74AVC4T245Q
4-Bit Dual-Supply Translating Transceiver with Configurable Voltage Translation and 3-State Outputs

GENERAL DESCRIPTION

The 74AVC4T245Q is a 4-bit, dual-supply voltage level transceiver with 3-state outputs and bidirectional level translation. The device can be used as two 2-bit transceivers or one 4-bit transceiver. The nAn and nBn are four data input-output ports. nDIR are the direction control inputs and $n\overline{OE}$ are the output enable inputs. 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 voltage nodes. The nAn, nDIR and $n\overline{OE}$ signals are referenced to V_{CCA} and nBn signals are referenced to V_{CCB}.

When nDIR is set high, it allows transmission from nAn to nBn. When nDIR is set low, it allows transmission from nBn to nAn. $n\overline{OE}$ can be used to make the outputs disabled so that the buses are effectively isolated. In suspend mode, both nAn and nBn are in high-impedance state when either V_{CCA} or V_{CCB} input is at GND level.

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

This device is AEC-Q100 qualified (Automotive Electronics Council Standard Q100 Grade 1) and the use of this device is suitable for automotive applications.

FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  Device Temperature Grade 1
  T_A = -40℃ to +125℃
- **V_{CCA} Supply Voltage Range: 0.8V to 3.6V**
- **V_{CCB} Supply Voltage Range: 0.8V to 3.6V**
- **Inputs Accept Voltages up to 3.6V**
- **+12mA/-12mA Output Current**
- **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)**
- **Outputs in High-Impedance State when V_{CCA} or V_{CCB} = 0V**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green TSSOP-16 Package**

APPLICATIONS

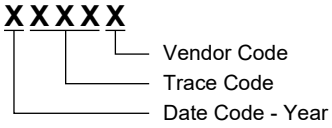
Personal Electronic
Industrial Equipment
Enterprise Infrastructures
Telecom Equipment

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE TOP MARKING	PACKING OPTION
74AVC4T245Q	TSSOP-16	-40℃ to +125℃	74AVC4T245QTS16G/TR	MEATS16 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 (1)

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 (2) ..... -0.5V to 4.6V
Output Voltage Range, V_O (2)
Suspend or 3-State Mode ..... -0.5V to 4.6V
Active Mode
A Ports .....-0.5V to MIN (4.6V, V_{CCA} + 0.5V)
B Ports .....-0.5V to MIN (4.6V, V_{CCB} + 0.5V)
Output Current, I_O (V_O = 0V to V_{CC})
High-State or Low-State .....±50mA
Supply Current, I_{CC}, per V_{CCA} or V_{CCB} Pin 100mA
Ground Current, I_{GND}, per GND Pin .....-100mA
Input Clamp Current, I_{IK} (V_I < 0).....-50mA
Output Clamp Current, I_{OK} (V_O < 0).....-50mA
Junction Temperature (3) .....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility
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
A Ports .....0V to V_{CCA}
B Ports .....0V to V_{CCB}
High-State or Low-State Output Current, I_O .....±12mA
Input Transition Rise or Fall Rate, Δt/ΔV
V_{CCI} = 0.8V to 3.6V..... 5ns/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.

