Integrated Device Technology, Inc.

3.3V CMOS 16-BIT BUFFER/LINE DRIVER

IDT74ALVCH16244
IDT74ALVCH162244
IDT74ALVC16244
IDT74ALVC162244
ADVANCE INFORMATION

FEATURES:

- **Common 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)
  - 25 mil pitch SSOP, 19.6 mil pitch TSSOP, and 15.7 mil 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
- **Features for ALVCH16244 and ALVC16244:**
  - High Drive Outputs: ±24mA
  - Suitable for heavy loads
- **Features for ALVCH162244 and ALVC162244:**
  - Light Balanced Output Driver: ±12mA
  - Minimal switching noise

DESCRIPTION:

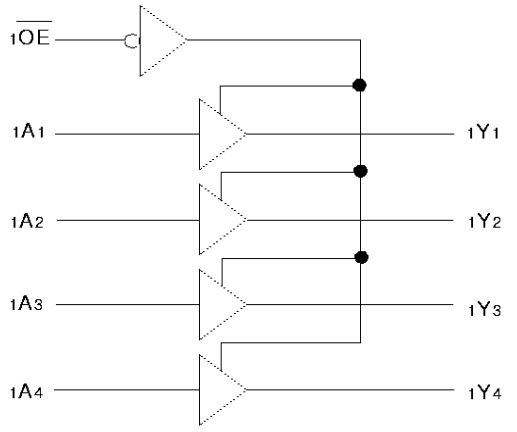
The 16-bit buffer line drivers are built using advanced dual metal CMOS technology. These high-speed, low power devices offer bus/backplane interface capability with improved packing density and a flow-through organization for simplifying board layout. The three-state controls operate these devices in a Quad-Nibble, Dual-Byte or single 16-bit word mode. All inputs are designed with hysteresis for improved noise margin.

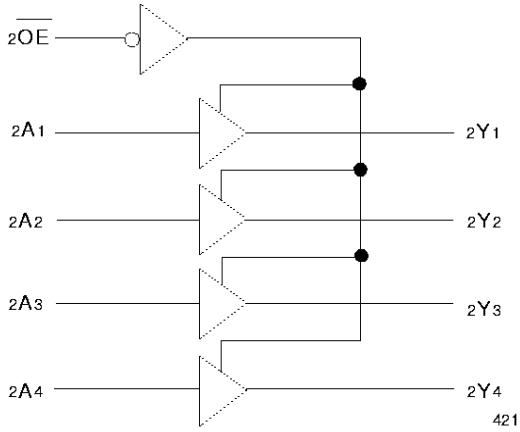
The ALVCH16x244 have "bus-hold" which retains the input's last state whenever the input bus goes to a high impedance. This prevents floating inputs and eliminates the need for pull-up/down resistors.

The ALVCH16244/ALVC16244 have been designed with a ±24mA output driver. These drivers are capable of driving a moderate to heavy load while maintaining speed performance.

The ALVCH162244/ALVC162244 have 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 ±12mA at the designated threshold levels.

FUNCTIONAL BLOCK DIAGRAM





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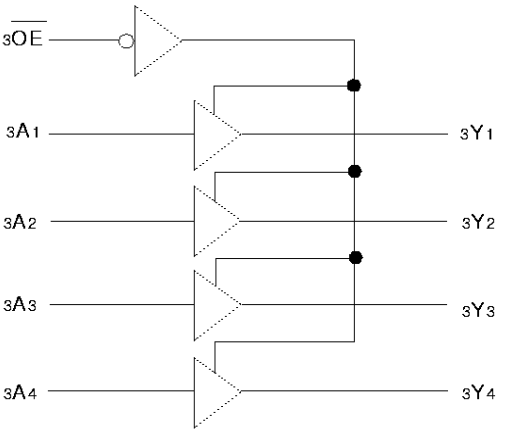

