

MOSFET - Single N-Channel

40 V, 2.1 mΩ, 150 A

NTTFS2D1N04HL

Features

- Max $R_{DS(on)}$ = 2.1 mΩ at $V_{GS} = 10$ V, $I_D = 23$ A
- Max $R_{DS(on)}$ = 3.3 mΩ at $V_{GS} = 4.5$ V, $I_D = 18$ A
- High Performance Technology for Extremely Low $R_{DS(on)}$
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- DC-DC Buck Converters
- Point of Load
- High Efficiency Load Switch and Low Side Switching
- Oring FET

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

Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		V_{DSS}	40	V	
Gate-to-Source Voltage		V_{GS}	± 20	V	
Continuous Drain Current $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	I_D	150	A
			P_D	83	W
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2)	Steady State	$T_A = 25^\circ\text{C}$	I_D	24	A
			P_D	2.2	W
Pulsed Drain Current	$T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$	I_{DM}	958	A	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +150	$^\circ\text{C}$	
Source Current (Body Diode)		I_S	69	A	
Single Pulse Drain-to-Source Avalanche Energy ($I_{AV} = 29$ A, $L = 0.3$ mH) (Note 3)		E_{AS}	126	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.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case - Steady State (Note 1)	$R_{\theta JC}$	1.5	$^\circ\text{C}/\text{W}$
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	54.8	

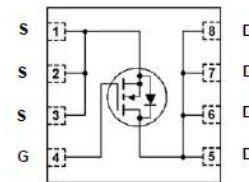
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using 1 in² pad size, 1 oz. Cu pad.
3. E_{AS} of 126 mJ is based on started $T_J = 25^\circ\text{C}$, $I_{AS} = 29$ A, $V_{DD} = 32$ V, $V_{GS} = 10$ V. 100% test at $I_{AS} = 29$ A.



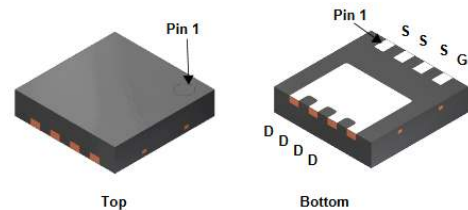
ON Semiconductor®

www.onsemi.com

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
40 V	2.1 mΩ @ 10 V	150 A
	3.3 mΩ @ 4.5 V	



N-CHANNEL MOSFET



WDFN8
3.3X3.3, 0.65P
CASE 483AW

MARKING DIAGRAM



S2D1 = Specific Device Code
A = Assembly Plant Code
Y = Numeric Year Code
WW = Work Week Code
ZZ = Assembly Lot Code

ORDERING INFORMATION

Device	Package	Shipping†
NTTFS2D1N04HLTWG	PQFN8 (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.

NTTFS2D1N04HL

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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 250\ \mu\text{A}$, ref to 25°C		21.80		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25^\circ\text{C}$		10	μA
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 120\ \mu\text{A}$	1.2		2.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	$I_D = 120\ \mu\text{A}$, ref to 25°C		-4.63		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 23\text{ A}$		1.7	2.1	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 18\text{ A}$		2.5	3.3	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 23\text{ A}$		256		S
Gate-Resistance	R_G	$T_A = 25^\circ\text{C}$		1		Ω

CHARGES & CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 20\text{ V}$		2745		pF
Output Capacitance	C_{OSS}			645		
Reverse Transfer Capacitance	C_{RSS}			38		
Total Gate Charge	$Q_G(\text{TOT})$	$V_{GS} = 10\text{ V}, V_{DS} = 32\text{ V}, I_D = 11.5\text{ A}$		43.6		nC
Total Gate Charge	$Q_G(\text{TOT})$	$V_{GS} = 4.5\text{ V}, V_{DS} = 32\text{ V}, I_D = 11.5\text{ A}$		20.7		nC
Gate-to-Source Charge	Q_{GS}			6.1		
Gate-to-Drain Charge	Q_{GD}			6.2		
Plateau Voltage	V_{GP}			2.5		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 32\text{ V}, I_D = 11.5\text{ A}, R_G = 2.5\ \Omega$		17		ns
Rise Time	t_r			12		
Turn-Off Delay Time	$t_{d(OFF)}$			32		
Fall Time	t_f			9		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 23\text{ A}$	$T_J = 25^\circ\text{C}$		0.79	1.2	V
			$T_J = 125^\circ\text{C}$		0.64		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 11.5\text{ A}$		22		ns	
Reverse Recovery Charge	Q_{RR}			17		nC	
Charge Time	t_a	$V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s}, I_S = 11.5\text{ A}$		22		ns	
Discharge Time	t_b			13		ns	

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. Switching characteristics are independent of operating junction temperatures

5. As an N-ch device, the negative V_{GS} rating is for low duty cycle pulse occurrence only. No continuous rating is implied.