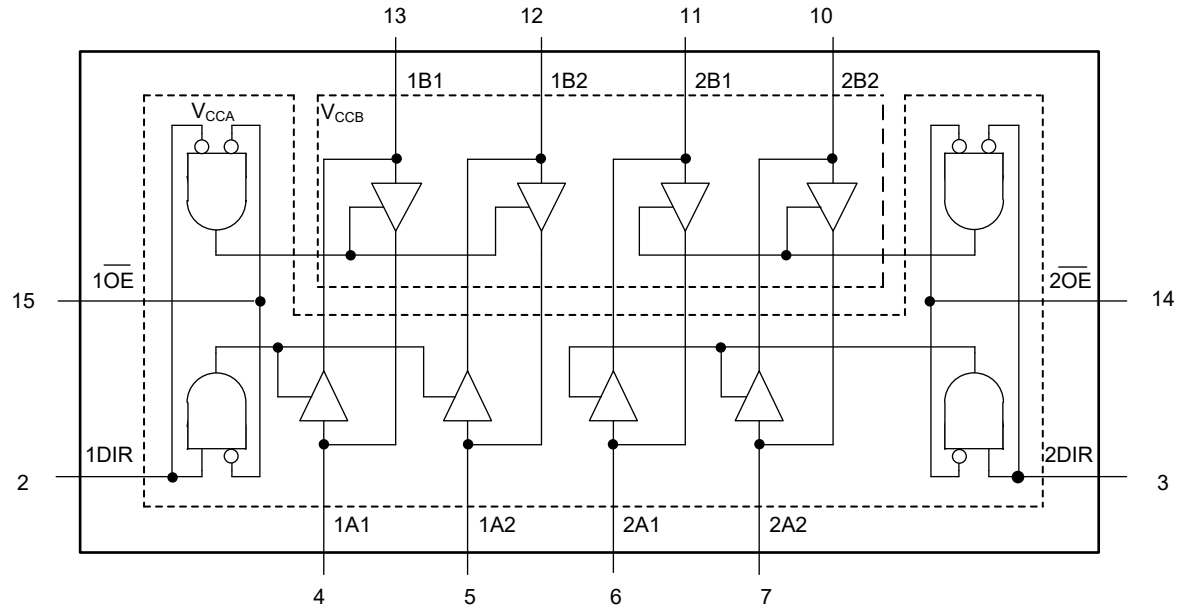
ESD SENSITIVITY CAUTION

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.

LOGIC DIAGRAM



FUNCTION TABLE

SUPPLY VOLTAGE	CONTROL INPUT		INPUT/OUTPUT	
V_{CCA}, V_{CCB} (1)	n$\overline{OE}$	nDIR	nAn	nBn
0.8V to 3.6V	L	L	nAn = nBn	Inputs
0.8V to 3.6V	L	H	Inputs	nBn = nAn
0.8V to 3.6V	H	*X*	Z	Z
GND (2)	*X*	*X*	Z	Z

H = High Voltage Level

L = Low Voltage Level

Z = High-Impedance State

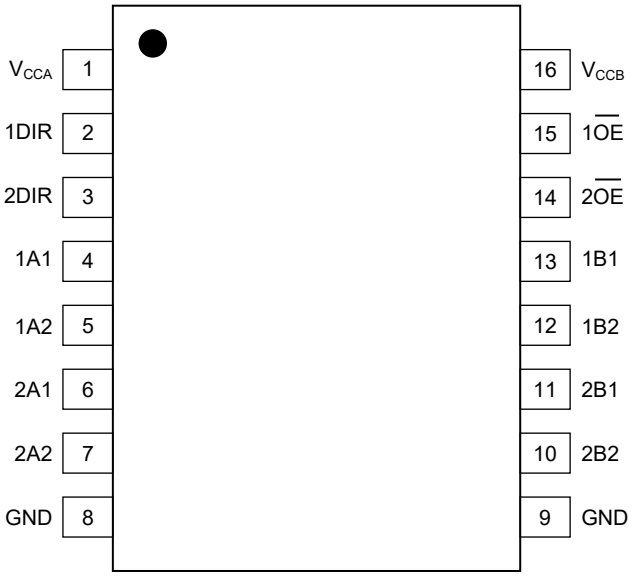
X = Don't Care

NOTES:

1. The nAn, nDIR and n$\overline{OE}$ signals are referenced to V_{CCA}. The nBn signals are referenced to V_{CCB}.
2. If at least one of V_{CCA} or V_{CCB} is at GND level, the device enters suspend mode.

PIN CONFIGURATION

(TOP VIEW)



TSSOP-16

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	V_{CCA}	Supply Voltage V_{CCA}. The nAn, nDIR and $n\overline{OE}$ signals are referenced to V_{CCA}.
2, 3	1DIR, 2DIR	Direction Control Inputs.
4, 5	1A1, 1A2	Data Inputs/Outputs.
6, 7	2A1, 2A2	Data Inputs/Outputs.
8, 9	GND	Ground.
11, 10	2B1, 2B2	Data Inputs/Outputs.
13, 12	1B1, 1B2	Data Inputs/Outputs.
15, 14	$1\overline{OE}$, $2\overline{OE}$	Output Enable Inputs (Active Low).
16	V_{CCB}	Supply Voltage V_{CCB}. The nBn signals are referenced to V_{CCB}.

