

# 74LVTH245

## 3.3V, Octal Transceiver with Direction Pin and 3-State Outputs

### GENERAL DESCRIPTION

The 74LVTH245 device is a high-performance 8-bit transceiver for 3.3V  $V_{CC}$  operation, but with the capability to provide an interface to 5V system environment. The non-inverting 3-state bus compatible outputs are available in both sending and receiving directions.

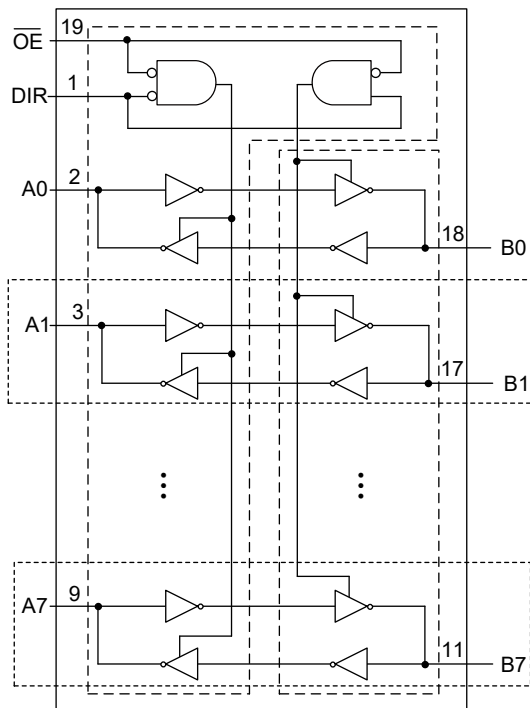
The device can be used as an 8-bit transceiver. The direction control (DIR) input determines the direction of the data flow. DIR (active high) enables data from An port to Bn port. DIR (active low) enables data from Bn port to An port. The output enable ( $\overline{OE}$ ) input, when high, disables both An and Bn ports by placing them in a high-impedance state.

The 74LVTH245 bus hold-on data inputs eliminate 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 Outputs Drive Bus Lines Directly**
- **Power-up and  $I_{OFF}$  3-State**
- **Bus Hold-on Data Inputs with No Need for External Pull-up/Pull-down Resistors**
- **-40°C to +125°C Operating Temperature Range**
- **Available in a Green TQFN-4.5×2.5-20L Package**

### LOGIC DIAGRAM



### FUNCTION TABLE

CONTROL INPUT		INPUT/OUTPUT	
$\overline{OE}$	DIR	An	Bn
L	L	An = Bn	Inputs
L	H	Inputs	Bn = An
H	X	Z	Z

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

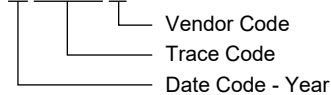
## PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
74LVTH245	TQFN-4.5×2.5-20L	-40°C to +125°C	74LVTH245XTRH20G/TR	R5CRH XXXXX	Tape and Reel, 6000

## MARKING INFORMATION

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

**XXXXX**



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 <sup>(1)</sup>

Supply Voltage, $V_{CC}$ .....	-0.5V to 4.6V
Input Voltage, $V_I$ <sup>(2)</sup> .....	-0.5V to 7V
Output Voltage, $V_O$ <sup>(2)</sup> .....	
Output in 3-State or High-State.....	-0.5V to 7V
Input Clamping Current, $I_{IK}$ ( $V_I < 0V$ ).....	-50mA
Output Clamping Current, $I_{OK}$ ( $V_O < 0V$ ).....	-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 <sup>(3)</sup> .....	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility.....	
HBM.....	8000V
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°C to +125°C

