74ALVC164245
16-Bit Dual-Supply Translating Transceiver with 3-State Outputs

GENERAL DESCRIPTION

The 74ALVC164245 is a 16-bit dual-supply translating transceiver with 3-state outputs. It is CMOS device that features high-performance, low-power, low-voltage and surpasses most advanced CMOS compatible TTL series. The inputs from 3V and 5V make this device can be used as a translator in a mixed 3V and 5V system environment.

The device can be used as two 8-bit transceivers or as a 16-bit transceiver. The nAn and nBn are four 8-bit input and output ports. nDIR are the direction control inputs and $n\overline{OE}$ are the output-enable inputs. V_{CCA} and V_{CCB} are dual-supply pins. The supply voltage of V_{CCA} and V_{CCB} can range from 1.5V to 3.6V and 1.5V to 5.5V. nAn, $n\overline{OE}$ and nDIR are referenced to V_{CCA} and pins nBn 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. When the output-enable ($n\overline{OE}$) input is high, both nAn and nBn ports are disabled by placing them in a high-impedance state.

In suspend mode, when V_{CCA} or V_{CCB} is 0V, there is no current flow from the non-zero supply to the zero supply. V_{CCA} must be less than or equal to V_{CCB} for proper device operation, except in suspend mode.

FEATURES

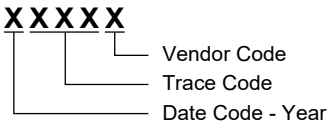
- **V_{CCA} Supply Voltage Range: 1.5V to 3.6V**
- **V_{CCB} Supply Voltage Range: 1.5V to 5.5V**
- **Inputs Accept Voltages up to 5.5V**
- **Control Inputs Voltage Range: 2.7V to 5.5V**
- **CMOS Low Power Dissipation**
- **Direct Interface with TTL Levels**
- **Outputs in High-Impedance State when V_{CCA} or V_{CCB} = 0V**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green TSSOP-48 Package**

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
74ALVC164245	TSSOP-48	-40℃ to +125℃	74ALVC164245XTS48G/TR	74ALVC164245 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, V_{CCB} ($V_{CCB} \geq V_{CCA}$) ..... -0.5V to 6.5V
Supply Voltage, V_{CCA} ($V_{CCB} \geq V_{CCA}$) ..... -0.5V to 4.6V
Control Input Voltage, V_I (2) ..... -0.5V to 6.5V
Input/Output Voltage, $V_{I/O}$ (2) ..... -0.5V to (V_{CC} + 0.5V)
Output Voltage Range, V_O (2)
High-Impedance State ..... -0.5V to 6.5V
High-State or Low-State
nAn ports ..... -0.5V to MIN (4.6V, V_{CCA} + 0.5V)
nBn ports ..... -0.5V to MIN (6.5V, V_{CCB} + 0.5V)
Input Clamping Current, I_{IK} (V_I < 0V) ..... -50mA
Output Clamping Current, I_{OK} (V_O > V_{CC} or V_O < 0V) ..... ±50mA
Output Sink/Source Current, $I_{O(SINK/SOURCE)}$ (V_O = 0V to V_{CC}) ..... ±50mA
Supply Current, I_{CC} 100mA
Ground Current, I_{GND} ..... -100mA
Junction Temperature (3) ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 8000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage, V_{CCB} ($V_{CCB} \geq V_{CCA}$)
Maximum Speed Performance ..... 2.7V to 5.5V
Low-Voltage Applications ..... 1.5V to 5.5V
Supply Voltage, V_{CCA} ($V_{CCB} \geq V_{CCA}$)
Maximum Speed Performance ..... 2.7V to 3.6V
Low-Voltage Applications ..... 1.5V to 3.6V
Control Input Voltage ($n\overline{OE}$ and nDIR), V_I ..... 0V to 5.5V
Input/Output Voltage, $V_{I/O}$
nAn Ports ..... 0V to V_{CCA}
nBn Ports ..... 0V to V_{CCB}
Input Transition Rise and Fall Rate, Δt/ΔV
V_{CCA} = 2.7V to 3.0V ..... 20ns/V (MAX)
V_{CCA} = 3.0V to 3.6V ..... 10ns/V (MAX)
V_{CCB} = 3.0V to 4.5V ..... 20ns/V (MAX)
V_{CCB} = 4.5V to 5.5V ..... 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.

