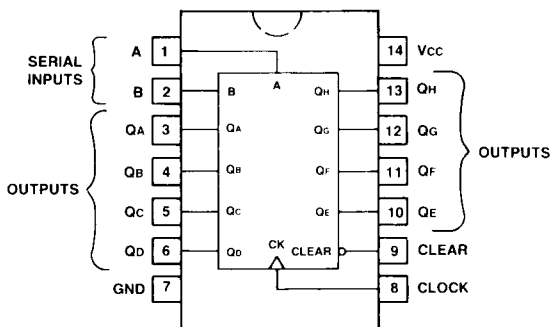


### Serial-In/Parallel-Out Shift Register

The LS164 is a bipolar, NPN, sealed-junction, silicon integrated circuit. It is manufactured in low-power Schottky technology and is available in a wire-bonded, 14-pin plastic DIP or surface mount package. This device features gated serial input with asynchronous master reset.



### Truth Table

Inputs				Outputs		
Clear	Clock	A	B	QA	QB . . . . .QH	
L	X	X	X	L	L L	
H	L	X	X	QA0	QB0 QH0	
H	↑	H	H	H	QA <sub>n</sub> QG <sub>n</sub>	
H	↑	L	X	L	QA <sub>n</sub> QG <sub>n</sub>	
H	↑	X	L	L	QA <sub>n</sub> QG <sub>n</sub>	

H = High level (steady state)

L = Low level (steady state)

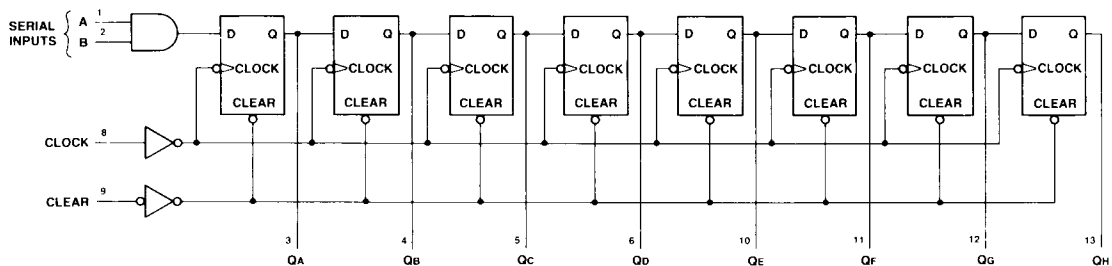
X = Irrelevant (any input, including transitions)

↑ = Transition from low to high level

QA0, QB0, QH0 = The level of QA, QB, or QH, respectively, before the indicated steady-state input conditions were established

QA<sub>n</sub>, QG<sub>n</sub>, = The level of QA, or QG before the most-recent ↑ transition of the clock; indicates a one-bit shift

### Logic Diagram



**Electrical Characteristics**

VCC = 5.0 ±0.5 V, TA = -55 to +125°C (WA-LS)

VCC = 5.0 ±0.25 V, TA = 0 to 70°C (WP90226L1)

VCC = 5.0 ±0.5 V, TA = -40 to +85°C (WA-LSD, WP90401L2)

Parameter	Symbol	WA-LS		WP, WA-LSD		Units
		Min	Max	Min	Max	
Output Voltage, VCC = 4.5 V (WA-LS), 4.75 V (WP, WA-LSD)						
Low, IOL = 4.0 mA	VOL	—	0.4	—	0.4	V
IOL = 8.0 mA	VOL	—	0.5	—	0.5	V
High, IOH = -0.4 mA	VOH	2.5	—	2.7	—	V
Input Voltage, VCC = 4.5 V (WA-LS), 4.75 V (WP, WA-LSD)						
Low	VIL	—	0.7	—	0.8*	V
High	VIH	2.0	7.5	2.0	5.5	V
Clamp, IIN = -18.0 mA	VIK	—	-1.5	—	-1.5	V
Input Current, VCC = 5.5 V (WA-LS), 5.25 V (WP, WA-LSD)						
Low, VIL = 0.4 V	IIL	—	-0.4	—	-0.4	mA
High, VIH = 2.7 V	IiH	—	20.0	—	20.0	µA
@ Vi max, Vi = 7.0 V (WA-LS), 5.5 V (WP, WA-LSD)	Ii	—	0.1	—	0.1	mA
Output Current, VCC = 5.5 V (WA-LS), 5.25 V (WP, WA-LSD)						
Short-Circuit	Ios	-20.0	-100.0	-20.0	-100.0	mA
Supply Current, VCC = 5.5 V (WA-LS), 5.25 V (WP, WA-LSD)	ICC	—	27.0	—	27.0	mA