## 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.

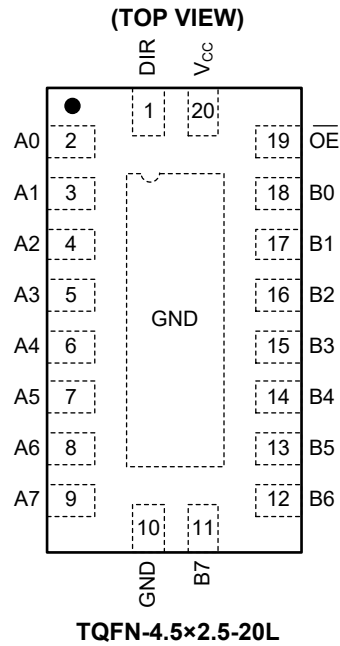
## ESD SENSITIVITY CAUTION

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



## PIN DESCRIPTION

PIN	NAME	FUNCTION
1	DIR	Direction Control.
2, 3, 4, 5, 6, 7, 8, 9	A0, A1, A2, A3, A4, A5, A6, A7	Data Inputs/Outputs.
10	GND	Ground.
18, 17, 16, 15, 14, 13, 12, 11	B0, B1, B2, B3, B4, B5, B6, B7	Data Inputs/Outputs.
19	$\overline{OE}$	Output Enable Input (Active Low).
20	V <sub>CC</sub>	Supply Voltage.

## ELECTRICAL CHARACTERISTICS

(Full = -40°C to +125°C, all typical values are measured at  $V_{CC} = 3.3V$  and  $T_A = +25^\circ C$ , 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, $I_{OH} = -100\mu A$	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	$V_{OL}$	$V_{CC} = 2.7V$	$I_{OL} = 100\mu A$	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		$\pm 0.01$	$\pm 1$	$\mu A$	
		Control pins, $V_{CC} = 0V$ or 3.6V, $V_I = 5.5V$	Full		0.01	5		
		Input/output data pins <sup>(1)</sup> , $V_{CC} = 3.6V, V_I = 5.5V$	Full		1.4	5		
		Input/output data pins <sup>(1)</sup> , $V_{CC} = 3.6V, V_I = V_{CC}$	Full		0.3	2		
		Input/output data pins <sup>(1)</sup> , $V_{CC} = 3.6V, V_I = 0V$	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	$\mu A$	
Power-up/down Output Current	$I_{O\_PU/PD}$	$V_{CC} \leq 1.2V, V_O = 0.5V$ to $V_{CC}$ , $V_I = GND$ or $V_{CC}$ , $\overline{OE} = \text{don't care}$	+25°C		50	100	$\mu A$	
Power-off Leakage Current	$I_{OFF}$	$V_{CC} = 0V, V_I$ or $V_O = 0V$ to 5.5V	Full		0.01	10	$\mu A$	
Supply Current	$I_{CC}$	$V_{CC} = 3.6V,$ $V_I = GND$ or $V_{CC},$ $I_O = 0A$	Output high	Full		15	90	$\mu A$
			Output low	Full		15	90	
			Outputs disabled <sup>(2)</sup>	Full		14	85	
Additional Supply Current	$\Delta I_{CC}$	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	$\mu A$	
Input Capacitance	$C_I$	DIR and $\overline{OE}$ inputs, $V_I = 0V$ or 3.0V	+25°C		6		pF	
Input/Output Capacitance	$C_{I/O}$	At input/output data pins, outputs disabled, $V_{I/O} = 0V$ or 3.0V	+25°C		9		pF	
Bus Hold Low Current	$I_{BHL}$	$V_{CC} = 3.0V, V_I = 0.8V$	Full	50	100		$\mu A$	
Bus Hold High Current	$I_{BHH}$	$V_{CC} = 3.0V, V_I = 2.0V$	Full		-130	-75	$\mu A$	
Bus Hold Low Overdrive Current <sup>(3)</sup>	$I_{BHLO}$	Input data pins, $V_{CC} = 3.6V, V_I = 0V$ to 3.6V	Full	500	200		$\mu A$	
Bus Hold High Overdrive Current <sup>(3)</sup>	$I_{BHHO}$	Input data pins, $V_{CC} = 3.6V, V_I = 0V$ to 3.6V	Full		-280	-500	$\mu A$	

