

74ALVCH16245

Low-Voltage 16-Bit Transceiver with Bus Hold 1.8/2.5/3.3 V (3-State, Non-Inverting)

The 74ALVCH16245 is an advanced performance, non-inverting 16-bit transceiver. It is designed for very high-speed, very low-power operation in 1.8 V, 2.5 V or 3.3 V systems.

The 74ALVCH16245 is designed with byte control. It can be operated as two separate octals, or with the controls tied together, as a 16-bit wide function. The Transmit/Receive ($T/\bar{R}n$) inputs determine the direction of data flow through the bi-directional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; Receive (active-LOW) enables data from B to A ports. The Output Enable inputs ($\bar{O}En$), when HIGH, disable both A and B ports by placing them in a HIGH Z condition. The data inputs include active bushold circuitry, eliminating the need for external pull-up resistors to hold unused or floating inputs at a valid logic state.

- Designed for Low Voltage Operation: $V_{CC} = 1.65 - 3.6$ V
- 3.6 V Tolerant Inputs and Outputs
- High Speed Operation: 2.5 ns max for 3.0 to 3.6 V
3.0 ns max for 2.3 to 2.7 V
6.0 ns max for 1.65 to 1.95 V
- Static Drive: ± 24 mA Drive at 3.0 V
 ± 18 mA Drive at 2.3 V
 ± 6 mA Drive at 1.65 V
- Supports Live Insertion and Withdrawal
- Includes Active Bushold to Hold Unused or Floating Inputs at a Valid Logic State
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0$ V†
- Near Zero Static Supply Current in All Three Logic States (20 μ A)
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds ± 250 mA @ 125°C
- ESD Performance: Human Body Model >2000 V;
Machine Model >200 V
- Second Source to Industry Standard 74ALVCH16245

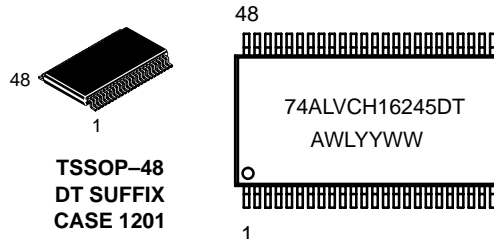
†To ensure the outputs activate in the 3-state condition, the output enable pins should be connected to V_{CC} through a pull-up resistor. The value of the resistor is determined by the current sinking capability of the output connected to the $\bar{O}E$ pin.



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MARKING DIAGRAM



A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week

ORDERING INFORMATION

| Device | Package | Shipping |
|-----------------|---------|------------------|
| 74ALVCH16245DT | TSSOP | 39 Units/Rail |
| 74ALVCH16245DTR | TSSOP | 2500/Tape & Reel |

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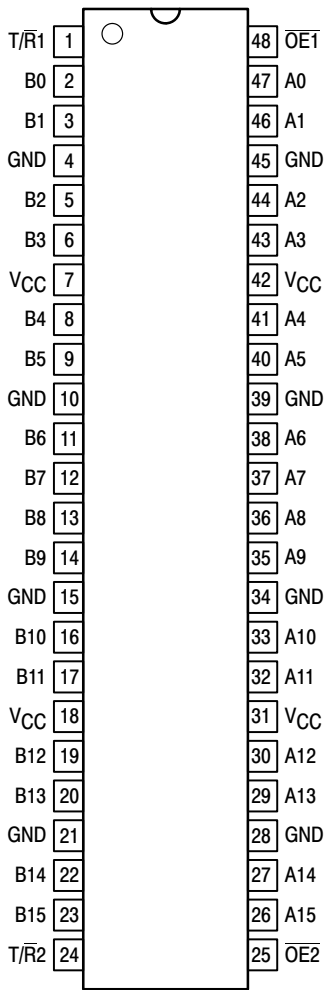


Figure 1. 48-Lead Pinout (Top View)

PIN NAMES

| Pins | Function |
|-------------------|----------------------------------|
| \overline{OE}_n | Output Enable Inputs |
| T/R _n | Transmit/Receive Inputs |
| A0–A15 | Side A Inputs or 3–State Outputs |
| B0–B15 | Side B Inputs or 3–State Outputs |

