

# MOSFET - Power, Single N-Channel, $\mu$ 8FL 30 V, 17 m $\Omega$ , 22 A



ON Semiconductor®

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

## NVTFS4C25N

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- NVTFS4C25NWF – Wettable Flanks Product
- NVT Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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

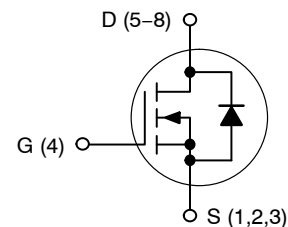
Parameter		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DSS}$	30	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 5)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	10.1	A
		$T_A = 85^\circ\text{C}$		7.8	
Power Dissipation $R_{\theta JA}$ (Notes 1, 3, 5)		$T_A = 25^\circ\text{C}$	$P_D$	3.0	W
		$T_A = 85^\circ\text{C}$		1.8	
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 4, 5)	Steady State	$T_C = 25^\circ\text{C}$	$I_D$	22.1	A
		$T_C = 85^\circ\text{C}$		17.1	
Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 4, 5)		$T_C = 25^\circ\text{C}$	$P_D$	14.3	W
		$T_C = 85^\circ\text{C}$		8.6	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	90	A	
Operating Junction and Storage Temperature		$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	14	A	
Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}, I_L = 6.7 \text{ A}_{pk}, L = 0.5 \text{ mH}$ )		$E_{AS}$	11.2	mJ	
Lead Temperature 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.

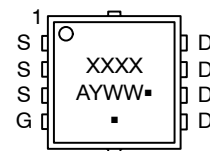
1. The entire application environment impacts the thermal resistance values shown; they are not constants and are valid for the specific conditions noted.
2. Psi ( $\psi$ ) is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to a single case surface.
3. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz. Cu Pad.
4. Assumes heat-sink sufficiently large to maintain constant case temperature independent of device power.
5. Continuous DC current rating. Maximum current for pulses as long as one second is higher but dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX
30 V	17 m $\Omega$ @ 10 V	22 A
	26.5 m $\Omega$ @ 4.5 V	

### N-Channel MOSFET



### MARKING DIAGRAM



4C25 = Specific Device Code for NVMTS4C25N

25WF = Specific Device Code of NVTFS4C25NWF

A = Assembly Location

Y = Year

WW = Work Week

▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# NVTFS4C25N

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain) (Notes 6, 7 and 9)	$\Psi_{\theta JC}$	10.5	°C/W
Junction-to-Ambient – Steady State (Notes 6 and 8)	$R_{\theta JA}$	50	

- The entire application environment impacts the thermal resistance values shown; they are not constants and are valid for the specific conditions noted.
- Psi ( $\psi$ ) is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to a single case surface.
- Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz. Cu Pad.
- Assumes heat-sink sufficiently large to maintain constant case temperature independent of device power.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			15.3		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA

## ON CHARACTERISTICS (Note 10)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.3		2.2	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-4.5		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 10\text{ A}$	13	17	m $\Omega$
		$V_{GS} = 4.5\text{ V}$	$I_D = 9\text{ A}$	21	26.5	
Forward Transconductance	$g_{FS}$	$V_{DS} = 1.5\text{ V}, I_D = 15\text{ A}$		23		S
Gate Resistance	$R_G$	$T_A = 25^\circ\text{C}$		1.0		$\Omega$

## CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$		500		pF
Output Capacitance	$C_{OSS}$			295		
Reverse Transfer Capacitance	$C_{RSS}$			85		
Capacitance Ratio	$C_{RSS}/C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V}, f = 1\text{ MHz}$		0.170		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 20\text{ A}$		5.1		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.9		
Gate-to-Source Charge	$Q_{GS}$			1.7		
Gate-to-Drain Charge	$Q_{GD}$			2.7		
Gate Plateau Voltage	$V_{GP}$			3.3		V
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 20\text{ A}$		10.3		nC

## SWITCHING CHARACTERISTICS (Note 11)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 10\text{ A}, R_G = 3.0\ \Omega$		8.0		ns
Rise Time	$t_r$			32		
Turn-Off Delay Time	$t_{d(OFF)}$			10		
Fall Time	$t_f$			3.0		
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$		4.0		ns
Rise Time	$t_r$			25		
Turn-Off Delay Time	$t_{d(OFF)}$			13		
Fall Time	$t_f$			2.0		

- Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.

