74LVTH16244/74LVTN16244
3.3V, 16-Bit Buffers/Line Drivers with 3-State Outputs

GENERAL DESCRIPTION

The 74LVTH16244 and 74LVTN16244 are high-performance products with non-inverting 3-state bus outputs and they are designed for 3.3V V_{CC} operation. These devices are organized as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer with separate output enable inputs (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, the 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

- **Operating Voltage Range: 2.7V to 3.6V**
- **Input and Output Interface Capability to 5V System Environment**
- **+64mA/-32mA Output Current**
- **3-State Buffers**
- **Bus Hold-on Data Inputs with No Need for External Pull-up/Pull-down Resistors**
- **Support Live Insertion and Extraction**
- **Input and Output Switching Levels of TTL**
- **Power-Up and 3-State**
- **-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
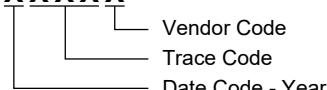
PACKAGE/ORDERING INFORMATION

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.

X X X X X
- Vendor Code
- Trace Code
- Date Code - Year

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, V_{CC}...-0.5V to 4.6V
Input Voltage, V_I [2] ....-0.5V to 7V
Output Voltage, V_O [2]
   Output in 3-State or High-State ....-0.5V to 7V
Input Clamping Current, I_{IK} ($V_I < 0$V)............................-50mA
Output Clamping Current, I_{OK} ($V_O < 0$V)......................-50mA
Output Current, I_O
   Output in High-State ....-64mA
   Output in 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, V_{CC}..2.7V to 3.6V
Input Voltage, V_I...0V to 5.5V
High-Level Output Current, I_{OH} ....-32mA
Low-Level Output Current, I_{OL}..64mA
Input Transition Rise and Fall Rate, $\Delta t/\Delta V$
....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 negative 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
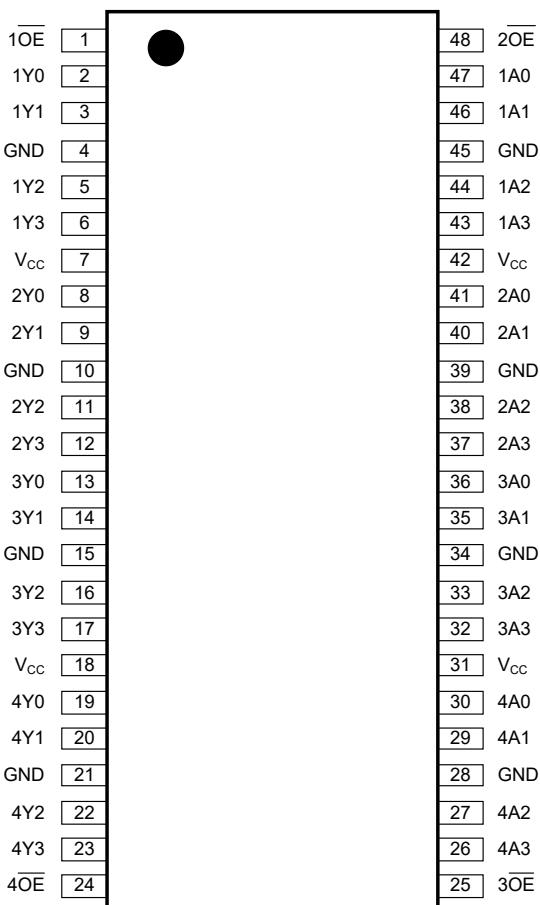
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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)

$1\overline{OE}$	1		48	$2\overline{OE}$	
1Y0	2		47	1A0	
1Y1	3		46	1A1	
GND	4		45	GND	
1Y2	5		44	1A2	
1Y3	6		43	1A3	
V_{CC}	7		42	V_{CC}	
2Y0	8		41	2A0	
2Y1	9		40	2A1	
GND	10		39	GND	
2Y2	11		38	2A2	
2Y3	12		37	2A3	
3Y0	13		36	3A0	
3Y1	14		35	3A1	
GND	15		34	GND	
3Y2	16		33	3A2	
3Y3	17		32	3A3	
V_{CC}	18		31	V_{CC}	
4Y0	19		30	4A0	
4Y1	20		29	4A1	
GND	21		28	GND	
4Y2	22		27	4A2	
4Y3	23		26	4A3	
$4\overline{OE}$	24		25	$3\overline{OE}$	

