

PART NUMBER

54L164DM-ROCV

Rochester Electronics

Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All re-creations are done with the approval of the Original Component Manufacturer. (OCM)

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceeds the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-38535
 - Class Q Military
 - Class V Space Level

Qualified Suppliers List of Distributors (QSLD)

- Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OCM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

54L164

8-Bit Parallel-Out Serial Shift Registers

These 8-bit shift registers feature gated serial inputs and an asynchronous clear. The gated serial inputs (A and B) permit complete control over incoming data as a low at either input inhibits entry of the new data and resets the first flip-flop to the low level at the next clock pulse. A high-level input enables the other input which will then determine the state of the first flip-flop. Data at the serial inputs may be changed while the clock is high or low, but only information meeting the setup-time requirements will be entered. Clocking occurs on the low-to-high-level transition of the clock input. All inputs are diode-clamped to minimize transmission-line effects.

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FOR REFERENCE ONLY

TYPES SN54164, SN54L164, SN54LS164, SN74164, SN74LS164 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

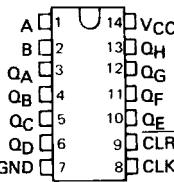
MARCH 1974—REVISED DECEMBER 1983

- **Gated Serial Inputs**
- **Fully Buffered Clock and Serial Inputs**
- **Asynchronous Clear**

| TYPE | TYPICAL | | TYPICAL POWER DISSIPATION |
|--------|---------|-----------------|------------------------------|
| | MAXIMUM | CLOCK FREQUENCY | |
| '164 | 36 | MHz | 21 mW per bit |
| 'L164 | 18 | MHz | 11 mW per bit |
| 'LS164 | 36 | MHz | 10 mW per bit |

SN54164, SN54LS164 . . . J OR W PACKAGE
SN54L164 . . . J PACKAGE
SN74164 . . . J OR N PACKAGE
SN74LS164 . . . D, J OR N PACKAGE

(TOP VIEW)



description

These 8-bit shift registers feature gated serial inputs and an asynchronous clear. The gated serial inputs (A and B) permit complete control over incoming data as a low at either input inhibits entry of the new data and resets the first flip-flop to the low level at the next clock pulse. A high-level input enables the other input which will then determine the state of the first flip-flop. Data at the serial inputs may be changed while the clock is high or low, but only information meeting the setup-time requirements will be entered. Clocking occurs on the low-to-high-level transition of the clock input. All inputs are diode-clamped to minimize transmission-line effects.

The SN54164, SN54L164 and SN54LS164 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74164 and SN74LS164 are characterized for operation from 0°C to 70°C .

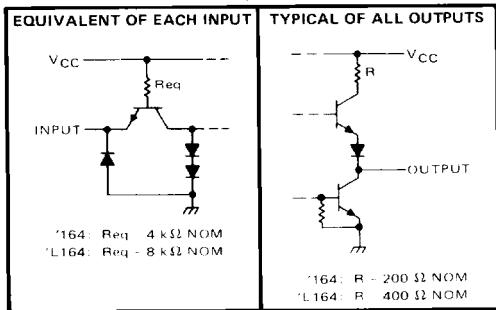
FUNCTION TABLE

| 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 _n | QG _n | |
| H | ↑ | L X | L | QA _n | QG _n | |
| H | ↑ | X L | L | QA _n | QG _n | |

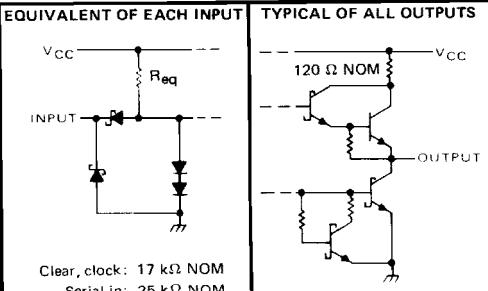
H = high level (steady state), L = low level (steady state)
X = irrelevant (any input, including transitions)
↑ = transition from low to high level.
QA₀, QB₀, QH₀ = the level of QA, QB, or QH, respectively, before the indicated steady-state input conditions were established.
QA_n, QG_n = the level of QA or QG before the most-recent ↑ transition of the clock; indicates a one-bit shift.

