These multivibrators feature dual negative-transition-triggered inputs and a single positive-transition-triggered input which can be used as an inhibit input. Complementary output pulses are provided.

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. Schmitt-trigger input circuitry (TTL hysteresis) for the B input allows jitter-free triggering from inputs with transition rates as slow as 1 volt/second, providing the circuit with an excellent noise immunity of typically 1.2 volts. A high immunity to VCC noise of typically 1.5 volts is also provided by internal latching circuitry.

Once fired, the outputs are independent of further transitions of the inputs and are a function only of the timing components. Input pulses may be of any duration relative to the output pulse. Output pulse length may be varied from 40 nanoseconds to 28 seconds by choosing appropriate timing components. With no external timing components (i.e., Rint connected to VCC, Cext and Rext/Cext open), an output pulse of typically 30 or 35 nanoseconds is achieved which may be used as a d-c triggered reset signal. Output rise and fall times are TTL compatible and independent of pulse length.

Pulse width stability is achieved through internal compensation and is virtually independent of VCC and temperature. In most applications, pulse stability will only be limited by the accuracy of external timing components.

Jitter-free operation is maintained over the full temperature and VCC ranges for more than six decades of timing capacitance (10 pF to 10 nF) and more than one decade of timing resistance (2 kΩ to 30 kΩ) for the SN54121 and 2 kΩ to 40 kΩ for the SN74121). Throughout these ranges, pulse width is defined by the relationship

\[ \text{Pulse Width} = \frac{C_{\text{ext}}}{R_{\text{int}}+2} \times \text{VCC} \]

In circuits where pulse cutoff is not critical, timing capacitance up to 1000 µF and timing resistance as low as 1.4 kΩ may be used. Also, the range of jitter-free output pulse widths is extended if VCC is held to 5 volts and free-air temperature is 25°C. Duty cycles as high as 90% are achieved when using maximum recommended R\text{in}. Higher duty cycles are available if a certain amount of pulse-width jitter is allowed.
SN54121, SN74121
MONOSTABLE MULTIVIBRATORS
WITH SCHMITT-TRIGGER INPUTS

logic diagram (positive logic)

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

NOTES: 1. An external capacitor may be connected between C_{ext} (positive) and R_{ext}/C_{ext}.
2. To use the internal timing resistor, connect R_{int} to V_{CC}. For improved output width
accuracy and repeatability, connect an external resistor between R_{ext}/C_{ext} and V_{CC}
with R_{int} open-circuited.

schematics of inputs and outputs

EQUIVALENT OF EACH INPUT

TYPICAL OF BOTH OUTPUTS

\[ R_{eq} = 130 \, \Omega \text{ NOM} \]
absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 3) ......................................................... 7 V
Input voltage ................................................................. 5.5 V
Operating free-air temperature range: SN54121 ................................... $-55^\circ C$ to $125^\circ C$
SN74121 ......................................................... $0^\circ C$ to $70^\circ C$
Storage temperature range ......................................................... $-65^\circ C$ to $150^\circ C$

NOTE 3: Voltage values are with respect to network ground terminal.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MIN</th>
<th>NOM</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$ Supply voltage</td>
<td></td>
<td>4.5</td>
<td>6</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>74 Family</td>
<td>4.75</td>
<td>5</td>
</tr>
<tr>
<td>$I_{OH}$ High-level output current</td>
<td></td>
<td></td>
<td>-0.4</td>
<td>mA</td>
</tr>
<tr>
<td>$I_{OL}$ Low-level output current</td>
<td></td>
<td></td>
<td>16</td>
<td>mA</td>
</tr>
<tr>
<td>$dV/dt$ Rate of rise or fall of input pulse</td>
<td>Schmitt input, B</td>
<td>1</td>
<td>V/ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logic inputs, A1, A2</td>
<td>1</td>
<td>V/ns</td>
</tr>
<tr>
<td>$t_{p(w)}$ Input pulse width</td>
<td></td>
<td>50</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$R_{ext}$ External timing capacitance</td>
<td>54 Family</td>
<td>1.4</td>
<td>30</td>
<td>kF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>74 Family</td>
<td>1.4</td>
<td>40</td>
</tr>
<tr>
<td>$C_{ext}$ External timing capacitance</td>
<td></td>
<td>0</td>
<td>1000</td>
<td>μF</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>$R_T = 2 , k\Omega$</td>
<td>87</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$R_T = \text{MAX } R_{ext}$</td>
<td>90</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>$T_A$ Operating free-air temperature</td>
<td>54 Family</td>
<td>-65</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>74 Family</td>
<td>0</td>
<td>70</td>
</tr>
</tbody>
</table>
SN54121, SN74121
MONOSTABLE MULTIVIBRATORS
WITH SCHMITT-TRIGGER INPUTS

