74AVC4T774
4-Bit Dual-Supply Translating Transceiver with Configurable Voltage Translation and 3-State Outputs

GENERAL DESCRIPTION

The 74AVC4T774 is a 4-bit, dual-supply voltage level transceiver with 3-state outputs and bidirectional level translation. The An and Bn are four data input-output ports. DIRn are the direction control inputs and $\overline{OE}$ is the output enable input. V_{CCA} and V_{CCB} are the supply pins. The supply voltage of V_{CCA} and V_{CCB} can range from 0.8V to 3.6V, making the device suitable for bidirectional translating among any of the 0.8V, 1.2V, 1.5V, 1.8V, 2.5V and 3.3V low voltage nodes. The An, DIRn and $\overline{OE}$ signals are referenced to V_{CCA} and Bn signals are referenced to V_{CCB}.

When DIRn is set high, it allows transmission from An to Bn. When DIRn is set low, it allows transmission from Bn to An. $\overline{OE}$ can make the outputs disabled in order to effectively isolate the buses. In suspend mode, both An and Bn are in high-impedance state when either V_{CCA} or V_{CCB} is at GND level.

This device is highly suitable for partial power-down applications by using power-off leakage current (I_{OFF}) circuit. When the device is powered down, the outputs are disabled, and the current backflow can be prevented from passing through the device.

The 74AVC4T774 is available in Green TSSOP-16, UTQFN-2.6×1.8-16L and TQFN-3.5×4-16L packages. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **V_{CCA} Supply Voltage Range: 0.8V to 3.6V**
- **V_{CCB} Supply Voltage Range: 0.8V to 3.6V**
- **Inputs Accept Voltages Higher than the Supply Voltage and up to 3.6V**
- **+12mA/-12mA Output Current**
- **Typical Data Rates:**
  - **380Mbps (≥ 1.8V to 3.3V Translation)**
  - **200Mbps (≥ 1.1V to 3.3V Translation)**
  - **200Mbps (≥ 1.1V to 2.5V Translation)**
  - **200Mbps (≥ 1.1V to 1.8V Translation)**
  - **150Mbps (≥ 1.1V to 1.5V Translation)**
  - **100Mbps (≥ 1.1V to 1.2V Translation)**
- **Support Partial Power-Down Mode**
- **Outputs in High-Impedance State when V_{CCA} or V_{CCB} = 0V**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TSSOP-16, UTQFN-2.6×1.8-16L and TQFN-3.5×4-16L Packages**

APPLICATIONS

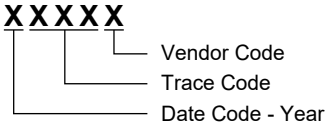
Personal Electronic
Industrial Equipment
Enterprise Infrastructure
Telecom Equipment

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
74AVC4T774	TSSOP-16	-40℃ to +125℃	74AVC4T774XTS16G/TR	181 XTS16 XXXXX	Tape and Reel, 4000
	UTQFN-2.6×1.8-16L	-40℃ to +125℃	74AVC4T774XUSY16G/TR	17Z XXXXX	Tape and Reel, 3000
	TQFN-3.5×4-16L	-40℃ to +125℃	74AVC4T774XTUU16G/TR	17Y XTUU16 XXXXX	Tape and Reel, 4000

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

Supply Voltage Range, V_{CCA} ..... -0.5V to 4.6V
Supply Voltage Range, V_{CCB} ..... -0.5V to 4.6V
Input Voltage Range, V_I (1) ..... -0.5V to 4.6V
Output Voltage Range, V_O (1) (2)
Suspend or 3-State Mode ..... -0.5V to 4.6V
Active Mode ..... -0.5V to MIN(4.6V, V_{CCO} + 0.5V)
Input Clamp Current, I_{IK} (V_I < 0V) .....-50mA
Output Clamp Current, I_{OK} (V_O < 0V) .....-50mA
Continuous Output Current, I_O (V_O = 0V to V_{CCO} (2)) .... ±50mA
Continuous Current through $V_{CCA/B}$ or GND ..... ±100mA
Junction Temperature (3) .....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s) .....+260℃
ESD Susceptibility (4) (5)
HBM.....±6000V
CDM .....±1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{CCA}.....0.8V to 3.6V
Supply Voltage Range, V_{CCB}.....0.8V to 3.6V
Input Voltage Range, V_I.....0V to 3.6V
Output Voltage Range, V_O
Suspend or 3-State Mode .....0V to 3.6V
Active Mode ..... 0V to V_{CCO}
Output Current, I_O .....±12mA
Input Transition Rise or Fall Rate, Δt/ΔV
V_{CCI} = 0.8V to 3.6V..... 10ns/V (MAX)
Operating Temperature Range.....-40℃ to +125℃

NOTES:

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

2. V_{CCO} is the supply voltage associated with the data output ports.

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

4. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

5. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

OVERSTRESS CAUTION

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.

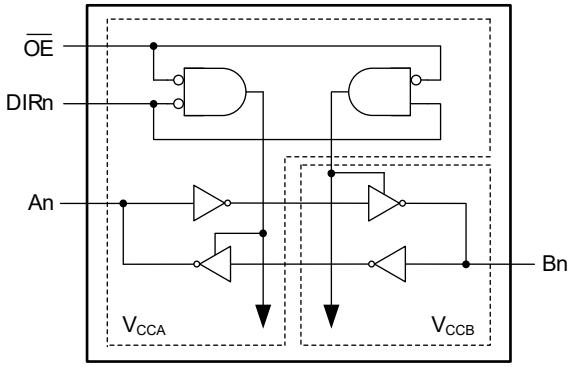
DISCLAIMER

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

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.

