

MOSFET - Power, N-Channel, Shielded Gate, POWER trench[®] 100 V, 50 A, 10.6 mΩ

NTTFS010N10MCL

General Description

This N-Channel POWER trench[®] MOSFET is produced using onsemi's advanced POWER trench[®] 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.

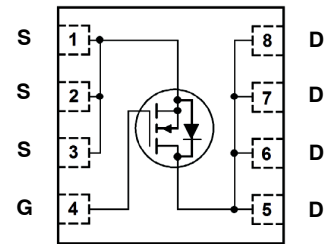
Features

- Shielded Gate MOSFET Technology
- Max $r_{DS(on)}$ = 10.6 mΩ at V_{GS} = 10 V, I_D = 15 A
- Max $r_{DS(on)}$ = 15.9 mΩ at V_{GS} = 4.5 V, I_D = 12 A
- 50% Lower Q_{rr} than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

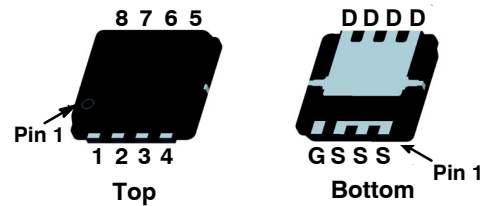
Applications

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

ELECTRICAL CONNECTION

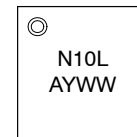


N-Channel MOSFET



WDFN8
(3.3x3.3, 0.65 P)
CASE 511DY

MARKING DIAGRAM



N10L = Device Code
A = Assembly Location
Y = Year Code
WW = Work Week Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

NTTFS010N10MCL

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

Symbol	Parameter	Ratings	Unit
V_{DS}	Drain to Source Voltage	100	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current –Continuous $T_C = 25^\circ\text{C}$ (Note 5)	50	A
	–Continuous $T_C = 100^\circ\text{C}$ (Note 5)	32	
	–Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	10.7	
	–Pulsed (Note 4)	250	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	73	mJ
P_D	Power Dissipation $T_C = 25^\circ\text{C}$	52	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to $+150$	$^\circ\text{C}$

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 CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.4	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Quantity
NTTFS010N10MCLTAG	N10L	WDFN8 (3.3x3.3)	7"	12 mm	1500 Units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

OFF CHARACTERISTICS

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C		64		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 80\ \text{V}, V_{GS} = 0\ \text{V}$			1	μA
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	$V_{GS} = V_{DS}, I_D = 85\ \mu\text{A}$	1.0	1.5	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 85\ \mu\text{A}$, referenced to 25°C		-5.3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}, I_D = 15\ \text{A}$		9.1	10.6	m Ω
		$V_{GS} = 4.5\ \text{V}, I_D = 12\ \text{A}$		13.5	15.9	
		$V_{GS} = 10\ \text{V}, I_D = 15\ \text{A}, T_J = 125^\circ\text{C}$		15.3	17.8	
g_{FS}	Forward Transconductance	$V_{DS} = 5\ \text{V}, I_D = 15\ \text{A}$		54		S

DYNAMIC CHARACTERISTICS

C_{ISS}	Input Capacitance	$V_{DS} = 50\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$		1530	2150	pF
C_{OSS}	Output Capacitance			625	875	
C_{RSS}	Reverse Transfer Capacitance			10	18	
R_G	Gate Resistance		0.1	1.1	2.1	

NTTFS010N10MCL

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

SWITCHING CHARACTERISTICS

$t_{d(ON)}$	Turn – On Delay Time	$V_{DD} = 50\text{ V}, I_D = 15\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		9	19	ns
$t_{rd(ON)}$	Rise Time			3	10	
$t_{d(OFF)}$	Turn – Off Delay Time			28	45	
t_f	Fall Time			5	10	
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to }10\text{ V}$		22	30	nC
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to }4.5\text{ V}$		10		
Q_{gs}	Gate to Source Charge	$V_{DD} = 50\text{ V}$ $I_D = 15\text{ A}$		4		
Q_{gd}	Gate to Drain “Miller” Charge			3		
Q_{oss}	Output Charge	$V_{DD} = 50\text{ V}, V_{GS} = 0\text{ V}$		41		nC
Q_{sync}	Total Gate Charge Sync	$V_{DS} = 0\text{ V}, V_{GS} = 0\text{ to }10\text{ V}$		19		

