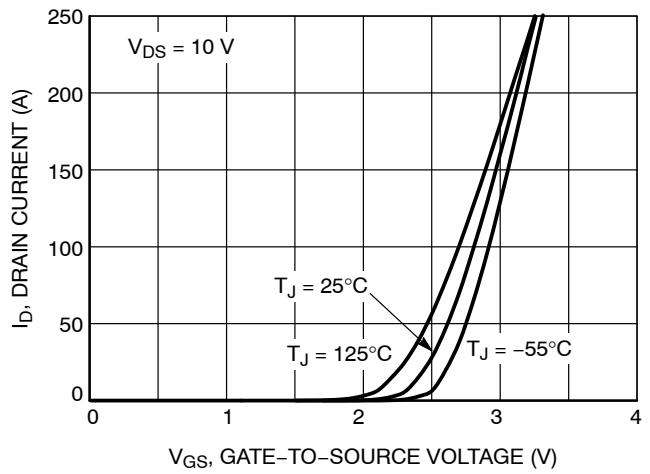


Figure 2. Transfer Characteristics

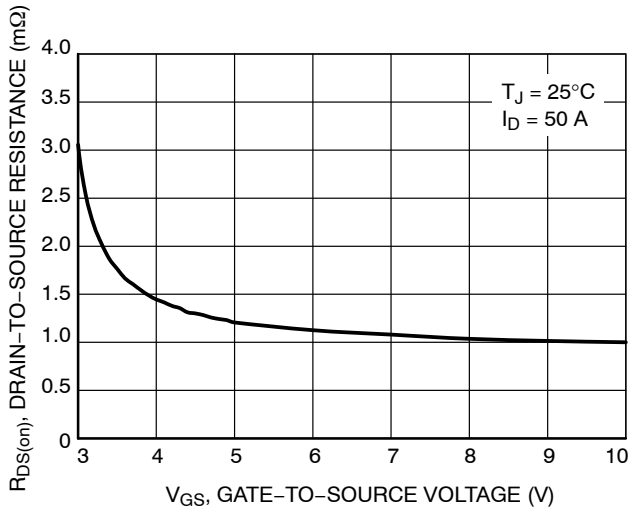


Figure 3. On-Resistance vs. Gate-to-Source Voltage

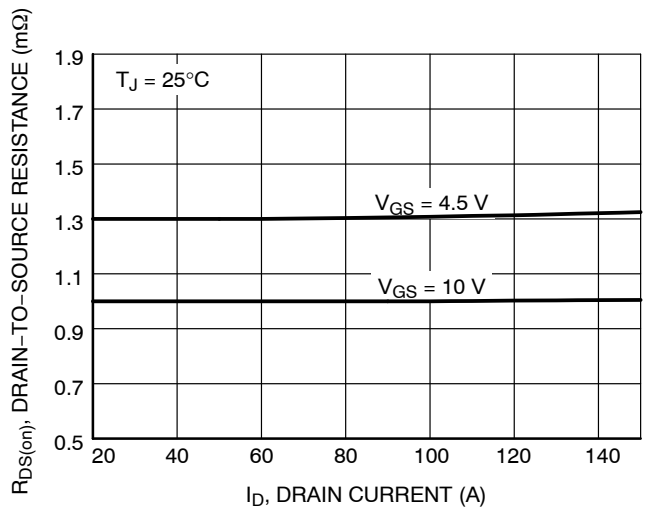


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

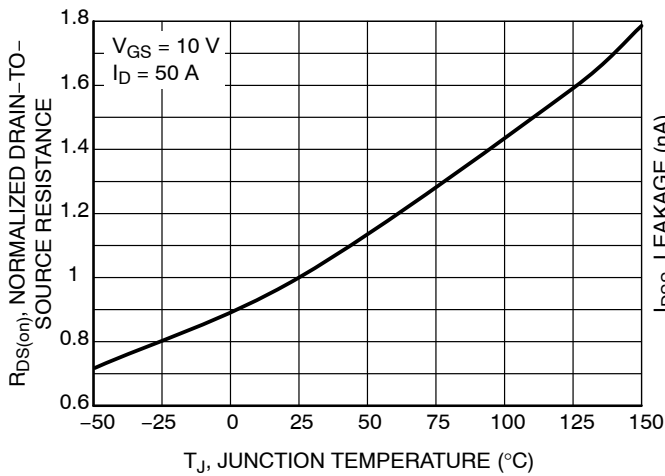


Figure 5. On-Resistance Variation with Temperature

