



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

IDT74ALVCH162601

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 $+85^{\circ}\text{C}$
- $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$, Normal Range
- $V_{CC} = 2.7\text{V}$ to 3.6V , Extended Range
- $V_{CC} = 2.5\text{V} \pm 0.2\text{V}$
- CMOS power levels (0.4 μW typ. static)
- Rail-to-Rail output swing for increased noise margin

Drive Features for ALVCH162601:

- High Output Drivers: $\pm 24\text{mA}$ (A port)
- Balanced Output Drivers: $\pm 12\text{mA}$ (B port)

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. The ALVCH162601 combines D-type latches

and D-type flip-flops to allow data flow in transparent, latched, clocked, and clock-enabled modes.

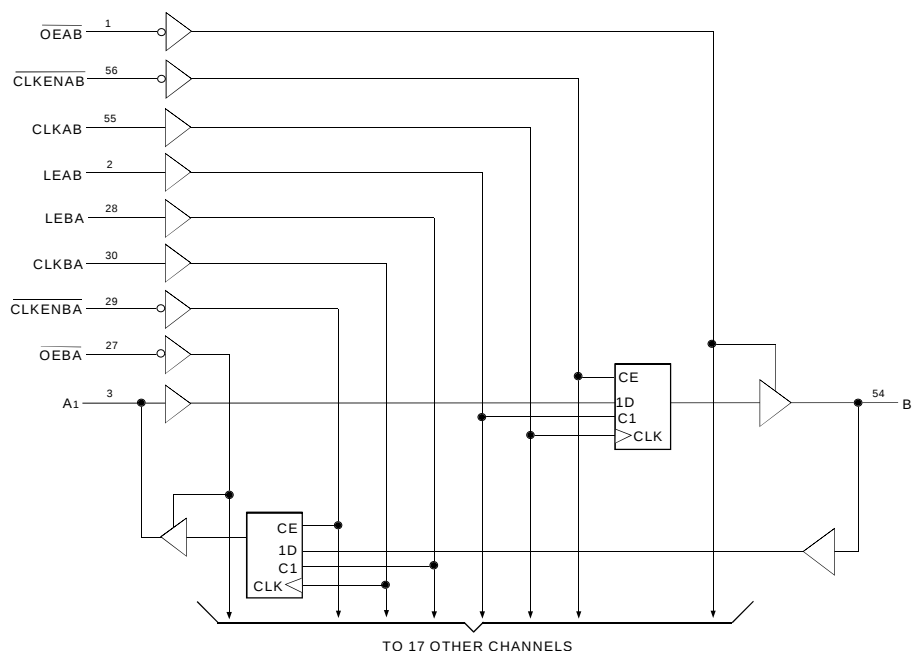
Data flow in each direction is controlled by output-enable ($\overline{\text{OEAB}}$ and $\overline{\text{OEBA}}$), latch-enable (LEAB and LEBA), and clock (CLKAB and CLKBA) inputs. The clock can be controlled by the clock-enable (CLKENAB and CLKENBA) inputs. For A-to-B data flow, the device operates in the 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 data is stored in the latch/flip-flop on the low-to-high transition of CLKAB. When $\overline{\text{OEAB}}$ is low, the outputs are active. When $\overline{\text{OEAB}}$ is high, the outputs are in the high-impedance state.

Data flow for B to A is similar to that of A to B but uses $\overline{\text{OEBA}}$, LEBA, CLKBA and CLKENBA.