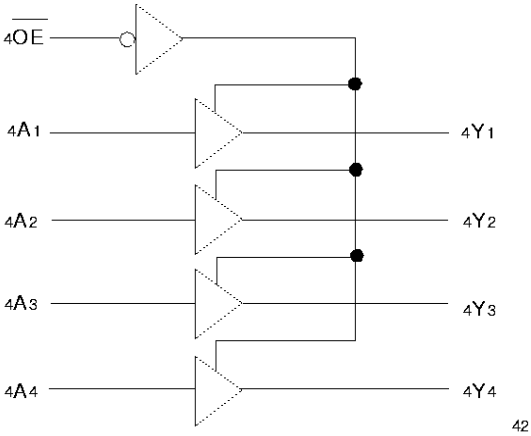

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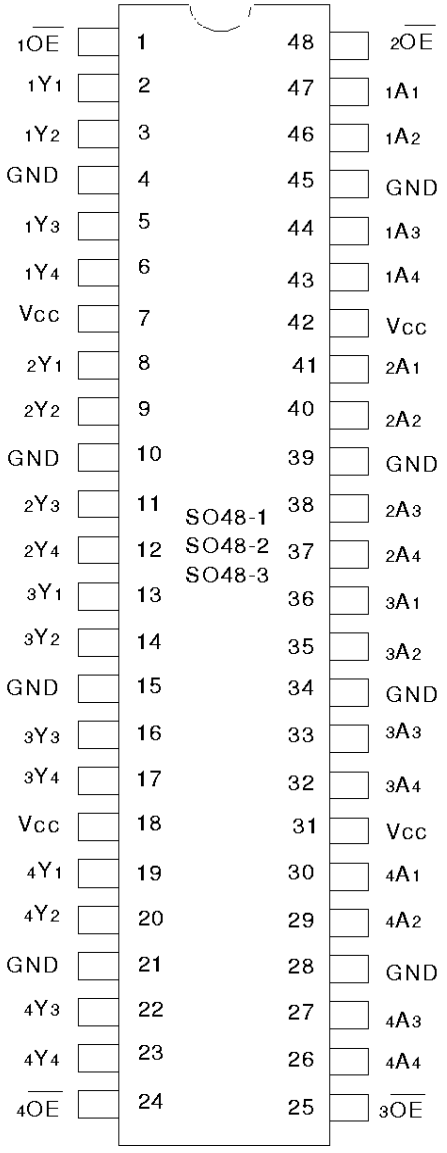
PIN CONFIGURATION



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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	–60 to +60	mA
I_{IK} I_{OK}	Continuous Clamp Current, V_I < 0 or 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}.

FUNCTION TABLE(1)

Inputs		Outputs
$x\overline{OE}$	xAx	xYx
L	L	L
L	H	H
H	X	Z

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

PIN DESCRIPTION

Pin Names	Description
$x\overline{OE}$	3–State Output Enable Inputs (Active LOW)
xAx	Data Inputs(1)
xYx	3-State Outputs

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NOTE:
1. On ALVCH these pins have "Bus-hold". All other pins are standard inputs, outputs or I/Os. On ALVC no pins have "Bus-hold".

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	5.0	7.0	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	7.0	9.0	pF
$C_{I/O}$	I/O Port Capacitance	V_{IN} = 0V	7.0	9.0	pF

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NOTE:
1. As applicable to the device type.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Operating Condition: T_A = –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 2.7 V		—	—	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}	—	—	±1	µA
I_{IL}	Input LOW Current	V_{CC} = 3.6V	V_I = GND	—	—	±1	
I_{OZH}	High Impedance Output Current	V_{CC} = 3.6V	V_O = V_{CC}	—	—	±1	µA
I_{OZL}	(3-State Output pins)		V_O = GND	—	—	±1	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

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BUS-HOLD CHARACTERISTICS FOR ALVCH16x244

Symbol	Parameter(2)	Test Conditions		Min.	Typ.(1)	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. Typical values are at V_{CC} = 3.3V, +25°C ambient.
2. Pins with Bus-hold are identified in the pin description.

