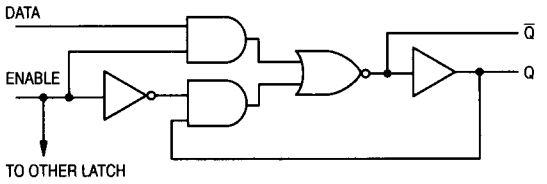
MOTOROLA

4-Bit Bistable Latch With Q and $\overline{Q}$

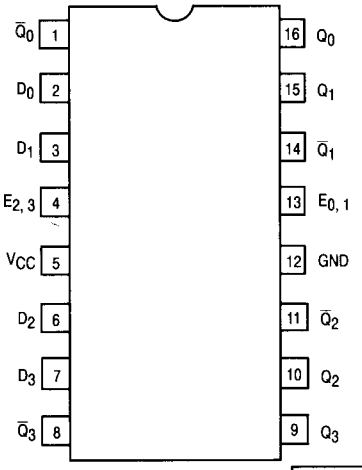
ELECTRICALLY TESTED PER:
MIL-M-38510/31601

The 54LS75 is a 4-Bit D-Type Latch for use as temporary storage for binary information between processing limits and input/output or indicator units. Information present at the data (D) input is transferred to the Q output when the Enable 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.

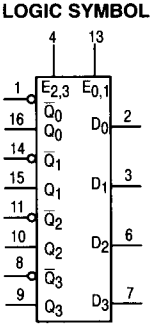
LOGIC DIAGRAM



CONNECTION DIAGRAM



LOGIC SYMBOL



Pin Names		Loading (Note a) HIGH	LOW
D_1-D_4	Data Inputs	0.5 U.L.	0.25 U.L.
E_0-E_1	Enable Input Latches 0, 1	2.0 U.L.	1.0 U.L.
E_2-E_3	Enable Input Latches 2, 3	2.0 U.L.	1.0 U.L.
Q_1-Q_4	Latch Outputs (Note b)	10 U.L.	5(2.5) U.L.
$\overline{Q}_1$-$\overline{Q}_4$	Complimentary Latch Outputs (Note b)	10 U.L.	5(2.5) U.L.

NOTES:
a. One unit load (U.L.) = 40 μA HIGH/1.6 mA LOW.
b. The output LOW drive factor is 2.5 U.L. for Military (54) and 5 U.L. for commercial (74) Temperature Ranges.

Military 54LS75

AVAILABLE AS:

1) JAN: JM38510/31601BXA
2) SMD: N/A
3) 883: 54LS75/BXAJC

X = CASE OUTLINE AS FOLLOWS:
PACKAGE: CERDIP: E
CERFLAT: F
LCC: SEE 54LS375

THE LETTER "M" APPEARS BEFORE THE / ON LCC.

PIN ASSIGNMENTS

FUNCT.	DIL 620-09	FLATS 650-05	BURN-IN (COND. A)
$\overline{Q}_0$	1	1	OPEN
D_0	2	2	V_{CC}
D_1	3	3	V_{CC}
E_{2-3}	4	4	V_{CC}
V_{CC}	5	5	V_{CC}
D_2	6	6	V_{CC}
D_3	7	7	V_{CC}
$\overline{Q}_3$	8	8	OPEN
Q_3	9	9	V_{CC}
Q_2	10	10	V_{CC}
$\overline{Q}_2$	11	11	OPEN
GND	12	12	GND
E_{0-1}	13	13	V_{CC}
$\overline{Q}_1$	14	14	OPEN
Q_1	15	15	V_{CC}
Q_0	16	16	V_{CC}

BURN-IN CONDITIONS:
V_{CC} = 5.0 V MIN/6.0 V MAX

TRUTH TABLE (Each Latch)

t_n	$t_n + 1$
D	Q
H	H
L	L

t_n = Bit time before enable negative-going transition
$t_n + 1$ = Bit time after enable negative-going transition.

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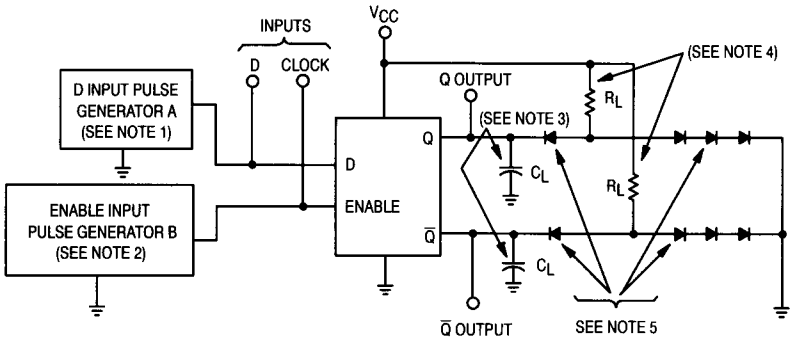
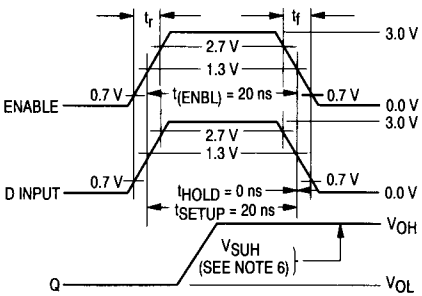
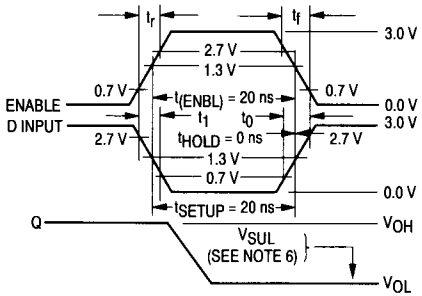
SWITCHING TEST CIRCUIT

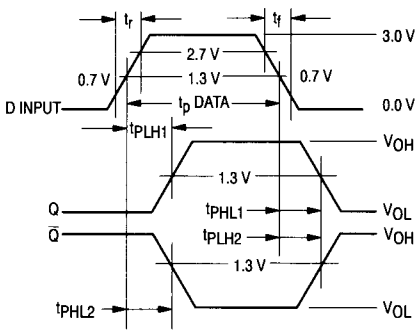


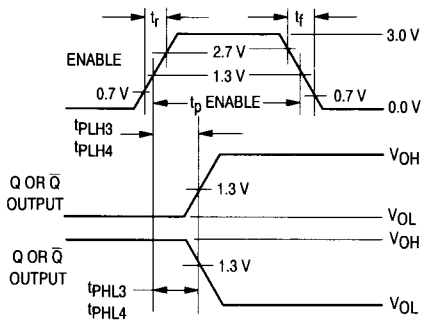
SETUP AND HOLD WAVEFORMS





TIMING WAVEFORMS





REFERENCE NOTES ON PAGE 5-67

Symbol	Parameter	Limits						Unit	Test Condition (Unless Otherwise Specified)
		+ 25°C		+ 125°C		– 55°C			
	Static Parameters:	Subgroup 1		Subgroup 2		Subgroup 3			
		Min	Max	Min	Max	Min	Max		
V_{OH}	Logical "1" Output Voltage	2.5		2.5		2.5		V	V_{CC} = 4.5 V, I_{OH} = –0.4 mA, V_{IH} 2.0 V or 0.7 V per truth table, Enable = (See Note 7).
V_{OL}	Logical "0" Output Voltage		0.4		0.4		0.4	V	V_{CC} = 4.5 V, I_{OL} = 4.0 mA, V_{IL} = 0.7 V or 2.0 V per truth table, Enable = (See Note 7).
V_{IC}	Input Clamping Voltage		–1.5					V	V_{CC} = 4.5 V, I_{IN} = –18 mA, other inputs are open.
I_{IH1}	Logical "1" Input Current (D inputs)		20		20		20	µA	V_{CC} = 5.5 V, V_{IH} = 2.7 V, other input is open.
I_{IHH1}	Logical "1" Input Current (E_n inputs)		80		80		80	µA	V_{CC} = 5.5 V, V_{IH} = GND, $V_{IN}(E_n)$ = 2.7 V.
I_{IH2}	Logical "1" Input Current (D inputs)		100		100		100	µA	V_{CC} = 5.5 V, V_{IH} –5.5 V, $V_{IN}(E_n)$ = GND.
I_{IHH2}	Logical "1" Input Current (E_n inputs)		400		400		400	µA	V_{CC} = 5.5 V, V_{IH} = GND, $V_{IN}(E_n)$ = 5.5 V.
I_{IL1}	Logical "0" Input Current (D inputs)	– 0.16	– 0.4	– 0.16	– 0.4	– 0.16	– 0.4	mA	V_{CC} = 5.5 V, V_{IL} = 0.4 V, $V_{IN}(E_n)$ = 4.5 V.
I_{IL2}	Logical "0" Input Current (E_n inputs)	– 0.64	– 1.6	– 0.64	– 1.6	– 0.64	– 1.6	mA	V_{CC} = 5.5 V, $V_{IN}(E_n)$ = 0.4 V, other input = 4.5 V.
I_{OS}	Output Short Circuit Current	– 15	– 100	– 15	– 100	– 15	– 100	mA	V_{CC} = 5.5 V, $V_{IN}(E_n)$ = 4.5 V, other inputs = 4.5 V or GND.
I_{CC}	Power Supply Current		12		12		12	mA	V_{CC} = 5.5 V, V_{IN} = GND (all inputs).
V_{IH}	Logical "1" Input Voltage	2.0		2.0		2.0		V	V_{CC} = 4.5 V.
V_{IL}	Logical "0" Input Voltage		0.7		0.7		0.7	V	V_{CC} = 4.5 V.
	Functional Tests	Subgroup 7		Subgroup 8A		Subgroup 8B			per Truth Table with V_{CC} = 5.0 V, V_{INL} = 0.4 V, and V_{INH} = 2.5 V.

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Symbol	Parameter	Limits						Unit	Test Condition (Unless Otherwise Specified)
	Switching Parameters:	+ 25°C		+ 125°C		– 55°C			
		Subgroup 9		Subgroup 10		Subgroup 11			
		Min	Max	Min	Max	Min	Max		
t_{PHL1} t_{PHL1}	Propagation Delay / Data-Output Data to Q	3.0 —	22 17	3.0 —	29 24	3.0 —	29 24	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PLH1} t_{PLH1}	Propagation Delay / Data-Output Data to Q	3.0 —	32 27	3.0 —	42 37	3.0 —	42 37	ns	V_{CC} = 6.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PHL2} t_{PHL2}	Propagation Delay / Data-Output Data to $\overline{Q}$	3.0 —	20 15	3.0 —	26 21	3.0 —	26 21	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PLH2} t_{PLH2}	Propagation Delay / Data-Output Data to $\overline{Q}$	3.0 —	25 20	3.0 —	32 27	3.0 —	32 27	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PHL3} t_{PHL3}	Propagation Delay / Data-Output E_n to Q	3.0 —	30 25	3.0 —	39 34	3.0 —	39 34	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PLH3} t_{PLH3}	Propagation Delay / Data-Output E_n to Q	3.0 —	32 27	3.0 —	42 37	3.0 —	42 37	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PHL4} t_{PHL4}	Propagation Delay / Data-Output E_n to $\overline{Q}$	3.0 —	20 15	3.0 —	26 21	3.0 —	26 21	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
t_{PLH4} t_{PLH4}	Propagation Delay / Data-Output E_n to $\overline{Q}$	3.0 —	35 30	3.0 —	46 44	3.0 —	46 44	ns	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%. V_{CC} = 5.0 V, C_L = 15 pF, R_L = 2.0 kΩ ± 5.0%.
V_{SUH}	Logical "1" Setup Voltage	2.5		2.5		2.5		V	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%.
V_{SUL}	Logical "0" Setup Voltage		0.4		0.4		0.4	V	V_{CC} = 5.0 V, C_L = 50 pF, R_L = 2.0 kΩ ± 5.0%.

NOTES:

1. The D input pulse generator has the following characteristics: V_{GEN} = 3.0 V, $t_r \leq 15$ ns, $t_f \leq 6.0$ ns, t_p = 30 ns and Z_{OUT} = 50 Ω except when measuring V_{SETUP}.
2. The enable pulse generator is identical to the D input pulse generator.
3. C_L = 15 pF ± 10%, which includes probe and jig capacitance.
4. R_L = 2.0 kΩ ± 5.0%.
5. All diodes are 1N3064 or equivalent.
6. V_{SETUP} is to be measured 500 ns minimum after input transition to assure that the device has latched with minimum setup and maximum hold conditions applied to inputs.
7. Apply 0 V/3.0 V – 5.0 V/0 V momentary pulse 500 ns minimum prior to measurement.
8. For all t_{PLH} and V_{SUH} tests, preset output into the ZERO state prior to making tests.
9. For all t_{PHL} and V_{SUL} tests, preset output into ONE state prior to making tests.
10. The limits specified for C_L = 15 pF are guaranteed but not tested.