LOGIC DIAGRAM



FUNCTION TABLE

CONTROL INPUTS					INPUT/OUTPUT	
$\overline{OE}$	DIR1	DIR2	DIR3	DIR4	An	Bn
L	L	*X*	*X*	*X*	A1 = B1	Input B1
L	H	*X*	*X*	*X*	Input A1	B1 = A1
L	*X*	L	*X*	*X*	A2 = B2	Input B2
L	*X*	H	*X*	*X*	Input A2	B2 = A2
L	*X*	*X*	L	*X*	A3 = B3	Input B3
L	*X*	*X*	H	*X*	Input A3	B3 = A3
L	*X*	*X*	*X*	L	A4 = B4	Input B4
L	*X*	*X*	*X*	H	Input A4	B4 = A4
H	*X*	*X*	*X*	*X*	Z	Z

H = High Voltage Level

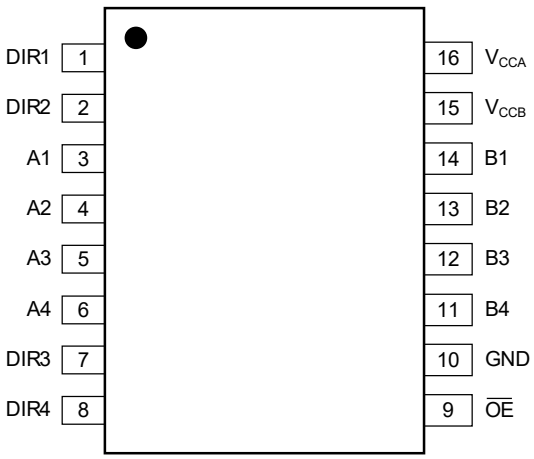
L = Low Voltage Level

Z = High-Impedance State.

X = Don't Care

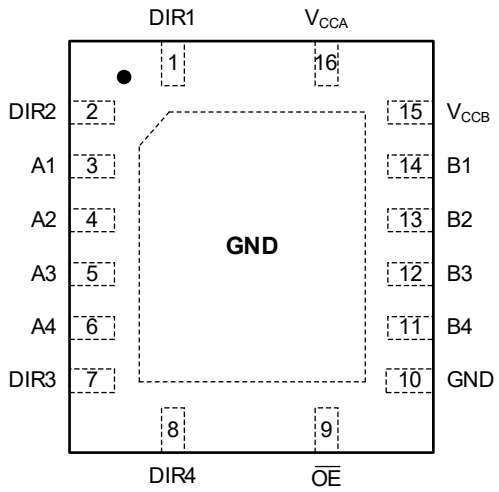
PIN CONFIGURATIONS

(TOP VIEW)



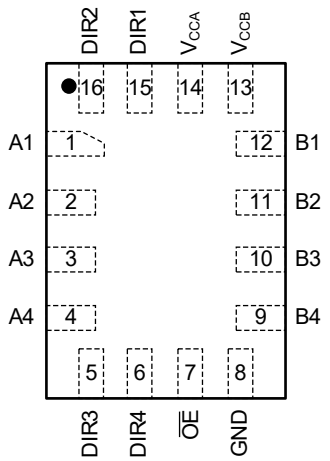
TSSOP-16

(TOP VIEW)



TQFN-3.5×4-16L

(TOP VIEW)



UTQFN-2.6×1.8-16L

PIN DESCRIPTION

PIN		NAME	FUNCTION
TSSOP-16/TQFN-3.5×4-16L	UTQFN-2.6×1.8-16L		
1	15	DIR1	Direction Control Input 1. DIR1 controls the signal direction of channel A1 and B1.
2	16	DIR2	Direction Control Input 2. DIR2 controls the signal direction of channel A2 and B2.
7	5	DIR3	Direction Control Input 3. DIR3 controls the signal direction of channel A3 and B3.
8	6	DIR4	Direction Control Input 4. DIR4 controls the signal direction of channel A4 and B4.
3, 4, 5, 6	1, 2, 3, 4	A1, A2, A3, A4	Data Inputs/Outputs.
9	7	$\overline{OE}$	Output Enable Input (Active-Low).
10	8	GND	Ground.
14, 13, 12, 11	12, 11, 10, 9	B1, B2, B3, B4	Data Inputs/Outputs.
15	13	V_{CCB}	Supply Voltage V_{CCB}. The Bn signals are referenced to V_{CCB}.
16	14	V_{CCA}	Supply Voltage V_{CCA}. The An, DIRn and $\overline{OE}$ signals are referenced to V_{CCA}.
Exposed Pad	—	GND	Connect it to GND internally. This pad is not an electrical connection point. TQFN-3.5×4-16L package only.

