National Semiconductor

June 1996

74ACT1284
IEEE 1284 Transceiver

General Description

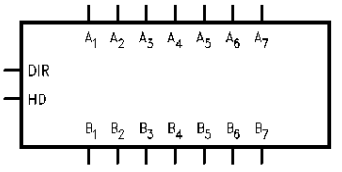
The 'ACT1284 contains four non-inverting bidirectional buffers and three non-inverting buffers with open Drain outputs and high drive capability on the B ports. It is intended to provide a standard signaling method for a bi-direction parallel peripheral in an Extended Capabilities Port mode (ECP).

The HD (active HIGH) input pin enables the B ports to switch from open Drain to a high drive totem pole output, capable of sourcing 14 mA on all seven buffers. The DIR input determines the direction of data flow on the bidirectional buffers. DIR (active HIGH) enables data flow from A ports to B ports. DIR (active LOW) enables data flow from B ports to A ports.

Features

- TTL-compatible inputs
- A ports have standard 4 mA totem pole outputs
- Typical input hysteresis of 0.5V
- B port high drive source/sink capability of 14 mA
- Bidirectional non-inverting buffers
- Supports IEEE P1284 Level 1 and Level 2 signaling standards for bidirectional parallel communications between personal computers and printing peripherals
- B-port outputs in High Impedance mode during power down
- Guaranteed 4000V minimum ESD protection

Logic Symbol



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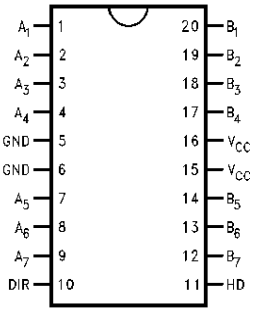
Connection Diagram

Pin Assignment for SOIC and SSOP



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Pin Descriptions

Pin Names	Description
HD	High Drive Enable Input (Active High)
DIR	Direction Control Input
A_1-A_4	Side A Inputs or Outputs
B_1-B_4	Side B Inputs or Outputs
A_5-A_7	Side A Inputs
B_5-B_7	Side B Outputs

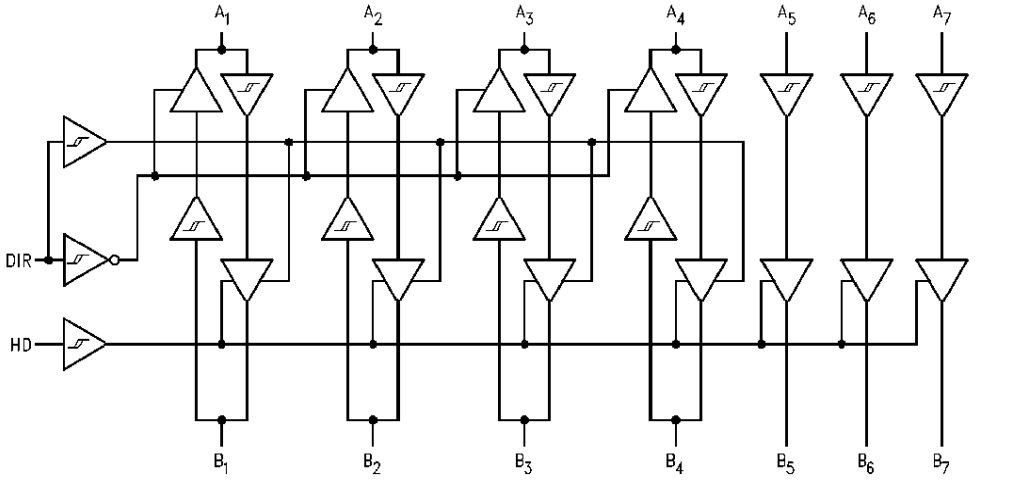
Truth Table

Inputs		Outputs
DIR	HD	
L	L	B_1-B_4 Data to A_1-A_4, and A_5-A_7 Data to B_5-B_7*
L	H	B_1-B_4 Data to A_1-A_4, and A_5-A_7 Data to B_5-B_7
H	L	A_1-A_7 Data to B_1-B_7**
H	H	A_1-A_7 Data to B_1-B_7

