ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

NTTFS4C13N

[MOSFET]() – Power, Single, N-Channel, µ8FL
30 V, 38 A

Features
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications
- CPU Power Delivery
- DC−DC Converters

ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
30 V	9.4 mΩ @ 10 V	38 A
	14 mΩ @ 4.5 V	

D (5–8)

G (4)

S (1,2,3)

N−CHANNEL MOSFET

MARKING DIAGRAM

WDFN8
(µ8FL)
CASE 511AB


```
S      D
S  4C13 D
S  AYWW■ D
G    ■ D
```

4C13 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
■ = Pb−Free Package

(Note: Microdot may be in either location)

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current $R_{θJA}$ (Note 1)	Steady State	T_A = 25°C	I_D	11.7	A
		T_A = 80°C		8.5	
Power Dissipation $R_{θJA}$ (Note 1)		T_A = 25°C	P_D	2.06	W
Continuous Drain Current $R_{θJA}$ ≤ 10 s (Note 1)		T_A = 25°C	I_D	15.8	A
		T_A = 80°C		11.4	
Power Dissipation $R_{θJA}$ ≤ 10 s (Note 1)		T_A = 25°C	P_D	3.73	W
Continuous Drain Current $R_{θJA}$ (Note 2)		T_A = 25°C	I_D	7.2	A
		T_A = 80°C		5.2	
Power Dissipation $R_{θJA}$ (Note 2)		T_A = 25°C	P_D	0.78	W
Continuous Drain Current $R_{θJC}$ (Note 1)		T_C = 25°C	I_D	38	A
		T_C =80°C		27	
Power Dissipation $R_{θJC}$ (Note 1)		T_C = 25°C	P_D	21.5	W
Pulsed Drain Current	T_A = 25°C, t_p = 10 µs		I_{DM}	68	A
Current Limited by Package	T_A = 25°C		I_{Dmax}	70	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to +150	°C
Source Current (Body Diode)			I_S	19	A
Drain to Source DV/DT			dV/d_t	7.0	V/ns
Single Pulse Drain−to−Source Avalanche Energy (T_J = 25°C, V_{GS} = 10 V, I_L = 4 A_{pk}, L = 0.1 mH, R_{GS} = 25 Ω) (Note 3)			E_{AS}	22	mJ
Lead Temperature 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.
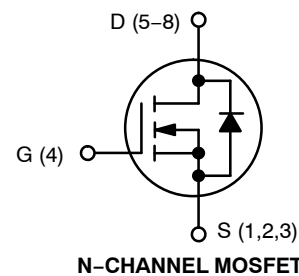1. Surface−mounted on FR4 board using 1 sq−in pad, 1 oz Cu.
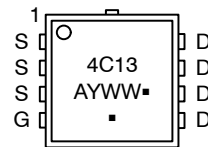2. Surface−mounted on FR4 board using the minimum recommended pad size.

ORDERING INFORMATION

Device	Package	Shipping†
NTTFS4C13NTAG	WDFN8 (Pb−Free)	1500 / Tape & Reel
NTTFS4C13NTWG	WDFN8 (Pb−Free)	5000 / Tape & Reel

†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.

NTTFS4C13N

3. This is absolute maximum rating. Parts are tested at $T_J = 25°C$ $V_{qs} = 10$ V,
   $I_L = 15$ Apk, $E_{AS} = 11$ mJ.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	5.8	°C/W
Junction−to−Ambient − Steady State (Note 4)	$R_{\theta JA}$	60.8	
Junction−to−Ambient − Steady State (Note 5)	$R_{\theta JA}$	160	
Junction−to−Ambient − (t ≤ 10 s) (Note 4)	$R_{\theta JA}$	33.5	

4. Surface−mounted on FR4 board using 1 sq−in pad, 1 oz Cu.
5. Surface−mounted on FR4 board using the minimum recommended pad size.

