

# NL7WB66



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## Ultra-Small SPST Analog Switch

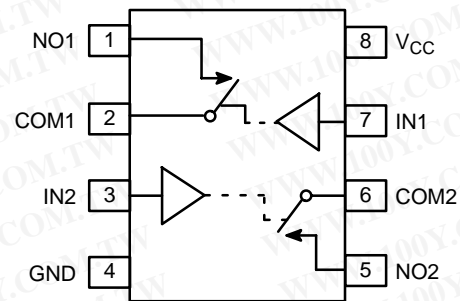
The NL7WB66 is a very low  $R_{ON}$  dual SPST analog switch.  $R_{ON}$  is a of  $5\ \Omega$  (Typ) at 5.0 V. The device is offered in the very popular low cost US8 package. It is designed as a general purpose dual switch and can be used to switch either analog signals such as audio and video or digital signal such as TTL, CMOS, LVDS, ECL, or complex digital signals such as QPSK.

### Features

- Excellent Performance  $R_{DS(ON)} < 5\ \Omega$  at 5.0 V
- Matching between the Switches  $\pm 1.0\ \Omega$
- 1.65 to 5.5 V Operating Range
- Reduced Threshold Voltages for LVTTTL on Control Pine
  - ◆ Eliminates the Need for Translators for Many Applications
  - ◆ TTL Compatibility when  $V_{CC}$  is 5.0 V
  - ◆ Can Operate with 1.8 V Inputs, if  $V_{CC}$  is 3.0
  - ◆ Also Meets Full CMOS Specifications
- Ultra-low charge Injection  $\leq 7.5\ PC$
- Low Stand-by Power  $I_{CC} = 1\ nA$  (Max) at  $T_A = 25^\circ C$
- Control Pins IN1, IN2, are Over Voltage Tollerant
- Pin for Pin replacement TC7WB66, NC7WB66, 74LVC2G56

### Typical Applications

- Cell Phones
- PDAs
- Digital Still Cameras
- Video
- Digital Video



### PIN ASSIGNMENT

| Pin | Function | OVT |
|-----|----------|-----|
| 1   | NO1      | Yes |
| 2   | COM1     | -   |
| 3   | IN2      | Yes |
| 4   | GND      | -   |
| 5   | NO2      | Yes |
| 6   | COM2     | -   |
| 7   | IN1      | Yes |
| 8   | $V_{CC}$ | -   |

### FUNCTION TABLE

| On/Off Enable Input | State of Analog Switch |
|---------------------|------------------------|
| L                   | Off                    |
| H                   | On                     |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

**MAXIMUM RATINGS1**

| Symbol           | Rating  | Value                  | Unit                 |
|------------------|---|------------------------|----------------------|
| V <sub>CC</sub>  | DC Supply Voltage                               | -0.5 to +7.0           | V                    |
| V <sub>I</sub>   | DC Input Voltage                                | -0.5 to +7.0           | V                    |
| V <sub>O</sub>   | DC Output Voltage                               | -0.5 to +7.0           | V                    |
| I <sub>IK</sub>  | DC Input Diode Current                          | V <sub>I</sub> < GND   | -50 mA               |
| I <sub>OK</sub>  | DC Output Diode Current                         | V <sub>O</sub> < GND   | -50 mA               |
| I <sub>O</sub>   | DC Output Sink Current                          |                        | ±50 mA               |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin                |                        | ±100 mA              |
| I <sub>GND</sub> | DC Ground Current per Ground Pin                |                        | ±100 mA              |
| T <sub>STG</sub> | Storage Temperature Range                       | -65 to +150            | °C                   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds | 260                    | °C                   |
| T <sub>J</sub>   | Junction Temperature under Bias                 | +150                   | °C                   |
| θ <sub>JA</sub>  | Thermal Resistance                              | 250                    | °C/W                 |
| P <sub>D</sub>   | Power Dissipation in Still Air at 85°C          | 250                    | mW                   |
| MSL              | Moisture Sensitivity                            | Level 1                | -                    |
| F <sub>R</sub>   | Flammability Rating                             | Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in |