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃. V_{CCI} is the supply voltage associated with the data input ports. V_{CCO} is the supply voltage associated with the data output ports, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
High-Level Input Voltage	V_{IH}	Data inputs	V_{CCI} = 0.8V	Full	0.70 × V_{CCI}			V
			V_{CCI} = 1.1V to 1.95V	Full	0.65 × V_{CCI}			
			V_{CCI} = 2.3V to 2.7V	Full	1.6			
			V_{CCI} = 3.0V to 3.6V	Full	2.0			
		DIRn, $\overline{OE}$ inputs	V_{CCA} = 0.8V	Full	0.70 × V_{CCA}			V
			V_{CCA} = 1.1V to 1.95V	Full	0.65 × V_{CCA}			
			V_{CCA} = 2.3V to 2.7V	Full	1.6			
			V_{CCA} = 3.0V to 3.6V	Full	2.0			
Low-Level Input Voltage	V_{IL}	Data inputs	V_{CCI} = 0.8V	Full			0.30 × V_{CCI}	V
			V_{CCI} = 1.1V to 1.95V	Full			0.35 × V_{CCI}	
			V_{CCI} = 2.3V to 2.7V	Full			0.7	
			V_{CCI} = 3.0V to 3.6V	Full			0.8	
		DIRn, $\overline{OE}$ inputs	V_{CCA} = 0.8V	Full			0.30 × V_{CCA}	V
			V_{CCA} = 1.1V to 1.95V	Full			0.35 × V_{CCA}	
			V_{CCA} = 2.3V to 2.7V	Full			0.7	
			V_{CCA} = 3.0V to 3.6V	Full			0.8	
High-Level Output Voltage	V_{OH}	V_{CCO} = 0.8V to 3.6V, I_{OH} = -100μA		Full	V_{CCO} - 0.1	V_{CCO} - 0.01		V
		V_{CCO} = 1.1V, I_{OH} = -3mA		Full	0.85	0.98		
		V_{CCO} = 1.4V, I_{OH} = -6mA		Full	1.05	1.22		
		V_{CCO} = 1.65V, I_{OH} = -8mA		Full	1.20	1.44		
		V_{CCO} = 2.3V, I_{OH} = -9mA		Full	1.75	2.12		
		V_{CCO} = 3.0V, I_{OH} = -12mA		Full	2.30	2.75		
Low-Level Output Voltage	V_{OL}	V_{CCO} = 0.8V to 3.6V, I_{OL} = 100μA		Full		0.01	0.10	V
		V_{CCO} = 1.1V, I_{OL} = 3mA		Full		0.09	0.25	
		V_{CCO} = 1.4V, I_{OL} = 6mA		Full		0.14	0.35	
		V_{CCO} = 1.65V, I_{OL} = 8mA		Full		0.17	0.45	
		V_{CCO} = 2.3V, I_{OL} = 9mA		Full		0.15	0.55	
		V_{CCO} = 3.0V, I_{OL} = 12mA		Full		0.21	0.70	

ELECTRICAL CHARACTERISTICS (continued)

(Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃. V_{CCI} is the supply voltage associated with the data input ports. V_{CCO} is the supply voltage associated with the data output ports, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Leakage Current	I_I	DIRn, $\overline{OE}$ inputs, V_{CCA} or V_{CCB} = 0.8V to 3.6V, V_I = 0V or 3.6V		Full		±0.02	±5	μA
Off-State Output Current (1)	I_{OZ}	A or B ports, V_{CCA} = V_{CCB} = 3.6V, V_O = 0V or V_{CCO}		Full		±0.02	±5	μA
		A ports, V_{CCA} = 3.6V, V_{CCB} = 0V, V_O = 0V or V_{CCO}		Full		±0.02	±5	
		B ports, V_{CCA} = 0V, V_{CCB} = 3.6V, V_O = 0V or V_{CCO}		Full		±0.02	±5	
Power-Off Leakage Current	I_{OFF}	A ports, V_{CCA} = 0V, V_{CCB} = 0.8V to 3.6V, V_I or V_O = 0V or 3.6V		Full		±0.02	±5	μA
		B ports, V_{CCB} = 0V, V_{CCA} = 0.8V to 3.6V, V_I or V_O = 0V or 3.6V		Full		±0.02	±5	
Supply Current	I_{CCA}	V_I = 0V or V_{CCI}, I_O = 0A	V_{CCA} = 0.8V to 3.6V, V_{CCB} = 0.8V to 3.6V	Full		0.9	10	μA
			V_{CCA} = 3.6V, V_{CCB} = 0V	Full		0.2	10	
			V_{CCA} = 0V, V_{CCB} = 3.6V	Full	-2	-0.02		
	I_{CCB}	V_I = 0V or V_{CCI}, I_O = 0A	V_{CCA} = 0.8V to 3.6V, V_{CCB} = 0.8V to 3.6V	Full		0.9	10	
			V_{CCA} = 3.6V, V_{CCB} = 0V	Full	-2	-0.02		
			V_{CCA} = 0V, V_{CCB} = 3.6V	Full		0.2	10	
	I_{CCA} + I_{CCB}	V_I = 0V or V_{CCI}, I_O = 0A	V_{CCA} = 0.8V to 3.6V, V_{CCB} = 0.8V to 3.6V	Full		1.8	20	
Additional Supply Current	ΔI_{CC}	V_{CCA} = V_{CCB} = 3.6V, V_I = 3.0V		Full		12.0	200	μA
Input Capacitance	C_I	DIRn, $\overline{OE}$ inputs, V_{CCA} = V_{CCB} = 3.3V, V_I = 0V or 3.3V		+25℃		4.0		pF
Input/Output Capacitance	$C_{I/O}$	A or B ports, V_{CCA} = V_{CCB} = 3.3V, V_O = 0V or 3.3V		+25℃		5.0		pF

NOTE:

1. For I/O ports, the parameter I_{OZ} includes the input leakage current.

ELECTRICAL CHARACTERISTICS (continued)

Typical Total Supply Current (I_{CCA} + I_{CCB})

(T_A = +25℃, unless otherwise noted.)

V_{CCA}	V_{CCB}							UNITS
	0V	0.8V	1.2V	1.5V	1.8V	2.5V	3.3V	
0V	0	0.2	0.2	0.2	0.2	0.2	0.2	μA
0.8V	0.2	1.3	1.3	1.3	1.3	1.3	1.3	μA
1.2V	0.2	1.3	1.3	1.3	1.3	1.3	1.3	μA
1.5V	0.2	1.3	1.3	1.3	1.3	1.3	1.3	μA
1.8V	0.2	1.3	1.3	1.3	1.3	1.3	1.3	μA
2.5V	0.2	1.3	1.3	1.3	1.3	1.3	1.3	μA
3.3V	0.2	1.3	1.3	1.3	1.3	1.3	1.3	μA