# NVTFS4C25N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>							
Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V},$ $I_S = 10\text{ A}$	$T_J = 25^\circ\text{C}$		0.87	1.2	V
			$T_J = 125^\circ\text{C}$		0.75		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$		18.2		ns	
Charge Time	$t_a$			9.8			
Discharge Time	$t_b$			8.4			
Reverse Recovery Charge	$Q_{RR}$			5.7			nC

10. Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

11. Switching characteristics are independent of operating junction temperatures.

# NVTFS4C25N

## TYPICAL CHARACTERISTICS

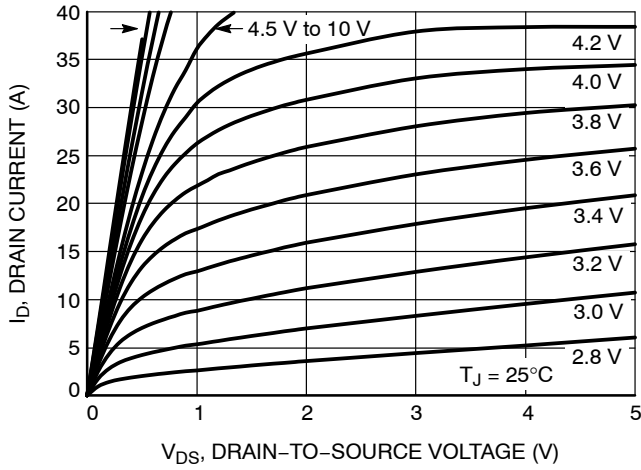


Figure 1. On-Region Characteristics

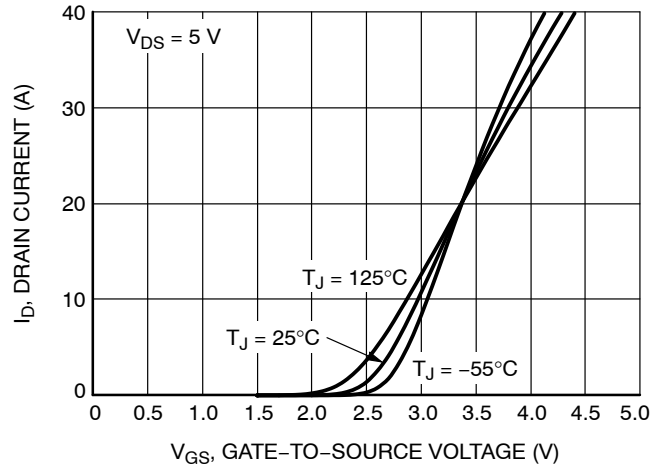


Figure 2. Transfer Characteristics

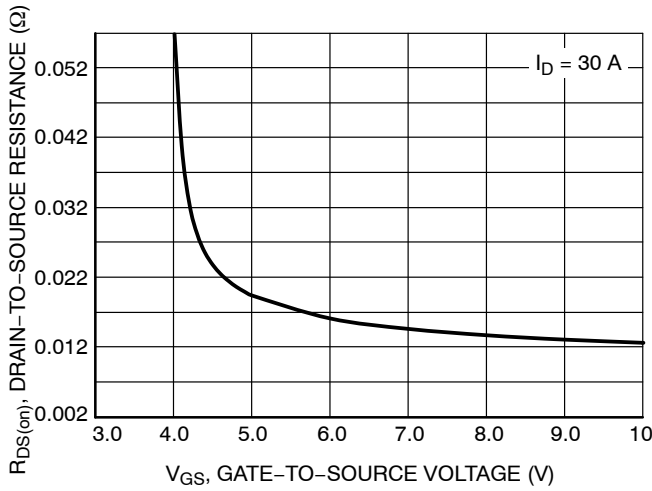


Figure 3. On-Resistance vs.  $V_{GS}$

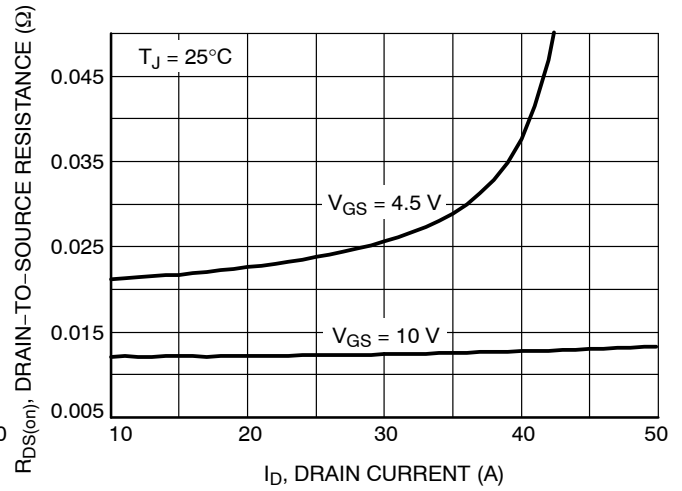


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

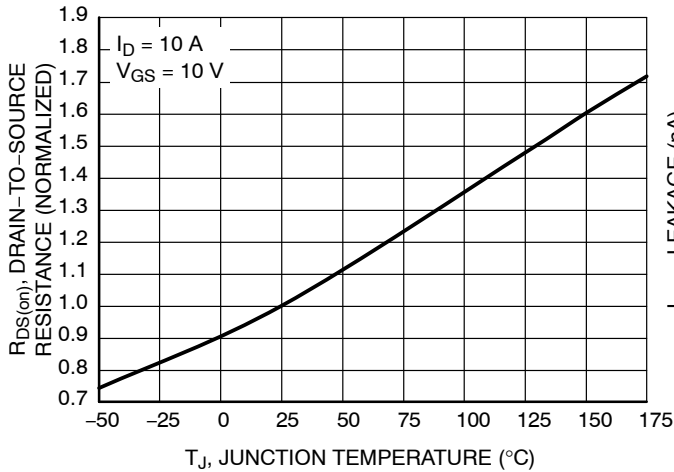


Figure 5. On-Resistance Variation with Temperature

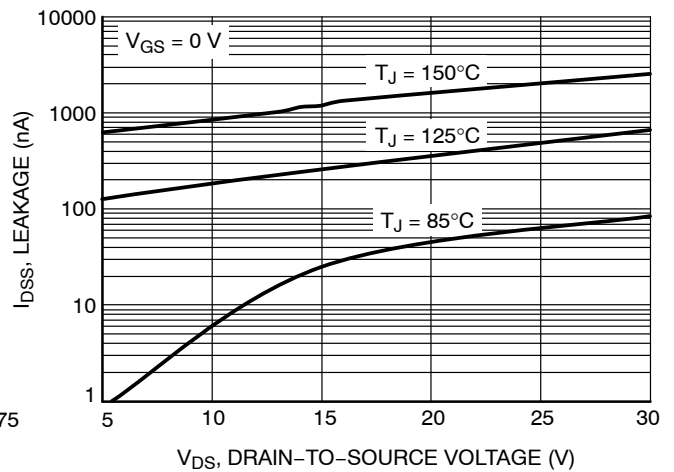