**RECOMMENDED OPERATING CONDITIONS**

| Symbol                          | Characteristics                                | Min  | Max             | Unit |
|---------------------------------|--|--|-----------------|------|
| V <sub>CC</sub>                 | Positive DC Supply Voltage                     | 1.65   | 5.5             | V    |
| V <sub>IN</sub>                 | Digital Input Voltage (Enable)                 | GND  | 5.5             | V    |
| V <sub>IO</sub>                 | Static or Dynamic Voltage Across an Off Switch | GND  | V <sub>CC</sub> | V    |
| V <sub>IS</sub>                 | Analog Input Voltage (NO, COM)                 | GND  | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating Temperature Range, All Package Types | -55  | +125            | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise or Fall Time (Enable Input)         | V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>20         | ns/V |

**DEVICE JUNCTION TEMPERATURE VS. TIME TO 0.1% BOND FAILURES**

| Junction Temperature °C | Time, Hours | Time, Years |
|-------------------------|-------------|-------------|
| 80                      | 1,032,200   | 117.8       |
| 90                      | 419,300     | 47.9        |
| 100                     | 178,700     | 20.4        |
| 110                     | 79,600      | 9.4         |
| 120                     | 37,000      | 4.2         |
| 130                     | 17,800      | 2.0         |
| 140                     | 8,900       | 1.0         |

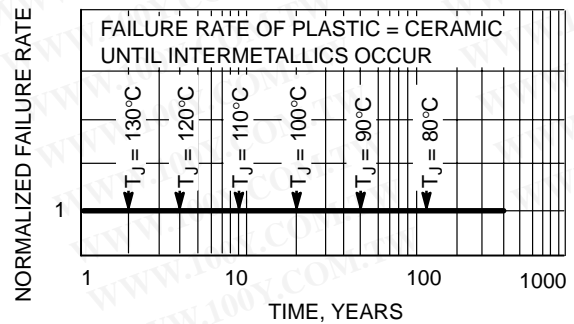


Figure 1. Failure Rate vs. Time Junction Temperature

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## DC CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Condition                      | V <sub>CC</sub>  | Guaranteed Max Limit  |   |   | Unit |
|-----------------|--|--------------------------------|--|---|---|---|------|
|                 |  |                                |  | 25°C  | -40 to 85°C   | -55 to <125°C   |      |
| V <sub>IH</sub> | High-Level Input Voltage, Control Input        |                                | 1.65 to 1.95<br>2.3 to 2.7<br>3.0 to 3.6<br>4.5 to 5.5 | V <sub>CC</sub> × 0.65<br>V <sub>CC</sub> × 0.7<br>V <sub>CC</sub> × 0.7<br>V <sub>CC</sub> × 0.7 | V <sub>CC</sub> × 0.65<br>V <sub>CC</sub> × 0.7<br>V <sub>CC</sub> × 0.7<br>V <sub>CC</sub> × 0.7 | V <sub>CC</sub> × 0.65<br>V <sub>CC</sub> × 0.7<br>V <sub>CC</sub> × 0.7<br>V <sub>CC</sub> × 0.7 | V    |
| V <sub>IL</sub> | Low-Level Input Voltage, Control Input         |                                | 1.65 to 1.95<br>2.3 to 2.7<br>3.0 to 3.6<br>4.5 to 5.5 | V <sub>CC</sub> × 0.35<br>V <sub>CC</sub> × 0.3<br>V <sub>CC</sub> × 0.3<br>V <sub>CC</sub> × 0.3 | V <sub>CC</sub> × 0.35<br>V <sub>CC</sub> × 0.3<br>V <sub>CC</sub> × 0.3<br>V <sub>CC</sub> × 0.3 | V <sub>CC</sub> × 0.35<br>V <sub>CC</sub> × 0.3<br>V <sub>CC</sub> × 0.3<br>V <sub>CC</sub> × 0.3 | V    |
| I <sub>IN</sub> | Maximum Input Leakage Current, Enable Inputs   | V <sub>IN</sub> = 5.5 V or GND | 0 V to 5.5 V   | ±0.1  | ±1.0  | ±1.0  | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per package) | Enable and VIS = VCC or GND    | 5.5  | 1.0   | 1.0   | 2.0   | μA   |

