

NL7WB66

Ultra-Small SPST Analog Switch

The NL7WB66 is a very low R_{ON} dual SPST analog switch. R_{ON} is 5.0 Ω (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 $R_{DS(ON)} = 5.0 \Omega$ at 5.0 V
- High Speed Operation: $t_{PD} = 0.25$ ns (Max) at 5.0 V
- 1.65 to 5.5 V Operating Range
- Reduced Threshold Voltages for LVTTTL on Control Pin
 - ◆ 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 = 7.5 pC at 5.0 V
- Low Stand-by Power $I_{CC} = 1.0$ nA (Max) at $T_A = 25^\circ\text{C}$
- Control Pins IN1, IN2, are Overvoltage Tolerant
- Pin for Pin Replacement TC7WB66, NC7WB66, 74LVC2G66
- ESD Protection:
 - Machine Model >200 V,
 - Human Body Model >2000 V
- Latchup Max Rating: 200 mA
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

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

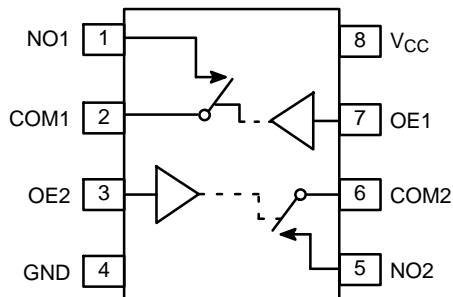
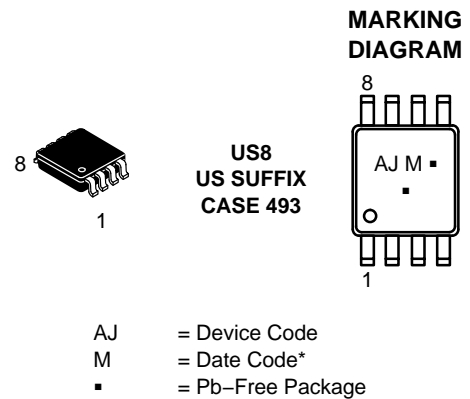


Figure 1. Pin Assignment Diagram



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(Note: Microdot may be in either location)
*Date Code orientation may vary depending upon manufacturing location.

PIN ASSIGNMENT

| Pin | Function | OVT |
|-----|----------|-----|
| 1 | NO1 | – |
| 2 | COM1 | – |
| 3 | OE2 | Yes |
| 4 | GND | – |
| 5 | NO2 | – |
| 6 | COM2 | – |
| 7 | OE1 | 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 5 of this data sheet.

NL7WB66

MAXIMUM RATINGS

| Symbol | Rating | Value | Unit |
|------------------|---|------------------------|------|
| V _{CC} | DC Supply Voltage | -0.5 to +7.0 | V |
| V _I | DC Input Voltage | -0.5 to +7.0 | V |
| V _O | DC Output Voltage | -0.5 to +7.0 | V |
| I _{IK} | DC Input Diode Current V _I < GND | -50 | mA |
| I _{OK} | DC Output Diode Current V _O < GND | -50 | mA |
| I _O | DC Output Sink Current | ±50 | mA |
| I _{CC} | DC Supply Current per Supply Pin | ±100 | mA |
| I _{GND} | DC Ground Current per Ground Pin | ±100 | mA |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |
| T _L | Lead Temperature, 1 mm from Case for 10 Seconds | 260 | °C |
| T _J | Junction Temperature under Bias | +150 | °C |
| θ _{JA} | Thermal Resistance | 250 | °C/W |
| P _D | Power Dissipation in Still Air at 85°C | 250 | mW |
| MSL | Moisture Sensitivity | Level 1 | - |
| F _R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | - |
| V _{ESD} | ESD Withstand Voltage Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4) | > 2000 > 200 N/A | V |

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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Characteristics | Min | Max | Unit |
|---------------------------------|---|--------|-----------------|------|
| V _{CC} | Positive DC Supply Voltage | 1.65 | 5.5 | V |
| V _{IN} | Digital Input Voltage (Enable) | GND | 5.5 | V |
| V _{IO} | Static or Dynamic Voltage Across an Off Switch | GND | V _{CC} | V |
| V _{IS} | Analog Input Voltage NO COM | GND | V _{CC} | V |
| T _A | Operating Temperature Range, All Package Types | -55 | +125 | °C |
| t _r , t _f | Input Rise or Fall Time (Enable Input) V _{CC} = 3.3 V ± 0.3 V V _{CC} = 5.0 V ± 0.5 V | 0 0 | 100 20 | ns/V |

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.