Note: *B_5-B_7 Open Drain Outputs

**B_1-B_7 Open Drain Outputs

Logic Diagram



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Absolute Maximum Ratings (Notes 1, 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
V_I = −0.5V	−20 mA
V_I = V_{CC} + 0.5V	+20 mA
DC Input Voltage (V_I) A Side	−0.5V to V_{CC} + 0.5V
DC Input Voltage (V_I) B Side	−2V to +7V
DC Output Diode Current (I_{OK})	
V_O = −0.5V	−20 mA
V_O = V_{CC} + 0.5V	+20 mA
DC Output Voltage (V_O) A Side	−0.5V to V_{CC} + 0.5V
DC Output Voltage (V_O) B Side	−2V to +7V
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	−65°C to +150°C

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Supply Voltage (V_{CC})	4.7V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
ACT	−40°C to +85°C

DC Characteristics

Symbol	Parameter	V_{CC} (V)	Guaranteed Limits			Units	Conditions
			T_A = +25°C	T_A = 0°C to +70°C	T_A = −40°C to +85°C		
V_{IH}	Minimum High Level Input Voltage	4.7 5.5	2.0 2.0	2.0 2.0	2.0 2.0	V	Recognized High Signal
V_{IL}	Maximum Low Level Input Voltage	4.7 5.5	0.8 0.8	0.8 0.8	0.8 0.8	V	Recognized Low Signal
V_{OH}	Minimum High Level Output Voltage	4.7 4.7	4.5 3.7	4.5 3.7	4.5 3.7	V	I_{OUT} = −50 μA (A_n) *V_{IN} = V_{IL} or V_{IH} I_{OH} = −4 mA (A_n)
		4.7	2.4	2.4	2.4	V	I_{OH} = −14 mA (B_n)
V_{OL}	Maximum Low Level Output Voltage	4.7 4.7	0.2 0.4	0.2 0.4	0.2 0.4	V	I_{OUT} = 50 μA (A_n) *V_{IN} = V_{IL} or V_{IH} I_{OL} = 4 mA (A_n)
		4.7	0.3	0.3	0.4	V	I_{OL} = 14 mA (B_n)
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	±1.0	±1.0	μA	V_I = V_{CC}, GND (DIR, A5, A6, A7, HD)
I_{CCT}	Maximum I_{CC}/Input	5.5		1.5	1.5	mA	V_I = V_{CC} − 2.1V
I_{CC}	Maximum Quiescent Supply Current	5.5	400	400	500	μA	V_{IN} = V_{CC} or GND
I_{OZ}	Maximum Output Leakage Current	5.5	±20	±20	±20	μA	V_O = V_{CC}, GND
I_{OFF}	Maximum B-Side Power Down Leakage Current	0.0	100	100	100	μA	V_{OUT} = 5.25V
ΔV_T	Input Hysteresis	5.0	0.4	0.4	0.35	V	$V_T^+ - V_T^-$
R_D	Maximum Output Impedance	5.0	22	22	24	Ω	B_n (Note 1)
	Minimum Output Impedance	5.0	8	8	6	Ω	B_n (Note 1)

*All outputs loaded; thresholds on input associated with output under test.

Note 1: This parameter is guaranteed but not tested, characterized only. R_D is the measure of the B-side output impedance with the output in the high state.

AC Electrical Characteristics

Symbol	Parameter	$T_A = +25°C$ $V_{CC} = 4.7V–5.5V$		$T_A = 0°C$ to $+70°C$ $V_{CC} = 4.7V–5.5V$		$T_A = -40°C$ to $+85°C$ $V_{CC} = 4.7V–5.5V$		Units	Fig. No.
		Min	Max	Min	Max	Min	Max		
t_{PHL}	$A_1–A_7$ to $B_1–B_7$	2.0	20.0	2.0	20.0	2.0	24.0	ns	1
t_{PLH}	$A_1–A_7$ to $B_1–B_7$	2.0	20.0	2.0	20.0	2.0	24.0	ns	2
t_{PHL}	$B_1–B_4$ to $A_1–A_4$	2.0	20.0	2.0	20.0	2.0	24.0	ns	3
t_{PLH}	$B_1–B_4$ to $A_1–A_4$	2.0	20.0	2.0	20.0	2.0	24.0	ns	3
$t_{pEnable}$	Output Enable Time HD to $B_1–B_7$	2.0	20.0	2.0	20.0	2.0	24.0	ns	2
$t_{pDisable}$	Output Disable Time HD to $B_1–B_7$	2.0	20.0	2.0	20.0	2.0	24.0	ns	2
t_{SLEW} t_{PLH} t_{PHL}	Output Slew Rate $B_1–B_7$	0.05	0.40	0.05	0.40	0.05	0.40	V/ns	1, 2
t_r, t_f	t_{RISE} and t_{FALL} $B_1–B_7$*		120		120		120	ns	4 (Note 1)

*Open Drain

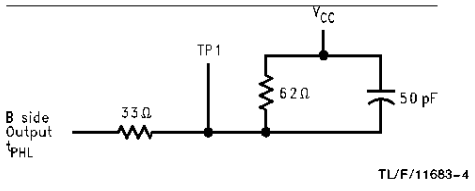
Note 1: This parameter is guaranteed but not tested, characterized only.