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NVTFS4C25N

## TYPICAL CHARACTERISTICS

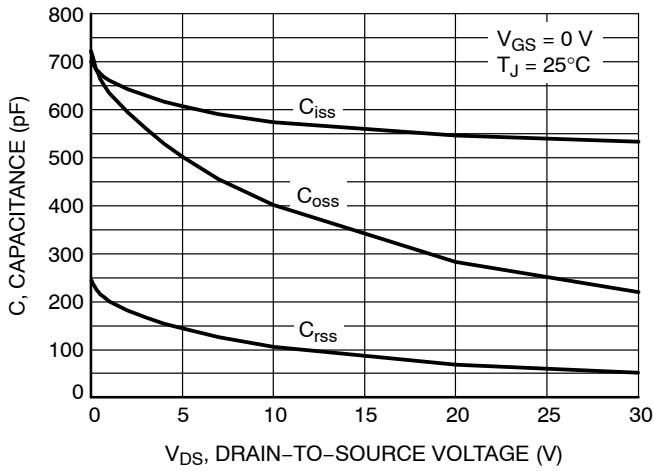


Figure 7. Capacitance Variation

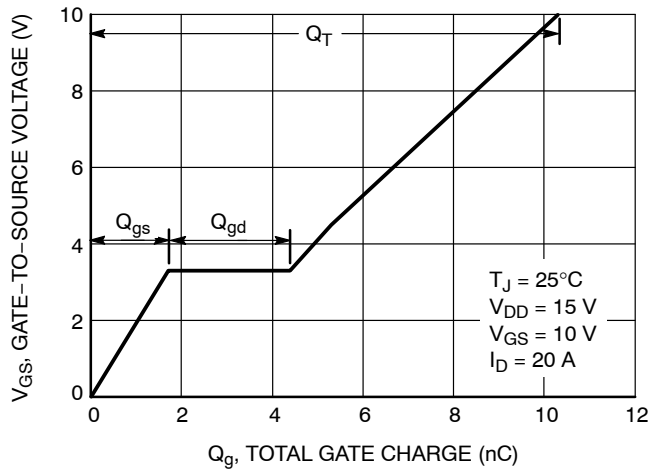


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

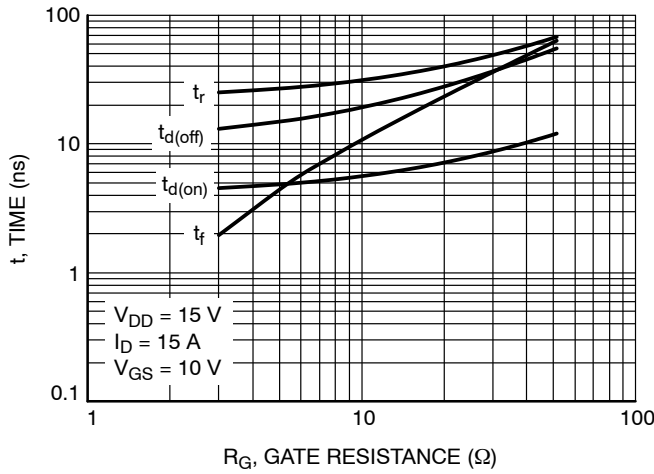


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

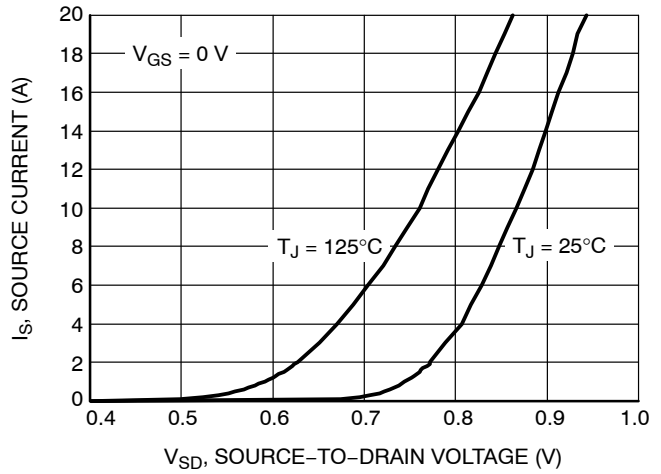


Figure 10. Diode Forward Voltage vs. Current

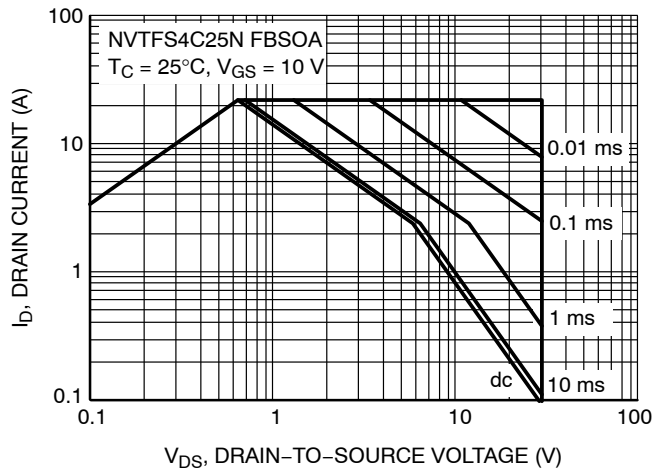


Figure 11. Maximum Rated Forward Biased Safe Operating Area