## DC ELECTRICAL CHARACTERISTICS – Analog Section

| Symbol                | Parameter  | Condition   | V <sub>CC</sub>  | Guaranteed Max Limit      |                          |                          | Unit |    |
|-----------------------|--|---|--|---------------------------|--------------------------|--------------------------|------|----|
|                       |  |   |  | 25°C                      | -40 to 85°C              | -55 to <125°C            |      |    |
| R <sub>ON</sub>       | On-State Switch Resistance                         | V <sub>IS</sub> = V <sub>CC</sub> or GND,<br>V <sub>IN</sub> = V <sub>IH</sub>  | I <sub>S</sub> = 4 mA<br>I <sub>S</sub> = 8 mA<br>I <sub>S</sub> = 24 mA<br>I <sub>S</sub> = 32 mA | 1.65<br>2.3<br>3.0<br>4.5 | 30<br>20<br>15<br>10     | 30<br>20<br>15<br>10     | Ω    |    |
| R <sub>ON(p)</sub>    | Peak On-State Resistance                           | V <sub>IS</sub> = V <sub>CC</sub> or GND,<br>V <sub>IN</sub> = V <sub>IH</sub>  | I <sub>S</sub> = 4 mA<br>I <sub>S</sub> = 8 mA<br>I <sub>S</sub> = 24 mA<br>I <sub>S</sub> = 32 mA | 1.65<br>2.3<br>3.0<br>4.5 | 120<br>30<br>20<br>15    | 120<br>30<br>20<br>15    | Ω    |    |
| Δ R <sub>ON</sub>     | Difference of On-State Resistance between Switches | V <sub>IS</sub> = V <sub>CC</sub> or GND,<br>V <sub>IN</sub> = V <sub>IH</sub>  | I <sub>S</sub> = 4 mA<br>I <sub>S</sub> = 8 mA<br>I <sub>S</sub> = 24 mA<br>I <sub>S</sub> = 32 mA | 1.65<br>2.3<br>3.0<br>4.5 | 7.0<br>5.0<br>3.0<br>2.0 | 7.0<br>5.0<br>3.0<br>2.0 | Ω    |    |
| I <sub>NO(OFF)</sub>  | Off Leakage Current                                | V <sub>IN</sub> = V <sub>IL</sub><br>V <sub>NO</sub> = 1.0 V, V <sub>COM</sub> = 4.5 V or<br>V <sub>COM</sub> = 1.0 V and V <sub>NO</sub> 4.5 V |  | 5.5                       | 1.0                      | 10                       | 100  | nA |
| I <sub>COM(OFF)</sub> | Off Leakage Current                                | V <sub>IN</sub> = V <sub>IL</sub><br>V <sub>NO</sub> = 4.5 V or 1.0 V<br>V <sub>COM</sub> = 1.0 V or 4.5 V                                      |  | 5.5                       | 1.0                      | 10                       | 100  | nA |

