

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 Ω 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

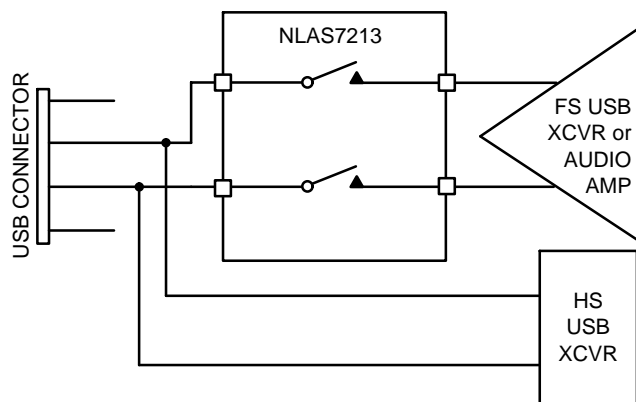


Figure 1. Application Diagram



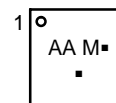
ON Semiconductor®

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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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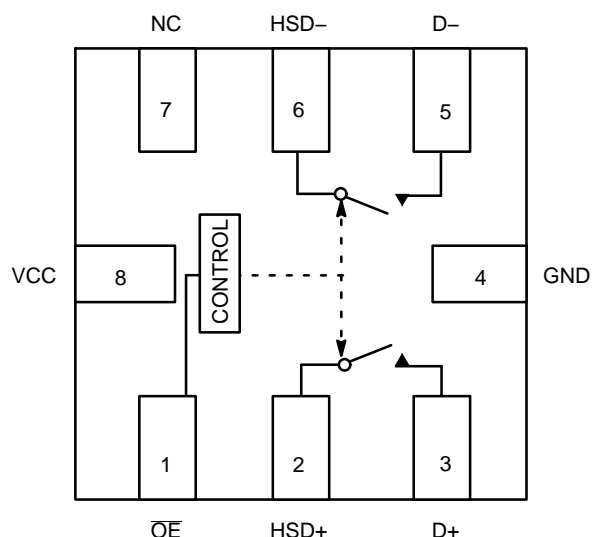


Figure 2. Pin Connections and Logic Diagram
(Top View)

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 | ± 300 | mA |
| I_{IS_PK} | HSD+, HSD-, D+, D- | Analog Signal Continuous Current 10% Duty Cycle | ± 500 | mA |
| I_{IN} | \overline{OE} | Control Input Current | ± 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_{CC} = 3.3 V)

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

SUPPLY CURRENT AND LEAKAGE (Typical: T = 25°C, V_{CC} = 3.3 V, V_{IN} = V_{CC} or GND)

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

ON RESISTANCE (Typical: T = 25°C, V_{CC} = 3.3 V)

| Symbol | Pins | Parameter | Test Conditions | V _{CC} (V) | -40°C to +85°C | | | Unit |
|-------------------|------|------------------------|---|---------------------|----------------|------|-----|------|
| | | | | | Min | Typ | Max | |
| R _{ON} | | On-Resistance | I _{ON} = –8 mA V _{IS} = 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 _{FLAT} | | On-Resistance Flatness | I _{ON} = –8 mA V _{IS} = 0 to 0.4 V | 2.7 | – | 0.8 | – | Ω |
| | | | | 3.3 | | 0.5 | | |
| | | | | 4.2 | | 0.3 | | |
| ΔR _{ON} | | On-Resistance Matching | I _{ON} = –8 mA V _{IS} = 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_{CC} = 3.3 V, R_L = 50 Ω, C_L = 35 pF, f = 1 MHz)

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

ISOLATION (Typical: T = 25°C, V_{CC} = 3.3 V, R_L = 50 Ω, C_L = 5 pF)

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

CAPACITANCE (Typical: T = 25°C, V_{CC} = 3.3 V, f = 1 MHz)