\* WA-LSD, WP90401L2: VIL = 0.7 V

**Timing Characteristics**

VCC = 5.0 V, TA = 25°C, CL = 15 pF

Parameter	Symbol	WA-LS		WP, WA-LSD		Units
		Min	Max	Min	Max	
Propagation Delay						
Clear-to-Any Q						
High-to-Low	tPHL	—	36.0	—	36.0	ns
Clock-to-Any Q						
Low-to-High	tPLH	—	27.0	—	27.0	ns
High-to-Low	tPHL	—	32.0	—	32.0	ns
Operating Conditions						
CP, MR Pulse Width	tw	20.0	—	20.0	—	ns
Data Setup Time, Low	tDSL	10.0	—	15.0	—	ns
High	tDSH	10.0	—	15.0	—	ns
Data Hold Time, Low	tDHL	10.0	—	5.0	—	ns
High	tDHH	10.0	—	5.0	—	ns
Maximum Clock Frequency	fmax	30.0	—	25.0	—	MHz

**Maximum Ratings**

Power supply voltage (VCC).....	7.0 V
Operating temperature (TA).....	WA-LS: -55 to +125°C WP90226L1: 0 to 70°C WA-LSD, WP90401L2: -40 to +85°C
Storage temperature (Tstg).....	-65 to +150°C

Maximum ratings are defined as the limiting conditions that the user can apply to the device under all variations of circuit and environmental conditions. If any rating is exceeded, permanent damage to the device may result.

Bonding or soldering of the external leads of this device can be performed safely at temperatures up to 300°C.

**Timing Diagrams**

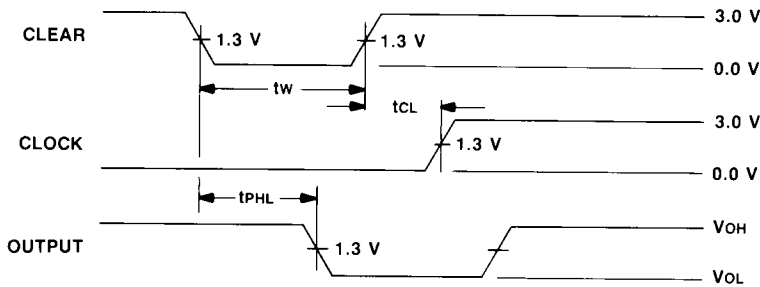
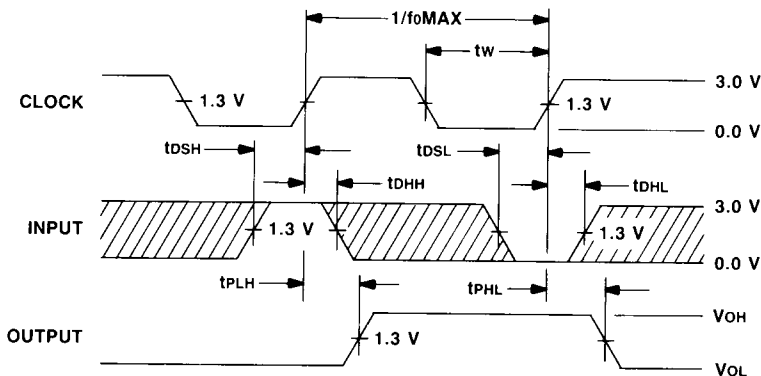


Figure 1.  $\overline{\text{Clear}}$  Pulse Width,  $\overline{\text{Clear}}$  to Output Delay, and  $\overline{\text{Clear}}$  to Clock Clearing



THE SHADED AREAS INDICATE WHEN THE INPUT IS PERMITTED TO CHANGE FOR PREDICTABLE OUTPUT PERFORMANCE

Figure 2. Data Set-Up and Hold Times