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## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

| Symbol    | Parameter | Test Conditions | Guaranteed Max Limit                      |      |  |     |  |     |  |     | Unit |
|-----------|-----------|-----------------|---|------|--|-----|--|-----|--|-----|------|
|           |           |                 | $V_{CC} = 1.8\text{ V} \pm 0.15\text{ V}$ |      | $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ |     | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ |     | $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ |     |      |
|           |           |                 | Min                                       | Max  | Min                                      | Max | Min                                      | Max | Min                                      | Max |      |
| $t_{ON}$  |           |                 | 2.3                                       | 10   | 1.6                                      | 5.6 | 1.5                                      | 4.4 | 1.3                                      | 3.9 | ns   |
| $t_{OFF}$ |           |                 | 2.5                                       | 10.5 | 1.2                                      | 6.9 | 2.0                                      | 7.2 | 1.1                                      | 6.3 | ns   |

|                        |   | Typical @ 25°C, $V_{CC} = 5.0\text{ V}$ | Unit |
|------------------------|---|---|------|
| $C_{IN}$               | Maximum Input Capacitance, Select Input | 3.0                                     | pF   |
| $C_{NO1}$ or $C_{NO2}$ | Analog I/O (Switch Off)                 | 10                                      |      |
| $C_{COM(OFF)}$         | Common I/O (Switch Off)                 | 10                                      |      |
| $C_{COM(ON)}$          | Feed-through (Switch Off)               | 10                                      |      |

## ADDITIONAL APPLICATIONS CHARACTERISTICS (Voltage Reference to GND Unless Noted)

| Symbol    | Parameter  | Condition   | $V_{CC}$ (V)      | Typical 25°C         | Unit |
|-----------|--|---|-------------------|----------------------|------|
| BW        | Maximum On-Channel -3.0 dB Bandwidth or Minimum Frequency Response | $V_{IS} = 0$ dBm<br>$V_{IS}$ centered between $V_{CC}$ and GND  | 2.0<br>3.0<br>4.5 | 102<br>180<br>186    | MHz  |
| $V_{ONL}$ | Maximum Feed-Through On Loss                                       | $V_{IS} = 0$ dBm @ 10 kHz<br>$V_{IS}$ centered between $V_{CC}$ and GND   | 2.0<br>3.0<br>4.5 | -2.2<br>-0.8<br>-0.4 | dB   |
| $V_{ISO}$ | Off-Channel Isolation  | $f = 100$ kHz<br>$V_{IS} = 1.0$ V RMS<br>$V_{IS}$ centered between $V_{CC}$ and GND   | 2.0<br>3.0<br>4.5 | -73<br>-74<br>-75    | dB   |
| Q         | Charge Injection<br>Enable Input to Common I/O                     | $V_{IS} = V_{CC}$ to GND, $F_{IS} = 20$ kHz<br>$t_r = t_f = 3.0$ nS<br>$R_{IS} = 0\ \Omega$ , $C_L = 100$ pF  | 3.0<br>5.5        | 48<br>85             | pC   |
| THD       | Total Harmonic Distortion<br>TDH + Noise                           | $F_{IS} = 10$ Hz to 100 kHz,<br>$R_L = R_{gen} = 600\ \Omega$ , $C_L = 50$ pF<br>$V_{IS} = 3.0$ V <sub>PP</sub> Sine Wave<br>$V_{IS} = 5.0$ V <sub>PP</sub> Sine Wave | 3.0<br>5.5        | 0.19<br>0.06         | %    |

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## TIMING INFORMATION

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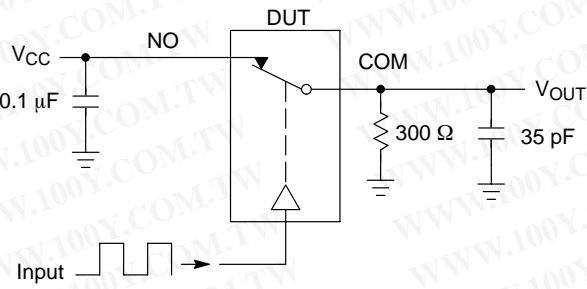


