# NLAS325

# Dual SPST Analog Switch, Low Voltage, Single Supply

The NLAS325 is a dual SPST (Single Pole, Single Throw) switch, similar to 1/2 a standard 4066. The device permits the independent selection of 2 analog/digital signals. Available in the Ultra–Small 8 package.

The use of advanced 0.6 μ CMOS process, improves the $R_{ON}$ resistance considerably compared to older higher voltage technologies.

- On Resistance is 20 Ω Typical at 5.0 V
- Matching is < 1 Ω Between Sections
- 2 – 6 V Operating Range
- Ultra Low < 5 pC Charge Injection
- Ultra Low Leakage < 1 nA at 5.0 V, 25 C
- Wide Bandwidth > 200 MHz, –3 dB
- CMOS/TTL Compatible
- 2000 V ESD (HBM)
- Ron Flatness +/– 6 Ω at 5.0 V
- US8 Package
- Independent Enables; One Positive, One Negative

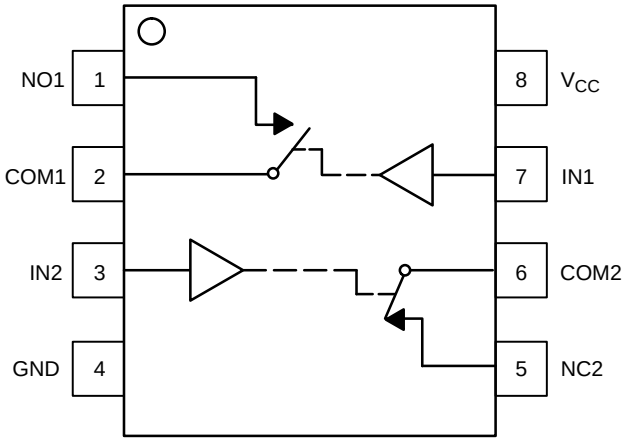
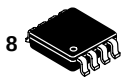



**Figure 1. Pinout**

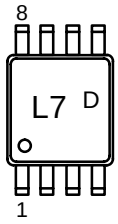
ON Semiconductor™

http://onsemi.com




**US8**
**US SUFFIX**
**CASE 493**

**MARKING DIAGRAM**




L7 = Device Code
D = Date Code

**PIN ASSIGNMENT**

| | |
|---|---|
| 1 | NO1 |
| 2 | COM1 |
| 3 | IN2 |
| 4 | GND |
| 5 | NC2 |
| 6 | COM2 |
| 7 | IN1 |
| 8 | $V_{CC}$ |

**FUNCTION TABLE**

| On/Off Enable Input | Analog Switch 1 | Analog Switch 2 |
|---|---|---|
| L | Off | On |
| H | On | Off |

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

**MAXIMUM RATINGS**

| Symbol | Parameter | | 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 |
| $\theta_{JA}$ | Thermal Resistance | (Note 1) | 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)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 200<br>N/A | V |

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum–rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

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 | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | 2.0 | 5.5 | V |
| $V_{IN}$ | Digital Select Input Voltage | | GND | 5.5 | V |
| $V_{IS}$ | Analog Input Voltage (NC, NO, COM) | | GND | $V_{CC}$ | V |
| $T_A$ | Operating Temperature Range | | −55 | +125 | °C |
| $t_r$, $t_f$ | Input Rise or Fall Time, SELECT | $V_{CC}$ = 3.3 V ± 0.3 V<br>$V_{CC}$ = 5.0 V ± 0.5 V | 0<br>0 | 100<br>20 | ns/V |

**DEVICE JUNCTION TEMPERATURE VERSUS 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 |

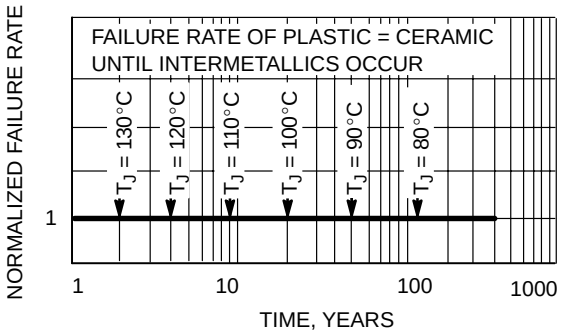



**Figure 2. Failure Rate vs. Time Junction Temperature**

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

| Symbol | Parameter | Condition | $V_{CC}$ | Guaranteed Limit | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | −55°C to 25°C | <85°C | <125°C | |
| $V_{IH}$ | Minimum High–Level Input Voltage, Select Inputs | | 2.0 | 1.5 | 1.5 | 1.5 | V |
| | | | 2.5 | 1.9 | 1.9 | 1.9 | |
| | | | 3.0 | 2.1 | 2.1 | 2.1 | |
| | | | 4.5 | 3.15 | 3.15 | 3.15 | |
| | | | 5.5 | 3.85 | 3.85 | 3.85 | |
| $V_{IL}$ | Maximum Low–Level Input Voltage, Select Inputs | | 2.0 | 0.5 | 0.5 | 0.5 | V |
| | | | 2.5 | 0.6 | 0.6 | 0.6 | |
| | | | 3.0 | 0.9 | 0.9 | 0.9 | |
| | | | 4.5 | 1.35 | 1.35 | 1.35 | |
| | | | 5.5 | 1.65 | 1.65 | 1.65 | |
| $I_{IN}$ | Maximum Input Leakage Current, Select Inputs | $V_{IN}$ = 5.5 V or GND | 0 V to 5.5 V | ±0.2 | ±2.0 | ±2.0 | μA |
| $I_{CC}$ | Maximum Quiescent Supply Current | Select and $V_{IS}$ = $V_{CC}$ or GND | 5.5 | 4.0 | 4.0 | 8.0 | μA |

