74LVTH16244/74LVTN16244 3.3V, 16-Bit Buffer/Line Driver with 3-State Outputs

GENERAL DESCRIPTION

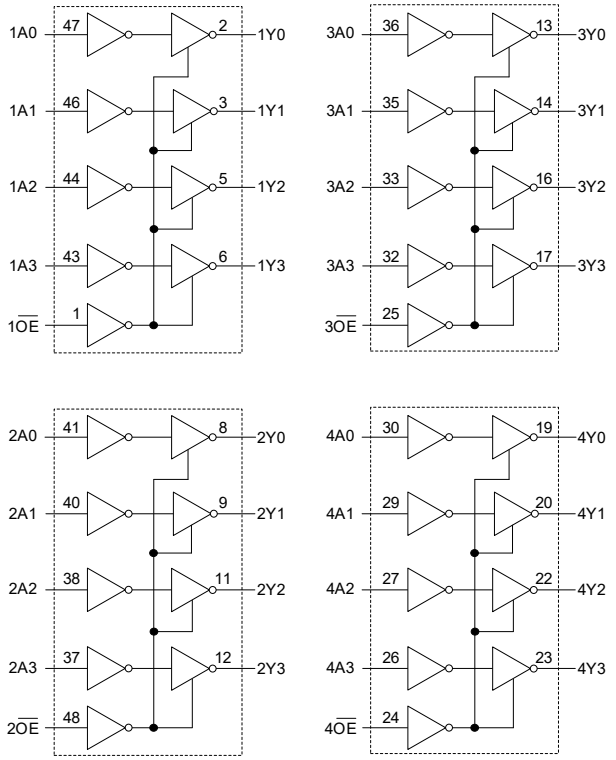
The 74LVTH16244 and 74LVTN16244 are 16-bit high-performance buffers/line drivers with non-inverting 3-state outputs designed for 3.3V V_{CC} operation. These devices can be operated as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer, and each buffer has a separate output enable input ($n\overline{OE}$). When $n\overline{OE}$ is low, these devices pass data from the nAn inputs to the nYn outputs. When $n\overline{OE}$ is high, all outputs are in the high-impedance state.

The 74LVTH16244 bus hold on data inputs eliminates the need for external pull-up/pull-down resistors to hold unused inputs.

FEATURES

- **Wide Operating Voltage Range: 2.7V to 3.6V**
- **Input and Output Interface Capability to 5V System Environment**
- **+64mA/-32mA Output Current**
- **3-State Buffers**
- **Input and Output Switching Levels of TTL**
- **Power-Up and I_{OFF} 3-State**
- **Bus Hold on Data Inputs with No Need for External Pull-Up/Pull-Down Resistors**
- **Support Live Insertion and Extraction**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green TSSOP-48 Package**

LOGIC DIAGRAM



FUNCTION TABLE

CONTROL INPUT	INPUT	OUTPUT
$n\overline{OE}$	nAn	nYn
L	L	L
L	H	H
H	*X*	Z

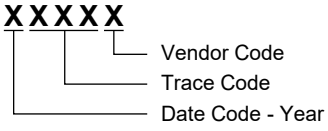
H = High Voltage Level
L = Low Voltage Level
Z = High-Impedance State
X = Don't Care

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
74LVTH16244	TSSOP-48	-40℃ to +125℃	74LVTH16244XTS48G/TR	74LVTH16244 XTS48 XXXXX	Tape and Reel, 2500
74LVTN16244	TSSOP-48	-40℃ to +125℃	74LVTN16244XTS48G/TR	74LVTN16244 XTS48 XXXXX	Tape and Reel, 2500

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS (1)

Supply Voltage Range, V_{CC} ..... -0.5V to 4.6V
Input Voltage Range, V_I (2) ..... -0.5V to 7.0V
Output Voltage Range, V_O (2)
3-State or High-State ..... -0.5V to 7.0V
Input Clamping Current, I_{IK} (V_I < 0V) ..... -50mA
Output Clamping Current, I_{OK} (V_O < 0V) ..... -50mA
Output Current, I_O
High-State ..... -64mA
Low-State 128mA
Supply Current, I_{CC} 128mA
Ground Current, I_{GND} ..... -256mA
Junction Temperature (3) ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 7000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{CC} ..... 2.7V to 3.6V
Input Voltage Range, V_I ..... 0V to 5.5V
High-Level Output Current, I_{OH} ..... -32mA
Low-Level Output Current, I_{OL} 64mA
Input Transition Rise or Fall Rate, Δt/ΔV ..... 10ns/V (MAX)
Operating Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

1. Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

2. The input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

3. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

ESD SENSITIVITY CAUTION

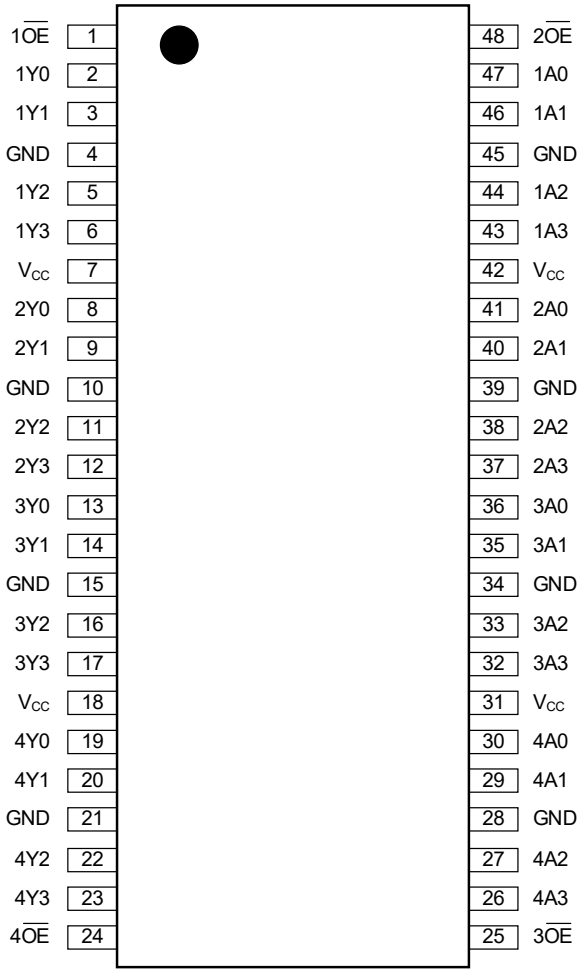
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION

(TOP VIEW)



TSSOP-48

PIN DESCRIPTION

PIN	NAME	FUNCTION
1, 48, 25, 24	1$\overline{OE}$, 2$\overline{OE}$, 3$\overline{OE}$, 4$\overline{OE}$	Output Enable Inputs (Active-Low).
2, 3, 5, 6	1Y0, 1Y1, 1Y2, 1Y3	Data Outputs.
8, 9, 11, 12	2Y0, 2Y1, 2Y2, 2Y3	Data Outputs.
13, 14, 16, 17	3Y0, 3Y1, 3Y2, 3Y3	Data Outputs.
19, 20, 22, 23	4Y0, 4Y1, 4Y2, 4Y3	Data Outputs.
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground.
7, 18, 31, 42	V_{CC}	Supply Voltage.
47, 46, 44, 43	1A0, 1A1, 1A2, 1A3	Data Inputs.
41, 40, 38, 37	2A0, 2A1, 2A2, 2A3	Data Inputs.
36, 35, 33, 32	3A0, 3A1, 3A2, 3A3	Data Inputs.
30, 29, 27, 26	4A0, 4A1, 4A2, 4A3	Data Inputs.