# NVTFS4C25N

## TYPICAL CHARACTERISTICS

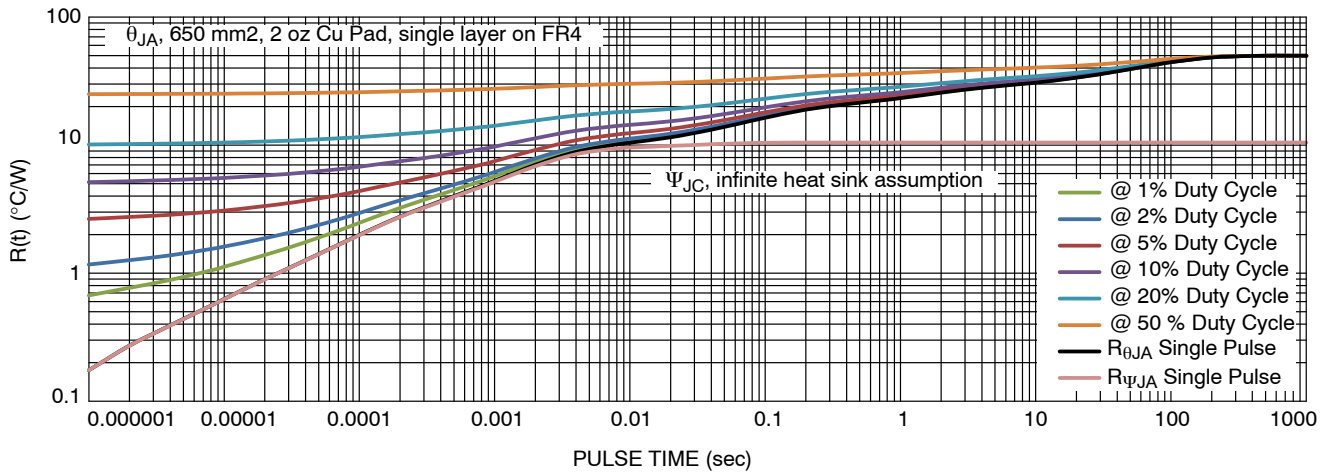


Figure 12. Thermal Response

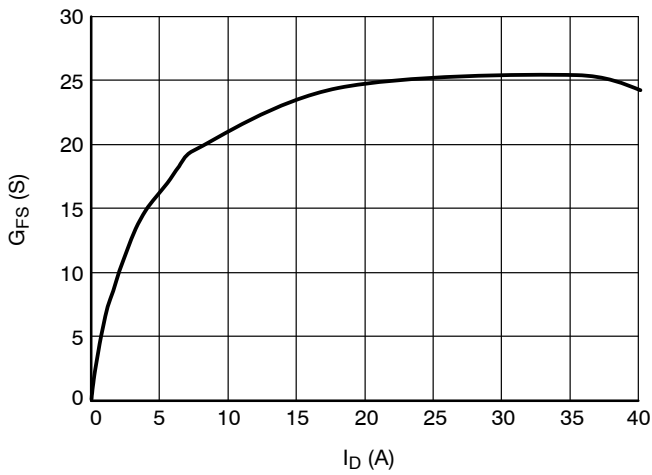


Figure 13.  $G_{FS}$  vs.  $I_D$

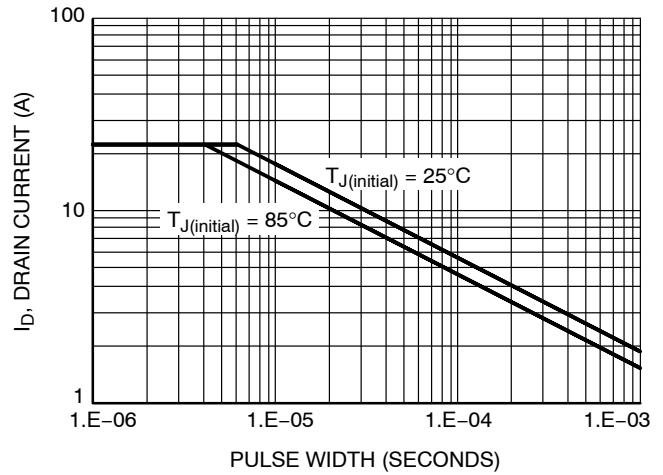


Figure 14. Avalanche Characteristics

### ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NVTFS4C25NTAG	4C25	WDFN8 (Pb-Free)	1500 / Tape & Reel
NVTFS4C25NWFTAG	25WF	WDFN8 (Pb-Free)	1500 / 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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