**DC ELECTRICAL CHARACTERISTICS – Analog Section**

| Symbol | Parameter | Condition | $V_{CC}$ | Guaranteed Limit | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | −55°C to 25°C | <85°C | <125°C | |
| $R_{ON}$ | Maximum “ON” Resistance (Figures 16 – 22) | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$V_{IS}$ = GND to $V_{CC}$<br>$\|I_{IN}\| \leq$ 10.0 mA | 2.5 | 85 | 95 | 105 | Ω |
| | | | 3.0 | 45 | 50 | 55 | |
| | | | 4.5 | 30 | 35 | 40 | |
| | | | 5.5 | 25 | 30 | 35 | |
| $R_{FLAT\ (ON)}$ | ON Resistance Flatness (Figures 16 – 22) | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$\|I_{IN}\| \leq$ 10.0 mA<br>$V_{IS}$ = 1 V, 2 V, 3.5 V | 4.5 | 4 | 4 | 5 | Ω |
| $I_{NC(OFF)}$<br>$I_{NO(OFF)}$ | NO or NC Off Leakage Current (Figure 8) | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$V_{NO}$ or $V_{NC}$ = 1.0 $V_{COM}$ 4.5 V | 5.5 | 1 | 10 | 100 | nA |
| $I_{COM(ON)}$ | COM ON Leakage Current (Figure 8) | $V_{IN}$ = $V_{IL}$ or $V_{IH}$<br>$V_{NO}$ 1.0 V or 4.5 V with $V_{NC}$ floating or<br>$V_{NO}$ 1.0 V or 4.5 V with $V_{NO}$ floating<br>$V_{COM}$ = 1.0 V or 4.5 V | 5.5 | 1 | 10 | 100 | nA |

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

| Symbol | Parameter | Test Conditions | $V_{CC}$ (V) | $V_{IS}$ (V) | Guaranteed Maximum Limit | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | −55°C to 25°C | | | <85°C | | <125°C | | |
| | | | | | Min | Typ* | Max | Min | Max | Min | Max | |
| $t_{ON}$ | Turn–On Time (Figures 11 and 12) | $R_L$ = 300 Ω, $C_L$ = 35 pF (Figures 4 and 5) | 2.5 | 2.0 | 5 | 23 | 35 | 5 | 38 | 5 | 41 | ns |
| | | | 3.0 | 2.0 | 5 | 16 | 24 | 5 | 27 | 5 | 30 | |
| | | | 4.5 | 3.0 | 2 | 11 | 16 | 2 | 19 | 2 | 22 | |
| | | | 5.5 | 3.0 | 2 | 9 | 14 | 2 | 17 | 2 | 20 | |
| $t_{OFF}$ | Turn–Off Time (Figures 11 and 12) | $R_L$ = 300 Ω, $C_L$ = 35 pF (Figures 4 and 5) | 2.5 | 2.0 | 1 | 7 | 12 | 1 | 15 | 1 | 18 | ns |
| | | | 3.0 | 2.0 | 1 | 5 | 10 | 1 | 13 | 1 | 16 | |
| | | | 4.5 | 3.0 | 1 | 4 | 6 | 1 | 9 | 1 | 12 | |
| | | | 5.5 | 3.0 | 1 | 3 | 5 | 1 | 8 | 1 | 11 | |
| $t_{BBM}$ | Minimum Break–Before–Make Time | $V_{IS}$ = 3.0 V (Figure 3) $R_L$ = 300 Ω, $C_L$ = 35 pF | 2.5 | 2.0 | 1 | 12 | | 1 | | 1 | | ns |
| | | | 3.0 | 2.0 | 1 | 11 | | 1 | | 1 | | |
| | | | 4.5 | 3.0 | 1 | 6 | | 1 | | 1 | | |
| | | | 5.5 | 3.0 | 1 | 5 | | 1 | | 1 | | |

*Typical Characteristics are at 25°C.

| | | Typical @ 25, $V_{CC}$ = 5.0 V | |
|---|---|---|---|
| $C_{IN}$ | Maximum Input Capacitance, Select Input | 8 | pF |
| $C_{NO}$ or $C_{NC}$ | Analog I/O (switch off) | 10 | |
| $C_{COM}$ | Common I/O (switch off) | 10 | |
| $C_{(ON)}$ | Feedthrough (switch on) | 20 | |

**ADDITIONAL APPLICATION CHARACTERISTICS** (Voltages Referenced to GND Unless Noted)

| Symbol | Parameter | Condition | $V_{CC}$ V | Typical 25°C | Unit |
|---|---|---|---|---|---|
| BW | Maximum On–Channel –3dB Bandwidth or Minimum Frequency Response (Figure 10) | $V_{IN}$ = 0 dBm $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6) | 3.0 | 145 | MHz |
| | | | 4.5 | 170 | |
| | | | 5.5 | 175 | |
| $V_{ONL}$ | Maximum Feedthrough On Loss | $V_{IN}$ = 0 dBm @ 100 kHz to 50 MHz $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6) | 3.0 | −2 | dB |
| | | | 4.5 | −2 | |
| | | | 5.5 | −2 | |
| $V_{ISO}$ | Off–Channel Isolation (Figure 9) | f = 100 kHz; $V_{IS}$ = 1 V RMS $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6) | 3.0 | −93 | dB |
| | | | 4.5 | −93 | |
| | | | 5.5 | −93 | |
| Q | Charge Injection Select Input to Common I/O (Figure 14) | $V_{IN}$ = $V_{CC}$ to GND, $F_{IS}$ = 20 kHz $t_r = t_f$ = 3 ns $R_{IS}$ = 0 Ω, $C_L$ = 1000 pF $Q = C_L * \Delta V_{OUT}$ (Figure 7) | 3.0 | 1.5 | pC |
| | | | 5.5 | 3.0 | |
| THD | Total Harmonic Distortion THD + Noise (Figure 13) | $F_{IS}$ = 20 Hz to 100 kHz, $R_L$ = Rgen = 600 Ω, $C_L$ = 50 pF $V_{IS}$ = 5.0 $V_{PP}$ sine wave | 5.5 | 0.1 | % |
| VCT | Channel–to–Channel Crosstalk | f = 100 kHz; $V_{IS}$ = 1 V RMS $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6) | 5.5 | −90 | dB |
| | | | 3.0 | −90 | |