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are at T_A = +25℃. V_{CCI} is the supply voltage associated with the data input port, V_{CCO} is the supply voltage associated with the data output port, 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			
		nDIR, n$\overline{OE}$ 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			
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	
		nDIR, n$\overline{OE}$ 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_I = V_{IH}	I_O = -100μA, V_{CCA} = V_{CCB} = 0.8V to 3.6V	Full	V_{CCO} - 0.1	V_{CCO} - 0.01		V
			I_O = -3mA, V_{CCA} = V_{CCB} = 1.1V	Full	0.85	0.98		
			I_O = -6mA, V_{CCA} = V_{CCB} = 1.4V	Full	1.05	1.22		
			I_O = -8mA, V_{CCA} = V_{CCB} = 1.65V	Full	1.20	1.43		
			I_O = -9mA, V_{CCA} = V_{CCB} = 2.3V	Full	1.75	2.09		
			I_O = -12mA, V_{CCA} = V_{CCB} = 3.0V	Full	2.30	2.75		
Low-Level Output Voltage	V_{OL}	V_I = V_{IL}	I_O = 100μA, V_{CCA} = V_{CCB} = 0.8V to 3.6V	Full		0.01	0.1	V
			I_O = 3mA, V_{CCA} = V_{CCB} = 1.1V	Full		0.10	0.25	
			I_O = 6mA, V_{CCA} = V_{CCB} = 1.4V	Full		0.16	0.35	
			I_O = 8mA, V_{CCA} = V_{CCB} = 1.65V	Full		0.19	0.45	
			I_O = 9mA, V_{CCA} = V_{CCB} = 2.3V	Full		0.18	0.55	
			I_O = 12mA, V_{CCA} = V_{CCB} = 3.0V	Full		0.23	0.70	

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Leakage Current	I_I	nDIR, $n\overline{OE}$ inputs, V_I = 0V or 3.6V, V_{CCA} = V_{CCB} = 0.8V to 3.6V		Full		±0.01	±5	μA
Off-State Output Current (1)	I_{OZ}	V_{CCA} = V_{CCB} = 3.6V, A or B ports, V_O = 0V or V_{CCO}		Full		±0.01	±5	μA
		V_{CCA} = 3.6V, V_{CCB} = 0V, suspend mode A ports, V_O = 0V or V_{CCO}		Full		±0.01	±5	
		V_O = 0V or V_{CCO}, V_{CCA} = 0V, V_{CCB} = 3.6V		Full		±0.01	±5	
Power-Off Leakage Current	I_{OFF}	V_{CCA} = 0V, V_{CCB} = 0.8V to 3.6V, A ports, V_I or V_O = 0V to 3.6V		Full		±0.01	±5	μA
		V_{CCB} = 0V, V_{CCA} = 0.8V to 3.6V, B ports, V_I or V_O = 0V to 3.6V		Full		±0.01	±5	