Typical Power Dissipation Capacitance

(T_A = +25℃, V_{CCA} = V_{CCB}, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	V_{CCA} = V_{CCB}						UNITS
			0.8V	1.2V	1.5V	1.8V	2.5V	3.3V	
Power Dissipation Capacitance (1) (2)	C_{PD}	A ports: (direction An to Bn), outputs enabled	2.5	2.5	2.5	3.0	3.0	3.0	pF
		A ports: (direction An to Bn), outputs disabled	1.0	1.0	1.0	1.0	1.0	1.5	
		A ports: (direction Bn to An), outputs enabled	11.5	11.5	11.5	11.5	12.0	12.0	
		A ports: (direction Bn to An), outputs disabled	2.0	2.0	2.0	2.0	2.0	2.0	
		B ports: (direction An to Bn), outputs enabled	11.5	11.5	11.5	11.5	12.0	12.0	
		B ports: (direction An to Bn), outputs disabled	2.0	2.0	2.0	2.0	2.0	2.0	
		B ports: (direction Bn to An), outputs enabled	2.5	2.5	2.5	3.0	3.0	3.0	
		B ports: (direction Bn to An), outputs disabled	1.0	1.0	1.0	1.0	1.0	1.5	

NOTES:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

   $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$

   where:

   f_i = Input frequency in MHz.

   f_o = Output frequency in MHz.

   C_L = Output load capacitance in pF.

   V_{CC} = Supply voltage in Volts.

   N = Number of inputs switching.

   $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of the outputs.

2. f_i = 10MHz, V_I = GND to V_{CC}, t_R = t_F = 1ns, C_L = 0pF, R_L = ∞.

DYNAMIC CHARACTERISTICS

Typical Dynamic Characteristics at V_{CCA} = 0.8V and T_A = +25℃

(See Figure 1 for test circuit. See Figure 2 and Figure 3 for waveforms, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	V_{CCB}						UNITS
			0.8V	1.2V	1.5V	1.8V	2.5V	3.3V	
Propagation Delay (1)	t_{PD}	An to Bn	17.5	9.5	9.0	8.5	8.5	9.5	ns
		Bn to An	17.5	13.5	13.0	12.5	12.5	12.0	
Disable Time	t_{DIS}	$\overline{OE}$ to An	20.5	20.5	20.5	20.5	20.5	20.5	ns
		$\overline{OE}$ to Bn	30.0	18.5	17.0	16.5	15.5	16.5	
Enable Time	t_{EN}	$\overline{OE}$ to An	27.0	27.0	27.0	27.0	27.0	27.0	ns
		$\overline{OE}$ to Bn	35.0	18.5	17.0	16.5	16.0	16.0	

NOTE:

1. t_{PD} is the same as t_{PLH} and t_{PHL}. t_{DIS} is the same as t_{PLZ} and t_{PHZ}. t_{EN} is the same as t_{PZL} and t_{PZH}.

Typical Dynamic Characteristics at V_{CCB} = 0.8V and T_A = +25℃

(See Figure 1 for test circuit. See Figure 2 and Figure 3 for waveforms, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	V_{CCA}						UNITS
			0.8V	1.2V	1.5V	1.8V	2.5V	3.3V	
Propagation Delay (1)	t_{PD}	An to Bn	17.5	13.5	13.0	12.5	12.5	12.5	ns
		Bn to An	17.5	9.5	9.0	8.5	9.5	9.5	
Disable Time	t_{DIS}	$\overline{OE}$ to An	20.5	7.0	5.0	4.5	4.0	4.0	ns
		$\overline{OE}$ to Bn	30.0	20.5	19.0	18.5	18.0	18.0	
Enable Time	t_{EN}	$\overline{OE}$ to An	27.0	7.5	5.5	4.5	3.0	3.0	ns
		$\overline{OE}$ to Bn	35.0	26.0	24.0	23.0	23.0	22.5	

NOTE:

1. t_{PD} is the same as t_{PLH} and t_{PHL}. t_{DIS} is the same as t_{PLZ} and t_{PHZ}. t_{EN} is the same as t_{PZL} and t_{PZH}.

DYNAMIC CHARACTERISTICS (continued)

