

# NTMFS08N2D5C

## MOSFET – Power Trench, N-Channel, Shielded Gate

**80 V, 166 A, 2.7 mΩ**

### General Description

This N-Channel MV MOSFET is produced using ON Semiconductor's advanced PowerTrench process that incorporates Shielded Gate technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

### Features

- Shielded Gate MOSFET Technology
- Max  $R_{DS(on)}$  = 2.7 mΩ at  $V_{GS} = 10$  V,  $I_D = 68$  A
- Max  $R_{DS(on)}$  = 8 mΩ at  $V_{GS} = 6$  V,  $I_D = 34$  A
- 50% Lower  $Q_{rr}$  than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Primary DC-DC MOSFET
- Synchronous Rectifier in DC-DC and AC-DC
- Motor Drive
- Solar

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

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain to Source Voltage	80	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current:		A
	Continuous, $T_C = 25^\circ\text{C}$ (Note 5)	166	
	Continuous, $T_C = 100^\circ\text{C}$ (Note 5)	105	
	Continuous, $T_A = 25^\circ\text{C}$ (Note 1a) Pulsed (Note 4)	24 823	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	600	mJ
$P_D$	Power Dissipation:		W
	$T_C = 25^\circ\text{C}$	138	
	$T_A = 25^\circ\text{C}$ (Note 1a)	2.7	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

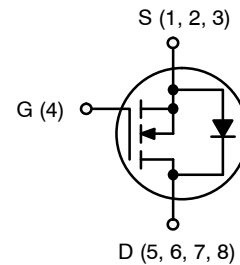
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



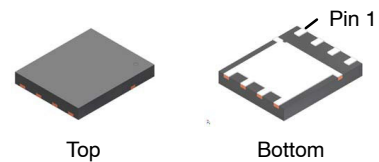
**ON Semiconductor®**

[www.onsemi.com](http://www.onsemi.com)

$V_{DS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
80 V	2.7 mΩ @ 10 V	166 A
	8 mΩ @ 6 V	



**N-CHANNEL MOSFET**



**Power 56  
(PQFN8)  
CASE 483AF**

### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
 &Z = Assembly Plant Code  
 &3 = Numeric Date Code  
 &K = Lot Code  
 NTMFS08N2D5C = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# NTMFS08N2D5C

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	45	

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

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

### OFF CHARACTERISTICS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	80			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$		62		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 64 \text{ V}, V_{GS} = 0 \text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA

### ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 380 \mu\text{A}$	2.0	2.9	4.0	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 380 \mu\text{A}$ , referenced to $25^\circ\text{C}$		-8.3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 68 \text{ A}$		2.2	2.7	m $\Omega$
		$V_{GS} = 6 \text{ V}, I_D = 34 \text{ A}$		3.3	8	
		$V_{GS} = 10 \text{ V}, I_D = 68 \text{ A}, T_J = 125^\circ\text{C}$		3.7	5.4	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_D = 68 \text{ A}$		148		S

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		4455	7500	pF
$C_{oss}$	Output Capacitance			1480	2485	pF
$C_{rss}$	Reverse Transfer Capacitance			59	105	pF
$R_g$	Gate Resistance			0.8	1.6	$\Omega$

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 40 \text{ V}, I_D = 68 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$		21	34	ns
$t_r$	Rise Time			11	20	ns
$t_{d(off)}$	Turn-Off Delay Time			29	47	ns
$t_f$	Fall Time			7	13	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0 \text{ V to } 10 \text{ V}, V_{DD} = 40 \text{ V}, I_D = 68 \text{ A}$		60	100	nC
		$V_{GS} = 0 \text{ V to } 6 \text{ V}, V_{DD} = 40 \text{ V}, I_D = 68 \text{ A}$		38	65	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = 40 \text{ V}, I_D = 68 \text{ A}$		19		nC
$Q_{gd}$	Gate to Drain "Miller" Charge	$V_{DD} = 40 \text{ V}, I_D = 68 \text{ A}$		12		nC
$Q_{oss}$	Output Charge	$V_{DD} = 40 \text{ V}, V_{GS} = 0 \text{ V}$		84		nC
$Q_{sync}$	Total Gate Charge Sync	$V_{DS} = 0 \text{ V}, I_D = 68 \text{ A}$		51		nC