Figure 2.  $t_{ON}/t_{OFF}$

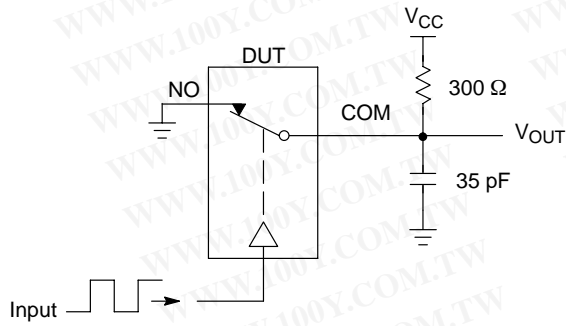
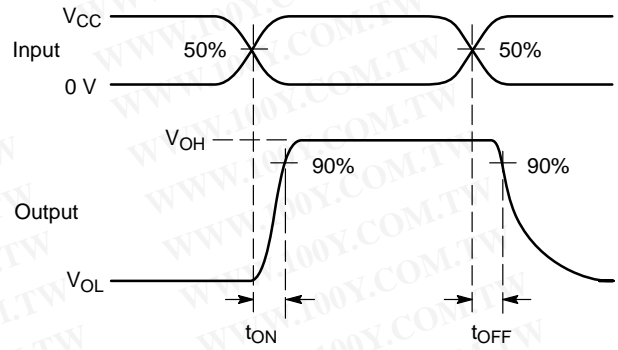
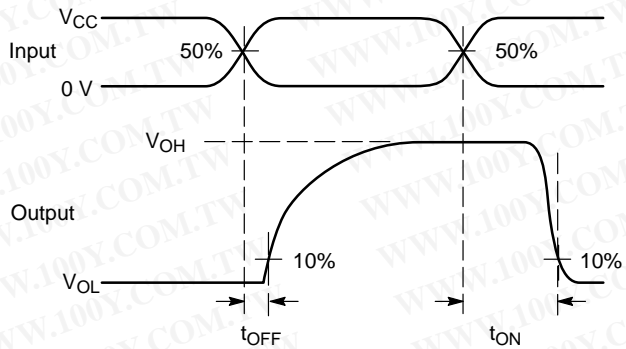
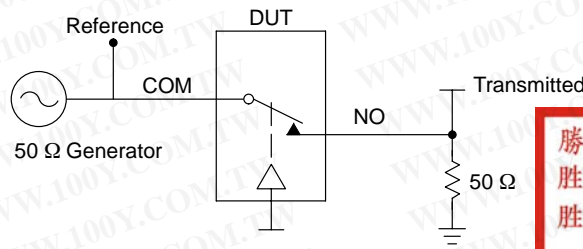


Figure 3.  $t_{ON}/t_{OFF}$



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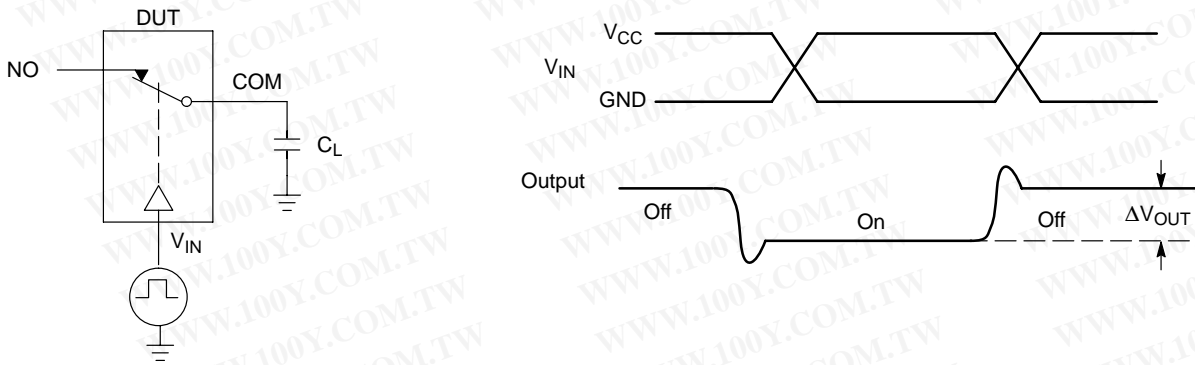
Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch.  $V_{ISO}$ , Bandwidth and  $V_{ONL}$  are independent of the input signal direction.