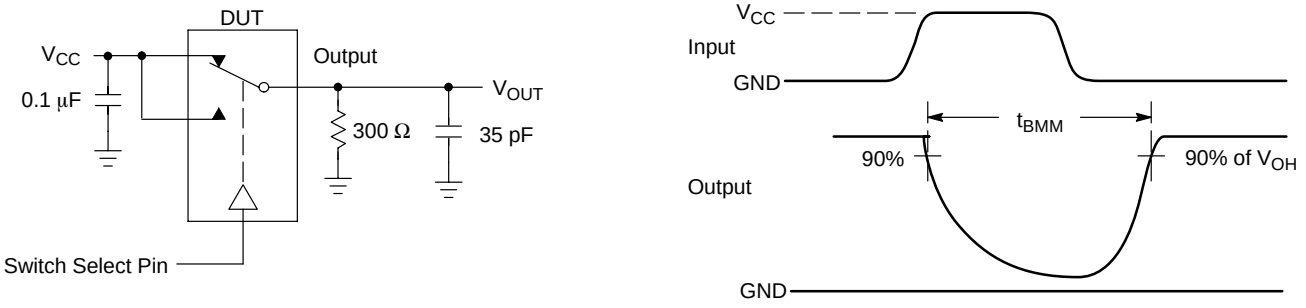



**Figure 3. $t_{BBM}$ (Time Break–Before–Make)**

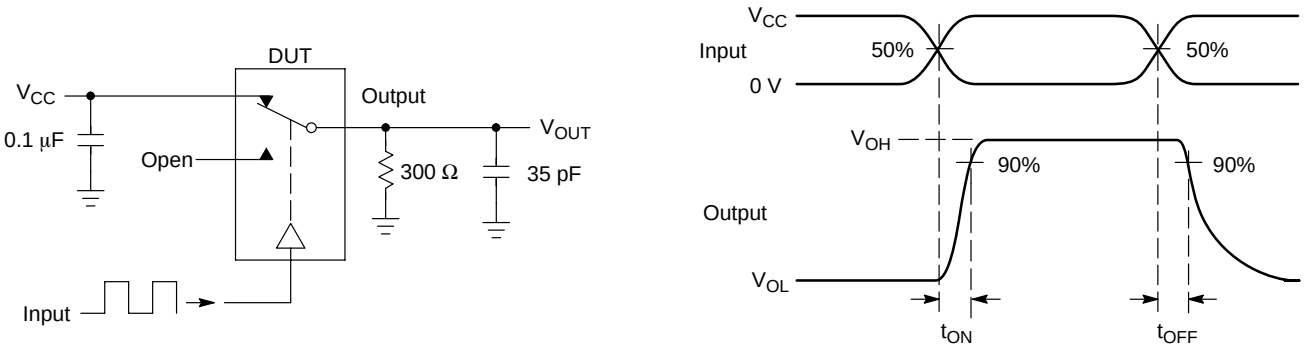



**Figure 4. $t_{ON}/t_{OFF}$**

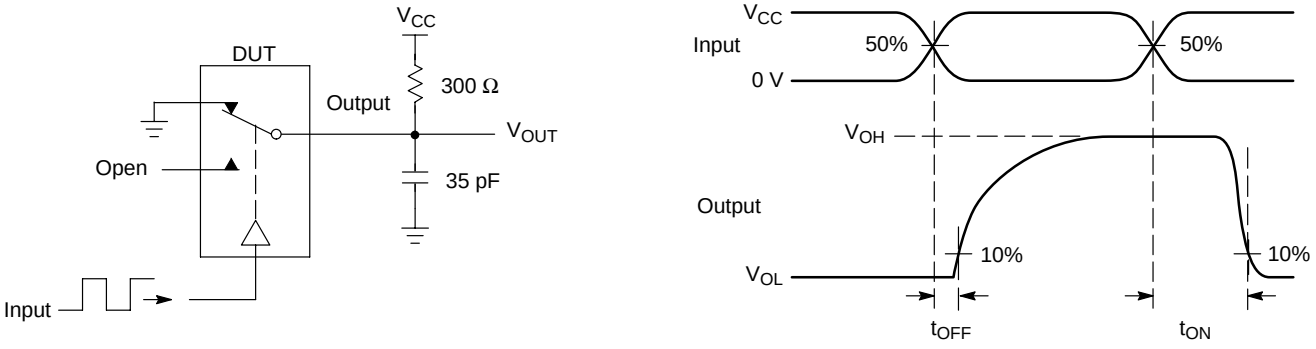
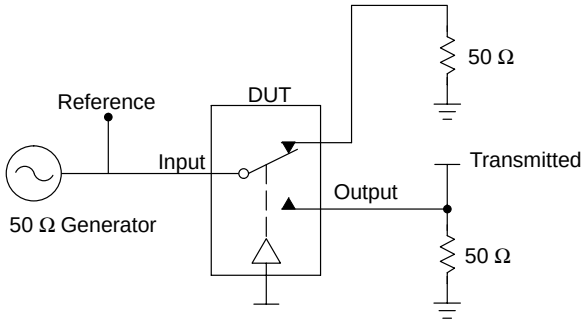



**Figure 5. $t_{ON}/t_{OFF}$**




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.

