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

GENERAL DESCRIPTION

The 74ALVC164245 is a high-performance, low-power, low-voltage CMOS device, superior to most advanced CMOS compatible TTL families.

The 74ALVC164245 is a 16-bit (dual-octal) dual-supply translating transceiver with non-inverting 3-state outputs. The supply rails consist of V_{CCB}, which is set to operate from 1.5V to 5.5V and V_{CCA}, which is set to operate from 1.5V to 3.6V.

Inputs can be driven from either 3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3V and 5V system environment.

This device can be used as two 8-bit transceivers or one 16-bit transceiver. The direction control (nDIR) input determines the direction of the data flow. The nDIR (active high) enables data from nAn ports to nBn ports. The nDIR (active low) enables data from nBn ports to nAn ports. The output enable ($n\overline{OE}$) input, when high, disables both nAn and nBn ports by placing them in a high-impedance state. The nDIR, $n\overline{OE}$ and nAn pins are powered by V_{CCA} and nBn pins are powered by V_{CCB}.

In suspend mode, when one of the supply voltages is 0V, there will be no current flow from the non-zero supply towards the zero supply. Note that $V_{CCB} \geq V_{CCA}$, except in suspend mode.

FEATURES

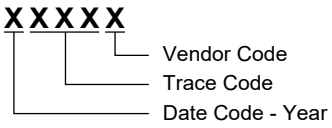
- **5V Tolerant Inputs/Outputs for Interfacing with 5V Logic**
- **Wide Supply Voltage Range:**
  - **3V V_{CCA}: 1.5V to 3.6V**
  - **5V V_{CCB}: 1.5V to 5.5V**
- **CMOS Low Power Consumption**
- **Direct Interface with TTL Levels**
- **Control Inputs Voltage Range from 2.7V to 5.5V**
- **Inputs Accept Voltages up to 5.5V**
- **High-Impedance Outputs 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, V_O (2)
  Output in High-State or Low-State .... -0.5V to (V_{CC} + 0.5V)
  Output in 3-State ..... -0.5V to (V_{CC} + 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

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.

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℃

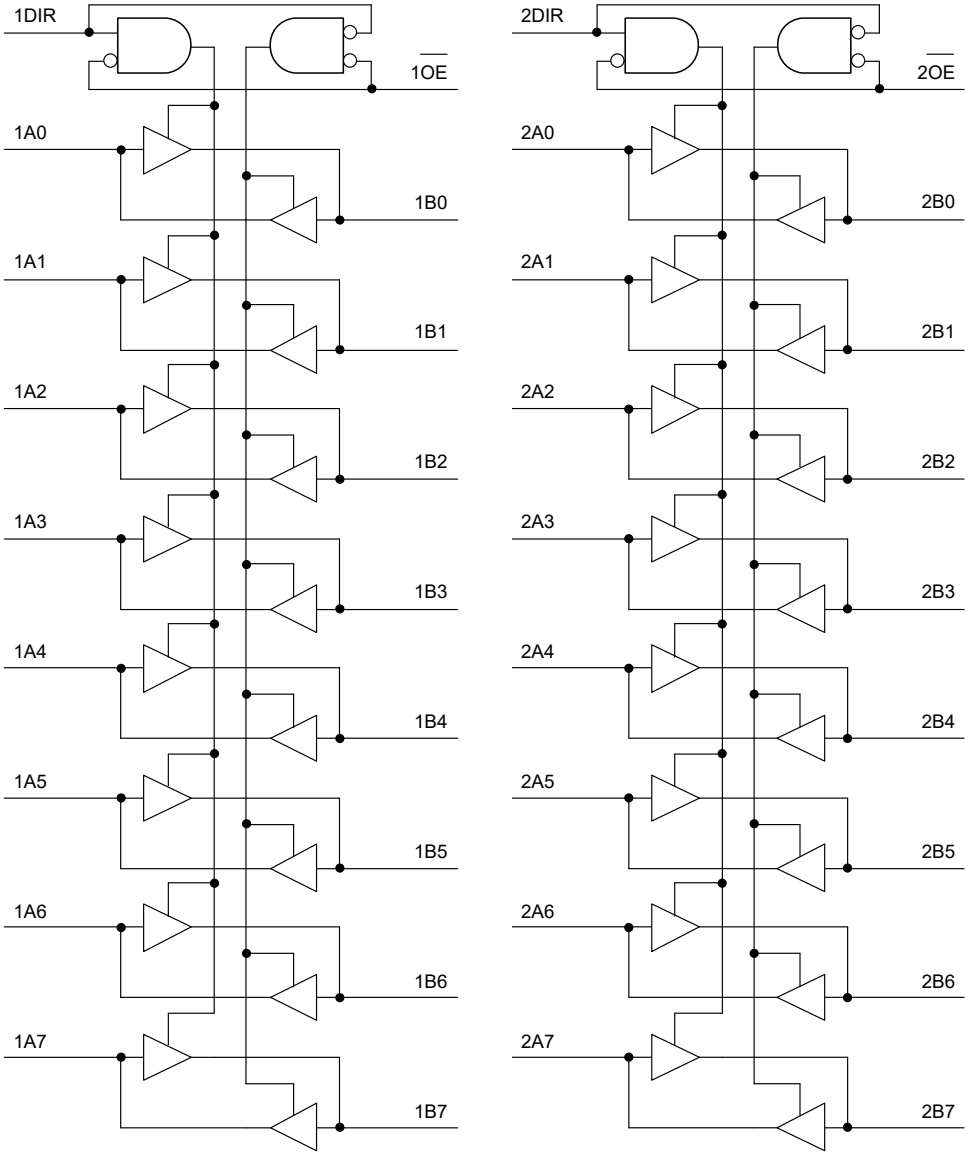
ESD SENSITIVITY CAUTION

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

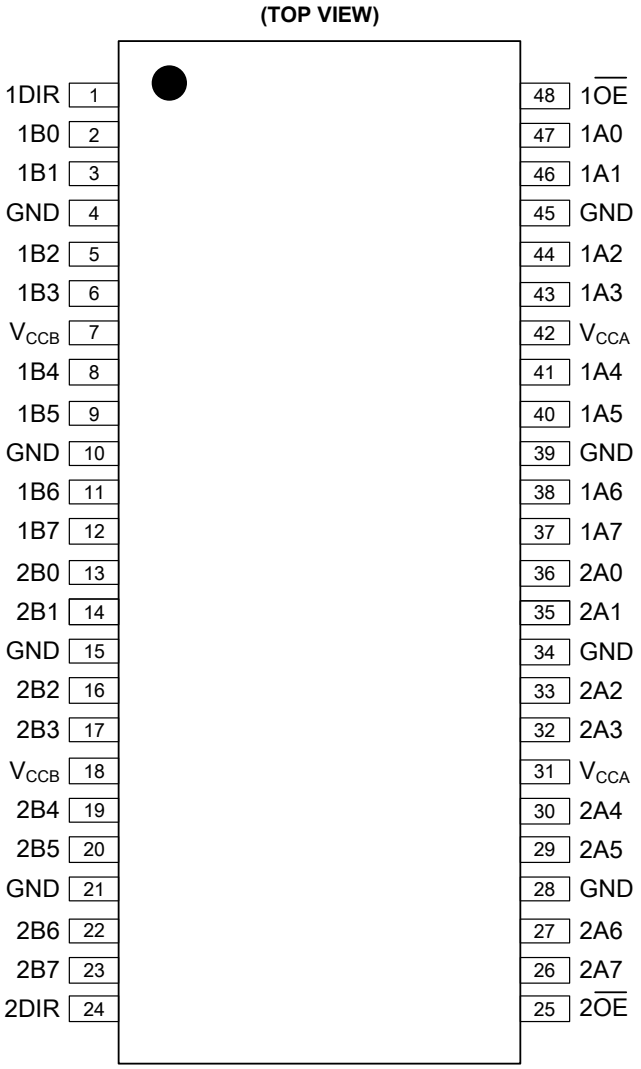
H = High Voltage Level

L = Low Voltage Level

Z = High-Impedance State

X = Don’t Care

PIN CONFIGURATION



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 (2)	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 (3)	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

NOTES:

1. If V_{CCA} < 2.7V, the switching levels at all inputs are not TTL compatible.
2. For transceivers, the parameter I_{OZ} includes the input leakage current.
3. V_{CCA} = 2.7V to 3.6V: other data inputs at V_{CCA} or GND; V_{CCB} = 4.5V to 5.5V: other data inputs at V_{CCB} or GND.

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°C, 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°C		6.2		ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25°C		5		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25°C		4.7		
		nBn to nAn, see Figure 2	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	+25°C		5.9		
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25°C		4.7		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25°C		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°C		6.3		ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25°C		5		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25°C		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°C		8		
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25°C		6.6		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25°C		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°C		6.7		ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25°C		6.8		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25°C		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°C		7.7		
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	+25°C		7.3		
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	+25°C		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°C		15		pF
		Outputs disabled		+25°C		5		
		Outputs enabled	3V port: nBn to nAn, V_I = GND to V_{CC}, V_{CCB} = 5V, V_{CCA} = 3.3V	+25°C		15		
		Outputs disabled		+25°C		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.

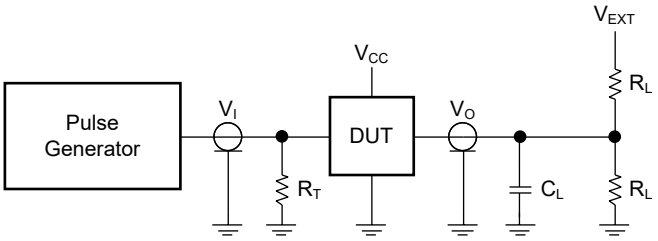
   C_L = Output load capacitance in pF.

   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 including jig and probe capacitance.

R_T = Termination resistance should be equal to output impedance Z_O of the pulse generator.

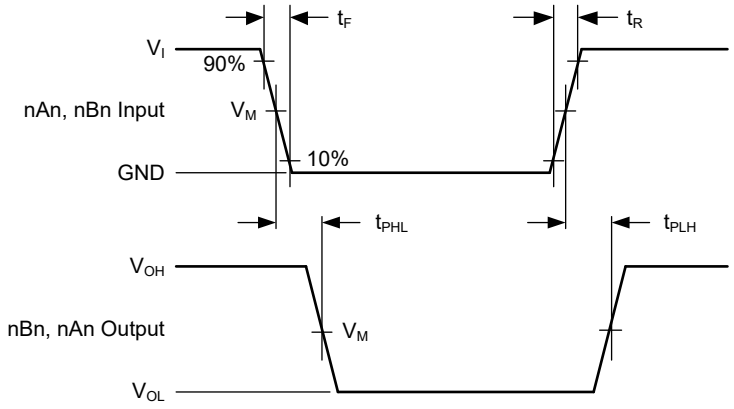
V_{EXT} = External voltage for measuring switching times.

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

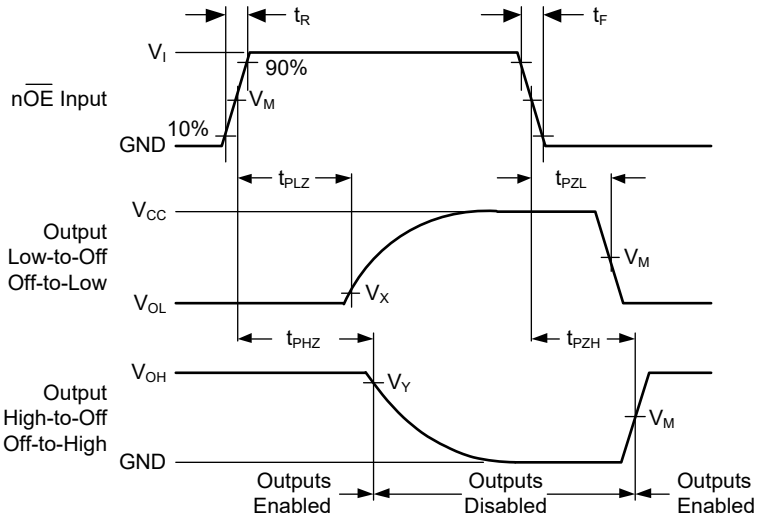


Test conditions are given in Table 1.

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.

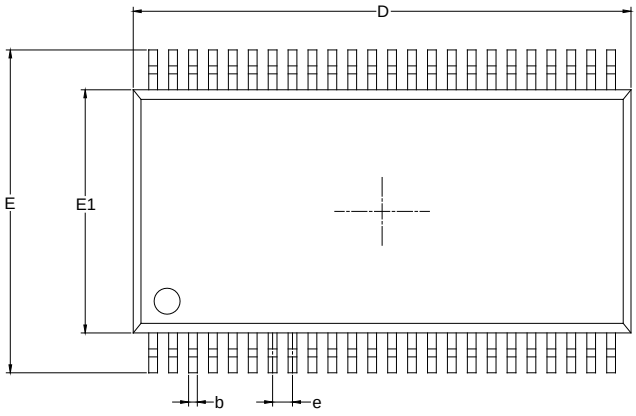
REVISION HISTORY

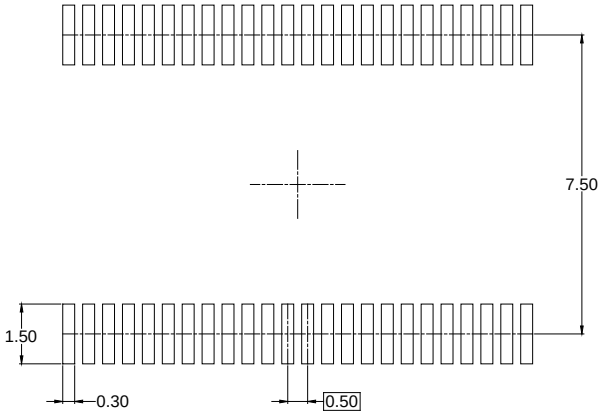
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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

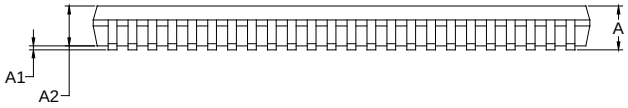
PACKAGE OUTLINE DIMENSIONS

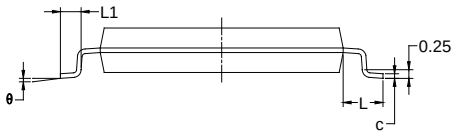
TSSOP-48





RECOMMENDED LAND PATTERN (Unit: mm)



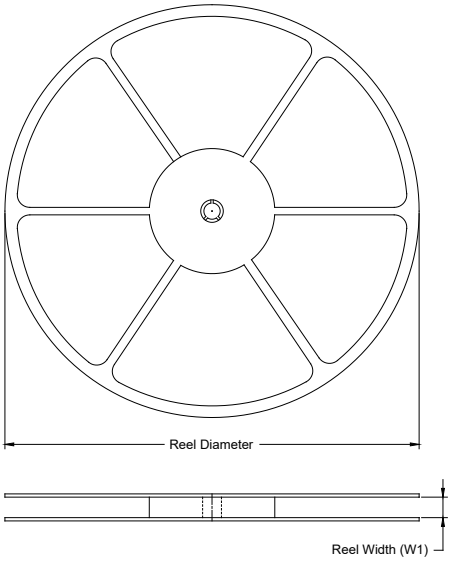


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A			1.20
A1	0.05	0.10	0.15
A2	0.85	0.95	1.05
b	0.18		0.26
c	0.15		0.19
D	12.40	12.50	12.60
E	7.90	8.10	8.30
E1	6.00	6.10	6.20
e	0.50 BSC		
L	1.00 REF		
L1	0.45		0.75
θ	0°		8°

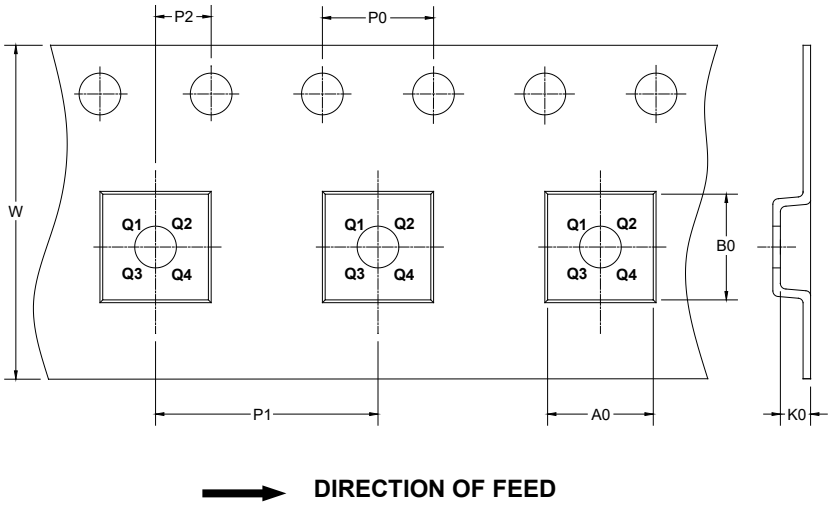
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

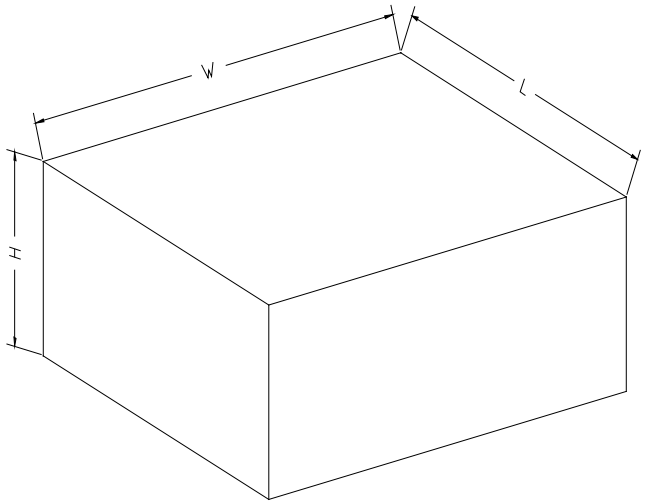
NOTE: The picture is only for reference. Please make the object as the standard.

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