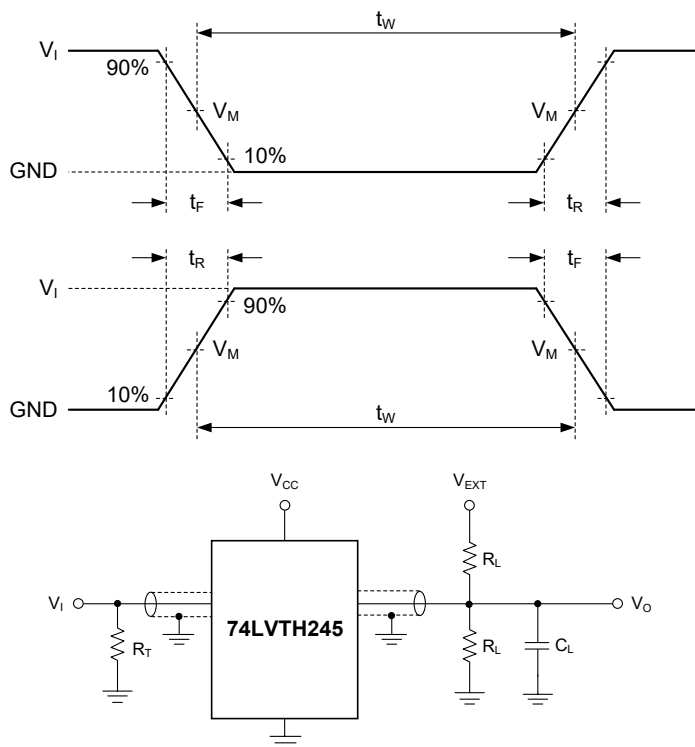
## NOTES:

- Other pins must be tied to  $V_{CC}$  or GND and should not be floating.
- $I_{CC}$  is measured with outputs pulled to  $V_{CC}$  or GND.
- 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  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Low to High Propagation Delay	$t_{PLH}$	An to Bn or Bn to An, see Figure 2	$V_{CC} = 2.7V$	$+25^\circ C$	4.3		ns
			$V_{CC} = 3.0V$ to $3.6V$	$+25^\circ C$	4.3		
High to Low Propagation Delay	$t_{PHL}$	An to Bn or Bn to An, see Figure 2	$V_{CC} = 2.7V$	$+25^\circ C$	3.9		ns
			$V_{CC} = 3.0V$ to $3.6V$	$+25^\circ C$	3.7		
Off-State to High Propagation Delay	$t_{PZH}$	$\overline{OE}$ to An or Bn, see Figure 3	$V_{CC} = 2.7V$	$+25^\circ C$	5.3		ns
			$V_{CC} = 3.0V$ to $3.6V$	$+25^\circ C$	4.9		
Off-State to Low Propagation Delay	$t_{PZL}$	$\overline{OE}$ to An or Bn, see Figure 3	$V_{CC} = 2.7V$	$+25^\circ C$	5.0		ns
			$V_{CC} = 3.0V$ to $3.6V$	$+25^\circ C$	4.9		
High to Off-State Propagation Delay	$t_{PHZ}$	$\overline{OE}$ to An or Bn, see Figure 3	$V_{CC} = 2.7V$	$+25^\circ C$	4.9		ns
			$V_{CC} = 3.0V$ to $3.6V$	$+25^\circ C$	4.6		
Low to Off-State Propagation Delay	$t_{PLZ}$	$\overline{OE}$ to An or Bn, see Figure 3	$V_{CC} = 2.7V$	$+25^\circ C$	5.4		ns
			$V_{CC} = 3.0V$ to $3.6V$	$+25^\circ C$	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).