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

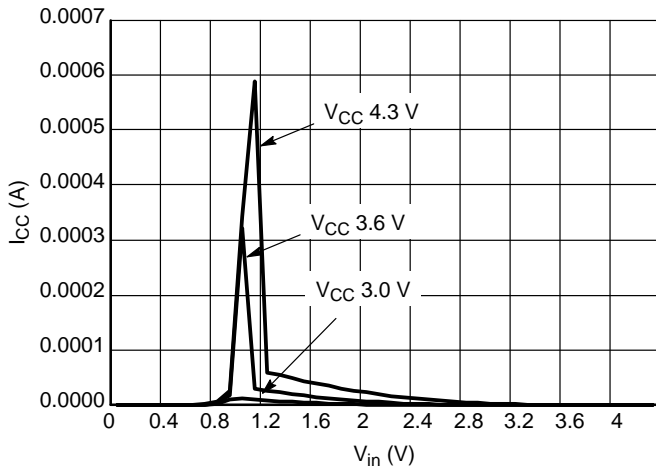


Figure 3. I_{CC} vs. V_{in}

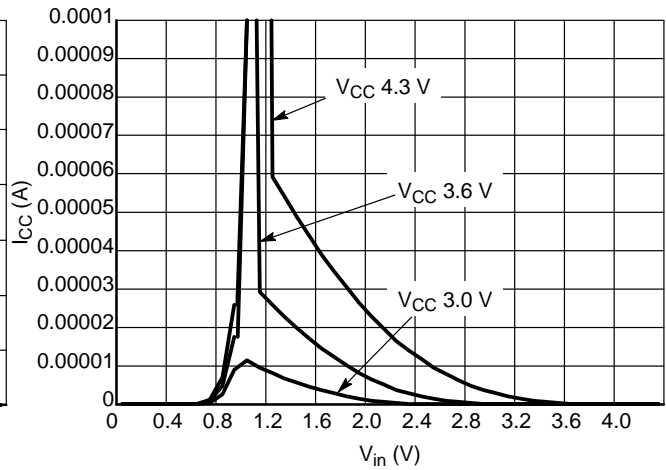


Figure 4. I_{CC} vs. V_{in}

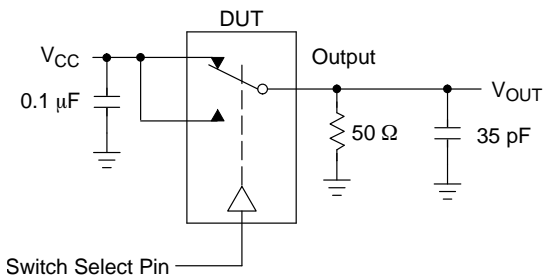


Figure 5. t_{BMM} (Time Break-Before-Make)

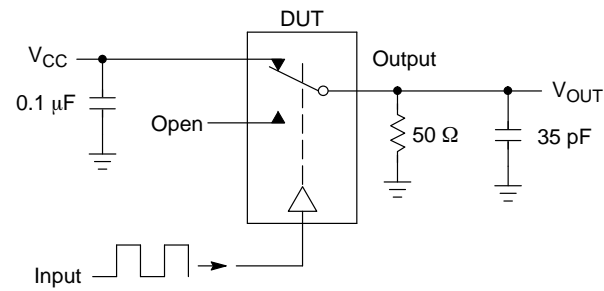
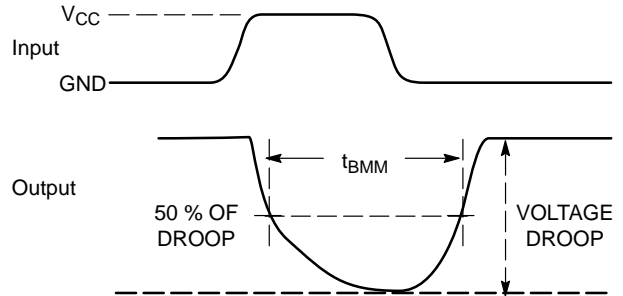


Figure 6. t_{ON}/t_{OFF}

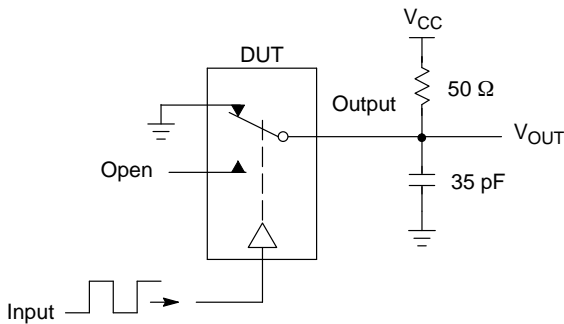
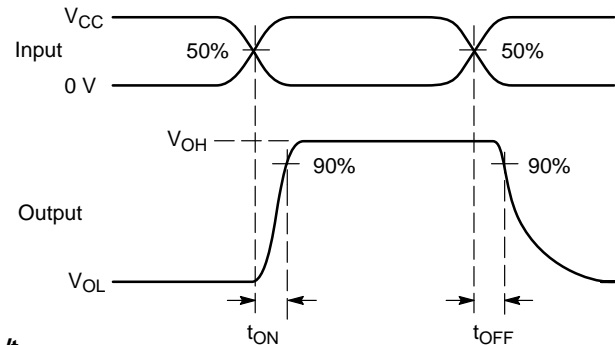
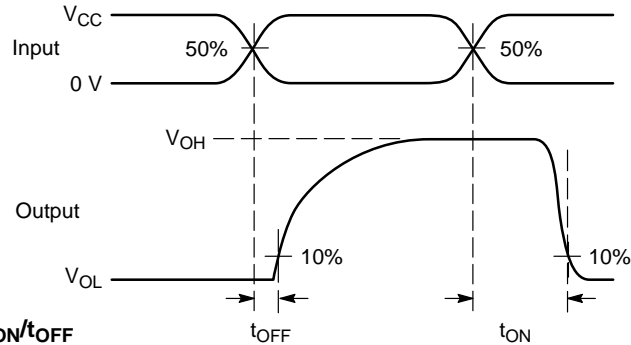
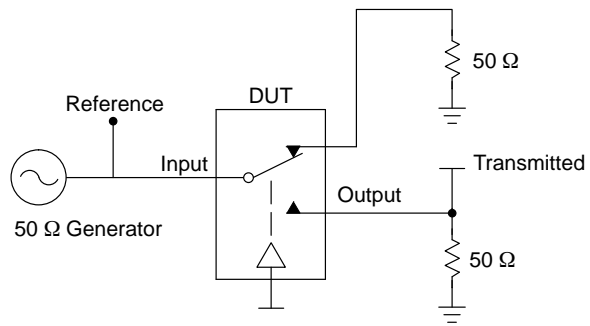