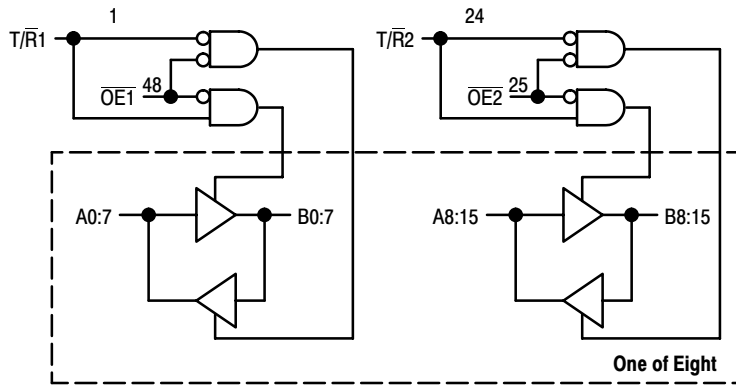


Figure 2. Logic Diagram

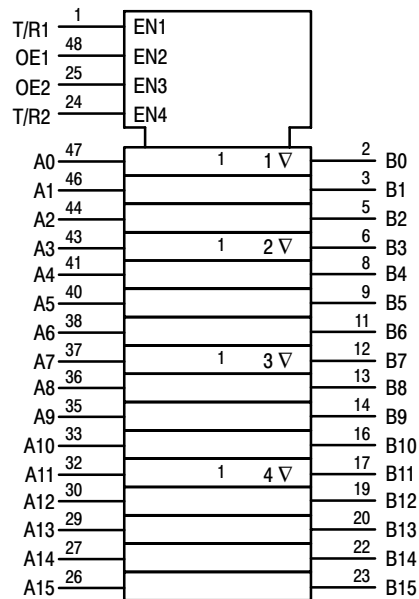


Figure 3. IEC Logic Diagram

| Inputs | | Outputs | Inputs | | Outputs |
|-------------------|------------------|----------------------------|-------------------|------------------|------------------------------|
| \overline{OE}_1 | T/R ₁ | | \overline{OE}_2 | T/R ₂ | |
| L | L | Bus B0:7 Data to Bus A0:7 | L | L | Bus B8:15 Data to Bus A8:15 |
| L | H | Bus A0:7 Data to Bus B0:7 | L | H | Bus A8:15 Data to Bus B8:15 |
| H | X | High Z State on A0:7, B0:7 | H | X | High Z State on A8:15, B8:15 |

H = High Voltage Level; L = Low Voltage Level; X = High or Low Voltage Level and Transitions Are Acceptable

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MAXIMUM RATINGS (Note 1)

| Symbol | Parameter | Value | Unit |
|------------------|---|------------------------|------|
| V _{CC} | DC Supply Voltage | -0.5 to +4.6 | V |
| V _I | DC Input Voltage | -0.5 to +4.6 | V |
| V _O | DC Output Voltage | -0.5 to +4.6 | 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 (Note 2) | 90 | °C/W |
| MSL | Moisture Sensitivity | Level 1 | |
| FR | Flammability Rating Oxygen Index: 30% – 35% | UL-94-VO (0.125 in) | |
| V _{ESD} | ESD Withstand Voltage Human Body Model (Note 3) Machine Model (Note 4) Charged Device Model (Note 5) | > 2000 > 200 N/A | V |
| LATCH-UP | Latch-Up Performance Above V _{CC} and Below GND at 85°C (Note 6) | ±250 | mA |

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. I_O absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
3. Tested to EIA/JESD22-A114-A.
4. Tested to EIA/JESD22-A115-A.
5. Tested to JESD22-C101-A.
6. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|-----------------|---|-------------|---------------|------|
| V _{CC} | Supply Voltage Operating Data Retention Only | 2.3 1.5 | 3.6 3.6 | V |
| V _I | Input Voltage (Note 7) | 0 | 3.6 | V |
| V _O | Output Voltage (HIGH or LOW State) | 0 | 3.6 | V |
| T _A | Operating Free-Air Temperature | -40 | +85 | °C |
| Δt/ΔV | Input Transition Rise or Fall Rate V _{CC} = 2.5 V ± 0.2 V V _{CC} = 3.0 V ± 0.3 V V _{CC} = 5.0 V ± 0.5 V | 0 0 0 | 20 10 5 | ns/V |

7. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

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DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | T _A = -40°C to +85°C | | Unit |
|----------------------|---------------------------------------|---|---------------------------------|------------------------|------|
| | | | Min | Max | |
| V _{IH} | HIGH Level Input Voltage (Note 8) | 1.65 V ≤ V _{CC} < 2.3 V | 0.65 × V _{CC} | | V |
| | | 2.3 V ≤ V _{CC} ≤ 2.7 V | 1.7 | | |
| | | 2.7 V < V _{CC} ≤ 3.6 V | 2.0 | | |
| V _{IL} | LOW Level Input Voltage (Note 8) | 1.65 V ≤ V _{CC} < 2.3 V | | 0.35 × V _{CC} | V |
| | | 2.3 V ≤ V _{CC} ≤ 2.7 V | | 0.7 | |
| | | 2.7 V < V _{CC} ≤ 3.6 V | | 0.8 | |
| V _{OH} | HIGH Level Output Voltage | 1.65 V ≤ V _{CC} ≤ 3.6 V; I _{OH} = -100 μA | V _{CC} - 0.2 | | V |
| | | V _{CC} = 1.65 V; I _{OH} = -4 mA | 1.20 | | |
| | | V _{CC} = 2.3 V; I _{OH} = -6 mA | 2.0 | | |
| | | V _{CC} = 2.3 V; I _{OH} = -12 mA | 1.7 | | |
| | | V _{CC} = 2.7 V; I _{OH} = -12 mA | 2.2 | | |
| | | V _{CC} = 3.0 V; I _{OH} = -12 mA | 2.4 | | |
| | | V _{CC} = 3.0 V; I _{OH} = -24 mA | 2.0 | | |
| V _{OL} | LOW Level Output Voltage | 1.65 V ≤ V _{CC} ≤ 3.6 V; I _{OL} = 100 μA | | 0.2 | V |
| | | V _{CC} = 1.65 V; I _{OL} = 4 mA | | 0.45 | |
| | | V _{CC} = 2.3 V; I _{OL} = 6 mA | | 0.4 | |
| | | V _{CC} = 2.3 V; I _{OL} = 12 mA | | 0.7 | |
| | | V _{CC} = 2.7 V; I _{OL} = 12 mA | | 0.4 | |
| | | V _{CC} = 3.0 V; I _{OL} = 24 mA | | 0.55 | |
| V _{OL} | LOW Level Output Voltage | V _{CC} = 3.6 V; V _I = 0 to 3.6 V | | ±500 | μA |
| I _I | Input Leakage Current | 1.65 V ≤ V _{CC} ≤ 3.6 V; 0 V ≤ V _I ≤ 3.6 V | | ±5.0 | μA |
| I _{I(HOLD)} | Minimum Bus-hold Input Current | V _{CC} = 3.0 V, V _{IN} = 0.8 V | 75 | | μA |
| | | V _{CC} = 3.0 V, V _{IN} = 2.0 V | -75 | | |
| | | V _{CC} = 2.3 V, V _{IN} = 0.7 V | 45 | | |
| | | V _{CC} = 2.3 V, V _{IN} = 1.7 V | -45 | | |
| | | V _{CC} = 1.65 V, V _{IN} = 0.58 V | 25 | | |
| | | V _{CC} = 1.65 V, V _{IN} = 1.07 V | -25 | | |
| I _{OZ} | 3-State Output Current | 1.65 V ≤ V _{CC} ≤ 3.6 V; 0 V ≤ V _O ≤ 3.6 V; V _I = V _{IH} or V _{IL} | | ±10 | μA |
| I _{OFF} | Power-Off Leakage Current | V _{CC} = 0 V; V _I or V _O = 3.6 V | | 10 | μA |
| I _{CC} | Quiescent Supply Current (Note 9) | 1.65 V ≤ V _{CC} ≤ 3.6 V; V _I = GND or V _{CC} | | 40 | μA |
| | | 1.65 V ≤ V _{CC} ≤ 3.6 V; 3.6 V ≤ V _I , V _O ≤ 3.6 V | | ±40 | |
| ΔI _{CC} | Increase in I _{CC} per Input | 2.7 V < V _{CC} ≤ 3.6 V; V _{IH} = V _{CC} - 0.6 V | | 750 | μA |