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

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

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

**Figure 4. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ $V_{ONL}$**



**Figure 5. Charge Injection: (Q)**

# NL7WB66

## DEVICE ORDERING INFORMATION

| Device Order Number | Device Nomenclature |            |                 |                | Package Type | Tape and Reel Size       |
|---------------------|---------------------|------------|-----------------|----------------|--------------|--------------------------|
|                     | Circuit Indicator   | Technology | Device Function | Package Suffix |              |                          |
| NL7WB66             | NL                  | AS         | 2066            | US             | US8          | 178 mm (7")<br>3000 Unit |

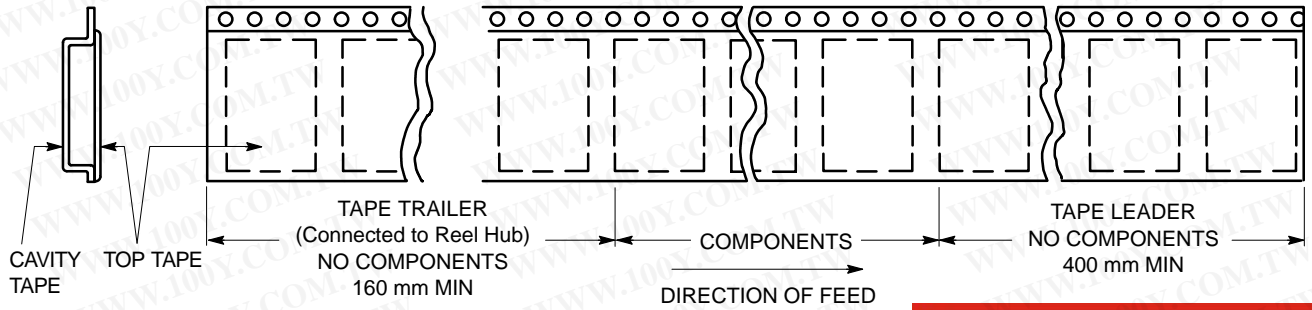


Figure 6. Tape Ends for Finished Goods

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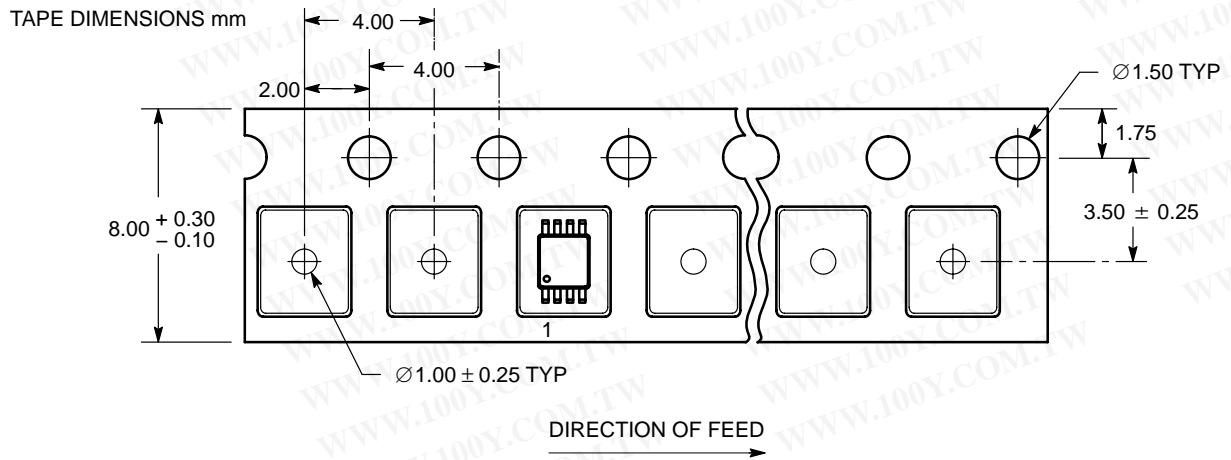


