# SN54196, SN54197, SN54LS196, SN54LS197, SN54S196, SN54S197, SN74196, SN74197, SN74LS196, SN74LS197, SN74S196, SN74S197

SDLS077

## 50/30/100-MHz PRESETTABLE DECADE OR BINARY COUNTERS/LATCHES

OCTOBER 1976—REVISED MARCH 1988

- Performs BCD, Bi-Quinary, or Binary Counting
- Fully Programmable
- Fully Independent Clear Input
- Input Clamping Diodes Simplify System Design
- Output $Q_A$ Maintains Full Fan-out Capability In Addition to Driving Clock-2 Input

| TYPES | GUARANTEED COUNT FREQUENCY | | TYPICAL POWER DISSIPATION |
|---|---|---|---|
| | CLOCK 1 | CLOCK 2 | |
| '196, '197 | 0-50 MHz | 0-25 MHz | 240 mW |
| 'LS196, 'LS197 | 0-30 MHz | 0-15 MHz | 80 mW |
| 'S196, 'S197 | 0-100 MHz | 0-50 MHz | 375 mW |

### description

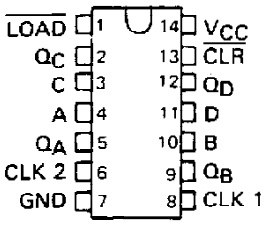
These high-speed monolithic counters consist of four d-c coupled, master-slave flip-flops, which are internally interconnected to provide either a divide-by-two and a divide-by-five counter ('196, 'LS196, 'S196) or a divide-by-two and a divide-by-eight counter ('197, 'LS197, 'S197). These four counters are fully programmable; that is, the outputs may be preset to any state by placing a low on the count/load input and entering the desired data at the data inputs. The outputs will change to agree with the data inputs independent of the state of the clocks.

During the count operation, transfer of information to the outputs occurs on the negative-going edge of the clock pulse. These counters feature a direct clear which when taken low sets all outputs low regardless of the states of the clocks.

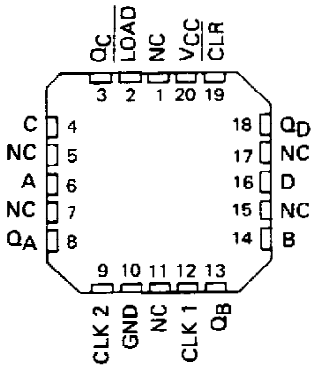
These counters may also be used as 4-bit latches by using the count/load input as the strobe and entering data at the data inputs. The outputs will directly follow the data inputs when the count/load is low, but will remain unchanged when the count/load is high and the clock inputs are inactive.

All inputs are diode-clamped to minimize transmission-line effects and simplify system design. These circuits are compatible with most TTL logic families. Series 54, 54LS, and 54S circuits are characterized for operation over the full military temperature range of −55°C to 125°C; Series 74, 74LS, and 74S circuits are characterized for operation from 0°C to 70°C.

**SN54196, SN54LS196, SN54S196, SN54197, SN54LS197, SN54S197 . . . J OR W PACKAGE**
**SN74196, SN74197 . . . N PACKAGE**
**SN74LS196, SN74S196, SN74LS197, SN74S197 . . . D OR N PACKAGE**
**(TOP VIEW)**



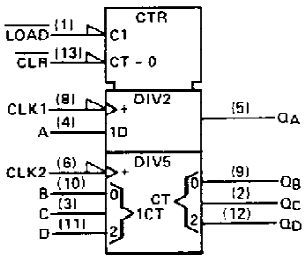

**SN54LS196, SN54S196, SN54LS197, SN54S197 . . . FK PACKAGE**
**(TOP VIEW)**



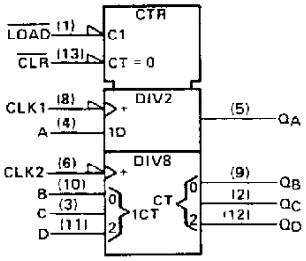

NC - No internal connection

### logic symbols†

**'196, 'LS196, 'S196**




**'197, 'LS197, 'S197**




† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, N, and W packages.