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

$V_{ONL}$ = On Channel Loss = 20 Log $\left(\frac{V_{OUT}}{V_{IN}}\right)$ for $V_{IN}$ at 100 kHz to 50 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 6. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/$V_{ONL}$**

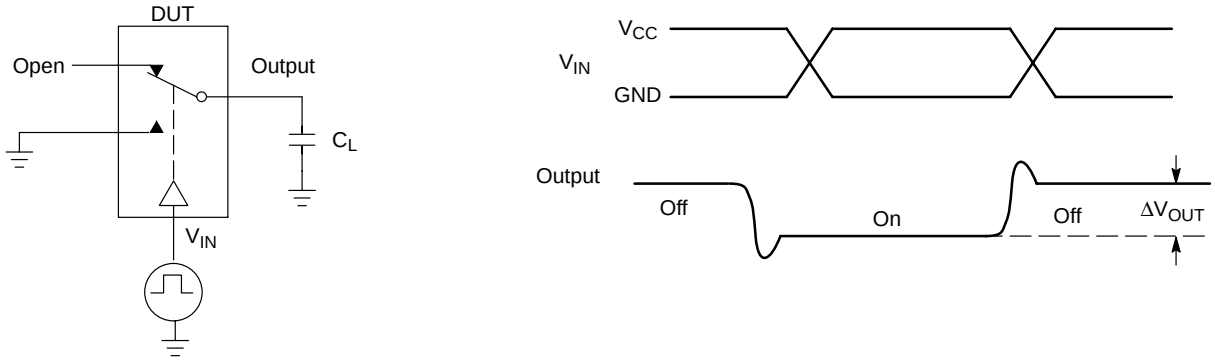



**Figure 7. Charge Injection: (Q)**

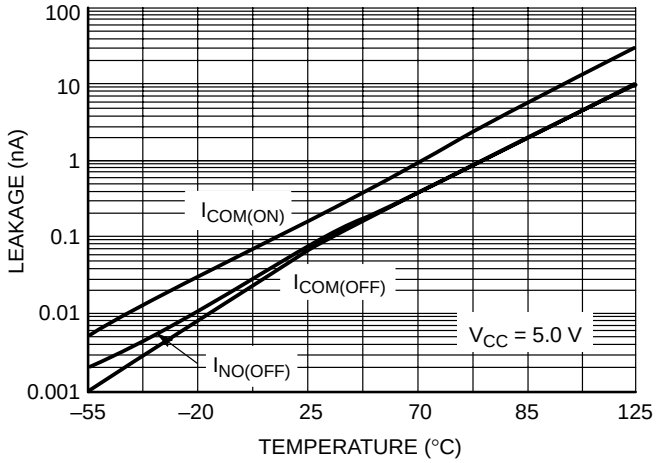



**Figure 8. Switch Leakage vs. Temperature**

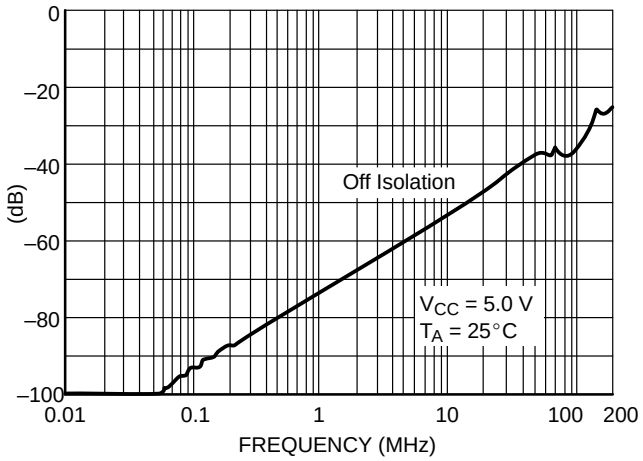



**Figure 9. Off–Channel Isolation**

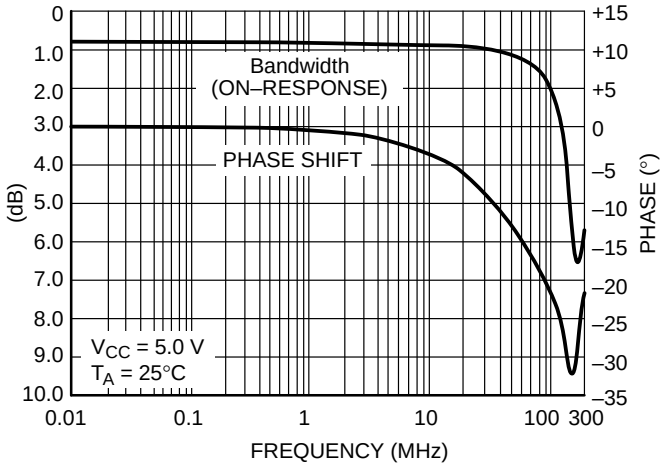



**Figure 10. Typical Bandwidth and Phase Shift**

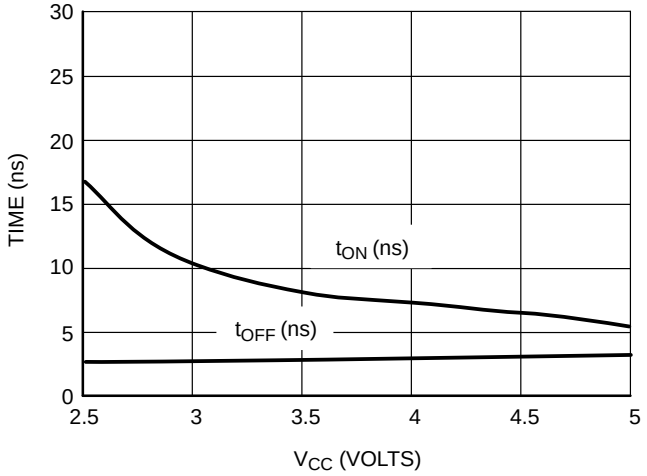