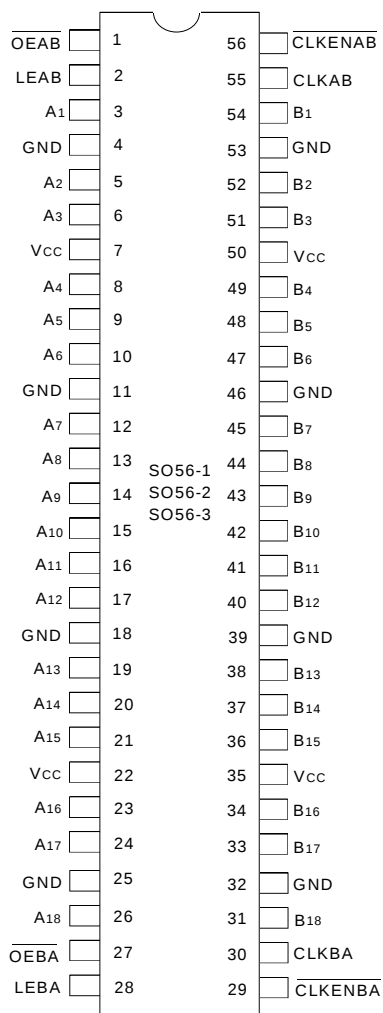
The ALVCH162601 has series resistors in the device output structure of the "B" port which will significantly reduce line noise when used with light loads. This driver has been designed to drive $\pm 12\text{mA}$ at the designated threshold levels. The "A" port has a $\pm 24\text{mA}$ driver.

The ALVCH162601 has "bus-hold" which retains the inputs' last state whenever the input 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

PIN DESCRIPTION

Pin Names	Description
$\overline{OEAB}$	A-to-B Output Enable Input (Active LOW)
$\overline{OEBA}$	B-to-A Output Enable Input (Active LOW)
LEAB	A-to-B Latch Enable Input
LEBA	B-to-A Latch Enable Input
CLKAB	A-to-B Clock Input
CLKBA	B-to-A Clock Input
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⁾
$\overline{CLKENAB}$	A-to-B Clock Enable Input (Active LOW)
$\overline{CLKENBA}$	B-to-A Clock Enable Input (Active LOW)

NOTE:

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

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
TSTG	Storage Temperature	- 65 to + 150	°C
IOUT	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}	Continuous Current through each V _{CC} or GND	±100	mA

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NOTES:

- 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.
- V_{CC} terminals.
- 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:

- As applicable to the device type.

FUNCTION TABLE^(1, 2)

Inputs					Outputs
$\overline{CLKENAB}$	$\overline{OEAB}$	LEAB	CLKAB	Ax	Bx
X	H	X	X	X	Z
X	L	H	X	L	L
X	L	H	X	H	H
H	L	L	X	X	B ₀
H	L	L	X	X	B ₀
L	L	L	↑	L	L
L	L	L	↑	H	H
L	L	L	L or H	X	B ₀

NOTES:

- A-to-B data flow is shown. B-to-A data flow is similar but uses $\overline{OEBA}$, LEBA, CLKBA and $\overline{CLKENBA}$.
- H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High-Impedance
↑ = LOW-to-HIGH Transition
B₀ = Output level before the indicated steady-state input conditions were established

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

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

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

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NOTE:

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

BUS-HOLD CHARACTERISTICS

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

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NOTES:

- Pins with Bus-hold are identified in the pin description.
- Typical values are at $V_{CC} = 3.3\text{V}$, $+25^{\circ}\text{C}$ ambient.

OUTPUT DRIVE CHARACTERISTICS (A PORT)

Symbol	Parameter	Test Conditions ⁽¹⁾		Min.	Max.	Unit
VOH	Output HIGH Voltage	VCC = 2.3V to 3.6V	IOH = - 0.1mA	VCC - 0.2	—	V
		VCC = 2.3V	IOH = - 6mA	2	—	
		VCC = 2.3V	IOH = - 12mA	1.7	—	
		VCC = 2.7V		2.2	—	
		VCC = 3.0V		2.4	—	
		VCC = 3.0V	IOH = - 24mA	2	—	
VOL	Output LOW Voltage	VCC = 2.3V to 3.6V	IOL = 0.1mA	—	0.2	V
		VCC = 2.3V	IOL = 6mA	—	0.4	
			IOL = 12mA	—	0.7	
		VCC = 2.7V	IOL = 12mA	—	0.4	
		VCC = 3.0V	IOL = 24mA	—	0.55	

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NOTE:

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate VCC range. TA = - 40°C to + 85°C.