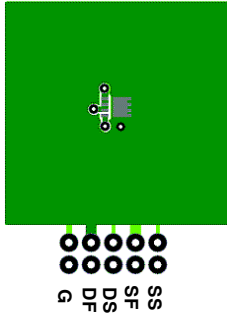
DRAIN–SOURCE DIODE CHARACTERISTICS

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 15\text{ A}$ (Note 2)		0.8	1.3	
t_{rr}	Reverse Recovery Time	$I_F = 8\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$		22	36	ns
Q_{rr}	Reverse Recovery Charge			35	56	nC
t_{rr}	Reverse Recovery Time	$I_F = 8\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}$		17	30	ns
Q_{rr}	Reverse Recovery Charge			79	126	nC

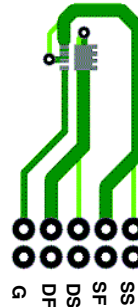
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 × 1.5 in. board of FR-4 material. $R_{\theta CA}$ is determined by the user's board design.



a) $53^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper.



b) $125^\circ\text{C}/\text{W}$ when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300 μs , Duty cycle < 2.0%.
- E_{AS} of 73 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 3\text{ mH}$, $I_{AS} = 7\text{ A}$, $V_{DD} = 100\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.5\text{ mH}$, $I_{AS} = 13\text{ A}$.
- Pulsed I_D 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.