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at V_{CC} = 3.3V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Clamping Voltage	V_{IK}	V_{CC} = 2.7V, I_{IK} = -18mA		Full	-1.2	-0.78		V
High-Level Input Voltage	V_{IH}	V_{CC} = 2.7V to 3.6V		Full	2.0			V
Low-Level Input Voltage	V_{IL}	V_{CC} = 2.7V to 3.6V		Full			0.8	V
High-Level Output Voltage	V_{OH}	V_{CC} = 2.7V to 3.6V, I_{OH} = -100μA		Full	V_{CC} - 0.05	V_{CC} - 0.001		V
		V_{CC} = 2.7V, I_{OH} = -8mA		Full	2.45	2.60		
		V_{CC} = 3.0V, I_{OH} = -32mA		Full	2.10	2.65		
Low-Level Output Voltage	V_{OL}	V_{CC} = 2.7V, I_{OL} = 100μA		Full		0.001	0.05	V
		V_{CC} = 2.7V, I_{OL} = 24mA		Full		0.15	0.28	
		V_{CC} = 3.0V, I_{OL} = 16mA		Full		0.1	0.18	
		V_{CC} = 3.0V, I_{OL} = 32mA		Full		0.2	0.36	
		V_{CC} = 3.0V, I_{OL} = 64mA		Full		0.4	0.55	
Input Leakage Current	I_I	Control pins, V_{CC} = 3.6V, V_I = V_{CC} or GND		Full		±0.01	±1	μA
		Control pins, V_{CC} = 0V or 3.6V, V_I = 5.5V		Full		0.01	5	
		Input data pins (1), V_{CC} = 0V or 3.6V, V_I = 5.5V		Full		0.4	5	
		Input data pins (1), V_{CC} = 3.6V, V_I = V_{CC}		Full		0.3	2	
		Input data pins (1), V_{CC} = 3.6V, V_I = GND		Full	-2	-0.01		
Off-State Output Current	I_{OZ}	V_{CC} = 3.6V, V_O = 3.0V		Full		0.01	2	μA
		V_{CC} = 3.6V, V_O = 0.5V		Full	-2	-0.01		
Output Leakage Current	I_{LO}	Outputs in high-state when V_O > V_{CC}, V_{CC} = 3.0V, V_O = 5.5V		Full		1	30	μA
Power-Up/Down Output Current	$I_{O\_PU/PD}$	V_{CC} ≤ 1.2V, V_O = 0.5V to V_{CC}, V_I = GND or V_{CC}, $n\overline{OE}$ = don't care		+25℃		0.01	10	μA
Power-Off Leakage Current	I_{OFF}	V_{CC} = 0V, V_I or V_O = 0V to 5.5V		Full		0.01	10	μA
Supply Current	I_{CC}	V_{CC} = 3.6V, V_I = GND or V_{CC}, I_O = 0A	Outputs high	Full		12	80	μA
			Outputs low	Full		12	80	
			Outputs disabled (2)	Full		12	80	
Additional Supply Current (3)	ΔI_{CC}	Per input pin, V_{CC} = 3.0V to 3.6V, one input at V_{CC} - 0.6V, other inputs at V_{CC} or GND		Full		0.2	200	μA
Input Capacitance	C_I	V_I = 0V or 3.0V		+25℃		6		pF
Output Capacitance	C_O	Outputs disabled, V_O = 0V or 3.0V		+25℃		9		pF
74LVTH16244 Only								
Bus Hold Low Current	I_{BHL}	V_{CC} = 3.0V, V_I = 0.8V		Full	50	100		μA
Bus Hold High Current	I_{BHH}	V_{CC} = 3.0V, V_I = 2.0V		Full		-130	-75	μA
Bus Hold Low Overdrive Current (4)	I_{BHLO}	Input data pins, V_{CC} = 3.6V, V_I = 0V to 3.6V		Full	500	200		μA
Bus Hold High Overdrive Current (4)	I_{BHHO}	Input data pins, V_{CC} = 3.6V, V_I = 0V to 3.6V		Full		-280	-500	μA

NOTES:

1. Other pins must be tied to V_{CC} or GND and should not be floating.
2. I_{CC} is measured with outputs pulled to V_{CC} or GND.
3. It is the increase in supply current for per input at the specified voltage level except V_{CC} or GND.
4. It is the minimum overdrive current required to switch the input from one state to another.