ELECTRICAL CHARACTERISTICS ($T_J = 25°C$ unless otherwise specified)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = 250$ μA		30			V
Drain−to−Source Breakdown Voltage (transient)	$V_{(BR)DSSt}$	$V_{GS} = 0$ V, $I_{D(aval)} = $ TBD A, $T_{case} = 25°C$, $t_{transient} = 100$ ns		34			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				14.9		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0$ V, $V_{DS} = 24$ V	$T_J = 25°C$			1.0	μA
			$T_J = 125°C$			10	
Gate−to−Source Leakage Current	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = ±20$ V				±100	nA
ON CHARACTERISTICS (Note 6)							
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, $I_D = 250$ μA		1.3		2.1	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				4.8		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10$ V	$I_D = 30$ A		7.5	9.4	mΩ
		$V_{GS} = 4.5$ V	$I_D = 12$ A		11.2	14	
Forward Transconductance	g_{FS}	$V_{DS} = 1.5$ V, $I_D = 15$ A			40		S
Gate Resistance	R_G	$T_A = 25°C$			1.0		Ω
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	$V_{GS} = 0$ V, f = 1 MHz, $V_{DS} = 15$ V			770		pF
Output Capacitance	C_{OSS}				443		
Reverse Transfer Capacitance	C_{RSS}				127		
Capacitance Ratio	C_{RSS}/C_{ISS}	$V_{GS} = 0$ V, $V_{DS} = 15$ V, f = 1 MHz			0.165		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5$ V, $V_{DS} = 15$ V; $I_D = 30$ A			7.8		nC
Threshold Gate Charge	$Q_{G(TH)}$				1.4		
Gate−to−Source Charge	Q_{GS}				2.9		
Gate−to−Drain Charge	Q_{GD}				3.7		
Gate Plateau Voltage	V_{GP}				3.6		V
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10$ V, $V_{DS} = 15$ V; $I_D = 30$ A			15.2		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.

6. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

NTTFS4C13N

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 7)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			9		ns
Rise Time	t_r				35		
Turn−Off Delay Time	$t_{d(OFF)}$				13		
Fall Time	t_f				5		
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			6.0		ns
Rise Time	t_r				26		
Turn−Off Delay Time	$t_{d(OFF)}$				16		
Fall Time	t_f				3.0		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 30 A	T_J = 25°C		0.82	1.1	V
			T_J = 125°C		0.69		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dIS/dt = 100 A/μs, I_S = 30 A			23.4		ns
Charge Time	t_a				12.1		
Discharge Time	t_b				11.3		
Reverse Recovery Charge	Q_{RR}				9.7		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.
6. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