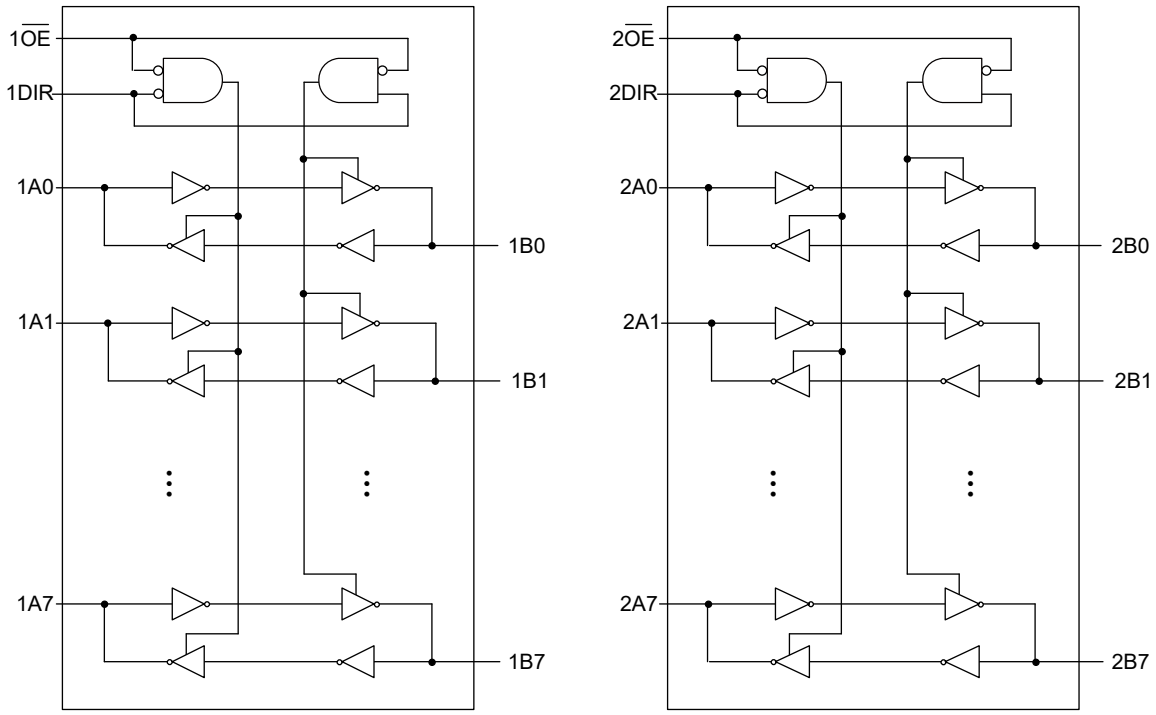
ESD SENSITIVITY CAUTION

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.

LOGIC SYMBOL



FUNCTION TABLE

CONTROL INPUT		INPUT/OUTPUT	
n$\overline{OE}$	**nDIR**	**nAn**	**nBn**
L	L	nAn = nBn	Inputs
L	H	Inputs	nBn = nAn
H	*X*	Z	Z

