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/$\overline{R}$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 ($\overline{OE}$n), 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: 3.0 ns max for 3.0 to 3.6 V
3.7 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
±12 mA Drive at 2.3 V
±4 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 (40 μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds ±250 mA @ 125°C
- ESD Performance: Human Body Model >2000V; Machine Model >200V
- 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 $\overline{OE}$ pin.

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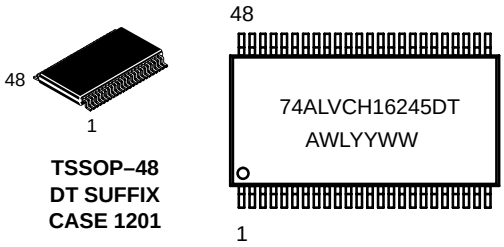
MARKING DIAGRAM



TSSOP–48
DT SUFFIX
CASE 1201

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

ORDERING INFORMATION

Device	Package	Shipping
74ALVCH16245DTR	TSSOP	2500/Tape & Reel

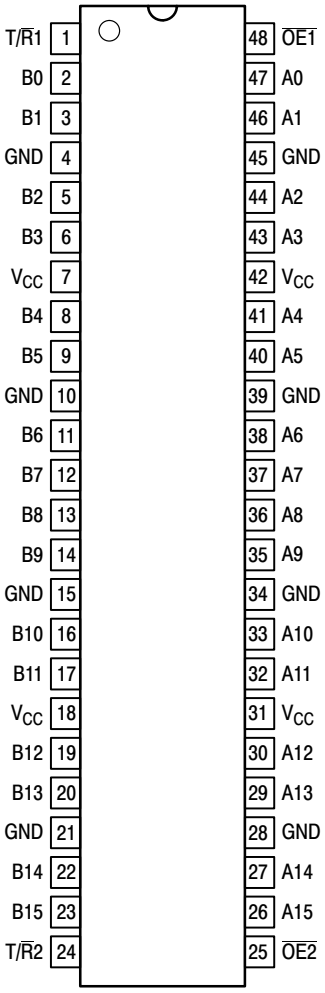


Figure 1. 48–Lead Pinout
(Top View)

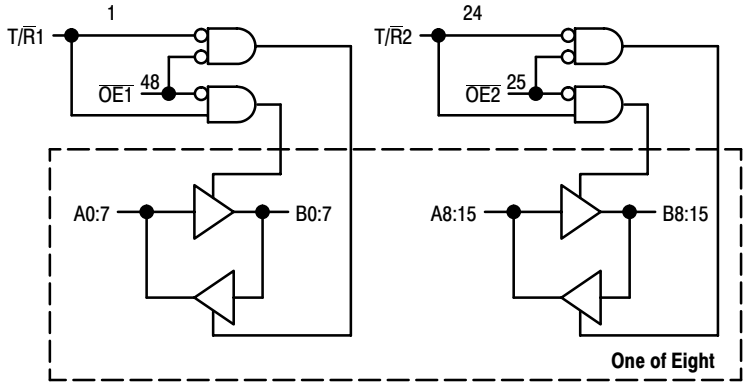


Figure 2. Logic Diagram

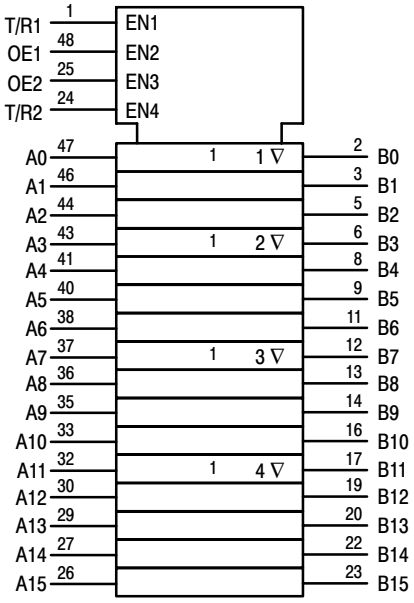


Figure 3. IEC Logic Diagram

PIN NAMES

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

Inputs		Outputs	Inputs		Outputs
OE1	T/$\overline{R}$1		OE2	T/$\overline{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