8. These values of V_I are used to test DC electrical characteristics only.

9. Outputs disabled or 3-state only.

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AC CHARACTERISTICS (Note 10; $t_R = t_F = 2.0\text{ns}$; $C_L = 30\text{pF}$; $R_L = 500\Omega$)

| Symbol | Parameter | Waveform | Limits | | | | | | Unit |
|------------|--|----------|---|-----|--|-----|--|------|------|
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | | | | |
| | | | $V_{CC} = 3.0\text{ V to } 3.6\text{ V}$ | | $V_{CC} = 2.3\text{ V to } 2.7\text{ V}$ | | $V_{CC} = 1.65\text{ V to } 1.95\text{ V}$ | | |
| | | | Min | Max | Min | Max | Min | Max | |
| t_{PLH} | Propagation Delay Input to Output | 1 | 0.5 | 2.5 | 0.5 | 3.0 | 0.5 | 6.0 | ns |
| t_{PHL} | Input to Output | | 0.5 | 2.5 | 0.5 | 3.0 | 0.5 | 6.0 | |
| t_{PZH} | Output Enable Time to High and Low Level | 2 | 0.5 | 3.8 | 0.5 | 4.9 | 0.5 | 9.3 | ns |
| t_{PZL} | High and Low Level | | 0.5 | 3.8 | 0.5 | 4.9 | 0.5 | 9.3 | |
| t_{PHZ} | Output Disable Time From High and Low Level | 2 | 0.5 | 3.7 | 0.5 | 4.2 | 0.5 | 7.6 | ns |
| t_{PLZ} | High and Low Level | | 0.5 | 3.7 | 0.5 | 4.2 | 0.5 | 7.6 | |
| t_{OSHL} | Output-to-Output Skew (Note 11) | | | 0.5 | | 0.5 | | 0.75 | ns |
| t_{OSLH} | (Note 11) | | | 0.5 | | 0.5 | | 0.75 | |

10. For $C_L = 50\text{ pF}$, add approximately 300 ps to the AC maximum specification.

11. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSHL}) or LOW-to-HIGH (t_{OSLH}); parameter guaranteed by design.

CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Unit |
|-----------|-------------------------------|----------------|---------|------|
| C_{IN} | Input Capacitance | Note 12 | 6 | pF |
| C_{OUT} | Output Capacitance | Note 12 | 7 | pF |
| C_{PD} | Power Dissipation Capacitance | Note 12, 10MHz | 20 | pF |

12. $V_{CC} = 1.8, 2.5\text{ or } 3.3\text{ V}$; $V_I = 0\text{ V or } V_{CC}$.

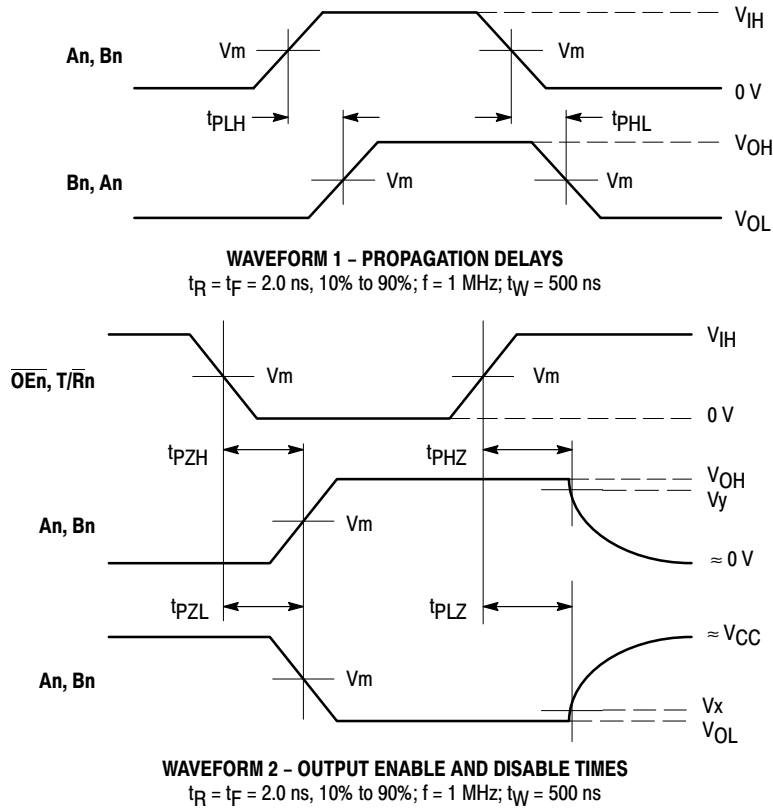
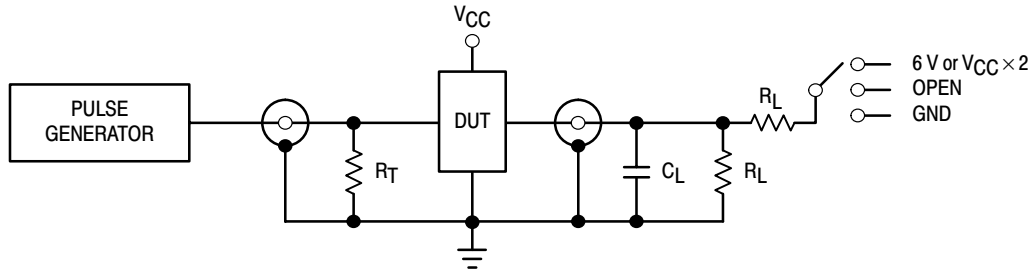


