3.3V CMOS 18-BIT UNIVERSAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS AND BUS-HOLD

IDT74ALVCHR16500

FEATURES:

- 0.5 MICRON CMOS Technology
- Typical $t_{SK(0)}$ (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
- 0.635mm pitch SSOP, 0.50mm pitch TSSOP, and 0.40mm pitch TVSOP packages
- Extended commercial range of – 40°C to + 85°C
- V_{CC} = 3.3V ± 0.3V, Normal Range
- V_{CC} = 2.7V to 3.6V, Extended Range
- V_{CC} = 2.5V ± 0.2V
- CMOS power levels (0.4µW typ. static)
- Rail-to-Rail output swing for increased noise margin

Drive Features for ALVCHR16500:

- Balanced Output Drivers: ±12mA
- Low switching noise

APPLICATIONS:

- 3.3V High Speed Systems
- 3.3V and lower voltage computing systems

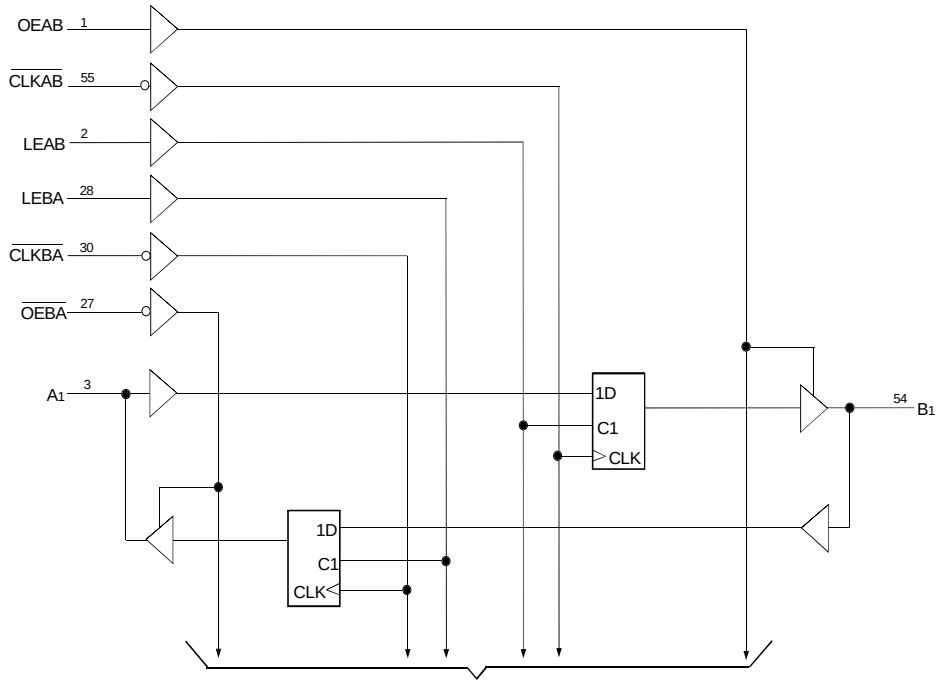
DESCRIPTION:

This 18-bit universal bus transceiver is built using advanced dual metal CMOS technology. Data flow in each direction is controlled by output-enable (OEAB and $\overline{OEBA}$), latch enable (LEAB and LEBA) and clock ($\overline{CLKAB}$ and $\overline{CLKBA}$) inputs. For A-to-B data flow, the device operates in transparent mode when LEAB is high. When LEAB is LOW, the A data is latched if CLKAB is held at a high or low logic level. If LEAB is LOW, the A bus data is stored in the latch/flip-flop on the high-to-low transition of $\overline{CLKAB}$. OEAB performs the output enable function on the B port. Data flow from B port to A port is similiar but requires using $\overline{OEBA}$, LEBA and $\overline{CLKBA}$. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