PRODUCTION DATA documents contain 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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### typical count configurations

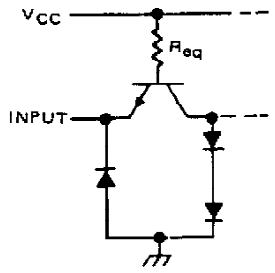
'196, 'LS196, and 'S196 typical count configurations and function tables are the same as those for '176.
'197, 'LS197, and 'S197 typical count configurations and function tables are the same as those for '177.

### logic diagrams

'196, 'LS196, and 'S196 logic diagrams are the same as those for '176.
'197, 'LS197, and 'S197 logic diagrams are the same as those for '177.

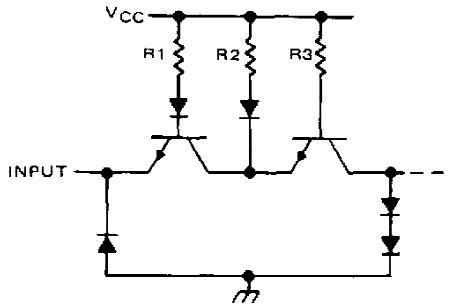
### schematics of inputs and outputs

**EQUIVALENT OF LOAD, CLEAR, AND DATA INPUTS**




Count/load, Data: $R_{eq}$ = 4 kΩ NOM
Clear: $R_{eq}$ = 2 kΩ NOM

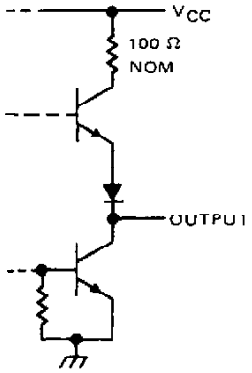
**EQUIVALENT OF CLOCK INPUTS**




NOMINAL VALUES OF R1, R2, and R3

| INPUT | '196 | '197 |
|---|---|---|
| Clock 1 | 4 kΩ | 4 kΩ |
| Clock 2 | 3 kΩ | 6 kΩ |

**TYPICAL OF ALL OUTPUTS**



### 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
Interemitter voltage (see Note 2) . . . . . 5.5 V
Operating free-air temperature range: SN54196, SN54197 Circuits . . . . . −55°C to 125°C
SN74196, SN74197 Circuits . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

NOTES: 1. Voltage values are with respect to network ground terminal.
2. This is the voltage between two emitters of a multiple-emitter transistor. For this circuit, this rating applies between the Clear and Load inputs.

### recommended operating conditions

| | | SN54196, SN54197 | | | SN74196, SN74197 | | | 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, $I_{OH}$ | | | | −800 | | | −800 | μA |
| Low-level output current, $I_{OL}$ | | | | 16 | | | 16 | mA |
| Count frequency | Clock-1 input | 0 | | 50 | 0 | | 50 | MHz |
| | Clock-2 input | 0 | | 25 | 0 | | 25 | |
| Pulse width, $t_w$ | Clock-1 input | 10 | | | 10 | | | ns |
| | Clock-2 input | 20 | | | 20 | | | |
| | Clear | 15 | | | 15 | | | |
| | Load | 20 | | | 20 | | | |
| Input hold time, $t_h$ (see Note 3) | High-level data | $t_{w(load)}$ | | | $t_{w(load)}$ | | | ns |
| | Low-level data | $t_{w(load)}$ | | | $t_{w(load)}$ | | | |
| Input setup time, $t_{su}$ (see Note 3) | High-level data | 10 | | | 10 | | | ns |
| | Low-level data | 15 | | | 15 | | | |
| Count enable time, $t_{en}$ (see Note 4) | | 20 | | | 20 | | | ns |
| Operating free-air temperature, $T_A$ | | −55 | | 125 | 0 | | 70 | °C |

NOTES: 3. Setup and hold times are with respect to the falling edge of the load input.
4. Minimum count enable time is the interval immediately preceding the negative-going edge of the clock pulse during which interval the count/load and clear inputs must both be high to ensure counting.