OUTPUT DRIVE CHARACTERISTICS FOR ALVCH16244 AND ALVC16244

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} = –6mA	2	—	
		V_{CC} = 2.3V	I_{OH} = –12mA	1.7	—	
		V_{CC} = 2.7V		2.2	—	
		V_{CC} = 3.0V		2.4	—	
		V_{CC} = 3.0V	I_{OH} = –24mA	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} = 6mA	—	0.4	
			I_{OL} = 12mA	—	0.7	
		V_{CC} = 2.7V	I_{OL} = 12mA	—	0.4	
		V_{CC} = 3.0V	I_{OL} = 24mA	—	0.55	

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OUTPUT DRIVE CHARACTERISTICS FOR ALVCH162244 AND ALVC162244

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	—	
		V_{CC} = 2.3V	I_{OH} = –6mA	1.7	—	
		V_{CC} = 2.7V	I_{OH} = –8mA	2	—	
		V_{CC} = 3.0V	I_{OH} = –6mA	2.4	—	
		V_{CC} = 3.0V	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} = 8mA	—	0.6	
		V_{CC} = 3.0V	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.

POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Standard Inputs HIGH	V_{CC} = Max.	V_{IN} = V_{CC} – 0.6V[3]	—	2.0	10	µA
ΔI_{CC}	Quiescent Power Supply Current TTL Bus-Hold Inputs HIGH	V_{CC} = Max.	V_{IN} = V_{CC} – 0.6V[3]	—	162	325	µA
I_{CCD}	Dynamic Power Supply Current[4,5]	V_{CC} = Max. Outputs Open 50% Duty Cycle $\overline{xOE}$ = GND One Input Toggling	V_{IN} = V_{CC} V_{IN} = GND	—	47	60	µA/ MHz
I_C	Total Power Supply Current[6]	V_{CC} = Max. Outputs Open fi = 10MHz	V_{IN} = V_{CC} V_{IN} = GND	—	0.47	0.64	mA
		50% Duty Cycle $\overline{xOE}$ = GND One Bit Toggling	V_{IN} = V_{CC} –0.6V V_{IN} = GND	—	0.55	0.8	
		V_{CC} = Max. Outputs Open fi = 2.5MHz	V_{IN} = V_{CC} V_{IN} = GND	—	1.9	2.4	
		50% Duty Cycle $\overline{xOE}$ = GND Sixteen Bits Toggling	V_{IN} = V_{CC} –0.6V V_{IN} = GND	—	3.2	5.0	

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NOTES:

1. V_{CC} (max.) = 3.6V
2. Typical values are at V_{CC} = 3.3V, +25°C ambient.
3. Per TTL driven input; all other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
5. C_{PD} = I_{CCD}/V_{CC}
   C_{PD} = Power Dissipation Capacitance
6. I_C = $I_{QUIESCENT}$ + I_{INPUTS} + $I_{DYNAMIC}$
   I_C = I_{CC} + $_{\Delta}I_{CC}$ $D_H N_T$ + I_{CCD} ($f_{CP} N_{CP}/2$ + $f_i N_i$)
   I_{CC} = Quiescent Current (I_{CCL}, I_{CCH} and I_{CCZ})
   $_{\Delta}I_{CC}$ = Power Supply Current for a TTL High Input
   D_H = Duty Cycle for TTL Inputs High
   N_T = Number of TTL Inputs at D_H
   I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
   f_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   N_{CP} = Number of Clock Inputs at f_{CP}
   f_i = Input Frequency
   N_i = Number of Inputs at f_i

SWITCHING CHARACTERISTICS FOR ALVCH16244 AND ALVC16244(1)

Symbol	Parameter	VCC = 2.5V ±0.2V		VCC = 2.7V		VCC = 3.3V ±0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
tPLH tPHL	Propagation Delay xAx to xYx	1	4.3	1	3.6	1	3.0	ns
tPZH tPZL	Output Enable Time	1	6.2	1	5.4	1	4.4	ns
tPHZ tPLZ	Output Disable Time	1	5.4	1	4.6	1	4.1	ns
tSK(o)	Output Skew(2)	0	500	0	500	0	500	ps

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SWITCHING CHARACTERISTICS FOR ALVCH162244 AND ALVC162244(1)