Supply Current	I_{CC}	A ports, V_I = 0V or V_{CCI}, I_O = 0A	V_{CCA} = 0.8V to 3.6V, V_{CCB} = 0.8V to 3.6V	Full		1.4	10	μA
			V_{CCA} = 1.1V to 3.6V, V_{CCB} = 1.1V to 3.6V	Full		1.2	10	
			V_{CCA} = 3.6V, V_{CCB} = 0V	Full		0.01	5	
			V_{CCA} = 0V, V_{CCB} = 3.6V	Full		0.01	5	
		B ports, V_I = 0V or V_{CCI}, I_O = 0A	V_{CCA} = 0.8V to 3.6V, V_{CCB} = 0.8V to 3.6V	Full		0.8	10	μA
			V_{CCA} = 1.1V to 3.6V, V_{CCB} = 1.1V to 3.6V	Full		0.7	10	
			V_{CCA} = 3.6V, V_{CCB} = 0V	Full		0.01	5	
			V_{CCA} = 0V, V_{CCB} = 3.6V	Full		0.01	5	
		A plus B ports (I_{CCA} + I_{CCB}), I_O = 0A, V_I = 0V or V_{CCI}, V_{CCA} = 0.8V to 3.6V, V_{CCB} = 0.8V to 3.6V		Full		1.4	15	μA
		A plus B ports (I_{CCA} + I_{CCB}), I_O = 0A, V_I = 0V or V_{CCI}, V_{CCA} = 1.1V to 3.6V, V_{CCB} = 1.1V to 3.6V		Full		1.2	15	μA
Input Capacitance	C_I	nDIR, $n\overline{OE}$ inputs, V_I = 0V or 3.3V, V_{CCA} = V_{CCB} = 3.3V		+25℃		3.2		pF
Input/Output Capacitance	$C_{I/O}$	A and B ports, suspend mode, V_O = V_{CCO} or GND, V_{CCA} = V_{CCB} = 3.3V		+25℃		4.5		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	0.01	0.01	0.01	0.01	0.01	0.01	μA
0.8V	0.01	0.01	0.01	0.01	0.03	0.20	0.60	μA
1.2V	0.01	0.01	0.01	0.01	0.01	0.10	0.40	μA
1.5V	0.01	0.01	0.01	0.01	0.01	0.03	0.30	μA
1.8V	0.01	0.05	0.01	0.01	0.01	0.01	0.20	μA
2.5V	0.01	0.40	0.20	0.06	0.02	0.01	0.02	μA
3.3V	0.01	1.10	0.70	0.50	0.30	0.03	0.01	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 nAn to nBn), output enabled	2.0	2.0	2.1	2.2	2.4	2.7	pF
		A ports: (direction nAn to nBn), output disabled	0.6	0.7	0.7	0.7	0.8	0.9	
		A ports: (direction nBn to nAn), output enabled	16.0	16.1	16.2	16.3	16.5	16.7	
		A ports: (direction nBn to nAn), output disabled	1.4	1.3	1.4	1.4	1.6	1.7	
		B ports: (direction nAn to nBn), output enabled	16.0	16.1	16.2	16.3	16.5	16.7	
		B ports: (direction nAn to nBn), output disabled	1.4	1.3	1.4	1.4	1.6	1.7	
		B ports: (direction nBn to nAn), output enabled	2.0	2.0	2.1	2.2	2.4	2.7	
		B ports: (direction nBn to nAn), output disabled	0.6	0.7	0.7	0.7	0.8	0.9	

