

## 74ACT164 Serial-In, Parallel-Out Shift Register

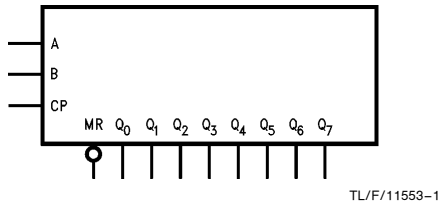
### General Description

The 74ACT164 is a high-speed 8-bit serial-in/parallel-out shift register. Serial data is entered through a 2-input AND gate synchronous with the Low-to-High transition of the clock. The device features an asynchronous Master Reset which clears the register, setting all outputs Low independent of the clock.

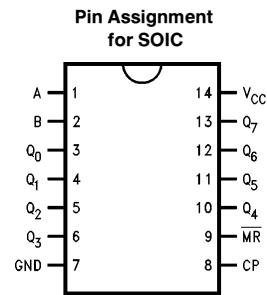
### Features

- Outputs source/sink 24 mA
- 'ACT has TTL-compatible inputs

### Logic Symbol



### Connection Diagram



Pin Names	Description
A, B	Data Inputs
CP	Clock Pulse Input (Active Rising Edge)
$\overline{\text{MR}}$	Master Reset Input (Active Low)
$Q_0$ - $Q_7$	Outputs

TL/F/11553-2

## Functional Description

The 74ACT164 is an edge-triggered 8-bit shift register with serial data entry and an output from each of the eight stages. Data is entered serially through one of two inputs (A or B); either of these inputs can be used as an active High Enable for data entry through the other input. An unused input must be tied High.

Each Low-to-High transition on the Clock (CP) input shifts data one place to the right and enters into  $Q_0$  the logical AND of the two data inputs ( $A \cdot B$ ) that existed before the rising clock edge. A Low level on the Master Reset ( $\overline{MR}$ ) input overrides all other inputs and clears the register asynchronously, forcing all Q outputs Low.

## Function Table

Operating Mode	Inputs			Outputs	
	$\overline{MR}$	A	B	$Q_0$	$Q_1-Q_7$
Reset (Clear)	L	X	X	L	L-L
Shift	H	L	L	L	$Q_0-Q_6$
	H	L	H	L	$Q_0-Q_6$
	H	H	L	L	$Q_0-Q_6$
	H	H	H	H	$Q_0-Q_6$

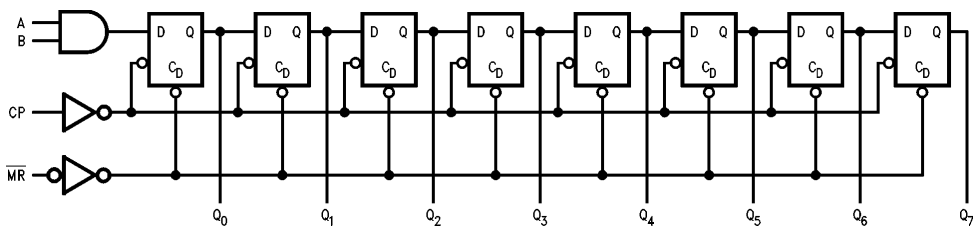
H = High Voltage Levels

L = Low Voltage Levels

X = Immaterial

Q = Lower case letters indicate the state of the referenced input or output one setup time prior to the Low-to-High clock transition.

## Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## Absolute Maximum Ratings (Note 1)

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

Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current ( $I_O$ )	±50 mA
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )	±50 mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Junction Temperature ( $T_J$ )	
SOIC	140°C

**Note 1:** Absolute maximum ratings are values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

## Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )	4.5V to 5.5V
'ACT	
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	
74ACT	-40°C to +85°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
'ACT Devices	
$V_{IN}$ from 0.8V to 2.0V	
$V_{CC}$ @ 4.5V, 5.5V	125 mV/ns