(See Figure 1 for test circuit. See Figure 2 and Figure 3 for waveforms. Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	V_{CCB}									UNITS
			1.2V ± 0.1V			1.5V ± 0.1V			1.8V ± 0.15V			
			MIN (1)	TYP	MAX (1)	MIN (1)	TYP	MAX (1)	MIN (1)	TYP	MAX (1)	
V_{CCA} = 1.1V to 1.3V												
Propagation Delay (2)	t_{PD}	An to Bn	1.0	6.5	12.1	1.0	5.0	9.0	0.5	4.5	8.0	ns
		Bn to An	1.0	6.5	12.1	1.0	5.5	10.5	1.0	5.0	10.0	
Disable Time	t_{DIS}	$\overline{OE}$ to An	1.0	8.0	13.7	1.0	8.0	13.7	1.0	8.0	13.7	ns
		$\overline{OE}$ to Bn	1.0	11.0	19.0	1.0	9.0	14.5	1.0	8.5	13.7	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	9.5	16.9	0.5	9.5	16.9	0.5	9.5	16.9	ns
		$\overline{OE}$ to Bn	1.0	11.5	20.9	0.5	9.0	15.6	0.5	8.5	13.9	
V_{CCA} = 1.4V to 1.6V												
Propagation Delay (2)	t_{PD}	An to Bn	1.0	5.5	10.5	0.5	4.0	7.4	0.5	4.0	6.5	ns
		Bn to An	1.0	5.0	9.0	0.5	4.0	7.4	0.5	4.0	6.9	
Disable Time	t_{DIS}	$\overline{OE}$ to An	1.0	5.5	8.6	1.0	5.5	8.6	1.0	5.5	8.6	ns
		$\overline{OE}$ to Bn	1.0	9.5	15.6	1.0	7.0	11.1	1.0	6.5	10.2	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	6.0	9.8	0.5	6.0	9.8	0.5	6.0	9.8	ns
		$\overline{OE}$ to Bn	0.5	10.0	17.4	0.5	7.0	12.1	0.5	6.5	10.5	
V_{CCA} = 1.65V to 1.95V												
Propagation Delay (2)	t_{PD}	An to Bn	1.0	5.0	10.0	0.5	4.0	6.9	0.5	3.5	6.0	ns
		Bn to An	0.5	5.0	8.0	0.5	4.0	6.5	0.5	3.5	6.0	
Disable Time	t_{DIS}	$\overline{OE}$ to An	1.0	5.0	7.7	1.0	5.0	7.6	1.0	5.0	7.6	ns
		$\overline{OE}$ to Bn	1.0	9.5	15.1	1.0	7.0	10.5	1.0	6.0	9.5	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	5.0	7.8	0.5	5.0	7.8	0.5	5.0	7.8	ns
		$\overline{OE}$ to Bn	0.5	9.0	16.3	0.5	6.5	10.9	0.5	5.5	9.4	
V_{CCA} = 2.3V to 2.7V												
Propagation Delay (2)	t_{PD}	An to Bn	1.0	5.0	9.4	0.5	3.5	6.3	0.5	3.0	5.4	ns
		Bn to An	0.5	4.5	6.8	0.5	3.5	5.6	0.5	3.0	5.0	
Disable Time	t_{DIS}	$\overline{OE}$ to An	0.5	3.5	5.5	0.5	3.5	5.5	0.5	3.5	5.5	ns
		$\overline{OE}$ to Bn	1.0	9.0	14.3	1.0	6.5	9.9	1.0	5.5	8.5	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	3.5	5.2	0.5	3.5	5.2	0.5	3.5	5.2	ns
		$\overline{OE}$ to Bn	0.5	8.5	15.2	0.5	6.0	9.8	0.5	5.0	8.2	
V_{CCA} = 3.0V to 3.6V												
Propagation Delay (2)	t_{PD}	An to Bn	0.5	5.0	9.2	0.5	3.5	6.1	0.5	3.0	5.1	ns
		Bn to An	0.5	4.0	6.6	0.5	3.0	5.0	0.5	3.0	4.6	
Disable Time	t_{DIS}	$\overline{OE}$ to An	0.5	4.5	6.4	0.5	4.5	6.4	0.5	4.5	6.4	ns
		$\overline{OE}$ to Bn	1.0	8.0	13.3	1.0	6.5	9.9	1.0	5.5	8.6	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	3.0	4.6	0.5	3.0	4.6	0.5	3.0	4.6	ns
		$\overline{OE}$ to Bn	0.5	8.0	14.7	0.5	5.5	9.3	0.5	5.0	7.8	

NOTES:

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

2. t_{PD} is the same as t_{PLH} and t_{PHL}. t_{DIS} is the same as t_{PLZ} and t_{PHZ}. t_{EN} is the same as t_{PZL} and t_{PZH}.

DYNAMIC CHARACTERISTICS (continued)

(See Figure 1 for test circuit. See Figure 2 and Figure 3 for waveforms. Full = -40℃ to +125℃, all typical values are measured at T_A = +25℃, unless otherwise noted.)

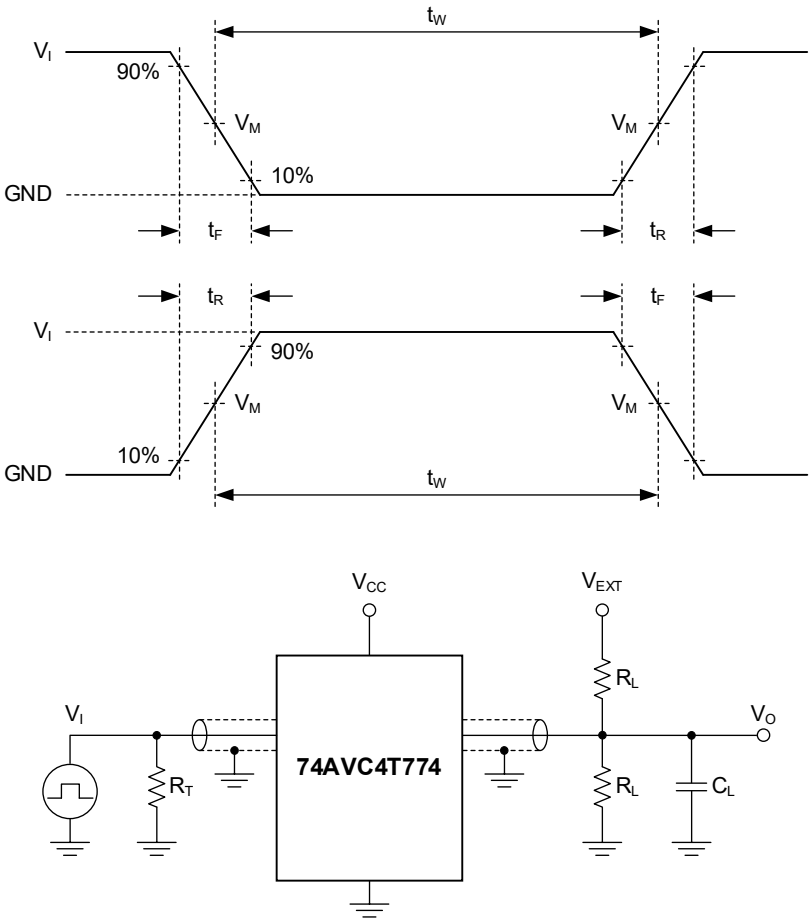
PARAMETER	SYMBOL	CONDITIONS	V_{CCB}						UNITS
			2.5V ± 0.2V			3.3V ± 0.3V			
			MIN (1)	TYP	MAX (1)	MIN (1)	TYP	MAX (1)	
V_{CCA} = 1.1V to 1.3V									
Propagation Delay (2)	t_{PD}	An to Bn	0.5	4.5	6.8	0.5	4.0	6.6	ns
		Bn to An	1.0	5.0	9.4	0.5	4.5	9.2	
Disable Time	t_{DIS}	$\overline{OE}$ to An	1.0	8.0	13.7	1.0	8.0	13.7	ns
		$\overline{OE}$ to Bn	1.0	7.0	11.5	1.0	7.5	11.8	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	9.5	16.9	0.5	9.5	16.9	ns
		$\overline{OE}$ to Bn	0.5	7.5	12.2	0.5	7.0	11.6	
V_{CCA} = 1.4V to 1.6V									
Propagation Delay (2)	t_{PD}	An to Bn	0.5	3.5	5.6	0.5	3.0	5.0	ns
		Bn to An	0.5	3.5	6.3	0.5	3.5	6.1	
Disable Time	t_{DIS}	$\overline{OE}$ to An	1.0	5.5	8.6	1.0	5.5	8.6	ns
		$\overline{OE}$ to Bn	1.0	5.5	8.5	1.0	6.0	8.8	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	6.0	9.8	0.5	6.0	9.8	ns
		$\overline{OE}$ to Bn	0.5	5.5	8.9	0.5	5.0	8.3	
V_{CCA} = 1.65V to 1.95V									
Propagation Delay (2)	t_{PD}	An to Bn	0.5	3.0	5.0	0.5	3.0	4.6	ns
		Bn to An	0.5	3.0	5.4	0.5	3.0	5.1	
Disable Time	t_{DIS}	$\overline{OE}$ to An	1.0	5.0	7.6	1.0	5.0	7.6	ns
		$\overline{OE}$ to Bn	0.5	5.0	7.5	1.0	5.5	7.7	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	5.0	7.8	0.5	5.0	7.8	ns
		$\overline{OE}$ to Bn	0.5	5.0	7.8	0.5	4.5	7.2	
V_{CCA} = 2.3V to 2.7V									
Propagation Delay (2)	t_{PD}	An to Bn	0.5	2.5	4.4	0.5	2.5	4.1	ns
		Bn to An	0.5	2.5	4.4	0.5	2.5	4.2	
Disable Time	t_{DIS}	$\overline{OE}$ to An	0.5	3.5	5.5	0.5	3.5	5.5	ns
		$\overline{OE}$ to Bn	0.5	4.5	7.1	1.0	4.5	6.6	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	3.5	5.2	0.5	3.5	5.2	ns
		$\overline{OE}$ to Bn	0.5	4.0	6.6	0.5	3.5	6.0	
V_{CCA} = 3.0V to 3.6V									
Propagation Delay (2)	t_{PD}	An to Bn	0.5	2.5	4.2	0.5	2.5	3.8	ns
		Bn to An	0.5	2.5	4.0	0.5	2.5	3.8	
Disable Time	t_{DIS}	$\overline{OE}$ to An	0.5	4.5	6.4	0.5	4.5	6.4	ns
		$\overline{OE}$ to Bn	0.5	4.0	6.6	1.0	4.5	6.4	
Enable Time	t_{EN}	$\overline{OE}$ to An	0.5	3.0	4.6	0.5	3.0	4.6	ns
		$\overline{OE}$ to Bn	0.5	4.0	6.1	0.5	3.5	5.5	