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	
F_R	Flammability Rating	Oxygen Index: 30 to 35	UL 94 V–O @ 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
$I_{LATCH–UP}$	Latch–Up Performance	Above V_{CC} and Below GND at 125°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)	–0.5	3.6	V
V_O	Output Voltage	(Active State) (3–State)	0 0	V_{CC} 3.6	V
T_A	Operating Free–Air Temperature		−40	+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate	V_{CC} = 2.5 V ± 0.2 V V_{CC} = 3.0 V ± 0.3 V	0 0	20 10	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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	$T_A = -40°C$ to $+85°C$		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 8)	$1.65\ V \le V_{CC} < 2.3\ V$	$0.65 \times V_{CC}$		V
		$2.3\ V \le V_{CC} \le 2.7\ V$	1.7		
		$2.7\ V < V_{CC} \le 3.6\ V$	2.0		
V_{IL}	LOW Level Input Voltage (Note 8)	$1.65\ V \le V_{CC} < 2.3\ V$		$0.35 \times V_{CC}$	V
		$2.3\ V \le V_{CC} \le 2.7\ V$		0.7	
		$2.7\ V < V_{CC} \le 3.6\ V$		0.8	
V_{OH}	HIGH Level Output Voltage	$1.65\ V \le V_{CC} \le 3.6\ V$; $I_{OH} = -100\ \mu A$	$V_{CC} - 0.2$		V
		$V_{CC} = 1.65\ V$; $I_{OH} = -4\ mA$	1.2		
		$V_{CC} = 2.3\ V$; $I_{OH} = -6\ mA$	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	$1.65\ V \le V_{CC} \le 3.6\ V$; $I_{OL} = 100\ \mu A$		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	
I_I	Input Leakage Current	$1.65\ V \le V_{CC} \le 3.6\ V$; $0\ V \le V_I \le 3.6\ V$		± 5.0	μA
$I_{I(HOLD)}$	Minimum Bus–hold Input Current	$V_{CC} = 3.6\ V$; $V_{IN} = 0$ to $3.6\ V$		± 500	μA
		$V_{CC} = 3.0\ V$, $V_{IN} = 0.8\ V$	75		
		$V_{CC} = 3.0\ V$, $V_{IN} = 2.0\ V$	-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	$1.65\ V \le V_{CC} \le 3.6\ V$; $0\ V \le V_O \le 3.6\ V$; $V_I = V_{IH}$ 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)	$1.65\ V \le V_{CC} \le 3.6\ V$; V_I = GND or V_{CC}		40	μA
		$1.65\ V \le V_{CC} \le 3.6\ V$; $3.6\ V \le V_I, V_O \le 3.6\ V$		± 40	
ΔI_{CC}	Increase in I_{CC} per Input	$2.7\ V < V_{CC} \le 3.6\ V$; $V_{IH} = V_{CC} - 0.6\ V$		750	μA

8. These values of V_I are used to test DC electrical characteristics only.
9. Outputs disabled or 3–state only.

AC CHARACTERISTICS (Note 10; $t_R = t_F$ = 2.0 ns; C_L = 30 pF; R_L = 500 Ω)

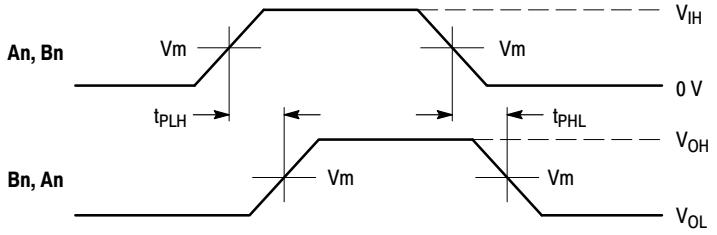
Symbol	Parameter	Waveform	Limits						Unit
			T_A = –40°C to +85°C						
			V_{CC} = 3.0 V to 3.6 V		V_{CC} = 2.3 V to 2.7 V		V_{CC} = 1.65 V to1.95 V		
			Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation Delay Input to Output	1	1.0 1.0	3.0 3.0	1.0 1.0	3.7 3.7	1.0 1.0	6.0 6.0	ns
t_{PZH} t_{PZL}	Output Enable Time to High and Low Level	2	1.0 1.0	4.4 4.4	1.0 1.0	5.7 5.7	1.0 1.0	9.3 9.3	ns
t_{PHZ} t_{PLZ}	Output Disable Time From High and Low Level	2	1.0 1.0	4.1 4.1	1.0 1.0	5.2 5.2	1.0 1.0	7.6 7.6	ns
t_{OSHL} t_{OSLH}	Output–to–Output Skew (Note 11)			0.5 0.5		0.5 0.5		0.75 0.75	ns