schematics of inputs and outputs

'164, 'L164



'LS164



PRODUCTION DATA
This document contains information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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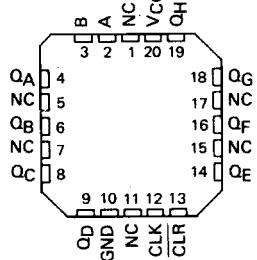
TEXAS
INSTRUMENTS

3-621

(TOP VIEW)

SN54LS164 . . . FK PACKAGE
SN74LS164 . . . FN PACKAGE

(TOP VIEW)



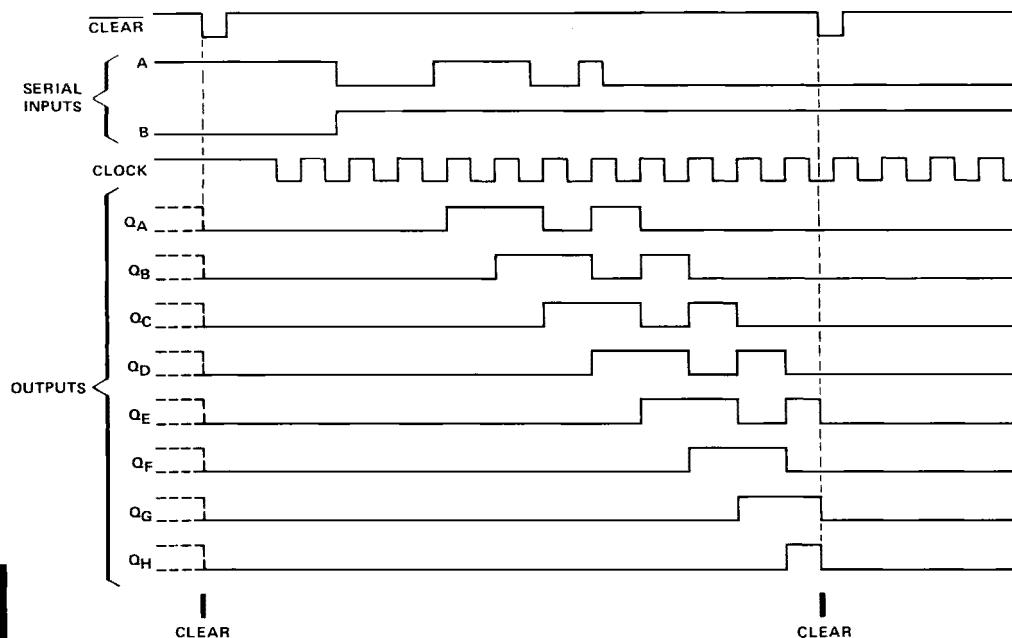
NC = No internal connection

3

TTL DEVICES

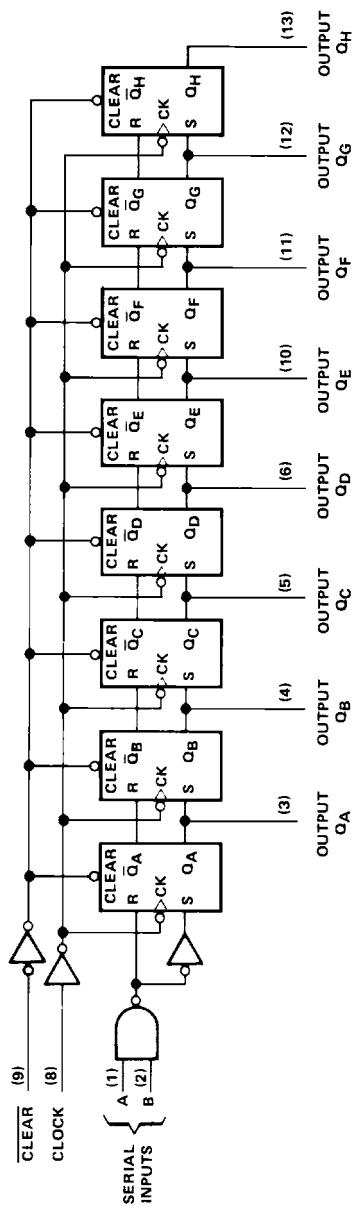
**TYPES SN54164, SN54L164, SN54LS164, SN74164, SN74LS164
8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS**

typical clear, shift, and clear sequences



TYPES SN54164, SN54L164, SN54LS164, SN74164, SN74LS164
8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

logic diagram



Pin numbers shown on logic notation are for D, J or N packages.