DYNAMIC CHARACTERISTICS

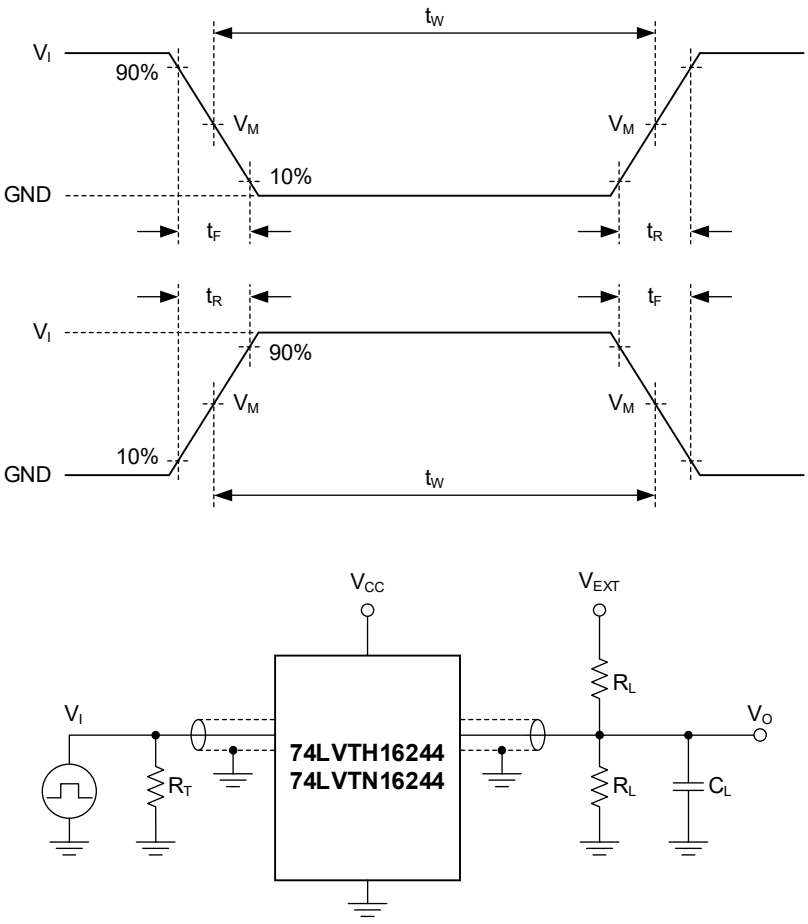
(See Figure 1 for test circuit. Full = -40℃ to +125℃, all typical values are measured at V_{CC} = 3.3V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN (1)	TYP	MAX (1)	UNITS
Low-to-High Propagation Delay	t_{PLH}	nAn to nYn, see Figure 2	V_{CC} = 2.7V	Full		3.6	8.5	ns
			V_{CC} = 3.0V to 3.6V	Full	0.5	3.4	7.2	
High-to-Low Propagation Delay	t_{PHL}	nAn to nYn, see Figure 2	V_{CC} = 2.7V	Full		3.2	6.2	ns
			V_{CC} = 3.0V to 3.6V	Full	0.5	3.0	5.6	
Off-to-High Propagation Delay	t_{PZH}	$n\overline{OE}$ to nYn, see Figure 3	V_{CC} = 2.7V	Full		4.2	9.4	ns
			V_{CC} = 3.0V to 3.6V	Full	0.5	4.0	7.8	
Off-to-Low Propagation Delay	t_{PZL}	$n\overline{OE}$ to nYn, see Figure 3	V_{CC} = 2.7V	Full		4.0	6.5	ns
			V_{CC} = 3.0V to 3.6V	Full	0.5	3.8	6.2	
High-to-Off Propagation Delay	t_{PHZ}	$n\overline{OE}$ to nYn, see Figure 3	V_{CC} = 2.7V	Full		4.4	7.6	ns
			V_{CC} = 3.0V to 3.6V	Full	0.5	4.0	7.0	
Low-to-Off Propagation Delay	t_{PLZ}	$n\overline{OE}$ to nYn, see Figure 3	V_{CC} = 2.7V	Full		4.2	6.8	ns
			V_{CC} = 3.0V to 3.6V	Full	0.5	4.0	6.5	

NOTE:

1. Specified by design and characterization, not production tested.

TEST CIRCUIT



Test conditions are given in Table 1.

Definitions for test circuit:

R_L: Load resistance.

C_L: Load capacitance (includes jig and probe).

R_T: Termination resistance (equals to output impedance Z_O of the pulse generator).

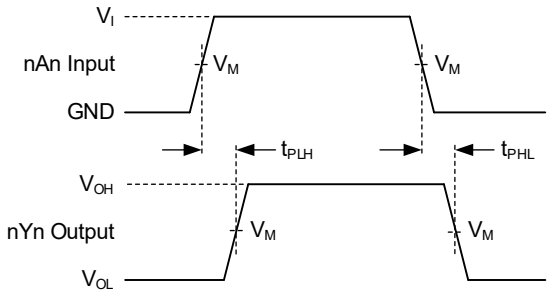
V_{EXT}: External voltage is used to measure switching time.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

