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

IDT74ALVCH16525

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)**
- **Vcc = 3.3V ± 0.3V, Normal Range**
- **Vcc = 2.7V to 3.6V, Extended Range**
- **Vcc = 2.5V ± 0.2V**
- **CMOS power levels (0.4µ W typ. static)**
- **Rail-to-Rail output swing for increased noise margin**
- **Available in SSOP, TSSOP, and TVSOP packages**

DRIVE FEATURES:

- **High Output Drivers: ±24mA**
- **Suitable for heavy loads**

APPLICATIONS:

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

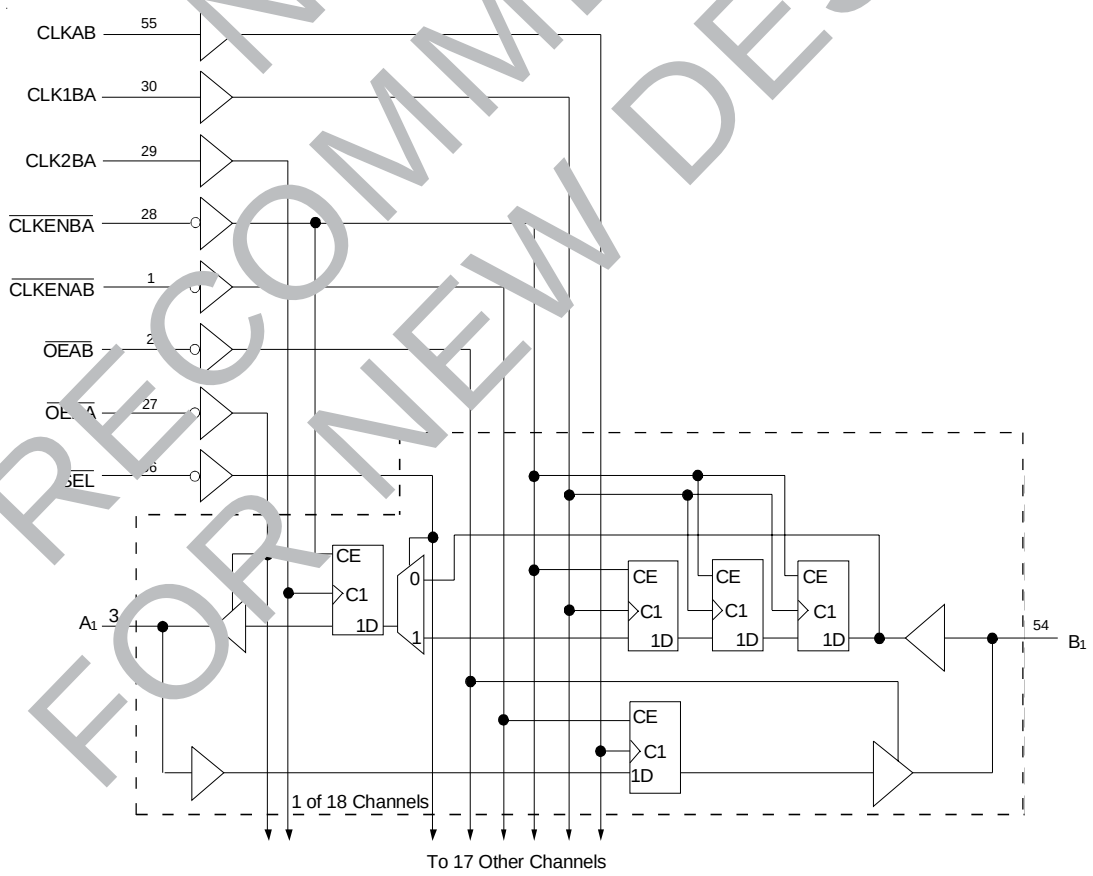
DESCRIPTION:

This 18-bit registered bus transceiver is built using advanced dual metal CMOS technology. Data flow in each direction is controlled by output-enable ($\overline{OEAB}$ and $\overline{OEBA}$) and clock-enable ($\overline{CLKENAB}$ and $\overline{CLKENBA}$) inputs. For the A-to-B data flow, the data flows through a single register. The B-to-A data can flow through a four-stage pipeline register path, or through a single register path, depending on the state of the select ($\overline{SEL}$) input. Data is stored in the internal registers on the low-to-high transition of the clock (CLK) input, provided that the appropriate $\overline{CLKEN}$ inputs are low. The A-to-B data transfer is synchronized to the CLKAB input, and B-to-A data transfer is synchronized with the CLK1BA and CLK2BA inputs.

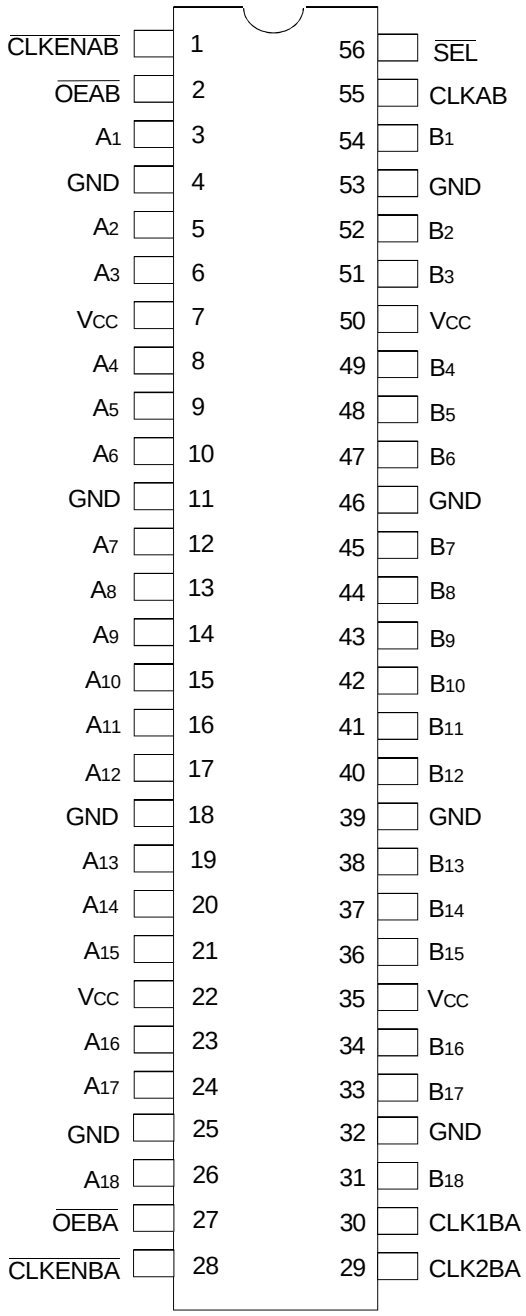
The ALVCH16525 has been designed with a ±24mA output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

The ALVCH16525 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 RATINGS(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

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

NOTE:
1. As applicable to the device type.

PIN DESCRIPTION

Pin Names	Description
CLKAB	Clock Input for the A to B direction
CLK1BA	Clock Input for the B to A pipeline register
CLK2BA	Clock Input for the B to A output register
$\overline{CLKENBA}$	Clock Enable for CLK1BA and CLK2BA clocks (Active LOW)
$\overline{CLKENAB}$	Clock Enable for CLKAB clock (Active LOW)
$\overline{OEAB}$	Output Enable for the B port (Active LOW)
$\overline{OEBA}$	Output Enable for the A port (Active LOW)
$\overline{SEL}$	Select pin for pipelined/non-pipelined mode in the B-to-A direction (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.