Figure 4. AC Waveforms

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| Symbol | V _{CC} | | |
|-----------------|-------------------------|--------------------------|--------------------------|
| | 3.3 V ±0.3 V | 2.5 V ±0.2 V | 1.8 V ±0.15 V |
| V _{IH} | 2.7 V | V _{CC} | V _{CC} |
| V _m | 1.5 V | V _{CC} /2 | V _{CC} /2 |
| V _x | V _{OL} + 0.3 V | V _{OL} + 0.15 V | V _{OL} + 0.15 V |
| V _y | V _{OH} - 0.3 V | V _{OH} - 0.15 V | V _{OH} - 0.15 V |



| TEST | SWITCH |
|-------------------------------------|--|
| t _{PLH} , t _{PHL} | Open |
| t _{PZL} , t _{PLZ} | 6 V at V _{CC} = 3.3 ±0.3 V; V _{CC} × 2 at V _{CC} = 2.5 ±0.2 V; 1.8 V ±0.15 V |
| t _{PZH} , t _{PHZ} | GND |

C_L = 50 pF for V_{CC} = 3.0 ± 0.3 V
R_L = 500 Ω or equivalent
R_T = Z_{OUT} of pulse generator (typically 50 Ω)

Figure 5. Test Circuit

AC CHARACTERISTICS (t_R = t_F = 2.0 ns; C_L = 50 pF; R_L = 500 Ω)

| Symbol | Parameter | Waveform | Limits | | | | Unit |
|--|--|----------|----------------------------------|------------|-------------------------|------------|------|
| | | | T _A = -40°C to +85°C | | | | |
| | | | V _{CC} = 3.0 V to 3.6 V | | V _{CC} = 2.7 V | | |
| | | | Min | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay Input to Output | 3 | 1.0 1.0 | 3.0 3.0 | | 3.6 3.6 | ns |
| t _{PZH} t _{PZL} | Output Enable Time to High and Low Level | 4 | 1.0 1.0 | 4.4 4.4 | | 5.4 5.4 | ns |
| t _{PHZ} t _{PLZ} | Output Disable Time From High and Low Level | 4 | 1.0 1.0 | 4.1 4.1 | | 4.6 4.6 | ns |
| t _{OSSL} t _{OSLH} | Output-to-Output Skew (Note 13) | | | 0.5 0.5 | | 0.5 0.5 | ns |

13. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t_{OSSL}) or LOW-to-HIGH (t_{OSLH}); parameter guaranteed by design.