Symbol	Parameter	VCC = 2.5V ±0.2V		VCC = 2.7V		VCC = 3.3V ±0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
tPLH tPHL	Propagation Delay xAx to xYx	1	5.0	1	4.0	1	3.6	ns
tPZH tPZL	Output Enable Time	1	6.8	1	6.0	1	5.0	ns
tPHZ tPLZ	Output Disable Time	1	6.0	1	5.2	1	5.0	ns
tSK(o)	Output Skew(2)	0	500	0	500	0	500	ps

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

TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

Symbol	Vcc = 3.3V ±0.3V	Vcc = 2.7V	Vcc = 2.5V±0.2V	Unit
V_{LOAD}	6	6	4.6	V
V_{IH}	2.7	2.7	2.3	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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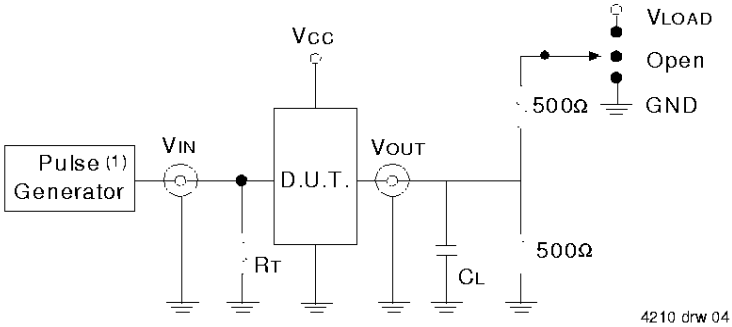
DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

TEST CIRCUITS FOR ALL OUTPUTS



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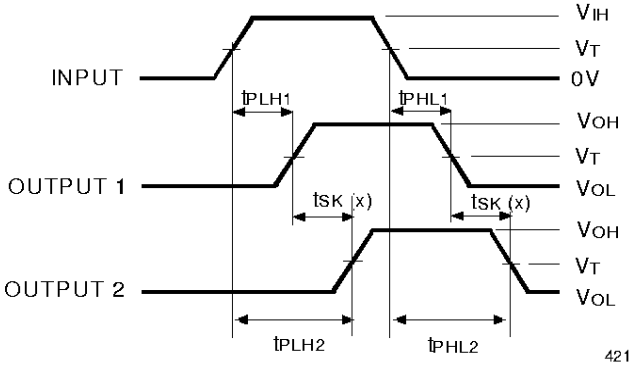
NOTE:
1. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

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)



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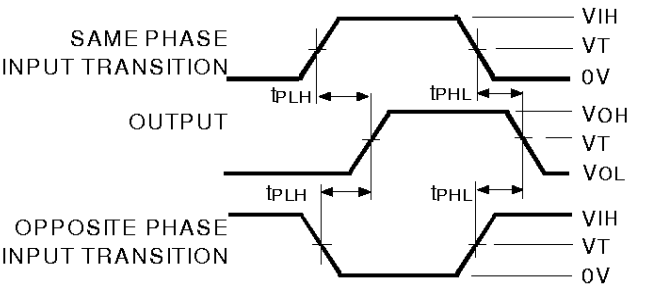
$t_{SK(x)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

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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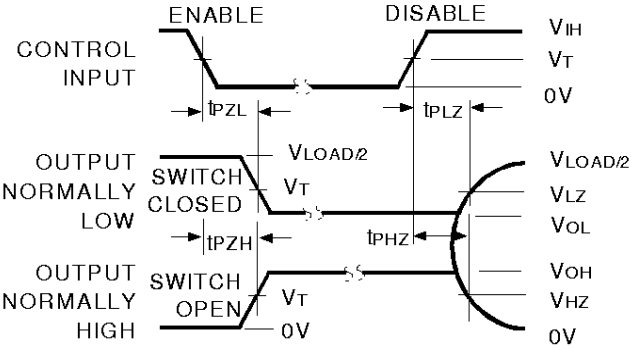
ENABLE AND DISABLE TIMES