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℃

(For test circuit, see Figure 1, for waveforms see Figure 2 and Figure 3, 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}	nAn to nBn	31.9	11.1	9.8	9.5	9.7	10.2	ns
		nBn to nAn	33.8	21.0	18.0	17.7	17.2	17.1	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	30.6	30.5	30.6	32.6	32.5	39.0	ns
		n$\overline{OE}$ to nBn	31.2	20.2	19.3	19.4	18.8	19.8	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	44.4	44.2	44.2	44.2	44.4	44.3	ns
		n$\overline{OE}$ to nBn	38.4	18.2	16.9	16.6	16.8	17.8	

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℃

(For test circuit, see Figure 1, for waveforms see Figure 2 and Figure 3, 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}	nAn to nBn	30.2	26.6	25.9	24.6	24.1	24.0	ns
		nBn to nAn	32.0	11.1	9.8	9.4	9.4	9.9	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	30.5	9.0	6.3	5.8	4.3	5.5	ns
		n$\overline{OE}$ to nBn	31.1	21.5	20.1	21.1	20.6	26.7	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	44.3	10.4	6.5	5.0	3.8	3.3	ns
		n$\overline{OE}$ to nBn	38.9	30.5	29.0	28.1	27.8	27.5	

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)

Dynamic Characteristics

(For test circuit, see Figure 1, for waveforms see Figure 2 and Figure 3. Full = -40℃ to +125℃, all typical values are 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}	nAn to nBn	0.5	8.9	15.0	0.5	6.5	10.5	0.5	5.9	9.4	ns
		nBn to nAn	0.5	8.9	14.9	0.3	7.6	12.3	0.1	7.1	11.7	
Disable Time	t_{DIS}	$n\overline{OE}$ to nAn	1.8	10.5	15.0	1.8	10.2	15.4	1.8	10.5	15.8	ns
		$n\overline{OE}$ to nBn	1.9	10.0	15.2	1.9	8.4	12.3	1.9	8.0	11.7	
Enable Time	t_{EN}	$n\overline{OE}$ to nAn	1.4	12.6	20.3	1.4	12.9	20.3	1.4	13.2	20.4	ns
		$n\overline{OE}$ to nBn	1.1	11.1	17.5	1.1	8.9	13.2	1.1	8.3	12.0	
V_{CCA} = 1.4V to 1.6V												
Propagation Delay (2)	t_{PD}	nAn to nBn	0.3	7.4	12.1	0.3	5.4	8.4	0.3	4.7	7.4	ns
		nBn to nAn	0.5	6.4	10.4	0.3	5.3	8.4	0.1	4.8	7.6	
Disable Time	t_{DIS}	$n\overline{OE}$ to nAn	1.8	6.9	11.8	1.8	6.3	11.8	1.5	7.4	11.8	ns
		$n\overline{OE}$ to nBn	1.9	7.7	13.0	1.9	6.0	11.9	1.9	5.6	10.6	
Enable Time	t_{EN}	$n\overline{OE}$ to nAn	1.1	7.1	10.9	1.1	7.3	11.0	0.7	7.5	11.0	ns
		$n\overline{OE}$ to nBn	1.4	8.9	11.1	1.1	6.6	9.0	0.9	5.7	9.0	
V_{CCA} = 1.65V to 1.95V												
Propagation Delay (2)	t_{PD}	nAn to nBn	0.1	7.0	11.7	0.1	4.8	7.7	0.1	4.1	6.6	ns
		nBn to nAn	0.5	5.8	9.3	0.3	4.7	7.0	0.1	4.1	6.5	
Disable Time	t_{DIS}	$n\overline{OE}$ to nAn	1.8	6.0	11.8	1.6	5.2	10.0	1.8	5.5	10.0	ns
		$n\overline{OE}$ to nBn	1.7	7.2	12.5	1.7	5.3	11.4	1.6	5.1	10.1	
Enable Time	t_{EN}	$n\overline{OE}$ to nAn	1.0	5.4	8.5	1.0	5.5	8.5	1.0	5.4	8.5	ns
		$n\overline{OE}$ to nBn	1.2	8.1	13.4	1.2	5.6	10.7	1.0	5.1	8.7	
V_{CCA} = 2.3V to 2.7V												
Propagation Delay (2)	t_{PD}	nAn to nBn	0.1	6.6	11.1	0.1	4.4	7.1	0.1	3.7	5.9	ns
		nBn to nAn	0.5	5.2	8.4	0.3	4.1	6.2	0.1	3.5	5.5	
Disable Time	t_{DIS}	$n\overline{OE}$ to nAn	4.3	5.0	7.4	1.0	4.1	7.4	1.0	4.9	7.4	ns
		$n\overline{OE}$ to nBn	6.7	6.7	12.0	1.5	4.8	10.9	1.3	4.5	9.6	
Enable Time	t_{EN}	$n\overline{OE}$ to nAn	0.7	3.7	5.8	0.7	3.8	5.8	0.7	3.8	5.8	ns
		$n\overline{OE}$ to nBn	0.9	7.3	12.9	0.9	4.9	10.2	0.8	4.3	8.2	
V_{CCA} = 3.0V to 3.6V												
Propagation Delay (2)	t_{PD}	nAn to nBn	0.1	6.4	10.8	0.1	4.3	6.8	0.1	3.6	5.7	ns
		nBn to nAn	0.5	5.2	8.3	0.3	3.9	5.8	0.3	3.3	5.0	
Disable Time	t_{DIS}	$n\overline{OE}$ to nAn	0.7	3.8	6.7	0.7	3.7	6.7	0.7	3.9	6.7	ns
		$n\overline{OE}$ to nBn	1.4	6.6	11.8	1.4	4.7	10.8	1.2	4.3	9.5	
Enable Time	t_{EN}	$n\overline{OE}$ to nAn	0.6	3.2	4.7	0.6	3.1	4.7	0.6	3.2	4.7	ns
		$n\overline{OE}$ to nBn	0.8	7.2	12.9	0.8	4.6	10.1	0.6	4.0	8.0	

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)