TTL DEVICES **3**

TYPES SN54164, SN74164 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

| | |
|---|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 5.5 V |
| Operating free-air temperature range: SN54164 | -55°C to 125°C |
| SN74164 | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | SN54164 | | | SN74164 | | | UNIT |
|--|---------|-----|------|---------|-----|------|---------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output current, I_{OH} | | | -400 | | | -400 | μ A |
| Low-level output current, I_{OL} | | | 8 | | | 8 | mA |
| Clock frequency, f_{clock} | 0 | | 25 | 0 | | 25 | MHz |
| Width of clock or clear input pulse, t_w | 20 | | | 20 | | | ns |
| Data setup time, t_{SU} (see Figure 1) | 15 | | | 15 | | | ns |
| Data hold time, t_h (see Figure 1) | 5 | | | 5 | | | ns |
| Operating free-air temperature, T_A | -55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | TEST CONDITIONS [†] | SN54164 | | | SN74164 | | | UNIT |
|--|--|---------|------------------|-------|---------|------------------|-------|---------------|
| | | MIN | TYP [‡] | MAX | MIN | TYP [‡] | MAX | |
| V_{IH} High-level input voltage | | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | | 0.8 | | | 0.8 | | V |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$ | | -1.5 | | | -1.5 | | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -400 \mu\text{A}$ | 2.4 | 3.2 | | 2.4 | 3.2 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 8 \text{ mA}$ | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$, | | 1 | | | 1 | | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$ | | 40 | | | 40 | | μA |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | -1.6 | | | -1.6 | | mA |
| I_{OS} Short-circuit output current [§] | $V_{CC} = \text{MAX}$ | -10 | | -27.5 | -9 | | -27.5 | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}$, $V_I(\text{clock}) = 0.4 \text{ V}$ See Note 2 | | 30 | | | 30 | | mA |
| | $V_I(\text{clock}) = 2.4 \text{ V}$ | | 37 | 54 | | 37 | 54 | |

[†] For conditions shown at MIN or MAX, use the appropriate value specified under recommended operating conditions.

[‡] All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

[§] Not more than two outputs should be shorted at a time.

NOTE 2: I_{CC} is measured with outputs open, serial inputs grounded, and a momentary ground, then 4.5 V, applied to clear.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | MIN TYP MAX | | | UNIT |
|---|--------------------------------------|------------------------|----|----|------|
| | | C _L = 15 pF | 25 | 36 | |
| t_{PHL} Propagation delay time, high-to-low-level Q outputs from clear input | $R_L = 800 \Omega$, See Figure 1 | C _L = 15 pF | 24 | 36 | MHz |
| t_{PLH} Propagation delay time, low-to-high-level Q outputs from clock input | | C _L = 50 pF | 28 | 42 | ns |
| t_{PHL} Propagation delay time, high-to-low-level Q outputs from the clock input | | C _L = 15 pF | 8 | 17 | ns |
| | | C _L = 50 pF | 10 | 20 | ns |
| | | C _L = 15 pF | 10 | 21 | ns |
| | | C _L = 50 pF | 10 | 25 | ns |

TYPE SN54L164
8-BIT PARALLEL-OUT SERIAL SHIFT REGISTER

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 5.5 V |
| Operating free-air temperature range: SN54L164 | -55°C to 125°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | | MIN | NOM | MAX | UNIT |
|-------------|-------------------------------------|-----|------|-----|------|
| 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 | | -0.2 | | mA |
| I_{OL} | Low-level output current | | 4 | | mA |
| f_{clock} | Clock frequency | 0 | 12 | | MHz |
| t_w | Width of clock or clear input pulse | 40 | | | ns |
| t_{su} | Data setup time (See Figure 1) | 30 | | | ns |
| t_{th} | Data hold time (See Figure 1) | 10 | | | ns |
| T_A | Operating free-air temperature | -55 | | 125 | °C |

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

| PARAMETER | TEST CONDITIONS [†] | MIN | TYP [‡] | MAX | UNIT |
|------------|--|-----|------------------|------|------|
| | | | | | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$ | | | -1.5 | V |
| V_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -0.2 \text{ mA}$ | 2.4 | 3.2 | | V |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 4 \text{ mA}$ | | 0.2 | 0.4 | V |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$ | | | 1 | mA |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$ | | | 20 | μA |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | | -0.8 | mA |
| $I_{OS\$}$ | $V_{CC} = \text{MAX}$ | -5 | | -20 | mA |
| I_{CC} | $V_{CC} = \text{MAX}$, See Note 3 | | 19 | 27 | mA |

[†] For conditions shown at MIN or MAX, use the appropriate value specified under recommended operating conditions.

