



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

IDT74ALVCH16600

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 ($0.4\mu\text{W}$ typ. static)
- Rail-to-Rail output swing for increased noise margin

Drive Features for ALVCH16600:

- High Output Drivers: $\pm 24\text{mA}$
- Suitable for heavy loads

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 transceiver combines D-type latches and

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

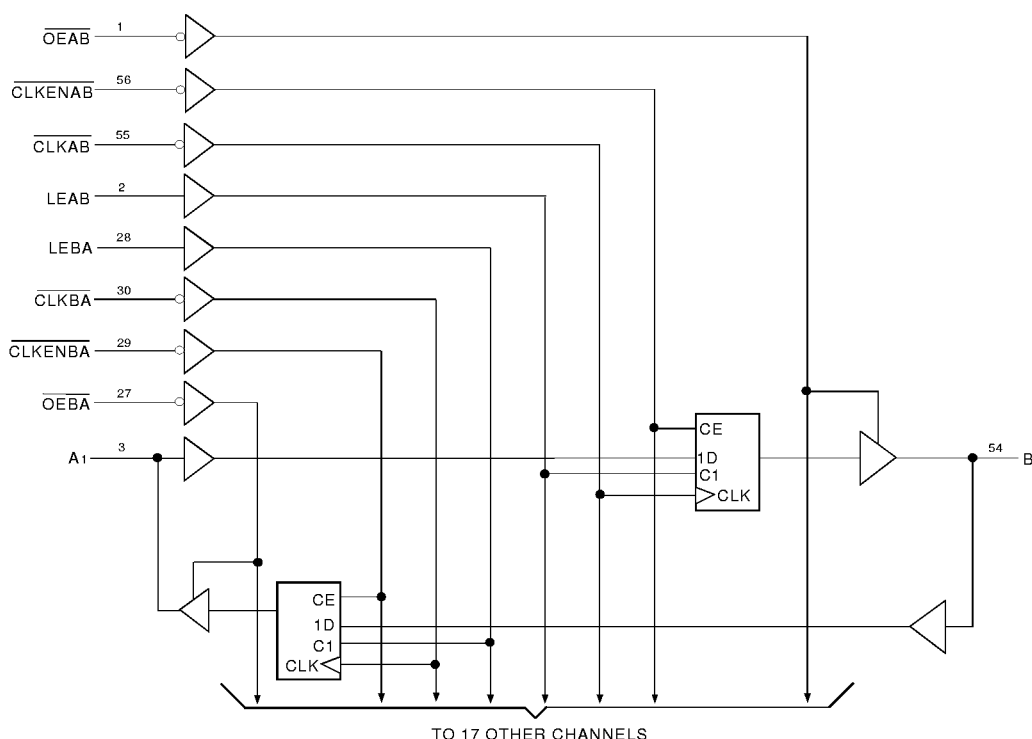
Data flow in each direction is controlled by output-enable ($\overline{\text{OEAB}}$ and $\overline{\text{OEBA}}$), latch-enable (LEAB and LEBA), and clock ($\overline{\text{CLKAB}}$ and $\overline{\text{CLKBA}}$) inputs. The clock can be controlled by the clock-enable ($\overline{\text{CLKENAB}}$ and $\overline{\text{CLKENBA}}$) 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 $\overline{\text{CLKAB}}$ is held at a high or low logic level. If LEAB is low, the A data is stored in the latch/flip-flop on the high-to-low transition of $\overline{\text{CLKAB}}$. Output enable $\overline{\text{OEAB}}$ is active low. 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, $\overline{\text{CLKBA}}$ and $\overline{\text{CLKENBA}}$.

The ALVCH16600 has been designed with a $\pm 24\text{mA}$ output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

The ALVCH16600 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.

