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. The device features high-performance, low power and low voltage and it is CMOS device that outperforms most advanced CMOS compatible TTL series.

The device can be used as two 8-bit transceivers or one 16-bit transceiver. The nAn and nBn are 16-bit 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 two supply pins that accept the voltage from 1.5V to 3.6V and 1.5V to 5.5V respectively. Both 3V and 5V devices can drive inputs, enabling this device to operate as translator in a mixed 3V and 5V system environment.

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, nAn and nBn ports are in high-impedance state. The nAn, $n\overline{OE}$ and nDIR pins are referenced to V_{CCA} and nBn pins are referenced to V_{CCB}.

In suspend mode, both nAn and nBn are in high-impedance state when either V_{CCA} or V_{CCB} input is 0V. V_{CCA} must be less than or equal to V_{CCB} for proper device operation, except in suspend mode.

FEATURES

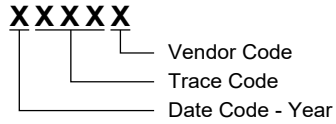
- **V_{CCA} Supply Voltage Range: 1.5V to 3.6V**
- **V_{CCB} Supply Voltage Range: 1.5V to 5.5V**
- **Inputs Accept Voltages up to 5.5V**
- **Input and Output Interface Capability to 5V System Environment**
- **+24mA/-24mA Output Current**
- **CMOS Low Power Dissipation**
- **Direct Interface with TTL Levels**
- **Outputs in High-Impedance State when V_{CCA} or V_{CCB} = 0V**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TSSOP-48 and SSOP-48 Packages**

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
	SSOP-48	-40℃ to +125℃	74ALVC164245XSS48G/TR	74ALVC164245 XSS48 XXXXX	Tape and Reel, 1000

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_{CCB} ($V_{CCB} \geq V_{CCA}$)..... -0.5V to 6.5V
Supply Voltage Range, V_{CCA} ($V_{CCB} \geq V_{CCA}$)..... -0.5V to 4.6V
Control Input Voltage Range, V_I (2)..... -0.5V to 6.5V
Input/Output Voltage Range, $V_{I/O}$ (2).....-0.5V to V_{CC} + 0.5V
Output Voltage Range, V_O (2)
High-State or Low-State.....-0.5V to V_{CC} + 0.5V
3-State Mode .....-0.5V to V_{CC} + 0.5V
Input Clamp Current, I_{IK} (V_I < 0V) .....-50mA
Output Clamp 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 Range, 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 Range, 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 Range ($n\overline{OE}$ and nDIR), V_I ....0V to 5.5V
Input/Output Voltage Range, $V_{I/O}$
nAn Ports.....0V to V_{CCA}
nBn Ports.....0V to V_{CCB}
Output Current, I_O..... ±24mA
Input Transition Rise or 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 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.