# NTMFS08N2D5C

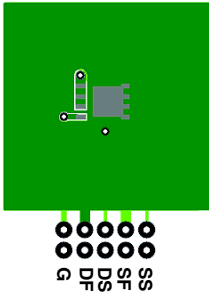
## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted) (continued)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.2 A (Note 2)		0.7	1.2	V
		V <sub>GS</sub> = 0 V, I <sub>S</sub> = 68 A (Note 2)		0.8	1.3	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 34 A, di/dt = 300 A/μs		30	48	ns
Q <sub>rr</sub>	Reverse Recovery Charge			55	88	nC
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 34 A, di/dt = 1000 A/μs		24	39	ns
Q <sub>rr</sub>	Reverse Recovery Charge			139	222	nC

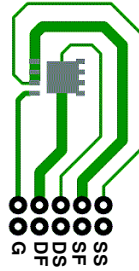
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. R<sub>θJA</sub> is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material. R<sub>θCA</sub> is determined by the user's board design.

### NOTES:



a) 45°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b) 115°C/W when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
- E<sub>AS</sub> of 600 mJ is based on starting T<sub>J</sub> = 25°C; N-ch: L = 3 mH, I<sub>AS</sub> = 20 A, V<sub>DD</sub> = 80 V, V<sub>GS</sub> = 10 V. 100% test at L = 0.1 mH, I<sub>AS</sub> = 63 A.
- Pulsed Id please refer to Figure 11 SOA graph for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

### ORDERING INFORMATION

Device	Marking	Package	Reel Size	Tape Width	Quantity
NTMFS08N2D5C	NTMFS08N2D5C	Power 56 (PQFN8) (Pb-Free / Halogen Free)	13"	12 mm	3000

