

MM54HC533/MM74HC533 TRI-STATE® Octal D-Type Latch with Inverted Outputs

General Description

These high speed OCTAL D-TYPE LATCHES utilize advanced silicon-gate CMOS technology. They possess the high noise immunity and low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LS-TTL loads. Due to the large output drive capability and the TRI-STATE feature, these devices are ideally suited for interfacing with bus lines in a bus organized system.

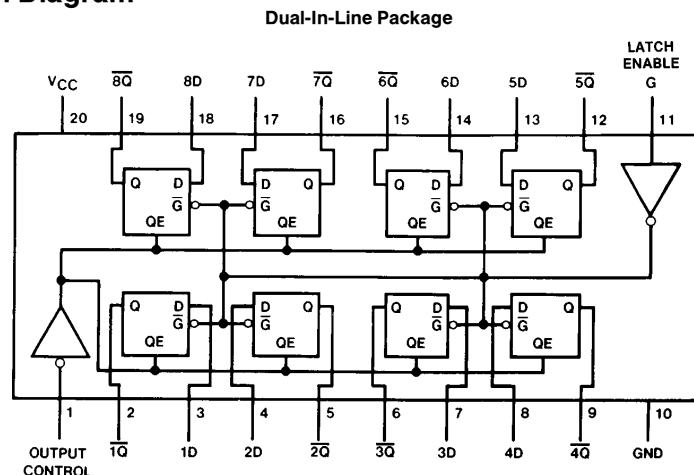
When the LATCH ENABLE input is high, the data present on the D inputs will appear inverted at the $\bar{Q}$ outputs. When the LATCH ENABLE goes low, the inverted data will be retained at the $\bar{Q}$ outputs until LATCH ENABLE returns high again. When a high logic level is applied to the OUTPUT CONTROL input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The 54HC/74HC logic family is speed, function, and pin-out compatible with the standard 54LS/74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

- Typical propagation delay: 18 ns
- Wide operating voltage range: 2 to 6 volts
- Low input current: 1 μ A maximum
- Low quiescent current: 80 μ A, maximum (74HC Series)
- Compatible with bus-oriented systems
- Output drive capability: 15 LS-TTL loads

Connection Diagram



TL/F/5339-1

Top View

Order Number MM54HC533 or MM74HC533

Truth Table

Output Control	Latch Enable G	Data	Output
L	H	H	L
L	H	L	H
L	L	X	$\bar{Q}_0$
H	X	X	Z

H = high level, L = low level

Q_0 = level of output before steady-state input conditions were established.

Z = high impedance

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Absolute Maximum Ratings (Notes 1 & 2)

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

Supply Voltage (V_{CC})	−0.5 to +7.0V
DC Input Voltage (V_{IN})	−1.5 to $V_{CC} + 1.5V$
DC Output Voltage (V_{OUT})	−0.5 to $V_{CC} + 0.5V$
Clamp Diode Current (I_{IK}, I_{OK})	±20 mA
DC Output Current, per pin (I_{OUT})	±35 mA
DC V_{CC} or GND Current, per pin (I_{CC})	±70 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Power Dissipation (P_D)	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temp. (T_L) (Soldering 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temp. Range (T_A)			
MM74HC	−40	+85	°C
MM54HC	−55	+125	°C
Input Rise or Fall Times (t_r, t_f)			
$V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

DC Electrical Characteristics

Symbol	Parameter	Conditions	V _{CC}	T _A = 25°C		74HC	54HC	Units
				Type	Guaranteed Limits			
V _{IH}	Minimum High Level Input Voltage		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V _{IL}	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V _{OH}	Minimum High Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 6.0 mA I _{OUT} ≤ 7.8 mA	4.5V	4.2	3.98	3.84	3.7	V
			6.0V	5.7	5.48	5.34	5.2	V
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 6.0 mA I _{OUT} ≤ 7.8 mA	4.5V	0.2	0.26	0.33	0.4	V
			6.0V	0.2	0.26	0.33	0.4	V
I _{IN}	Maximum Input Current	V _{IN} = V _{CC} or GND	6.0V		± 0.1	± 1.0	± 1.0	μA
I _{OZ}	Maximum TRI-STATE Output Leakage Current	V _{IN} = V _{IH} or V _{IL} , OC = V _{IH} V _{OUT} = V _{CC} or GND	6.0V		± 0.5	± 5	± 10	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	6.0V		8.0	80	160	μA

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C; ceramic "J" package: −12 mW/°C from 100°C to 125°C.

Note 4: For a power supply of 5V ±10% the worst case output voltages (V_{OH} , and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

** V_{IL} limits are currently tested at 20% of V_{CC} . The above V_{IL} specification (30% of V_{CC}) will be implemented no later than Q1, CY'89.

AC Electrical Characteristics $V_{CC}=5V$, $T_A=25^{\circ}C$, $t_r=t_f=6\text{ ns}$

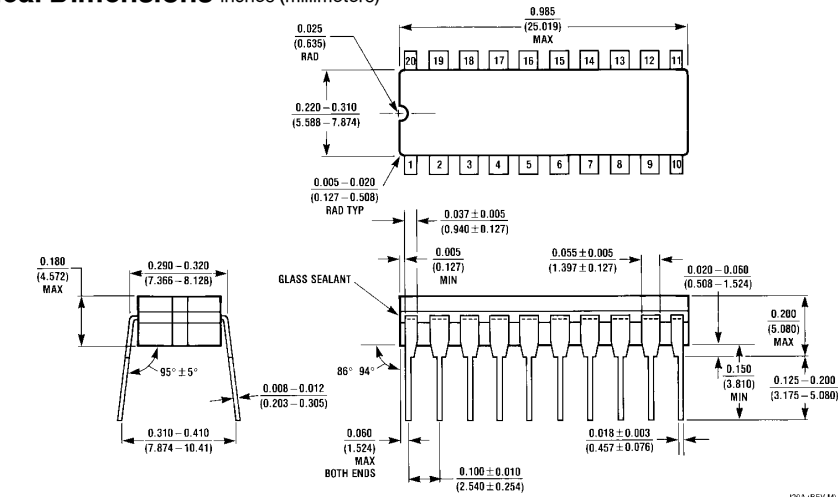
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Data to $\bar{Q}$	$C_L = 45\text{ pF}$	18	25	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay, Enable to $\bar{Q}$	$C_L = 45\text{ pF}$	21	30	ns
t_{PZH} , t_{PZL}	Maximum Output Enable Time	$R_L = 1\text{ k}\Omega$ $C_L = 45\text{ pF}$	20	28	ns
t_{PHZ} , t_{PLZ}	Maximum Output Disable Time	$R_L = 1\text{ k}\Omega$ $C_L = 5\text{ pF}$	18	25	ns
t_S	Minimum Set Up Time			5	ns
t_H	Minimum Hold Time			10	ns
t_W	Minimum Pulse Width			16	ns

AC Electrical Characteristics $V_{CC}=2.0V-6.0V$, $C_L=50\text{ pF}$, $t_r=t_f=6\text{ ns}$ (unless otherwise specified)

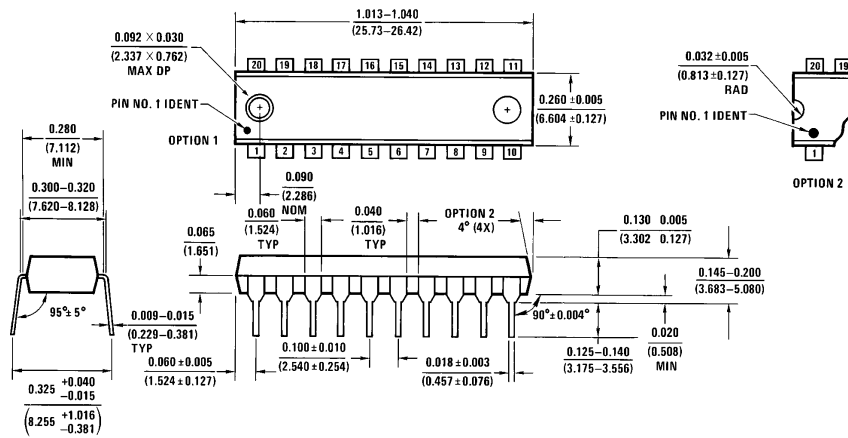
Symbol	Parameter	Conditions	V _{CC}	T _A = 25°C		74HC T _A = −40 to 85°C	54HC T _A = −55 to 125°C	Units
				Typ	Guaranteed Limits			
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Data to Q	C _L = 50 pF	2.0V	50	150	188	225	ns
		C _L = 150 pF	2.0V	80	200	250	300	ns
		C _L = 50 pF	4.5V	22	30	37	45	ns
		C _L = 150 pF	4.5V	30	40	50	60	ns
		C _L = 50 pF	6.0V	19	26	31	39	ns
		C _L = 150 pF	6.0V	26	35	44	53	ns
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Enable to Q	C _L = 50 pF	2.0V	63	175	220	263	ns
		C _L = 150 pF	2.0V	110	225	280	338	ns
		C _L = 50 pF	4.5V	25	35	44	52	ns
		C _L = 150 pF	4.5V	35	45	56	68	ns
		C _L = 50 pF	6.0V	21	30	37	45	ns
		C _L = 150 pF	6.0V	28	39	49	59	ns
t _{PZH} , t _{PZL}	Maximum Output Enable Time	R _L = 1 kΩ						
		C _L = 50 pF	2.0V	50	150	188	225	ns
		C _L = 150 pF	2.0V	80	200	250	300	ns
		C _L = 50 pF	4.5V	21	30	37	45	ns
		C _L = 150 pF	4.5V	30	40	50	60	ns
		C _L = 50 pF	6.0V	19	26	31	39	ns
C _L = 150 pF	6.0V	26	35	44	53	ns		
t _{PHZ} , t _{PLZ}	Maximum Output Disable Time	R _L = 1 kΩ	2.0V	50	150	188	225	ns
		C _L = 50 pF	4.5V	21	30	37	45	ns
		C _L = 50 pF	6.0V	19	26	31	39	ns
t _S	Minimum Set Up Time		2.0V		50	60	75	ns
			4.5V		9	13	15	ns
			6.0V		9	11	13	ns
t _H	Minimum Hold Time		2.0V		5	5	5	ns
			4.5V		5	5	5	ns
			6.0V		5	5	5	ns
t _W	Minimum Pulse Width		2.0V	30	80	100	120	ns
			4.5V	10	16	20	24	ns
			6.0V	9	14	18	20	ns
t _{THL} , t _{TLH}	Maximum Output Rise and Fall Time, Clock	C _L = 50 pF	2.0V	25	60	75	90	ns
		C _L = 50 pF	4.5V	7	12	15	18	ns
		C _L = 50 pF	6.0V	6	10	13	15	ns
C _{PD}	Power Dissipation Capacitance (Note 5)	(per latch) OC = V _{CC} OC = Gnd		30 50				pF pF
C _{IN}	Maximum Input Capacitance			5	10	10	10	pF
C _{OUT}	Maximum Output Capacitance			15	20	20	20	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters)



Order Number MM54HC533J or MM74HC533J NS Package J20A



Order Number MM74HC533N NS Package N20A

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