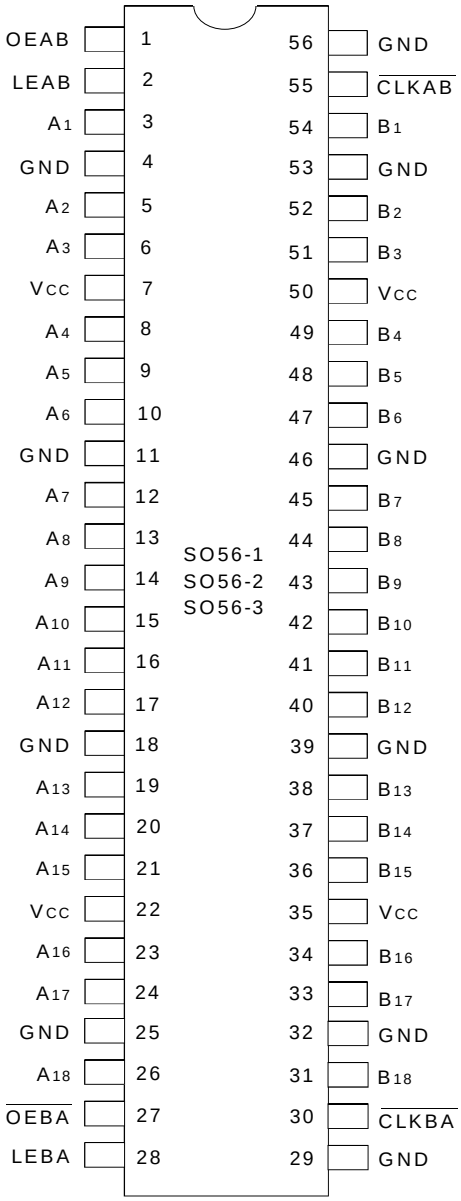
The ALVCHR16500 has series resistors in the device output structure which will significantly reduce reduce line noise when used with light loads. This driver has been designed to drive ±12mA at the designated threshold levels.

The ALVCHR16500 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



PIN CONFIGURATION



SSOP/
TSSOP/TVSOP
TOP VIEW

ABSOLUTE MAXIMUM RATING (1)

Symbol	Description	Max.	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	– 0.5 to + 4.6	V
V_{TERM}(3)	Terminal Voltage with Respect to GND	– 0.5 to V_{CC} + 0.5	V
T_{STG}	Storage Temperature	– 65 to + 150	°C
I_{OUT}	DC Output Current	– 50 to + 50	mA
I_{IK}	Continuous Clamp Current, $V_I < 0$ or $V_I > V_{CC}$	± 50	mA
I_{OK}	Continuous Clamp Current, $V_O < 0$	– 50	mA
I_{CC} I_{SS}	Continuous Current through each V_{CC} or GND	±100	mA

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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_{CC} terminals.
3. All terminals except V_{CC}.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	5	7	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	7	9	pF
$C_{I/O}$	I/O Port Capacitance	V_{IN} = 0V	7	9	pF

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NOTE:
1. As applicable to the device type.

FUNCTION TABLE (1, 2)

Inputs				Outputs
OEAB	LEAB	$\overline{CLKAB}$	Ax	Bx
L	X	X	X	Z
H	H	X	L	L
H	H	X	H	H
H	L	↓	L	L
H	L	↓	H	H
H	L	H	X	B_O(3)
H	L	L	X	B_O(4)

NOTES:
1. A-to-B data flow is shown. B-to-A data flow is similar but uses $\overline{OEBA}$, LEBA, and $\overline{CLKBA}$
2. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   Z = High-Impedance
   ↓ = HIGH-to-LOW Transition
3. Output level before the indicated steady-state input conditions were established
4. Output level before the indicated steady-state input conditions were established, provided that $\overline{CLKAB}$ was low before LEAB went low.

PIN DESCRIPTION

Pin Names	Description
OEAB	A-to-B Output Enable Input
$\overline{OEBA}$	B-to-A Output Enable Input (Active LOW)
LEAB	A-to-B Latch Enable Input
LEBA	B-to-A Latch Enable Input
$\overline{CLKAB}$	A-to-B Clock Input (Active LOW)
$\overline{CLKBA}$	B-to-A Clock Input (Active LOW)
Ax	A-to-B Data Inputs or B-to-A 3-State Outputs(1)
Bx	B-to-A Data Inputs or A-to-B 3-State Outputs(1)