10. For C_L = 50 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.

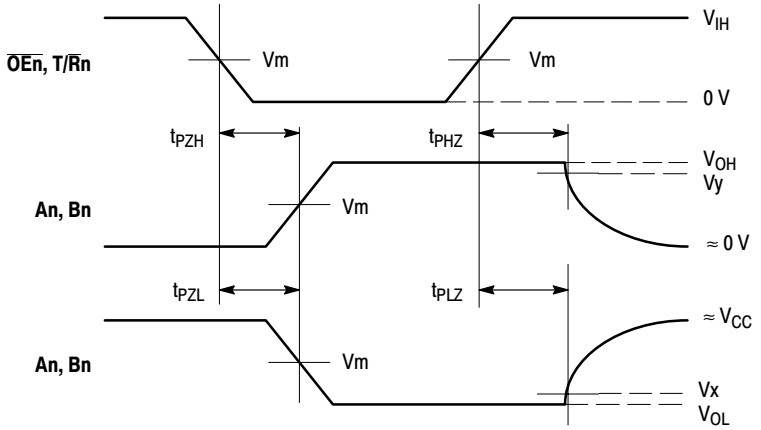
CAPACITIVE CHARACTERISTICS

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 or 3.3 V; V_I = 0 V or V_{CC}.



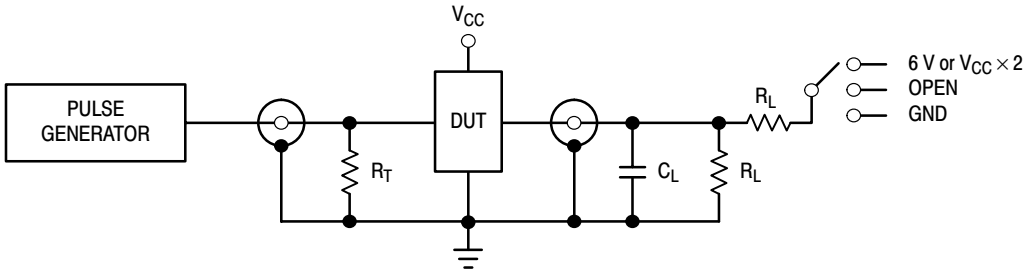
WAVEFORM 1 – PROPAGATION DELAYS
$t_R = t_F$ = 2.0 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns



WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES
$t_R = t_F$ = 2.0 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns

Figure 4. AC Waveforms

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

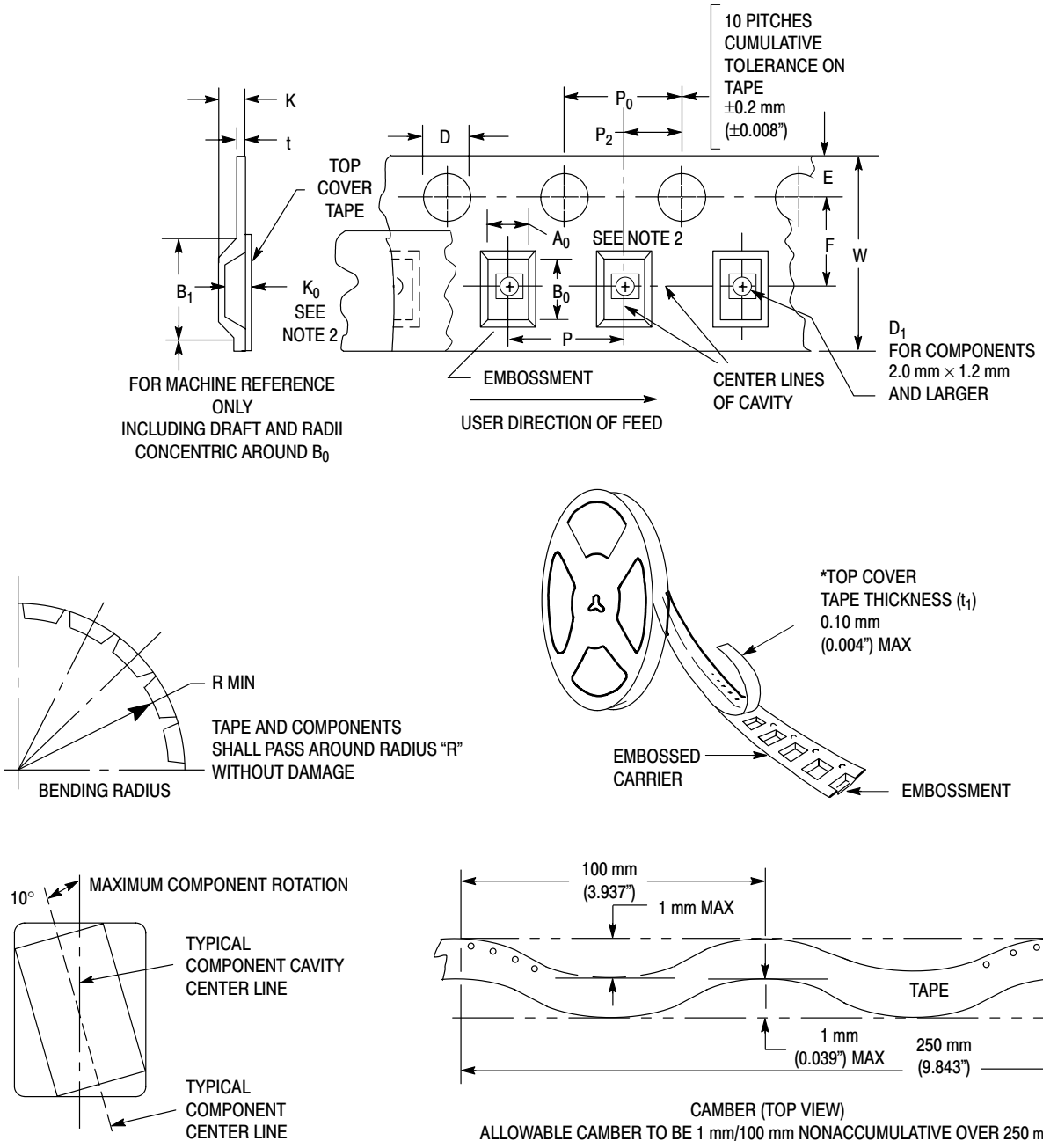


Figure 6. Carrier Tape Specifications

EMBOSSED CARRIER DIMENSIONS (See Notes 13 and 14)

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 ±0.1 mm (0.069 ±0.004")	11.5 ±0.10 mm (0.453 ±0.004")	11.9 mm Max (0.468")	16.0 ±0.1 mm (0.63 ±0.004")	4.0 ±0.1 mm (0.157 ±0.004")	2.0 ±0.1 mm (0.079 ±0.004")	30 mm (1.18")	0.6 mm (0.024")	24.3 mm (0.957")