NOTES:

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

2. t_{PD} is the same as t_{PLH} and t_{PHL}. t_{DIS} is the same as t_{PLZ} and t_{PHZ}. t_{EN} is the same as t_{PZL} and t_{PZH}.

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

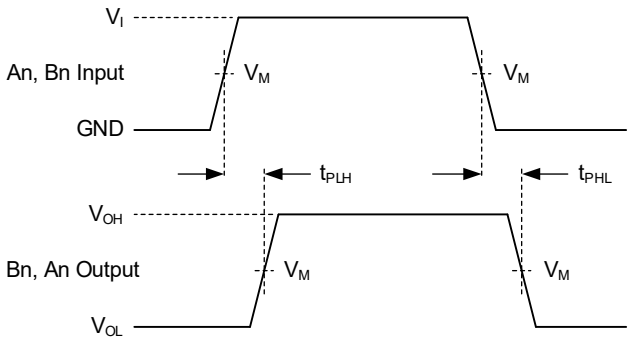
SUPPLY VOLTAGE	INPUT		LOAD		V_{EXT}		
V_{CCA}, V_{CCB}	V_I (1)	Δt/ΔV	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ} (2)
0.8V to 1.6V	V_{CCI}	≤ 1.0ns/V	15pF	2kΩ	Open	GND	2 × V_{CCO}
1.65V to 2.7V	V_{CCI}	≤ 1.0ns/V	15pF	2kΩ	Open	GND	2 × V_{CCO}
3.0V to 3.6V	V_{CCI}	≤ 1.0ns/V	15pF	2kΩ	Open	GND	2 × V_{CCO}

NOTES:

1. V_{CCI} is the supply voltage associated with the data input ports.

2. V_{CCO} is the supply voltage associated with the data output ports.

WAVEFORMS

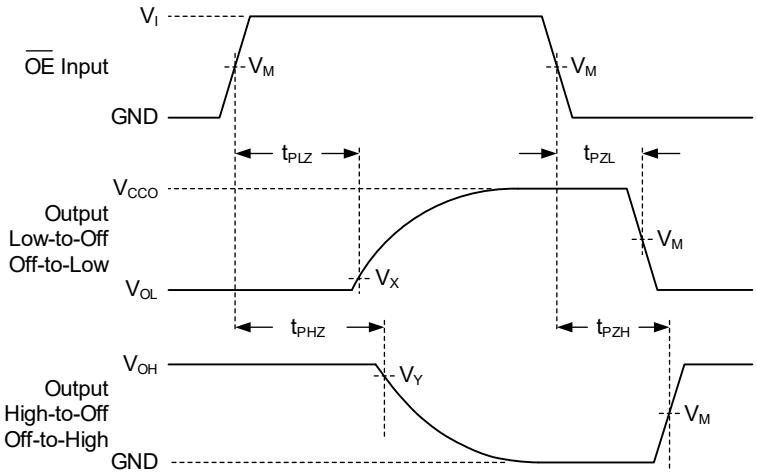


Test conditions are given in Table 1.