NTTFS4C13N

TYPICAL CHARACTERISTICS
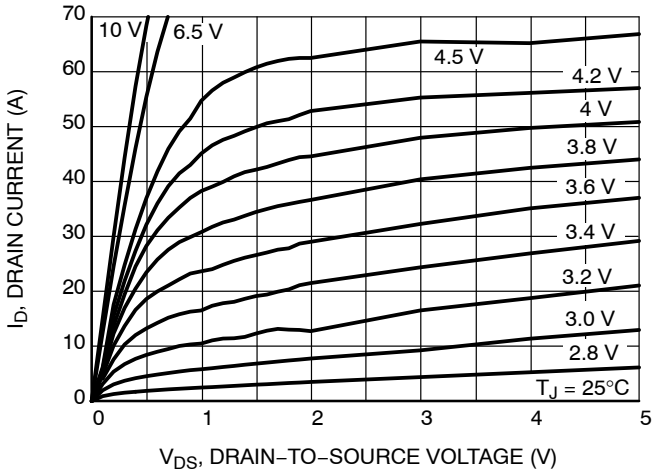
Figure 1. On−Region Characteristics
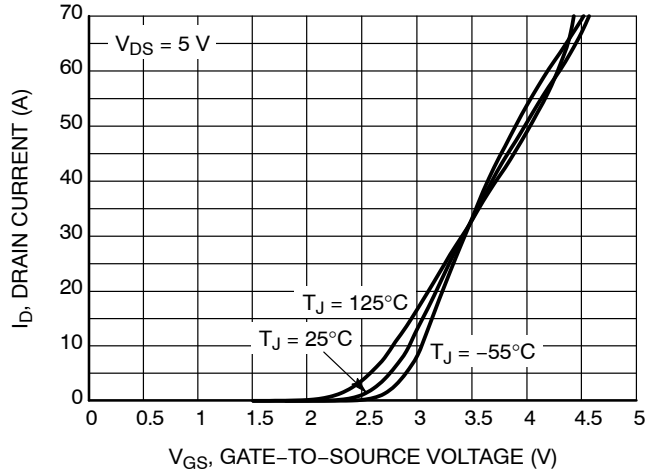
Figure 2. Transfer Characteristics
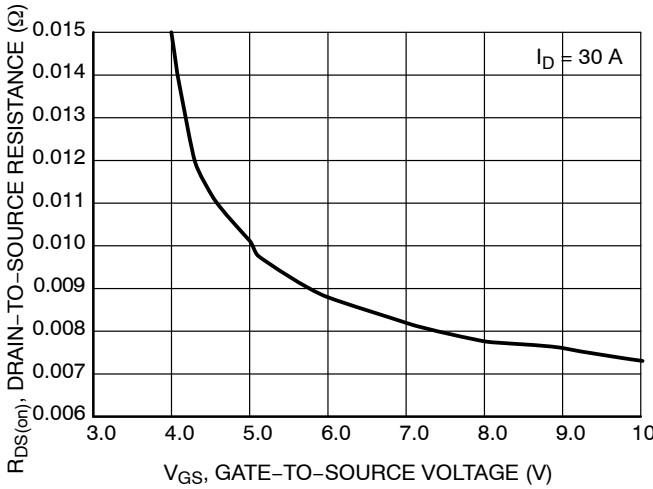
Figure 3. On−Resistance vs. V$_{GS}$
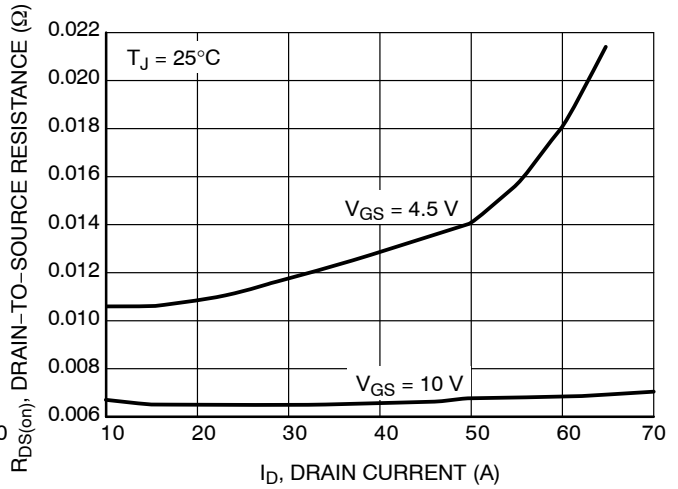
Figure 4. On−Resistance vs. Drain Current and Gate Voltage
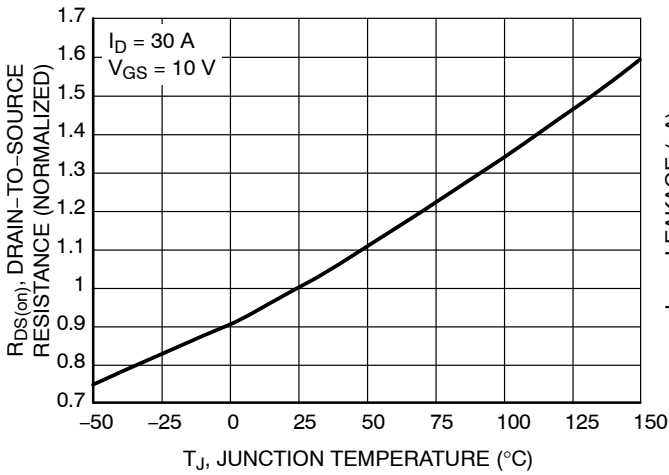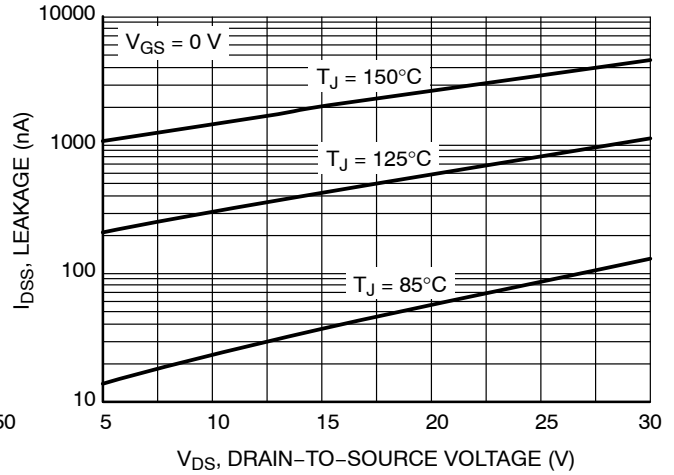