Figure 7. US8 Reel Configuration/Orientation

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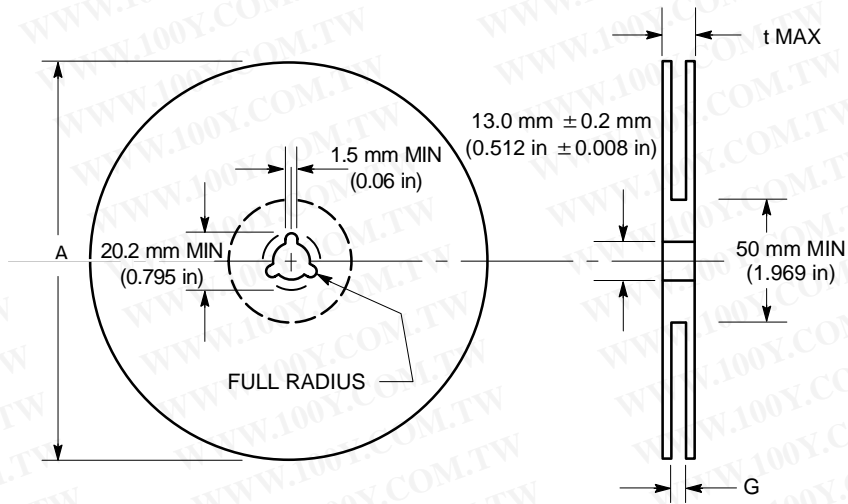


Figure 8. Reel Dimensions

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## REEL DIMENSIONS

| Tape Size | T and R Suffix | A Max            | G   | t Max                |
|-----------|----------------|------------------|---|----------------------|
| 8 mm      | US             | 178 mm<br>(7 in) | 8.4 mm, + 1.5 mm, -0.0<br>(0.33 in + 0.059 in, -0.00) | 14.4 mm<br>(0.56 in) |

