

TYPES SN5475, SN5477, SN54L75, SN54L77, SN54LS75, SN54LS77, SN7475, SN74LS75

4-BIT BISTABLE LATCHES

MARCH 1974—REVISED DECEMBER 1983

logic

FUNCTION TABLE
(each latch)

INPUTS		OUTPUTS	
D	C	Q	$\bar{Q}$
L	H	L	H
H	H	H	L
X	L	Q_0	$\bar{Q}_0$

H = high level, L = low level, X = irrelevant

Q_0 = the level of Q before the high-to-low transition of G

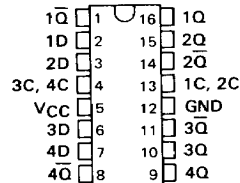
description

These latches are ideally suited for use as temporary storage for binary information between processing units and input/output or indicator units. Information present at a data (D) input is transferred to the Q output when the enable (C) is high and the Q output will follow the data input as long as the enable remains high. When the enable goes low, the information (that was present at the data input at the time the transition occurred) is retained at the Q output until the enable is permitted to go high.

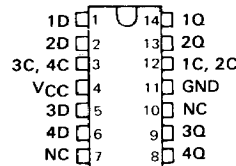
The '75, 'L75, and 'LS75 feature complementary Q and $\bar{Q}$ outputs from a 4-bit latch, and are available in various 16-pin packages. For higher component density applications, the '77, 'L77, and 'LS77 4-bit latches are available in 14-pin flat packages.

These circuits are completely compatible with all popular TTL families. All inputs are diode-clamped to minimize transmission-line effects and simplify system design. Series 54, 54L, and 54LS devices are characterized for operation over the fully military temperature range of -55°C to 125°C; Series 74, and 74LS devices are characterized for operation from 0°C to 70°C.

SN5475, SN54LS75 ... J OR W PACKAGE
SN54L75 ... J PACKAGE
SN7475 ... J OR N PACKAGE
SN74LS75 ... D, J OR N PACKAGE
(TOP VIEW)



SN5477, SN54LS77 ... W PACKAGE
SN54L77 ... T PACKAGE
(TOP VIEW)



NC - No internal connection

FOR CHIP CARRIER INFORMATION,
CONTACT THE FACTORY

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage: '75, 'L75, '77, 'L77	5.5 V
'LS75, 'LS77	7 V
Intermitter voltage (see Note 2)	5.5 V
Operating free-air temperature range: SN54'	-55°C to 125°C
SN74'	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTES: 1. Voltage values are with respect to network ground terminal.

2. This is the voltage between two emitters of a multiple-emitter input transistor and is not applicable to the 'LS75 and 'LS77.

PRODUCTION DATA
This document contains information current as

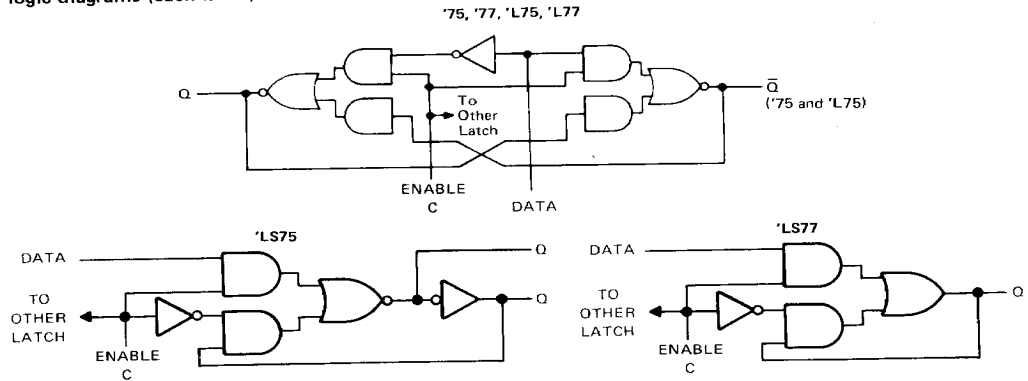


3

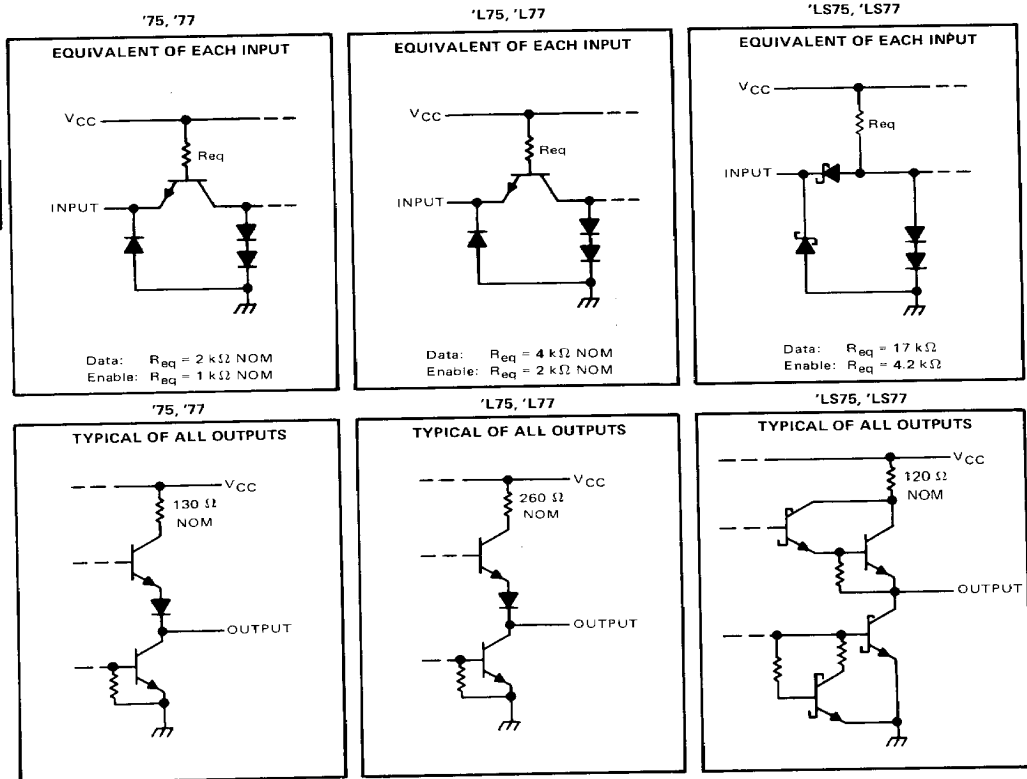
TTL DEVICES

TYPES SN5475, SN5477, SN54L75, SN54L77, SN54LS75, SN54LS77, SN7475, SN74LS75 4-BIT BISTABLE LATCHES

logic diagrams (each latch)



schematics of inputs and outputs



3-306

TEXAS INSTRUMENTS

 POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

TYPES SN5475, SN5477, SN7475 4-BIT BISTABLE LATCHES

recommended operating conditions

	SN5475, SN5477			SN7475			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-400			-400	μ A
Low-level output current, I_{OL}			16			16	mA
Width of enabling pulse, t_W	20			20			ns
Setup time, t_{su}	20			20			ns
Hold time, t_h	5			5			ns
Operating free-air temperature, T_A	-55		125	0		70	$^{\circ}$ C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage			2			V
V_{IL}	Low-level input voltage					0.8	V
V_{IK}	Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$				-1.5	V
V_{OH}	High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -400 \mu\text{A}$		2.4	3.4		V
V_{OL}	Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$			0.2	0.4	V
I_I	Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$				1	mA
I_{IH}	High-level input current	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$	D input			80	μ A
			C input			160	
I_{IL}	Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$	D input			-3.2	mA
			C input			-6.4	
I_{OS}	Short-circuit output current§	$V_{CC} = \text{MAX}$	SN54'	-20		-57	mA
			SN74'	-18		-57	
I_{CC}	Supply current	$V_{CC} = \text{MAX},$ See Note 3	SN54'		32	46	mA
			SN74'		32	53	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$.

§ Not more than one output should be shorted at a time.

NOTE 3: I_{CC} is tested with all inputs grounded and all outputs open.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	D	Q	$C_L = 15 \text{ pF},$ $R_L = 400 \Omega,$ See Figure 1	16	30	ns	
t_{PHL}				14	25		
$t_{PLH}^{\parallel}$	D	$\bar{Q}$		24	40	ns	
$t_{PHL}^{\parallel}$				7	15		
t_{PLH}	C	Q		16	30	ns	
t_{PHL}				7	15		
$t_{PLH}^{\parallel}$	C	$\bar{Q}$		16	30	ns	
$t_{PHL}^{\parallel}$				7	15		

t_{PLH} = propagation delay time, low-to-high-level output

t_{PHL} = propagation delay time, high-to-low-level output

$\parallel$ These parameters are not applicable for the SN5477.

3
TTL DEVICES

TEXAS
INSTRUMENTS

POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

3-307

TYPES SN54L75, SN54L77

4-BIT BISTABLE LATCHES

recommended operating conditions

	MIN	NOM	MAX	UNIT
V_{CC} Supply voltage	4.5	5	5.5	V
V_{IH} High-level input voltage	2			V
V_{IL} Low-level input voltage			0.8	V
I_{OH} High-level output current			-0.2	mA
I_{OL} Low-level output current			8	mA
t_W Width of enabling pulse	100			ns
t_{SU} Setup time	40			ns
t_H Hold time	10			ns
T_A Operating free-air temperature	-55		125	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS †	MIN	TYP ‡	MAX	UNIT
V_{IK}	$V_{CC} = \text{MIN.}$, $I_I = -12 \text{ mA}$			-1.5	V
V_{OH}	$V_{CC} = \text{MIN.}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -0.2 \text{ mA}$	2.4	3.4		V
V_{OL}	$V_{CC} = \text{MIN.}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 8 \text{ mA}$		0.2	0.4	V
I_I	$V_{CC} = \text{MAX.}$, $V_I = 5.5 \text{ V}$			1	mA
I_{IH}	D Input			40	μA
	C Input			80	
I_{IL}	D Input			-1.6	mA
	C Input			-3.2	
$I_{OS} §$	$V_{CC} = \text{MAX.}$	-10		-29	mA
I_{CC}	$V_{CC} = \text{MAX.}$, See Note 3		16	23	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

§ Not more than one output should be shorted at a time.

NOTE 3: I_{CC} is tested with all inputs grounded and all outputs open.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	D	Q	$R_L = 800 \Omega$, See Figure 1 $C_L = 15 \text{ pF}$	32	60		ns
t_{PHL}				28	50		ns
$t_{PLH\%}$	D	$\overline{Q}$		48	80		ns
$t_{PLH\%}$				14	30		ns
t_{PLH}	C	Q		32	60		ns
t_{PHL}				14	30		ns
$t_{PLH\%}$	C	$\overline{Q}$		32	60		ns
$t_{PLH\%}$				14	30		ns

¶ These parameters are not applicable for the SN54L77.

TYPES SN54LS75, SN54LS77, SN74LS75 4-BIT BISTABLE LATCHES

recommended operating conditions

	SN54LS75 SN54LS77			SN74LS75			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-400			-400	μ A
Low-level output current, I_{OL}			4			8	mA
Width of enabling pulse, t_w	20			20			ns
Setup time, t_{su}	20			20			ns
Hold time, t_h	5			5			ns
Operating free-air temperature, T_A	-55		125	0		70	$^{\circ}$ C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54LS75 SN54LS77			SN74LS75			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_{IK} Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			-1.5			-1.5	V
V_{OH} High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$	2.5	3.5		2.7	3.5		V
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$							V
				$I_{OL} = 4 \text{ mA}$			0.25	0.4
				$I_{OL} = 8 \text{ mA}$			0.35	0.5
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$							mA
				D input			0.1	0.1
				C input			0.4	0.4
I_{IH} High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$							μ A
				D input			20	20
				C input			80	80
I_{IL} Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$							mA
				D input			-0.4	-0.4
				C input			-1.6	-1.6
I_{OS} Short-circuit output current§	$V_{CC} = \text{MAX}$	-20		-100	-20		-100	mA
I_{CC} Supply current	$V_{CC} = \text{MAX}, \text{ See Note 2}$							mA
				LS75			6.3	12
				LS77			6.9	13

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$.

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

NOTE 2: I_{CC} is tested with all inputs grounded and all outputs open.

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

PARAMETER ¶	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS75			'LS77			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
t _{PLH}	D	Q	C _L = 15 pF, R _L = 2 kΩ, See Figure 1	15	27		11	19		ns
t _{PHL}				9	17		9	17		
t _{PLH}	D	Q̄		12	20					ns
t _{PHL}				7	15					
t _{PLH}	C	Q		15	27		10	18		ns
t _{PHL}				14	25		10	18		
t _{PLH}	C	Q̄		16	30					ns
t _{PHL}				7	15					

¶ t_{PLH} = propagation delay time, low-to-high-level output

t_{PHL} = propagation delay time, high-to-low-level output

3
TTL DEVICES

TEXAS
INSTRUMENTS

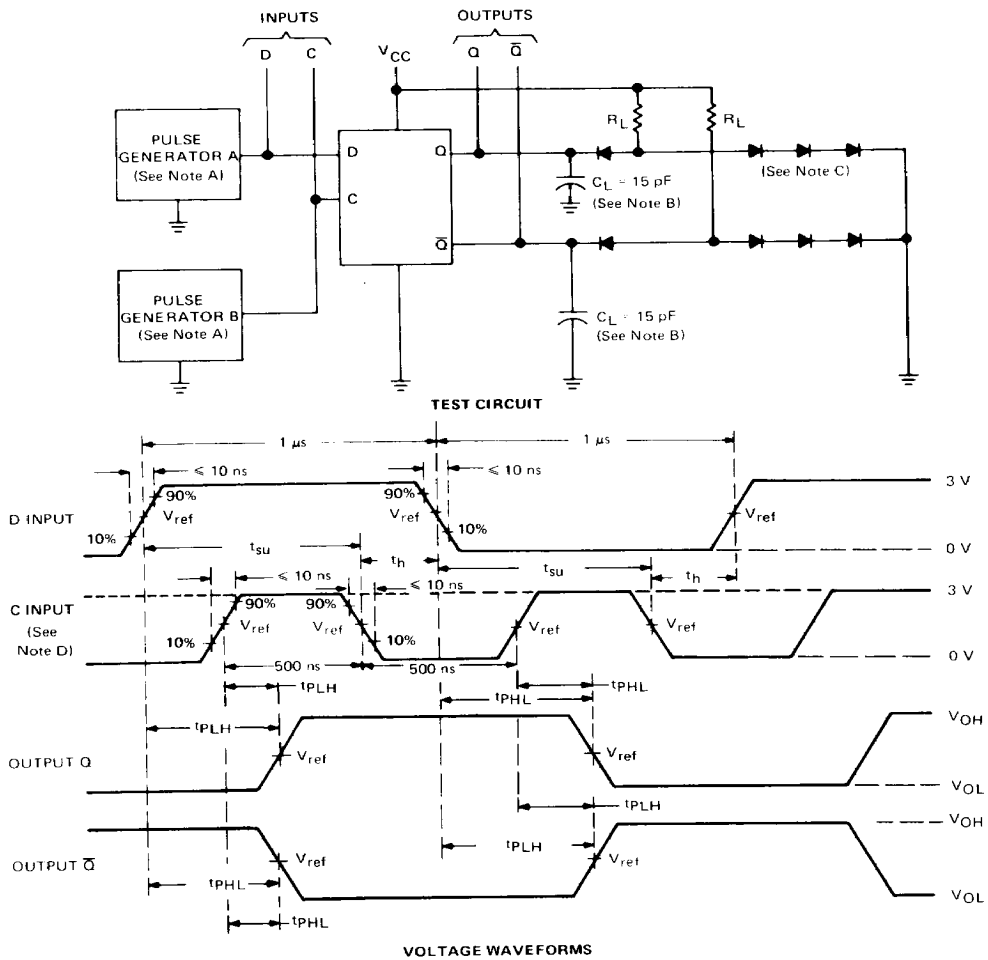
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

3-309

**TYPES SN5475, SN5477, SN54L75, SN54L77, SN54LS75, SN54LS77,
SN7475, SN74LS75
4-BIT BISTABLE LATCHES**

PARAMETER MEASUREMENT INFORMATION

switching characteristics†



† Complementary Q outputs are on the '75, 'L75, and 'LS75 only.

NOTES: A. The pulse generators have the following characteristics: $Z_{out} \approx 50 \Omega$; for pulse generator A, $PRR \leq 500 \text{ kHz}$; for pulse generator B, $PRR \leq 1 \text{ MHz}$. Positions of D and C input pulses are varied with respect to each other to verify setup times.

B. C_L includes probe and jig capacitance.

C. All diodes are 1N3064 or equivalent.

D. When measuring propagation delay times from the D input, the corresponding C input must be held high.

E. For '75, '77, 'L75, and 'L77, $V_{ref} = 1.5 \text{ V}$; for 'LS75 and 'LS77, $V_{ref} = 1.3 \text{ V}$.

FIGURE 1