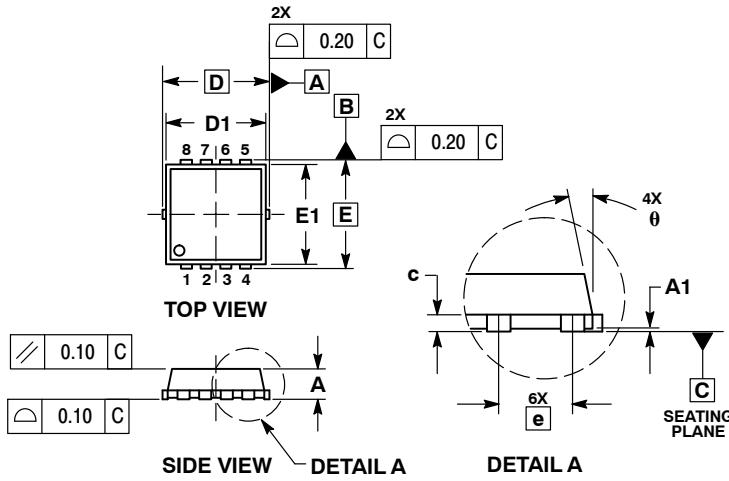
ON Semiconductor®



SCALE 2:1

### WDFN8 3.3x3.3, 0.65P CASE 511AB ISSUE D

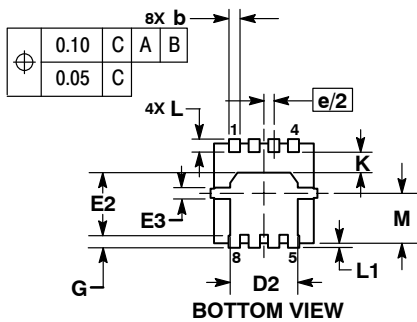
DATE 23 APR 2012



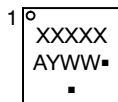
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	---	0.05	0.000	---	0.002
b	0.23	0.30	0.40	0.009	0.012	0.016
c	0.15	0.20	0.25	0.006	0.008	0.010
D	3.30 BSC			0.130 BSC		
D1	2.95	3.05	3.15	0.116	0.120	0.124
D2	1.98	2.11	2.24	0.078	0.083	0.088
E	3.30 BSC			0.130 BSC		
E1	2.95	3.05	3.15	0.116	0.120	0.124
E2	1.47	1.60	1.73	0.058	0.063	0.068
E3	0.23	0.30	0.40	0.009	0.012	0.016
e	0.65 BSC			0.026 BSC		
G	0.30	0.41	0.51	0.012	0.016	0.020
K	0.65	0.80	0.95	0.026	0.032	0.037
L	0.30	0.43	0.56	0.012	0.017	0.022
L1	0.06	0.13	0.20	0.002	0.005	0.008
M	1.40	1.50	1.60	0.055	0.059	0.063
θ	0°	---	12°	0°	---	12°



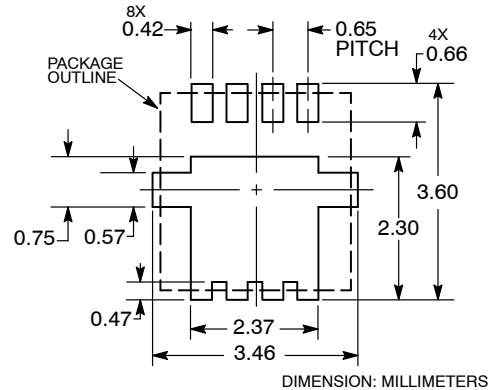
#### GENERIC MARKING DIAGRAM\*



- XXXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb-Free Package

\*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.

#### SOLDERING FOOTPRINT\*



DIMENSION: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

DOCUMENT NUMBER:	98AON30561E	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 ON 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.

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 owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor'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). 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor 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](mailto:orderlit@onsemi.com)

ON Semiconductor Website: [www.onsemi.com](http://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