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 |

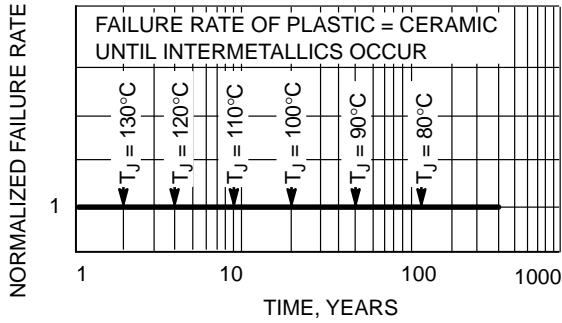


Figure 2. Failure Rate vs. Time Junction Temperature

DC CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

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

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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DC ELECTRICAL CHARACTERISTICS – Analog Section

| Symbol | Parameter | Condition | V _{CC} | Guaranteed Max Limit | | | Unit |
|-----------------------|--|--|---------------------------|--------------------------|--------------------------|--------------------------|------|
| | | | | 25°C | -40 to 85°C | -55 to <125°C | |
| R _{ON} | On-State Switch Resistance | V _{IS} = V _{CC} I _S = 4 mA | 1.65 | 30 | 30 | 30 | Ω |
| | | V _{IS} = GND I _S = 4 mA | 1.65 | 15 | 15 | | |
| | | V _{IS} = V _{CC} I _S = 8 mA | 2.3 | 20 | 20 | | |
| | | V _{IS} = GND I _S = 8 mA | 2.3 | 10 | 10 | | |
| | | V _{IS} = V _{CC} I _S = 24 mA | 3.0 | 15 | 15 | | |
| | | V _{IS} = GND I _S = 24 mA | 3.0 | 7.0 | 7.0 | | |
| | | V _{IS} = V _{CC} I _S = 32 mA | 4.5 | 10 | 10 | | |
| | | V _{IS} = 2.4 I _S = 15 mA | 4.5 | 8.0 | 8.0 | | |
| | | V _{IS} = GND I _S = 32 mA | 4.5 | 5.0 | 5.0 | | |
| R _{ON(p)} | Peak On-State Resistance | V _{IS} = V _{CC} to GND, I _S = 4 mA V _{IN} = V _{IH} I _S = 8 mA I _S = 24 mA I _S = 32 mA | 1.65 2.3 3.0 4.5 | 120 30 20 15 | 120 30 20 15 | 120 30 20 15 | Ω |
| Δ R _{ON} | Difference of On-State Resistance between Switches | V _{IS} = V _{CC} to GND, I _S = 4 mA V _{IN} = V _{IH} I _S = 8 mA I _S = 24 mA I _S = 32 mA | 1.65 2.3 3.0 4.5 | 1.2 1.3 1.5 2.0 | 1.2 1.3 1.5 2.0 | 1.2 1.3 1.5 2.0 | Ω |
| R _{FLAT} | | V _{IS} = V _{CC} to GND I _S = 4 mA I _S = 8 mA I _S = 24 mA I _S = 32 mA | 1.65 2.3 3.0 4.5 | 240 60 14 5.0 | 240 60 14 5.0 | 240 60 14 5.0 | Ω |
| I _{NO(OFF)} | Off Leakage Current | V _{IN} = V _{IL} V _{NO} = 1.0 V, V _{COM} = 4.5 V or V _{COM} = 1.0 V and V _{NO} 4.5 V | 5.5 | 1.0 | 10 | 100 | nA |
| I _{COM(OFF)} | Off Leakage Current | V _{IN} = V _{IL} V _{NO} = 4.5 V or 1.0 V V _{COM} = 1.0 V or 4.5 V | 5.5 | 1.0 | 10 | 100 | nA |

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

| Symbol | Parameter | Test Conditions | Guaranteed Max Limit | | | | | | | | Unit |
|------------------|------------------------|-----------------|----------------------------------|------|---------------------------------|-----|---------------------------------|------|---------------------------------|------|------|
| | | | V _{CC} = 1.8 V ± 0.15 V | | V _{CC} = 2.5 V ± 0.2 V | | V _{CC} = 3.3 V ± 0.3 V | | V _{CC} = 5.0 V ± 0.5 V | | |
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| t _{ON} | Output Enable Time | | 2.3 | 10 | 1.6 | 5.6 | 1.5 | 4.4 | 1.3 | 3.9 | ns |
| t _{OFF} | Output Disable Time | | 2.5 | 10.5 | 1.2 | 6.9 | 2.0 | 7.2 | 1.1 | 6.3 | ns |
| t _{PD} | Propagation Delay Time | | - | 0.55 | - | 0.5 | - | 0.35 | - | 0.25 | ns |

| | | Typical @ 25°C, V _{CC} = 5.0 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 | |