NTTFS2D1N04HL

TYPICAL CHARACTERISTICS

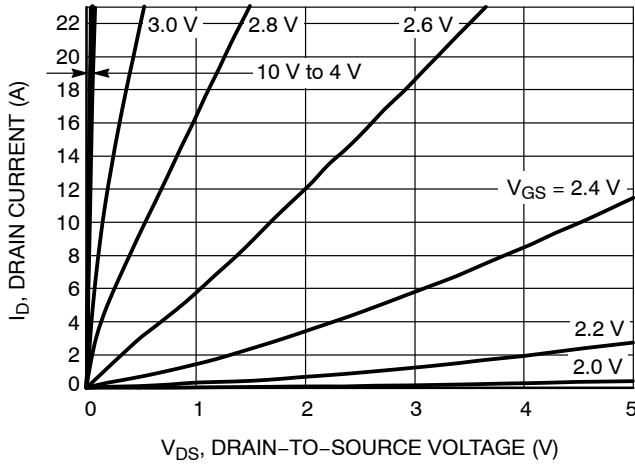


Figure 1. On-Region Characteristics

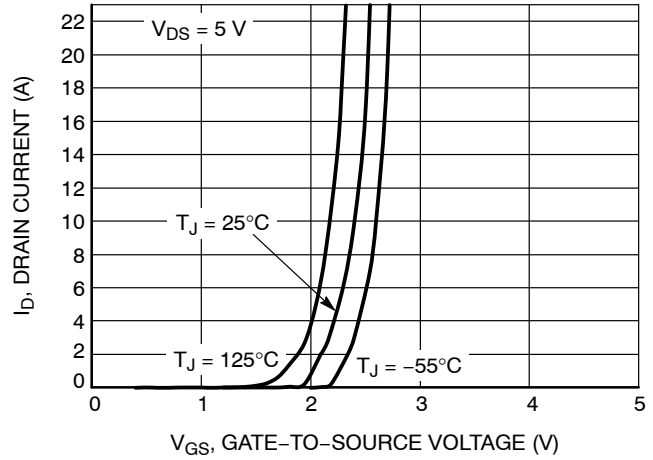


Figure 2. Transfer Characteristics

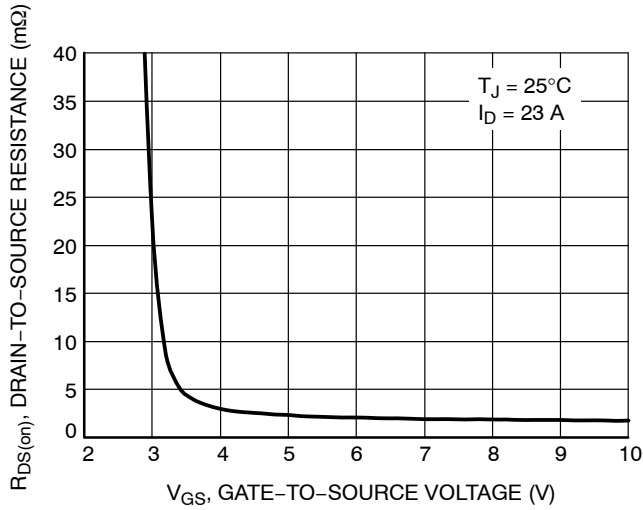


Figure 3. On-Resistance vs. Gate-to-Source Voltage

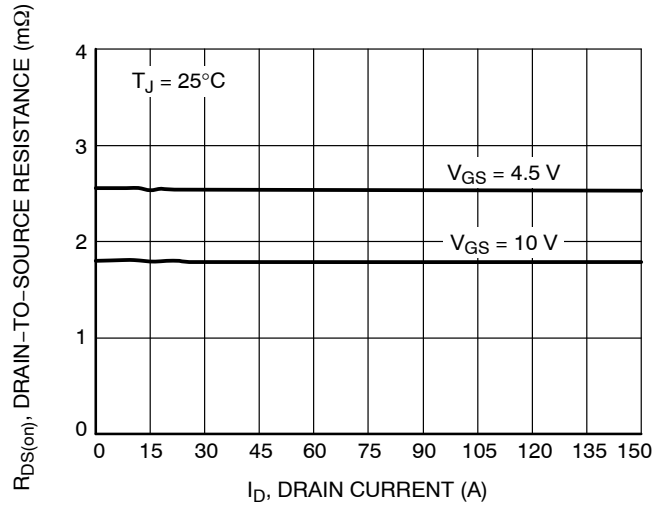


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

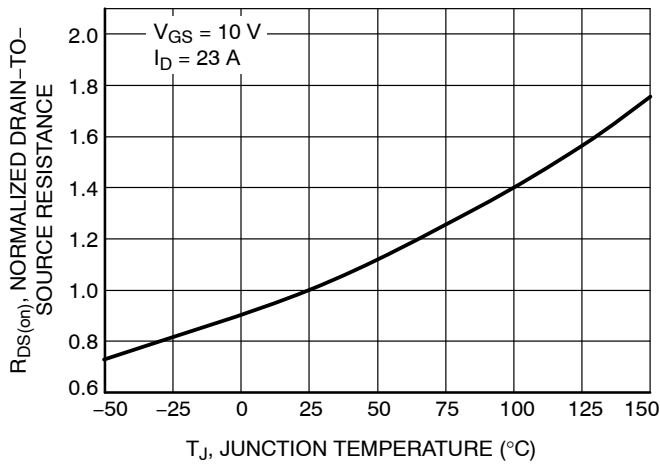


Figure 5. On-Resistance Variation with Temperature

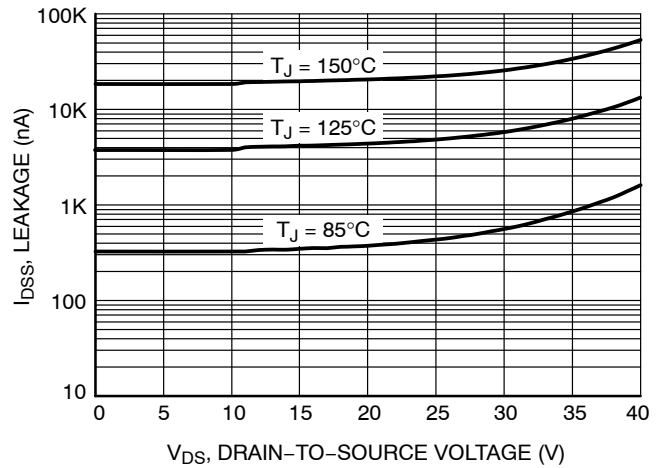


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTTFS2D1N04HL

TYPICAL CHARACTERISTICS

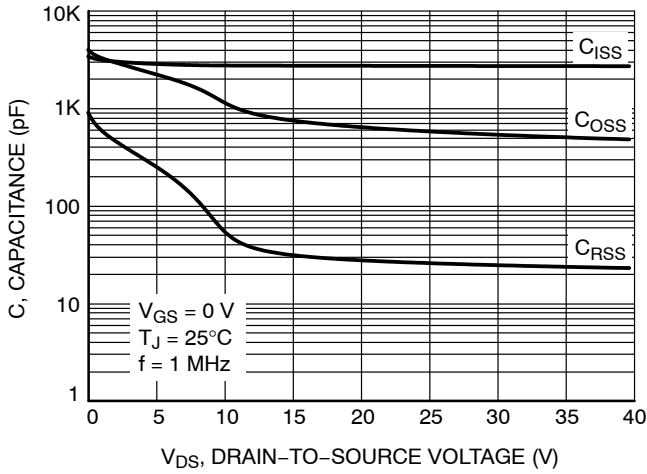