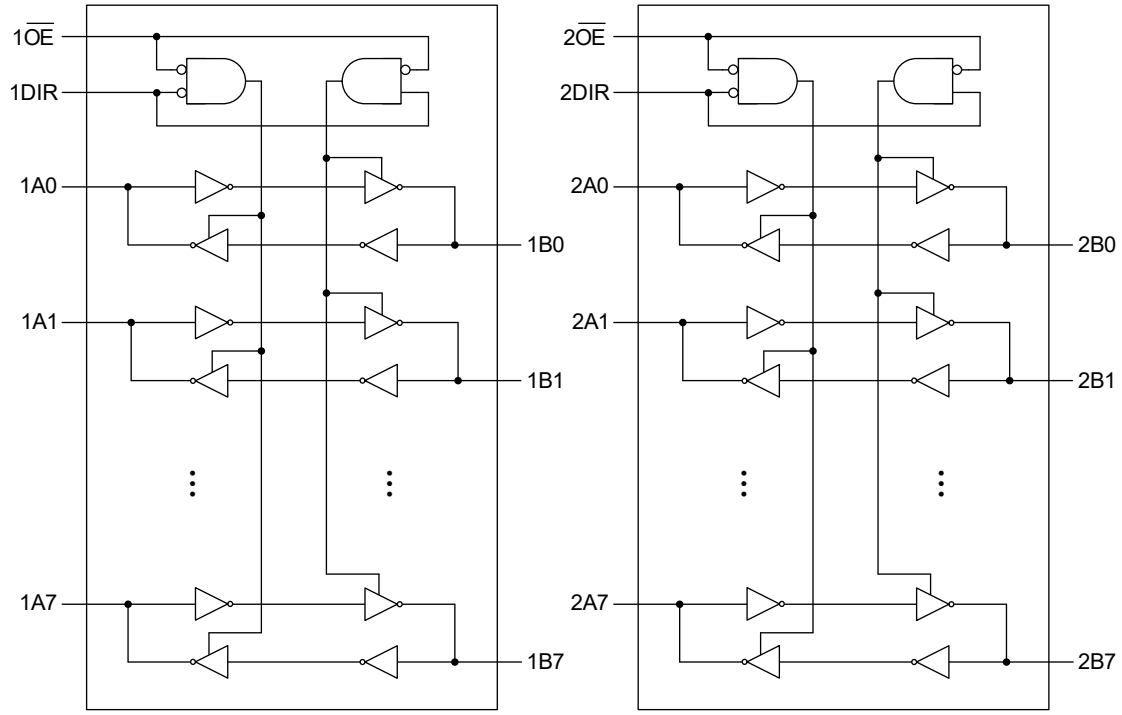
ESD SENSITIVITY CAUTION

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

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

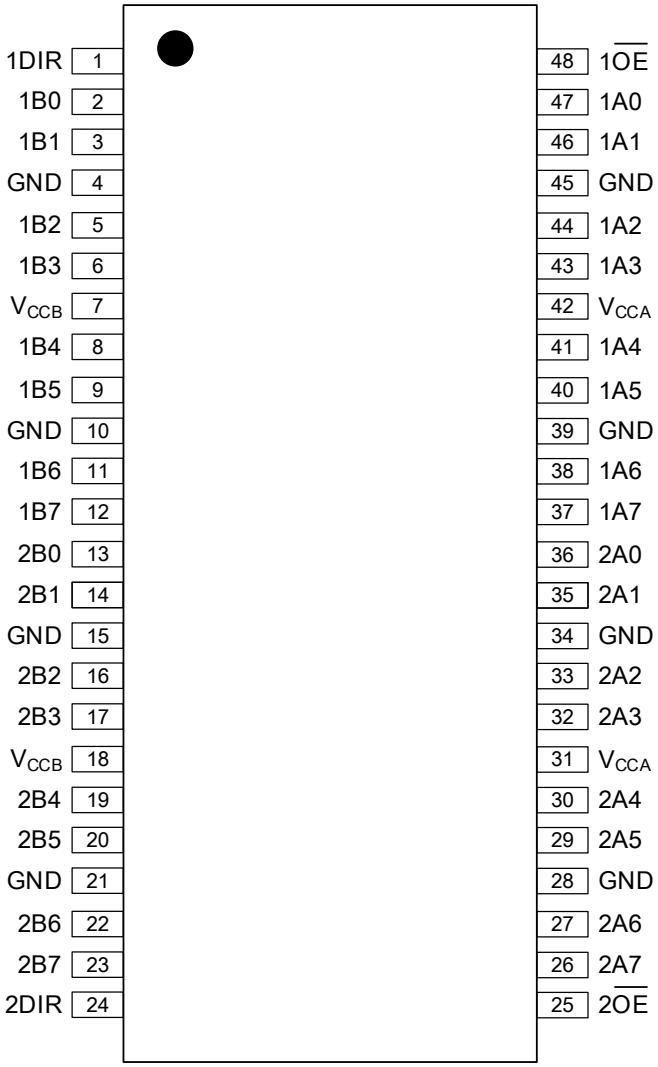
L = Low Voltage Level

Z = High-Impedance State

X = Don’t Care

PIN CONFIGURATIONS

(TOP VIEW)



TSSOP-48/SSOP-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. The nBn signals are referenced to V_{CCB}.
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. The nAn, nDIR and $n\overline{OE}$ signals are referenced to V_{CCA}.