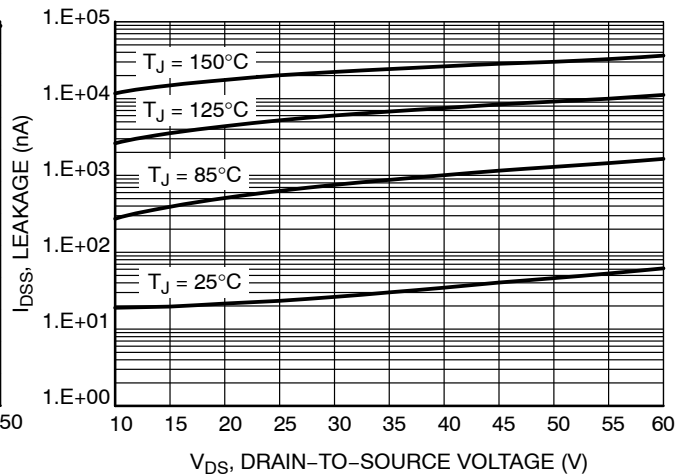


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTMFSS1D3N06CL

TYPICAL CHARACTERISTICS

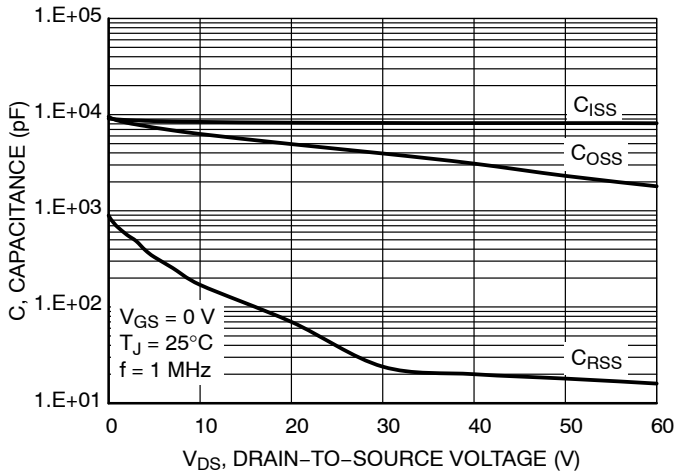


Figure 7. Capacitance Variation

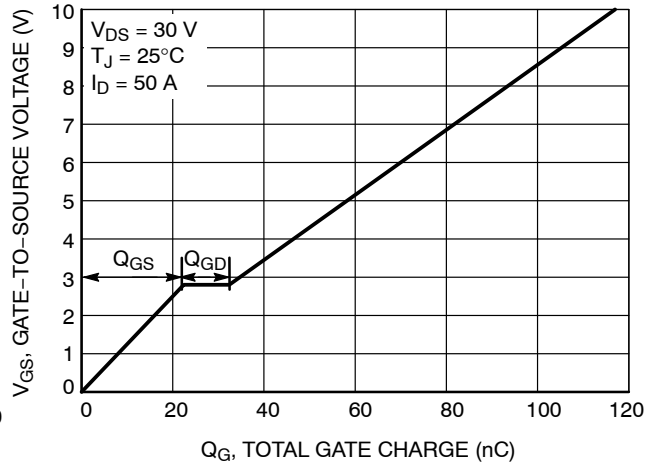


Figure 8. Gate-to-Source vs. Total Charge

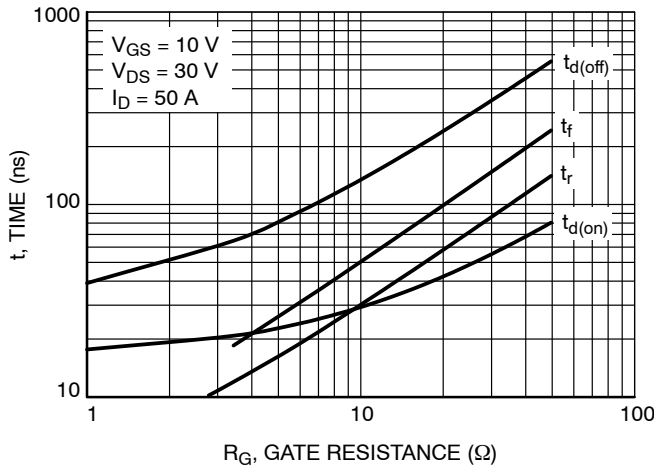


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