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

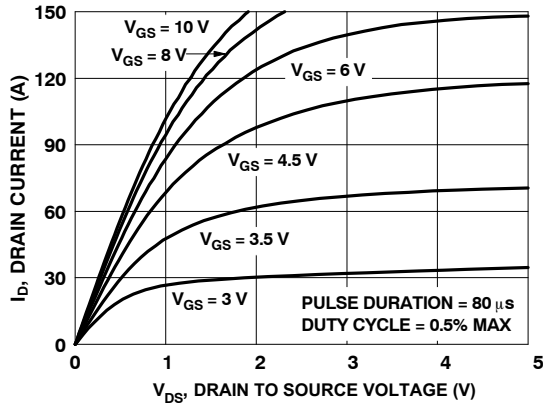


Figure 1. On Region Characteristics

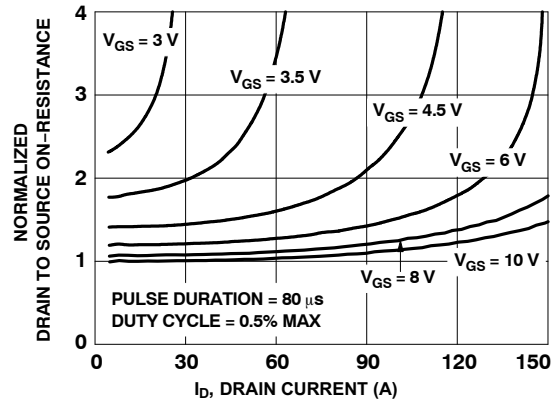


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

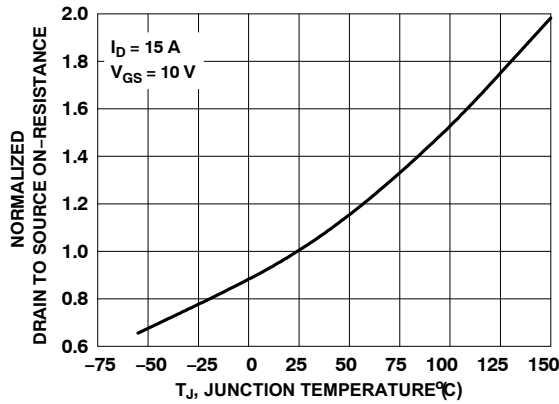


Figure 3. Normalized On Resistance vs. Junction Temperature

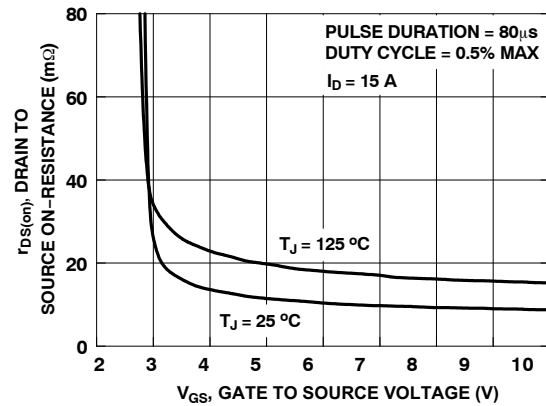


Figure 4. On-Resistance vs. Gate to Source Voltage

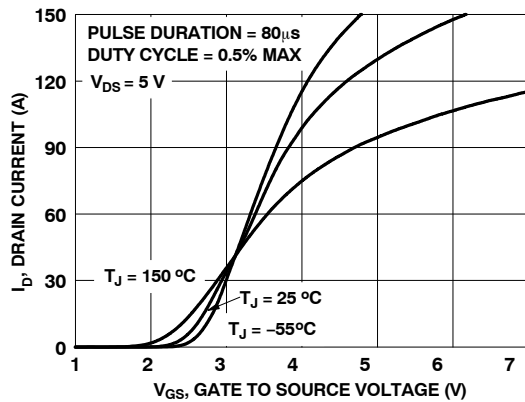


Figure 5. Transfer Characteristics

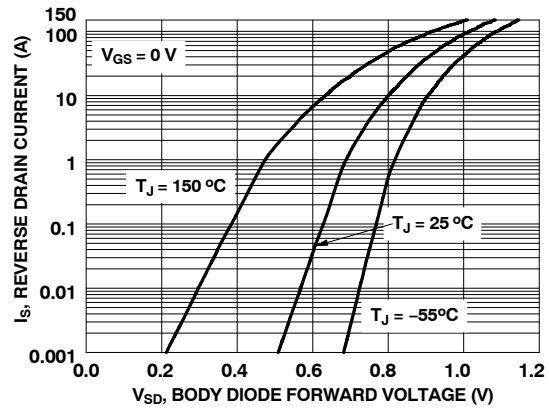


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

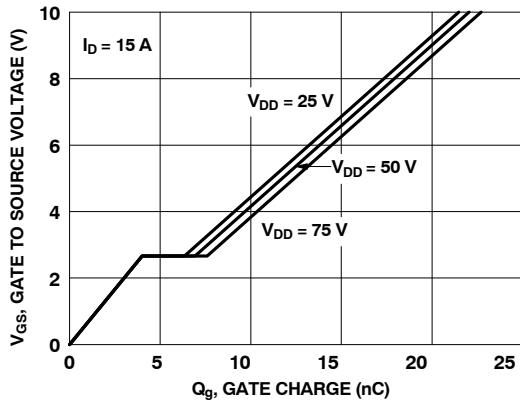


Figure 7. Gate Charge Characteristics

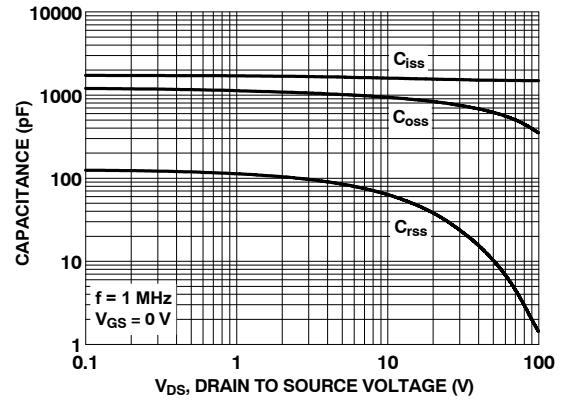