Dynamic Characteristics

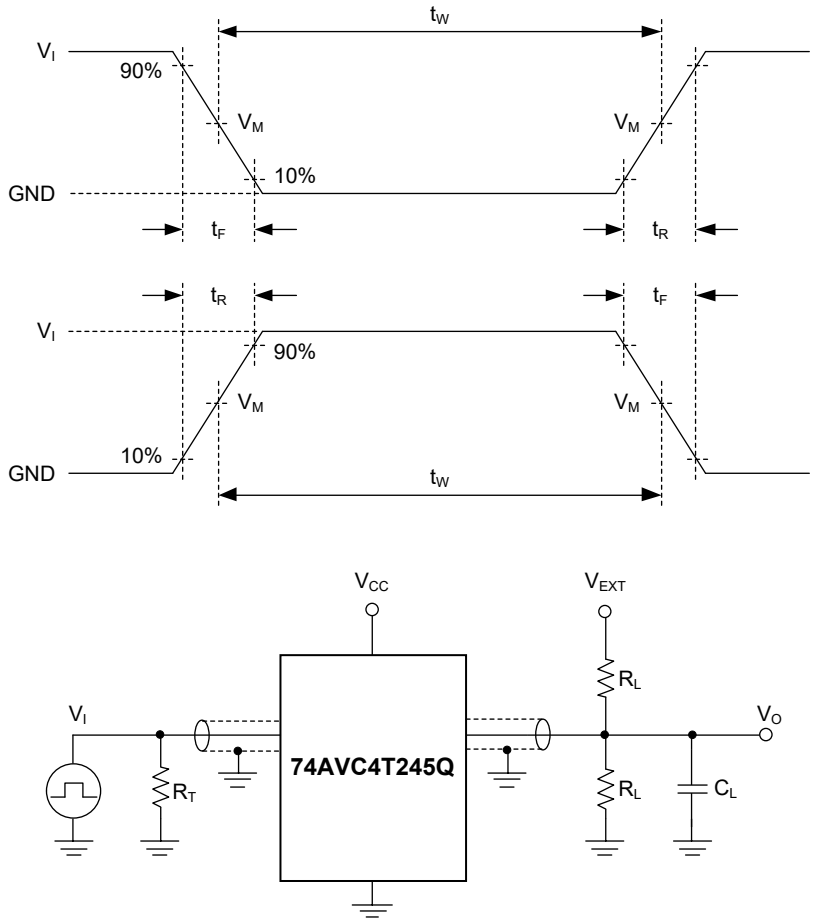
(For test circuit, see Figure 1, for waveforms see Figure 2 and Figure 3. Full = -40℃ to +125℃, all typical values are at T_A = +25℃, unless otherwise noted.)

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}	nAn to nBn	0.5	5.3	8.5	0.5	5.1	8.4	ns
		nBn to nAn	0.1	6.6	11.1	0.1	6.4	10.7	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	1.8	10.2	15.5	1.8	11.2	16.0	ns
		n$\overline{OE}$ to nBn	1.4	7.4	10.8	1.2	8.7	12.4	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	1.4	14.5	22.5	1.4	15.9	23.4	ns
		n$\overline{OE}$ to nBn	1.0	7.7	11.2	1.0	7.6	11.1	
V_{CCA} = 1.4V to 1.6V									
Propagation Delay (2)	t_{PD}	nAn to nBn	0.3	4.1	6.2	0.3	3.9	5.8	ns
		nBn to nAn	0.1	4.3	6.9	0.1	4.2	6.7	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	1.3	6.3	11.8	1.6	8.3	11.8	ns
		n$\overline{OE}$ to nBn	1.4	5.0	8.7	1.2	5.3	8.9	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	0.7	7.7	11.1	0.4	8.1	11.9	ns
		n$\overline{OE}$ to nBn	0.9	5.4	7.9	0.9	5.2	7.7	
V_{CCA} = 1.65V to 1.95V									
Propagation Delay (2)	t_{PD}	nAn to nBn	0.1	3.5	5.4	0.3	3.3	5.1	ns
		nBn to nAn	0.1	3.7	5.9	0.1	3.6	5.7	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	1.3	5.1	10.0	1.6	6.5	10.0	ns
		n$\overline{OE}$ to nBn	1.2	4.4	8.1	1.0	4.7	8.1	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	0.6	5.5	8.5	0.4	5.9	8.6	ns
		n$\overline{OE}$ to nBn	0.8	5.8	7.7	0.8	5.5	7.3	
V_{CCA} = 2.3V to 2.7V									
Propagation Delay (2)	t_{PD}	nAn to nBn	0.2	3.1	4.7	0.1	2.8	4.5	ns
		nBn to nAn	0.2	3.1	4.8	0.1	3.0	4.6	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	1.0	3.9	7.4	1.0	5.0	7.4	ns
		n$\overline{OE}$ to nBn	1.1	3.8	7.4	0.9	4.2	6.3	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	0.6	3.9	5.8	0.4	3.9	5.8	ns
		n$\overline{OE}$ to nBn	0.6	3.6	5.8	0.6	3.4	4.9	
V_{CCA} = 3.0V to 3.6V									
Propagation Delay (2)	t_{PD}	nAn to nBn	0.1	3.0	4.5	0.1	2.7	4.1	ns
		nBn to nAn	0.1	2.9	4.5	0.1	2.8	4.2	
Disable Time	t_{DIS}	n$\overline{OE}$ to nAn	0.7	3.7	6.7	0.7	4.4	6.7	ns
		n$\overline{OE}$ to nBn	1.0	3.8	7.6	0.8	4.0	7.4	
Enable Time	t_{EN}	n$\overline{OE}$ to nAn	0.6	3.2	4.7	0.4	3.3	4.7	ns
		n$\overline{OE}$ to nBn	0.5	3.3	5.7	0.5	3.1	4.7	

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 used to measure switching time.