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 Delay Times



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 (1)		OUTPUT		
V_{CCA}, V_{CCB}	V_I	V_M (2)	V_M (3)	V_X	V_Y
0.8V to 1.6V	V_{CCI}	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.1V	V_{OH} - 0.1V
1.65V to 2.7V	V_{CCI}	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.15V	V_{OH} - 0.15V
3.0V to 3.6V	V_{CCI}	0.5 × V_{CCI}	0.5 × V_{CCO}	V_{OL} + 0.3V	V_{OH} - 0.3V

NOTES:

1. V_{CCI} is the supply voltage associated with the data input ports.

2. The measurement points should be V_{IH} or V_{IL} when $\Delta t/\Delta V$ > 1.0ns/V.

3. V_{CCO} is the supply voltage associated with the data output ports.

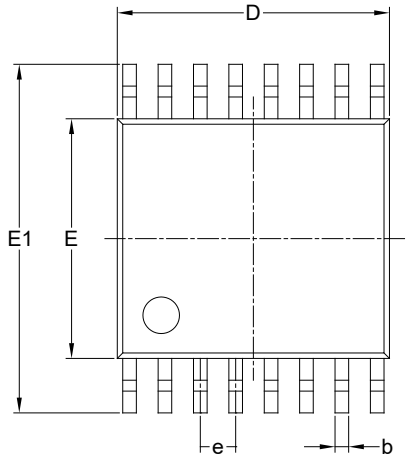
REVISION HISTORY

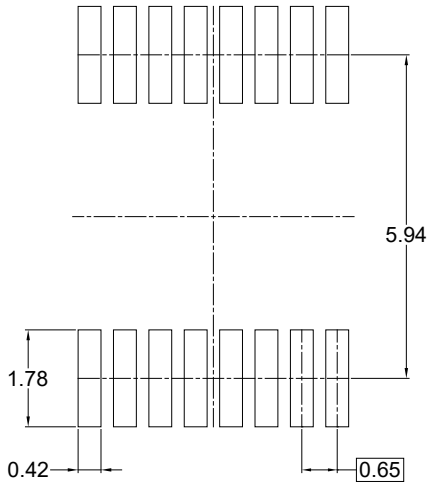
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (DECEMBER 2024) to REV.A	Page
Changed from product preview to production data	All

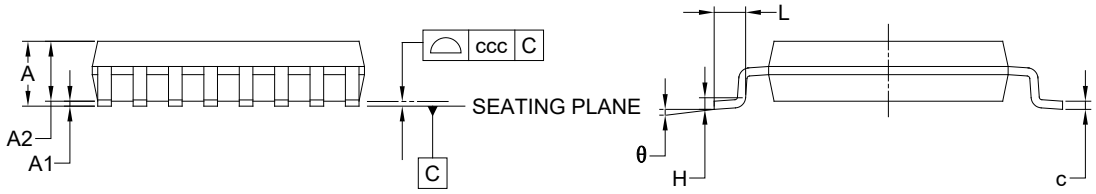
PACKAGE OUTLINE DIMENSIONS

TSSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)

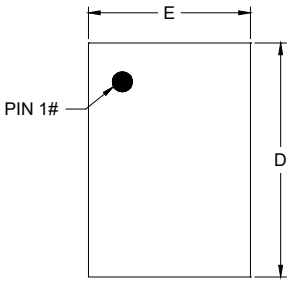


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

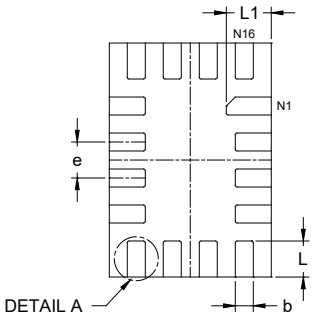
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

