

# NTTFS5C453NL

## Power MOSFET

40 V, 3 mΩ, 107 A, Single N-Channel

### Features

- Small Footprint (3.3x3.3 mm) for Compact Design
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

**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	$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	$T_C = 25^\circ\text{C}$	$I_D$	107
			75
Power Dissipation $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$	$P_D$	68
			34
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	$T_A = 25^\circ\text{C}$	$I_D$	23
			16
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)	$T_A = 25^\circ\text{C}$	$P_D$	3.3
			1.6
Pulsed Drain Current	$I_{DM}$	740	A
Operating Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +175	°C
Source Current (Body Diode)	$I_S$	76	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 7\text{ A}$ )	$E_{AS}$	215	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.

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	$R_{\theta JC}$	2.2	°C/W
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	46	

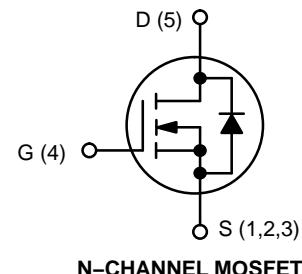
1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.



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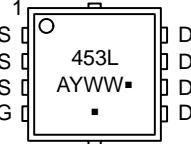
$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	3 mΩ @ 10 V 4.8 mΩ @ 4.5 V	107 A



N-CHANNEL MOSFET



**MARKING DIAGRAM**  
WDFN8  
(μ8FL)  
CASE 511AB



453L = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
■ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

# NTTFS5C453NL

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>				1.6		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V	T <sub>J</sub> = 25 °C			10	μA
			T <sub>J</sub> = 125°C			250	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V				100	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 63 μA		1.2		2.0	V
Threshold Temperature Coefficient	V <sub>GS(TH)/T<sub>J</sub></sub>				-5.3		mV/°C
Drain-to-Source On Resistance	R <sub>DSS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 40 A		2.5	3	mΩ
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 40 A		3.8	4.8	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 40 A			120		S

### CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 25 V		2100		pF
Output Capacitance	C <sub>OSS</sub>			1000		
Reverse Transfer Capacitance	C <sub>rss</sub>			42		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V; I <sub>D</sub> = 40 A		35		nC
Total Gate Charge	Q <sub>G(TOT)</sub>			16		
Threshold Gate Charge	Q <sub>G(TH)</sub>			4.0		
Gate-to-Source Charge	Q <sub>GS</sub>			7.0		
Gate-to-Drain Charge	Q <sub>GD</sub>			5.0		
Plateau Voltage	V <sub>GP</sub>			3.2		V

### SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 20 V, I <sub>D</sub> = 40 A, R <sub>G</sub> = 2.5 Ω		11		ns
Rise Time	t <sub>r</sub>			110		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			21		
Fall Time	t <sub>f</sub>			5		