**Figure 11. $t_{ON}$ and $t_{OFF}$ vs. $V_{CC}$ at 25°C**

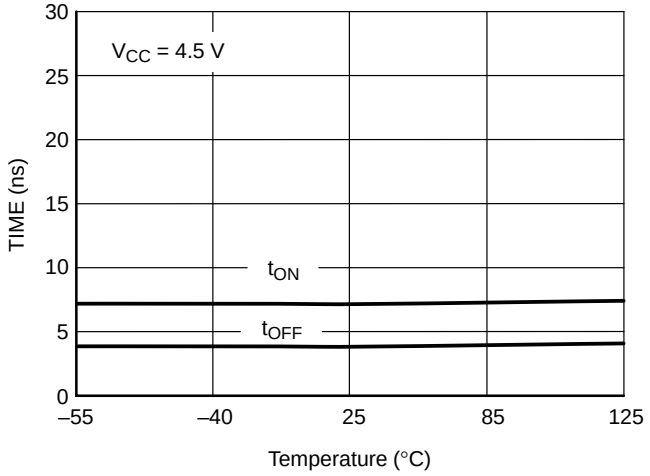



**Figure 12. $t_{ON}$ and $t_{OFF}$ vs. Temp**

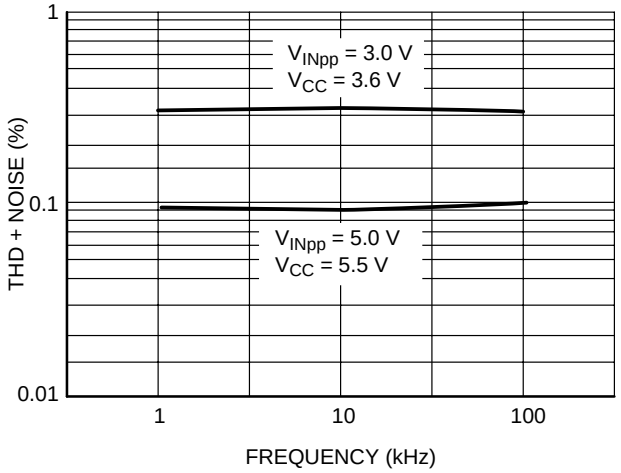



**Figure 13. Total Harmonic Distortion Plus Noise vs. Frequency**

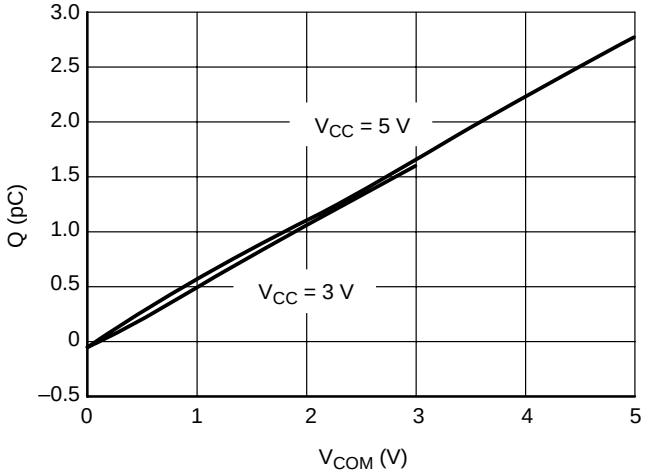



**Figure 14. Charge Injection vs. COM Voltage**

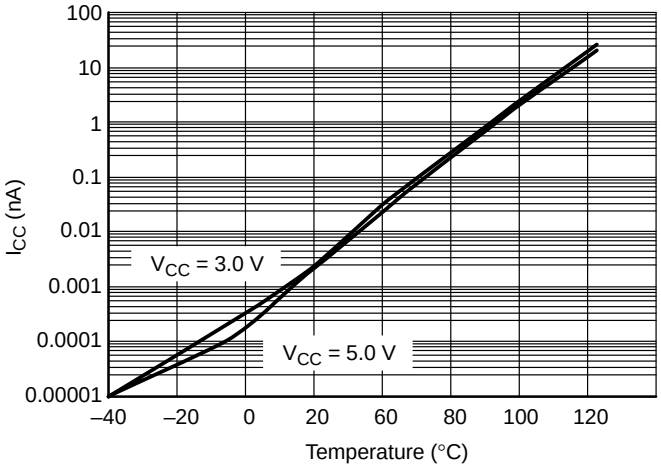



**Figure 15. $I_{CC}$ vs. Temp, $V_{CC}$ = 3 V & 5 V**

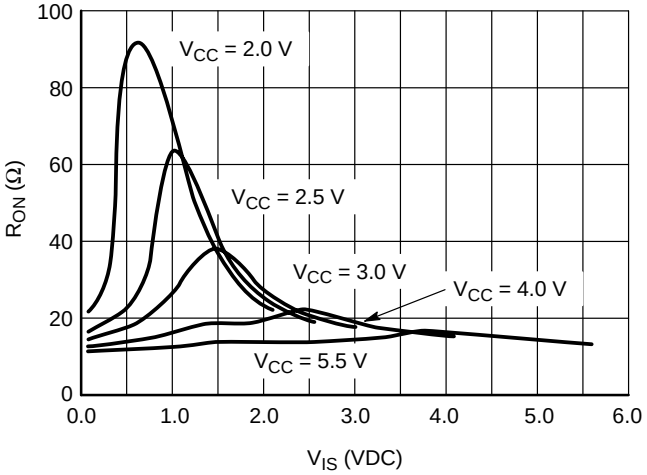



**Figure 16. $R_{ON}$ vs. $V_{CC}$, Temp = 25°C**

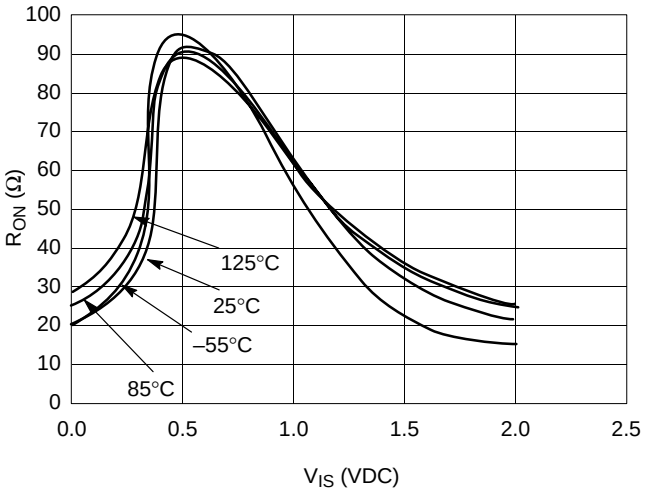



**Figure 17. $R_{ON}$ vs Temp, $V_{CC}$ = 2.0 V**

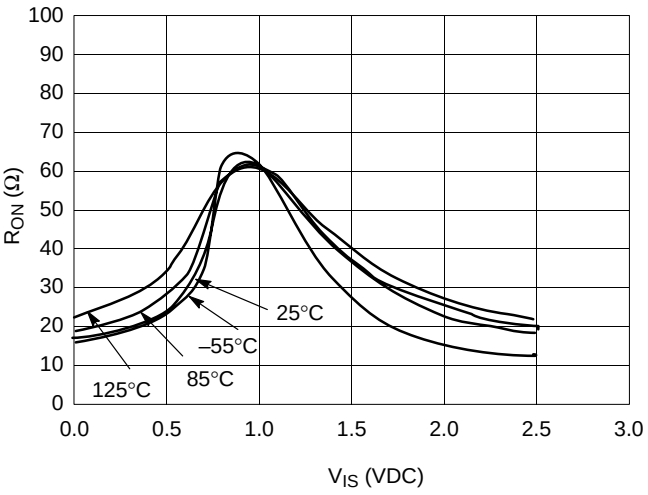