Figure 5. On−Resistance Variation with Temperature

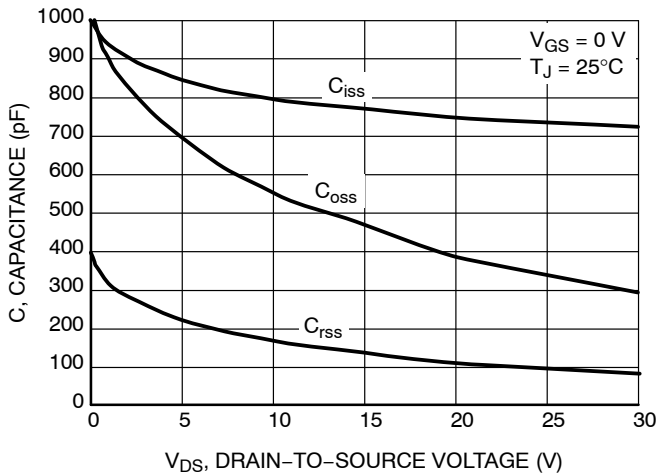Figure 6. Drain−to−Source Leakage Current vs. Voltage

http://onsemi.com

4

NTTFS4C13N

TYPICAL CHARACTERISTICS

Figure 7. Capacitance Variation
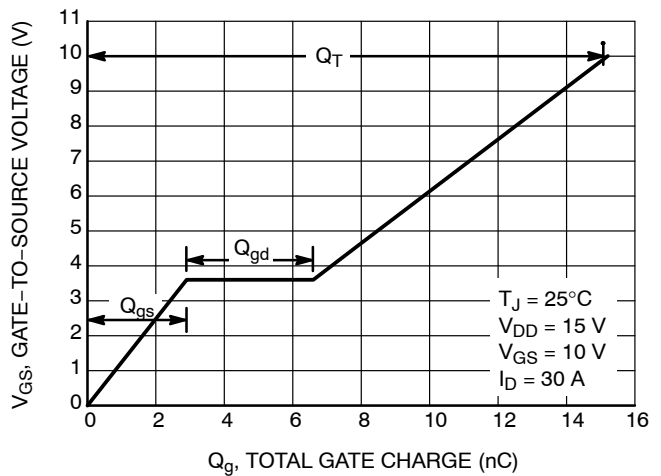
Figure 8. Gate–to–Source and
Drain–to–Source Voltage vs. Total Charge
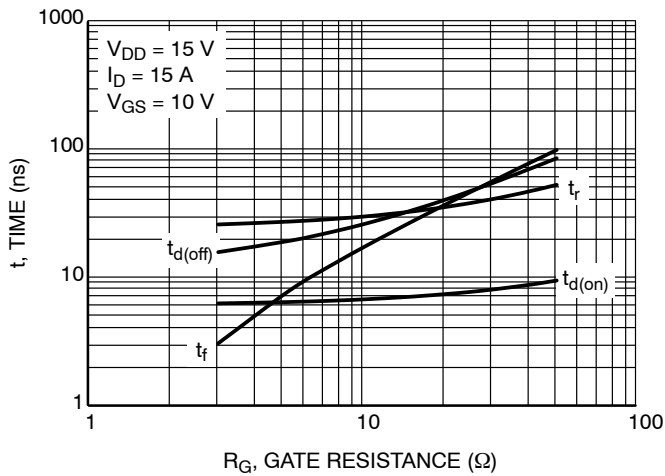
Figure 9. Resistive Switching Time Variation
vs. Gate Resistance
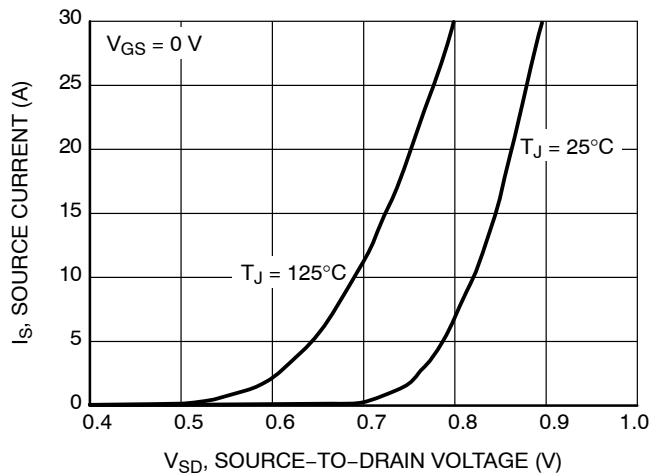
Figure 10. Diode Forward Voltage vs. Current
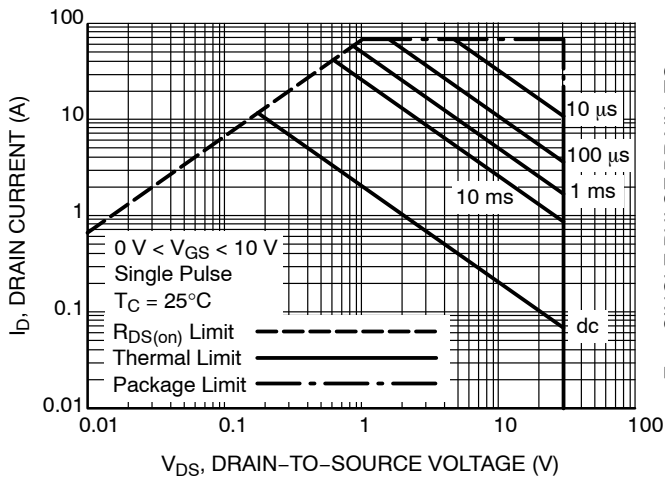
Figure 11. Maximum Rated Forward Biased
Safe Operating Area
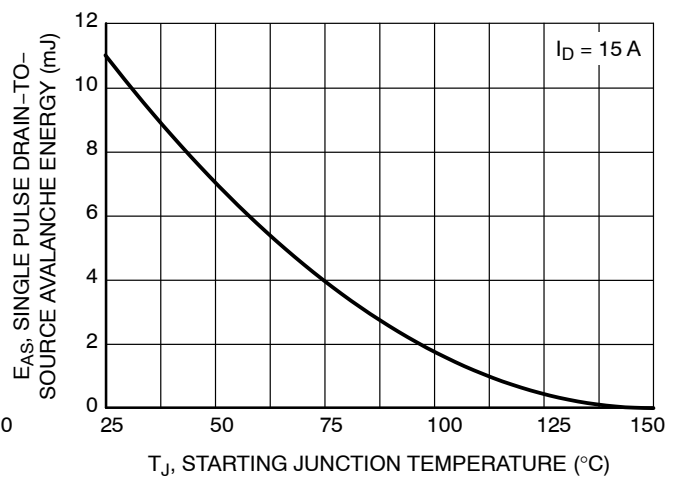
Figure 12. Maximum Avalanche Energy vs.
Starting Junction Temperature