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			V
Low-Level Input Voltage	V_{IL}	V_{CC} = 2.7V to 3.6V		Full			0.8	V
High-Level Output Voltage	V_{OH}	I_{OH} = -100µA, V_{CC} = 2.7V to 3.6V		Full	V_{CC} - 0.05	V_{CC} - 0.001		V
		I_{OH} = -8mA, V_{CC} = 2.7V		Full	2.45	2.6		
		I_{OH} = -32mA, V_{CC} = 3.0V		Full	2.1	2.65		
Low-Level Output Voltage	V_{OL}	V_{CC} = 2.7V	I_{OL} = 100µA	Full		0.001	0.05	V
			I_{OL} = 24mA	Full		0.15	0.28	
		V_{CC} = 3.0V	I_{OL} = 16mA	Full		0.1	0.18	
			I_{OL} = 32mA	Full		0.2	0.36	
			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_O = 0.5V	Full	-2	-0.01		
Output Leakage Current	I_{LO}	Output in high-state when $V_O > V_{CC}$, V_O = 5.5V, V_{CC} = 3.0V		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	Output high	Full		12	80	µA
			Output 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_I = 0V to 3.6V, V_{CC} = 3.6V		Full	500	200		µA
Bus Hold High Overdrive Current [(4)]	I_{BHHO}	Input data pins, V_I = 0V to 3.6V, V_{CC} = 3.6V		Full		-280	-500	µA

NOTES:
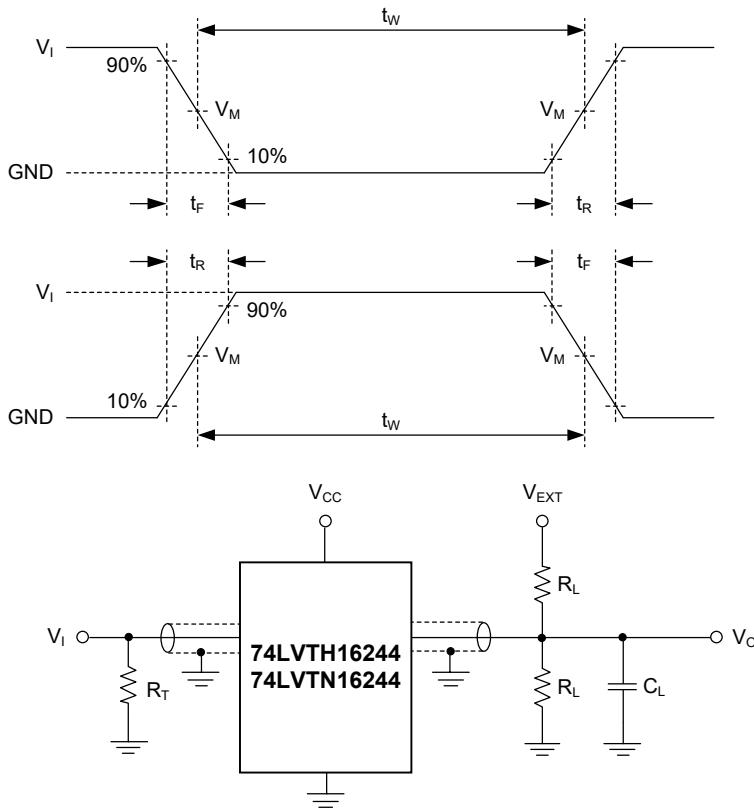
1. Other pins must be tied to V_{CC} or GND and should not be floating.