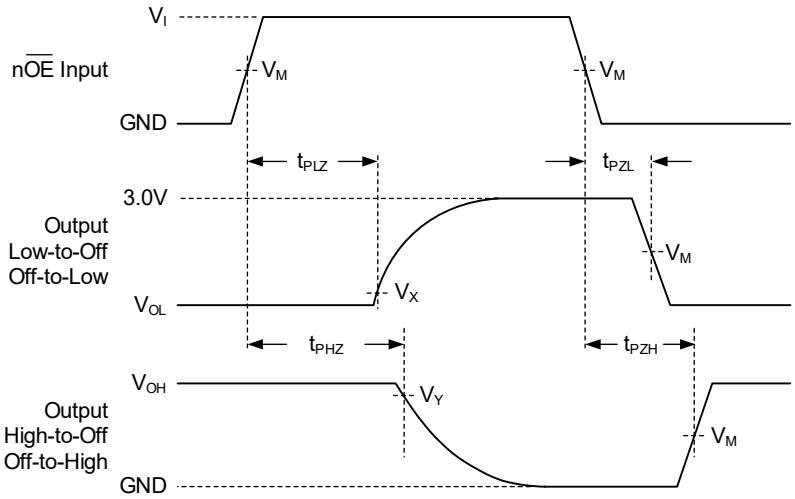
SUPPLY VOLTAGE	INPUT				LOAD		V_{EXT}		
V_{CC}	V_I	f_i	t_W	t_R, t_F	C_L	R_L	t_{PHZ}, t_{PZH}	t_{PLZ}, t_{PZL}	t_{PLH}, t_{PHL}
2.7V to 3.6V	2.7V	≤ 10MHz	500ns	≤ 2.5ns	50pF	500Ω	GND	6V	Open

WAVEFORMS



Test conditions are given in Table 1.
Measurement points are given in Table 2.
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Figure 2. Input (nAn) to Output (nYn) Propagation Delays



Test conditions are given in Table 1.
Measurement points are given in Table 2.
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Figure 3. Enable and Disable Times

Table 2. Measurement Points

SUPPLY VOLTAGE	INPUT		OUTPUT		
V_{CC}	V_I	V_M (1)	V_M	V_X	V_Y
2.7V to 3.6V	2.7V	1.5V	1.5V	V_{OL} + 0.3V	V_{OH} - 0.3V

NOTE:
1. The measurement points should be V_{IH} or V_{IL} when the input rising or falling time exceeds 2.5ns.

REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

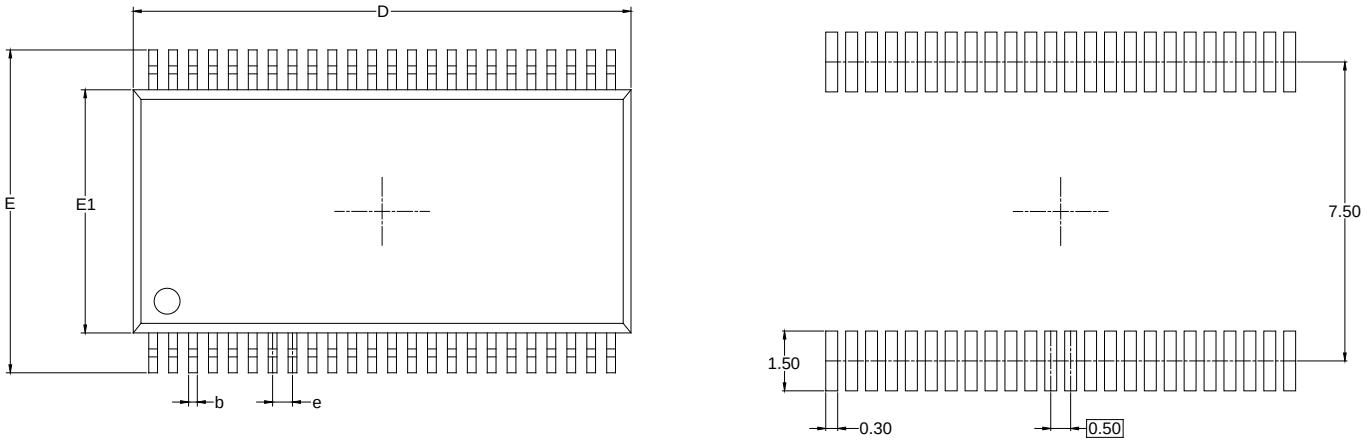
JANUARY 2024 – REV.A.1 to REV.A.2	Page
Updated Dynamic Characteristics section	5

NOVEMBER 2021 – REV.A to REV.A.1	Page
Updated HBM value in Absolute Maximum Ratings section	2