FUNCTION TABLE(1)

A-TO-B STORAGE ($\overline{OEAB}$ = L, $\overline{OEBA}$ = H)			
Inputs			Output
$\overline{CLKENAB}$	CLKAB	Ax	Bx
H	X	X	B(2)
L	↑	L	L
L	↑	H	H

B-TO-A STORAGE ($\overline{OEBA}$ = L, $\overline{OEAB}$ = H)					
Inputs					Output
$\overline{CLKENBA}$	CLK2BA	CLK1BA	$\overline{SEL}$	Bx	Ax
H	X	X	X	X	A(2)
L	↑	X	H	L	L
L	↑	X	H	H	H
L	↑	↑	L	L	L(3)
L	↑	↑	L	H	H(3)

NOTES:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   ↑ = LOW-to-HIGH Transition
2. Output level before the indicated steady-state input conditions were established.
3. Three CLK1BA edges and one CLK2BA are needed to propagate data from B to A when $\overline{SEL}$ is LOW.

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 2.7V		—	—	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	µA
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	
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

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} = 3V	V_I = 2V	–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}							

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} = –6mA	2	—	
		V_{CC} = 2.3V	I_{OH} = –12mA	1.7	—	
		V_{CC} = 2.7V		2.2	—	
		V_{CC} = 3V		2.4	—	
		V_{CC} = 3V	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} = 3V	I_{OL} = 24mA	—	0.55	

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 Typical	V_{CC} = 3.3V ± 0.3V Typical	Unit
C_{PD}	Power Dissipation Capacitance Outputs enabled	C_L = 0pF, f = 10Mhz	—	160	pF
C_{PD}	Power Dissipation Capacitance Outputs disabled		—	160	

SWITCHING CHARACTERISTICS(1)

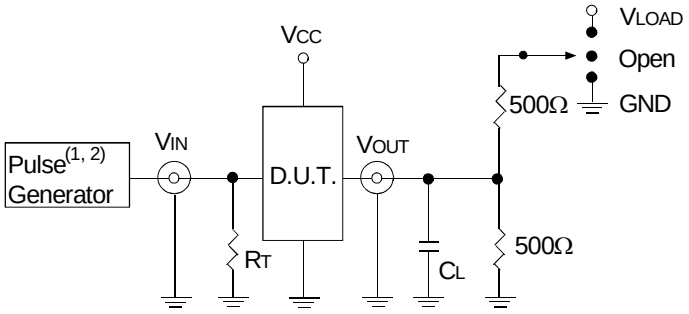
Symbol	Parameter	Vcc = 2.5V ± 0.2V		Vcc = 2.7V		Vcc = 3.3V ± 0.3V		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
f_{MAX}		120	—	125	—	150	—	MHz
t_{PLH} t_{PHL}	Propagation Delay CLKAB to Bx or CLK2BA to Ax	1	4.5	—	4.4	1	4.2	ns
t_{PZH} t_{PZL}	Output Enable Time $\overline{OEAB}$ to Bx or $\overline{OEBA}$ to Ax	1	6.1	—	6.1	1	5.1	ns
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{OEAB}$ to Bx or $\overline{OEBA}$ to Ax	1	6.3	—	5.4	1	4.9	ns
t_{SU}	Set-up Time, Ax data before CLKAB↑	1.3	—	1.3	—	1.3	—	ns
t_{SU}	Set-up Time, Bx data before CLK2BA↑	2.1	—	1.8	—	1.7	—	ns
t_{SU}	Set-up Time, Bx data before CLK1BA↑	1.3	—	1.2	—	1.1	—	ns
t_{SU}	Set-up Time, $\overline{SEL}$ before CLK2BA↑	3.3	—	3.3	—	3.3	—	ns
t_{SU}	Set-up Time, $\overline{CLKENAB}$ before CLKAB↑	2.1	—	1.9	—	1.6	—	ns
t_{SU}	Set-up Time, $\overline{CLKENBA}$ before CLK1BA↑	2.7	—	2.5	—	2.1	—	ns
t_{SU}	Set-up Time, $\overline{CLKENBA}$ before CLK2BA↑	2.7	—	2.5	—	2.2	—	ns
t_H	Hold Time, Ax data after CLKAB↑	0.7	—	0.4	—	0.9	—	ns
t_H	Hold Time, Bx data after CLK2BA↑	0.4	—	0	—	0.6	—	ns
t_H	Hold Time, Bx data after CLK1BA↑	0.8	—	0.4	—	1	—	ns
t_H	Hold Time, $\overline{SEL}$ after CLK2BA↑	0	—	0	—	0.1	—	ns
t_H	Hold Time, $\overline{CLKENAB}$ after CLKAB↑	0.1	—	0.3	—	0.3	—	ns
t_H	Hold Time, $\overline{CLKENBA}$ after CLK1BA↑	0	—	0	—	0.1	—	ns
t_H	Hold Time, $\overline{CLKENBA}$ after CLK2BA↑	0	—	0	—	0	—	ns
t_W	Pulse Duration, CLK HIGH or LOW	3.2	—	3.2	—	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	$V_{CC}^{(1)}$=3.3V±0.3V	$V_{CC}^{(1)}$=2.7V	$V_{CC}^{(2)}$=2.5V±0.2V	Unit
V_{LOAD}	6	6	2 x 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