### DRAIN-SOURCE DIODE CHARACTERISTICS

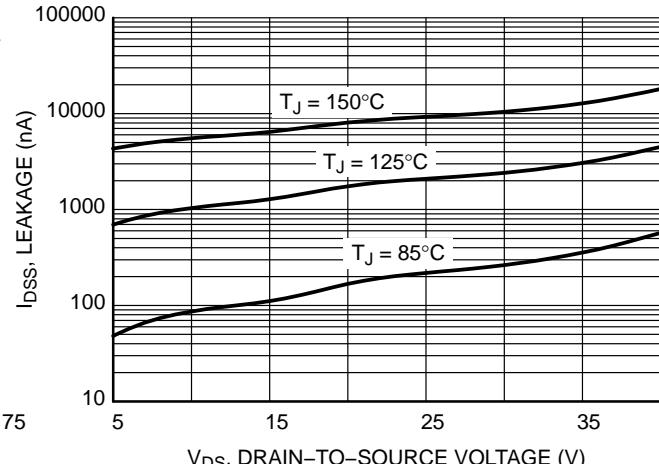
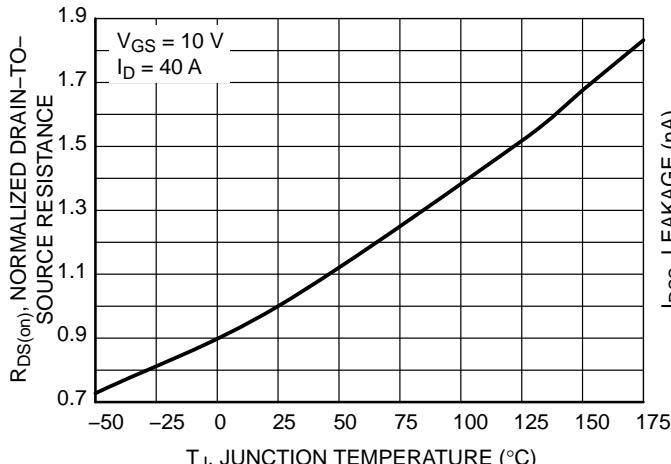
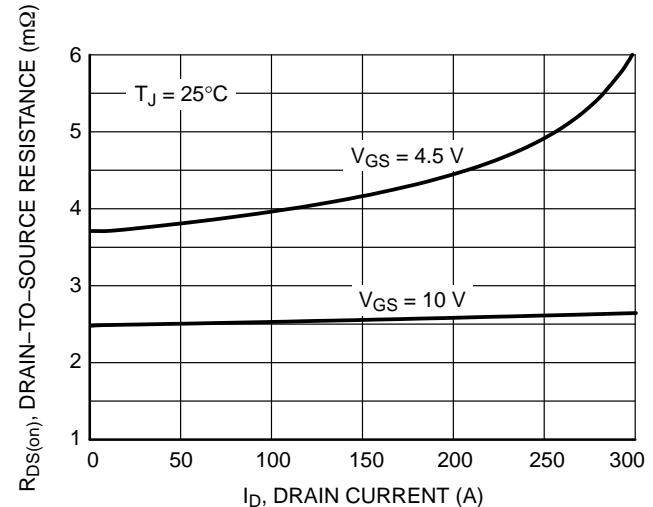
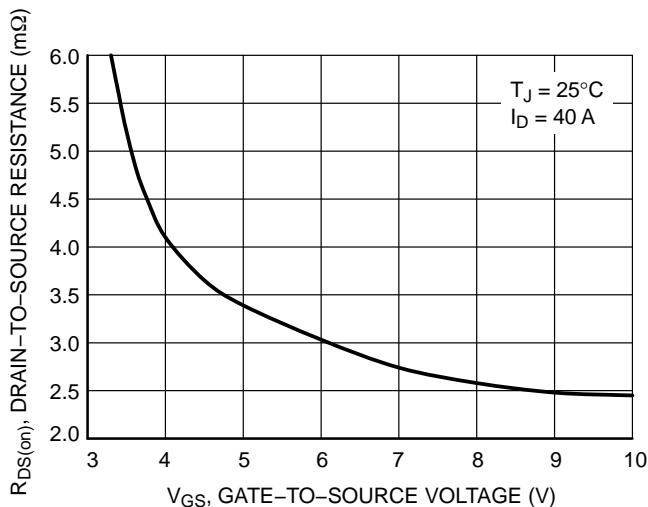
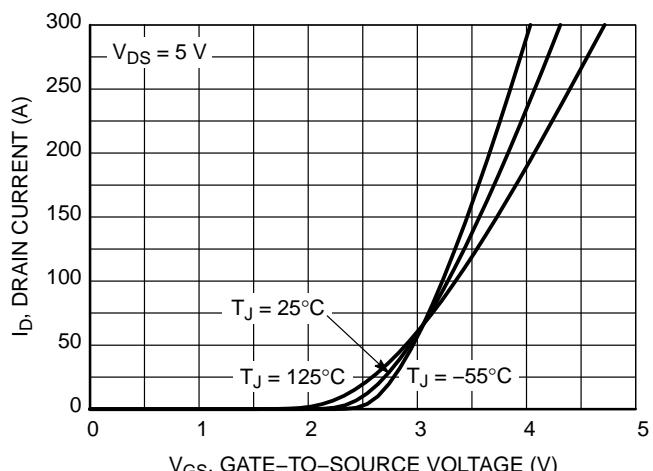
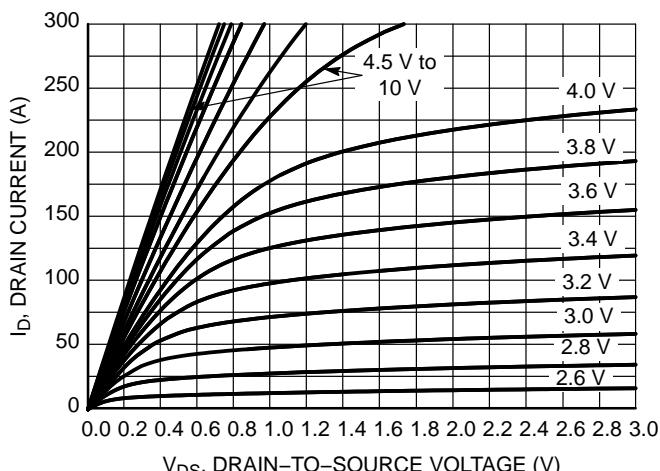
Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 40 A	T <sub>J</sub> = 25°C		0.84	1.2	V
			T <sub>J</sub> = 125°C		0.72		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = 40 A			41		ns
Charge Time	t <sub>a</sub>				19		
Discharge Time	t <sub>b</sub>				22		
Reverse Recovery Charge	Q <sub>RR</sub>				30		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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS

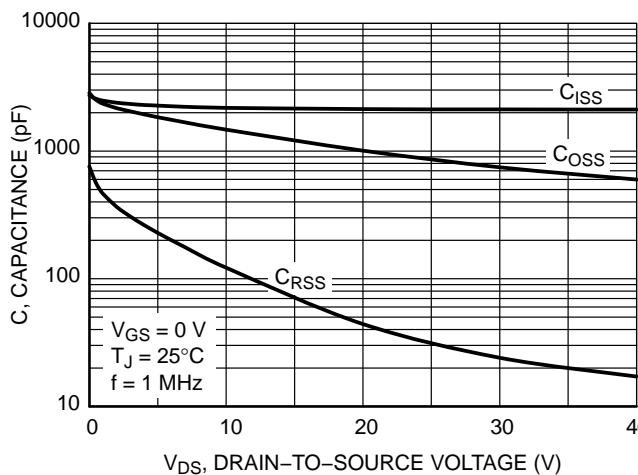


Figure 7. Capacitance Variation

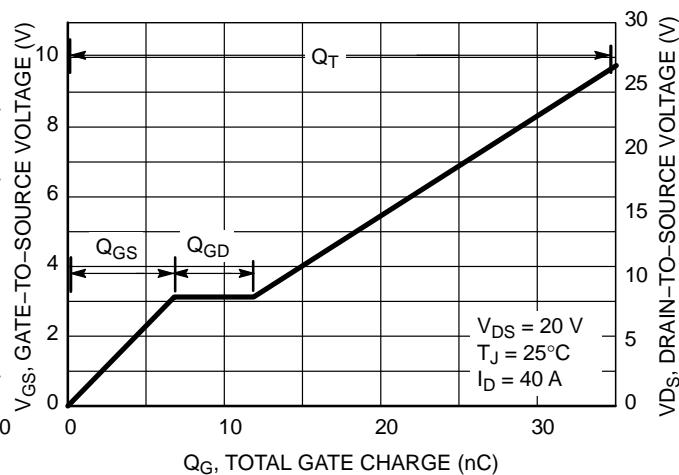


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

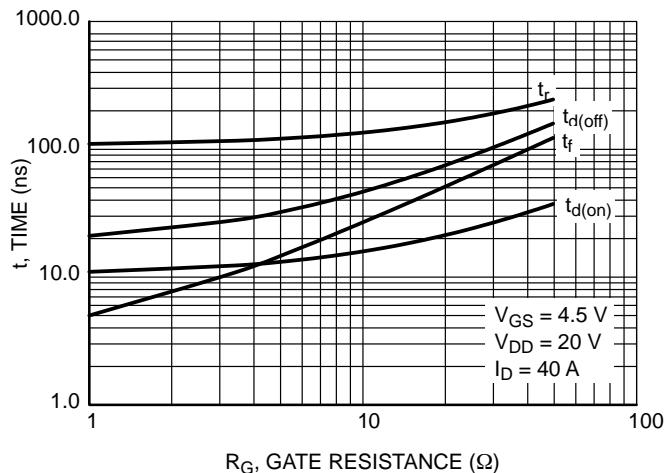


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

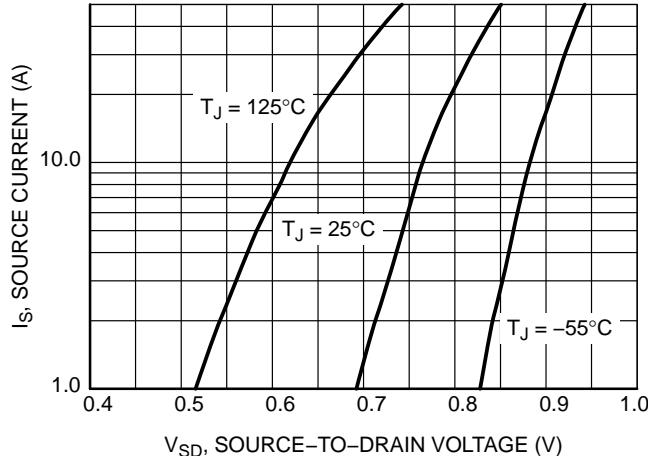


Figure 10. Diode Forward Voltage vs. Current

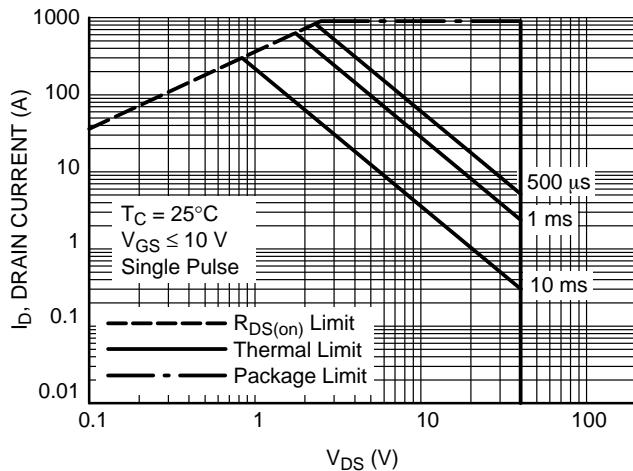
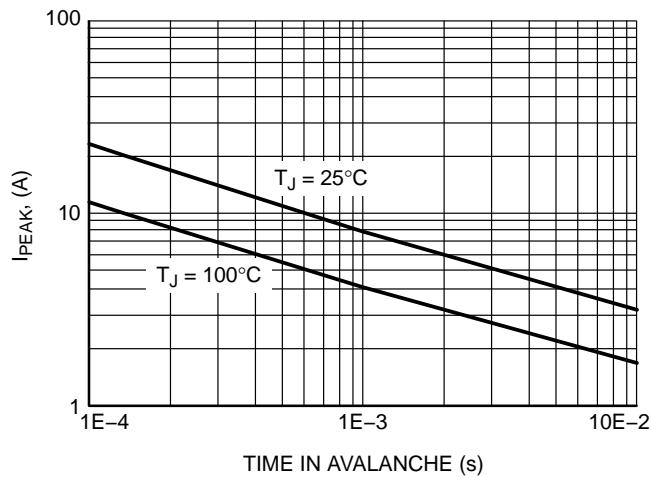


Figure 11. Safe Operating Area

Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

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## TYPICAL CHARACTERISTICS

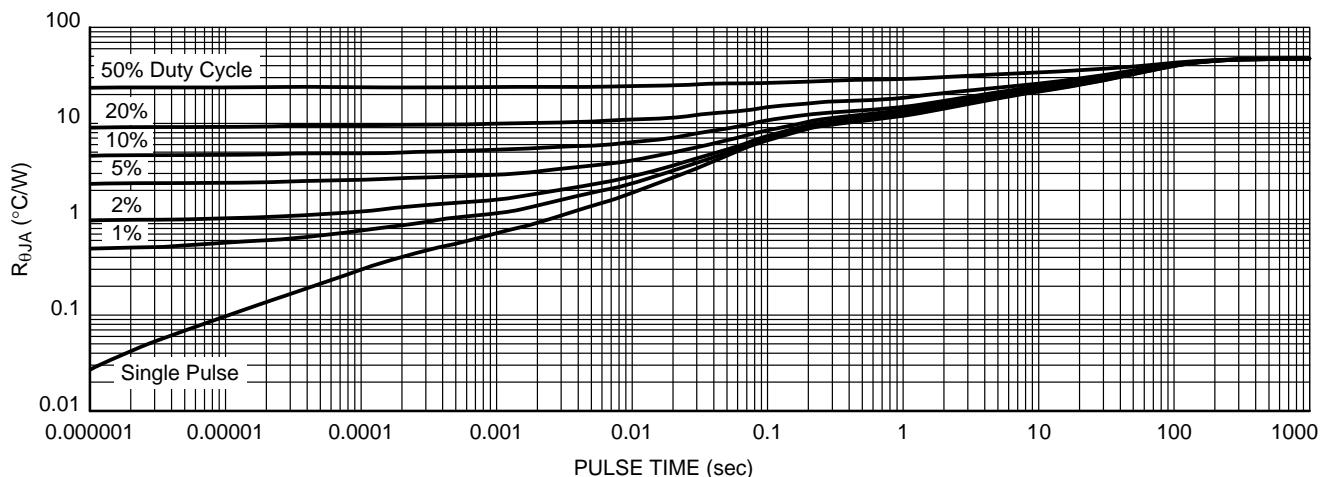


Figure 13. Thermal Characteristics

### DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTTFS5C453NLTAG	453L	WDFN8 (Pb-Free)	1500 / Tape & Reel
NTTFS5C453NLTWG	453L	WDFN8 (Pb-Free)	5000 / Tape & Reel

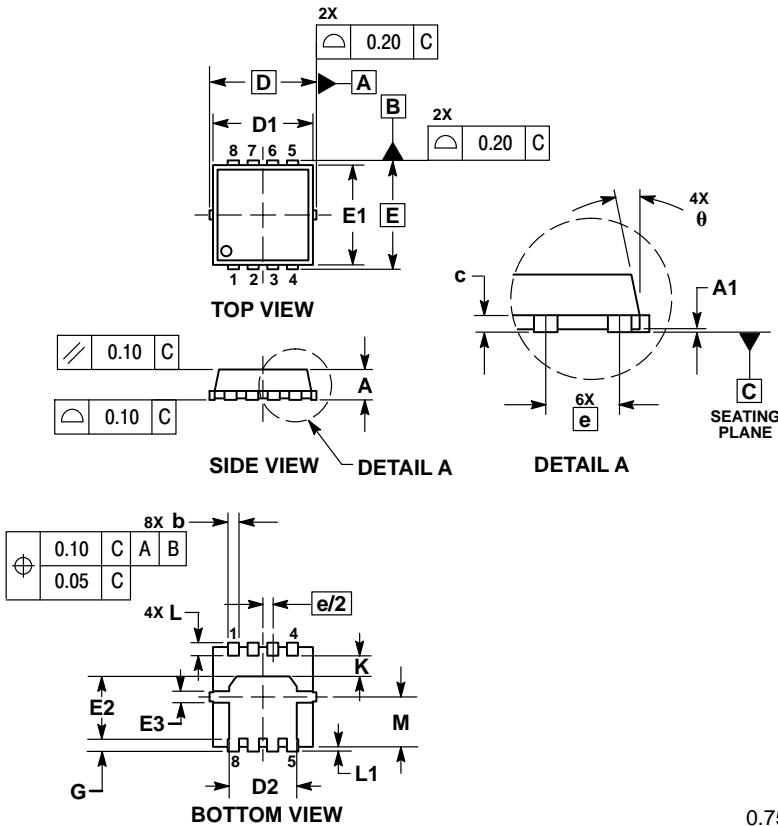
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NTTFS5C453NL

## PACKAGE DIMENSIONS

### WDFN8 3.3x3.3, 0.65P

CASE 511AB  
ISSUE D

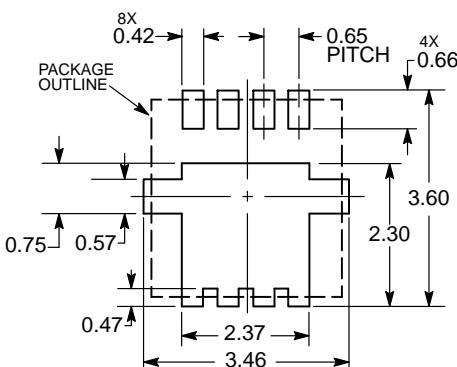


#### NOTES:

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

### SOLDERING FOOTPRINT\*



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

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