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, all typical values are measured at V_{CCA} = 3.3V, V_{CCB} = 5.0V 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	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	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	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	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℃		5		pF
Input/Output Capacitance	$C_{I/O}$	nAn and nBn ports		+25℃		7		pF

NOTES:

1. Once V_{CCA} is less than 2.7V, the switching levels of all inputs are incompatible with TTL.
2. For I/O ports, the parameter I_{OZ} includes the input leakage current.
3. When V_{CCA} is in the range of 2.7V to 3.6V, other data inputs are at V_{CCA} or GND. When V_{CCB} is in the range of 4.5V to 5.5V, other data inputs are at V_{CCB} or GND.

DYNAMIC CHARACTERISTICS

(See Figure 1 for test circuit. Full = -40℃ to +125℃, all typical values are measured at V_{CCA} = 3.3V, V_{CCB} = 5.0V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN (1)	TYP	MAX (1)	UNITS
Propagation Delay (2)	t_{PD}	nAn to nBn, see Figure 2	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	Full	0.5	6.2	12	ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	Full	0.5	5	10	
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	Full	0.5	4.7	9.5	
		nBn to nAn, see Figure 2	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	Full	0.5	5.9	13	
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	Full	0.5	4.7	11	
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	Full	0.5	4.5	9.5	
Enable Time (2)	t_{EN}	$n\overline{OE}$ to nBn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	Full	0.5	6.3	14.5	ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	Full	0.5	5	11.5	
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	Full	0.5	4.6	11	
		$n\overline{OE}$ to nAn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	Full	0.5	8	17.5	
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	Full	0.5	6.6	15	
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	Full	0.5	5.8	14	
Disable Time (2)	t_{DIS}	$n\overline{OE}$ to nBn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	Full	0.5	6.7	13	ns
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	Full	0.5	6.8	13	
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	Full	0.5	7.8	14.5	
		$n\overline{OE}$ to nAn, see Figure 3	V_{CCA} = 2.3V to 2.7V, V_{CCB} = 3.0V to 3.6V	Full	0.5	7.7	15	
			V_{CCA} = 2.7V, V_{CCB} = 4.5V to 5.5V	Full	0.5	7.3	13.5	
			V_{CCA} = 3.0V to 3.6V, V_{CCB} = 4.5V to 5.5V	Full	0.5	6.5	12.5	
Power Dissipation Capacitance (3)	C_{PD}	Outputs enabled	5V port: nAn to nBn, V_I = GND to V_{CC}, V_{CCA} = 3.3V, V_{CCB} = 5.0V	+25℃		15		pF
		Outputs disabled		+25℃		5		
		Outputs enabled	3V port: nBn to nAn, V_I = GND to V_{CC}, V_{CCA} = 3.3V, V_{CCB} = 5.0V	+25℃		15		
		Outputs disabled		+25℃		5		

NOTES:

1. Specified by design and characterization, not production tested.
2. 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}.
3. 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.