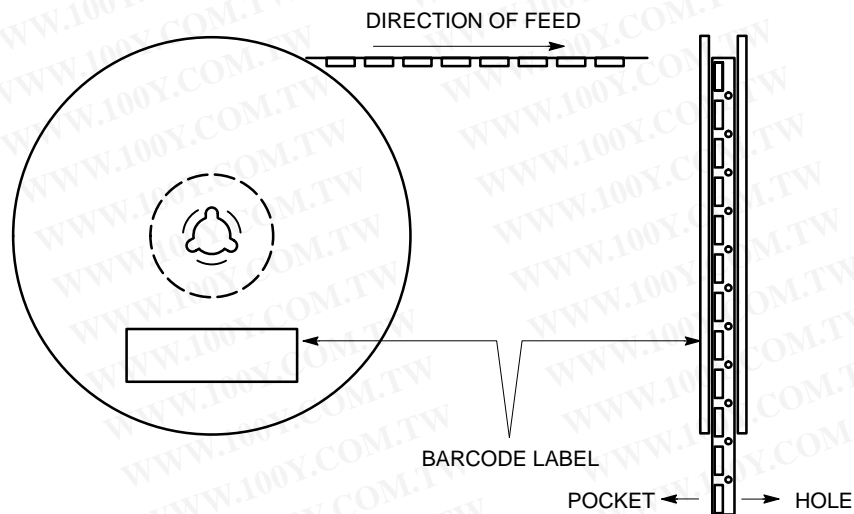


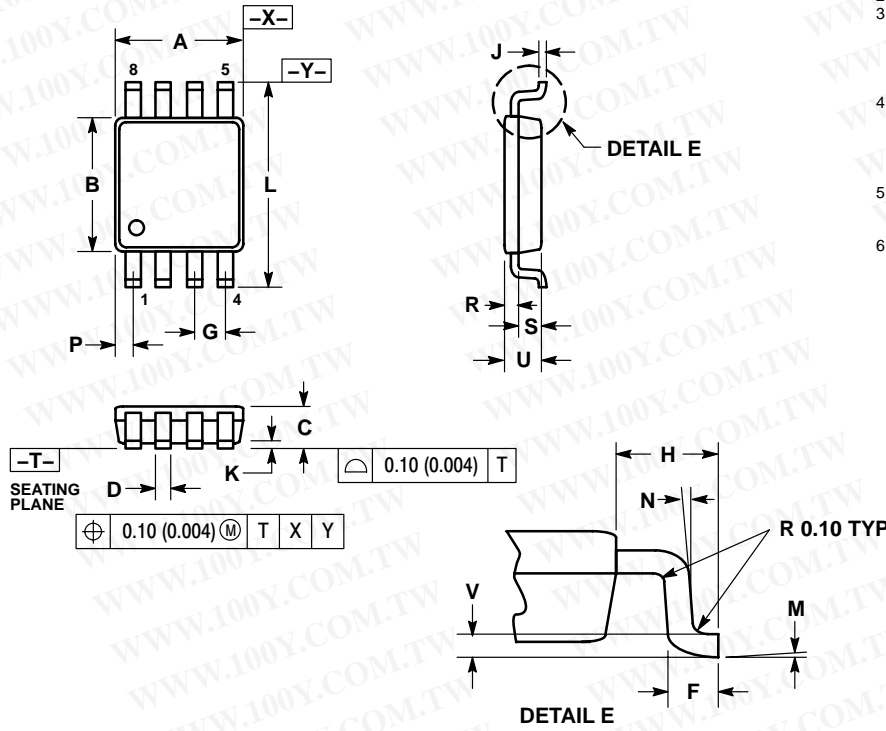
Figure 9. Reel Winding Direction

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## PACKAGE DIMENSIONS

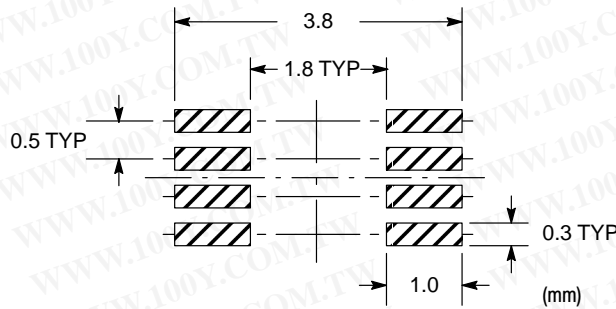
US8  
US SUFFIX  
CASE 493-02  
ISSUE A

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- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH, PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE.
  4. DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION. INTER-LEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.140 (0.0055") PER SIDE.
  5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM. (300-800").
  6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED  $\pm 0.0508$  (0.0002").

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.90        | 2.10 | 0.075     | 0.083 |
| B   | 2.20        | 2.40 | 0.087     | 0.094 |
| C   | 0.60        | 0.90 | 0.024     | 0.035 |
| D   | 0.17        | 0.25 | 0.007     | 0.010 |
| F   | 0.20        | 0.35 | 0.008     | 0.014 |
| G   | 0.50 BSC    |      | 0.020 BSC |       |
| H   | 0.40 REF    |      | 0.016 REF |       |
| J   | 0.10        | 0.18 | 0.004     | 0.007 |
| K   | 0.00        | 0.10 | 0.000     | 0.004 |
| L   | 3.00        | 3.20 | 0.118     | 0.126 |
| M   | 0°          | 6°   | 0°        | 6°    |
| N   | 5°          | 10°  | 5°        | 10°   |
| P   | 0.23        | 0.34 | 0.010     | 0.013 |
| R   | 0.23        | 0.33 | 0.009     | 0.013 |
| S   | 0.37        | 0.47 | 0.015     | 0.019 |
| U   | 0.60        | 0.80 | 0.024     | 0.031 |
| V   | 0.12 BSC    |      | 0.005 BSC |       |



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