Note: Pulse Generator for all pulses; Rate ≤1.0 MHz; $Z_O \leq 50\Omega$; $t_f \leq 2.5$ ns, $t_r \leq 2.5$ ns.

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.0	pF	V_{CC} = OPEN (HD, DIR, $A_5–A_7$)
$C_{I/O}$ (Note 1)	I/O Pin Capacitance	12.0	pF	V_{CC} = 5.0V

AC Loading and Waveforms



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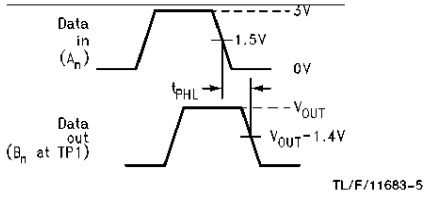

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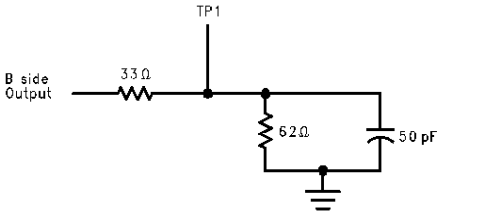
t_{SLEW} measures between 10% to 90% on the t_{PHL} Transition

FIGURE 1. A to B Direction Test Load and Waveforms

AC Loading and Waveforms (Continued)



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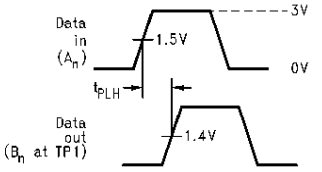

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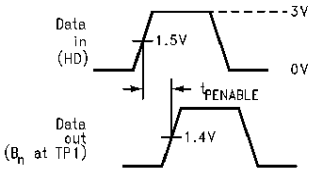
t_{SLEW} measures between 10% to 90% on the t_{PLH} Transition



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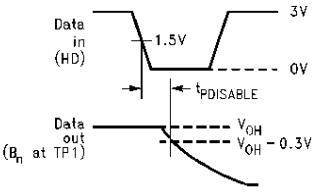

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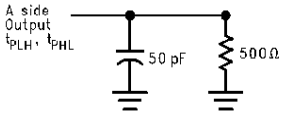
FIGURE 2. B Output Test Load and Waveforms



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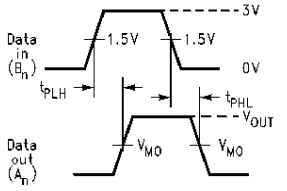

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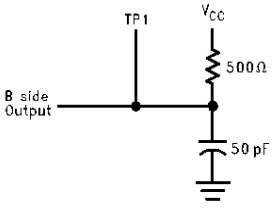
V_{MO} = 50% V_{CC}

FIGURE 3. B to A Direction Test Load and Waveforms for Outputs A_1–A_4



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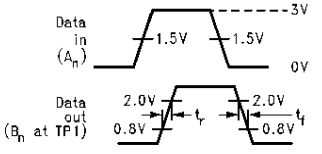

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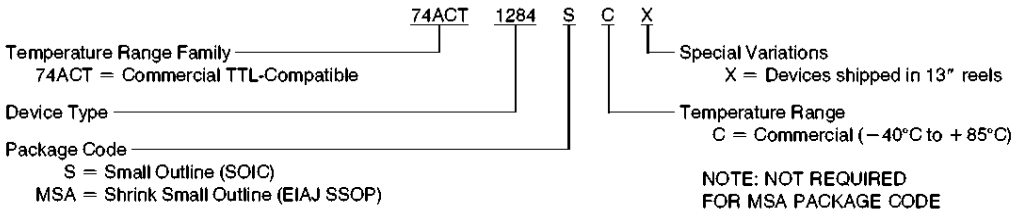
t_r = Output Rise Time, Open Drain