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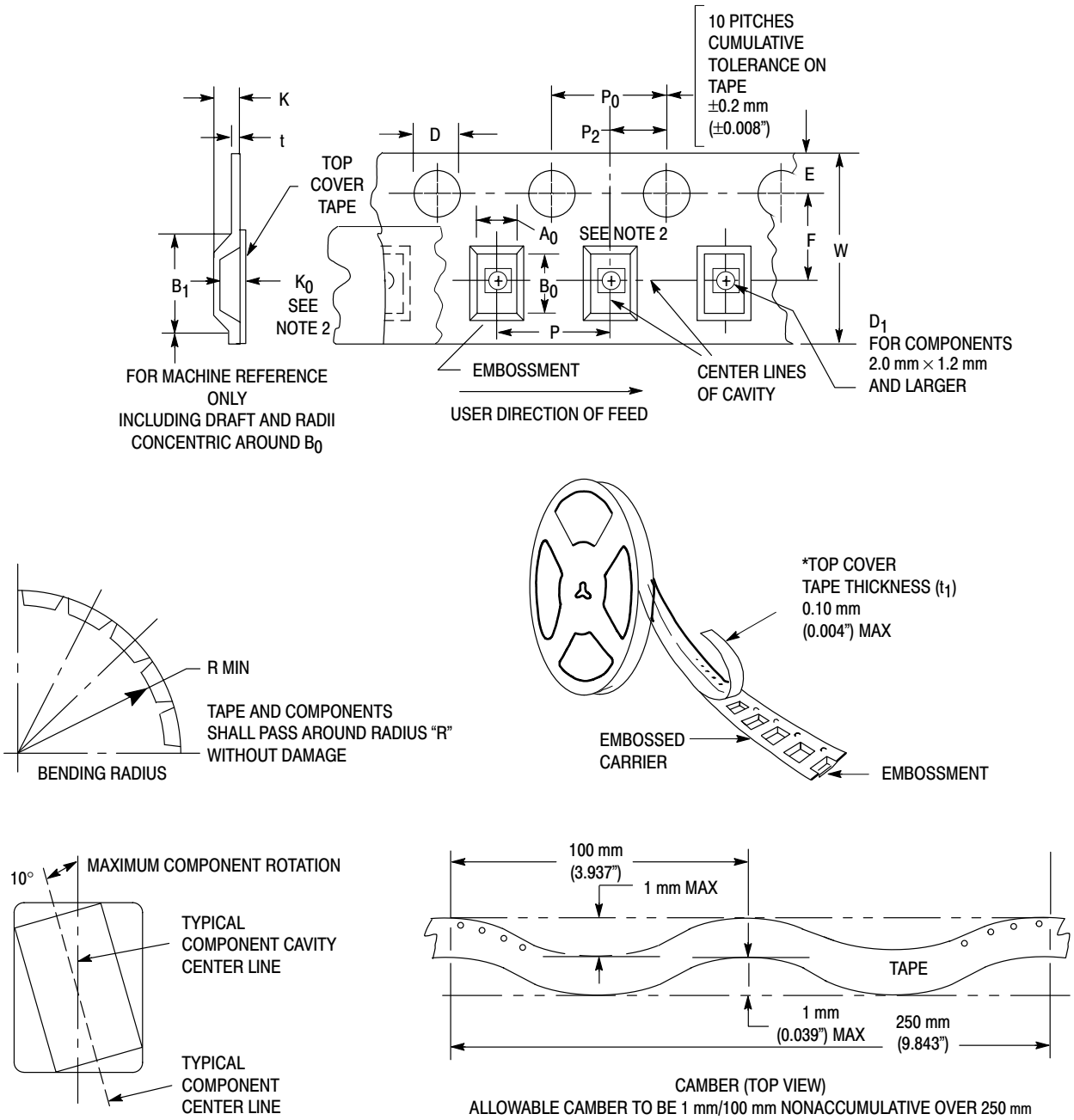


Figure 6. Carrier Tape Specifications

EMBOSSED CARRIER DIMENSIONS (See Notes 14 and 15)

| Tape Size | B_1 Max | D | D_1 | E | F | K | P | P_0 | P_2 | R | T | W |
|-----------|-----------------|--|--------------------|--|---|----------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------|-----------------|------------------|
| 24mm | 20.1mm (0.791") | 1.5 + 0.1mm - 0.0 (0.059 +0.004" -0.0) | 1.5mm Min (0.060") | 1.75 \pm 0.1 mm (0.069 \pm 0.004") | 11.5 \pm 0.10 mm (0.453 \pm 0.004") | 11.9 mm Max (0.468") | 16.0 \pm 0.1 mm (0.63 \pm 0.004") | 4.0 \pm 0.1 mm (0.157 \pm 0.004") | 2.0 \pm 0.1 mm (0.079 \pm 0.004") | 30 mm (1.18") | 0.6 mm (0.024") | 24.3 mm (0.957") |

14. Metric Dimensions Govern—English are in parentheses for reference only.

15. A_0 , B_0 , and K_0 are determined by component size. The clearance between the components and the cavity must be within 0.05 mm min to 0.50 mm max. The component cannot rotate more than 10° within the determined cavity.

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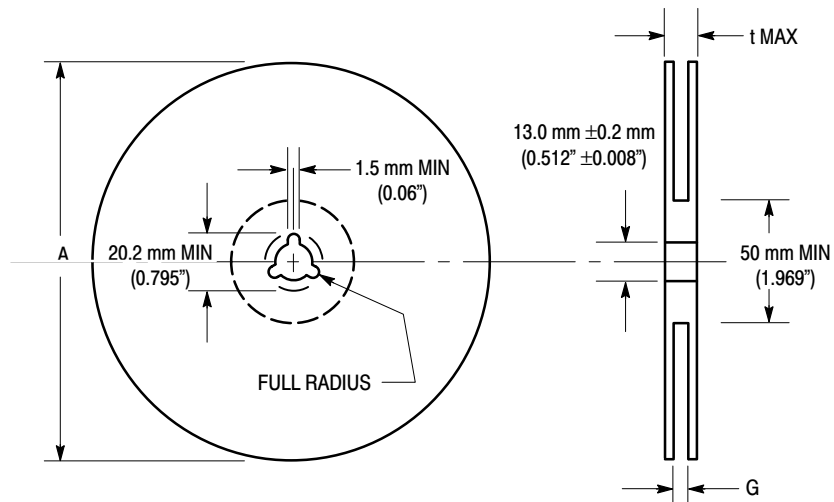