Test Circuit for All Outputs

DEFINITIONS:

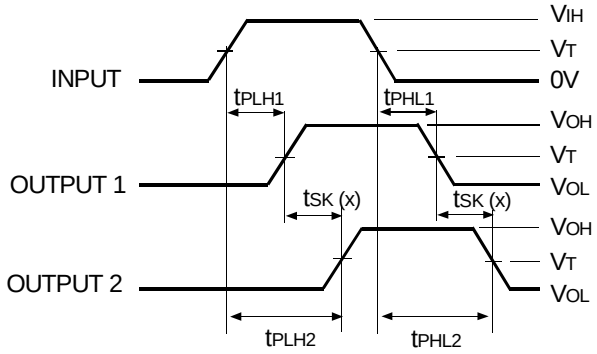
C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

NOTES:

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

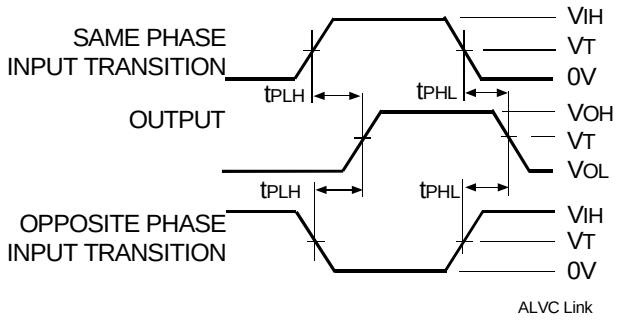


$t_{SK(x)} = |t_{PLH2} - t_{PLH1}|$ or $|t_{PHL2} - t_{PHL1}|$

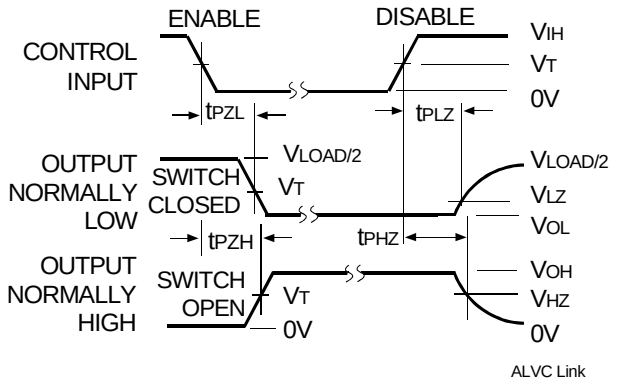
Output Skew - $t_{SK(x)}$

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.