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

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: TA = – 40°C to +85°C

Symbol	Parameter	Test Conditions		Min.	Typ.(1)	Max.	Unit
V_{IH}	Input HIGH Voltage Level	V_{CC} = 2.3V to 2.7V		1.7	—	—	V
		V_{CC} = 2.7V to 3.6V		2	—	—	
V_{IL}	Input LOW Voltage Level	V_{CC} = 2.3V to 2.7V		—	—	0.7	V
		V_{CC} = 2.7V to 3.6V		—	—	0.8	
I_{IH}	Input HIGH Current	V_{CC} = 3.6V	V_I = V_{CC}	—	—	± 5	µA
I_{IL}	Input LOW Current	V_{CC} = 3.6V	V_I = GND	—	—	± 5	
I_{OZH}	High Impedance Output Current	V_{CC} = 3.6V	V_O = V_{CC}	—	—	± 10	µA
I_{OZL}	(3-State Output pins)		V_O = GND	—	—	± 10	µA
V_{IK}	Clamp Diode Voltage	V_{CC} = 2.3V, I_{IN} = – 18mA		—	– 0.7	– 1.2	V
V_H	Input Hysteresis	V_{CC} = 3.3V		—	100	—	mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	V_{CC} = 3.6V V_{IN} = GND or V_{CC}		—	0.1	40	µA
ΔI_{CC}	Quiescent Power Supply Current Variation	One input at V_{CC} – 0.6V, other inputs at V_{CC} or GND		—	—	750	µA

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NOTE:
1. Typical values are at V_{CC} = 3.3V, +25°C ambient.

BUS-HOLD CHARACTERISTICS

Symbol	Parameter[1]	Test Conditions		Min.	Typ.[2]	Max.	Unit
I_{BHH}	Bus-Hold Input Sustain Current	V_{CC} = 3.0V	V_I = 2.0V	– 75	—	—	µA
I_{BHL}			V_I = 0.8V	75	—	—	
I_{BHH}	Bus-Hold Input Sustain Current	V_{CC} = 2.3V	V_I = 1.7V	– 45	—	—	µA
I_{BHL}			V_I = 0.7V	45	—	—	
I_{BHHO}	Bus-Hold Input Overdrive Current	V_{CC} = 3.6V	V_I = 0 to 3.6V	—	—	± 500	µA
I_{BHLO}							

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NOTES:
1. Pins with Bus-hold are identified in the pin description.
2. Typical values are at V_{CC} = 3.3V, +25°C ambient.

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = 2.3V to 3.6V	I_{OH} = – 0.1mA	V_{CC} – 0.2	—	V
		V_{CC} = 2.3V	I_{OH} = – 4mA	1.9	—	
			I_{OH} = – 6mA	1.7	—	
		V_{CC} = 2.7V	I_{OH} = – 4mA	2.2	—	
			I_{OH} = – 8mA	2	—	
		V_{CC} = 3.0V	I_{OH} = – 6mA	2.4	—	
			I_{OH} = – 12mA	2	—	
V_{OL}	Output LOW Voltage	V_{CC} = 2.3V to 3.6V	I_{OL} = 0.1mA	—	0.2	V
		V_{CC} = 2.3V	I_{OL} = 4mA	—	0.4	
			I_{OL} = 6mA	—	0.55	
		V_{CC} = 2.7V	I_{OL} = 4mA	—	0.4	
			I_{OL} = 8mA	—	0.6	
		V_{CC} = 3.0V	I_{OL} = 6mA	—	0.55	
			I_{OL} = 12mA	—	0.8	

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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 V_{CC} range. T_A = – 40°C to + 85°C.

OPERATING CHARACTERISTICS, T_A = 25°C

Symbol	Parameter	Test Conditions	V_{CC} = 2.5V ± 0.2V	V_{CC} = 3.3V ± 0.3V	Unit
			Typical	Typical	
C_{PD}	Power Dissipation Capacitance Outputs enabled	C_L = 0pF, f = 10Mhz	—	—	pF
C_{PD}	Power Dissipation Capacitance Outputs disabled		—	—	pF

SWITCHING CHARACTERISTICS (1)