Figure 7. Reel Dimensions

REEL DIMENSIONS

| Tape Size | A Max | G | t Max |
|-----------|---------------------|--|---------------------|
| 24 mm | 360 mm (14.173") | 24.4 mm + 2.0 mm, -0.0 (0.961" + 0.078", -0.00) | 30.4 mm (1.197") |

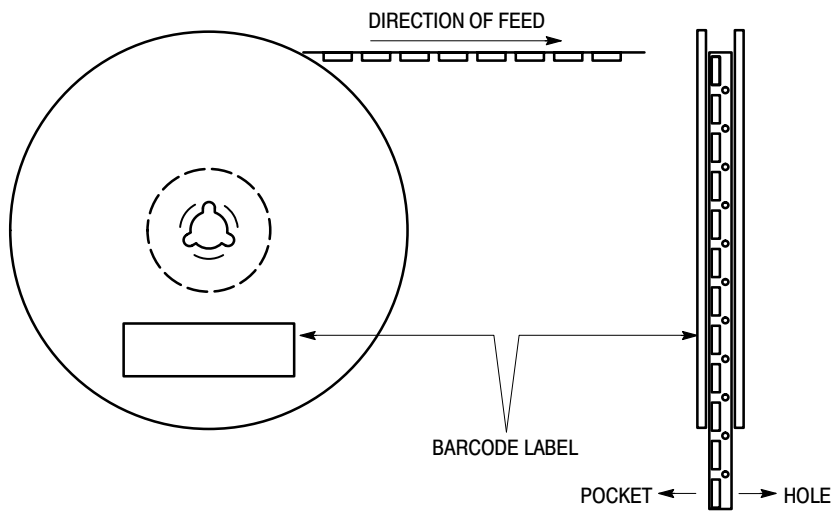


Figure 8. Reel Winding Direction

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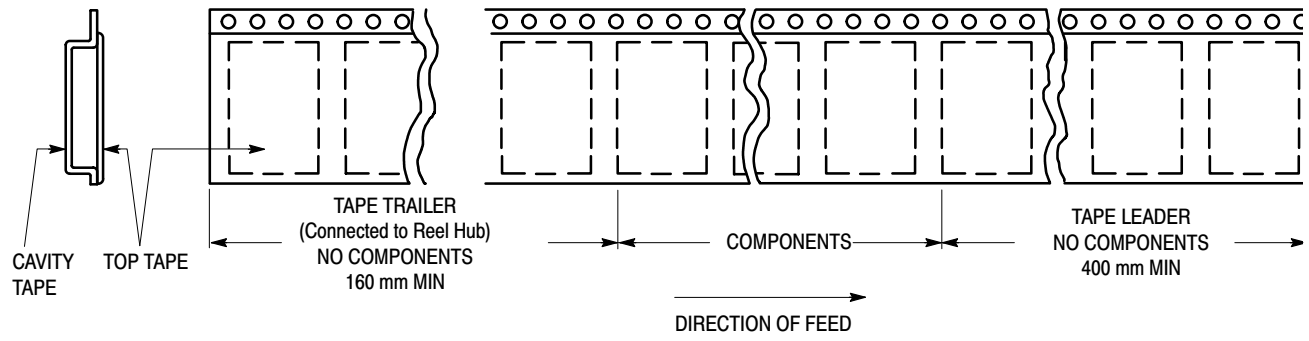


