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FAIRCHILD SEMICONDUCTOR™

January 1986
Revised February 2000

DM74ALS165
8-Bit Parallel In/Serial Out Shift Register

General Description

The DM74ALS165 is an 8-bit serial register that, when clocked, shifts the data toward serial output, $\overline{Q}_H$. Parallel-in access to each stage is provided by eight individual direct data inputs that are enabled by a low level at the SH/$\overline{LD}$ input. The DM74ALS165 also features a clock inhibit function and a complemented serial output, $\overline{Q}_H$.

Clocking is accomplished by a LOW-to-HIGH transition of the CLK input while SH/$\overline{LD}$ is held HIGH and CLK INH is held LOW. The functions of the CLK and CLK INH (clock inhibit) inputs are interchangeable. Since a LOW CLK input and a LOW-to-HIGH transition of CLK INH will also accomplish clocking, CLK INH should be changed to the high level only while the CLK input is HIGH. Parallel loading is inhibited when SH/$\overline{LD}$ is held HIGH. The parallel inputs to the register are enabled while SH/$\overline{LD}$ is LOW independently of the levels of CLK, CLK INH, or SER inputs.

Features

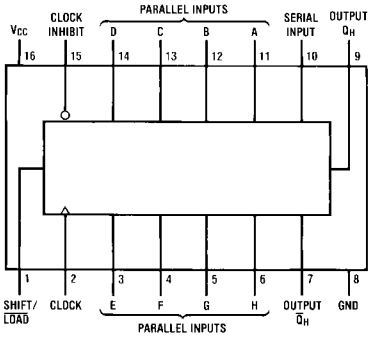
- Complementary outputs
- Direct overriding load (data) inputs
- Gated clock inputs
- Parallel-to-serial data conversion

Ordering Code:

Order Number	Package Number	Package Description
DM74ALS165M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
DM74ALS165N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram

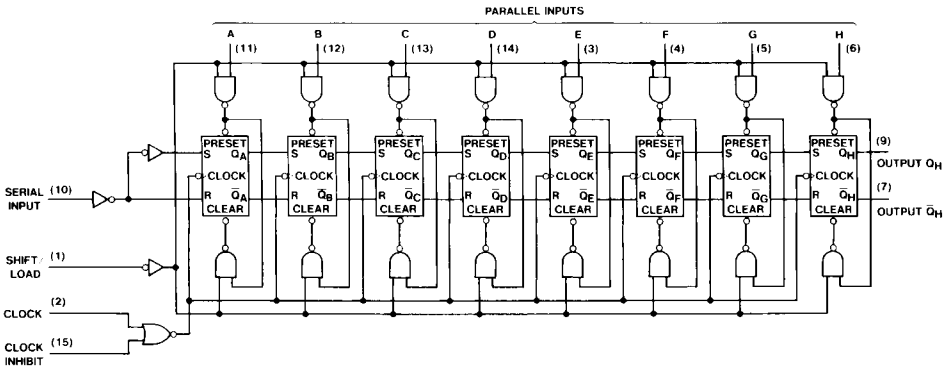


Function Table

Inputs					Internal Outputs		Output
Shift/ Load	Clock Inhibit	Clock	Serial	Parallel A...H	Q_A	Q_B	Q_H
L	X	X	X	a...h	a	b	h
H	L	L	X	X	Q_{A0}	Q_{B0}	Q_{H0}
H	L	↑	H	X	H	Q_{An}	Q_{Gn}
H	L	↑	L	X	L	Q_{An}	Q_{Gn}
H	↑	L	H	X	H	Q_{An}	Q_{Gn}
H	↑	L	L	X	L	Q_{An}	Q_{Gn}
H	H	X	X	X	Q_{A0}	Q_{B0}	Q_{H0}

