National Semiconductor

February 1996

DP8303A 8-Bit TRI-STATE® Bidirectional Transceiver (Inverting)

General Description

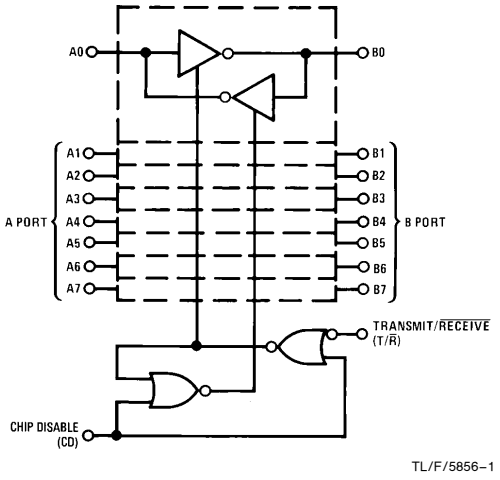
This family of high speed Schottky 8-bit TRI-STATE bidirectional transceivers are designed to provide bidirectional drive for bus oriented microprocessor and digital communications systems. They are all capable of sinking 16 mA on the A ports and 48 mA on the B ports (bus ports). PNP inputs for low input current and an increased output high (V_{OH}) level allow compatibility with MOS, CMOS, and other technologies that have a higher threshold and less drive capabilities. In addition, they all feature glitch-free power up/down on the B port preventing erroneous glitches on the system bus in power up or down.

DP8303A and DP7304B/DP8304B are featured with Transmit/$\overline{\text{Receive}}$ (T/$\overline{\text{R}}$) and Chip Disable (CD) inputs to simplify control logic. For greater design flexibility, DP8307A and DP7308/DP8308 are featured with $\overline{\text{Transmit}}$ ($\overline{\text{T}}$) and $\overline{\text{Receive}}$ ($\overline{\text{R}}$) control inputs.

Features

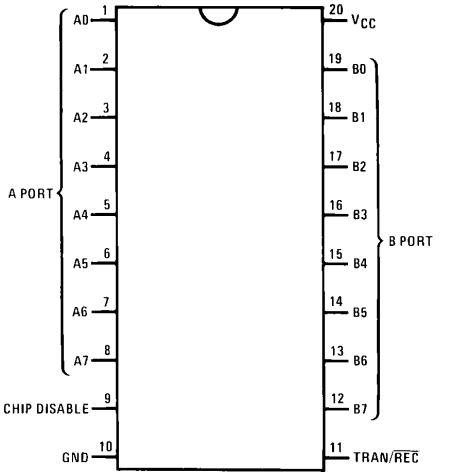
- 8-bit directional data flow reduces system package count
- Bidirectional TRI-STATE inputs/outputs interface with bus oriented systems
- PNP inputs reduce input loading
- Output high voltage interfaces with TTL, MOS, and CMOS
- 48 mA/300 pF bus drive capability
- Pinouts simplify system interconnections
- Transmit/$\overline{\text{Receive}}$ and chip disable simplify control logic
- Compact 20-pin dual-in-line package
- Bus port glitch free power up/down

Logic and Connection Diagrams



TL/F/5856–1

Dual-In-Line Package



TL/F/5856–2

Top View
Order Number DP8303AN
See NS Package Number N20A

Logic Table

Inputs		Resulting Conditions	
Chip Disable	**Transmit/$\overline{\text{Receive}}$**	**A Port**	**B Port**
0	0	OUT	IN
0	1	IN	OUT
1	X	TRI-STATE	TRI-STATE

X = Don't care

TRI-STATE® is a registered trademark of National Semiconductor Corp.

Absolute Maximum Ratings (Note 1)

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

Supply Voltage	7V
Input Voltage	5.5V
Output Voltage	5.5V
Maximum Power Dissipation* at 25°C	
Cavity Package	1667 mW
Molded Package	1832 mW

*Derate cavity package 11.1 mW/°C above 25°C; derate molded package 14.7 mW/°C.