PACKAGE OUTLINE DIMENSIONS

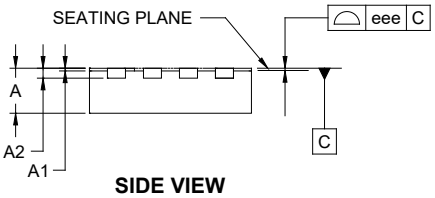
UTQFN-2.6×1.8-16L



TOP VIEW

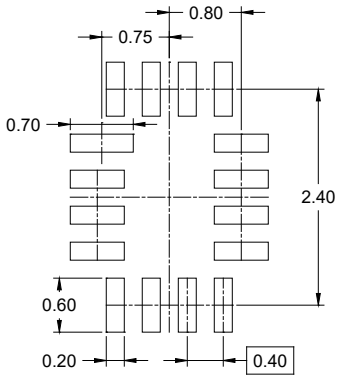


BOTTOM VIEW



SIDE VIEW

DETAIL A
ALTERNATE TERMINAL CONSTRUCTION



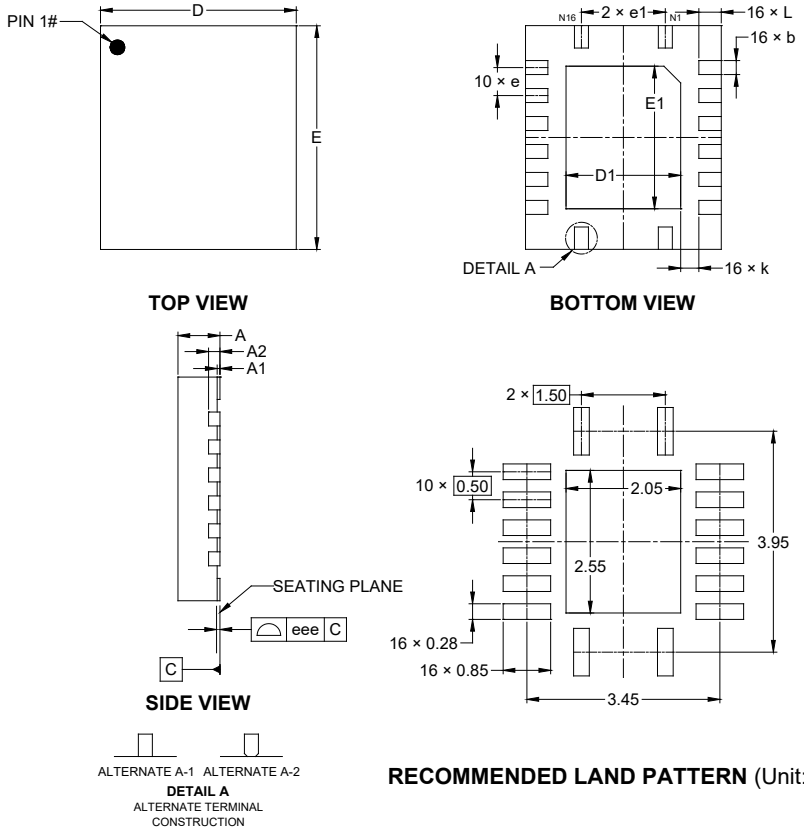
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.450	-	0.550
A1	-0.004	-	0.050
A2	0.110 REF		
b	0.150	-	0.250
D	2.500	-	2.700
E	1.700	-	1.900
e	0.400 BSC		
L	0.300	-	0.500
L1	0.400	-	0.600
eee	0.050		

NOTE: This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

TQFN-3.5×4-16L

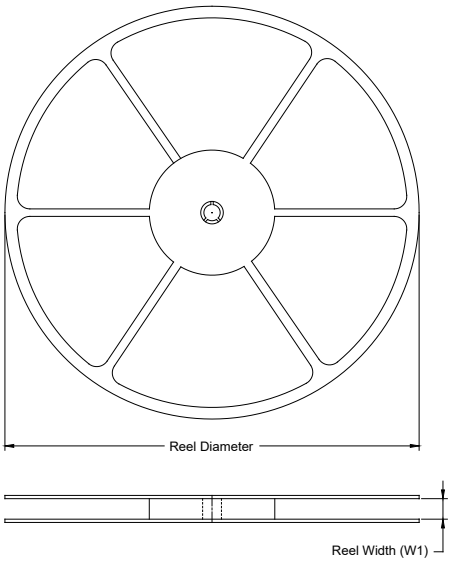


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.700	-	0.800
A1	0.000	-	0.050
A2		0.203 REF	
b	0.200	-	0.300
D	3.400	-	3.600
E	3.900	-	4.100
D1	1.950	-	2.150
E1	2.450	-	2.650
e		0.500 BSC	
e1		1.500 BSC	
k		0.325 REF	
L	0.300	-	0.500
eee		0.080	

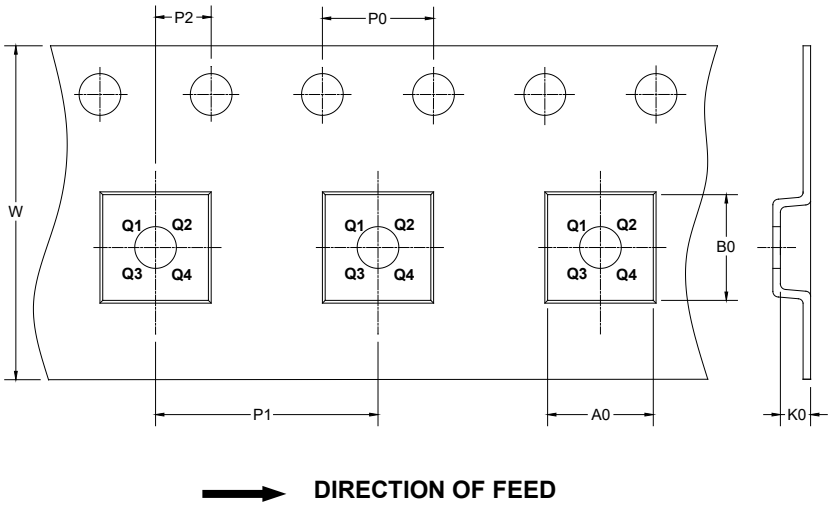
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



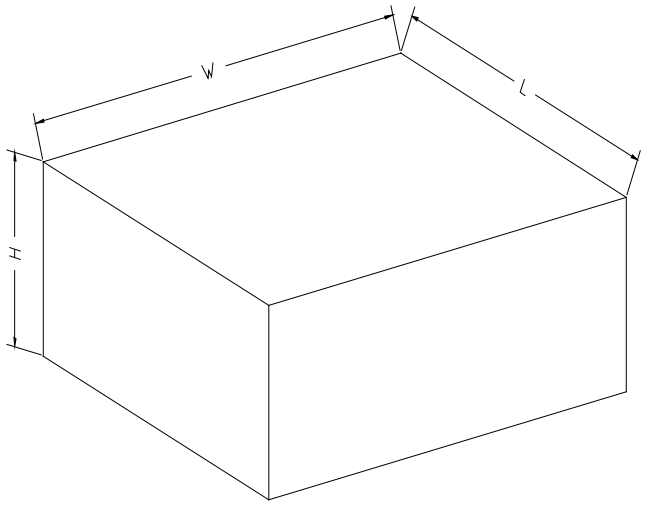
NOTE: The picture is only for reference. Please make the object as the standard.

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
TSSOP-16	13"	12.4	6.80	5.40	1.50	4.0	8.0	2.0	12.0	Q1
UTQFN-2.6×1.8-16L	7"	12.4	2.10	2.90	0.75	4.0	4.0	2.0	12.0	Q1
TQFN-3.5×4-16L	13"	12.4	3.75	4.25	1.05	4.0	8.0	2.0	12.0	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
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002