**Figure 18. $R_{ON}$ vs. Temp, $V_{CC}$ = 2.5 V**

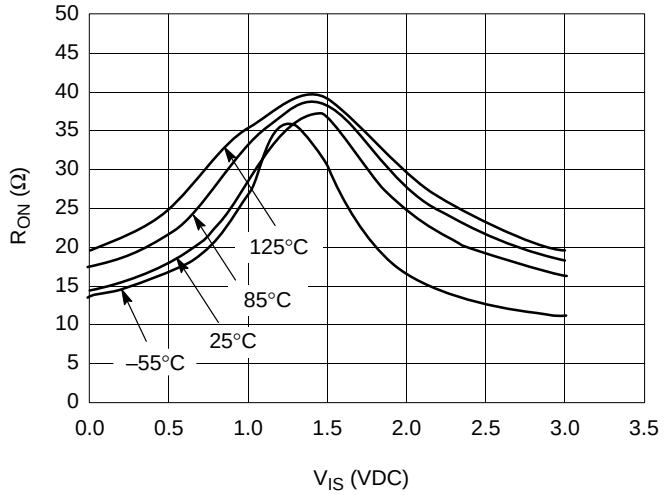



**Figure 19. $R_{ON}$ vs. Temp, $V_{CC}$ = 3.0 V**

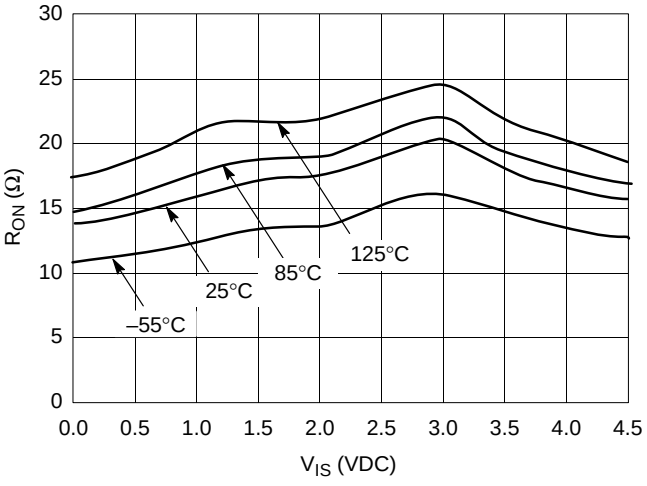



**Figure 20. $R_{ON}$ vs. Temp, $V_{CC}$ = 4.5 V**

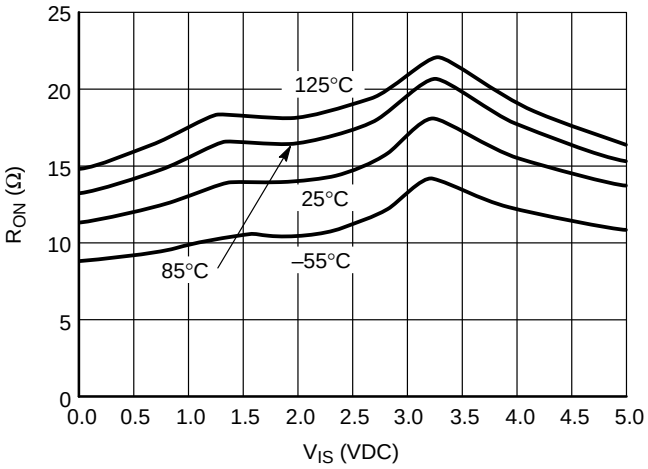



**Figure 21. $R_{ON}$ vs. Temp, $V_{CC}$ = 5.0 V**

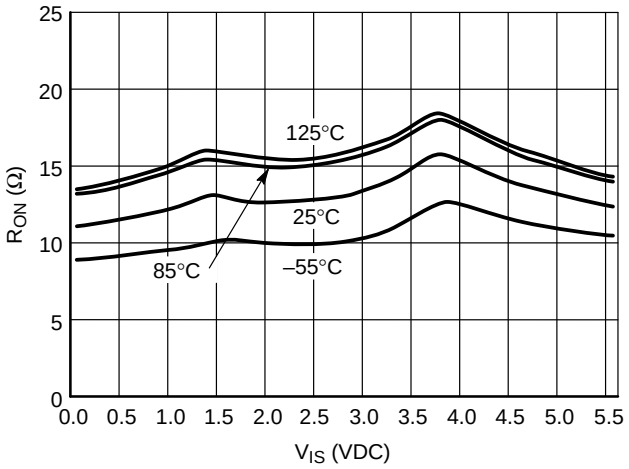



**Figure 22. $R_{ON}$ vs. Temp, $V_{CC}$ = 5.5 V**

**DEVICE ORDERING INFORMATION**

| Device Order Number | Device Nomenclature | | | | Package Type | Tape and Reel Size |
|---|---|---|---|---|---|---|
| | Circuit Indicator | Technology | Device Function | Package Suffix | | |
| NLAS325US | NL | AS | 325 | US | US8 | 178 mm (7″) 3000 Unit |