OUTPUT DRIVE CHARACTERISTICS (B PORT)

Symbol	Parameter	Test Conditions ⁽¹⁾		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 = 3.0V	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 = 3.0V	IOL = 6mA	—	0.55	
			IOL = 12mA	—	0.8	

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NOTE:

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate VCC range. TA = - 40°C to + 85°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	41	50	pF
CPD	Power Dissipation Capacitance Outputs disabled		6	6	pF

SWITCHING CHARACTERISTICS (A AND B PORTS)⁽¹⁾

Symbol	Parameter	Vcc = 2.5V $\pm$ 0.2V		Vcc = 2.7V		Vcc = 3.3V $\pm$ 0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
fMAX		140	—	150	—	150	—	MHz
tPLH tPHL	Propagation Delay Ax to Bx	1.3	4.8	—	5.2	1.6	4.5	ns
tPLH tPHL	Propagation Delay Bx to Ax	1	4.3	—	4.6	1	4.1	ns
tPLH tPHL	Propagation Delay LEAB to Bx	1	5.5	—	5.9	1.5	5.1	ns
tPLH tPHL	Propagation Delay LEBA to Ax	1	5	—	5.3	1	4.7	ns
tPLH tPHL	Propagation Delay CLKAB to Bx	1.5	6.1	—	6.3	1.6	5.5	ns
tPLH tPHL	Propagation Delay CLKBA to Ax	1.3	5.6	—	5.8	1.4	5	ns
tPZH tPZL	Output Enable Time OEAB to Bx	1.6	6.1	—	6.7	1.6	5.7	ns
tPZH tPZL	Output Enable Time OEBA to Ax	1.1	5.5	—	6.1	1.1	5.2	ns
tPHZ tPLZ	Output Disable Time OEAB to Bx	1.8	5.7	—	5.3	1.8	4.8	ns
tPHZ tPLZ	Output Disable Time OEBA to Ax	1.3	5.2	—	4.8	1.6	4.4	ns
tsu	Setup Time, data before CLK $\uparrow$	2.3	—	2.4	—	2.1	—	ns
tsu	Setup Time, data before LE $\downarrow$, CLK HIGH	2	—	1.6	—	1.6	—	ns
tsu	Setup Time, data before LE $\downarrow$, CLK LOW	1.3	—	1.2	—	1.1	—	ns
tsu	Setup Time, $\overline{\text{CLKEN}}$ before CLK $\uparrow$	2	—	2	—	1.7	—	ns
th	Hold Time, data after CLK $\uparrow$	0.7	—	0.7	—	0.8	—	ns
th	Hold Time, data after LE $\downarrow$, CLK HIGH	1.3	—	1.6	—	1.4	—	ns
th	Hold Time, data after LE $\downarrow$, CLK LOW	1.7	—	2	—	1.7	—	ns
th	Hold Time, $\overline{\text{CLKEN}}$ after CLK $\uparrow$	0.3	—	0.5	—	0.6	—	ns
tw	Pulse Width, LE HIGH	3.3	—	3.3	—	3.3	—	ns
tw	Pulse Width, CLK HIGH or LOW	3.3	—	3.3	—	3.3	—	ns
tsk(0)	Output Skew ⁽²⁾	—	—	—	—	—	500	ps

NOTES:

- See test circuits and waveforms. $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$.
- Skew between any two outputs of the same package and switching in the same direction.

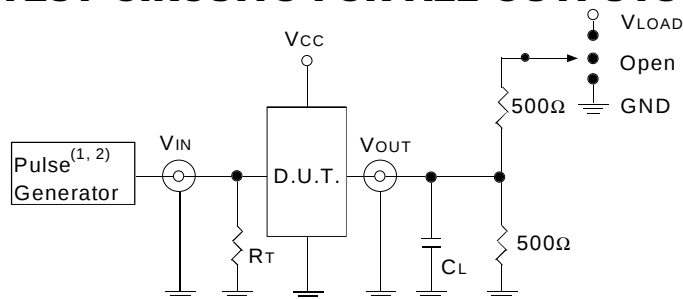
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	V _{CC} (1)= 3.3V±0.3V	V _{CC} (1)= 2.7V	V _{CC} (2)= 2.5V±0.2V	Unit
V _{LOAD}	6	6	2 x 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