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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 V _{IS} centered between V _{CC} and GND | 2.0 | 102 | MHz |
| | | | 3.0 | 180 | |
| | | | 4.5 | 186 | |
| V _{ONL} | Maximum Feed-Through On Loss | V _{IS} = 0 dBm @ 10 kHz V _{IS} centered between V _{CC} and GND | 2.0 | -2.2 | dB |
| | | | 3.0 | -0.8 | |
| | | | 4.5 | -0.4 | |
| V _{ISO} | Off-Channel Isolation | f = 100 kHz V _{IS} = 1.0 V RMS V _{IS} centered between V _{CC} and GND | 2.0 | -73 | dB |
| | | | 3.0 | -74 | |
| | | | 4.5 | -75 | |
| Q | Charge Injection Enable Input to Common I/O | V _{IS} = V _{CC} to GND, F _{IS} = 20 kHz t _r = t _f = 3.0 nS R _{IS} = 0 Ω, C _L = 100 pF | 3.0 | 4.8 | pC |
| | | | 5.5 | 7.5 | |
| THD | Total Harmonic Distortion TDH + Noise | F _{IS} = 10 Hz to 100 kHz, R _L = R _{gen} = 600 Ω, C _L = 50 pF V _{IS} = 3.0 V _{PP} Sine Wave V _{IS} = 5.0 V _{PP} Sine Wave | 3.0 | 0.19 | % |
| | | | 5.5 | 0.06 | |

DEVICE ORDERING INFORMATION

| Device Order Number | Package | Shipping† |
|---------------------|------------------|--------------------------|
| NL7WB66USG | US8 (Pb-Free) | 3000 Units / 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.

TIMING INFORMATION

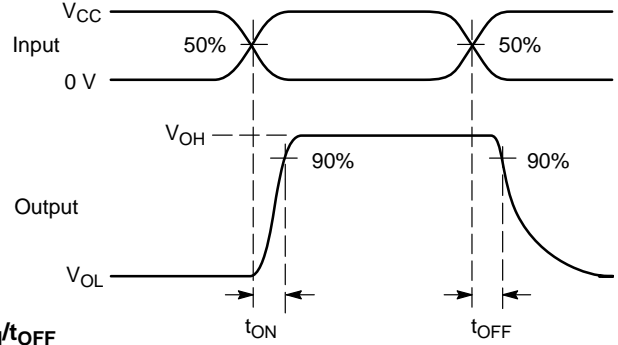
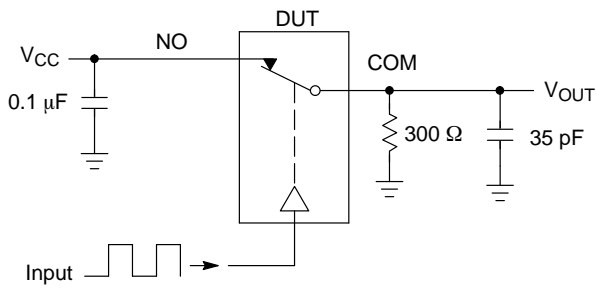


Figure 3. t_{ON}/t_{OFF}

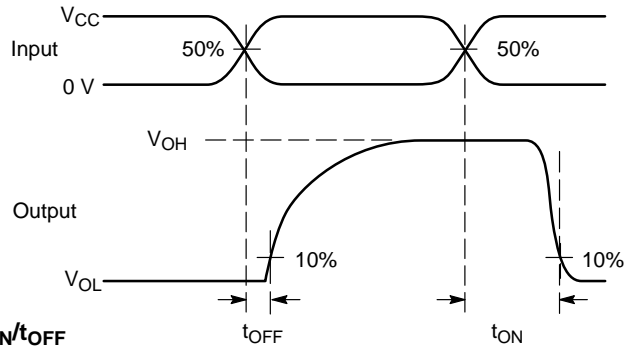
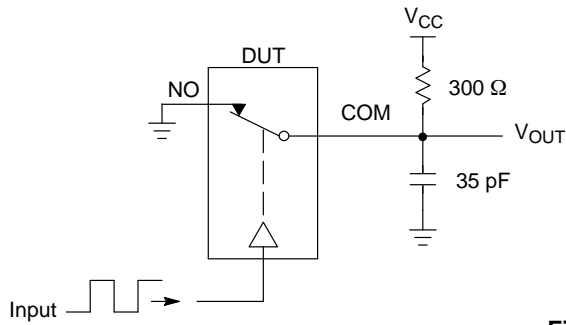
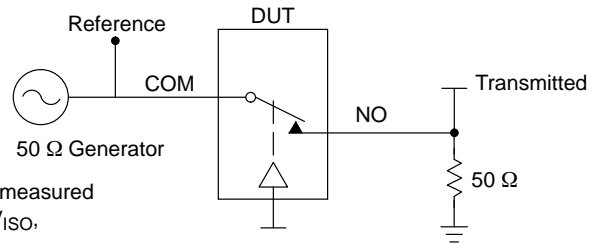