# NTMFS08N2D5C

## TYPICAL CHARACTERISTICS

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

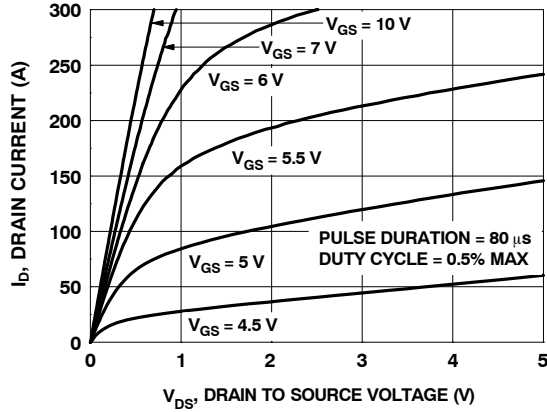


Figure 1. On Region Characteristics

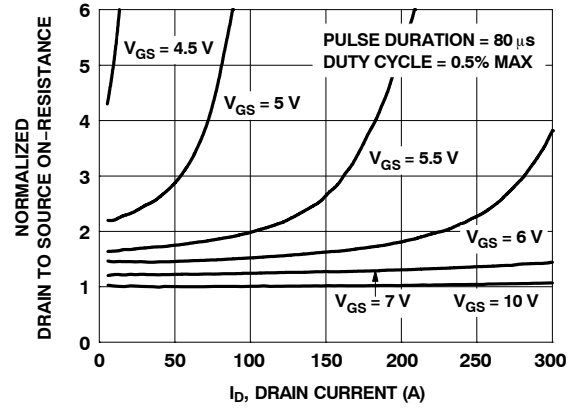


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

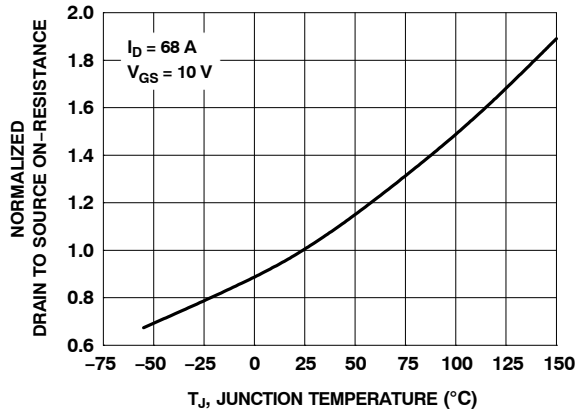


Figure 3. Normalized On-Resistance vs. Junction Temperature

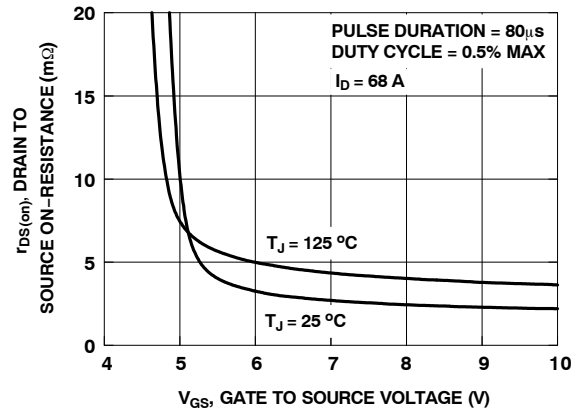


Figure 4. On-Resistance vs. Gate to Source Voltage

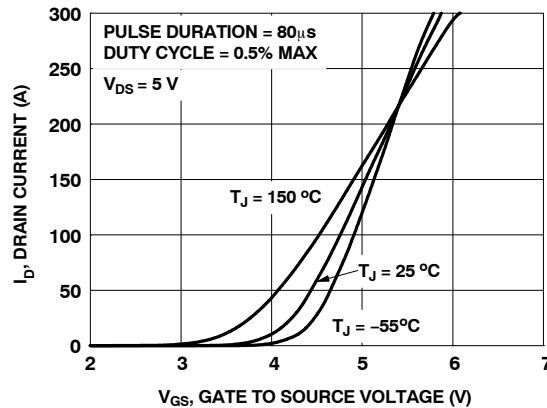


Figure 5. Transfer Characteristics

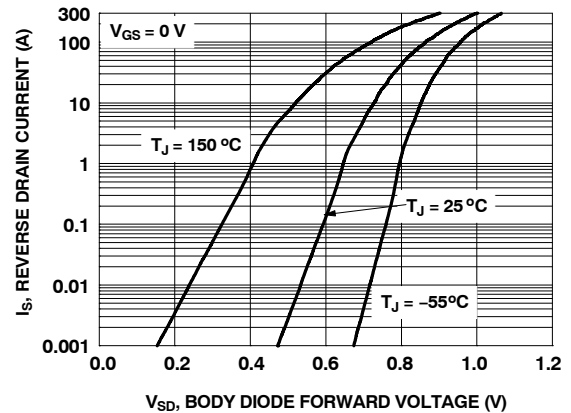


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

# NTMFS08N2D5C

## TYPICAL CHARACTERISTICS

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

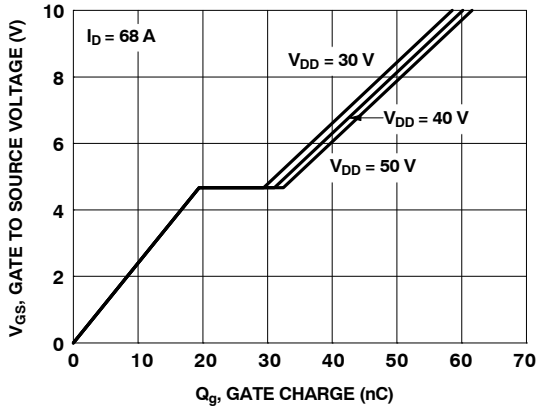


Figure 7. Gate Charge Characteristics