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

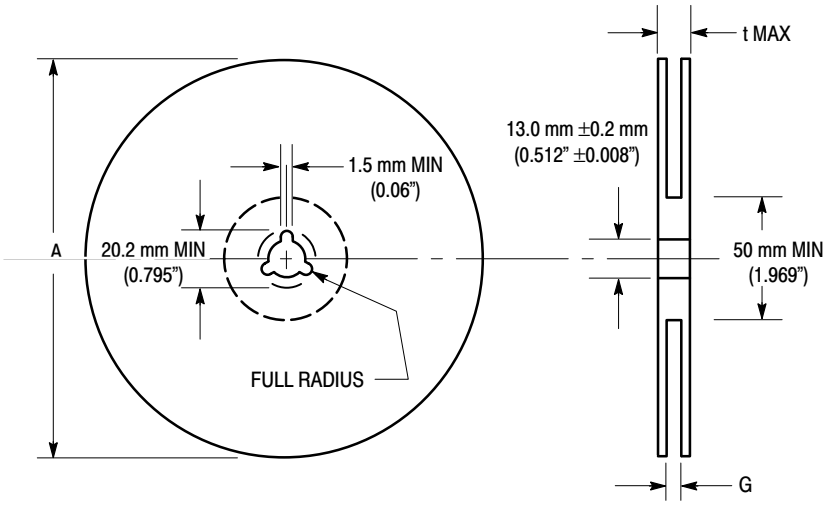


Figure 7. Reel Dimensions

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")