[‡] All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

§ Not more than two outputs should be shorted at a time.

NOTE 3: I_{CC} is measured with outputs open, serial inputs grounded, the clock input at 2.4 V, and a momentary ground, then 4.5 V, applied to clear.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------|--|-----------------------|-----|-----|------|
| | | | | | |
| f_{max} | Maximum clock frequency | | | | |
| t_{PHL} | Propagation delay time, high-to-low-level Q outputs from clear input | $C_L = 15 \text{ pF}$ | 12 | 18 | MHz |
| | | $C_L = 15 \text{ pF}$ | 48 | 72 | ns |
| | | $C_L = 50 \text{ pF}$ | 56 | 84 | |
| | Propagation delay time, low-to-high-level Q outputs from clock input | $C_L = 15 \text{ pF}$ | 8 | 34 | 54 |
| | | $C_L = 50 \text{ pF}$ | 10 | 20 | 60 |
| | Propagation delay time, high-to-low-level Q outputs from the clock input | $C_L = 15 \text{ pF}$ | 10 | 42 | 64 |
| | | $C_L = 50 \text{ pF}$ | 10 | 50 | 74 |

3

TTL DEVICES

TYPES SN54LS164, SN74LS164 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

| | |
|---|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 7 V |
| Operating free-air temperature range: SN54LS164 | -55°C to 125°C |
| SN74LS164 | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | | SN54LS164 | | | SN74LS164 | | | UNIT |
|-------------|--|-----------|-----|------|-----------|-----|------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V_{CC} | Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V_{IH} | High-level input voltage | 2 | | | 2 | | | V |
| V_{IL} | Low-level input voltage | | | 0.7 | | | 0.8 | V |
| I_{OH} | High-level output current | | | -0.4 | | | -0.4 | mA |
| I_{OL} | Low-level output current | | | 4 | | | 8 | mA |
| f_{clock} | Clock frequency | 0 | 25 | | 0 | 25 | | MHz |
| t_w | Width of clock or clear input pulse | 20 | | | 20 | | | ns |
| t_{su} | Data setup time (See Figure 1) | 15 | | | 15 | | | ns |
| t_{su} | Clear inactive setup time (See Figure 1) | 15 | | | 15 | | | ns |
| t_h | Data hold time (See Figure 1) | 5 | | | 5 | | | ns |
| T_A | Operating free-air temperature | -55 | 125 | | 0 | 70 | | °C |

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

| PARAMETER | TEST CONDITIONS† | SN54LS164 | | | SN74LS164 | | | UNIT |
|-----------|---|-----------|-------------------------|------|-----------|------|------|---------------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$ | | | -1.5 | | | -1.5 | V |
| V_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$ $I_{OH} = -0.4 \mu\text{A}$ | 2.5 | 3.5 | | 2.7 | 3.5 | | V |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$ | 0.25 | | | 0.25 | 0.4 | | V |
| | | | $I_{OL} = 4 \text{ mA}$ | | 0.35 | 0.5 | | |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$ | | | 0.1 | | | 0.1 | mA |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$ | | | 20 | | | 20 | μA |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | | -0.4 | | | -0.4 | mA |
| I_{OS} | $V_{CC} = \text{MAX}$ | -20 | -100 | | -20 | -100 | | mA |
| I_{CC} | $V_{CC} = \text{MAX}$, See Note 3 | 16 | 27 | | 16 | 27 | | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