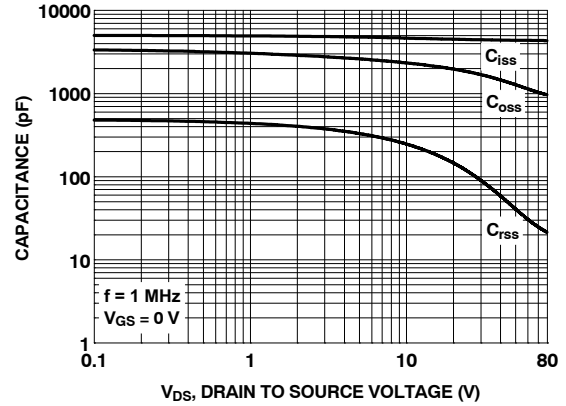


Figure 8. Capacitance vs. Drain to Source Voltage

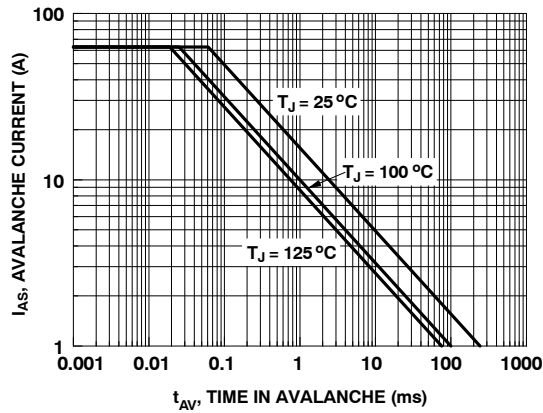


Figure 9. Unclamped Inductive Switching Capability

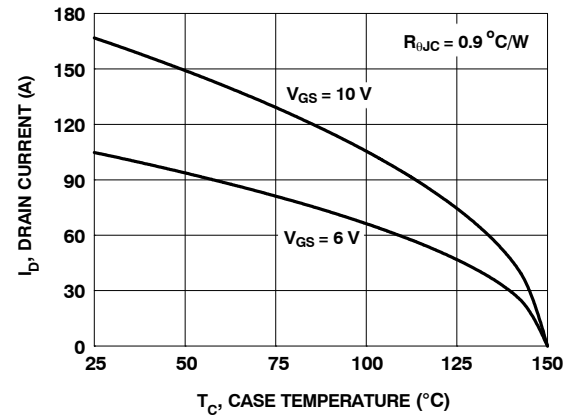


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

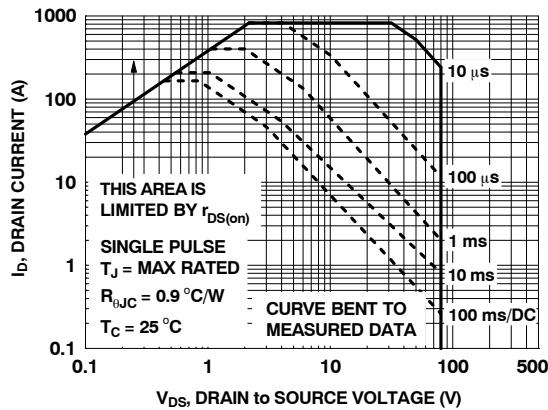


Figure 11. Forward Bias Safe Operating Area

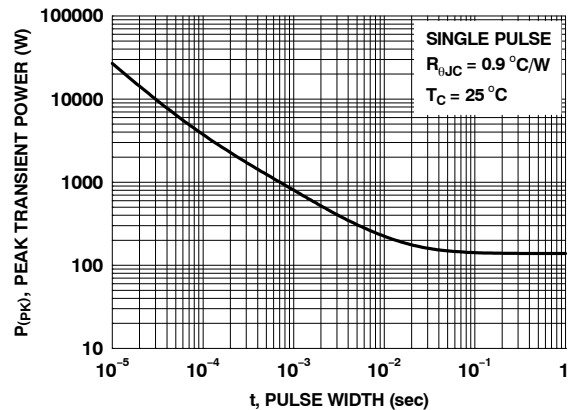


Figure 12. Single Pulse Maximum Power Dissipation

# NTMFS08N2D5C

## TYPICAL CHARACTERISTICS

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

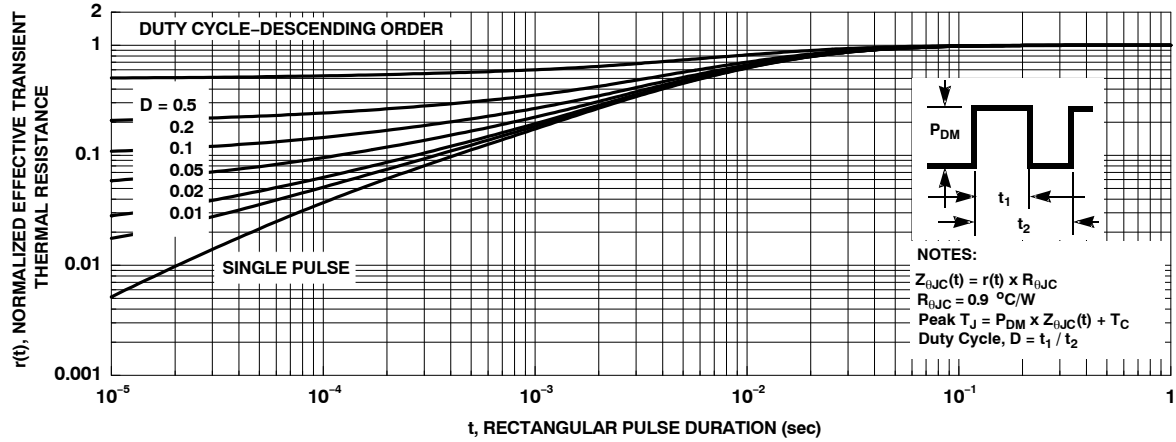
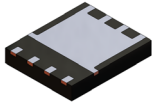


Figure 13. Junction-to-Case Transient Thermal Response Curve

# MECHANICAL CASE OUTLINE

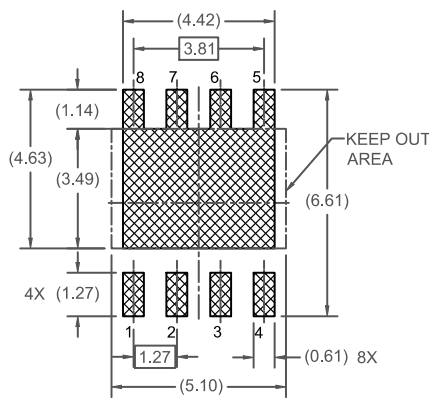
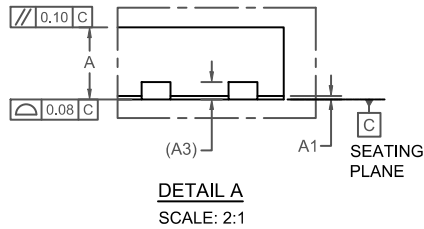
## PACKAGE DIMENSIONS

ON Semiconductor®



### PQFN8 5X6, 1.27P CASE 483AF ISSUE A

DATE 06 JUL 2021



\*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: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. AA,
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	-	0.05
A3	0.20 REF.		
b	0.37	0.42	0.47
D	4.90	5.00	5.10
D2	4.13	4.23	4.33
E	5.90	6.00	6.10
E2	4.23	4.33	4.43
E3	0.35 REF.		
e	1.27 BSC		
e/2	0.635 BSC		
e1	3.81 BSC		
L	0.52	0.57	0.62
L4	0.55	0.65	0.75
z	0.38 REF		

<b>DOCUMENT NUMBER:</b>	<b>98AON13656G</b>	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
<b>DESCRIPTION:</b>	<b>PQFN8 5X6, 1.27P</b>	<b>PAGE 1 OF 1</b>

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](http://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](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)