Figure 7. Capacitance Variation

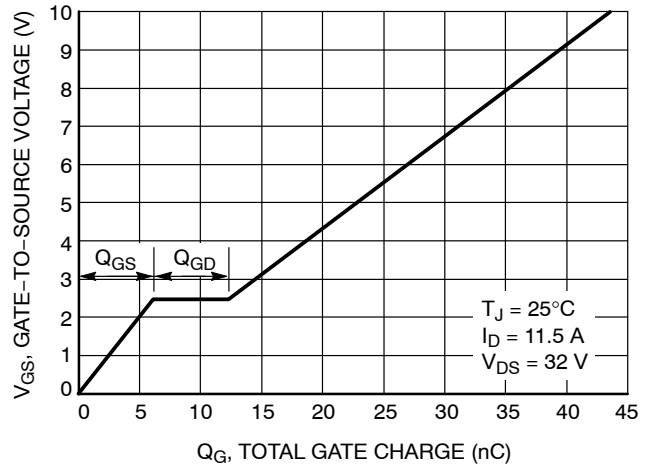


Figure 8. Gate-to-Source Voltage vs. Total Charge

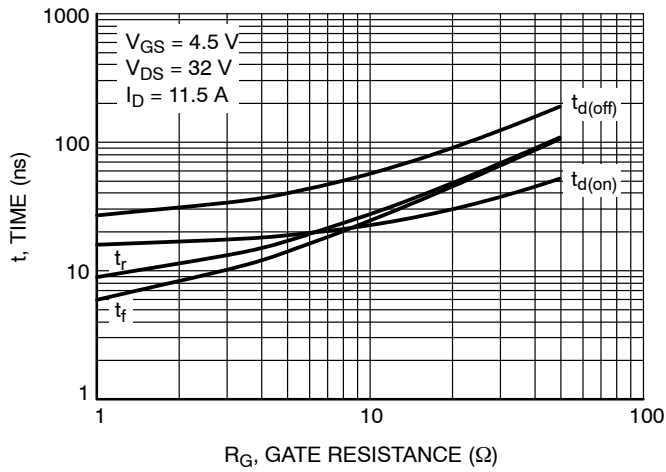


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

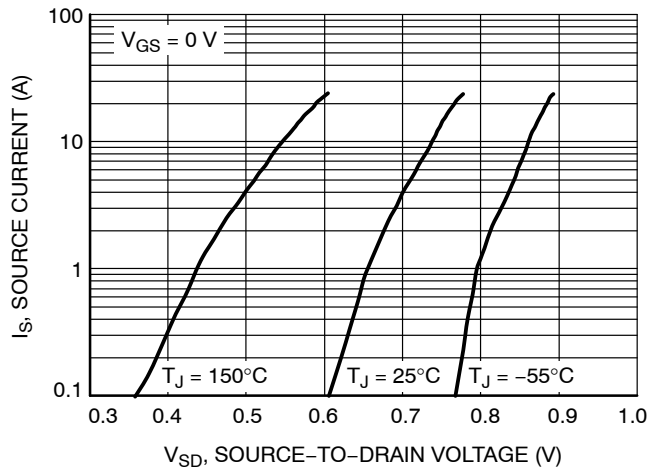


Figure 10. Diode Forward Voltage vs. Current

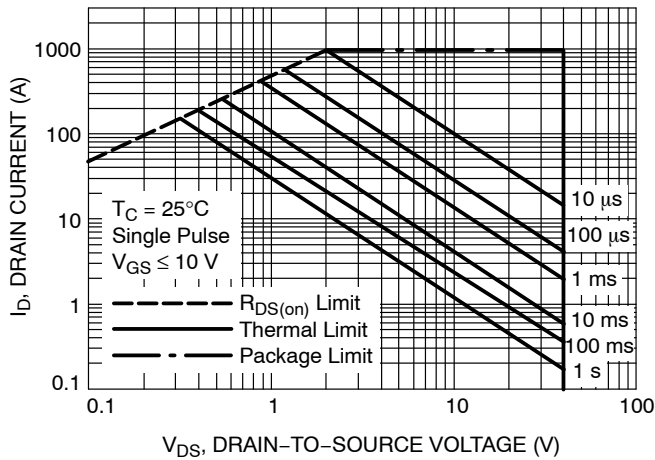


Figure 11. Maximum Rated Forward Biased Safe Operating Area

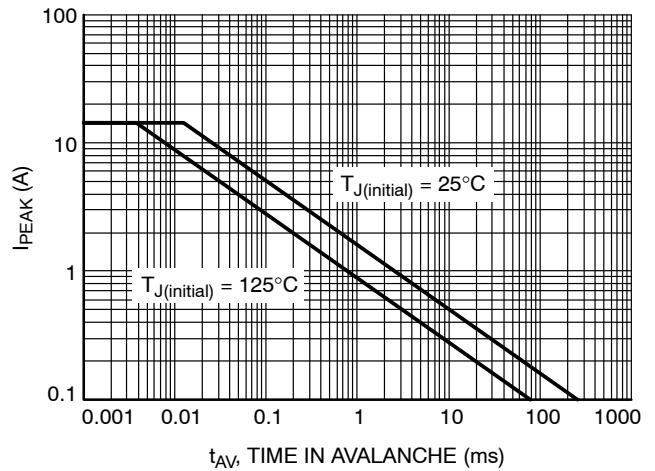


Figure 12. Maximum Drain Current vs. Time in Avalanche

NTTFS2D1N04HL

TYPICAL CHARACTERISTICS

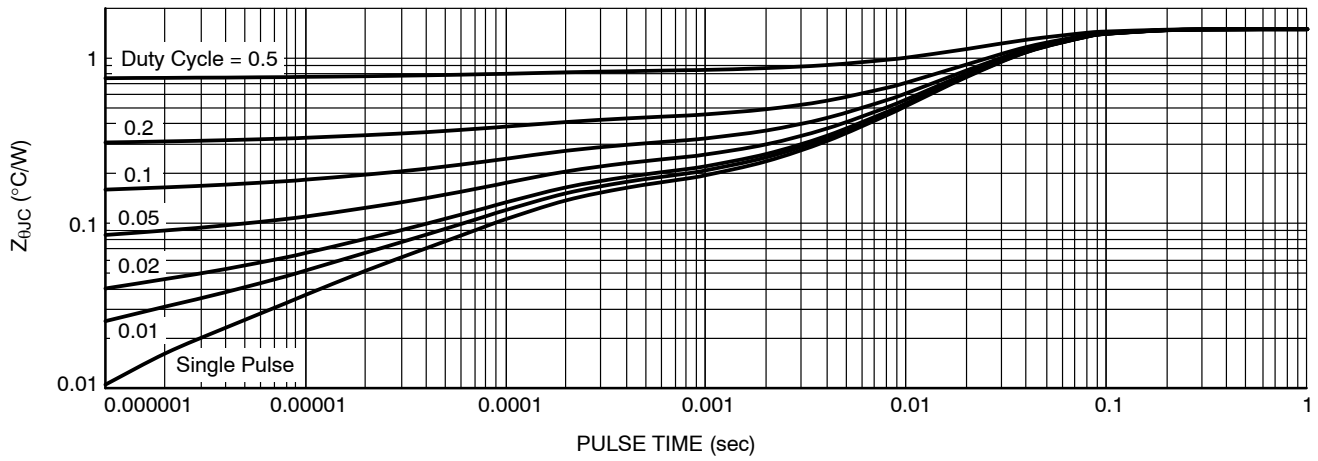


Figure 13. Transient Thermal Impedance