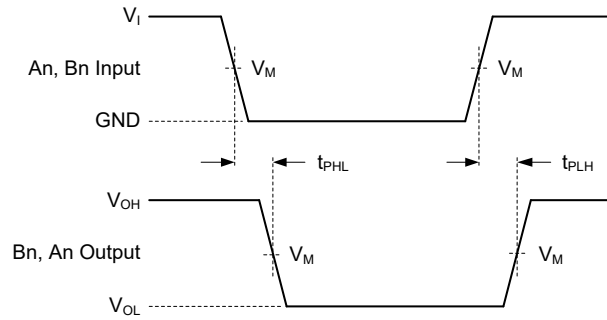
$V_{EXT}$ : External voltage used to measure switching time.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

SUPPLY VOLTAGE	INPUT		LOAD		$V_{EXT}$		
$V_{CC}$	$V_I$	$t_R, t_F$	$C_L$	$R_L$	$t_{PHZ}, t_{PZH}$	$t_{PLZ}, t_{PZL}$	$t_{PLH}, t_{PHL}$
2.7V to 3.6V	2.7V	$\leq 2.5\text{ns}$	50pF	500 $\Omega$	GND	6V	Open

WAVEFORMS

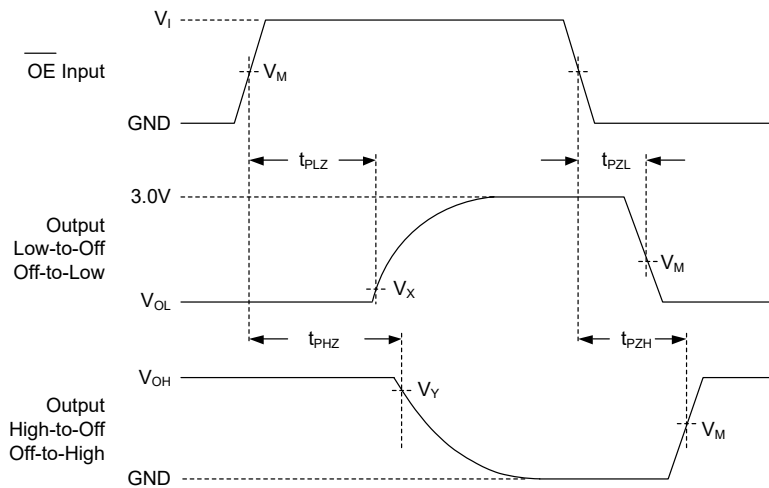


Test conditions are given in Table 1.

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 (An, Bn) to Output (Bn, An) 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.

<b>JANUARY 2022 – REV.A to REV.A.1</b>	<b>Page</b>
Updated $I_I$ and $I_{CC}$ values in Electrical Characteristics section .....	4

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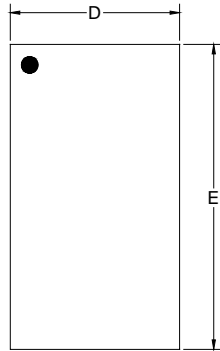
<b>Changes from Original (MARCH 2021) to REV.A</b>	<b>Page</b>
Changed from product preview to production data.....	All

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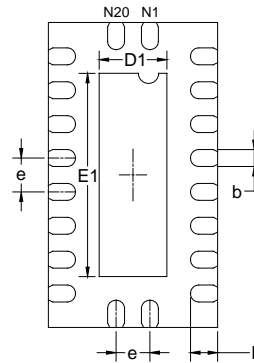


## PACKAGE OUTLINE DIMENSIONS

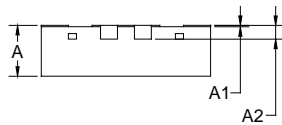
### TQFN-4.5x2.5-20L



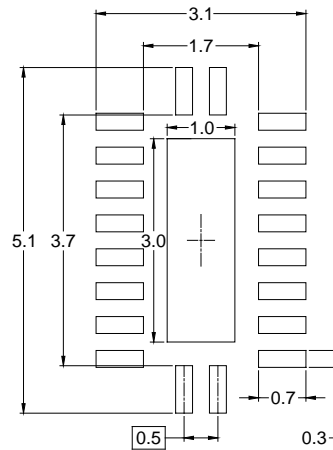
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