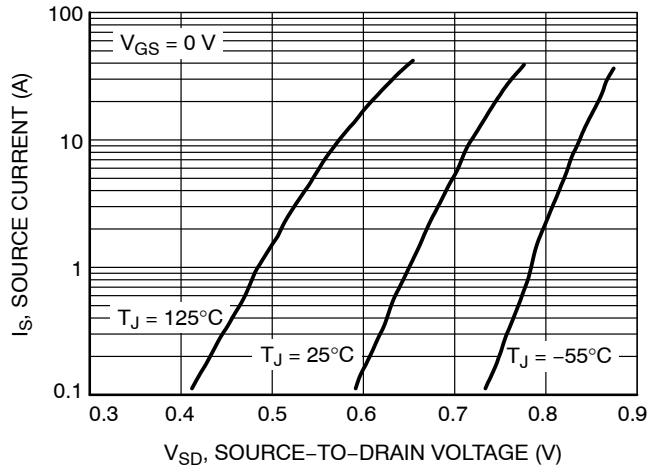


Figure 10. Diode Forward Voltage vs. Current

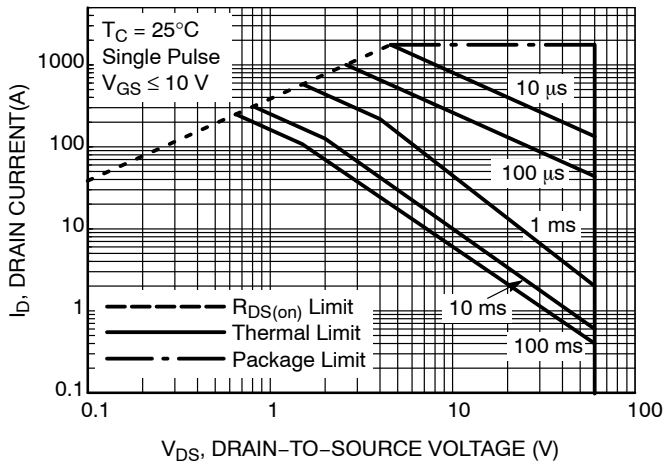


Figure 11. Safe Operating Area

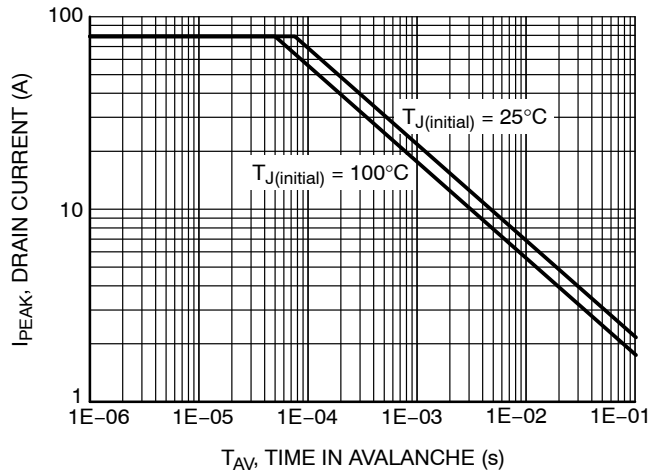


Figure 12. I_{PEAK} vs. Time in Avalanche

NTMFSS1D3N06CL

TYPICAL CHARACTERISTICS

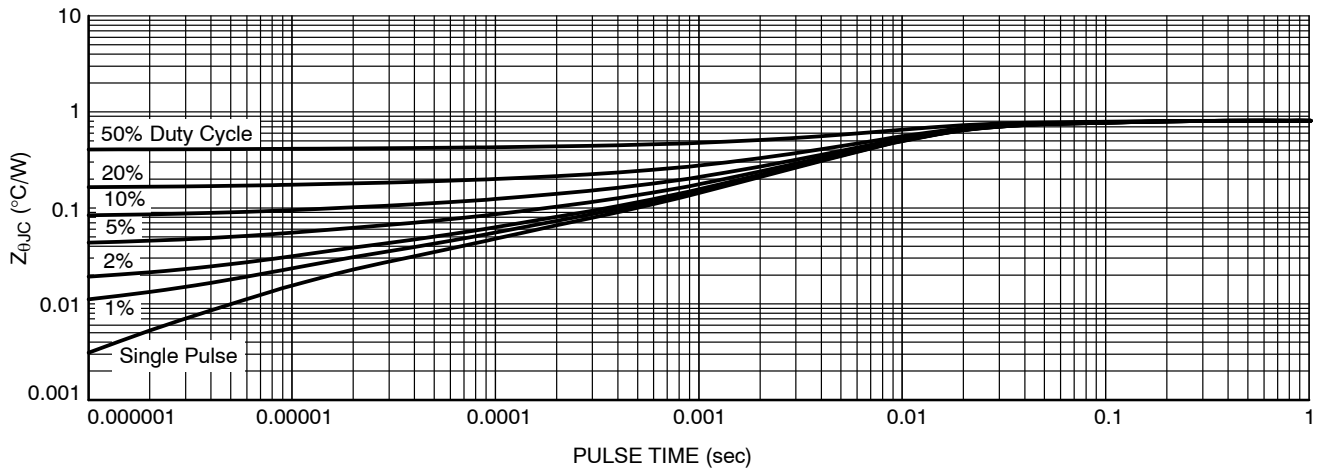
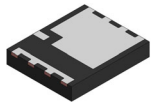