TYPICAL CHARACTERISTICS
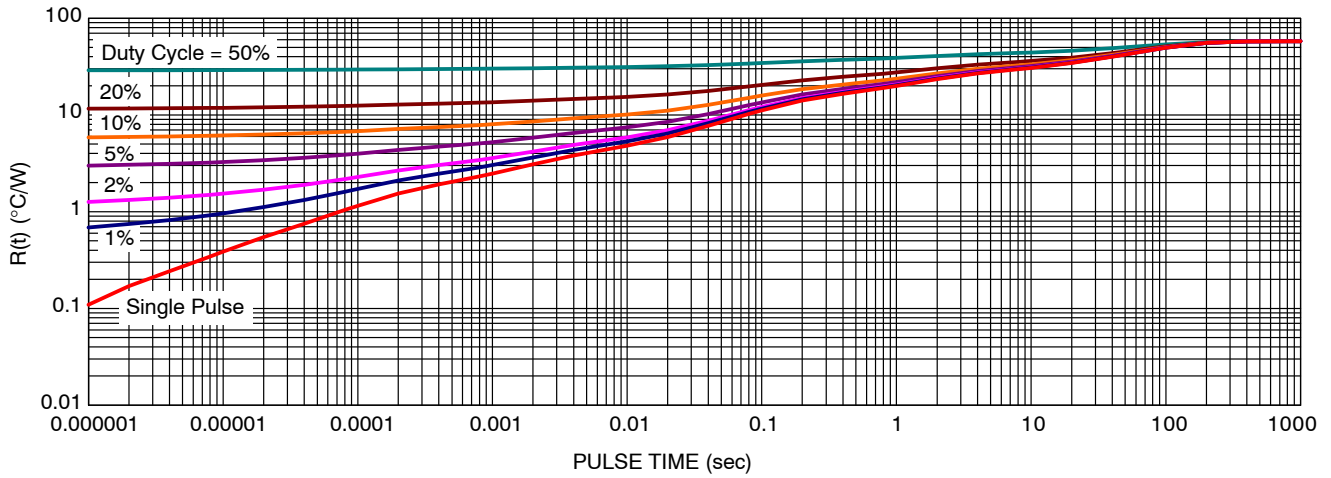
Figure 13. Thermal Response
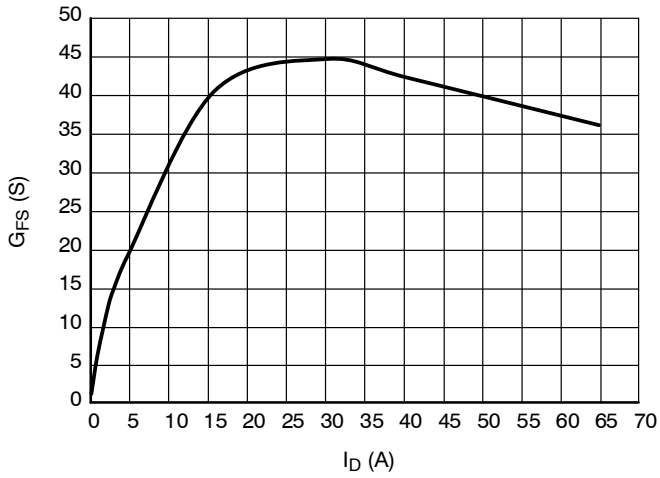
Figure 14. G$_{FS}$ vs. I$_D$
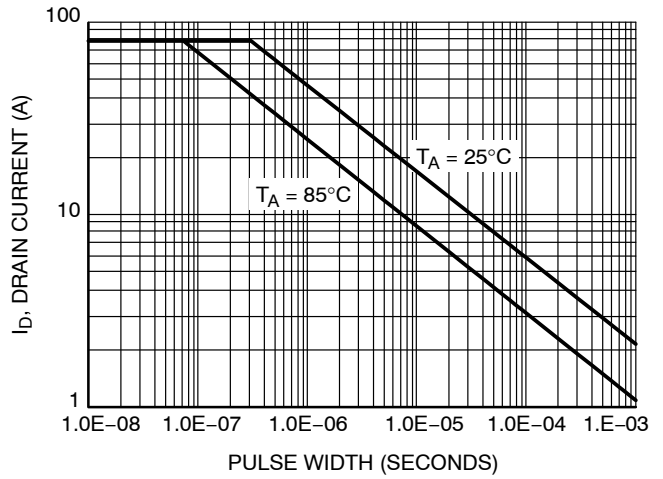
Figure 15. Avalanche Characteristics