Symbol	Parameter		Vcc = 2.5V ± 0.2V		Vcc = 2.7V		Vcc = 3.3V ± 0.3V		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
f_{MAX}			150	—	150	—	150	—	MHz
t_{PLH} t_{PHL}	Propagation Delay Ax to Bx or Bx to Ax		1	6.2	—	5.4	—	4.5	ns
t_{PLH} t_{PHL}	Propagation Delay LEBA to Ax or LEAB to Bx		1	7	—	6.2	1	5.3	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{CLKBA}$ to Ax or $\overline{CLKAB}$ to Bx		1	7.7	—	7.3	1.1	6.1	ns
t_{PZH} t_{PZL}	Output Enable Time $\overline{OEBA}$ to Ax		1	7.2	—	6.9	1	5.8	ns
t_{PZH} t_{PZL}	Output Enable Time OEAB to Bx		1	6.7	—	6.1	1	5.2	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{OEBA}$ to Ax		1	6.1	—	5.1	1	4.8	ns
t_{PHZ} t_{PLZ}	Output Disable Time OEAB to Bx		1.7	6.8	—	6.2	1.5	5.5	ns
t_{SU}	Setup Time, data before $\overline{CLK}\downarrow$		1.7	—	1.4	—	1.3	—	ns
t_H	Hold Time, data after $\overline{CLK}\downarrow$		1.7	—	1.6	—	1.3	—	ns
t_{SU}	Setup Time, data before $\overline{LE}\downarrow$	$\overline{CLK}$ LOW	1.9	—	1.6	—	1.4	—	ns
		$\overline{CLK}$ HIGH	1.1	—	1	—	1	—	ns
t_H	Hold Time, data after $\overline{LE}\downarrow$	$\overline{CLK}$ LOW	1.6	—	1.5	—	1.2	—	ns
		$\overline{CLK}$ HIGH	2	—	1.8	—	1.5	—	ns
t_W	Pulse Width, LE HIGH		3.3	—	3.3	—	3.3	—	ns
t_W	Pulse Width, $\overline{CLK}$ HIGH or LOW		3.3	—	3.3	—	3.3	—	ns
$t_{SK}(o)$	Output Skew(2)		—	—	—	—	—	500	ps

NOTES:
1. See test circuits and waveforms. T_A = – 40°C to + 85°C.
2. Skew between any two outputs of the same package and switching in the same direction.

TEST CIRCUITS AND WAVEFORMS:

TEST CONDITIONS

Symbol	Vcc(1)= 3.3V±0.3V	Vcc(1)= 2.7V	Vcc(2)= 2.5V±0.2V	Unit
V_{LOAD}	6	6	2 x Vcc	V
V_{IH}	2.7	2.7	Vcc	V
V_T	1.5	1.5	Vcc / 2	V
V_{LZ}	300	300	150	mV
V_{HZ}	300	300	150	mV
C_L	50	50	30	pF

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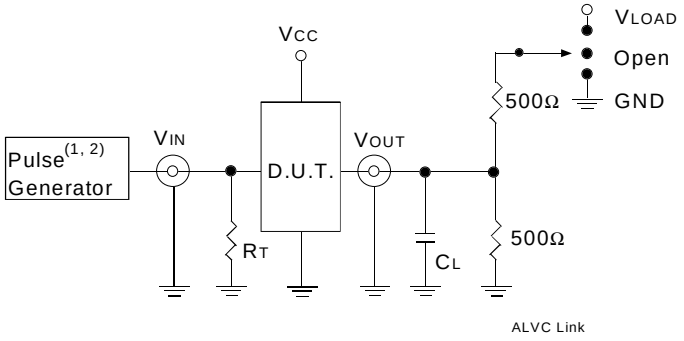
TEST CIRCUITS FOR ALL OUTPUTS



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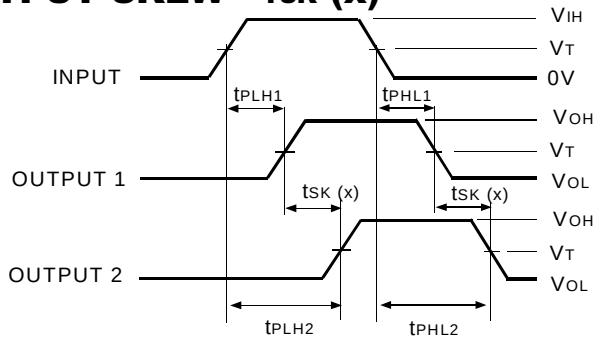
SWITCH POSITION

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

OUTPUT SKEW - tSK (x)