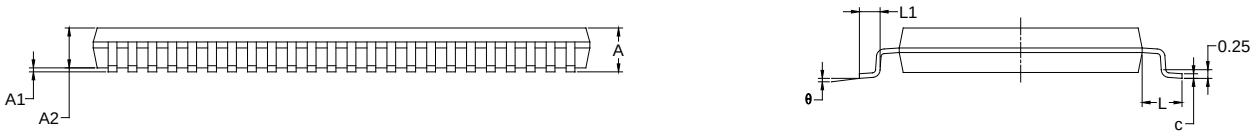
Changes from Original (MARCH 2021) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

TSSOP-48



RECOMMENDED LAND PATTERN (Unit: mm)

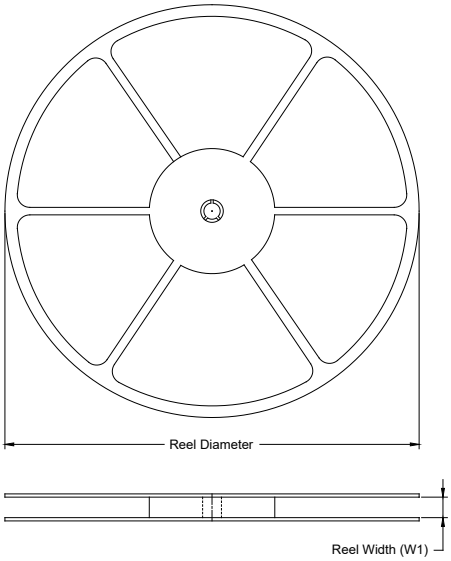


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A			1.20
A1	0.05	0.10	0.15
A2	0.85	0.95	1.05
b	0.18		0.26
c	0.15		0.19
D	12.40	12.50	12.60
E	7.90	8.10	8.30
E1	6.00	6.10	6.20
e	0.50 BSC		
L	1.00 REF		
L1	0.45		0.75
θ	0°		8°

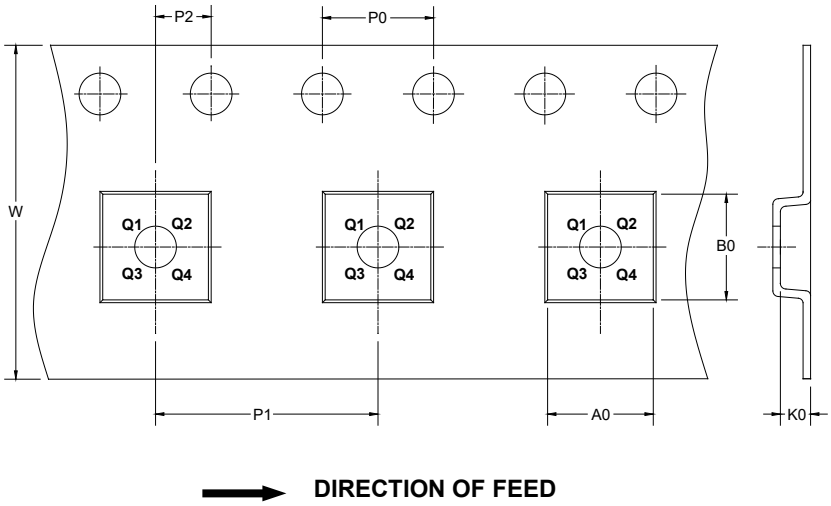
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

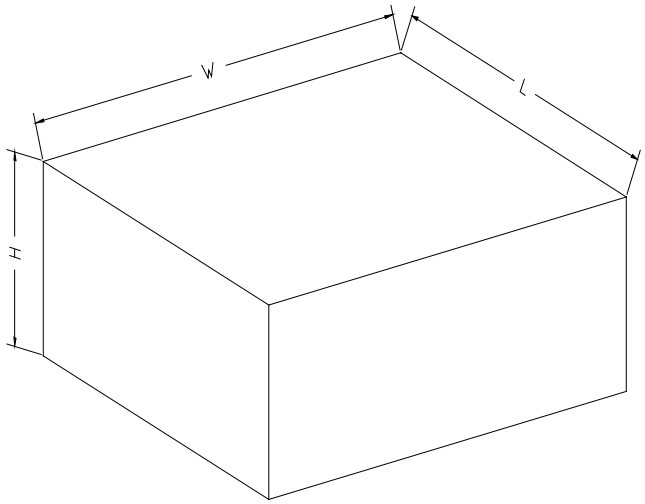
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP-48	13”	24.4	8.60	13.00	1.80	4.0	12.0	2.0	24.0	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5

DD0002