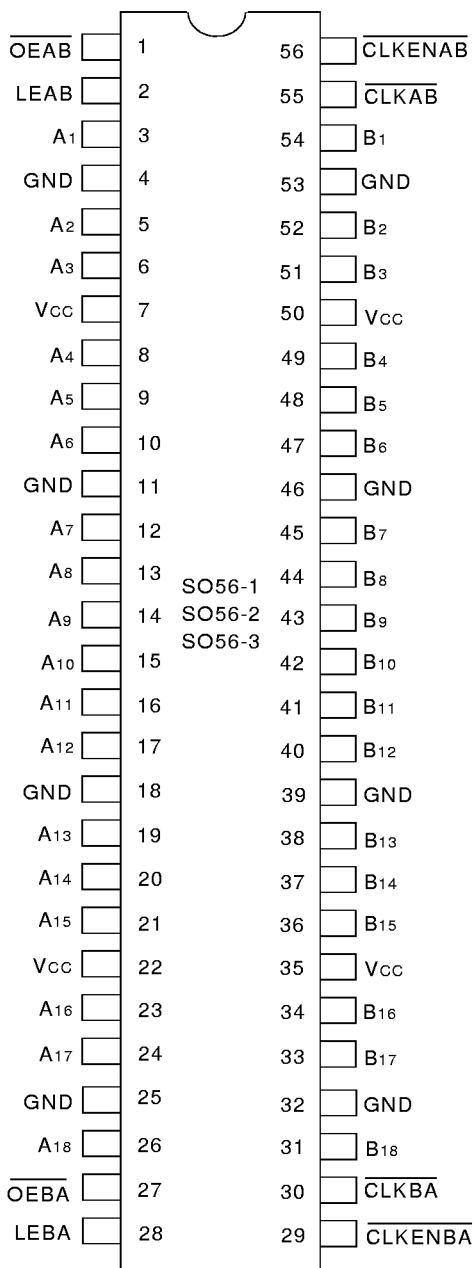
Functional Block Diagram



EXTENDED COMMERCIAL TEMPERATURE RANGE

APRIL 1999

PIN CONFIGURATION



SSOP/TSSOP/TVSOP
TOP VIEW

ABSOLUTE MAXIMUM RATING (1)

Symbol	Description	Max.	Unit
VTERM ⁽²⁾	Terminal Voltage with Respect to GND	– 0.5 to + 4.6	V
VTERM ⁽³⁾	Terminal Voltage with Respect to GND	– 0.5 to V _{CC} + 0.5	V
TSTG	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:

- 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.

PIN DESCRIPTION

Pin Names	Description
OEAB	A-to-B Output Enable Input (Active LOW)
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
A _x	A-to-B Data Inputs or B-to-A 3-State Outputs ⁽¹⁾
B _x	B-to-A Data Inputs or A-to-B 3-State Outputs ⁽¹⁾
CLKENAB	A-to-B Clock Enable Input (Active LOW)
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.

FUNCTION TABLE (1, 2)

Inputs					Output
$\overline{\text{CLKENAB}}$	$\overline{\text{OEAB}}$	LEAB	$\overline{\text{CLKAB}}$	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:

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

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} I _{OZL}	High Impedance Output Current (3-State Output pins)	V _{CC} = 3.6V	V _O = V _{CC}	—	—	± 10	μA
			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

NOTE:

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

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BUS-HOLD CHARACTERISTICS

Symbol	Parameter ⁽¹⁾	Test Conditions		Min.	Typ. ⁽²⁾	Max.	Unit
IBHH	Bus-Hold Input Sustain Current	V _{CC} = 3.0V	V _I = 2.0V	- 75	—	—	μA
IBHL			V _I = 0.8V	75	—	—	
IBHH	Bus-Hold Input Sustain Current	V _{CC} = 2.3V	V _I = 1.7V	- 45	—	—	μA
IBHL			V _I = 0.7V	45	—	—	
IBHHO	Bus-Hold Input Overdrive Current	V _{CC} = 3.6V	V _I = 0 to 3.6V	—	—	± 500	μA
IBHLO				—	—		

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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} = - 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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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	
CPD	Power Dissipation Capacitance Outputs enabled	C _L = 0pF, f = 10Mhz	43	56	pF
CPD	Power Dissipation Capacitance Outputs disabled		6	6	pF

SWITCHING CHARACTERISTICS ⁽¹⁾

Symbol	Parameter	V _{CC} = 2.5V ± 0.2V		V _{CC} = 2.7V		V _{CC} = 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	5.1	—	4.7	1	4	ns
t _{PLH} t _{PHL}	Propagation Delay LEAB to Bx or LEBA to Ax	1	5.9	—	5.5	1	4.8	ns
t _{PLH} t _{PHL}	Propagation Delay CLKAB to Bx or CLKBA to Ax	1	7.3	—	6.8	1.3	5.7	ns
t _{PZH} t _{PZL}	Output Enable Time OEAB to Bx or OEBA to Ax	1	6.5	—	6.3	1.1	5.2	ns
t _{PHZ} t _{PLZ}	Output Disable Time OEAB to Bx or OEBA to Ax	1	5.1	—	4.7	1.2	4.4	ns
t _{SU}	Set-up Time, data before $\overline{\text{CLK}}\downarrow$	1.3	—	1.3	—	1.2	—	ns
t _{SU}	Set-up Time, data before LE $\downarrow$, $\overline{\text{CLK}}$ HIGH	1.2	—	1.1	—	1.1	—	ns
t _{SU}	Set-up Time, data before LE $\downarrow$, $\overline{\text{CLK}}$ LOW	1.8	—	1.5	—	1.5	—	ns
t _{SU}	Set-up Time, $\overline{\text{CLKEN}}$ before $\overline{\text{CLK}}\downarrow$	0.7	—	0.7	—	0.8	—	ns
t _H	Hold Time, data after $\overline{\text{CLK}}\downarrow$	1.5	—	1.8	—	1.5	—	ns
t _H	Hold Time, data after LE $\downarrow$, $\overline{\text{CLK}}$ HIGH	1.6	—	1.9	—	1.6	—	ns
t _H	Hold Time, data after LE $\downarrow$, $\overline{\text{CLK}}$ LOW	1.2	—	1.6	—	1.3	—	ns
t _H	Hold Time, $\overline{\text{CLKEN}}$ after $\overline{\text{CLK}}\downarrow$	1.4	—	1.7	—	1.4	—	ns
t _W	Pulse Width, LEAB or LEBA HIGH	3.3	—	3.3	—	3.3	—	ns
t _W	Pulse Width, $\overline{\text{CLKAB}}$ or $\overline{\text{CLKBA}}$, 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.