$t_{SK(x)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

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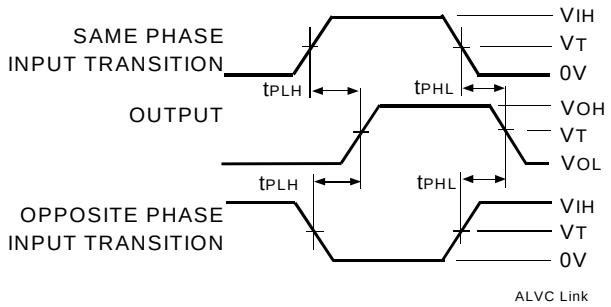
NOTES:
1. For tSK(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For tSK(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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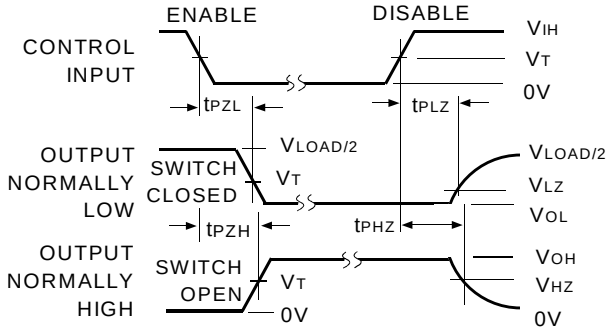
ENABLE AND DISABLE TIMES



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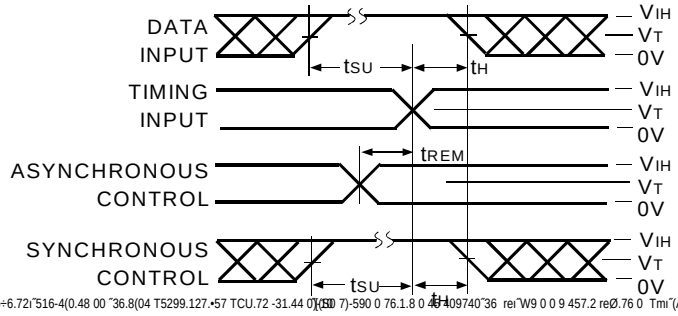
SET-UP, HOLD, AND RELEASE TIMES



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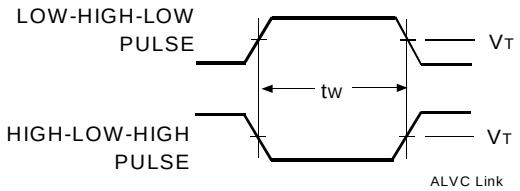

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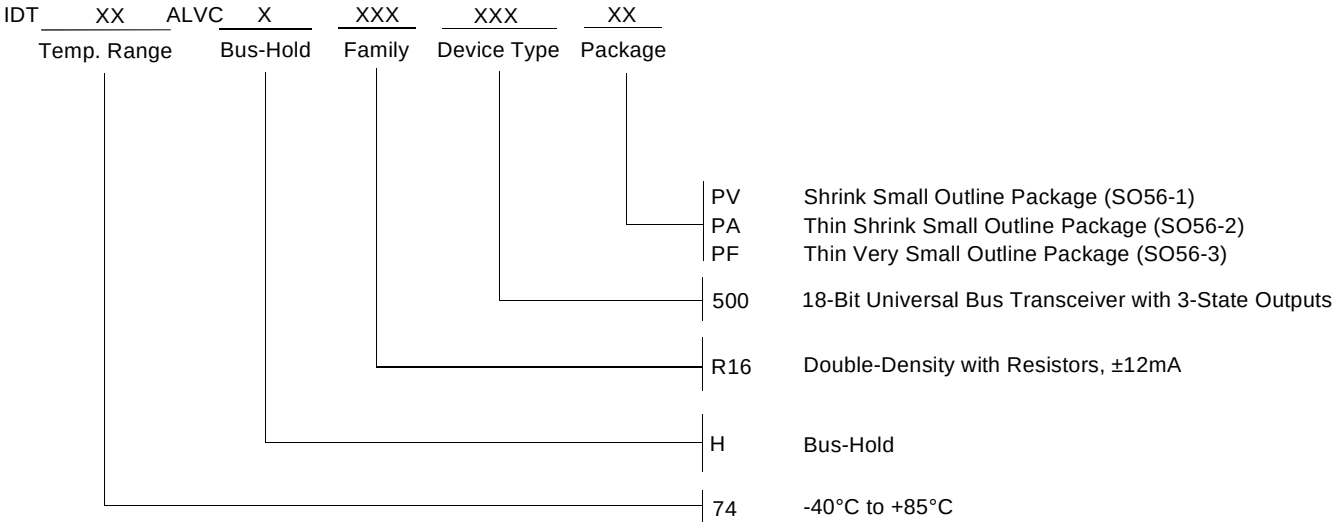
ORDERING INFORMATION



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