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

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

DATE 23 APR 2012

SCALE 2:1

TOP VIEW

SIDE VIEW — DETAIL A

DETAIL A

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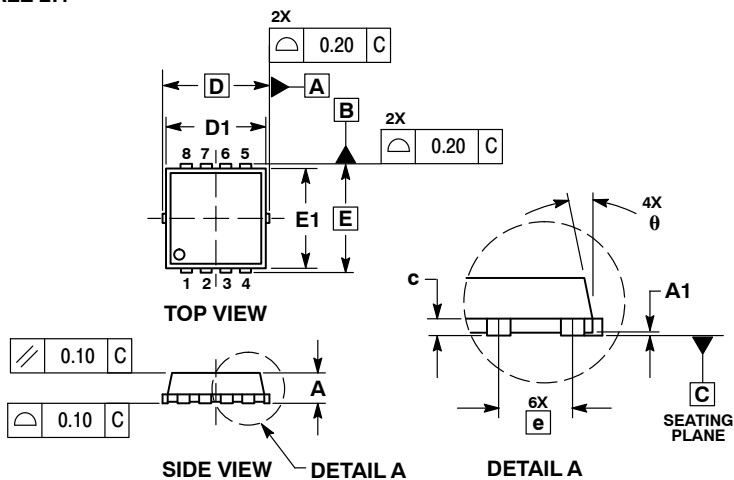
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

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 °

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.
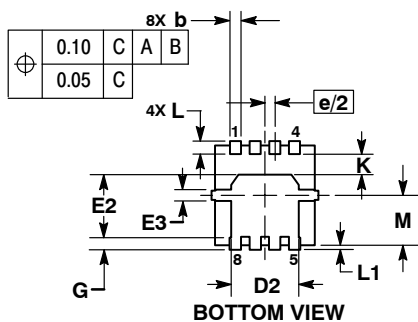
GENERIC
MARKING DIAGRAM*
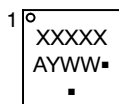
XXXXX
AYWW▪
▪

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.

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

© Semiconductor Components Industries, LLC, 2019

www.onsemi.com

PUBLICATION ORDERING INFORMATION

◊