

## 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,  $Q_H$ . Parallel-in access to each stage is provided by eight individual direct data inputs that are enabled by a low level at the SH/LD input. The DM74ALS165 also features a clock inhibit function and a complemented serial output,  $\bar{Q}_H$ .

Clocking is accomplished by a LOW-to-HIGH transition of the CLK input while SH/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/LD is held HIGH. The parallel inputs to the register are enabled while SH/LD is LOW independently of the levels of CLK, CLK INH, or SER inputs.

#### Features

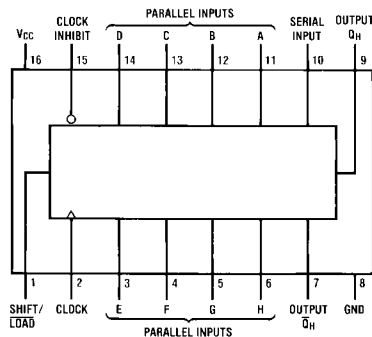
- Complementary outputs
- Direct overriding load (data) inputs
- Gated clock inputs
- Parallel-to-serial data conversion

#### 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

Shift/Load	Clock Inhibit	Inputs			Internal Outputs		Output $Q_H$
		Clock	Serial	Parallel A...H	$Q_A$	$Q_B$	
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

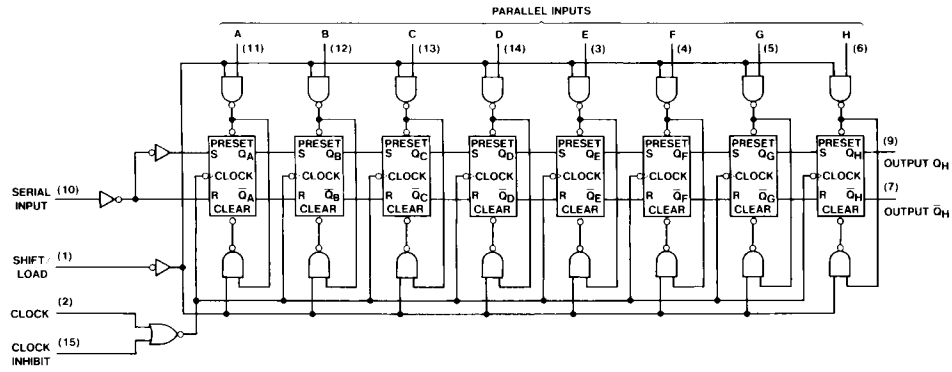
a...h = The level of steady-state input at inputs A through H, respectively

$Q_{A0}$ ,  $Q_{B0}$ ,  $Q_{H0}$  = 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

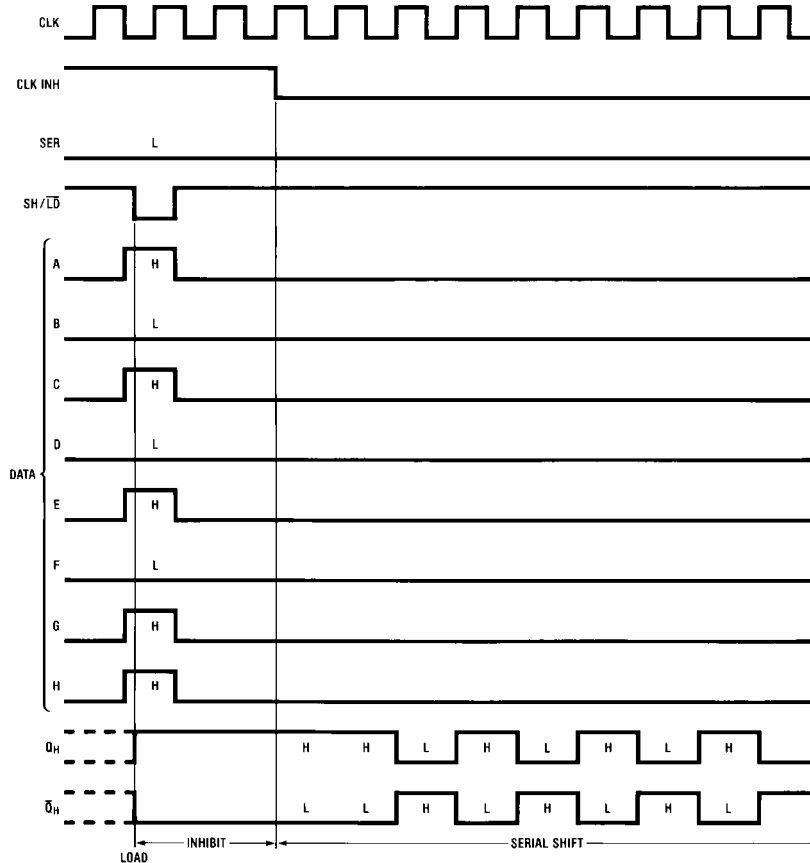
↑ transition of the clock

### 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 $\theta_{JA}$	
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/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	$V_{CC} = 4.5V, I_I = -18\text{ mA}$			-1.5	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -0.4\text{ mA}$ $V_{CC} = 4.5V\text{ to }5.5V$	$V_{CC} - 2$			V
	LOW Level Output Voltage	$V_{CC} = 4.5V$		0.25	0.4	V
$V_{OL}$	Output Voltage	$I_{OL} = 4\text{ mA}$		0.35	0.5	
		$I_{OL} = 8\text{ mA}$				
$I_I$	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  $V_{CC} = 5V, T_A = 25^\circ\text{C}$ .

**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/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  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ .

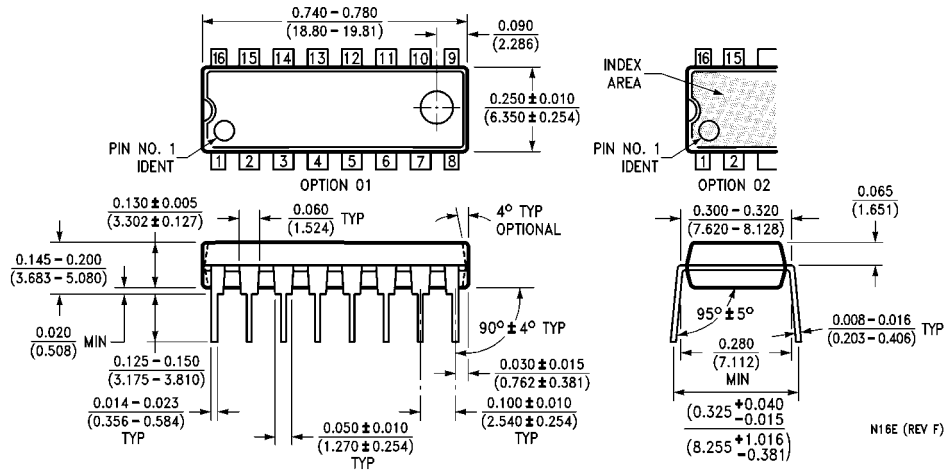
Symbol	Parameter	Input	Output	Conditions	Min	Typ	Max	Units
$f_{MAX}$	Maximum Frequency			$V_{CC} = 4.5V$ to $5.5V$ , $C_L = 50$ pF, $R_L = 500\Omega$ $T_A = \text{Min to Max}$	45	60		MHz
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH Level Output	Load	$Q_H$ or $\bar{Q}_H$		4	13	20	ns
$t_{PHL}$	Propagation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

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