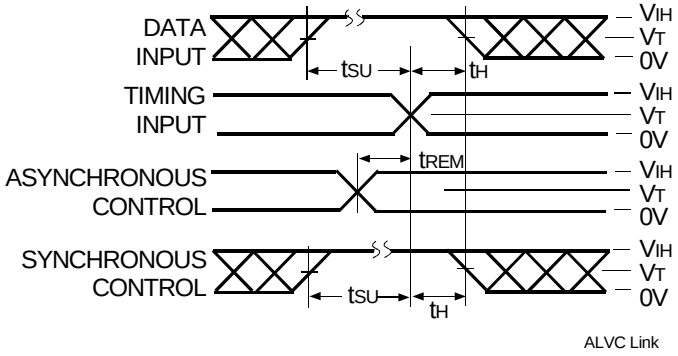
Propagation Delay



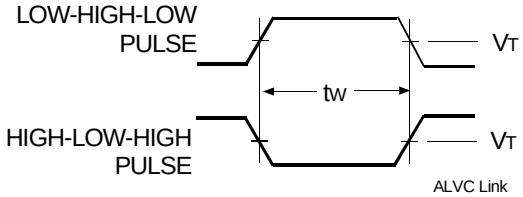
Enable and Disable Times

NOTE:

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

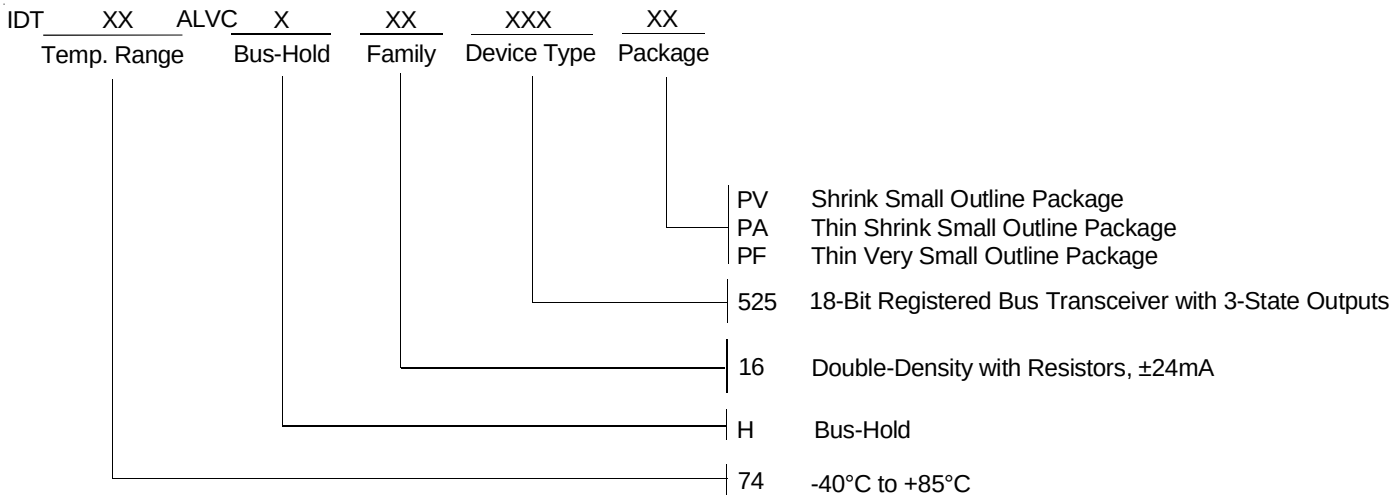


Set-up, Hold, and Release Times



Pulse Width

ORDERING INFORMATION



CORPORATE HEADQUARTERS
2975 Stender Way
Santa Clara, CA 95054

for SALES:
800-345-7015 or 408-727-6116
fax: 408-492-8674
www.idt.com

for Tech Support:
logichelp@idt.com
(408) 654-6459