Figure 4. t_{ON}/t_{OFF}



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 5. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ V_{ONL}

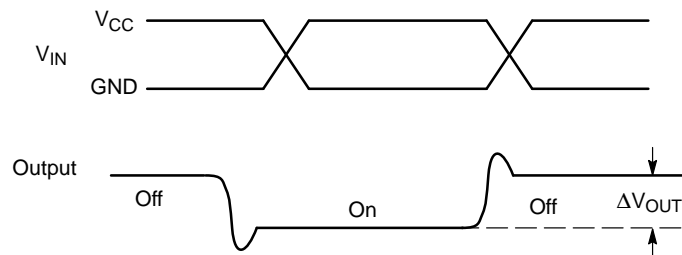
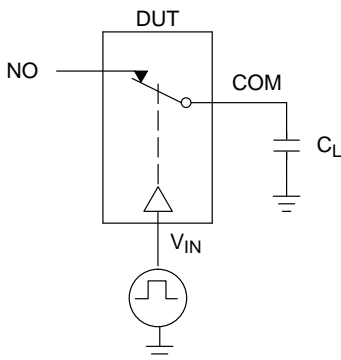


Figure 6. Charge Injection: (Q)

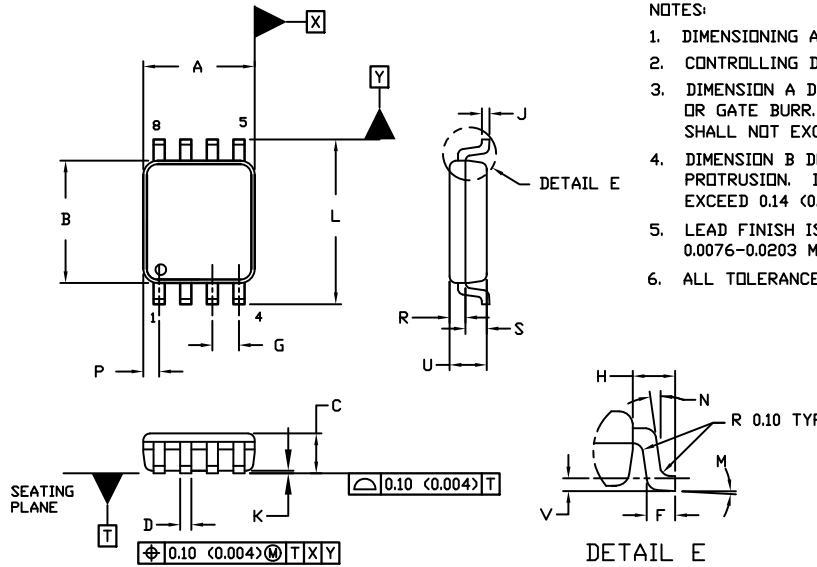
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 4:1

US8
CASE 493
ISSUE F

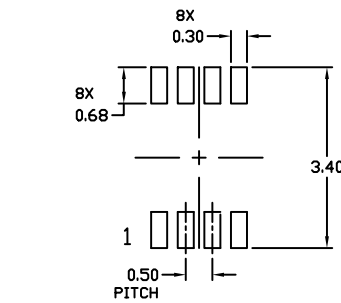
DATE 01 SEP 2021



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, OR GATE BURR SHALL NOT EXCEED 0.14 (0.0055") PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.14 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM (0.003-0.008").
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 MM (0.002").

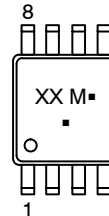
| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 1.90 | 2.10 | 0.075 | 0.083 |
| B | 2.20 | 2.40 | 0.087 | 0.094 |
| C | 0.60 | 0.90 | 0.024 | 0.035 |
| D | 0.17 | 0.25 | 0.007 | 0.010 |
| F | 0.20 | 0.35 | 0.008 | 0.014 |
| G | 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 | 3.25 | 0.118 | 0.128 |
| M | 0° | 6° | 0° | 6° |
| N | 0° | 10° | 0° | 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 | |



**RECOMMENDED *
MOUNTING FOOTPRINT**

* For additional information on our Pb-Free strategy and soldering details, please download the DN Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDER09/D.

**GENERIC
MARKING DIAGRAM***



- XX = Specific Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

*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. Some products may not follow the Generic Marking.

| | | |
|-------------------------|--------------------|--|
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| DESCRIPTION: | US8 | PAGE 1 OF 1 |

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