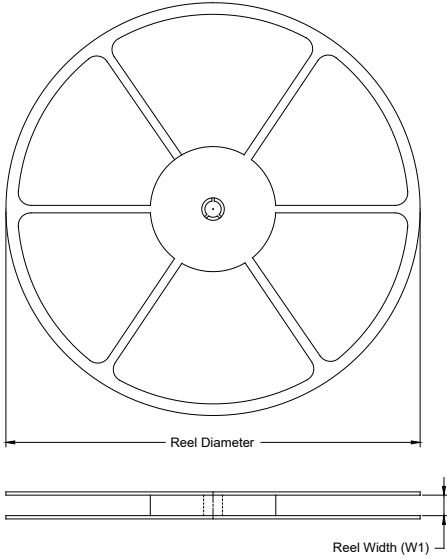
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2	0.203 REF		
b	0.20	0.25	0.30
D	2.40	2.50	2.60
D1	0.85	1.00	1.15
E	4.40	4.50	4.60
E1	2.85	3.00	3.15
e	0.45	0.50	0.55
L	0.30	0.40	0.50

NOTE: This drawing is subject to change without notice.

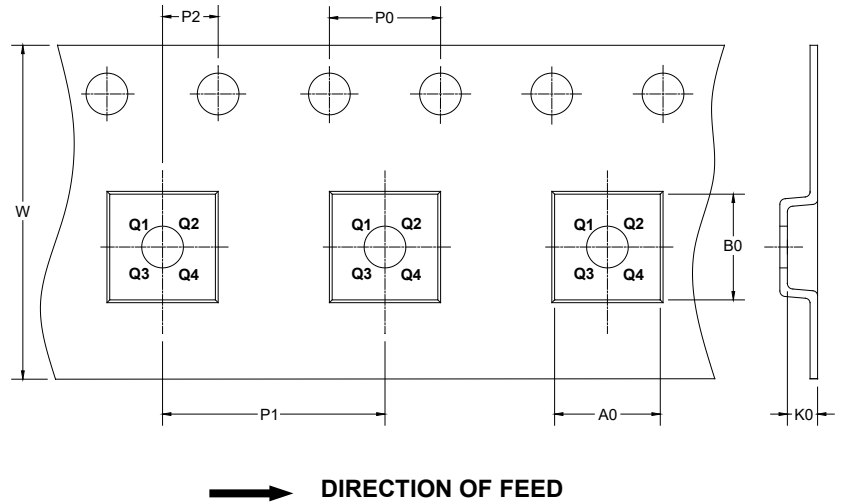
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

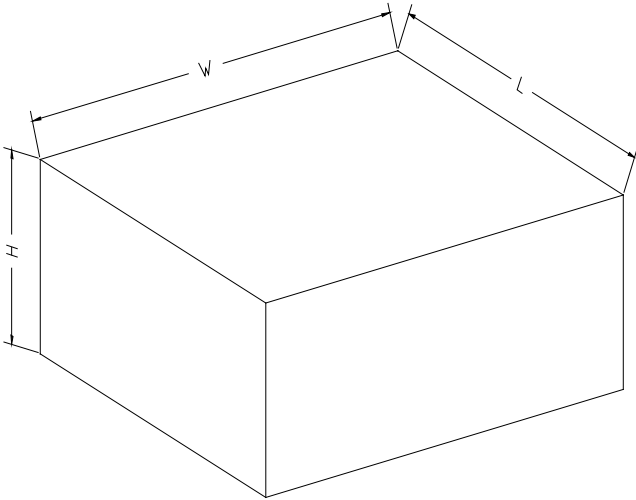
### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TQFN-4.5×2.5-20L	13"	12.4	2.75	4.75	1.00	4.0	8.0	2.0	12.0	Q1

DD0001

# PACKAGE INFORMATION

## 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