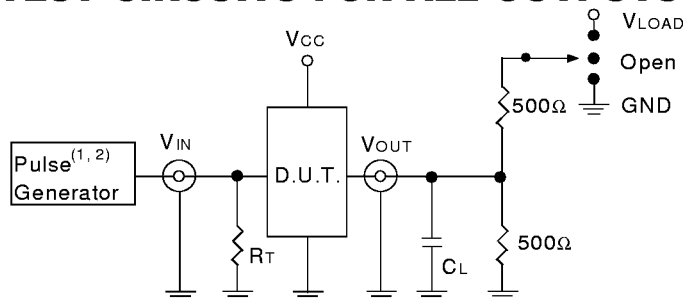
TEST CIRCUITS AND WAVEFORMS:

TEST CONDITIONS

Symbol	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:

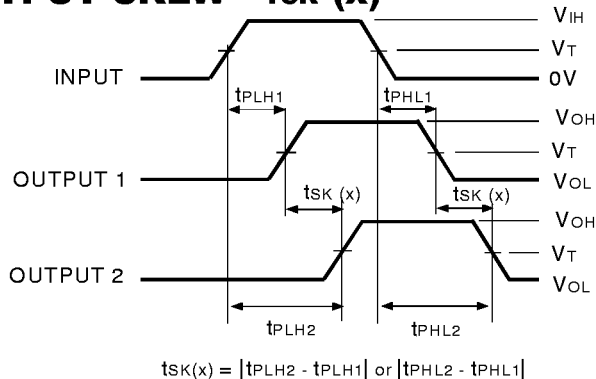
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t_F ≤ 2ns; t_R ≤ 2ns.

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)



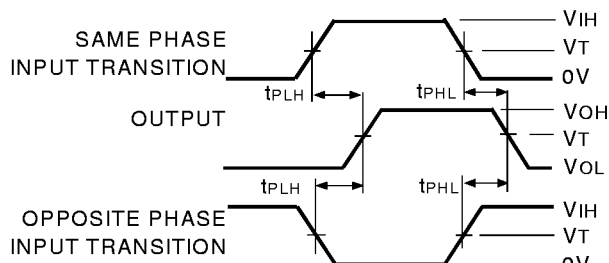
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

ALVC Link

NOTES:

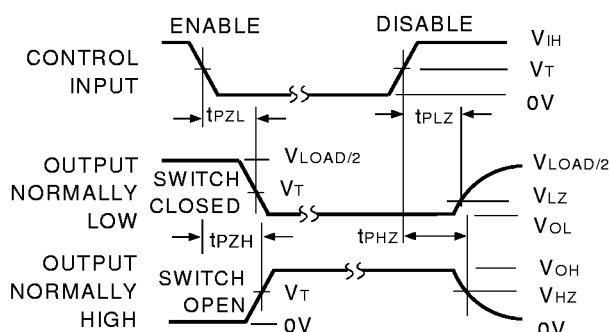
1. For t_{SK}(o) OUTPUT1 and OUTPUT2 are any two outputs.
2. For t_{SK}(b) OUTPUT1 and OUTPUT2 are in the same bank.

PROPAGATION DELAY



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ENABLE AND DISABLE TIMES

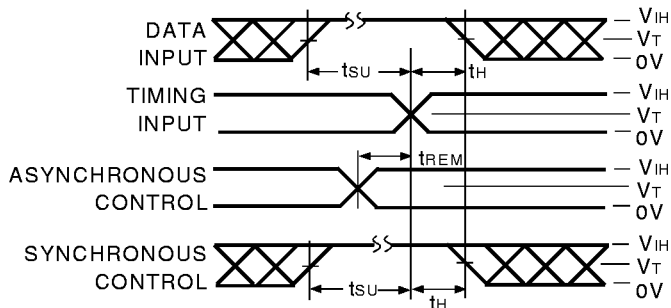


ALVC Link

NOTE:

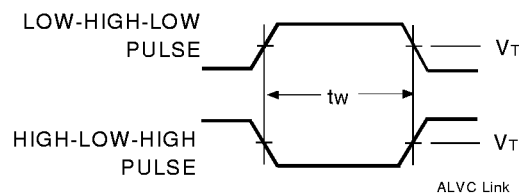
1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

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)
					600		18-Bit Universal Bus Transceiver with 3-State Outputs
				16			Double-Density with Resistors, $\pm 24\text{mA}$
			H				Bus-Hold
			74				-40°C to +85°C



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