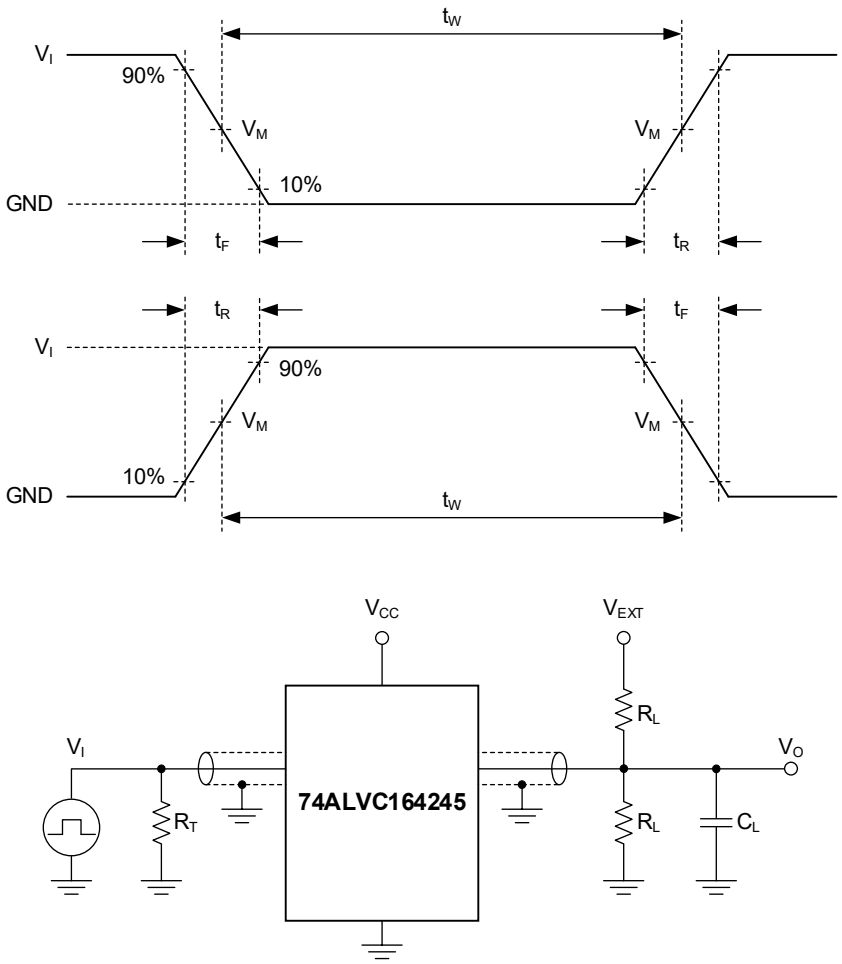
   C_L = Output load capacitance in pF.

   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).

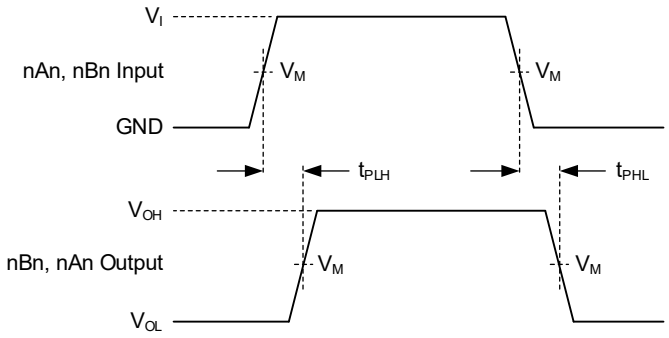
V_{EXT}: External voltage is used to measure switching time.

Figure 1. Test Circuit for Measuring Switching Times

Table 1. Test Conditions

DIRECTION	SUPPLY VOLTAGE		INPUT		LOAD		V_{EXT}		
	V_{CCA}	V_{CCB}	V_I	t_R, t_F	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
nAn to nBn	2.3V to 2.7V	2.7V to 3.6V	V_{CCA}	≤ 2.5ns	50pF	500Ω	Open	GND	2 × V_{CC}
nBn to nAn	2.3V to 2.7V	2.7V to 3.6V	2.7V	≤ 2.5ns	50pF	500Ω	Open	GND	6.0V
nAn to nBn	2.7V to 3.6V	4.5V to 5.5V	2.7V	≤ 2.5ns	50pF	500Ω	Open	GND	2 × V_{CC}
nBn to nAn	2.7V to 3.6V	4.5V to 5.5V	3.0V	≤ 2.5ns	50pF	500Ω	Open	GND	6.0V

WAVEFORMS

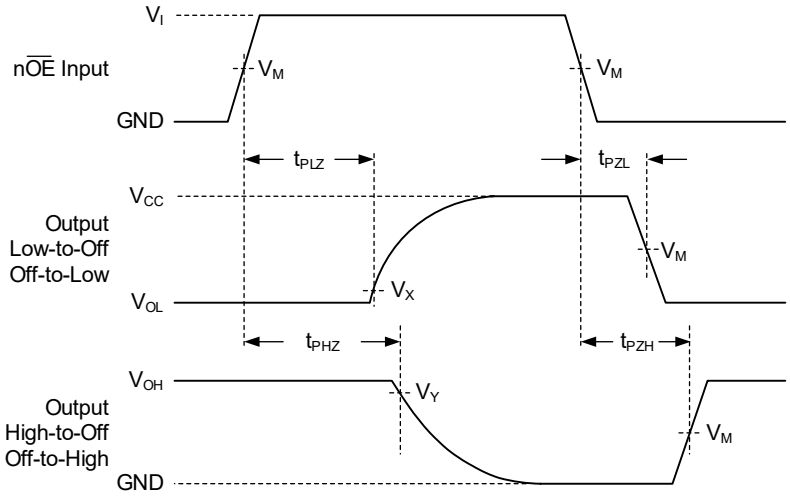


Test conditions are given in Table 1.

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)	V_M	V_X	V_Y
nAn to nBn	2.3V to 2.7V	2.7V to 3.6V	V_{CCA}	0.5 × V_{CCA}	1.5V	V_{OLB} + 0.3V	V_{OHB} - 0.3V
nBn to nAn	2.3V to 2.7V	2.7V to 3.6V	2.7V	1.5V	0.5 × V_{CCA}	V_{OLA} + 0.15V	V_{OHA} - 0.15V
nAn to nBn	2.7V to 3.6V	4.5V to 5.5V	2.7V	1.5V	0.5 × V_{CCB}	0.2 × V_{CCB}	0.8 × V_{CCB}
nBn to nAn	2.7V to 3.6V	4.5V to 5.5V	3.0V	1.5V	1.5V	V_{OLA} + 0.3V	V_{OHA} - 0.3V

NOTE:

1. 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.

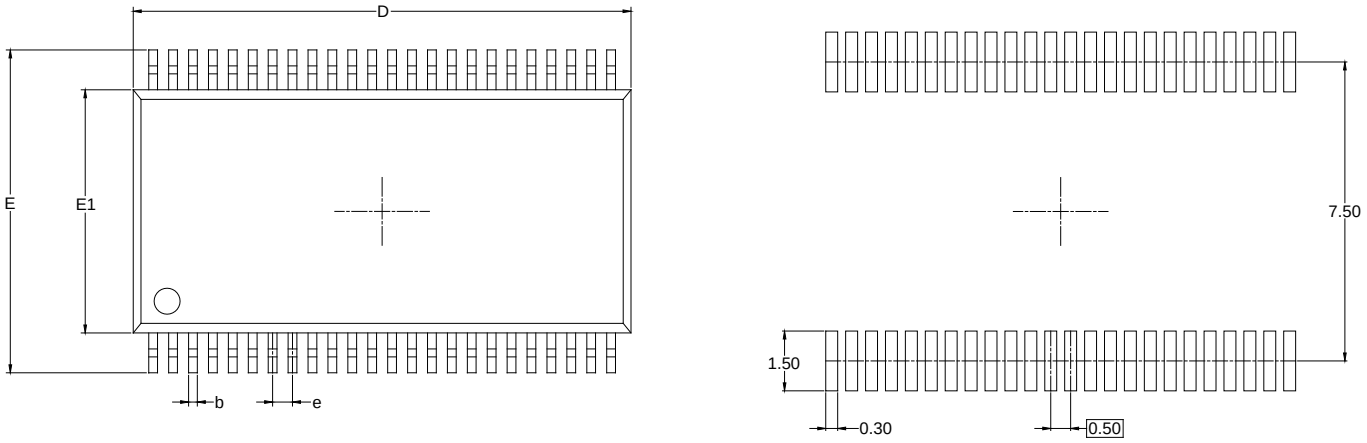
FEBRUARY 2024 – REV.A.1 to REV.A.2	Page
Added SSOP-48 package	All
Updated Electrical Characteristics section	6

APRIL 2023 – REV.A to REV.A.1	Page
Updated Dynamic Characteristics section	6

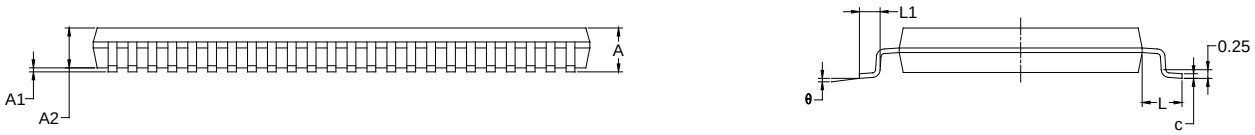
Changes from Original (SEPTEMBER 2021) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

TSSOP-48



RECOMMENDED LAND PATTERN (Unit: mm)

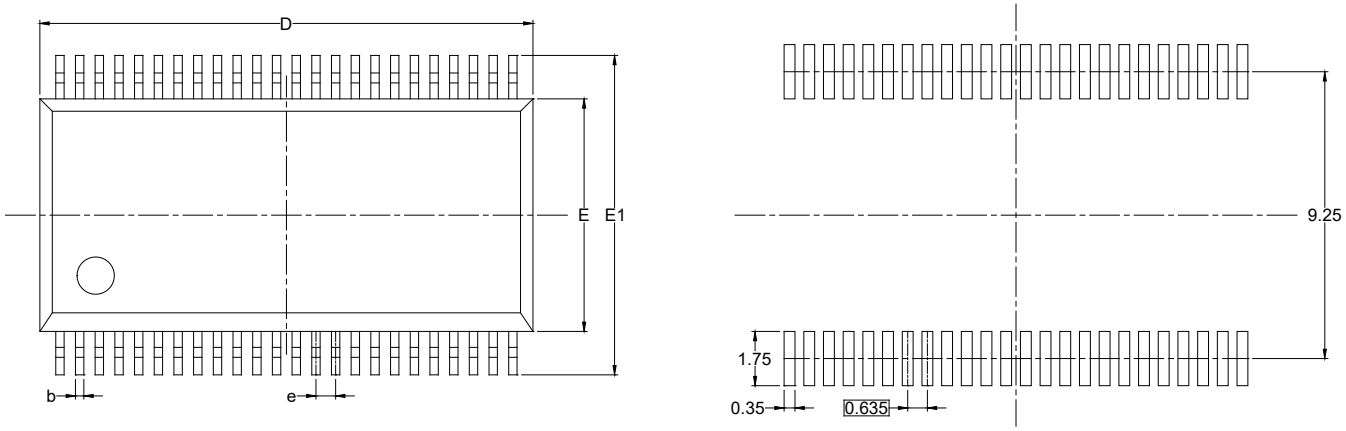


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A			1.20
A1	0.05	0.10	0.15
A2	0.85	0.95	1.05
b	0.18		0.26
c	0.15		0.19
D	12.40	12.50	12.60
E	7.90	8.10	8.30
E1	6.00	6.10	6.20
e	0.50 BSC		
L	1.00 REF		
L1	0.45		0.75
θ	0°		8°

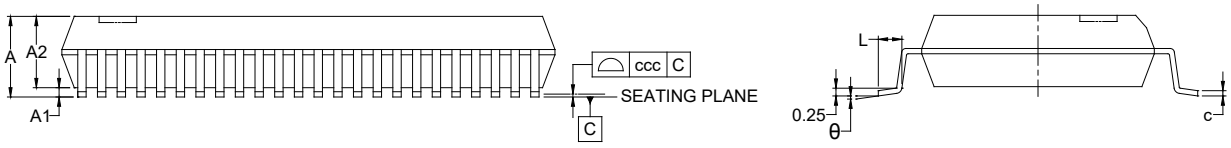
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

SSOP-48



RECOMMENDED LAND PATTERN (Unit: mm)

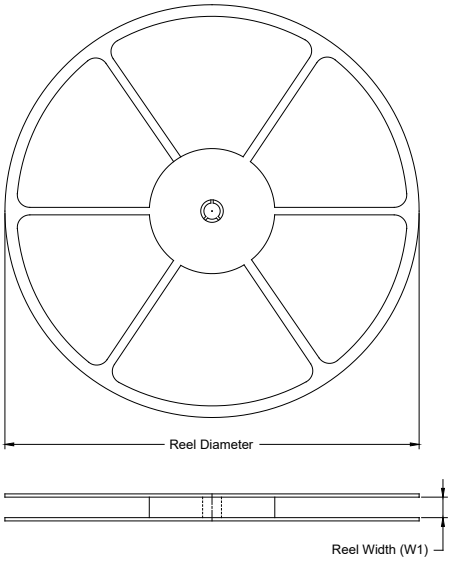


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	2.800
A1	0.200	-	0.400
A2	2.300 REF		
b	0.203	-	0.343
c	0.130	-	0.250
D	15.750	-	16.000
E	7.390	-	7.600
E1	10.030	-	10.670
e	0.635 BSC		
L	0.510	-	1.020
θ	0°	-	8°
ccc	0.100		

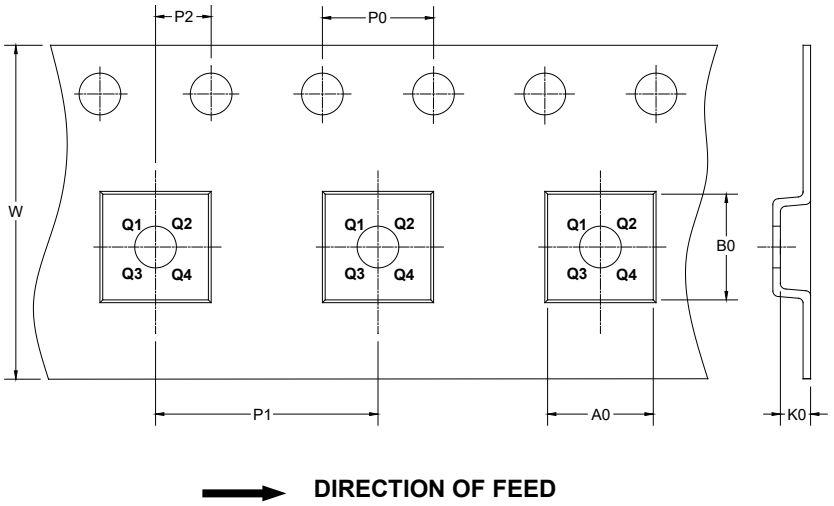
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-118.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



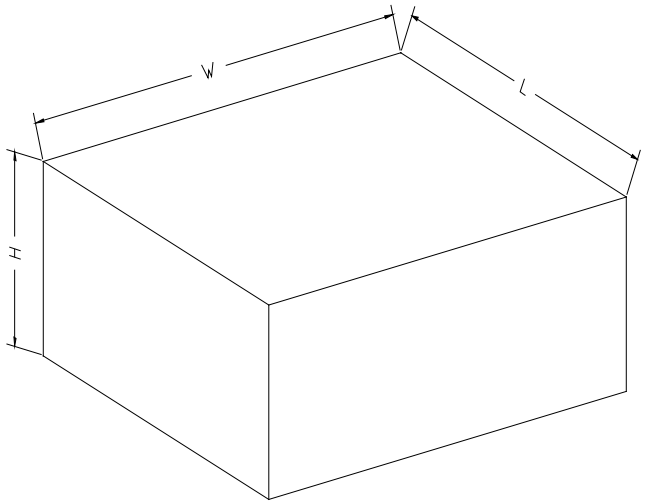
NOTE: The picture is only for reference. Please make the object as the standard.

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-48	13″	24.4	8.60	13.00	1.80	4.0	12.0	2.0	24.0	Q1
SSOP-48	13"	32.4	10.80	16.20	3.20	4.0	16.0	2.0	32.0	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