Figure 1. Test Circuit for Measuring Switching Times

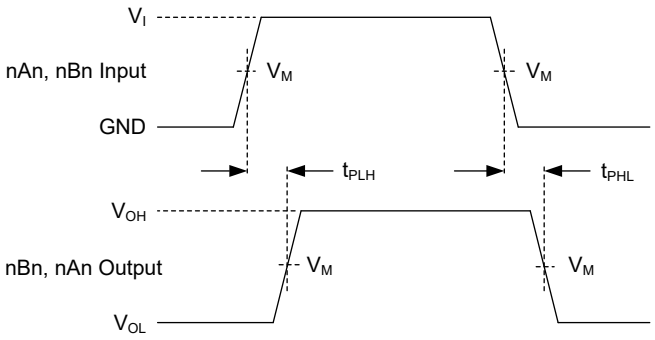
Table 1. Test Conditions

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

WAVEFORMS

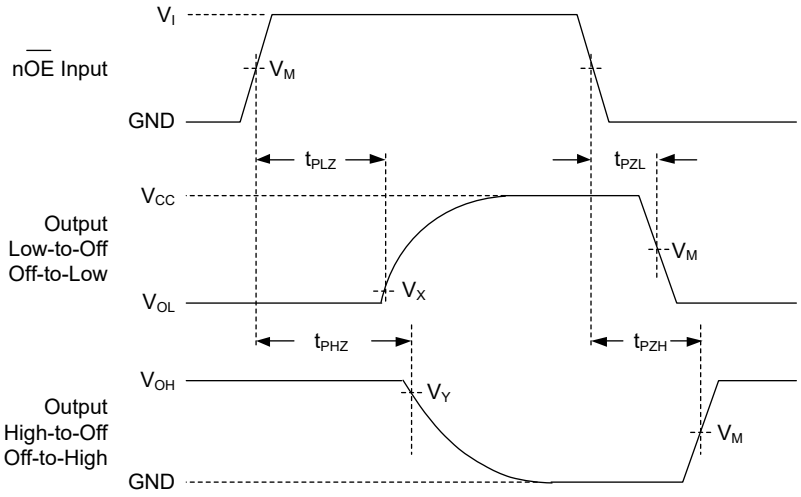


Test conditions are given in Table 1.

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, nBn) to Output (nBn, nAn) 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 port.
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 port.

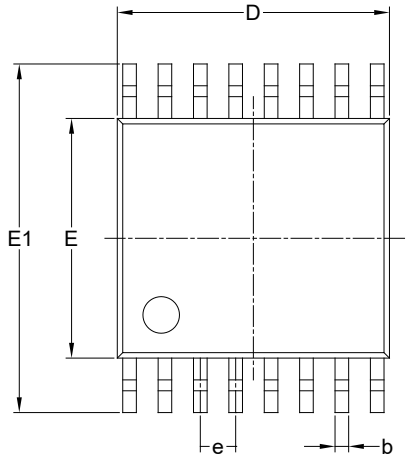
REVISION HISTORY

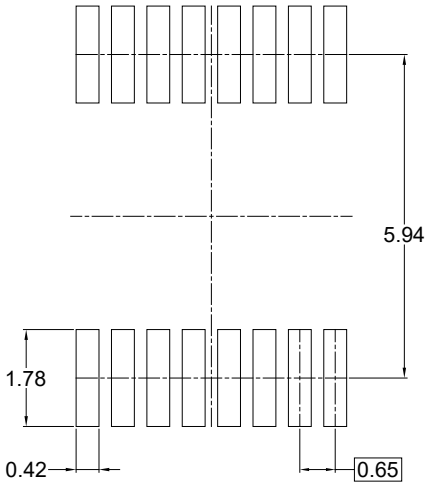
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (SEPTEMBER 2022) to REV.A	Page
Changed from product preview to production data	All