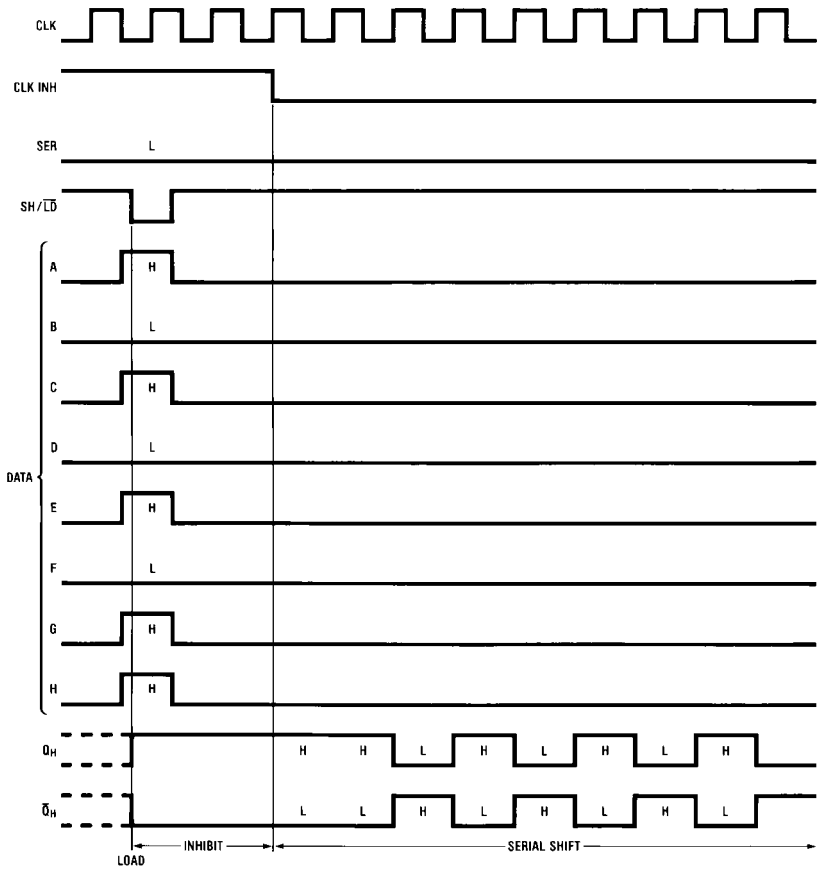
H = HIGH Level (steady-state),
L = LOW Level (steady-state)
X = Don't Care (any input, including transitions)
↑ = Transition from LOW-to-HIGH level
a...h = The level of steady-state input at inputs A through H, respectively
Q_{A0}, Q_{B0}, Q_{H0} = The level of Q_A, Q_B, or Q_H, respectively, before the indicated steady-state input conditions were established
Q_{An}, Q_{Gn} = The level of Q_A or Q_G, respectively, before the most recent ↑ transition of the clock

Logic Diagram



Timing Diagram

Typical Shift, Load, and Inhibit Sequences



Absolute Maximum Ratings(Note 1)

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Typical θ_{JA}	
N Package	74.0°C/W
M Package	104.0°C/W

Note 1: The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Recommended Operating Conditions

Symbol	Parameter		Min	Typ	Max	Units
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				−0.4	mA
I_{OL}	LOW Level Output Current				8	mA
f_{CLOCK}	Clock Frequency		45			MHz
t_W	Pulse Duration	CLK HIGH	11			ns
		CLK LOW	11			
		Load	12			
t_{SU}	Setup Time	SH/$\overline{LD}$	10			ns
		Data	10			
t_{SU}	Setup Time	CLK INH ↓ before CLK	11			ns
		Serial before CLK	10			
t_H	Hold Time		4			ns
T_A	Operating Free Air Temperature		0		70	°C

Electrical Characteristics

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

Symbol	Parameter	Conditions		Min	Typ (Note 2)	Max	Units
V_{IK}	Input Clamp Voltage	V_{CC} = 4.5V, I_I = −18 mA				−1.5	V
V_{OH}	HIGH Level Output Voltage	I_{OH} = −0.4 mA, V_{CC} = 4.5V to 5.5V		V_{CC} − 2			V
V_{OL}	LOW Level Output Voltage	V_{CC} = 4.5V	I_{OL} = 4 mA		0.25	0.4	V
			I_{OL} = 8 mA		0.35	0.5	
I_I	Input Current at Max Input Voltage	V_{CC} = 5.5V, V_I = 7V				0.1	mA
I_{IH}	HIGH Level Input Current	V_{CC} = 5.5V, V_I = 2.7V				20	μA
I_{IL}	LOW Level Input Current	V_{CC} = 5.5V, V_I = 0.4V				−0.1	mA
I_O (Note 3)	Output Drive Current	V_{CC} = 5.5V, V_O = 2.25V		−30		−112	mA
I_{CC}	Supply Current	V_{CC} = 5.5V (Note 4)			16	24	mA

Note 2: All typical values are at V_{CC} = 5V, T_A = 25°C.