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TEST CIRCUITS FOR ALL OUTPUTS



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DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:

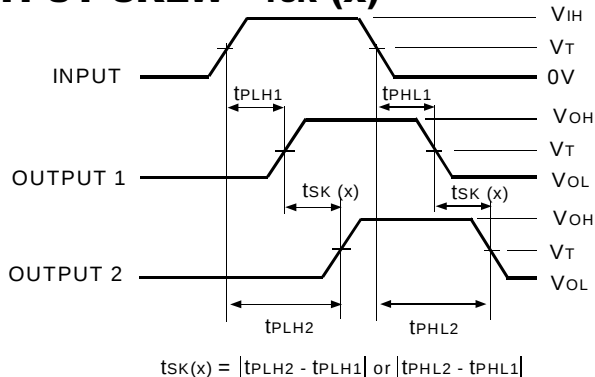
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.

SWITCH POSITION

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

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OUTPUT SKEW - t_{SK} (x)

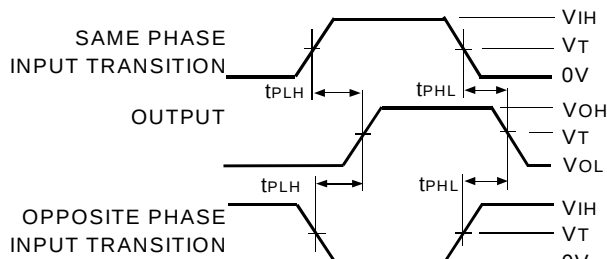


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NOTES:

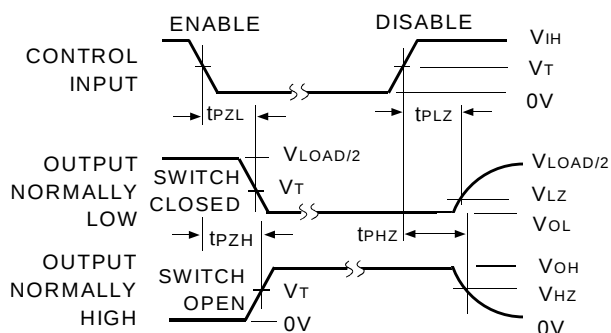
1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

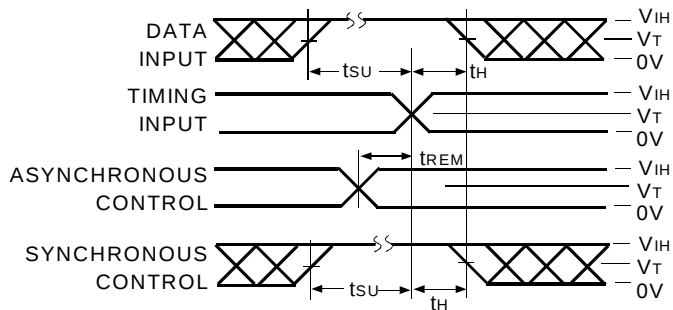


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NOTE:

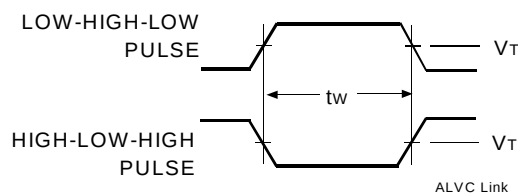
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

SET-UP, HOLD, AND RELEASE TIMES



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PULSE WIDTH



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ORDERING INFORMATION

IDT	XX	ALVC	X	XX	XXX	XX	
	Temp. Range		Bus-Hold	Family	Device Type	Package	
						PV	Shrink Small Outline Package (SO56-1)
						PA	Thin Shrink Small Outline Package (SO56-2)
						PF	Thin Very Small Outline Package (SO56-3)
						601	18-Bit Universal Bus Transceiver with 3-State Outputs
						162	Double-Density with Resistors, $\pm 24\text{mA}$ (A port) $\pm 12\text{mA}$ (B port)
						H	Bus-Hold
						74	-40°C to $+85^{\circ}\text{C}$



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