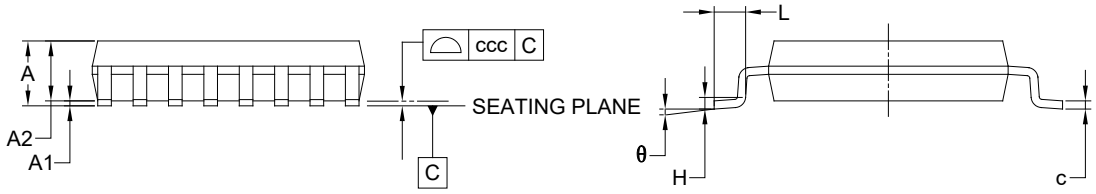
PACKAGE OUTLINE DIMENSIONS

TSSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)

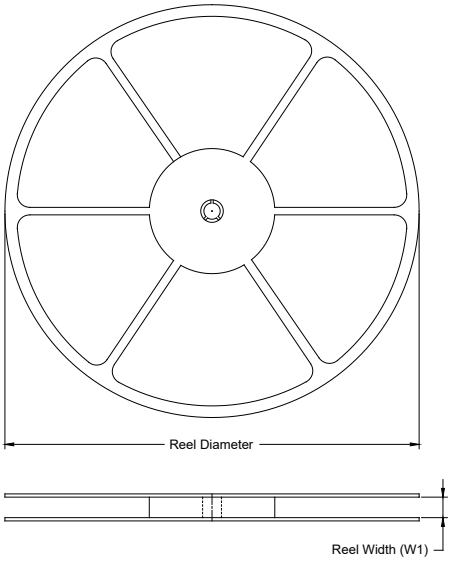


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

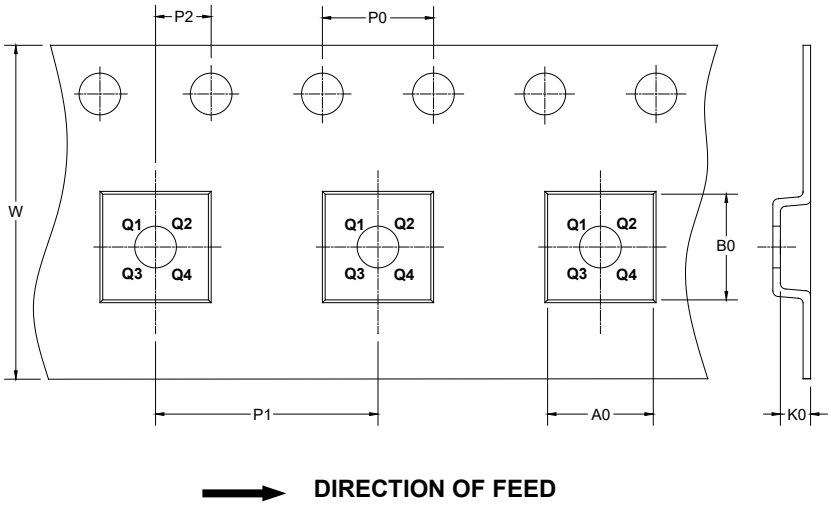
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



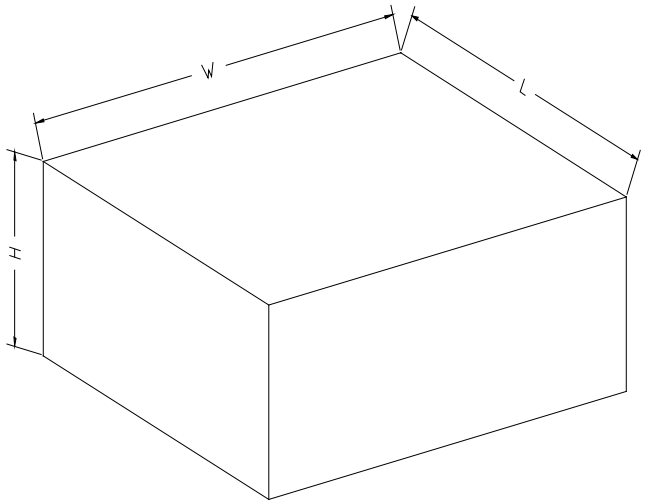
NOTE: The picture is only for reference. Please make the object as the standard.

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

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