H = High Voltage Level

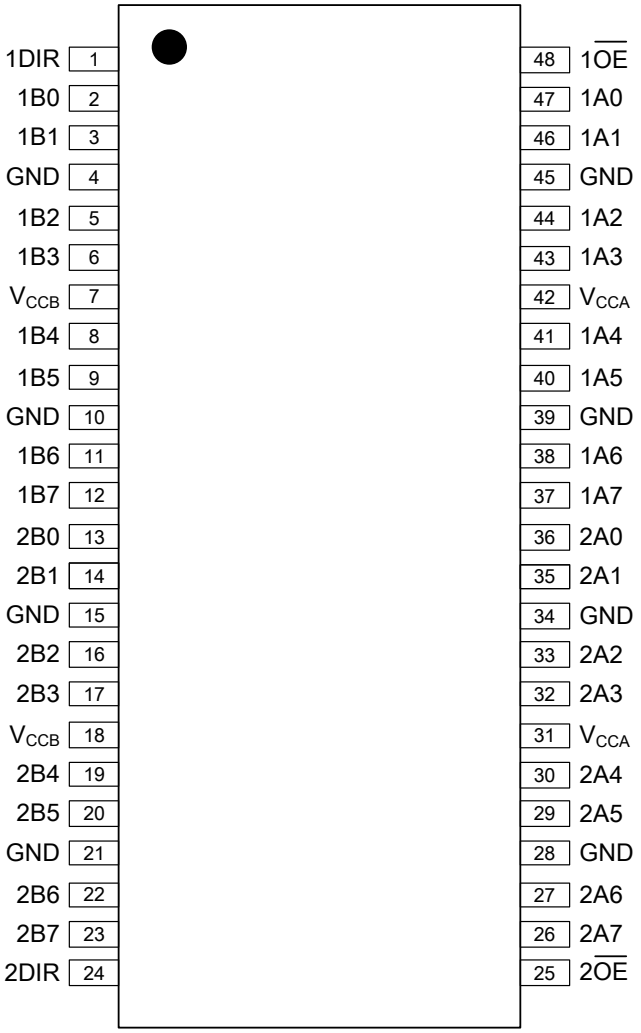
L = Low Voltage Level

Z = High-Impedance State

X = Don't Care

PIN CONFIGURATION

(TOP VIEW)



TSSOP-48

PIN DESCRIPTION

PIN	NAME	FUNCTION
1, 24	1DIR, 2DIR	Direction Control Inputs.
2, 3, 5, 6, 8, 9, 11, 12	1B0, 1B1, 1B2, 1B3, 1B4, 1B5, 1B6, 1B7	Data Inputs/Outputs.
13, 14, 16, 17, 19, 20, 22, 23	2B0, 2B1, 2B2, 2B3, 2B4, 2B5, 2B6, 2B7	Data Inputs/Outputs.
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground.
7, 18	V_{CCB}	Supply Voltage V_{CCB} (5V Bus).
48, 25	$1\overline{OE}$, $2\overline{OE}$	Output-Enable Inputs (Active Low).
47, 46, 44, 43, 41, 40, 38, 37	1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7	Data Inputs/Outputs.
36, 35, 33, 32, 30, 29, 27, 26	2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7	Data Inputs/Outputs.
31, 42	V_{CCA}	Supply Voltage V_{CCA} (3V Bus).