Storage Temperature	−65°C to +150°C
Lead Temperature (soldering, 4 seconds)	260°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})			
DP8303A	4.75	5.25	V
Temperature (T_A)			
DP8303A	0	70	°C

DC Electrical Characteristics (Notes 2 and 3)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
A PORT (A0−A7)							
V_{IH}	Logical "1" Input Voltage	CD = V_{IL}, T/$\overline{R}$ = 2.0V		2.0			V
V_{IL}	Logical "0" Input Voltage	CD = V_{IL}, T/$\overline{R}$ = 2.0V				0.7	V
V_{OH}	Logical "1" Output Voltage	CD = T/$\overline{R}$ = V_{IL}, V_{IL} = 0.5V	I_{OH} = −0.4 mA	V_{CC} − 1.15	V_{CC} − 0.7		V
			I_{OH} = −3 mA	2.7	3.95		V
V_{OL}	Logical "0" Output Voltage	CD = T/$\overline{R}$ = V_{IL}, V_{IL} = 0.5V	I_{OL} = 16 mA		0.35	0.5	V
			I_{OL} = 8 mA		0.3	0.4	V
I_{OS}	Output Short Circuit Current	CD = V_{IL}, T/$\overline{R}$ = V_{IL}, V_O = 0V, V_{CC} = Max, (Note 4)		−10	−38	−75	mA
I_{IH}	Logical "1" Input Current	CD = V_{IL}, T/$\overline{R}$ = 2.0V, V_{IH} = 2.7V			0.1	80	μA
I_I	Input Current at Maximum Input Voltage	CD = 2.0V, V_{CC} = Max, V_{IH} = 5.25V				1	mA
I_{IL}	Logical "0" Input Current	CD = V_{IL}, T/$\overline{R}$ = 2.0V, V_{IN} = 0.4V			−70	−200	μA
V_{CLAMP}	Input Clamp Voltage	CD = 2.0V, I_{IN} = −12 mA			−0.7	−1.5	V
I_{OD}	Output/Input TRI-STATE Current	CD = 2.0V	V_{IN} = 0.4V			−200	μA
			V_{IN} = 4.0V			80	μA
B PORT (B0−B7)							
V_{IH}	Logical "1" Input Voltage	CD = V_{IL}, T/$\overline{R}$ = V_{IL}		2.0			V
V_{IL}	Logical "0" Input Voltage	CD = V_{IL}, T/$\overline{R}$ = V_{IL}				0.7	V
V_{OH}	Logical "1" Output Voltage	CD = V_{IL}, T/$\overline{R}$ = 2.0V, V_{IL} = 0.5V	I_{OH} = −0.4 mA	V_{CC} − 1.15	V_{CC} −0.8		V
			I_{OH} = −5 mA	2.7	3.9		V
			I_{OH} = −10 mA	2.4	3.6		V
V_{OL}	Logical "0" Output Voltage	CD = V_{IL}, T/$\overline{R}$ = 2.0V	I_{OL} = 20 mA		0.3	0.4	V
			I_{OL} = 48 mA		0.4	0.5	V
I_{OS}	Output Short Circuit Current	CD = V_{IL}, T/$\overline{R}$ = 2.0V, V_O = 0V, V_{CC} = Max, (Note 4)		−25	−50	−150	mA
I_{IH}	Logical "1" Input Current	CD = V_{IL}, T/$\overline{R}$ = V_{IL}, V_{IH} = 2.7V			0.1	80	μA
I_I	Input Current at Maximum Input Voltage	CD = 2.0V, V_{CC} = Max, V_{IH} = 5.25V				1	mA
I_{IL}	Logical "0" Input Current	CD = V_{IL}, T/$\overline{R}$ = V_{IL}, V_{IN} = 0.4V			−70	−200	μA
V_{CLAMP}	Input Clamp Voltage	CD = 2.0V, I_{IN} = −12 mA			−0.7	−1.5	V
I_{OD}	Output/Input TRI-STATE Current	CD = 2.0V	V_{IN} = 0.4V			−200	μA
			V_{IN} = 0.4V			+200	μA

DC Electrical Characteristics (Notes 2 and 3) (Continued)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
CONTROL INPUTS CD, T/$\overline{R}$							
V_{IH}	Logical "1" Input Voltage			2.0			V
V_{IL}	Logical "0" Input Voltage					0.7	V
I_{IH}	Logical "1" Input Current	V_{IH} = 2.7V			0.5	20	μA
I_I	Maximum Input Current	V_{CC} = Max, V_{IH} = 5.25V				1.0	mA
I_{IL}	Logical "0" Input Current	V_{IL} = 0.4V	T/$\overline{R}$		−0.1	−0.25	mA
			CD		−0.25	−0.5	mA
V_{CLAMP}	Input Clamp Voltage	I_{IN} = −12 mA			−0.8	−1.5	V
POWER SUPPLY CURRENT							
I_{CC}	Power Supply Current	CD = 2.0V, V_{IN}, V_{CC} = Max			70	100	mA
		CD = 0.4V, V_{INA} = T/$\overline{R}$ = 2V, V_{CC} = Max			100	150	mA

AC Electrical Characteristics V_{CC} = 5V, T_A = 25°C

Symbol	Parameter	Conditions	Min	Typ	Max	Units
A PORT DATA/MODE SPECIFICATIONS						
t_{PDHLA}	Propagation Delay to a Logical "0" from B Port to A Port	CD = 0.4V, T/$\overline{R}$ = 0.4V *(Figure A)* R1 = 1k, R2 = 5k, C1 = 30 pF		8	12	ns
t_{PDLHA}	Propagation Delay to a Logical "1" from B Port to A Port	CD = 0.4V, T/$\overline{R}$ = 0.4V *(Figure A)* R1 = 1k, R2 = 5k, C1 = 30 pF		11	16	ns
t_{PLZA}	Propagation Delay from a Logical "0" to TRI-STATE from CD to A Port	B0 to B7 = 2.4V, T/$\overline{R}$ = 0.4V *(Figure C)* S3 = 1, R5 = 1k, C4 = 15 pF		10	15	ns
t_{PHZA}	Propagation Delay from a Logical "1" to TRI-STATE from CD to A Port	B0 to B7 = 0.4V, T/$\overline{R}$ = 0.4V *(Figure C)* S3 = 0, R5 = 1k, C4 = 15 pF		8	15	ns
t_{PZLA}	Propagation Delay from TRI-STATE to a Logical "0" from CD to A Port	B0 to B7 = 2.4V, T/$\overline{R}$ = 0.4V *(Figure C)* S3 = 1, R5 = 1k, C4 = 30 pF		20	30	ns
t_{PZHA}	Propagation Delay from TRI-STATE to a Logical "1" from CD to A Port	B0 to B7 = 0.4V, T/$\overline{R}$ = 0.4V *(Figure C)* S3 = 0, R5 = 5k, C4 = 30 pF		19	30	ns
B PORT DATA/MODE SPECIFICATIONS						
t_{PDHLB}	Propagation Delay to a Logical "0" from A Port to B Port	CD = 0.4V, T/$\overline{R}$ = 2.4V *(Figure A)* R1 = 100Ω, R2 = 1k, C1 = 300 pF R1 = 667Ω, R2 = 5k, C1 = 45 pF		12 7	18 12	ns ns
t_{PDLHB}	Propagation Delay to a Logical "1" from A Port to B Port	CD = 0.4V, T/$\overline{R}$ = 2.4V *(Figure A)* R1 = 100Ω, R2 = 1k, C1 = 300 pF R1 = 667Ω, R2 = 5k, C1 = 45 pF		15 9	20 14	ns ns
t_{PLZB}	Propagation Delay from a Logical "0" to TRI-STATE from CD to B Port	A0 to A7 = 2.4V, T/$\overline{R}$ = 2.4V *(Figure C)* S3 = 1, R5 = 1k, C4 = 15 pF		13	18	ns
t_{PHZB}	Propagation Delay from a Logical "1" to TRI-STATE from CD to B Port	A0 to A7 = 0.4V, T/$\overline{R}$ = 2.4V *(Figure C)* S3 = 0, R5 = 1k, C4 = 15 pF		8	15	ns
t_{PLZB}	Propagation Delay from TRI-STATE to a Logical "0" from CD to B Port	A0 to A7 = 2.4V, T/$\overline{R}$ = 2.4V *(Figure C)* S3 = 1, R5 = 100Ω, C4 = 300 pF S3 = 1, R5 = 667Ω, C4 = 45 pF		25 16	35 25	ns ns
t_{PZHB}	Propagation Delay from TRI-STATE to a Logical "1" from CD to B Port	A0 to A7 = 0.4V, T/$\overline{R}$ = 2.4V *(Figure C)* S3 = 0, R5 = 1k, C4 = 300 pF S3 = 0, R5 = 5kΩ, C4 = 45 pF		22 14	35 25	ns ns

AC Electrical Characteristics V_{CC} = 5V, T_A = 25°C (Continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
TRANSMIT/RECEIVE MODE SPECIFICATIONS						
t_{TRL}	Propagation Delay from Transmit Mode to Receive a Logical "0", T/$\overline{R}$ to A Port	CD = 0.4V *(Figure B)* S1 = 1, R4 = 100Ω, C3 = 5 pF S2 = 1, R3 = 1k, C2 = 30 pF		23	35	ns
t_{TRH}	Propagation Delay from Transmit Mode to Receive a Logical "1", T/$\overline{R}$ to A Port	CD = 0.4V *(Figure B)* S1 = 0, R4 = 100Ω, C3 = 5 pF S2 = 0, R3 = 5k, C2 = 30 pF		23	35	ns
t_{RTL}	Propagation Delay from Receive Mode to Transmit a Logical "0", T/$\overline{R}$ to B Port	CD = 0.4V *(Figure B)* S1 = 1, R4 = 100Ω, C3 = 300 pF S2 = 1, R3 = 300Ω, C2 = 5 pF		23	35	ns
t_{RTH}	Propagation Delay from Receive Mode to Transmit a Logical "1", T/$\overline{R}$ to B Port	CD = 0.4V (*Figure B*) S1 = 0, R4 = 1k, C3 = 300 pF S2 = 0, R3 = 300Ω, C2 = 5 pF		27	35	ns

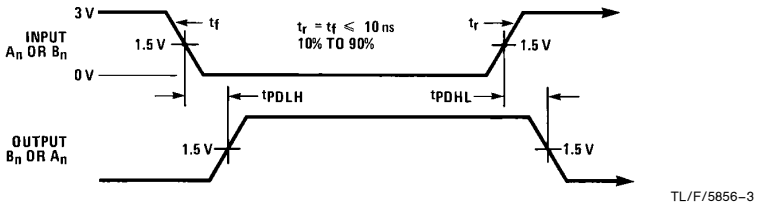
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

Note 2: Unless otherwise specified, min/max limits apply across the supply and temperature range listed in the table of Recommended Operating Conditions. All typical values given are for V_{CC} = 5V and T_A = 25°C.

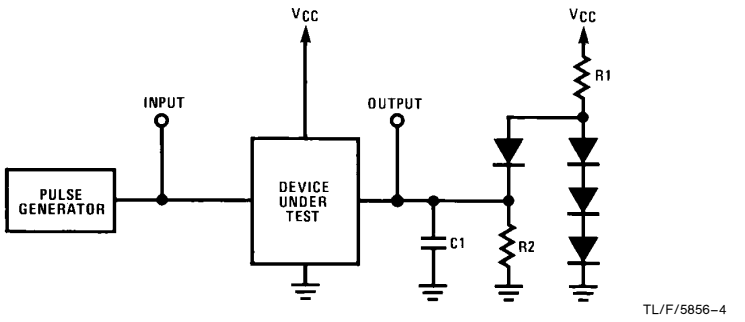
Note 3: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to ground unless otherwise specified.

Note 4: Only one output at a time should be shorted.

Switching Time Waveforms and AC Test Circuits



TL/F/5856–3

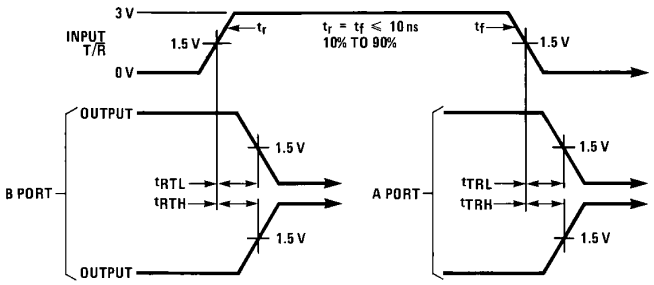


TL/F/5856–4

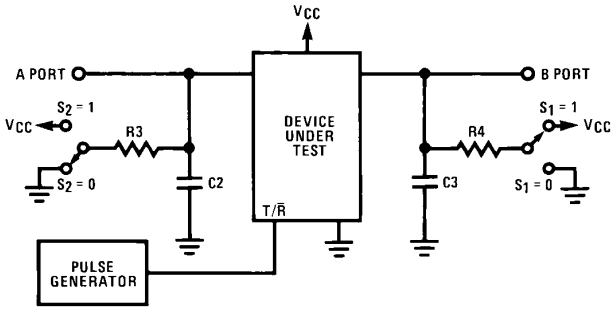
Note: C1 includes test fixture capacitance.

