Octal Buffers

Features/Benefits

- 3-state outputs drive bus lines
- Schmitt trigger guarantees high noise margin
- Low current PNP inputs reduce loading
- 20-pin Skinny DIP™ saves space
- 8-bits matches byte boundaries
- Ideal for microprocessor interface

PART NUMBER	TYPE	TEMP.	ENABLE	POLARITY	THRESH-OLD	POWER
~~SN74LS240~~ ~~SN54LS240~~	N,J J	com mil	LOW	Invert	Hysteresis	LS
67LS306 57LS306	N,J J	com mil	LOW-HIGH			
~~SN74LS244~~ ~~SN54LS244~~	N,J J	com mil	LOW	Non-invert		
~~SN74LS241~~ ~~SN54LS241~~	N,J J	com mil	LOW-HIGH			
~~67LS300~~ ~~57LS300~~	N,J N	com mil	LOW	Invert	Schmitt trigger	
67LS307 57LS307	N,J N	com mil	LOW-HIGH			
67LS304 57LS304	N,J N	com mil	LOW	Non-invert		
67LS301 57LS301	N,J N	com mil	LOW-HIGH			
~~SN74S240~~ ~~SN54S240~~	N,J N	com mil	LOW	Invert	Hysteresis	S
67S306 57S306	N,J N	com mil	LOW-HIGH			
~~SN74S244~~ ~~SN54S244~~	N,J N	com mil	LOW	Non-invert		
~~SN74S241~~ ~~SN54S241~~	N,J N	com mil	LOW-HIGH			
67S300 57S300	N,J N	com mil	LOW	Invert	Schmitt trigger	
67S307 57S307	N,J N	com mil	LOW-HIGH			
67S304 57S304	N,J N	com mil	LOW	Non-invert		
67S301 57S301	N,J N	com mil	LOW-HIGH			

PRELIM

Description

The Octal 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 133Ω) or sink a pull-up to V_{CC} as in the popular 220Ω/330Ω computer peripheral termination. The PNP inputs provide improved fan-in with 0.2 mA I_{IL} on the Low Power Schottky buffers and 0.4 mA I_{OC} on the Schottky buffers.

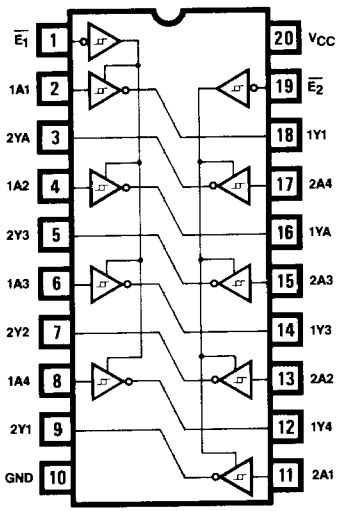
The 240 and 244 provide inverting and non-inverting outputs with active low enables. The 241 and 306 provide inverting and non-inverting outputs with both active low and active high enables allowing transceiver operation.

In addition to the standard Schottky and Low Power Schottky Octal Buffers, Monolithic Memories provides a full hysteresis with "a true" Schmitt trigger circuit. The improved performance characteristics are designed to be consistent with the SN54/74LS14 Hex Schmitt trigger and guarantee a full 400 mV noise immunity.

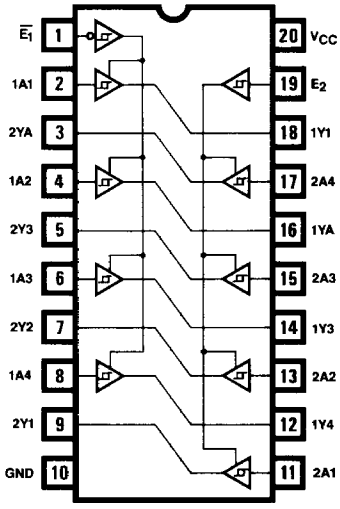
The Schmitt Trigger operation makes the LS buffers ideal for bus receivers in a noisy environment. The Schmitt Trigger operation on the S buffers acts as a safeguard against feedback oscillation and prevents slow transitions through the threshold region, insuring fast transitions and reducing I_{CC} spikes.

Logic Symbols

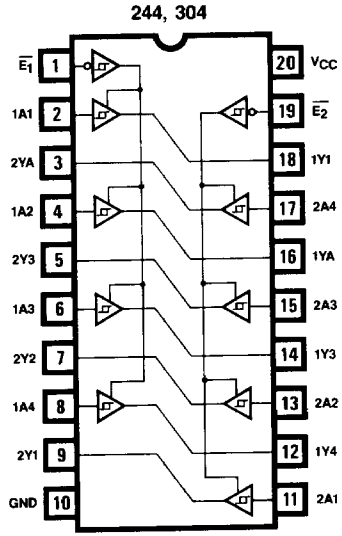
240, 300



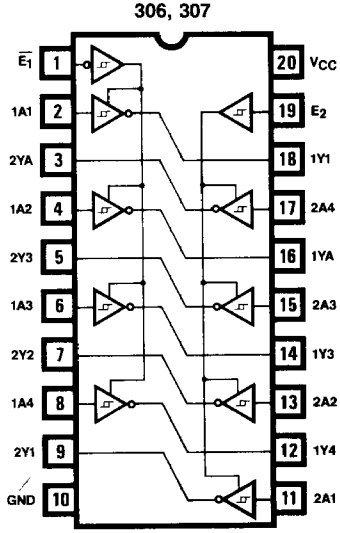
241, 301



244, 304



306, 307



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Absolute Maximum Ratings

Supply Voltage, V_{CC} 7V
Input Voltage 7V
Off-State Output Voltage 7V
Storage Temperature Range ..... −65°C to +150°C

Recommended Operating Conditions

SYMBOL	PARAMETER	MILITARY			COMMERCIAL			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I_{OH}	High-level output current			−12			−15	mA
I_{OL}	Low-level output current			12			24	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

Electrical Characteristics Over Recommended Operating Free Air Temperature Range

SYMBOL	PARAMETER	TEST CONDITIONS		MILITARY			COMMERCIAL			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{IH}	High-level input voltage			2			2			V
V_{IL}	Low-level input voltage					0.7			0.8	V
V_{IC}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
	Hysteresis ($V_{T+} - V_{T-}$)	V_{CC} = MIN		0.2	0.4		0.2	0.4		V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IL} = MAX	V_{IH} = 2 V, I_{OH} = −3mA	2.4	3.4		2.4	3.4		V
		V_{CC} = MIN, V_{IL} = 0.5 V,	V_{IH} = 2 V, I_{OH} = MAX	2			2			
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL}MAX	I_{OL} = 12 mA			0.4			0.4	V
			I_{OL} = 24 mA						0.5	
I_{OZH}	Off-state output current	V_{CC}, V_{IL} = MAX, V_{IH} = 2 V	V_O = 2.7 V			20			20	μA
I_{OZL}			V_O = 0.4 V			−20			−20	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}	High-level input current, any input	V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_{IL} = 0.4 V				−0.2			−0.2	mA
I_{OS}	Short-circuit output current	V_{CC} = MAX		−40		−225	−40		−225	mA
I_{CC}	Supply current	Outputs high	V_{CC} = MAX, Outputs open	All		13	23		13	23	mA
		Outputs low		'LS240, LS306		26	44		26	44	
				'LS241, 'LS244		27	46		27	46	
		All outputs disabled		'LS240, LS306		29	59		29	50	
				'LS241, 'LS244		32	54		32	54	

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

SYMBOL	PARAMETER	TEST CONDITIONS	LS240, LS306			LS241, LS244			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	Propagation delay, low-to-high	C_L = 45 pF, R_L = 667 Ω, See Page 10-4		9	14		12	18	ns
t_{PHL}	Propagation delay, high-to-low			12	18		12	18	ns
t_{PZL}	Ouptut enable time to low level			20	30		20	30	ns
t_{PZH}	Output enable time to high level			15	23		15	23	ns
t_{PLZ}	Output disable time from low level	C_L = 5 pF, R_L = 667 Ω, See Page 10-4		15	25		15	25	ns
t_{PHZ}	Output disable time from high level			10	18		10	18	ns

Absolute Maximum Ratings

Supply Voltage, V_{CC} 7V
Input Voltage 7V
Off-state ouptut voltage 7V
Storage temperature range ..... −65°C to +150°C

Recommended Operating Conditions

SYMBOL	PARAMETER	MILITARY MIN	MILITARY NOM	MILITARY MAX	COMMERCIAL MIN	COMMERCIAL NOM	COMMERCIAL MAX	UNIT
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I_{OH}	High-level output current			−12			−15	mA
I_{OL}	Low-level output current			12			24	mA
T_A	Operating free-air temperature	−55		125	0		70	°C

Electrical Characteristics Over Recommended Operating Free Air Temperature Range

SYMBOL	PARAMETER	TEST CONDITIONS		MILITARY MIN	MILITARY TYP	MILITARY MAX	COMMERCIAL MIN	COMMERCIAL TYP	COMMERCIAL MAX	UNIT
V_{T+}	Positive-going threshold voltage	V_{CC} = 5V		1.5	1.7	1.9	1.5	1.7	1.9	V
V_{T-}	Negative-going threshold voltage	V_{CC} = 5V		0.7	0.9	1.1	0.7	0.9	1.1	V
V_{IC}	Input clamp voltage	V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
	Hysteresis ($V_{T+} - V_{T-}$)	V_{CC} = 5V		0.4	0.8		0.4	0.8		V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX, I_{OH} = −3mA		2.4	3.4		2.4	3.4		V
		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.5 V, I_{OH} = MAX		2			2			
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} MAX	I_{OL} = 12 mA			0.4			0.4	V
			I_{OL} = 24 mA						0.5	
I_{OZH}	Off-state output current	V_{CC}, V_{IL} = MAX, V_{IH} = 2 V	V_O = 2.7 V			20			20	μA
I_{OZL}			V_O = 0.4 V			−20			−20	
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 7 V				0.1			0.1	mA
I_{IH}	High-level input current, any input	V_{CC} = MAX, V_I = 2.7 V				20			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_{IL} = 0.4 V				−0.2			−0.2	mA
I_{OS}	Short-circuit output current	V_{CC} = MAX		−40		−225	−40		−225	mA
I_{CC}	Supply current, Outputs high	V_{CC} = MAX, Outputs open	LS300, LS307		13	23		13	23	mA
			LS301, LS304		18	31		18	31	
	Supply current, Outputs low		LS300, LS307		26	44		26	44	
			LS301, LS304		32	46		32	46	
	Supply current, All outputs disabled		LS300, LS307		29	59		29	50	
			LS301, LS304		34	54		34	54	

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

SYMBOL	PARAMETER	TEST CONDITIONS	LS300, LS307 MIN	LS300, LS307 TYP	LS300, LS307 MAX	LS301, LS304 MIN	LS301, LS304 TYP	LS301, LS304 MAX	UNIT
t_{PLH}	Propagation delay, low-to-high	C_L = 45 pF, R_L = 667 Ω, See Page 10-4		19	25		19	25	ns
t_{PHL}	Propagation delay, high-to-low			19	25		19	25	ns
t_{PZL}	Ouptut enable time to low level			37	45		26	34	ns
t_{PZH}	Output enable time to high level			26	34		26	34	ns
t_{PLZ}	Output disable time from low level	C_L = 5 pF, R_L = 667 Ω, See Page 10-4		19	29		22	32	ns
t_{PHZ}	Output disable time from high level			19	29		22	32	ns

Absolute Maximum Ratings

Supply Voltage, V_{CC} 7V
Input Voltage 5.5V
Off-state ouptut voltage 5.5V
Storage temperature range ..... −65°C to +150°C

Recommended Operating Conditions

SYMBOL	PARAMETER	MILITARY			COMMERCIAL			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I_{OH}	High-level output current			−12			−15	mA
I_{OL}	Low-level output current			48			64	mA
T_A	Operating free-air temperature	−55		125*	0		70	°C

*The SN54S241/244J operating at free air temperature above 116°C requires a heat sink such that $R_{\theta CA}$ is not more than 40°C/W

Electrical Characteristics Over Recommended Operating Free Air Temperature Range

SYMBOL	PARAMETER		CONDITIONS		S240, S306 MIN	S240, S306 TYP	S240, S306 MAX	S241, S244 MIN	S241, S244 TYP	S241, S244 MAX	UNIT
V_{IH}	High-level input voltage				2			2			V
V_{IL}	Low-level input voltage						0.8			0.8	V
V_{IC}	Input clamp voltage		V_{CC} = MIN, I_I = −18mA				−1.2			−1.2	V
	Hystersis ($V_{T+} - V_{T-}$)		V_{CC} = MIN		0.2	0.4		0.2	0.4		V
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IH} = 2V, V_{IL} = 0.8V, I_{OH} = −3mA		2.4	3.4		2.4	3.4		V
			V_{CC} = MIN, V_{IH} = 2V, V_{IL} = 0.5V, I_{OH} = MAX		2			2			
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IH} = 2V, V_{IL} = 0.8V, I_{OL} = MAX				0.55			0.55	V
I_{OZH}	Off-state output current		V_{CC} = MAX, V_{IH} = 2V, V_{IL} = 0.8V	V_O = 2.4V			50			50	μA
I_{OZL}				V_O = 0.5V			−50			−50	
I_I	Maximum input current		V_{CC} = MAX, V_I = 5.5V				1			1	mA
I_{IH}	High-level input current		V_{CC} = MAX, V_I = 2.7V				50			50	μA
I_{IL}	Low-level input current	Any A	V_{CC} = MAX, V_I = 0.5V				−400			−400	μA
		Any E					−2			−2	mA
I_{OS}	Short circuit output current[1]		V_{CC} = MAX		−50		−225	−50		−225	mA
I_{CC}	Supply current	Outputs high	V_{CC} = MAX, Outputs Open	SN54S'		80	123		95	147	mA
				SN74S'		80	135		95	160	
		Outputs low		SN54S'		100	145		120	170	
				SN74S'		100	150		120	180	
		Outputs disabled		SN54S'		100	145		120	170	
				SN74S'		100	150		120	180	

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

SYMBOL	PARAMETER	TEST CONDITIONS	S240, S306 MIN	S240, S306 TYP	S240, S306 MAX	S241, S244 MIN	S241, S244 TYP	S241, S244 MAX	UNIT
t_{PLH}	Data to output delay	C_L = 50 pF, R_L = 90Ω, See Page 10-4		4.5	7		6	9	ns
t_{PHL}				4.5	7		6	9	ns
t_{PZL}	Output enable delay			10	15		10	15	ns
t_{PZH}				6.5	10		8	12	ns
t_{PLZ}	Output disable delay	C_L = 5 pF, R_L = 90Ω, See Page 10-4		10	15		10	15	ns
t_{PHZ}				6	9		6	9	ns

PRELIMINARY DATA

Absolute Maximum Ratings

Supply Voltage, V_{CC} 7V
Input Voltage 5.5V
Off-state ouptut voltage 5.5V
Storage temperature range ..... −65°C to +150°C

Recommended Operating Conditions

SYMBOL	PARAMETER	MILITARY MIN	MILITARY NOM	MILITARY MAX	COMMERCIAL MIN	COMMERCIAL NOM	COMMERCIAL MAX	UNIT
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
I_{OH}	High-level output current			−12			−15	mA
I_{OL}	Low-level output current			48			64	mA
T_A	Operating free-air temperature	−55		125*	0		70	°C

*The SN54S241/244J operating at free air temperature above 116°C requires a heat sink such that $R_{\theta CA}$ is not more than 40°C/W

Electrical Characteristics Over Recommended Operating Free Air Temperature Range

SYMBOL	PARAMETER	CONDITIONS		S300, S307, MIN	S300, S307, TYP	S300, S307, MAX	S301, S304 MIN	S301, S304 TYP	S301, S304 MAX	UNIT
V_{T+}	Positive going threshold voltage	V_{CC} = 5V		1.5	1.7	1.9	1.5	1.7	1.9	V
V_{T-}	Negative-going threshold voltage	V_{CC} = 5V		0.7	0.9	1.1	0.7	0.9	1.1	V
V_{IC}	Input clamp voltage	V_{CC} = MIN, I_I = −18mA				−1.2			−1.2	V
	Hystersis ($V_{T+} - V_{T-}$)	V_{CC} = MIN 5V		0.4	0.8		0.4	0.8		V
V_{OH}	High level output voltage	V_{CC} = MIN, V_{IH} = 2V, V_{IL} = 0.8V, I_{OH} = −3mA		2.4	3.4		2.4	3.4		V
		V_{CC} = MIN, V_{IH} = 2V, V_{IL} = 0.5V, I_{OH} = MAX		2			2			V
V_{OL}	Low level output voltage	V_{CC} = MIN, V_{IH} = 2V, V_{IL} = 0.8V, I_{OL} = MAX				0.55			0.55	V
I_{OZH}	Off state output current	V_{CC} = MAX, V_{IH} = 2V, V_{IL} = 0.8V	V_O = 2.4V			50			50	μA
I_{OZL}			V_O = 0.5V			−50			−50	μA
I_I	Maximum input current	V_{CC} = MAX, V_I = 5.5V				1			1	mA
I_{IH}	High level input current	V_{CC} = MAX, V_I = 2.7V				50			50	μA
I_{IL}	Low level input current, Any A	V_{CC} = MAX, V_I = 0.5V				−400			−400	μA
	Low level input current, Any E					−400			−400	μA
I_{OS}	Short circuit output current[1]	V_{CC} = MAX		−50		−225	−50		−225	mA
I_{CC}	Supply current, Outputs high	V_{CC} = MAX, Outputs Open	Military			123			147	mA
			Commercial			135			160	mA
	Supply current, Outputs low		Military		100	145		120	170	mA
			Commercial		100	150		120	180	mA
	Supply current, Outputs disabled		Military		100	145		120	170	mA
			Commercial		100	150		120	180	mA

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

SYMBOL	PARAMETER	TEST CONDITIONS	S300, S307 MIN	S300, S307 TYP	S300, S307 MAX	S301, S304 MIN	S301, S304 TYP	S301, S304 MAX	UNIT
t_{PLH}	Data to output delay	C_L = 50 pF, R_L = 90Ω, See Page 10-4							ns
t_{PHL}									ns
t_{PZL}	Output enable delay								ns
t_{PZH}									ns
t_{PLZ}	Output disable delay	C_L = 5 pF See, R_L = 90Ω Page 10-4							ns
t_{PHZ}									ns

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