Figure 7. t_{ON}/t_{OFF}



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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}

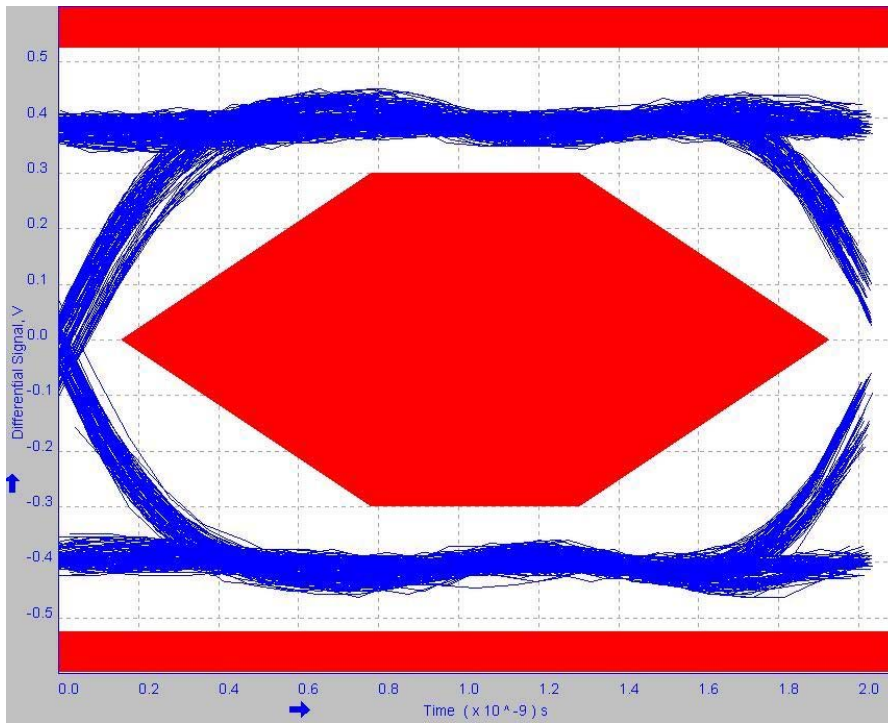


Figure 9. Signal Quality

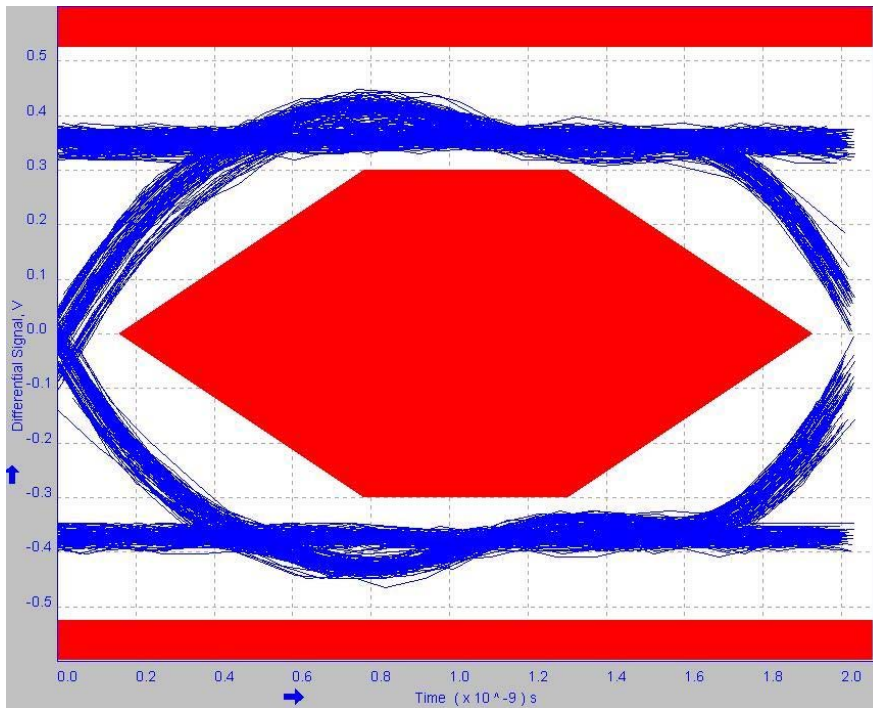


Figure 10. Near End Eye Diagram

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| Near End Test Data | | | | | Min | Max |
|--------------------|--------------------------|--------|-------|----|---------|---------|
| Std. | 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 | | |
| NO | 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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