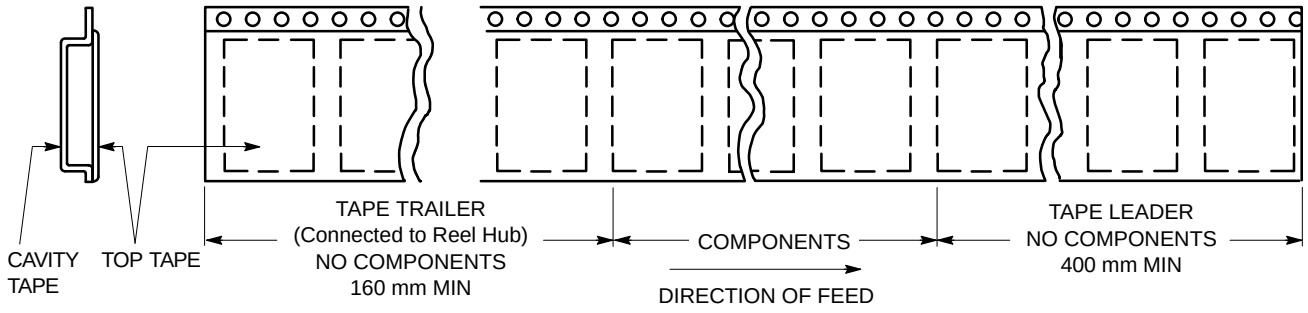



**Figure 23. Tape Ends for Finished Goods**

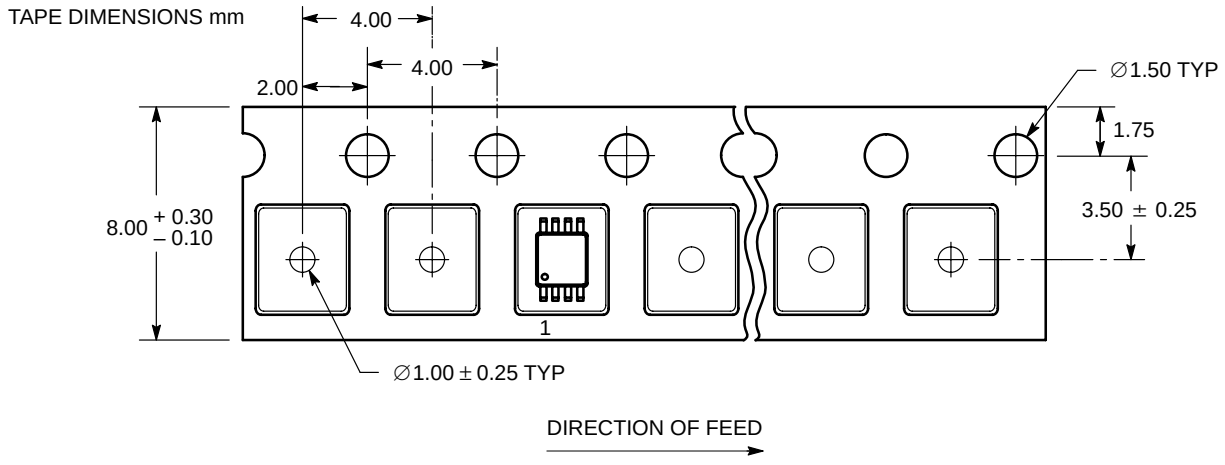



**Figure 24. US8 Reel Configuration/Orientation**

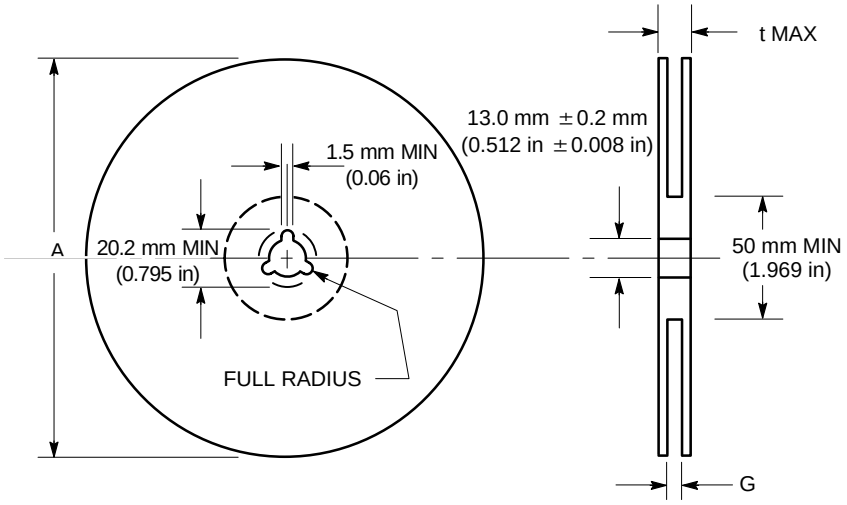



**Figure 25. Reel Dimensions**

**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) |

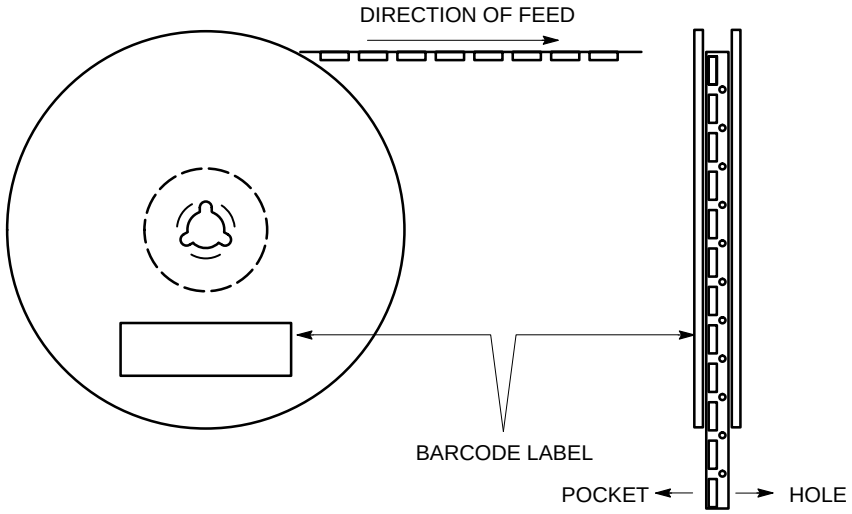
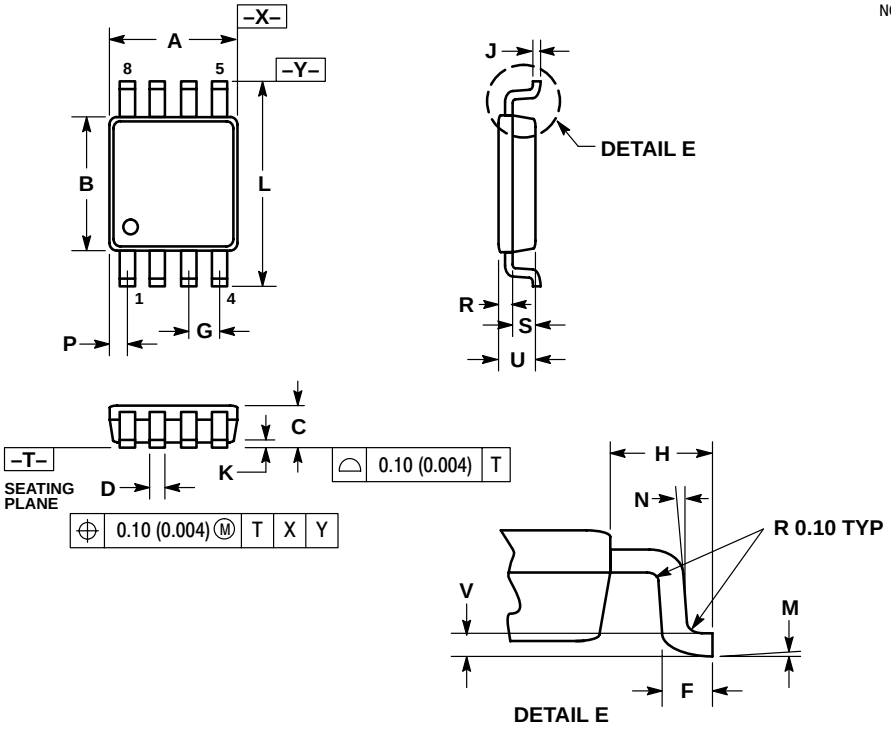



**Figure 26. Reel Winding Direction**

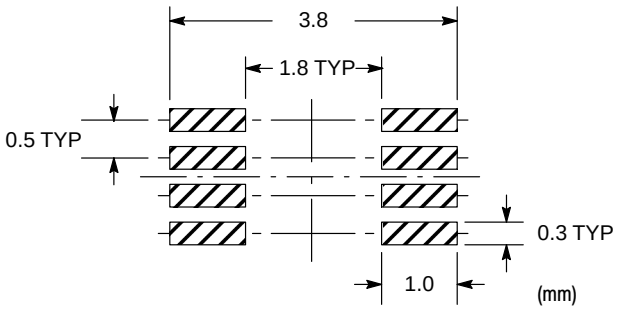
## PACKAGE DIMENSIONS

**US8**
**US SUFFIX**
CASE 493–01
ISSUE O




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 E3XCEED 0.140 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076–0. 0203 MM. (300–800 INCH).
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002").

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 | 0.28 | 0.44 | 0.011 | 0.017 |
| 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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