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

(For test circuit, see Figure 1. 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
Low to High Propagation Delay	t_{PLH}	nAn to nYn, See Figure 2	V_{CC} = 2.7V	+25℃		4.3		ns
			V_{CC} = 3.0V to 3.6V	+25℃		4.3		
High to Low Propagation Delay	t_{PHL}	nAn to nYn, See Figure 2	V_{CC} = 2.7V	+25℃		3.9		ns
			V_{CC} = 3.0V to 3.6V	+25℃		3.7		
Off-State to High Propagation Delay	t_{PZH}	n$\overline{OE}$ to nYn, See Figure 3	V_{CC} = 2.7V	+25℃		5.3		ns
			V_{CC} = 3.0V to 3.6V	+25℃		4.9		
Off-State to Low Propagation Delay	t_{PZL}	n$\overline{OE}$ to nYn, See Figure 3	V_{CC} = 2.7V	+25℃		5		ns
			V_{CC} = 3.0V to 3.6V	+25℃		4.9		
High to Off-State Propagation Delay	t_{PHZ}	n$\overline{OE}$ to nYn, See Figure 3	V_{CC} = 2.7V	+25℃		4.9		ns
			V_{CC} = 3.0V to 3.6V	+25℃		4.6		
Low to Off-State Propagation Delay	t_{PLZ}	n$\overline{OE}$ to nYn, See Figure 3	V_{CC} = 2.7V	+25℃		5.4		ns
			V_{CC} = 3.0V to 3.6V	+25℃		5.4		

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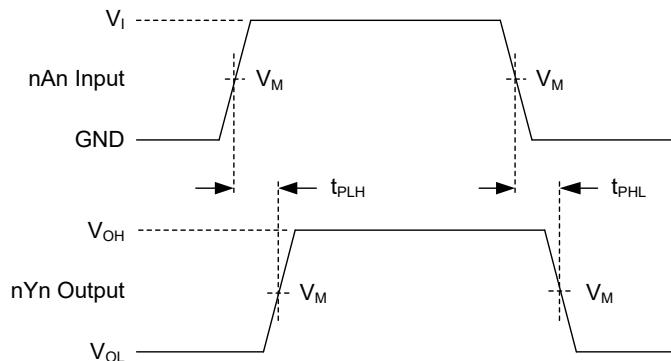
V_{EXT}: External voltage used to measure switching time.

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
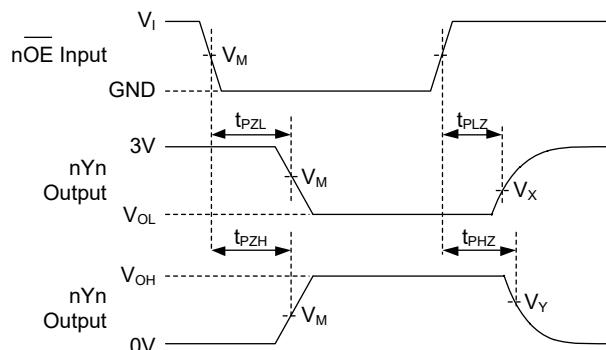
Test conditions are given in Table 1.