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

| PARAMETER | | | TEST CONDITIONS† | | SN54196, SN74196 | | | SN54197, SN74197 | | | 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 | | $V_{CC}$ = MIN, $I_I$ = −12 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | High-level output voltage | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OH}$ = −800 μA | | 2.4 | 3.4 | | 2.4 | 3.4 | | V |
| $V_{OL}$ | Low-level output voltage | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OL}$ = 16 mA¶ | | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| $I_I$ | Input current at maximum input voltage | | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | | 1 | | | 1 | mA |
| $I_{IH}$ | High-level input current | Data, Load | $V_{CC}$ = MAX, $V_I$ = 2.4 V | | | | 40 | | | 40 | μA |
| | | Clear, clock 1 | | | | | 80 | | | 80 | |
| | | Clock 2 | | | | | 120 | | | 80 | |
| $I_{IL}$ | Low-level input current | Data, Load | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | | −1.6 | | | −1.6 | mA |
| | | Clear | | | | | −3.2 | | | −3.2 | |
| | | Clock 1 | | | | | −4.8 | | | −4.8 | |
| | | Clock 2 | | | | | −6.4 | | | −3.2 | |
| $I_{OS}$ | Short-circuit output current§ | | $V_{CC}$ = MAX | SN54' | −20 | | −57 | −20 | | −57 | mA |
| | | | | SN74' | −18 | | −57 | −18 | | −57 | |
| $I_{CC}$ | Supply current | | $V_{CC}$ = MAX, See Note 5 | | | 48 | 59 | | 48 | 59 | mA |

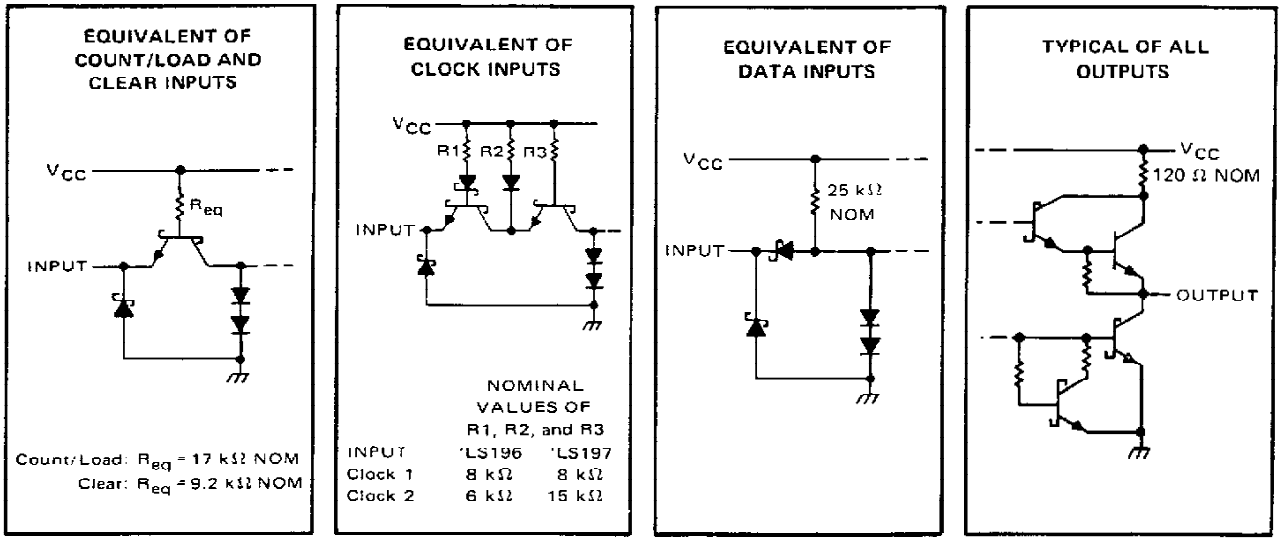
NOTE 5: $I_{CC}$ is measured with all inputs grounded and all outputs open.
†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§Not more than one output should be shorted at a time.
¶$Q_A$ outputs are tested at $I_{OL}$ = 16 mA plus the limit value of $I_{IL}$ for the clock-2 input. This permits driving the clock-2 input while fanning out to 10 Series 54/74 loads.

## switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

| PARAMETER# | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | SN54196 SN74196 | | | SN54197 SN74197 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $f_{max}$ | Clock 1 | $Q_A$ | $C_L$ = 15 pF, $R_L$ = 400 Ω, See Note 6 | 50 | 70 | | 50 | 70 | | MHz |
| $t_{PLH}$ | Clock 1 | $Q_A$ | | | 7 | 12 | | 7 | 12 | ns |
| $t_{PHL}$ | | | | | 10 | 15 | | 10 | 15 | |
| $t_{PLH}$ | Clock 2 | $Q_B$ | | | 12 | 18 | | 12 | 18 | ns |
| $t_{PHL}$ | | | | | 14 | 21 | | 14 | 21 | |
| $t_{PLH}$ | Clock 2 | $Q_C$ | | | 24 | 36 | | 24 | 36 | ns |
| $t_{PHL}$ | | | | | 28 | 42 | | 28 | 42 | |
| $t_{PLH}$ | Clock 2 | $Q_D$ | | | 14 | 21 | | 36 | 54 | ns |
| $t_{PHL}$ | | | | | 12 | 18 | | 42 | 63 | |
| $t_{PLH}$ | A, B, C, D | $Q_A$, $Q_B$, $Q_C$, $Q_D$ | | | 16 | 24 | | 16 | 24 | ns |
| $t_{PHL}$ | | | | | 25 | 38 | | 25 | 38 | |
| $t_{PLH}$ | Load | Any | | | 22 | 33 | | 22 | 33 | ns |
| $t_{PHL}$ | | | | | 24 | 36 | | 24 | 36 | |
| $t_{PHL}$ | Clear | Any | | | 25 | 37 | | 25 | 37 | ns |

#$f_{max}$ = maximum count frequency.
$t_{PLH}$ = propagation delay time, low-to-high-level output.
$t_{PHL}$ = propagation delay time, high-to-low-level output.
NOTE 6: Load circuit, input conditions, and voltage waveforms are the same as those shown for the '176, '177 except that testing $f_{max}$, $V_{IL}$ = 0.3 V.

## schematics of inputs and outputs




## 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: SN54LS196, SN54LS197 Circuits . . . . . −55°C to 125°C
SN74LS196, SN74LS197 Circuits . . . . . 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

| | | | SN54LS196, SN54LS197 | | | SN74LS196, SN74LS197 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | NOM | MAX | MIN | NOM | MAX | |
| $V_{CC}$ | Supply voltage | | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| $I_{OH}$ | High-level output current | | | | −400 | | | −400 | μA |
| $I_{OL}$ | Low-level output current | | | | 4 | | | 8 | mA |
| | Count frequency | Clock-1 input | 0 | | 30 | 0 | | 30 | MHz |
| | | Clock-2 input | 0 | | 15 | 0 | | 15 | |
| $t_w$ | Pulse width | Clock-1 input | 20 | | | 20 | | | ns |
| | | Clock-2 input | 30 | | | 30 | | | |
| | | Clear | 15 | | | 15 | | | |
| | | Load | 20 | | | 20 | | | |
| $t_h$ | Input hold time, (see Note 3) | High-level data | $t_{w(load)}$ | | | $t_{w(load)}$ | | | ns |
| | | Low-level data | $t_{w(load)}$ | | | $t_{w(load)}$ | | | |
| $t_{su}$ | Input setup time, (see Note 3) | High-level data | 10 | | | 10 | | | ns |
| | | Low-level data | 15 | | | 15 | | | |
| $t_{enable}$ | Count enable time, (see Note 4) | Clock 1 | 30 | | | 30 | | | ns |
| | | Clock 2 | 50 | | | 50 | | | |
| $T_A$ | Operating free-air temperature | | −55 | | 125 | 0 | | 70 | °C |

NOTES: 3. Setup and hold times are with respect to the falling edge of the load input.
4. Minimum count enable time is the interval immediately preceding the negative-going edge of the clock pulse during which interval the count/load and clear inputs must both be high to ensure counting.