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are at V_{CCB} = 5.0V, V_{CCA} = 3.3V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
High-Level Input Voltage	V_{IH}	nBn ports, V_{CCB} = 3.0V to 5.5V (1)		Full	2			V
		nAn ports, $n\overline{OE}$ and nDIR	V_{CCA} = 3.0V to 3.6V	Full	2			
			V_{CCA} = 2.3V to 2.7V (1)	Full	1.7			
Low-Level Input Voltage	V_{IL}	nBn ports	V_{CCB} = 4.5V to 5.5V (1)	Full			0.8	V
			V_{CCB} = 3.0V to 3.6V (1)	Full			0.7	
		nAn ports, $n\overline{OE}$ and nDIR	V_{CCA} = 3.0V to 3.6V	Full			0.8	
			V_{CCA} = 2.3V to 2.7V (1)	Full			0.7	
High-Level Output Voltage	V_{OH}	nBn ports, $V_I = V_{IH}$	I_O = -24mA, V_{CCB} = 4.5V	Full	V_{CCB} - 0.6			V
			I_O = -12mA, V_{CCB} = 4.5V	Full	V_{CCB} - 0.3			
			I_O = -18mA, V_{CCB} = 3.0V	Full	V_{CCB} - 0.6			
			I_O = -100μA, V_{CCB} = 3.0V	Full	V_{CCB} - 0.05			
		nAn ports, $V_I = V_{IH}$	I_O = -24mA, V_{CCA} = 3.0V	Full	V_{CCA} - 0.8			
			I_O = -100μA, V_{CCA} = 3.0V	Full	V_{CCA} - 0.05			
			I_O = -12mA, V_{CCA} = 2.7V	Full	V_{CCA} - 0.45			
			I_O = -8mA, V_{CCA} = 2.3V	Full	V_{CCA} - 0.35			
			I_O = -100μA, V_{CCA} = 2.3V	Full	V_{CCA} - 0.05			
Low-Level Output Voltage	V_{OL}	nBn ports, $V_I = V_{IL}$	I_O = 24mA, V_{CCB} = 4.5V	Full			0.6	V
			I_O = 12mA, V_{CCB} = 4.5V	Full			0.35	
			I_O = 100μA, V_{CCB} = 4.5V	Full			0.05	
			I_O = 18mA, V_{CCB} = 3.0V	Full			0.55	
			I_O = 100μA, V_{CCB} = 3.0V	Full			0.05	
		nAn ports, $V_I = V_{IL}$	I_O = 24mA, V_{CCA} = 3.0V	Full			0.7	
			I_O = 100μA, V_{CCA} = 3.0V	Full			0.05	
			I_O = 12mA, V_{CCA} = 2.7V	Full			0.4	
			I_O = 12mA, V_{CCA} = 2.3V	Full			0.45	
			I_O = 100μA, V_{CCA} = 2.3V	Full			0.05	
Input Leakage Current	I_I	V_I = 5.5V or GND		Full		±0.1	2	μA
Off-State Output Current (1)	I_{OZ}	$V_I = V_{IH}$ or V_{IL}, $V_O = V_{CC}$ or GND		Full		±0.1	5	μA
Supply Current	I_{CC}	$V_I = V_{CC}$ or GND, I_O = 0A		Full		0.1	10	μA
Additional Supply Current	ΔI_{CC}	Any one data input at V_{CC} - 0.6V, others at V_{CC} or GND, I_O = 0A		Full		0.1	20	μA
Input Capacitance	C_I			+25℃		4		pF
Input/Output Capacitance	$C_{I/O}$	nAn and nBn ports		+25℃		5		pF

NOTE:

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

DYNAMIC CHARACTERISTICS

(For test circuit, see Figure 1. All typical values are measured at V_{CCB} = 5.0V, V_{CCA} = 3.3V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Propagation Delay (1)	t_{PD}	nAn to nBn, see Figure 2	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25℃		6.2		ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25℃		5		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25℃		4.7		
		nBn to nAn, see Figure 2	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25℃		5.9		
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25℃		4.7		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25℃		4.5		
Enable Time (1)	t_{EN}	$n\overline{OE}$ to nBn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25℃		6.3		ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25℃		5		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25℃		4.6		
		$n\overline{OE}$ to nAn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25℃		8		
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25℃		6.6		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25℃		5.8		
Disable Time (1)	t_{DIS}	$n\overline{OE}$ to nBn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25℃		6.7		ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25℃		6.8		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25℃		7.8		
		$n\overline{OE}$ to nAn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25℃		7.7		
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25℃		7.3		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25℃		6.5		
Power Dissipation Capacitance (2)	C_{PD}	Outputs enabled	5V port: nAn to nBn, V_I = GND to V_{CC}, V_{CCB} = 5V, V_{CCA} = 3.3V	+25℃		15		pF
		Outputs disabled		+25℃		5		
		Outputs enabled	3V port: nBn to nAn, V_I = GND to V_{CC}, V_{CCB} = 5V, V_{CCA} = 3.3V	+25℃		15		
		Outputs disabled		+25℃		5		