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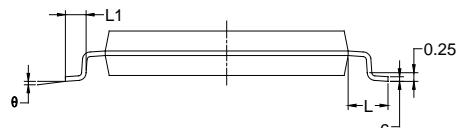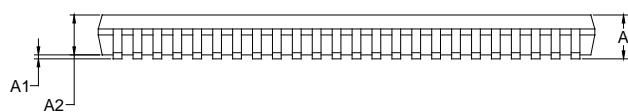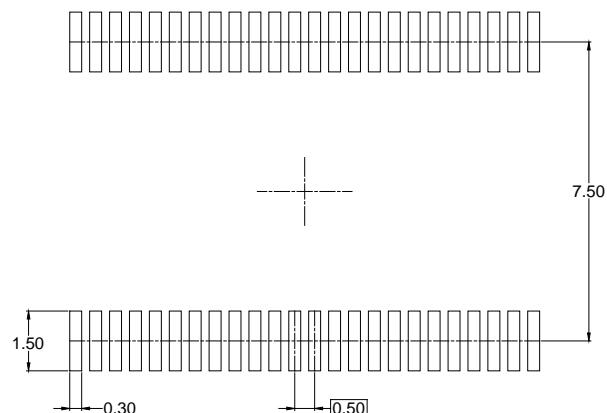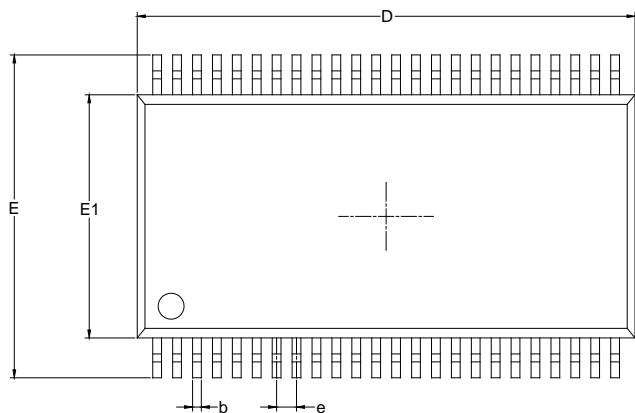
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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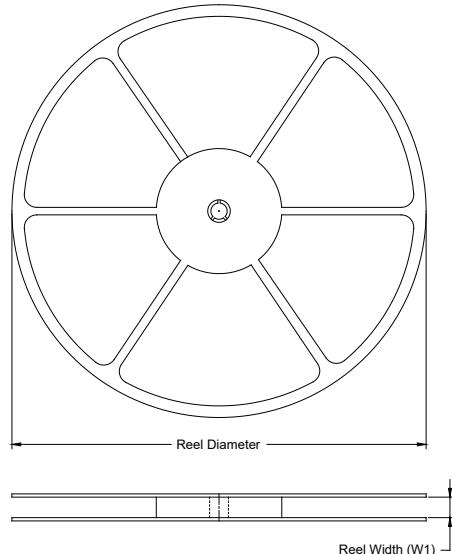
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.
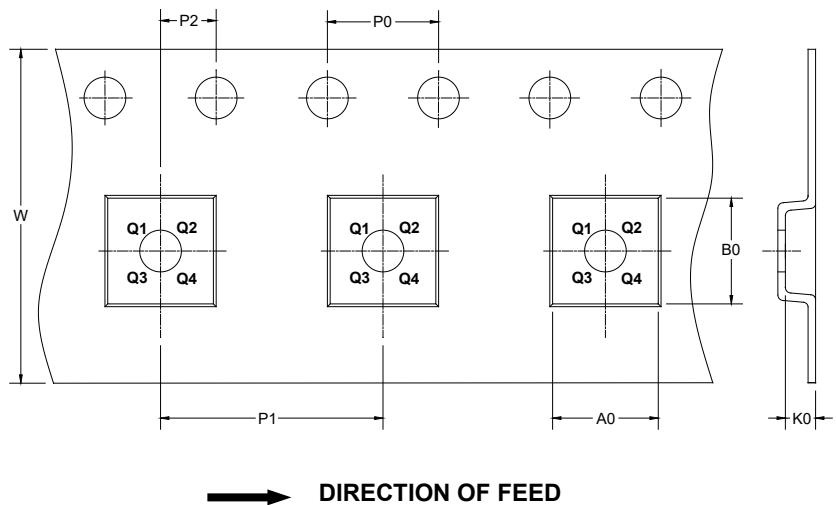
TAPE AND REEL INFORMATION

REEL DIMENSIONS
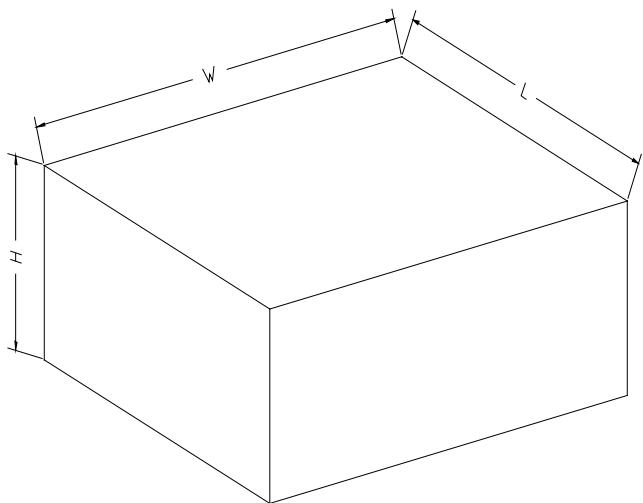
Reel Diameter

Reel Width (W1)

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

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