



October 1987
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MM74C165

Parallel-Load 8-Bit Shift Register

General Description

The MM74C165 functions as an 8-bit parallel-load, serial shift register. Data is loaded into the register independent of the state of the clock(s) when PARALLEL LOAD (\overline{PL}) is low. Shifting is inhibited as long as \overline{PL} is low. Data is sequentially shifted from complementary outputs, Q_7 and $\overline{Q_7}$, highest-order bit (P7) first. New serial data may be entered via the SERIAL DATA (Ds) input. Serial shifting occurs on the rising edge of CLOCK1 or CLOCK2. Clock inputs may be used separately or together for combined clocking from independent sources. Either clock input may be used also as an active-low clock enable. To prevent double-clocking when a clock input is used as an enable,

the enable must be changed to a high level (disabled) only while the clock is HIGH.

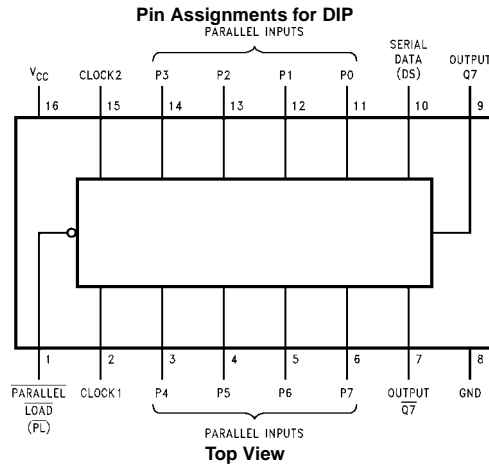
Features

- Wide supply voltage range: 3V to 15V
- Guaranteed noise margin: 1V
- High noise immunity: 0.45 V_{CC} (typ.)
- Low power TTL compatibility: fan out of 2 driving 74L
- Parallel loading independent of clock
- Dual clock inputs
- Fully static operation

Ordering Code:

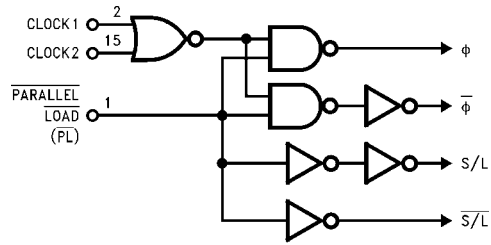
Order Number	Package Number	Package Description
MM74165N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Connection Diagram

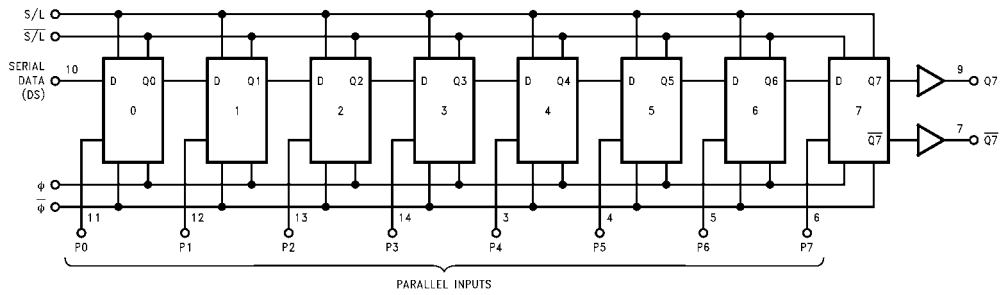


MM74C165 Parallel-Load 8-Bit Shift Register

Block Diagrams



*Please look into Section 8, Appendix D for availability of various package types.



Truth Table

State	Inputs					Internal		Outputs	
	PL	Clock1	Clock2 (as enable)	Ds	P0 thru P7	Q0	Q1	Q7	Q7-bar
Parallel Load	L	X	X	X	P0...P7	P0	P1	P7	P7-bar
Enable	H	L	L	X	X	P0	P1	P7	P7-bar
Shift (with Ds)	H	↑	L	H	X	H	P0	P6	P6-bar
Shift (with Ds)	H	↑	L	L	X	L	H	P5	P5-bar
Hold (Disable)	H	↑	H	X	X	L	H	P5	P5-bar

X = Don't Care
H = $V_{IN(1)}$
L = $V_{IN(0)}$
↑ = Clock transition from $V_{IN(0)}$ to $V_{IN(1)}$
P0 thru P7 = Data present (and loaded into) parallel inputs
Q0 thru Q6 = Internal flip-flop outputs

Absolute Maximum Ratings (Note 1)		Operating V_{CC} Range	3V to 15V
Voltage at Any Pin	-0.3V to $V_{CC} + 0.3V$	Lead Temperature (Soldering, 10 seconds)	260°C
Operating Temperature Range	-40°C to +85°C		
Storage Temperature Range	-65°C to +150°C		
Absolute Maximum V_{CC}	18V		
Power Dissipation			
Dual-In-Line	700 mW		
Small Outline	500 mW		

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The Electrical Characteristics table provides conditions for actual device operation.

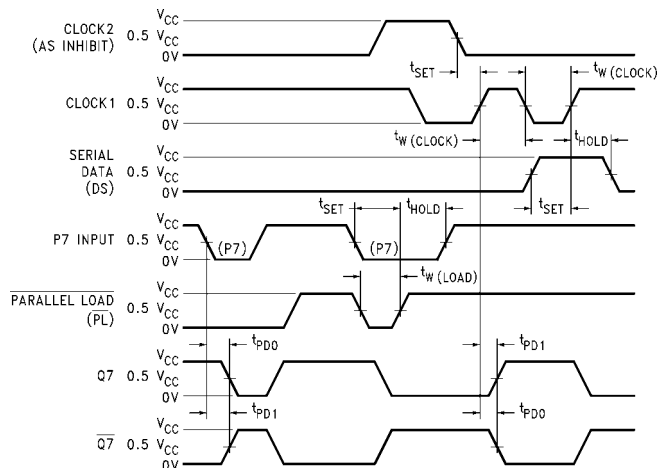
DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

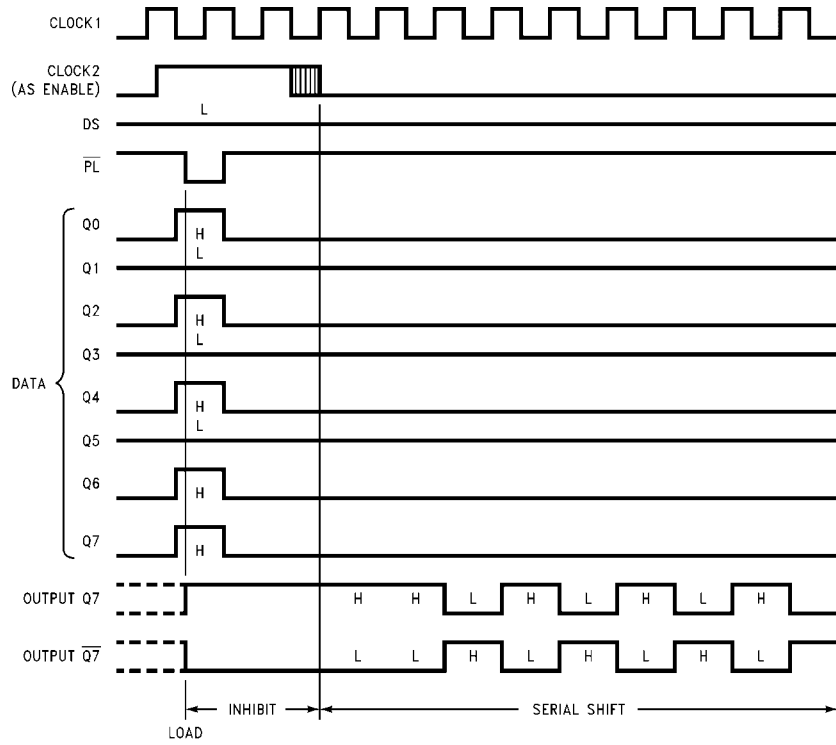
Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V, I_O = -10 \mu A$ $V_{CC} = 10V, I_O = -10 \mu A$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V, I_O = +10 \mu A$ $V_{CC} = 10V, I_O = +10 \mu A$			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		μA
I_{CC}	Supply Current	$V_{CC} = 15V$		0.05	300	μA
CMOS TO LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 4.75V$		$V_{CC} - 1.5$		V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 4.75V$			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 4.75V, I_O = -360 \mu A$	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 4.75V, I_O = 360 \mu A$			0.4	V
OUTPUT DRIVE (See Family Characteristics Data Sheet) (short circuit current)						
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 5V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-1.75	-3.3		mA
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 10V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-8.0	-15		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 5V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	1.75	3.6		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 10V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	8.0	16		mA