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

ON Semiconductor®

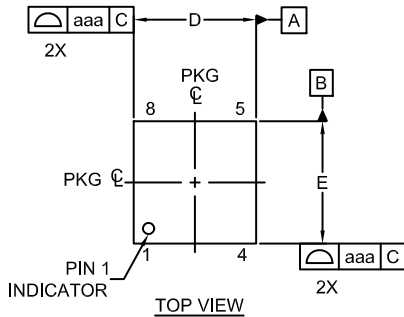


WDFN8 3.3X3.3, 0.65P

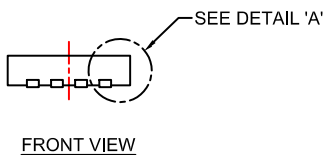
CASE 483AW

ISSUE A

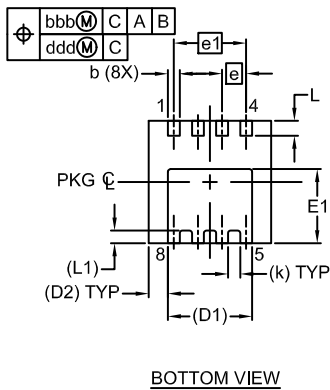
DATE 10 SEP 2019



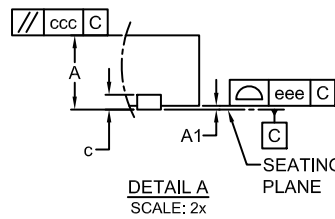
TOP VIEW



FRONT VIEW

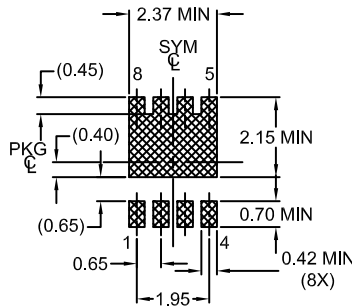


BOTTOM VIEW



DETAIL A
SCALE: 2x

LAND PATTERN RECOMMENDATION*



NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS.
2. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. 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	0.70	0.75	0.80
A1	-	-	0.05
b	0.27	0.32	0.37
c	0.15	0.20	0.25
D	3.20	3.30	3.40
D1	2.27 REF		
D2	0.52 REF		
E	3.20	3.30	3.40
E1	1.85	1.95	2.05
e	0.65 BSC		
e1	1.95 BSC		
k	0.33 REF		
L	0.30	0.40	0.50
L1	0.34 REF		
aaa	0.10		
bbb	0.10		
ccc	0.10		
ddd	0.05		
eee	0.05		

*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
 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 "•", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	98AON13672G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	WDFN8 3.3X3.3, 0.65P	PAGE 1 OF 1

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor 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.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales