

**FEATURES:**

- 0.5 MICRON CMOS Technology
- Typical  $t_{sk(o)}$  (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- $V_{CC} = 3.3V \pm 0.3V$ , Normal Range
- $V_{CC} = 2.7V$  to  $3.6V$ , Extended Range
- $V_{CC} = 2.5V \pm 0.2V$
- CMOS power levels ( $0.4\mu W$  typ. static)
- Rail-to-Rail output swing for increased noise margin
- Available in TSSOP package

**DRIVE FEATURES:**

- Balanced Output Drivers:  $\pm 12mA$
- Low Switching Noise

**APPLICATIONS:**

- 3.3V high speed systems
- 3.3V and lower voltage computing systems

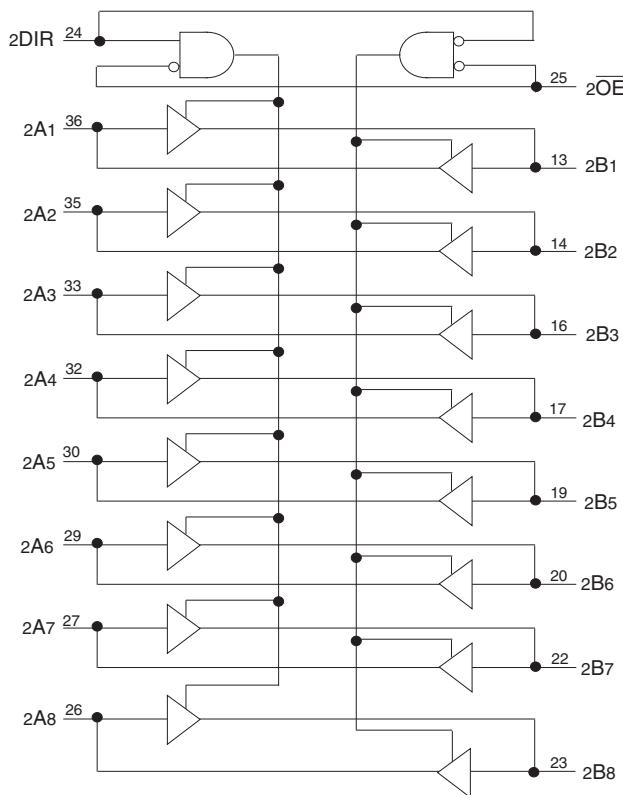
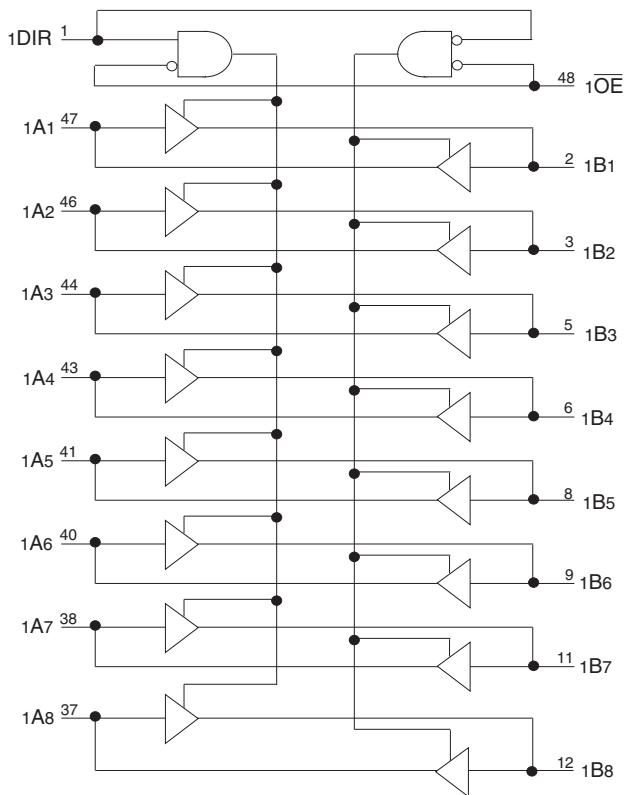
**DESCRIPTION:**

This 16-bit bus transceiver is built using advanced dual metal CMOS technology. The ALVCHR162245 device is designed for asynchronous communication between data buses. The control-function implementation minimizes external timing requirements.

This device can be used as two 8-bit transceivers or one 16-bit transceiver. It allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction control (DIR) input. The output-enable ( $\bar{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

The ALVCHR162245 has series resistors in the device output structure which will significantly reduce line noise when used with light loads. This driver has been designed to drive  $\pm 12mA$  at the designated threshold levels.

The ALVCHR162245 has "bus-hold" which retains the inputs' last state whenever the input bus goes to a high impedance. This prevents floating inputs and eliminates the need for pull-up/down resistors.

**FUNCTIONAL BLOCK DIAGRAM**

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INDUSTRIAL TEMPERATURE RANGE

## PIN CONFIGURATION

1DIR	1	48	1 $\bar{OE}$
1B1	2	47	1A1
1B2	3	46	1A2
GND	4	45	GND
1B3	5	44	1A3
1B4	6	43	1A4
Vcc	7	42	Vcc
1B5	8	41	1A5
1B6	9	40	1A6
GND	10	39	GND
1B7	11	38	1A7
1B8	12	37	1A8
2B1	13	36	2A1
2B2	14	35	2A2
GND	15	34	GND
2B3	16	33	2A3
2B4	17	32	2A4
Vcc	18	31	Vcc
2B5	19	30	2A5
2B6	20	29	2A6
GND	21	28	GND
2B7	22	27	2A7
2B8	23	26	2A8
2DIR	24	25	2 $\bar{OE}$

TSSOP  
TOP VIEWABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Description	Max	Unit
VTERM <sup>(2)</sup>	Terminal Voltage with Respect to GND	-0.5 to +4.6	V
VTERM <sup>(3)</sup>	Terminal Voltage with Respect to GND	-0.5 to Vcc+0.5	V
TSTG	Storage Temperature	-65 to +150	°C
I <sub>OUT</sub>	DC Output Current	-50 to +50	mA
I <sub>IK</sub>	Continuous Clamp Current, V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>cc</sub>	±50	mA
I <sub>OK</sub>	Continuous Clamp Current, V <sub>O</sub> < 0	-50	mA
I <sub>CC</sub>	Continuous Current through each V <sub>cc</sub> or GND	±100	mA
I <sub>SS</sub>			

## NOTES:

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. V<sub>cc</sub> terminals.
3. All terminals except V<sub>cc</sub>.

## CAPACITANCE (TA = +25°C, F = 1.0MHz)

Symbol	Parameter <sup>(1)</sup>	Conditions	Typ.	Max.	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0V	5	7	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = 0V	7	9	pF
C <sub>I/O</sub>	I/O Port Capacitance	V <sub>IN</sub> = 0V	7	9	pF

## NOTE:

1. As applicable to the device type.

## PIN DESCRIPTION

Pin Names	Description
x $\bar{OE}$	Output Enable Inputs (Active LOW)
DIR	Direction Control Inputs
xA <sub>X</sub> <sup>(1)</sup>	Side A Inputs or 3-State Outputs
xB <sub>X</sub> <sup>(1)</sup>	Side B Inputs or 3-State Outputs

## NOTE:

1. These pins have "Bus-Hold". All other pins are standard inputs, outputs, or I/Os.

FUNCTION TABLE (EACH 8-BIT SECTION)<sup>(1)</sup>

Inputs		Outputs
x $\bar{OE}$	xDIR	
L	L	Bus B data to A bus
L	H	Bus A data to B bus
H	X	High Z State

## NOTE:

1. H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $TA = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ 

Symbol	Parameter	Test Conditions		Min.	Typ. <sup>(1)</sup>	Max.	Unit
VIH	Input HIGH Voltage Level	Vcc = 2.3V to 2.7V		1.7	—	—	V
		Vcc = 2.7V to 3.6V		2	—	—	
VIL	Input LOW Voltage Level	Vcc = 2.3V to 2.7V		—	—	0.7	V
		Vcc = 2.7V to 3.6V		—	—	0.8	
I <sub>IH</sub>	Input HIGH Current	Vcc = 3.6V	Vi = Vcc	—	—	$\pm 5$	$\mu\text{A}$
I <sub>IL</sub>	Input LOW Current	Vcc = 3.6V	Vi = GND	—	—	$\pm 5$	$\mu\text{A}$
I <sub>OZH</sub>	High Impedance Output Current (3-State Output pins)	Vcc = 3.6V	Vo = Vcc	—	—	$\pm 10$	$\mu\text{A}$
			Vo = GND	—	—	$\pm 10$	
V <sub>IK</sub>	Clamp Diode Voltage	Vcc = 2.3V, I <sub>IN</sub> = $-18\text{mA}$		—	-0.7	-1.2	V
V <sub>H</sub>	Input Hysteresis	Vcc = 3.3V		—	100	—	mV
I <sub>CCL</sub> I <sub>CCH</sub> I <sub>CZZ</sub>	Quiescent Power Supply Current	Vcc = 3.6V VIN = GND or Vcc		—	0.1	40	$\mu\text{A}$
$\Delta I_{CC}$	Quiescent Power Supply Current Variation	One input at Vcc - 0.6V, other inputs at Vcc or GND		—	—	750	$\mu\text{A}$

## NOTE:

1. Typical values are at  $Vcc = 3.3\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.

## BUS-HOLD CHARACTERISTICS

Symbol	Parameter <sup>(1)</sup>	Test Conditions		Min.	Typ. <sup>(2)</sup>	Max.	Unit
I <sub>BHH</sub> I <sub>BHL</sub>	Bus-Hold Input Sustain Current	Vcc = 3V	Vi = 2V	-75	—	—	$\mu\text{A}$
			Vi = 0.8V	75	—	—	
I <sub>BHH</sub> I <sub>BHL</sub>	Bus-Hold Input Sustain Current	Vcc = 2.3V	Vi = 1.7V	-45	—	—	$\mu\text{A}$
			Vi = 0.7V	45	—	—	
I <sub>BHHO</sub> I <sub>BHLO</sub>	Bus-Hold Input Overdrive Current	Vcc = 3.6V	Vi = 0 to 3.6V	—	—	$\pm 500$	$\mu\text{A}$

## NOTES:

1. Pins with Bus-Hold are identified in the pin description.

2. Typical values are at  $Vcc = 3.3\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.

## OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Max.	Unit
VOH	Output HIGH Voltage	Vcc = 2.3V to 3.6V	IOH = - 0.1mA	Vcc - 0.2	—	V
		Vcc = 2.3V	IOH = - 4mA	1.9	—	
			IOH = - 6mA	1.7	—	
		Vcc = 2.7V	IOH = - 4mA	2.2	—	
			IOH = - 8mA	2	—	
		Vcc = 3V	IOH = - 6mA	2.4	—	
			IOH = - 12mA	2	—	
VOL	Output LOW Voltage	Vcc = 2.3V to 3.6V	IOL = 0.1mA	—	0.2	V
		Vcc = 2.3V	IOL = 4mA	—	0.4	
			IOL = 6mA	—	0.55	
		Vcc = 2.7V	IOL = 4mA	—	0.4	
			IOL = 8mA	—	0.6	
		Vcc = 3V	IOL = 6mA	—	0.55	
			IOL = 12mA	—	0.8	

## NOTE:

1.  $V_{IH}$  and  $V_{IL}$  must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate Vcc range.  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ .

OPERATING CHARACTERISTICS,  $T_A = 25^\circ\text{C}$ 

Symbol	Parameter	Test Conditions	Vcc = 2.5V $\pm$ 0.2V	Vcc = 3.3V $\pm$ 0.3V	Unit
			Typical	Typical	
CPD	Power Dissipation Capacitance Outputs enabled	CL = 0pF, f = 10Mhz	24	32	pF
	Power Dissipation Capacitance Outputs disabled		4	5	

SWITCHING CHARACTERISTICS<sup>(1)</sup>

Symbol	Parameter	Vcc = 2.5V $\pm$ 0.2V		Vcc = 2.7V		Vcc = 3.3V $\pm$ 0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
tPLH	Propagation Delay xAx to xBx or xBx to xAx	1	4.9	—	4.7	1	4.2	ns
tPHL	Output Enable Time xOE to xAx or xBx	1	6.8	—	6.7	1	5.6	ns
tpZH	Output Disable Time xOE to xAx or xBx	1	6.3	—	5.7	1	5.5	ns
tsk(o)	Output Skew <sup>(2)</sup>	—	—	—	—	—	500	ps

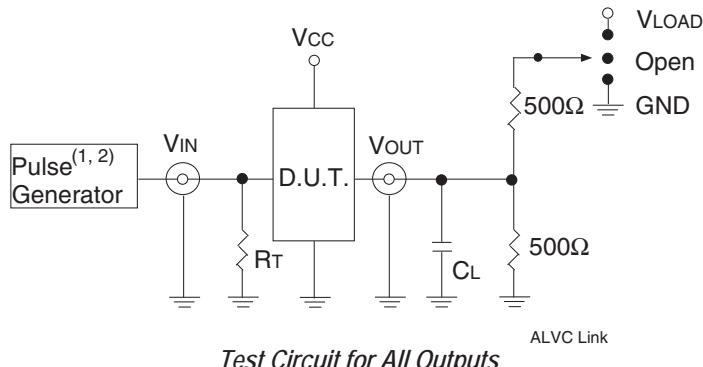
## NOTES:

1. See TEST CIRCUITS AND WAVEFORMS.  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ .
2. Skew between any two outputs of the same package and switching in the same direction.

## TEST CIRCUITS AND WAVEFORMS

## TEST CONDITIONS

Symbol	$V_{CC}^{(1)} = 3.3V \pm 0.3V$	$V_{CC}^{(1)} = 2.7V$	$V_{CC}^{(2)} = 2.5V \pm 0.2V$	Unit
$V_{LOAD}$	6	6	$2 \times V_{CC}$	V
$V_{IH}$	2.7	2.7	$V_{CC}$	V
$V_T$	1.5	1.5	$V_{CC} / 2$	V
$V_{LZ}$	300	300	150	mV
$V_{HZ}$	300	300	150	mV
$C_L$	50	50	30	pF



Test Circuit for All Outputs

## DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

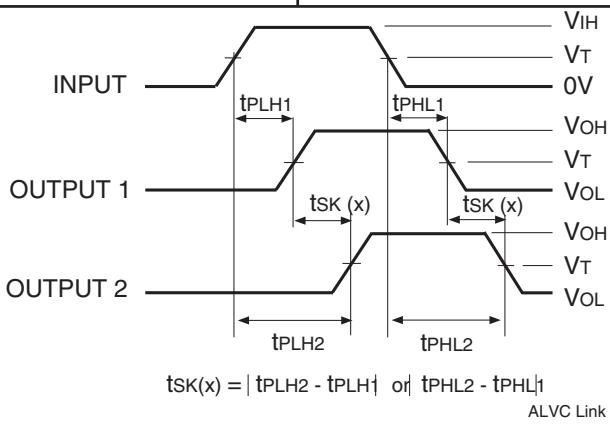
RT = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

## NOTES:

1. Pulse Generator for All Pulses: Rate  $\leq 1.0\text{MHz}$ ;  $t_f \leq 2.5\text{ns}$ ;  $t_r \leq 2.5\text{ns}$ .
2. Pulse Generator for All Pulses: Rate  $\leq 1.0\text{MHz}$ ;  $t_f \leq 2\text{ns}$ ;  $t_r \leq 2\text{ns}$ .

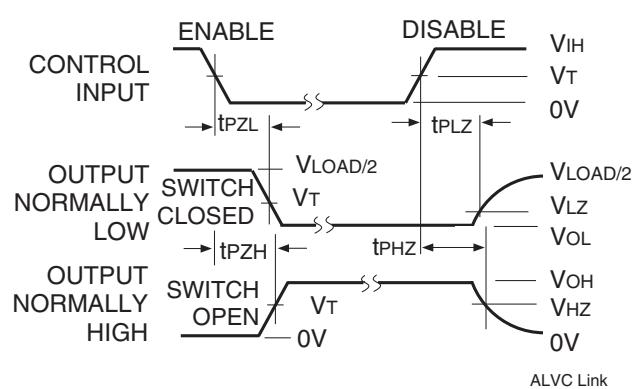
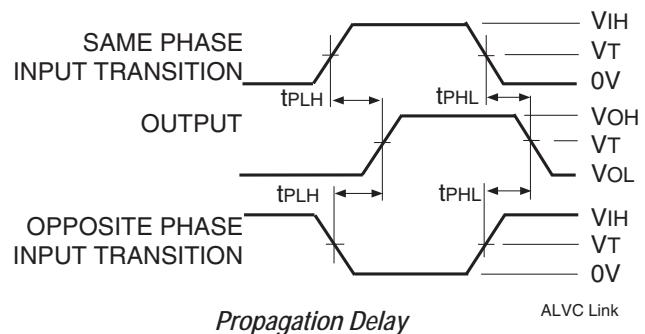
## SWITCH POSITION

Test	Switch
Open Drain	
Disable Low	$V_{LOAD}$
Enable Low	
Disable High	$GND$
Enable High	
All Other Tests	Open

Output Skew -  $t_{sk(x)}$ 

## NOTES:

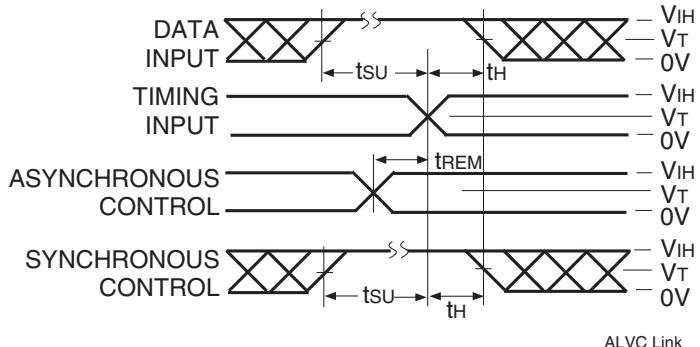
1. For  $t_{sk(o)}$  OUTPUT1 and OUTPUT2 are any two outputs.
2. For  $t_{sk(b)}$  OUTPUT1 and OUTPUT2 are in the same bank.



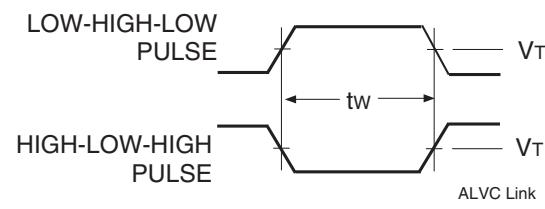
Enable and Disable Times

## NOTE:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.



Set-up, Hold, and Release Times



Pulse Width

## ORDERING INFORMATION

XX	ALVC	X	XX	XXX	XX	X
Temp. Range	Bus-Hold		Family	Device Type	Package	
					Blank	Tube
					8	Tape and Reel
					PAG	Thin Shrink Small Outline Package - Green
					245	16-Bit Bus Transceiver with 3-State Outputs
					R162	Double-Density with Resistors, $\pm 12\text{mA}$
					H	Bus-Hold
					74	-40°C to +85°C

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