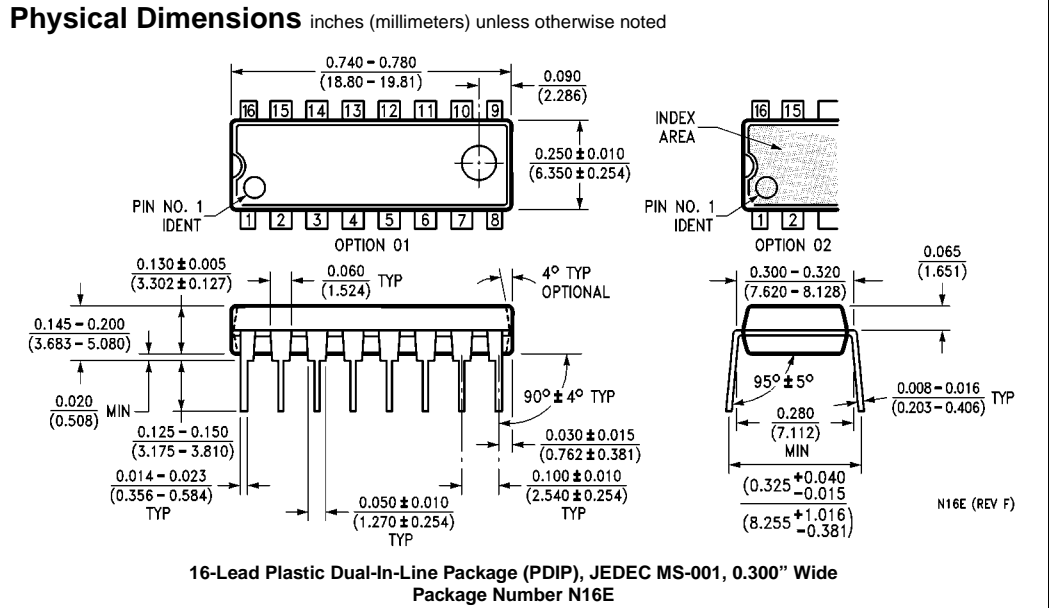
AC Electrical Characteristics (Note 2) $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd0} , t_{pd1}	Propagation Delay Time to a Logical "0" or Logical "1" from Clock or Load to Q or \bar{Q}	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		200 80	400 200	ns
t_{pd0} , t_{pd1}	Propagation Delay Time to a Logical "0" or Logical "1" from H to Q or \bar{Q}	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		200 80	400 200	ns
t_S	Clock Inhibit Set-up Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	150 60	75 30		ns
t_S	Serial Input Set-up Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	50 30	25 15		ns
t_H	Serial Input Hold Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	50 30	0 0		ns
t_S	Parallel Input Set-Up Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	150 60	75 30		ns
t_H	Parallel Input Hold Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	50 30	0 0		ns
t_W	Minimum Clock Pulse Width	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		70 30	200 100	ns
t_W	Minimum Load Pulse Width	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		85 30	180 90	ns
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	2.5 5	6 12		MHz
t_r , t_f	Maximum Clock Rise and Fall Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	10 5			μs μs
C_{IN}	Input Capacitance	(Note 3)		5		pF
C_{PD}	Power Dissipation Capacitance	(Note 4)		65		pF

Note 2: AC Parameters are guaranteed by DC correlated testing.**Note 3:** Capacitance is guaranteed by periodic testing.**Note 4:** C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics application note AN-90.**Switching Time Waveform****Note A:** The remaining six data and the serial input are LOW.**Note B:** Prior to test, HIGH level data is loaded into the P7 input.

Logic Waveform





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