Figure 9. Tape Ends for Finished Goods

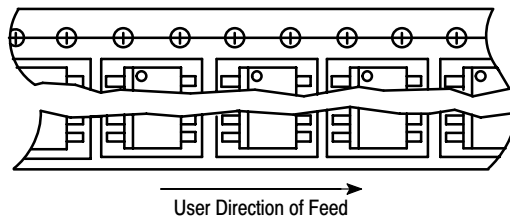


Figure 10. Reel Configuration

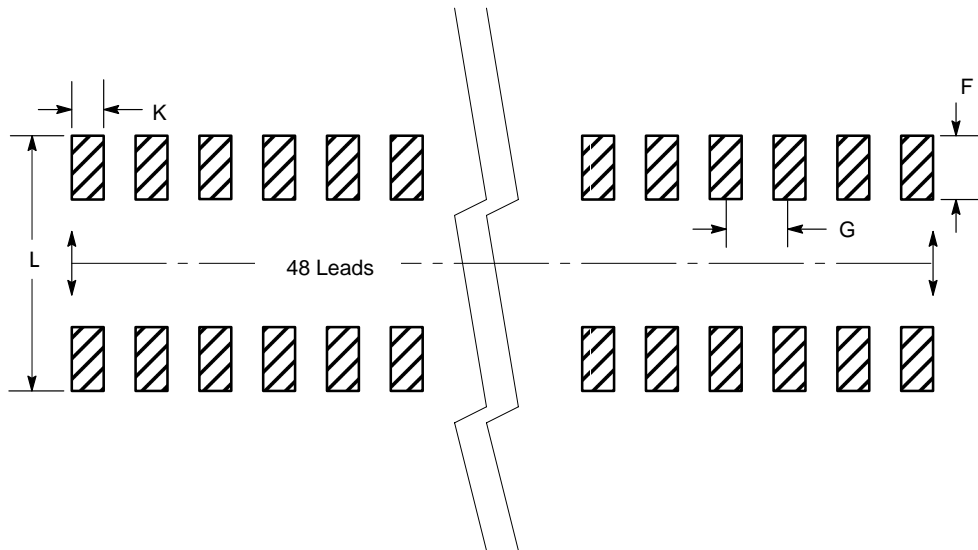
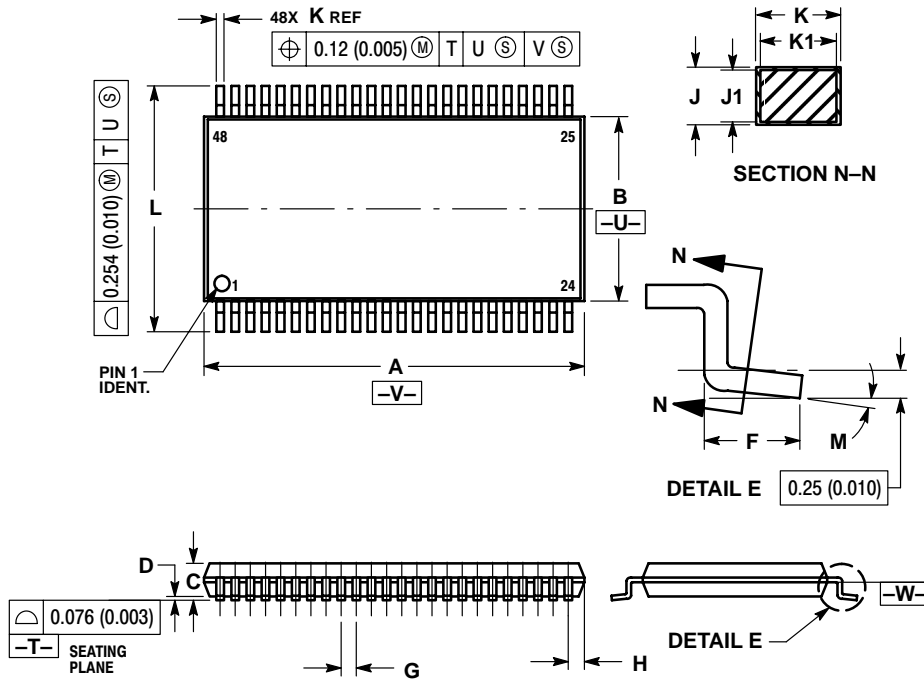


Figure 11. Package Footprint

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PACKAGE DIMENSIONS

TSSOP
DT SUFFIX
CASE 1201-01
ISSUE A




NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
6. DIMENSIONS A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 12.40 | 12.60 | 0.488 | 0.496 |
| B | 6.00 | 6.20 | 0.236 | 0.244 |
| C | --- | 1.10 | --- | 0.043 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.50 BSC | | 0.0197 BSC | |
| H | 0.37 | --- | 0.015 | --- |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.17 | 0.27 | 0.007 | 0.011 |
| K1 | 0.17 | 0.23 | 0.007 | 0.009 |
| L | 7.95 | 8.25 | 0.313 | 0.325 |
| M | 0 ° | 8 ° | 0 ° | 8 ° |

Notes

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