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

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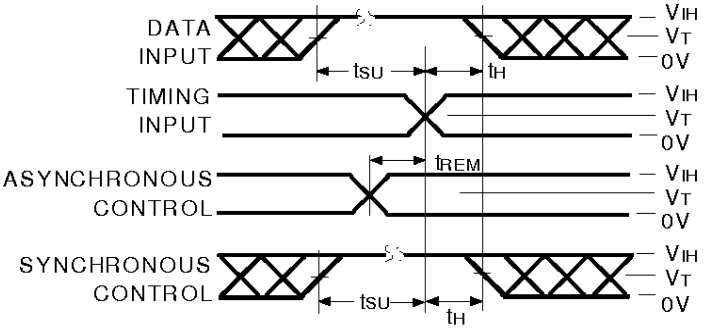
SET-UP, HOLD AND RELEASE TIMES



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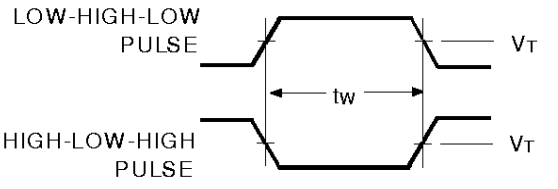
PULSE WIDTH



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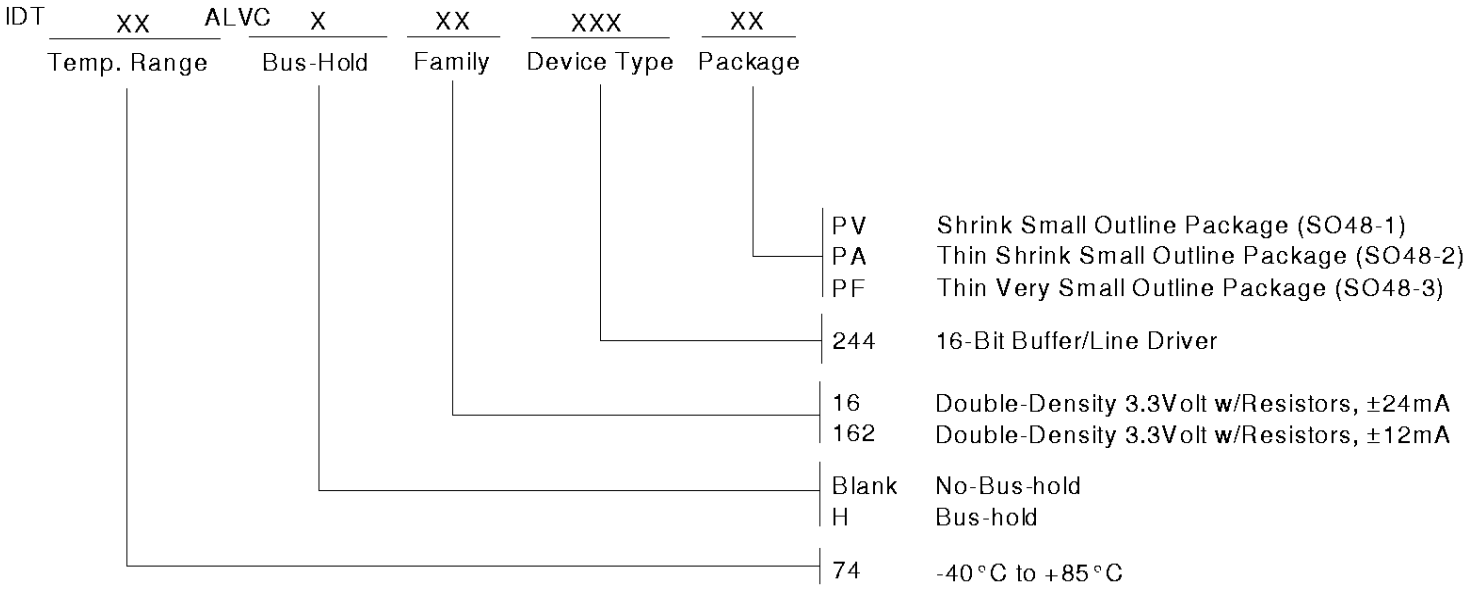
ORDERING INFORMATION



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