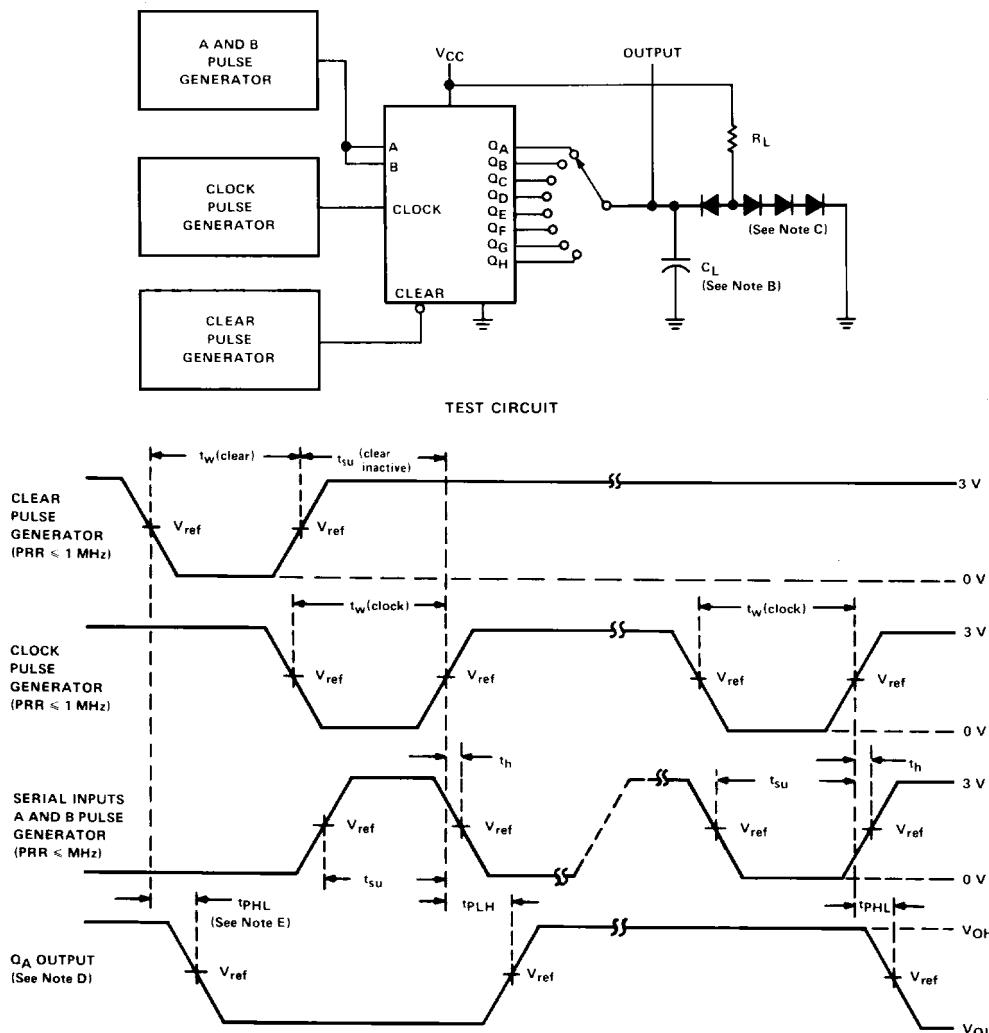
NOTE 3: I_{CC} is measured with outputs open, serial inputs grounded, the clock input at 2.4 V, and a momentary ground, then 4.5 V applied to clear.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|---|-----|-----|-----|------|
| f_{max} Maximum clock frequency | | 25 | 36 | | MHz |
| t_{PHL} Propagation delay time, high-to-low-level Q outputs from clear input | $R_L = 2 \text{ k}\Omega$, $C_L = 15 \text{ pF}$, See Figure 1 | | 24 | 36 | ns |
| t_{PLH} Propagation delay time, low-to-high-level Q outputs from clock input | | | 17 | 27 | ns |
| t_{PHL} Propagation delay time, high-to-low-level Q outputs from clock input | | | 21 | 32 | ns |

**TYPES SN54164, SN54L164, SN54LS164, SN74164, SN74L164, SN74LS164
8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS**

PARAMETER MEASUREMENT INFORMATION



NOTES: A. The pulse generators have the following characteristics: duty cycle $\leq 50\%$, $Z_{out} \approx 50 \Omega$, for '164 and 'L164, $t_f \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$, and for 'LS164, $t_f \leq 15 \text{ ns}$, $t_f \leq 6 \text{ ns}$.
 B. C_L includes probe and jig capacitance.
 C. All diodes are 1N3064 or equivalent.
 D. Q_A output is illustrated. Relationship of serial input A and B data to other Q outputs is illustrated in the typical shift sequence.
 E. Outputs are set to the high level prior to the measurement of t_{PHL} from the clear input.
 F. For '164 and 'L164, $V_{ref} = 1.5 \text{ V}$; for 'LS164, $V_{ref} = 1.3 \text{ V}$.

FIGURE 1—SWITCHING TIMES