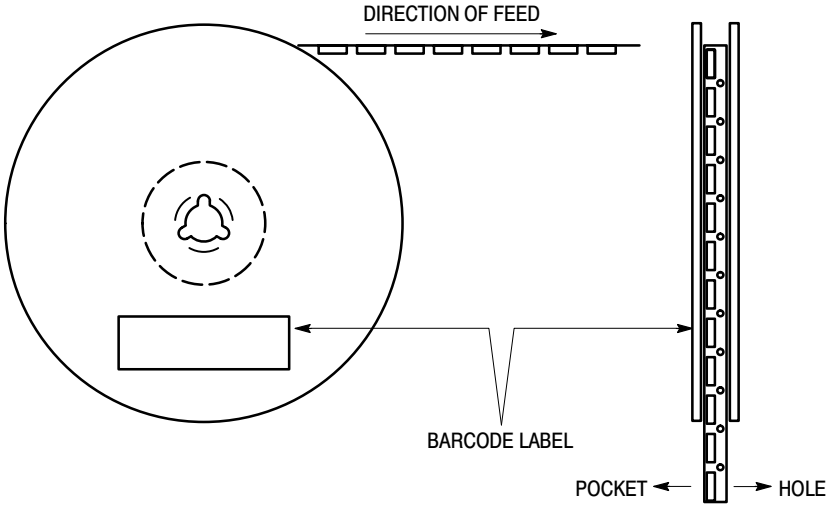


Figure 8. Reel Winding Direction

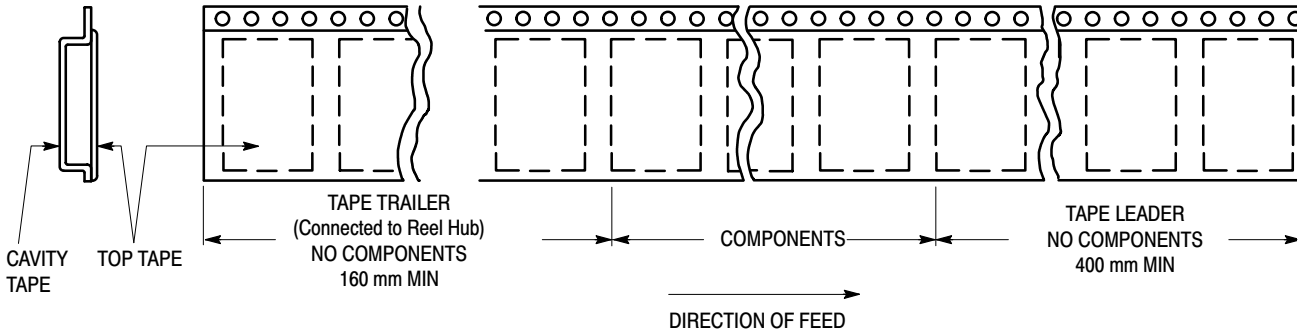


Figure 9. Tape Ends for Finished Goods

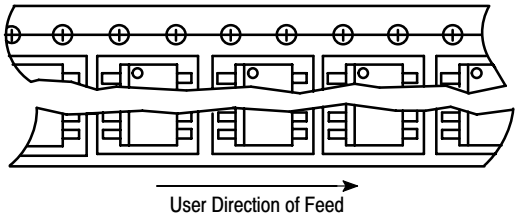


Figure 10. Reel Configuration

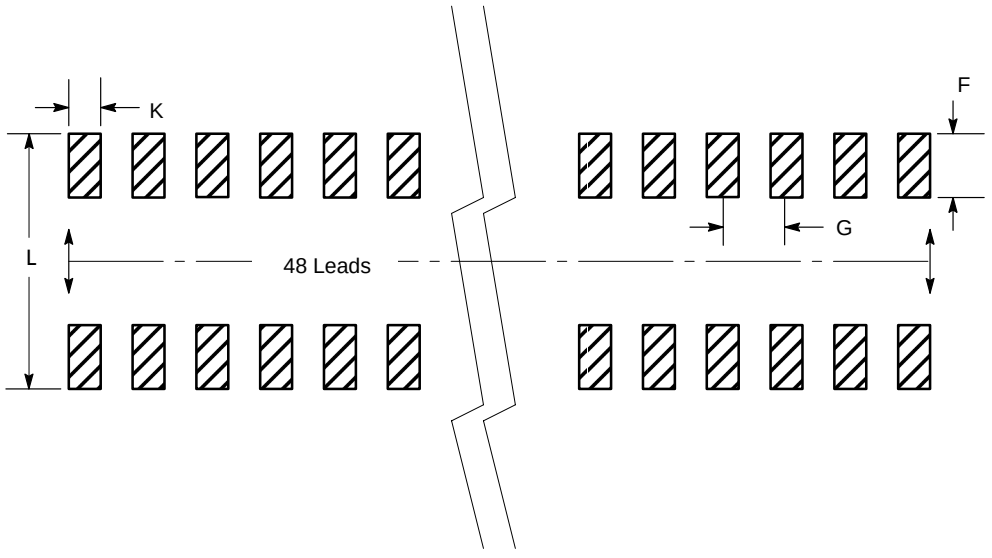
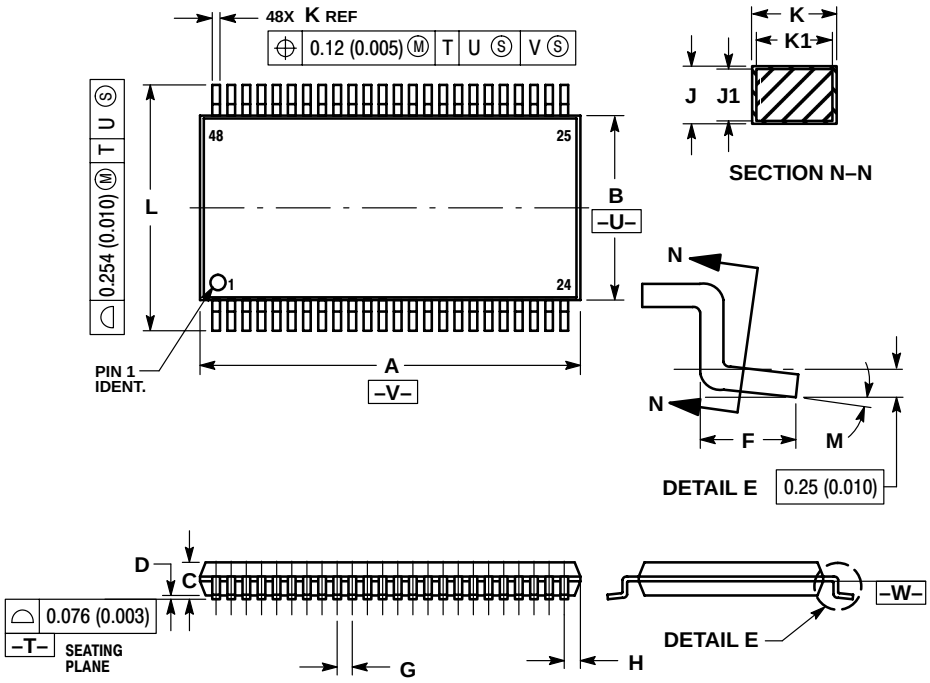


Figure 11. Package Footprint

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–.

	MILLIMETERS		INCHES	
DIM	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

PUBLICATION ORDERING INFORMATION

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