Note 3: The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

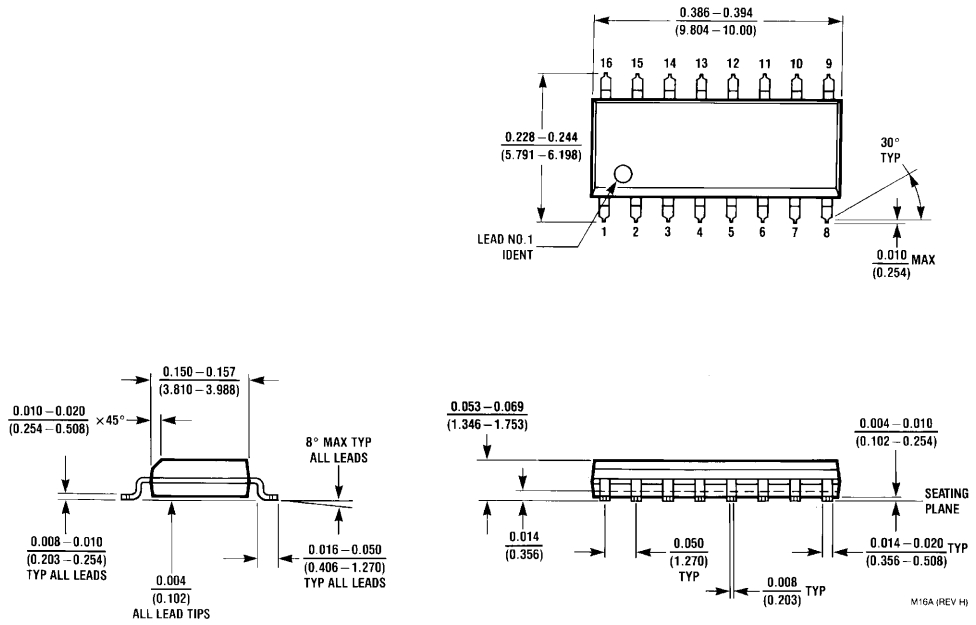
Note 4: With the outputs open, CLK INH and CLK at 4.5V, and a clock pulse applied to the SH/$\overline{LD}$ input, I_{CC} is measured first with the parallel inputs at 4.5V, then with the parallel inputs grounded.

Switching Characteristics

over recommended free air temperature range. All typical values are measured at V_{CC} = 5V, T_A = 25°C.

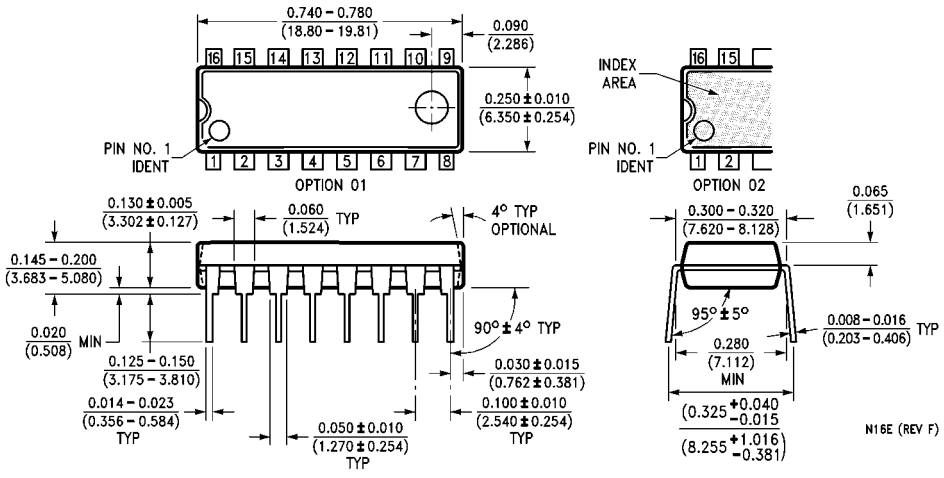
Symbol	Parameter	Input	Output	Conditions	Min	Typ	Max	Units
f_{MAX}	Maximum Frequency			V_{CC} = 4.5V to 5.5V,	45	60		MHz
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	Load	Q_H or $\overline{Q}_H$	C_L = 50 pF, R_L = 500Ω T_A = Min to Max	4	13	20	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	Load	Q_H or $\overline{Q}_H$		4	14	22	
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	CLK	Q_H or $\overline{Q}_H$		3	7	13	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	CLK	Q_H or $\overline{Q}_H$		3	9	14	
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	H	Q_H		3	7	13	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	H	Q_H		3	9	16	
t_{PLH}	Propagation Delay Time LOW-to-HIGH Level Output	H	$\overline{Q}_H$		2	8	15	ns
t_{PHL}	Propagation Delay Time HIGH-to-LOW Level Output	H	$\overline{Q}_H$		3	9	16	

Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
Package Number M16A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



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