NOTES:

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

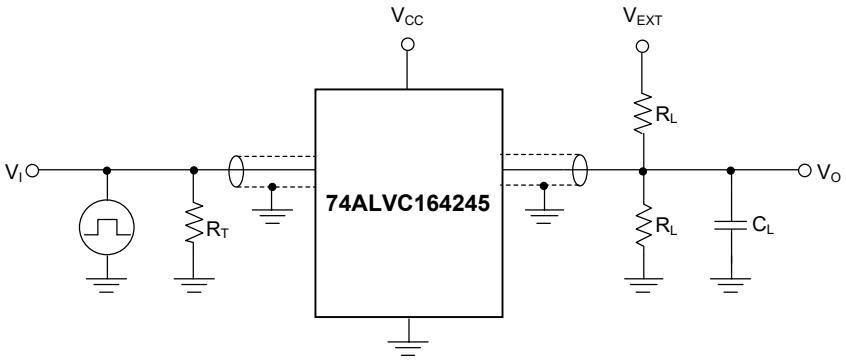
   C_L = Output load capacitance in pF.

   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.

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).

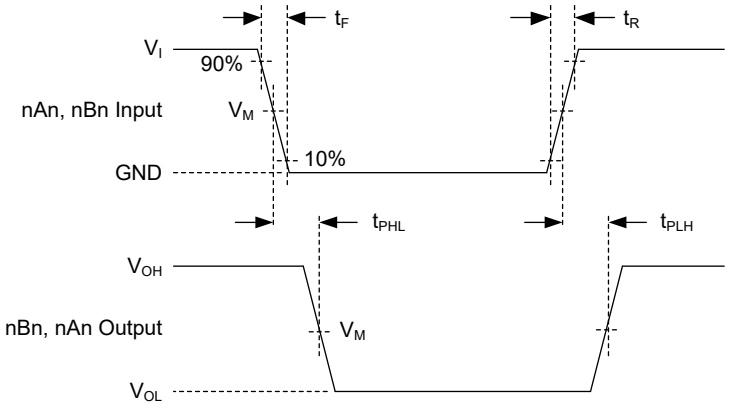
V_{EXT}: External voltage used to measure switching time.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

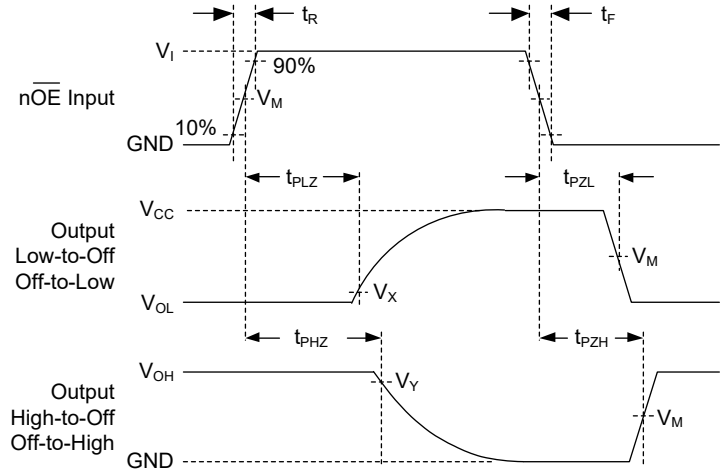
DIRECTION	SUPPLY VOLTAGE		LOAD		V_{EXT}		
	V_{CCA}	V_{CCB}	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
nAn ports to nBn ports	2.3V to 2.7V	2.7V to 3.6V	50pF	500Ω	Open	GND	2 × V_{CC}
nBn ports to nAn ports	2.3V to 2.7V	2.7V to 3.6V	50pF	500Ω	Open	GND	6.0V
nAn ports to nBn ports	2.7V to 3.6V	4.5V to 5.5V	50pF	500Ω	Open	GND	2 × V_{CC}
nBn ports to nAn ports	2.7V to 3.6V	4.5V to 5.5V	50pF	500Ω	Open	GND	6.0V