FIGURE A. Propagation Delay from A Port to B Port or from B Port to A Port

Switching Time Waveforms and AC Test Circuits (Continued)



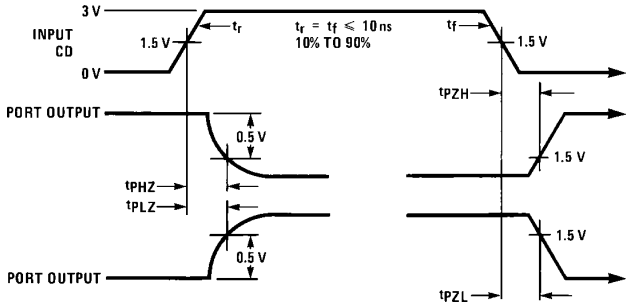
TL/F/5856–5



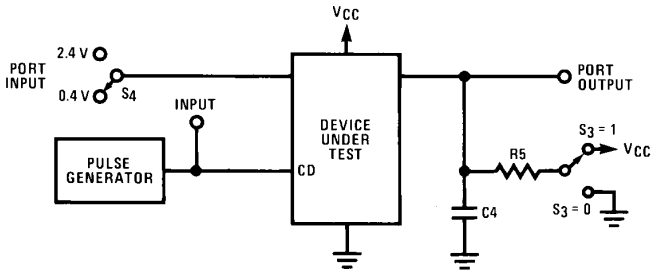
TL/F/5856–6

Note: C2 ad C3 include test fixture capacitance.

FIGURE B. Propagation Delay from T/$\overline{R}$ to A Port or B Port



TL/F/5856–7

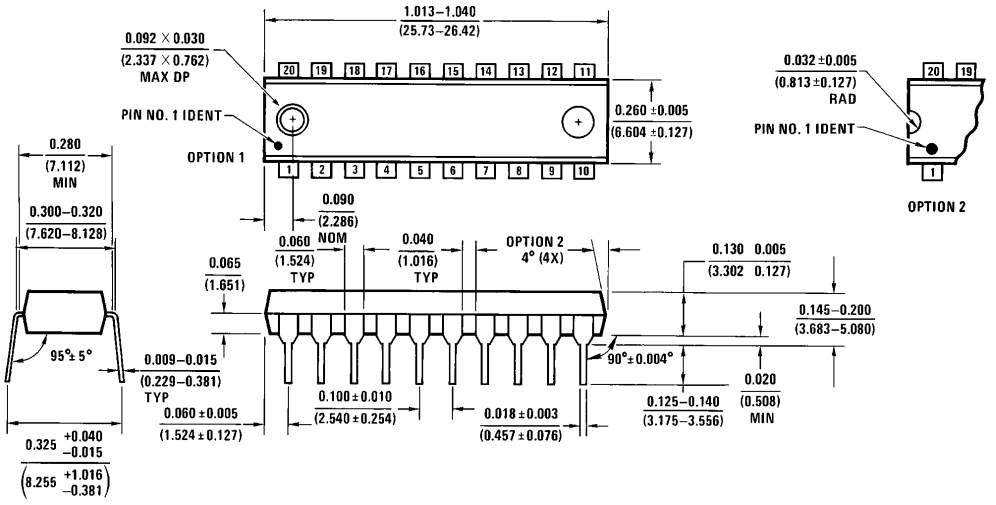


TL/F/5856–8

Note: C4 includes test fixture capacitance. Port input is in a fixed logical condition. See AC table.

FIGURE C. Propagation Delay to/from TRI-STATE from CD to A Port or B Port

Physical Dimensions inches (millimeters)



Molded Dual-In-Line Package (N)
Order Number DP8303AN
NS Package Number N20A

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

http://www.national.com

National Semiconductor Europe
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 180-530 85 85
English Tel: +49 (0) 180-532 78 32
Français Tel: +49 (0) 180-532 93 58
Italiano Tel: +49 (0) 180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2308
Fax: 81-043-299-2408