## DC Characteristics for 'ACT Family Devices

Symbol	Parameter	$V_{CC}$ (V)	74ACT		74ACT		Units	Conditions
			$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			
			Typ	Guaranteed Limits				
$V_{IH}$	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		5.5	1.5	2.0	2.0			
$V_{IL}$	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		5.5	1.5	0.8	0.8			
$V_{OH}$	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	V	$I_{OUT} = -50 \mu\text{A}$	
		5.5	5.49	5.4	5.4			
		4.5		3.86	3.76	V	* $V_{IN} = V_{IL}$ or $V_{IH}$ -24 mA $I_{OH}$ -24 mA	
		5.5		4.86	4.76			
$V_{OL}$	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	V	$I_{OUT} = 50 \mu\text{A}$	
		5.5	0.001	0.1	0.1			
		4.5		0.36	0.44	V	* $V_{IN} = V_{IL}$ or $V_{IH}$ 24 mA $I_{OL}$ 24 mA	
		5.5		0.36	0.44			
$I_{IN}$	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	$V_I = V_{CC}, \text{GND}$	
$I_{CCT}$	Maximum $I_{CC}$ /Input	5.5	0.6		1.5	mA	$V_I = V_{CC} - 2.1V$	
$I_{OLD}$	†Minimum Dynamic Output Current	5.5			75	mA	$V_{OLD} = 1.65V \text{ Max}$	
$I_{OHD}$		5.5			-75	mA	$V_{OHD} = 3.85V \text{ Min}$	
$I_{CC}$	Maximum Quiescent Supply Current	5.5		4.0	40.0	μA	$V_{IN} = V_{CC}$ or GND	

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT			74ACT		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Min	Typ	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency	5.0	100			80		MHz
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>n</sub>	5.0	1.0	6.0	11.5	1.0	12.5	ns
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub>	5.0	1.0	6.0	11.5	1.0	12.5	ns
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>n</sub>	5.0	1.0	6.0	13.0	1.0	14.5	ns

\*Voltage Range 5.0 is 5.0V ±0.5V

## AC Operating Requirements

Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT		74ACT		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Typ	Guaranteed Minimum			
t <sub>S</sub>	Set-Up Time, HIGH or LOW A or B to CP	5.0	0.5	7.0	8.0		ns
t <sub>H</sub>	Hold Time, HIGH or LOW CP to A or B	5.0	0.0	1.5	1.5		ns
t <sub>W</sub>	Pulse Width, HIGH or LOW CP to MR	5.0	0.5	7.0	8.0		ns
t <sub>REC</sub>	Recovery Time MR to CP	5.0	0.5	2.0	2.0		ns

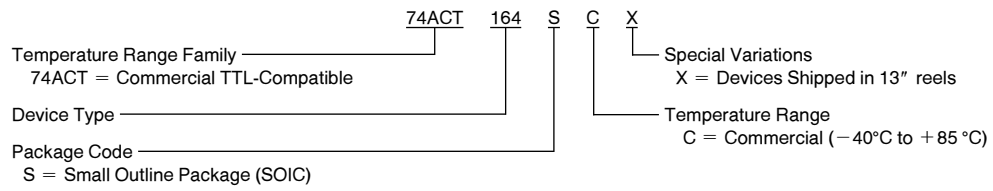
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## Capacitance

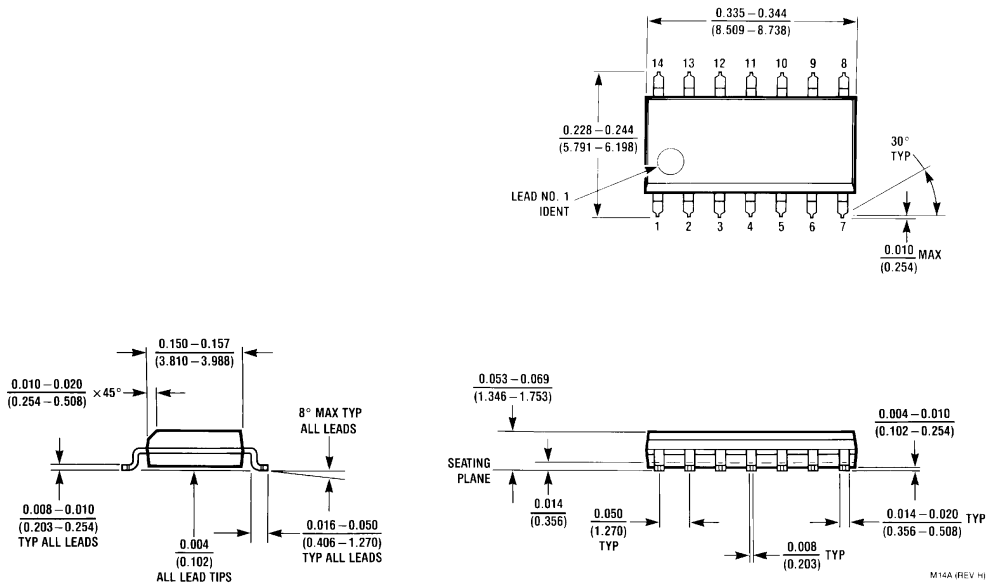
Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance	45.0	pF	V <sub>CC</sub> = 5.0V

## Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



**Physical Dimensions** inches (millimeters)



**14-Lead Small Outline Integrated Circuit (S)  
NS Package Number M14A**

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