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

DIRECTION	SUPPLY VOLTAGE		INPUT			OUTPUT		
	V_{CCA}	V_{CCB}	V_I	V_M (1)	t_R, t_F	V_M	V_X	V_Y
nAn ports to nBn ports	2.3V to 2.7V	2.7V to 3.6V	V_{CCA}	0.5 × V_{CCA}	≤ 2.5ns	1.5V	V_{OLB} + 0.3V	V_{OHB} - 0.3V
nBn ports to nAn ports	2.3V to 2.7V	2.7V to 3.6V	2.7V	1.5V	≤ 2.5ns	0.5 × V_{CCA}	V_{OLA} + 0.15V	V_{OHA} - 0.15V
nAn ports to nBn ports	2.7V to 3.6V	4.5V to 5.5V	2.7V	1.5V	≤ 2.5ns	0.5 × V_{CCB}	0.2 × V_{CCB}	0.8 × V_{CCB}
nBn ports to nAn ports	2.7V to 3.6V	4.5V to 5.5V	3.0V	1.5V	≤ 2.5ns	1.5V	V_{OLA} + 0.3V	V_{OHA} - 0.3V

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

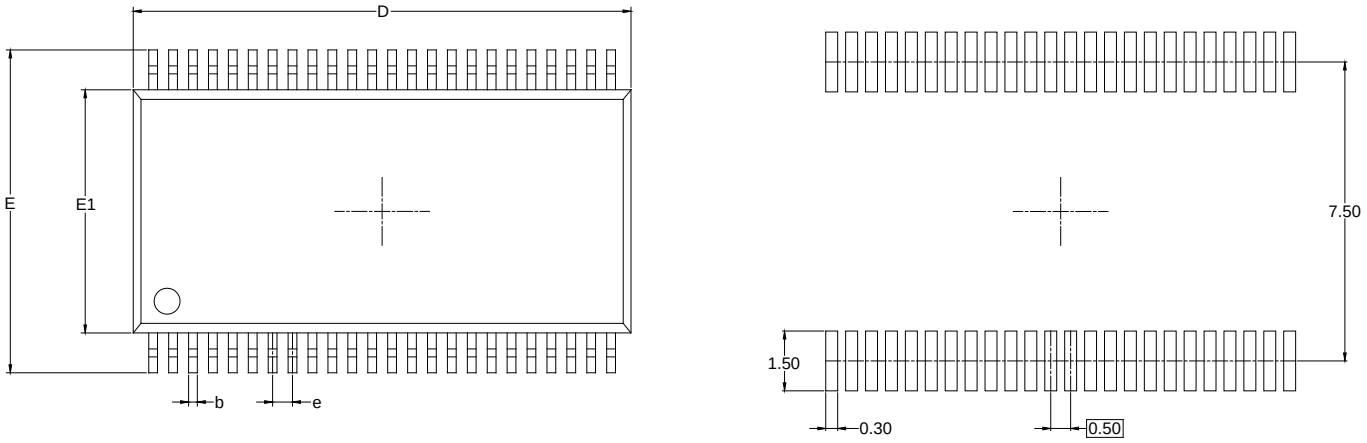
REVISION HISTORY

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

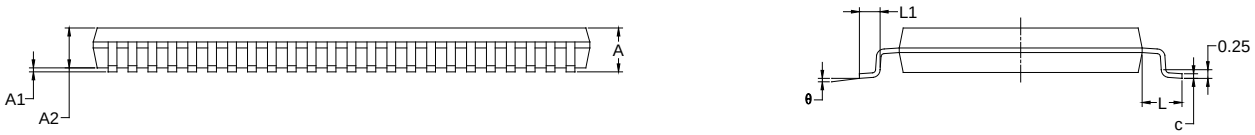
Changes from Original (SEPTEMBER 2021) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

TSSOP-48



RECOMMENDED LAND PATTERN (Unit: mm)

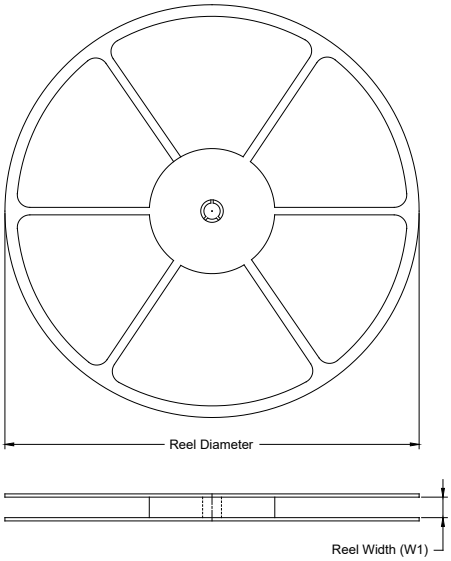


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A			1.20
A1	0.05	0.10	0.15
A2	0.85	0.95	1.05
b	0.18		0.26
c	0.15		0.19
D	12.40	12.50	12.60
E	7.90	8.10	8.30
E1	6.00	6.10	6.20
e	0.50 BSC		
L	1.00 REF		
L1	0.45		0.75
θ	0°		8°

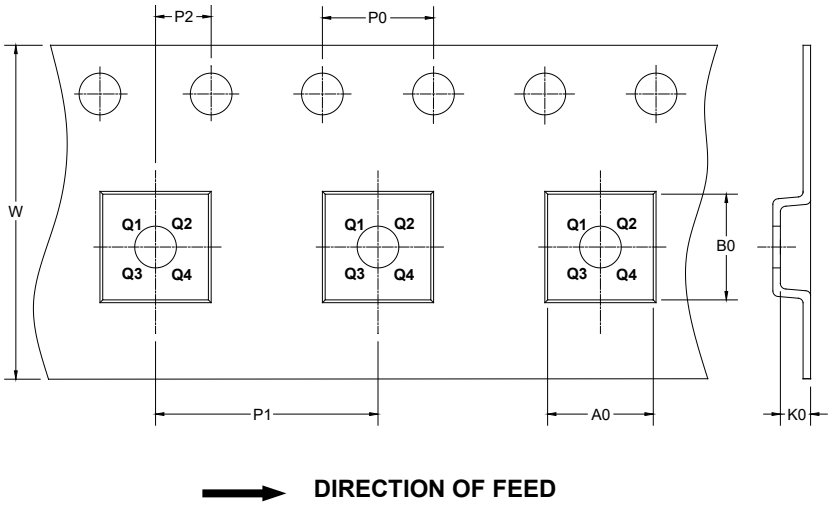
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

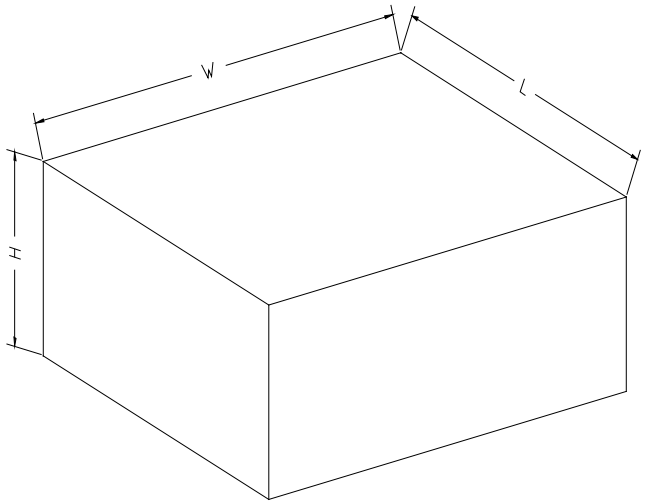
NOTE: The picture is only for reference. Please make the object as the standard.

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