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

| PARAMETER | | TEST CONDITIONS† | | SN54LS196 SN54LS197 | | | SN74LS196 SN74LS197 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IH}$ | High-level input voltage | | | 2 | | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | | | | | 0.7 | | | 0.8 | V |
| $V_{IK}$ | Input clamp voltage | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = $V_{IL\ max}$, $I_{OH}$ = −400 μA | | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = $V_{IL\ max}$ | $I_{OL}$ = 4 mA¶ | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | | $I_{OL}$ = 8 mA¶ | | | | | 0.35 | 0.5 | |
| $I_I$ | Input current at maximum input voltage | Data, Load | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | 0.1 | | | 0.1 | mA |
| | | Clear, clock 1 | | | | 0.2 | | | 0.2 | |
| | | Clock 2 of 'LS196 | | | | 0.4 | | | 0.4 | |
| | | Clock 2 of 'LS197 | | | | 0.2 | | | 0.2 | |
| $I_{IH}$ | High-level input current | Data, Load | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | 20 | | | 20 | μA |
| | | Clear, clock 1 | | | | 40 | | | 40 | |
| | | Clock 2 of 'LS196 | | | | 80 | | | 80 | |
| | | Clock 2 of 'LS197 | | | | 40 | | | 40 | |
| $I_{IL}$ | Low-level Input current | Data, Load | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | −0.4 | | | −0.4 | mA |
| | | Clear | | | | −0.8 | | | −0.8 | |
| | | Clock 1 | | | | −2.4 | | | −2.4 | |
| | | Clock 2 of 'LS196 | | | | −2.8 | | | −2.8 | |
| | | Clock 2 of 'LS197 | | | | −1.3 | | | −1.3 | |
| $I_{OS}$ | Short-circuit output current§ | $V_{CC}$ = MAX | | −20 | | −100 | −20 | | −100 | mA |
| $I_{CC}$ | Supply current | $V_{CC}$ = MAX, See Note 5 | | | 16 | 27 | | 16 | 27 | mA |

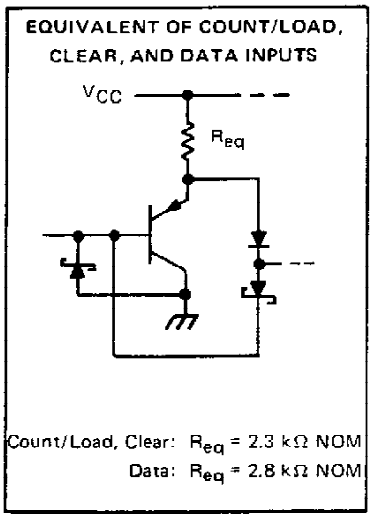
†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.
¶$Q_A$ outputs are tested at specified $I_{OL}$ plus the limit value of $I_{IL}$ for the clock-2 input. This permits driving the clock-2 input while maintaining full fan-out capability.
NOTE 5. $I_{CC}$ is measured with all inputs grounded and all outputs open.

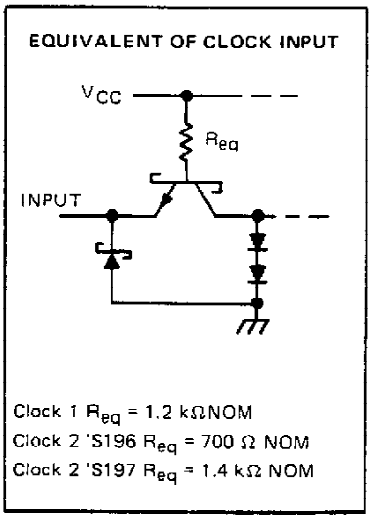
## switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

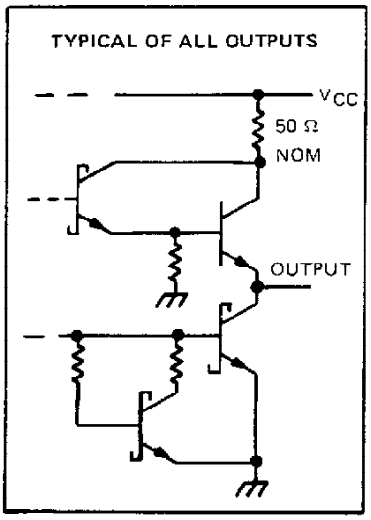
| PARAMETER# | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | SN54LS196 SN74LS196 | | | SN54LS197 SN74LS197 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $f_{max}$ | Clock 1 | $Q_A$ | $C_L$ = 15 pF, $R_L$ = 2 kΩ, See Note 6 | 30 | 40 | | 30 | 40 | | MHz |
| $t_{PLH}$ | Clock 1 | $Q_A$ | | | 8 | 15 | | 8 | 15 | ns |
| $t_{PHL}$ | | | | | 13 | 20 | | 14 | 21 | |
| $t_{PLH}$ | Clock 2 | $Q_B$ | | | 16 | 24 | | 12 | 19 | ns |
| $t_{PHL}$ | | | | | 22 | 33 | | 23 | 35 | |
| $t_{PLH}$ | Clock 2 | $Q_C$ | | | 38 | 57 | | 34 | 51 | ns |
| $t_{PHL}$ | | | | | 41 | 62 | | 42 | 63 | |
| $t_{PLH}$ | Clock 2 | $Q_D$ | | | 12 | 18 | | 55 | 78 | ns |
| $t_{PHL}$ | | | | | 30 | 45 | | 63 | 95 | |
| $t_{PLH}$ | A, B, C, D | $Q_A$, $Q_B$, $Q_C$ $Q_D$ | | | 20 | 30 | | 18 | 27 | ns |
| $t_{PHL}$ | | | | | 29 | 44 | | 29 | 44 | |
| $t_{PLH}$ | Load | Any | | | 27 | 41 | | 26 | 39 | ns |
| $t_{PHL}$ | | | | | 30 | 45 | | 30 | 45 | |
| $t_{PHL}$ | Clear | Any | | | 34 | 51 | | 34 | 51 | ns |

#$f_{max}$ ≡ maximum count frequency.
$t_{PLH}$ ≡ propagation delay time, low-to-high-level output, $t_{PHL}$ ≡ propagation delay time, high-to-low-level output.
NOTE 6: Load circuit, input conditions, and voltage waveforms are the same as those shown for the '176, '177 except that $t_r$ ≤ 15 ns, $t_f$ ≤ 6 ns, and $V_{ref}$ = 1.3 V (as opposed to 1.5 V).

## schematics of inputs and outputs




## 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: SN54S196, SN54S197 Circuits . . . . . −55°C to 125°C
SN74S196, SN74S197 Circuits . . . . . 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

| | | SN54S196, SN54S197 | | | SN74S196, SN74S197 | | | 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, $I_{OH}$ | | | | −1 | | | −1 | mA |
| Low-level output current, $I_{OL}$ | | | | 20 | | | 20 | mA |
| Clock frequency | Clock-1 input | 0 | | 100 | 0 | | 100 | MHz |
| | Clock-2 input | 0 | | 50 | 0 | | 50 | |
| Pulse width, $t_w$ | Clock-1 input | 5 | | | 5 | | | ns |
| | Clock-2 input | 10 | | | 10 | | | |
| | Clear | 30 | | | 30 | | | |
| | Load | 5 | | | 5 | | | |
| Input hold time, $t_h$ (see Note 3) | High-level data | 3↓ | | | 3↓ | | | ns |
| | Low-level data | 3↓ | | | 3↓ | | | |
| Input setup time, $t_{su}$ (see Note 3) | High-level data | 6↓ | | | 6↓ | | | ns |
| | Low-level data | 6↓ | | | 6↓ | | | |
| Count enable time, $t_{en}$ (see Note 4) | | 12 | | | 12 | | | ns |
| Operating free-air temperature, $T_A$ | | −55 | | 125 | 0 | | 70 | °C |

NOTES: 3. Setup and hold times are with respect to the falling edge of the load input.
4. Minimum count enable time is the interval immediately preceding the negative-going edge of the clock pulse during which interval the count/load and clear inputs must both be high to ensure counting.

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

| PARAMETER | | TEST CONDITIONS † | | SN54S196, SN74S196 | | | SN54S197, SN74S197 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| $V_{IH}$ | | | | 2 | | | 2 | | | V |
| $V_{IL}$ | | | | | | 0.8 | | | 0.8 | V |
| $V_{IK}$ | | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.2 | | | −1.2 | V |
| $V_{OH}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OH}$ = −1 mA | 54S | 2.5 | 3.4 | | 2.5 | 3.4 | | V |
| | | | 74S | 2.7 | 3.4 | | 2.7 | 3.4 | | |
| $V_{OL}$ | | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OL}$ = 20 mA¶ | | | | 0.5 | | | 0.5 | V |
| $I_I$ | | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | | 1 | | | 1 | mA |
| $I_{IH}$ | Clock 1, clock 2 | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | | 150 | | | 150 | μA |
| | All other inputs | | | | | 50 | | | 50 | |
| $I_{IL}$ | Data, Load Clear | $V_{CC}$ = MAX, $V_I$ = 0.5V | | | | −0.75 | | | −0.75 | mA |
| | Clock 1 | | | | | −8 | | | −8 | mA |
| | Clock 2 | | | | | −10 | | | −6 | mA |
| $I_{OS}$§ | | $V_{CC}$ = MAX | | −30 | | −110 | −30 | | −110 | mA |
| $I_{CC}$ | | $V_{CC}$ = MAX, See Note 5 | 54S | | 75 | 110 | | 75 | 110 | mA |
| | | | 74S | | 75 | 120 | | 75 | 120 | |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at $V_{CC}$ = 5 V, $T_A$ = 25°C.
¶ $Q_A$ outputs are tested at $I_{OL}$ = 20 mA plus the limit value of $I_{IL}$ for the clock-2 input. This permits driving the clock-2 input while fanning out to 10 Series 54S/74S loads.
§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.
NOTE 5: $I_{CC}$ is measured with all input grounded and all outputs open.

## switching characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

| PARAMETER# | (FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | SN54S196, SN74S196 | | | SN54S197, SN74S197 | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $f_{max}$ | Clock 1 | $Q_A$ | $R_L$ = 280 Ω, $C_L$ = 15 pF, See Note 7 | 100 | 140 | | 100 | 140 | | MHz |
| $t_{PLH}$ | Clock 1 | $Q_A$ | | | 5 | 10 | | 5 | 10 | ns |
| $t_{PHL}$ | | | | | 6 | 10 | | 6 | 10 | |
| $t_{PLH}$ | Clock 2 | $Q_B$ | | | 5 | 10 | | 5 | 10 | ns |
| $t_{PHL}$ | | | | | 8 | 12 | | 8 | 12 | |
| $t_{PLH}$ | Clock 2 | $Q_C$ | | | 12 | 18 | | 12 | 18 | ns |
| $t_{PHL}$ | | | | | 16 | 24 | | 15 | 22 | |
| $t_{PLH}$ | Clock 2 | $Q_D$ | | | 5 | 10 | | 18 | 27 | ns |
| $t_{PHL}$ | | | | | 8 | 12 | | 22 | 33 | |
| $t_{PLH}$ | A,B,C,D | $Q_A$,$Q_B$,$Q_C$,$Q_D$ | | | 7 | 12 | | 7 | 12 | ns |
| $t_{PHL}$ | | | | | 12 | 18 | | 12 | 18 | |
| $t_{PLH}$ | Load | Any | | | 10 | 18 | | 10 | 18 | ns |
| $t_{PHL}$ | | | | | 12 | 18 | | 12 | 18 | |
| $t_{PHL}$ | Clear | Any | | | 26 | 37 | | 26 | 37 | ns |

#$f_{max}$ = maximum count frequency.
$t_{PLH}$ = propagation delay time, low-to-high-level output.
$t_{PHL}$ = propagation delay time, high-to-low-level output.
NOTE 7: Load circuit, input conditions, and voltage waveforms are the same as those shown in Section 1.

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