t_f = Output Fall Time, Open Drain

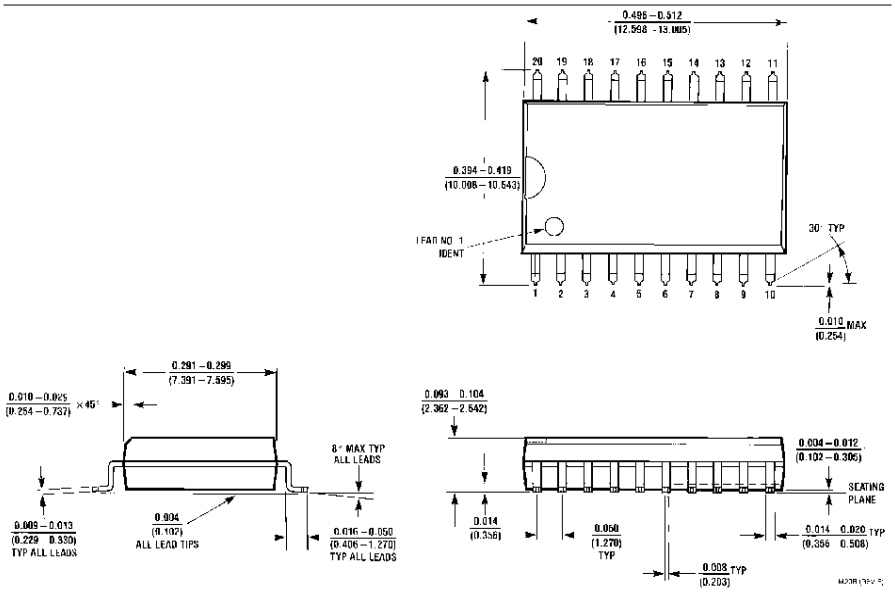
FIGURE 4. A to B Direction Test Load and Waveforms for Open Drain Outputs B_1–B_7

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:

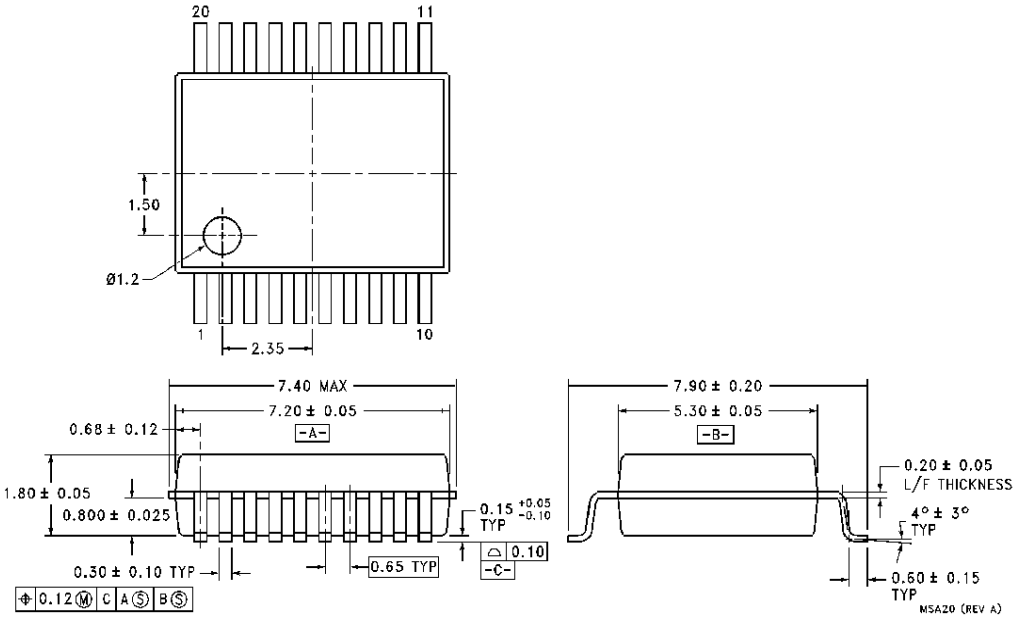


Physical Dimensions inches (millimeters) unless otherwise noted



20 Lead Small Outline Integrated Circuit (S)
NS Package Number M20B

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20 Lead Plastic EIAJ SSOP (MSA)
NS Package Number MSA20

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