Figure 13. Thermal Characteristics

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

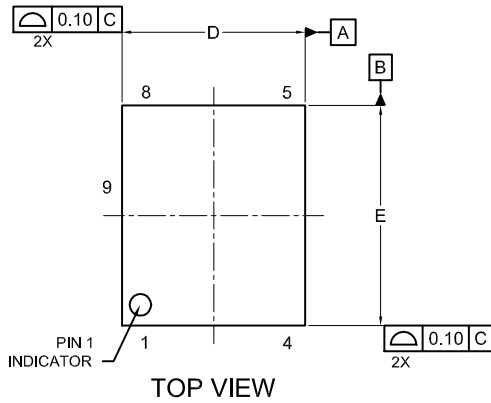


TDFN9 5x6, 1.27P CASE 520AE ISSUE B

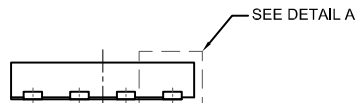
DATE 24 NOV 2022

NOTES:

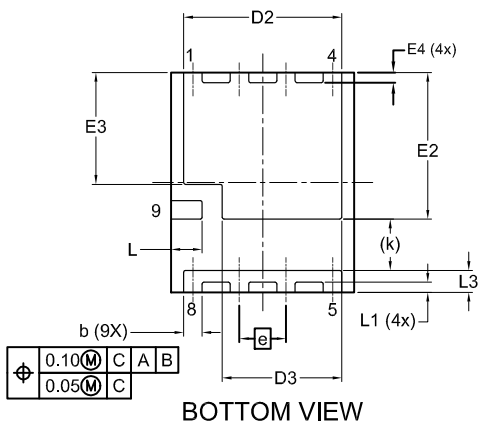
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- CONTROLLING DIMENSION: MILLIMETERS
- COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
- DIMENSIONS D1, D2, E1 AND E2 DO NOT INCLUDE MOLD FLASH.
- SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



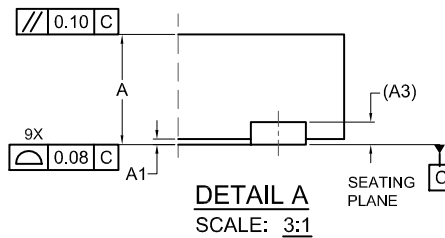
TOP VIEW



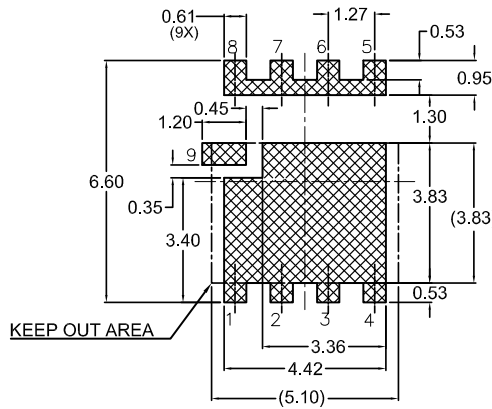
FRONT VIEW



BOTTOM VIEW



DETAIL A
SCALE: 3:1



LAND PATTERN
RECOMMENDATION

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.95	1.00	1.05
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.45	0.50	0.55
D	4.90	5.00	5.10
D2	4.10	4.30	4.50
D3	3.16	3.26	3.36
E	5.90	6.00	6.10
E2	3.90	4.00	4.10
E3	2.95	3.05	3.15
E4	0.18	0.28	0.38
e	1.27 BSC		
k	1.40 REF		
L	0.75	0.85	0.95
L1	0.18	0.28	0.38
L3	0.50	0.60	0.70

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

GENERIC MARKING DIAGRAM*



XXXX = 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.

DOCUMENT NUMBER:	98AON99041G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TDFN9 5x6, 1.27P	PAGE 1 OF 1

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative