

# NLAS7213

## High-Speed USB 2.0 (480 Mbps) DPST Switch

The NLAS7213 is a DPST switch optimized for high-speed USB 2.0 applications within portable systems. It features ultra-low off capacitance,  $C_{OFF} = 3.0$  pF (typ), and a bandwidth above 1118 MHz. It is optimized for applications that use a single USB interface connector to route multiple signal types. The  $C_{ON}$  and  $R_{ON}$  of both switches are suitably low to allow the NLAS7213 to pass any speed USB data or audio signals going to a moderately resistive terminal such as an external headset.

The NLAS7213 is protected on all pins with 8 kV Human Body Model ESD protection. It is offered in a 1.5 x 1.5 mm UQFN8 package.

### Features

- $R_{ON}$ : 8.5  $\Omega$  Max @  $V_{CC} = 3.3$  V
- $C_{OFF}$ : 3.0 pF Typ @  $V_{CC} = 3.3$  V
- $V_{CC}$  Operating Range: 1.65 V to 4.5 V
- > 1118 MHz Bandwidth
- OVT up to 5.25 V on D+/D- Pins
- 1.5 x 1.5 x 0.55 mm UQFN8
- 8 kV ESD Protection on All Pins
- This is a Pb-Free Device

### Typical Applications

- High Speed USB 2.0 Data
- Mobile Phones
- Portable Devices

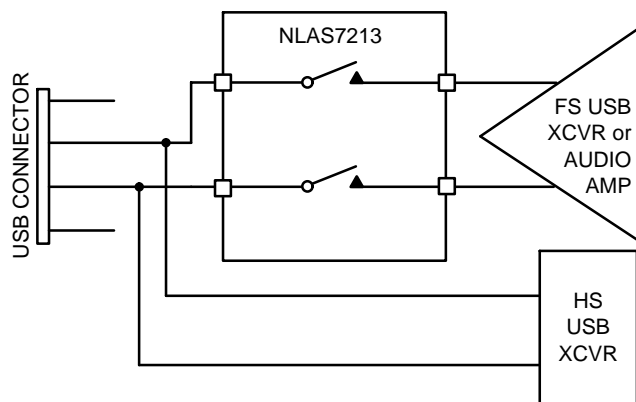


Figure 1. Application Diagram



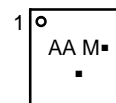
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### MARKING DIAGRAM



UQFN8  
(1.5 x 1.5 mm)  
CASE 523AH



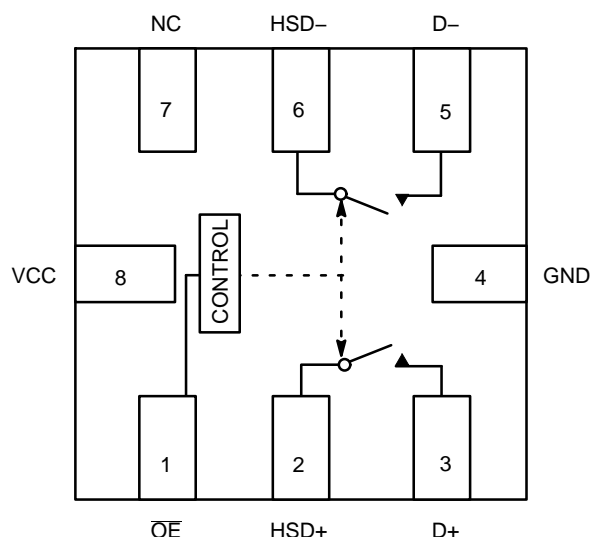
AA = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

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**Figure 2. Pin Connections and Logic Diagram**  
(Top View)

**Table 1. PIN DESCRIPTION**

Pin	Function
$\overline{OE}$	Control Input Select Line
HSD+, HSD-, D+, D-	Data Ports

**Table 2. TRUTH TABLE**

$\overline{OE}$	Both Switches
1	OPEN
0	CLOSED

## MAXIMUM RATINGS

Symbol	Pins	Parameter	Value	Unit
$V_{CC}$	$V_{CC}$	Positive DC Supply Voltage	-0.5 to +4.6	V
$V_{IS}$	HSD+, HSD-	Analog Signal Voltage	-0.5 to $V_{CC} + 0.3$	V
	D+, D-		-0.5 to +5.25	
$V_{IN}$	$\overline{OE}$	Control Input Voltage	-0.5 to +4.6	V
$I_{CC}$	$V_{CC}$	Positive DC Supply Current	50	mA
$T_S$		Storage Temperature	-65 to +150	°C
$I_{IS\_CON}$	HSD+, HSD-, D+, D-	Analog Signal Continuous Current—Closed Switch	$\pm 300$	mA
$I_{IS\_PK}$	HSD+, HSD-, D+, D-	Analog Signal Continuous Current 10% Duty Cycle	$\pm 500$	mA
$I_{IN}$	$\overline{OE}$	Control Input Current	$\pm 20$	mA

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.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Pins	Parameter	Min	Max	Unit
$V_{CC}$		Positive DC Supply Voltage	1.65	4.5	V
$V_{IS}$	HSD+, HSD-	Analog Signal Voltage	GND	$V_{CC}$	V
	D+, D-		GND	4.5	
$V_{IN}$	$\overline{OE}$	Digital Select Input Voltage	GND	$V_{CC}$	V
$T_A$		Operating Temperature Range	-40	+85	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## ESD PROTECTION

Symbol	Parameter	Value	Unit
ESD	Human Body Model – All Pins	8.0	kV

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## DC ELECTRICAL CHARACTERISTICS

### CONTROL INPUT (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
V <sub>IH</sub>	$\overline{OE}$	Control Input HIGH Voltage		2.7	1.3	–	–	V
				3.3	1.3			
				4.2	1.4			
V <sub>IL</sub>	$\overline{OE}$	Control Input LOW Voltage		2.7	–	–	0.4	V
				3.3			0.4	
				4.2			0.4	
I <sub>IN</sub>	$\overline{OE}$	Control Input Leakage Current	V <sub>IS</sub> = GND	1.65 – 4.5	–	–	±1.0	μA

### SUPPLY CURRENT AND LEAKAGE (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V, V<sub>IN</sub> = V<sub>CC</sub> or GND)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
I <sub>CC</sub>	V <sub>CC</sub>	Quiescent Supply Current	V <sub>IS</sub> = V <sub>CC</sub> or GND; I <sub>D</sub> = 0 A	1.65 – 4.5	–	–	1.0	μA
I <sub>NC(OFF)</sub>	HSD+, HSD–	OFF State Leakage Current	V <sub>COM</sub> = 3.6 V, V <sub>NC</sub> = 1.0 V	1.65 – 4.5	–	–	±1.0	μA
I <sub>OFF</sub>		Power OFF Leakage Current	V <sub>IS</sub> = GND	0	–	–	±1.0	μA

### ON RESISTANCE (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
R <sub>ON</sub>		On-Resistance	I <sub>ON</sub> = –8 mA V <sub>IS</sub> = 0 to 0.4 V	2.7	–	9.0	9.5	Ω
				3.3		8.0	8.5	
				4.2		7.2	7.5	
R <sub>FLAT</sub>		On-Resistance Flatness	I <sub>ON</sub> = –8 mA V <sub>IS</sub> = 0 to 0.4 V	2.7	–	0.8	–	Ω
				3.3		0.5		
				4.2		0.3		
ΔR <sub>ON</sub>		On-Resistance Matching	I <sub>ON</sub> = –8 mA V <sub>IS</sub> = 0 to 0.4 V	2.7	–	0.07	–	Ω
				3.3		0.07		
				4.2		0.04		

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.

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## AC ELECTRICAL CHARACTERISTICS

**TIMING/FREQUENCY** (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 35 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
t <sub>ON</sub>		Turn-ON Time (Figures 6, 7)		1.65 – 4.5	–	13.0	30.0	ns
t <sub>OFF</sub>		Turn-OFF Time (Figures 6, 7)		1.65 – 4.5	–	12.0	25.0	ns
t <sub>PD</sub>		Propagation Delay		1.65 – 4.5	–	0.25	–	ns
BW		-3 dB Bandwidth	C <sub>L</sub> = 5 pF	1.65 – 4.5	–	1118	–	MHz

**ISOLATION** (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 5 pF)

Symbol	Pins	Parameter	Test Conditions	-40°C to +85°C			Unit
				Min	Typ	Max	
O <sub>IRR</sub>	Open	OFF-Isolation	f = 240 MHz	–	-20	–	dB
X <sub>TALK</sub>	HSD+, HSD-	Non-Adjacent Channel Crosstalk	f = 240 MHz	–	-30	–	dB

**CAPACITANCE** (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	-40°C to +85°C			Unit
				Min	Typ	Max	
C <sub>IN</sub>	$\overline{\text{OE}}$	Control Pin Input Capacitance	V <sub>IS</sub> = 3.3 V <sub>p-p</sub> , V <sub>CC</sub> = 0 V	–	2.0	–	pF
C <sub>ON</sub>	I/O to GND	ON Capacitance	V <sub>IS</sub> = 3.3 V <sub>p-p</sub> , $\overline{\text{OE}}$ = 0 V	–	3.0	–	pF
C <sub>OFF</sub>	I/O to GND	OFF Capacitance	V <sub>IS</sub> = 3.3 V <sub>p-p</sub> , $\overline{\text{OE}}$ = 3.3 V	–	3.0	–	pF

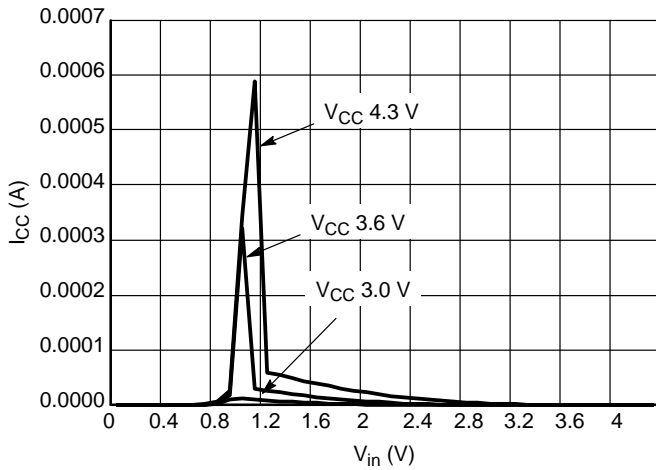


Figure 3.  $I_{CC}$  vs.  $V_{in}$

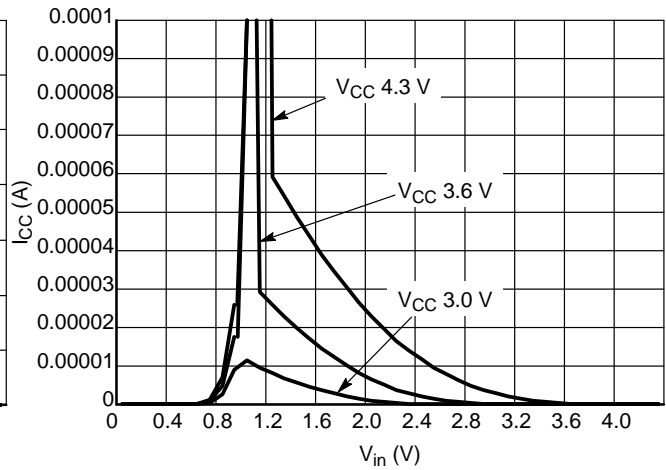


Figure 4.  $I_{CC}$  vs.  $V_{in}$

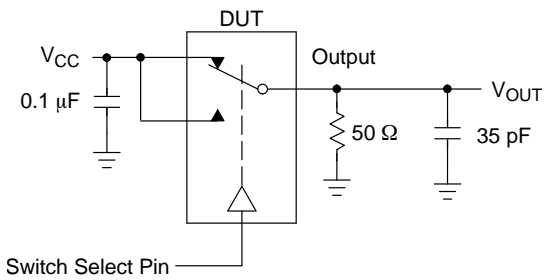


Figure 5.  $t_{BMM}$  (Time Break-Before-Make)

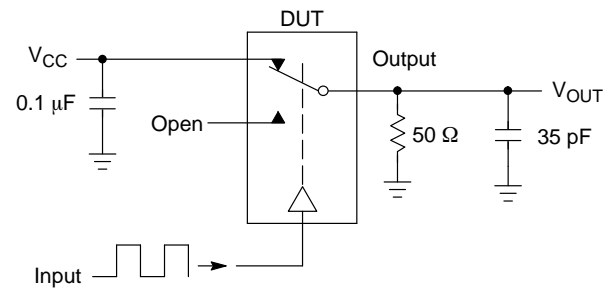
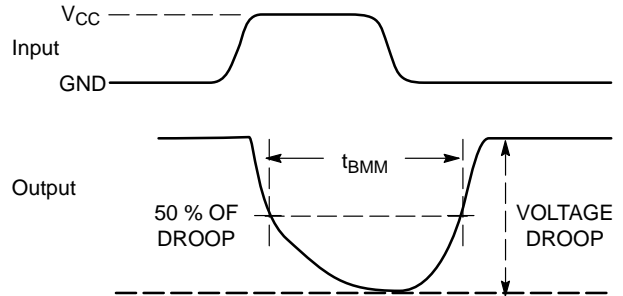


Figure 6.  $t_{ON}/t_{OFF}$

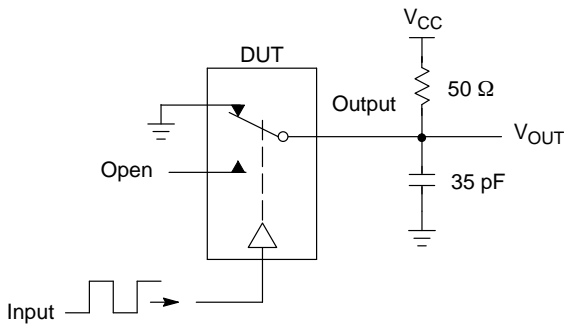
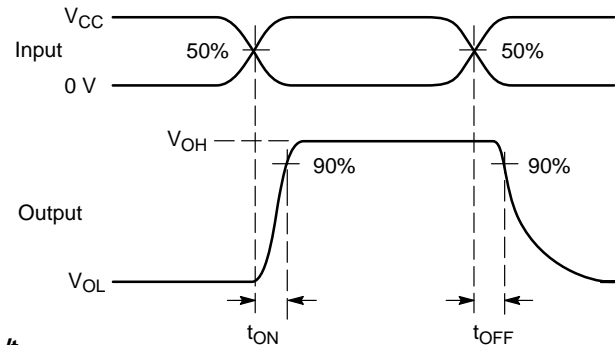
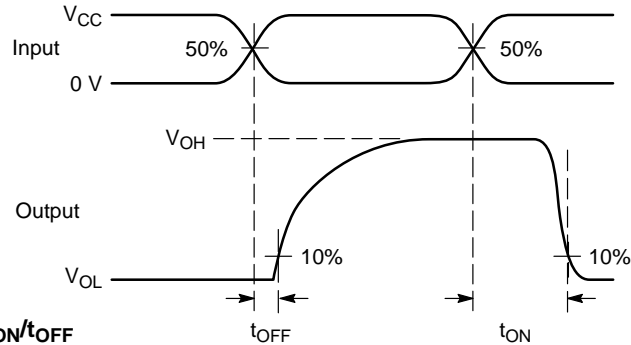
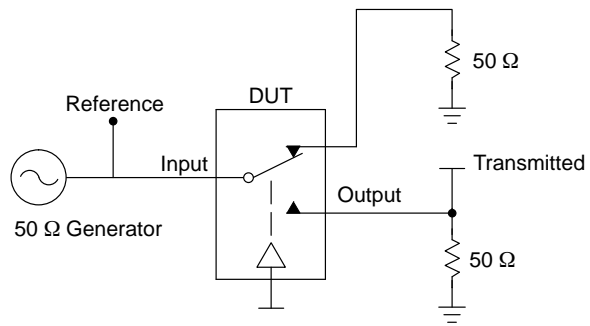


Figure 7.  $t_{ON}/t_{OFF}$



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Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch.  $V_{ISO}$ , Bandwidth and  $V_{ONL}$  are independent of the input signal direction.

$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

$$V_{ONL} = \text{On Channel Loss} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz}$$

Bandwidth (BW) = the frequency 3 dB below  $V_{ONL}$

$V_{CT}$  = Use  $V_{ISO}$  setup and test to all other switch analog input/outputs terminated with 50 Ω

**Figure 8. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ $V_{ONL}$**

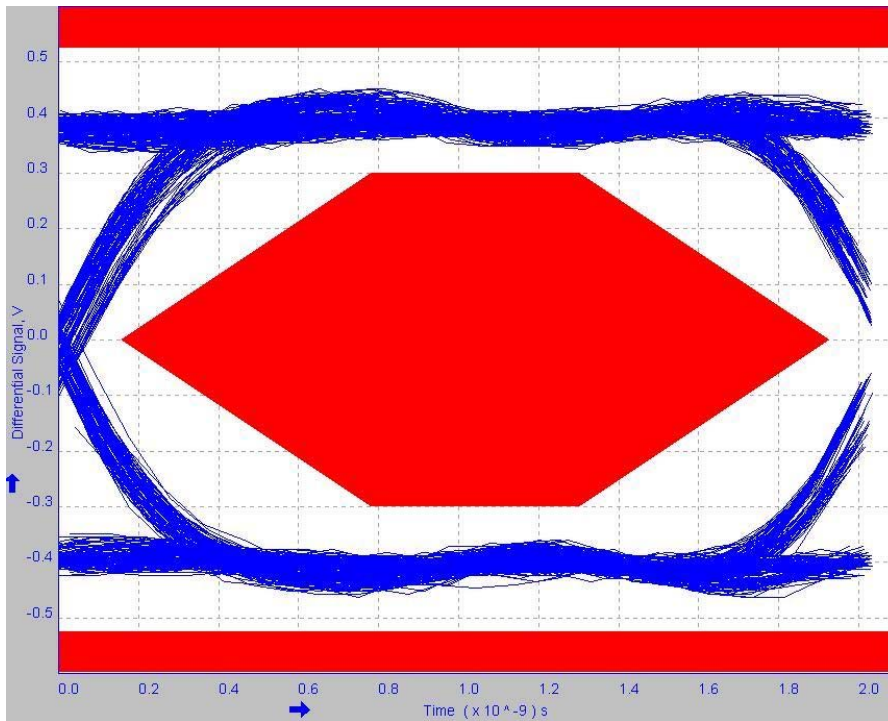


Figure 9. Signal Quality

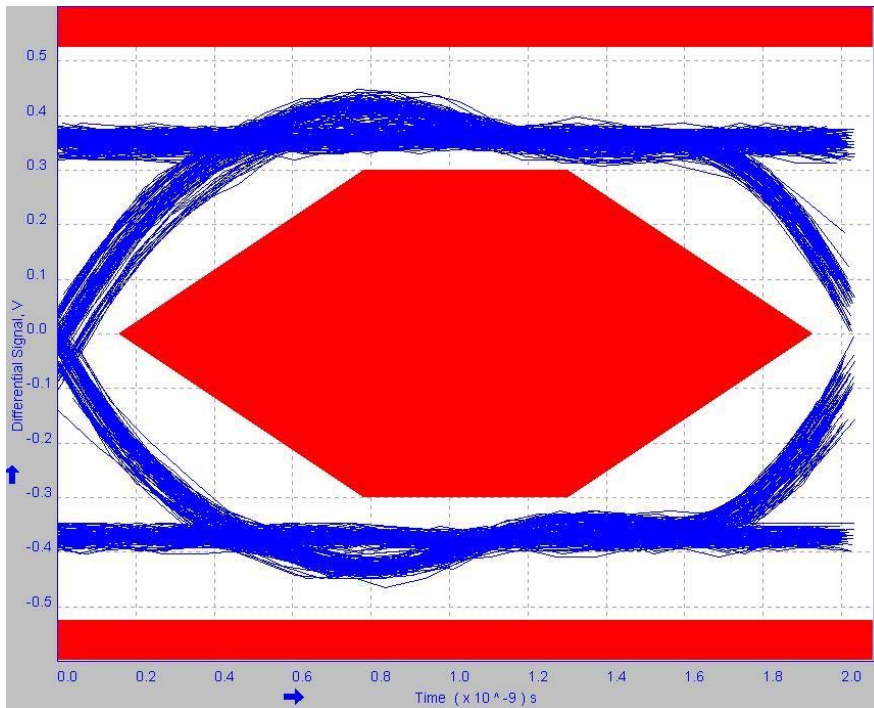


Figure 10. Near End Eye Diagram

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Near End Test Data					Min	Max
<b>Std.</b>	Consecutive Jitter Range	-44.80	76.30	ps	-200 ps	+200 ps
	Paired JK Jitter Range	-63.59	56.33	ps		
	Paired KJ Jitter Range	-44.15	45.68	ps		
<b>NO</b>	Consecutive Jitter Range	-58.40	90.58	ps	-200 ps	+200 ps
	Paired JK Jitter Range	-65.90	70.64	ps		
	Paired KJ Jitter Range	-52.43	55.14	ps		

## ORDERING INFORMATION

Device	Package	Shipping†
NLAS7213MUTBG	UQFN8 (Pb-Free)	3000 / Tape & Reel

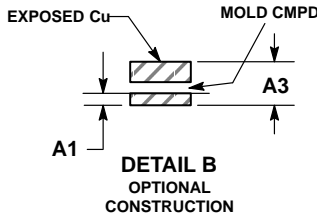
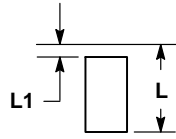
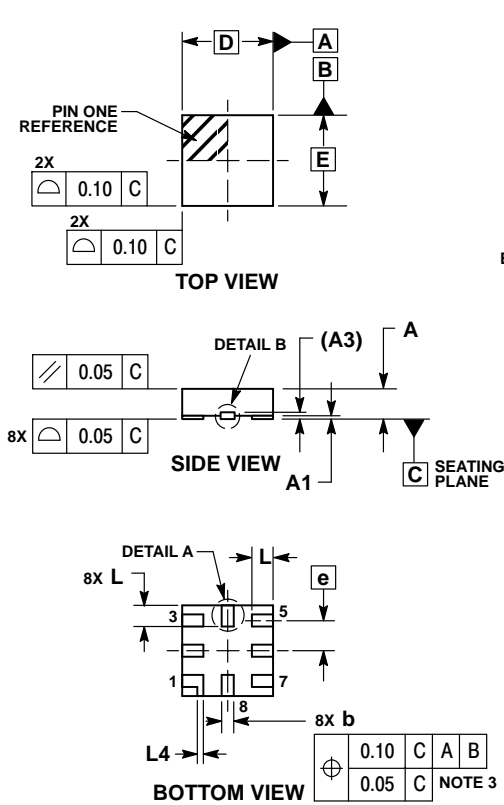
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



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## PACKAGE DIMENSIONS

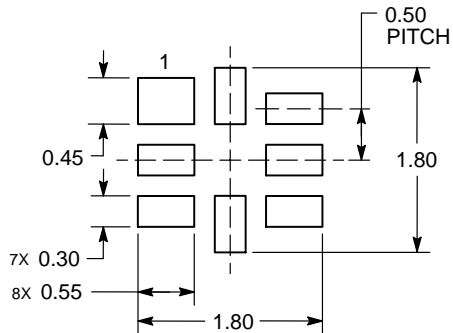
### UQFN8, 1.5x1.5, 0.5P CASE 523AH ISSUE O



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.15	0.25
D	1.50 BSC	
E	1.50 BSC	
e	0.50 BSC	
L	0.30	0.40
L1	0.00	0.03
L4	0.10 REF	

### SOLDERING FOOTPRINT\*



DIMENSIONS: 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.

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