

8-Bit Buffers with Schmitt Trigger Inputs

SN54/74LS310 SN54/74S310
SN54/74LS340 SN54/74S340
SN54/74LS341 SN54/74S341
SN54/74LS344 SN54/74S344

Features

- Schmitt-trigger inputs guarantee high noise margin
- Three-state outputs drive bus lines
- Typical input and output capacitance ≤ 10 pF
- Low-current PNP inputs reduce loading
- 20-pin SKINNYDIP® saves space
- 8-bit data path matches byte boundaries
- Ideal for microprocessor interface
- Complementary-enable '310 and '341 types combine multiplexer and driver functions
- Pin-compatible with SN54/74S210/240/1/4 and SN54/74LS210/240/1/4; can be direct replacement in systems with noise problems

Description

In addition to the standard Schottky and low-power Schottky 8-bit buffers, Monolithic Memories provides full hysteresis with a "true" Schmitt-trigger circuit. The improved performance characteristics are designed (1) for the low-power Schottky buffers, to be consistent with the SN54/74LS14 hex Schmitt-trigger inverter, and to guarantee a full 400 mV noise immunity; (2) for the Schottky buffers to have low propagation delays, and to guarantee a full 500 mV noise immunity. The Schmitt-trigger operation makes these L/S buffers ideal for bus receivers in a noisy environment.

These 8-bit buffers provide high-speed and high-current interface capability for bus organized digital systems. The three-state drivers will source a termination to ground (up to 133 Ω) or sink a pull-up to V_{CC} as in the popular 220 Ω /330 Ω computer

Ordering Information

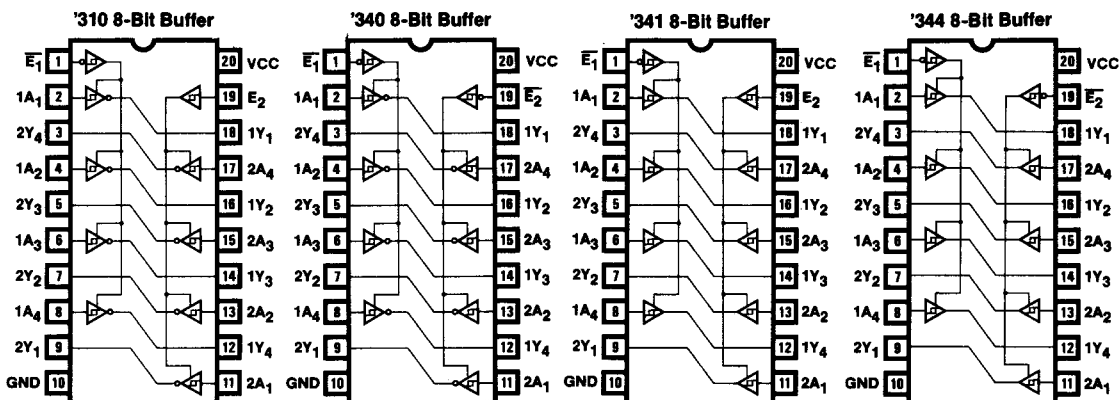
PART NUMBER	PKG*	TEMP	ENABLE	POLARITY	POWER
SN54LS310	J,F	mil	High-Low	Invert	LS
SN74LS310	N,J	com	Low		
SN54LS340	J,F	mil	High-Low		
SN74LS340	N,J	com	Low		
SN54LS341	J,F	mil	High-Low	Non-Invert	S
SN74LS341	N,J	com	Low		
SN54LS344	J,F	mil	High-Low		
SN74LS344	N,J	com	Low		

peripheral termination. The PNP inputs provide improved fan-in with 0.2 mA I_{IL} for the low-power Schottky buffers and 0.25 mA I_{IL} for the Schottky buffers.

The '340 and '344 provide inverting and non-inverting outputs respectively, with assertive-low enables. The '310 and '341 also provide inverting and non-inverting outputs respectively, but with complementary (both assertive-low and assertive-high) enables, to allow transceiver or multiplexer operation.

All of the 8-bit devices are packaged in the popular 20-pin SKINNYDIP®.

Logic Symbols



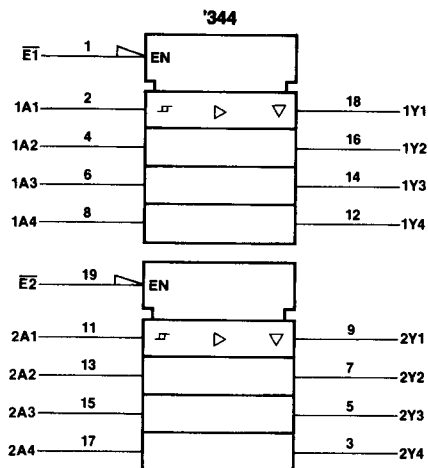
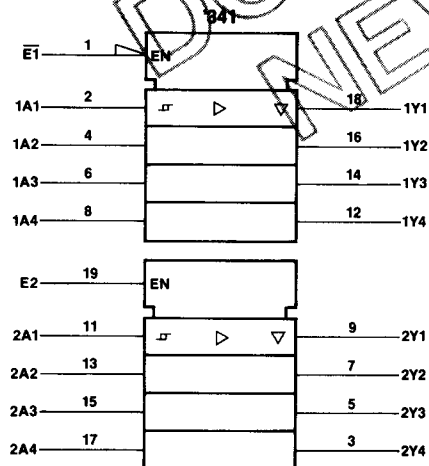
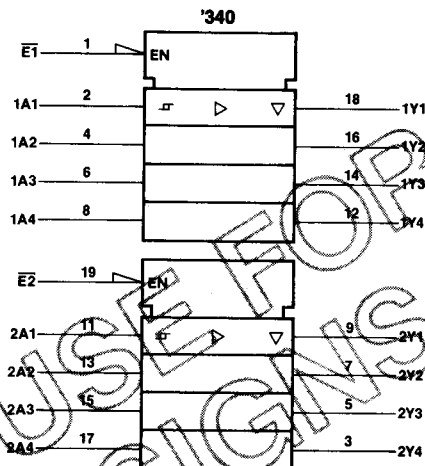
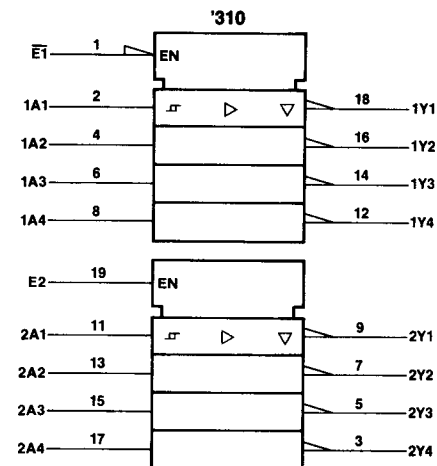
*For other package types, please contact your local sales representative.

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IEEE Symbols



Absolute Maximum Ratings

Supply voltage V_{CC}	7 V
Input voltage	7 V
Off-state output voltage	5.5 V
Storage temperature	-65° to +150°C

Operating Conditions

SYMBOL	PARAMETER	MILITARY			COMMERCIAL			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
T_A	Operating free-air temperature	-55		125	0		75	°C

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS	MILITARY			COMMERCIAL			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{T+}	Positive threshold voltage	Any A*	1.5	1.7	2.0	1.5	1.7	2.0	V
V_{T-}	Negative threshold voltage	Any A*	0.6	0.9	1.1	0.6	0.9	1.1	V
V_{IC}	Input clamp voltage	$V_{CC} = \text{MIN}$ $I_I = -18 \text{ mA}$			-1.5			-1.5	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	Any A*	0.4	0.8		0.4	0.8		V
ΔV_{DB}	Dead band voltage	Any A*	0.4			0.4			V
V_{IL}	Input low voltage	Any E*			0.8			0.8	V
V_{IH}	Input high voltage	Any E*	2.0			2.0			V
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}$ $V_I = 0.4 \text{ V}$			-0.2			-0.2	mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}$ $V_I = 2.7 \text{ V}$			20			20	μA
I_I	Maximum input current	$V_{CC} = \text{MAX}$ $V_I = 7 \text{ V}$			0.1			0.1	mA
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}$ $V_{T+} = 2 \text{ V}$ $V_{T-} = 0.6 \text{ V}$ $I_{OL} = 12 \text{ mA}$			0.4			0.4	V
		$I_{OL} = 24 \text{ mA}$						0.5	
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}$ $V_{T+} = 2 \text{ V}$ $V_{T-} = 0.6 \text{ V}$ $I_{OH} = -3 \text{ mA}$	2.4	3.4		2.4	3.4		V
		$I_{OH} = -12 \text{ mA}$	2						
		$I_{OH} = -15 \text{ mA}$				2			
I_{OZL}	Off-state output current	$V_{CC} = \text{MAX}$ $V_{T+} = 2 \text{ V}$ $V_{T-} = 0.6 \text{ V}$ $V_O = 0.4 \text{ V}$			-20			-20	μA
I_{OZH}		$V_O = 2.7 \text{ V}$			20			20	μA
I_{OS}	Output short-circuit current**	$V_{CC} = \text{MAX}$	-40	-225		-40	-225		mA
I_{CC}	Supply Current	Outputs High Outputs Low Outputs Disabled $V_{CC} = \text{MAX}$ Outputs open	'LS310, 'LS340		17	27	17	27	mA
			'LS341, 'LS344		18	35	18	35	
			'LS310, 'LS340		26	44	26	44	
			'LS341, 'LS344		32	46	32	46	
			'LS310, 'LS340		29	50	29	50	
			'LS341, 'LS344		34	54	34	54	

** Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

* "A" indicates data input, "E" indicates enable input.

Switching Characteristics $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

SYMBOL	PARAMETER	TEST CONDITIONS (See Test Load/Waveforms)	'LS310, 'LS340 MIN TYP MAX		'LS341, 'LS344 MIN TYP MAX		UNIT
t _{PLH}	Data to Output delay	C _L = 45 pF R _L = 667 Ω	19	25	19	25	ns
t _{PHL}			19	25	19	25	ns
t _{PZL}	Output Enable delay		32	40	25	40	ns
t _{PZH}			23	35	24	35	ns
t _{PLZ}	Output Disable delay	C _L = 5 pF R _L = 667 Ω	18	30	21	30	ns
t _{PHZ}			18	25	18	25	ns

DO NOT USE FOR
NEW DESIGNS

Absolute Maximum Ratings

Supply voltage V_{CC}	7.0 V
Input voltage	5.5 V
Off-state output voltage	5.5 V
Storage temperature	-65° to +150°C

Operating Conditions

SYMBOL	PARAMETER	MILITARY			COMMERCIAL			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
T_A	Operating free-air temperature	-55		125	0	75		°C

Electrical Characteristics Over Operating Conditions

SYMBOL	PARAMETER	TEST CONDITIONS	MILITARY			COMMERCIAL			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{T+}	Positive threshold voltage	Any A*	1.5	1.8	2.05	1.6	1.8	2.0	V
V_{T-}	Negative threshold voltage	Any A*	0.8	1.1	1.35	0.8	1.1	1.3	V
V_{IC}	Input clamp voltage	$V_{CC} = \text{MIN}$ $I_I = -18 \text{ mA}$			-1.2			-1.2	V
ΔV_T	Hysteresis ($V_{T+} - V_{T-}$)	Any A*	0.5	0.7		0.5	0.7		V
ΔV_{DB}	Dead band voltage	Any A*	0.5			0.3			V
V_{IL}	Input low voltage	Any E*			0.8			0.8	V
V_{IH}	Input high voltage	Any E*	2.0			2.0			V
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}$ $V_I = 0.5 \text{ V}$			-0.25			-0.25	mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}$ $V_I = 2.7 \text{ V}$			50			50	μA
I_I	Maximum input current	$V_{CC} = \text{MAX}$ $V_I = 5.5 \text{ V}$			1			1	mA
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}$ $V_T = 2 \text{ V}$ $I_{OL} = 48 \text{ mA}$			0.55				V
		$V_T = 0.8 \text{ V}$ $I_{OL} = 64 \text{ mA}$						0.55	
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}$ $I_{OH} = -1 \text{ mA}$				2.7			V
		$I_{OH} = -3 \text{ mA}$	2.4	3.4		2.4	3.4		
		$V_{T+} = 2 \text{ V}$ $I_{OH} = -12 \text{ mA}$	2						
		$V_{T-} = 0.8 \text{ V}$ $I_{OH} = -15 \text{ mA}$				2			
I_{OZL}	Off-state output current	$V_{CC} = \text{MAX}$ $V_{IH} = 2.0 \text{ V}$ $V_{IL} = 0.8 \text{ V}$ $V_O = 0.5 \text{ V}$			-50			-50	μA
I_{OZH}		$V_O = 2.7 \text{ V}$			50			50	μA
I_{OS}	Output short-circuit current**	$V_{CC} = \text{MAX}$	-50	-225		-50	-225		mA
I_{CC}	Supply Current	$V_{CC} = \text{MAX}$ Outputs open	Outputs High	'S310, 'S340	50	80	50	80	mA
				'S341, 'S344	80	130	80	130	
			Outputs Low	'S310, 'S340	110	155	100	155	
				'S341, 'S344	130	180	130	185	
			Outputs Disabled	'S310, 'S340	135	180	135	180	
				'S341, 'S344	155	180	150	200	

** Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

* "A" indicates data input, "E" indicates enable input.

Switching Characteristics $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

SYMBOL	PARAMETER	TEST CONDITIONS (See Test Load/Waveforms)	'S310, 'S340 MIN TYP MAX		'S341, 'S344 MIN TYP MAX		UNIT
t _{PLH}	Data to Output delay	C _L = 50 pF R _L = 90 Ω	11	15	16	22	ns
t _{PHL}			16	22	10	15	ns
t _{PZL}	Output Enable delay		8	15	10	15	ns
t _{PZH}			6	12	7	12	ns
t _{PLZ}	Output Disable delay	C _L = 5 pF R _L = 90 Ω	10	15	10	15	ns
t _{PHZ}			7	12	7	12	ns

DO NOT USE FOR
NEW DESIGNS

Function Tables

'310

$\overline{E_1}$	E_2	1Y OUTPUTS	2Y OUTPUTS
H	H	Z	Enabled (Inverting)
H	L	Z	Z
L	H	Enabled (Inverting)	Enabled (Inverting)
L	L	Enabled (Inverting)	Z

'340

$\overline{E_1}$	$\overline{E_2}$	1Y OUTPUTS	2Y OUTPUTS
H	H	Z	Z
H	L	Z	Enabled (Inverting)
L	H	Enabled (Inverting)	Z
L	L	Enabled (Inverting)	Enabled (Inverting)

'341

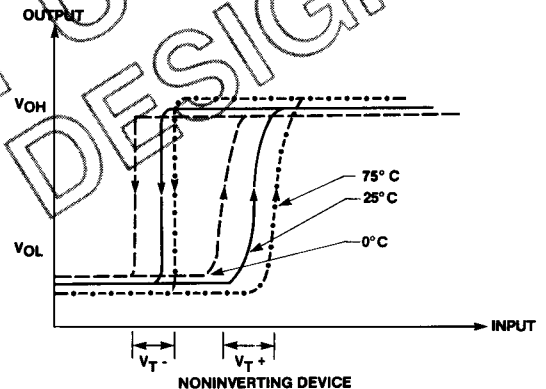
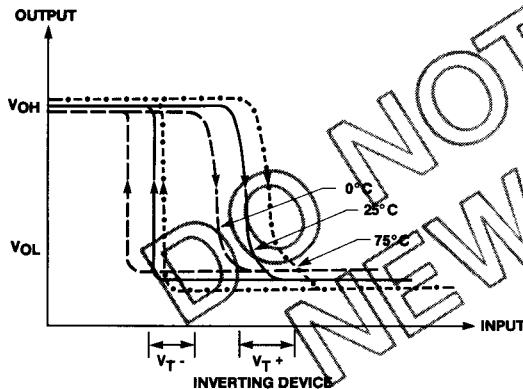
$\overline{E_1}$	E_2	1Y OUTPUTS	2Y OUTPUTS
H	H	Z	Enabled
H	L	Z	Z
L	H	Enabled	Enabled
L	L	Enabled	Z

'344

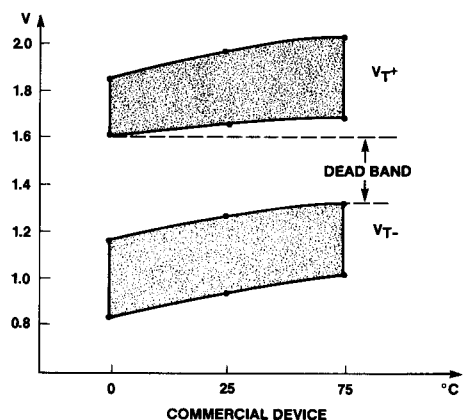
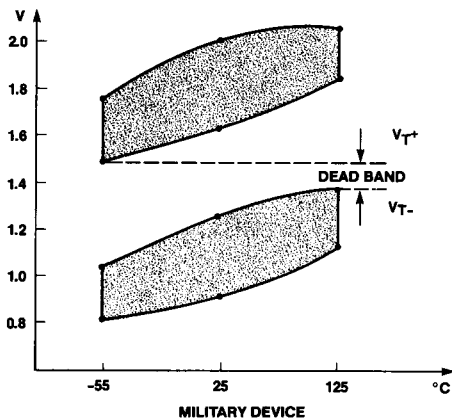
$\overline{E_1}$	$\overline{E_2}$	1Y OUTPUTS	2Y OUTPUTS
H	H	Z	Z
H	L	Z	Enabled
L	H	Enabled	Enabled
L	L	Enabled	Enabled

Z = High impedance (output off).

INPUT VS OUTPUT VOLTAGE TRANSFER CHARACTERISTIC



THRESHOLD VOLTAGE VS OPERATING TEMPERATURE



* Dead Band: The hysteresis is guaranteed at any operating temperature and voltage.

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