Figure 8. Capacitance vs. Drain to Source Voltage

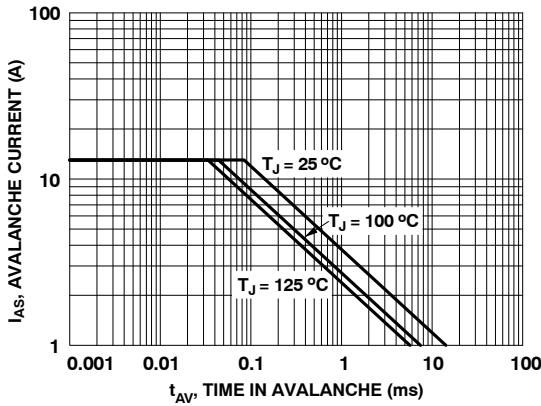


Figure 9. Unclamped Inductive Switching Capability

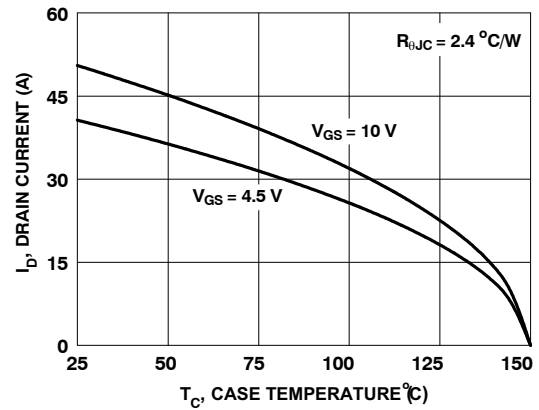


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

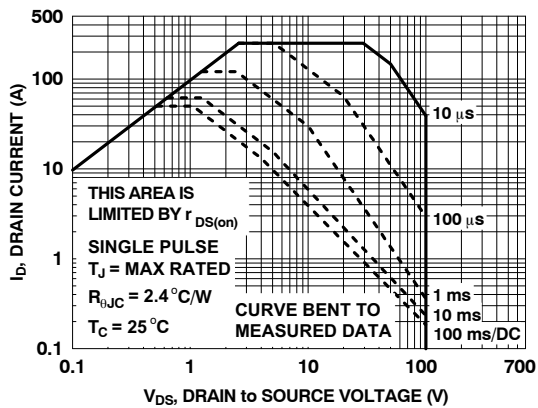


Figure 11. Forward Bias Safe Operating Area

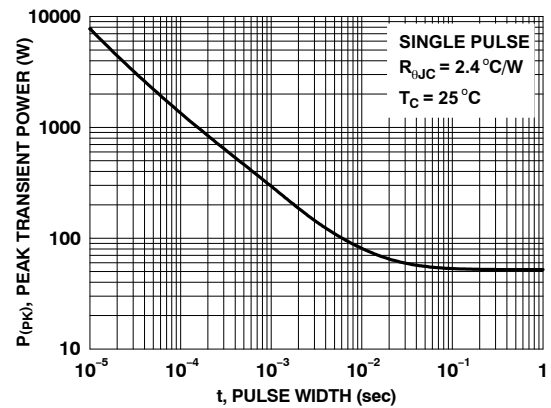


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

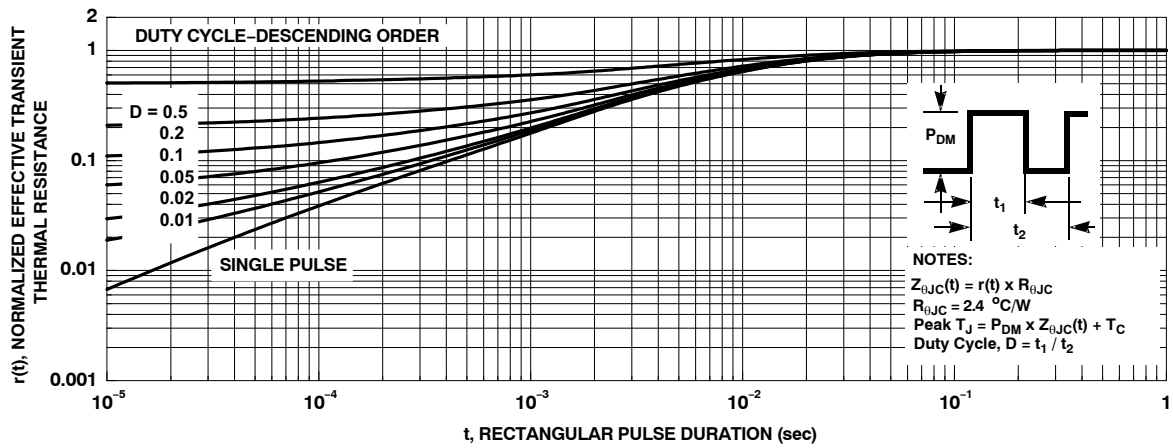
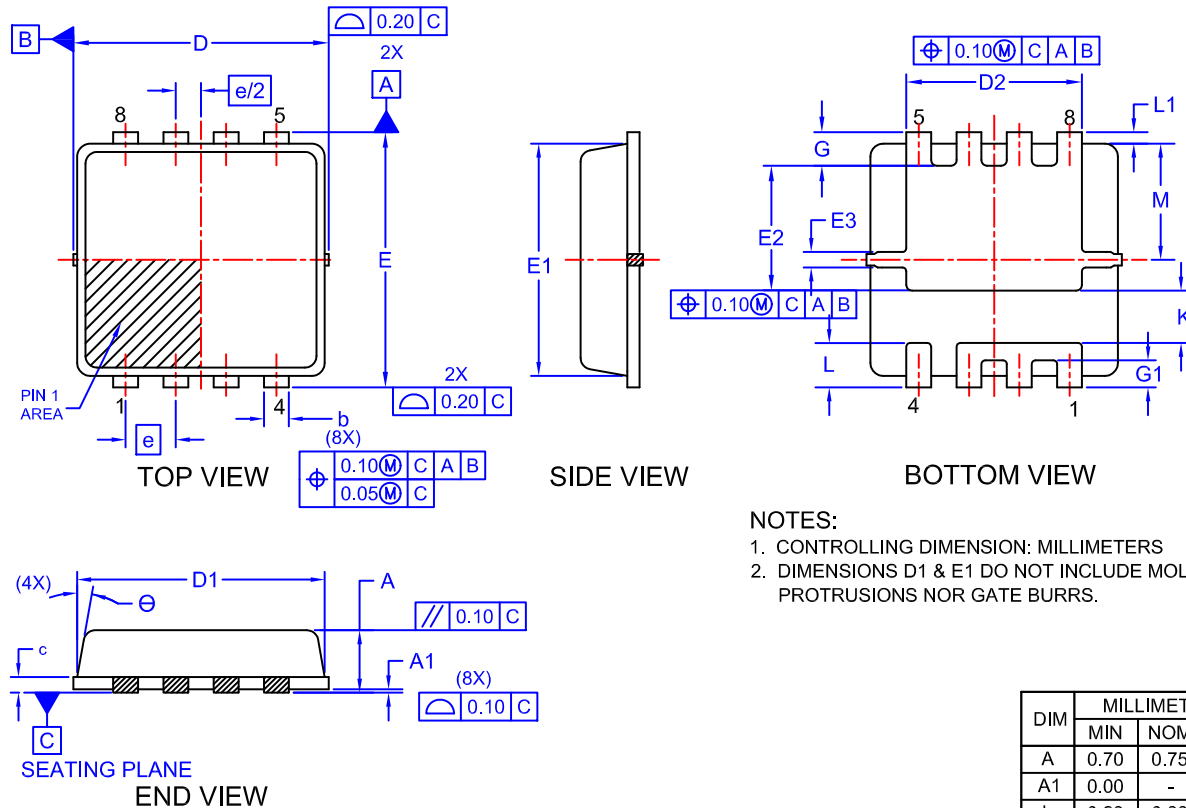


Figure 13. Junction-to-Case Transient Thermal Response Curve

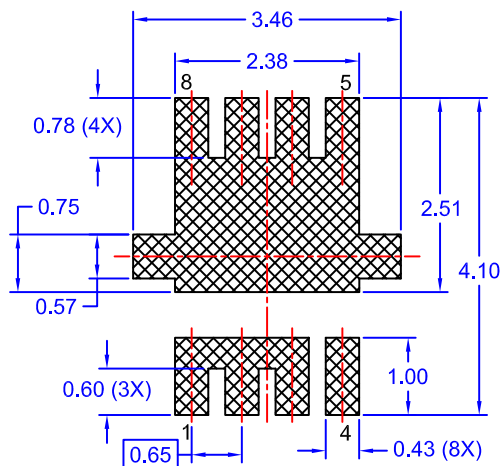
WDFN8 3.3x3.3, 0.65P
CASE 511DY
ISSUE A

DATE 21 AUG 2018

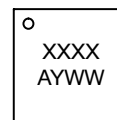


NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS
2. DIMENSIONS D1 & E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS NOR GATE BURRS.



GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	-	0.05
b	0.23	0.33	0.43
c	0.15	0.20	0.25
D	3.20	3.30	3.40
D1	2.95	3.13	3.30
D2	1.98	2.20	2.40
E	3.20	3.30	3.40
E1	2.80	3.00	3.15
E2	1.40	1.60	1.80
E3	0.15	0.25	0.40
e	0.65 BSC		
G	0.30	0.43	0.55
G1	0.25	0.35	0.45
K	0.55	0.75	0.95
L	0.35	0.52	0.65
L1	0.06	0.15	0.30
M	1.35	1.50	1.60
Θ	0	-	12

DOCUMENT NUMBER:	98AON90827G	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

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.

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