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

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIL</td>
<td>VCC = MIN</td>
<td>2</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>VIL</td>
<td>VCC = MIN</td>
<td>0.8</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>VTT</td>
<td>VCC = MIN</td>
<td>1.55</td>
<td></td>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td>VTN</td>
<td>VCC = MIN</td>
<td>0.8</td>
<td></td>
<td>1.35</td>
<td>V</td>
</tr>
<tr>
<td>VIH</td>
<td>VCC = MIN, I = -12 mA</td>
<td></td>
<td></td>
<td>-1.5</td>
<td>V</td>
</tr>
<tr>
<td>IOH</td>
<td>VCC = MIN, IOH  = MAX</td>
<td>2.4</td>
<td>3.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>VOL</td>
<td>VCC = MIN, VOL  = MAX</td>
<td>0.2</td>
<td>0.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Ii</td>
<td>VCC = MAX, V = 5.5 V</td>
<td>1</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>IIL</td>
<td>VCC = MAX, IIL  = A1 or A2</td>
<td>40</td>
<td>80</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>IOS</td>
<td>VCC = MAX, IOS  = A1 or A2</td>
<td>1.6</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>IOS</td>
<td>VCC = MAX, IOS  = 84 Family</td>
<td>-20</td>
<td>-55</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>IOS</td>
<td>VCC = MAX, IOS  = 74 Family</td>
<td>-18</td>
<td>-55</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>ICC</td>
<td>VCC = MAX</td>
<td>13</td>
<td>25</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>ICC</td>
<td>VCC = MAX</td>
<td>23</td>
<td>40</td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

¹For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
²All typical values are at VCC = 5 V, TA = 25°C.
³Not more than one output should be shorted at a time.

switching characteristics, VCC = 5 V, TA = 25°C

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPLH</td>
<td>C = 15 pF, R = 400 kΩ, See Note 4</td>
<td>45</td>
<td>70</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>tPHL</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>35</td>
<td>55</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>tPHL</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>50</td>
<td>80</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>tPHL</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>40</td>
<td>65</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>twidthout</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>70</td>
<td>110</td>
<td>150</td>
<td>ns</td>
</tr>
<tr>
<td>twidthout</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>30</td>
<td>50</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>twidthout</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>600</td>
<td>700</td>
<td>800</td>
<td>ns</td>
</tr>
<tr>
<td>twidthout</td>
<td>C = 80 pF, R = 1 kΩ, R = 1 kΩ, See Note 4</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>ms</td>
</tr>
</tbody>
</table>

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.
TYPICAL CHARACTERISTICS†

Distribution of Units

for Output Pulse Width

\[ \Delta t_w(\text{out}) - \text{Output Pulse Width - ns} \]

\[ T_A = 25^\circ C \]
\[ V_{CC} = 5 \text{ V} \]
\[ C_{ext} = 101 \text{ pF} \]
\[ R_T = 10 \text{ k}\Omega \] (External)

99% of Units

691 694 697 700 703 706

Figure 1

Variation in Internal Timing Resistor Value

as FREE-AIR TEMPERATURE

\[ \Delta R_T(\text{in}) - \text{Variation in Internal Timing Resistor Value} \]

\[ T_A - \text{FREE-AIR Temperature - }^\circ C \]

Figure 2

Variation in Output Pulse Width

vs Supply Voltage

\[ \Delta t_w(\text{out}) - \text{Variation in Output Pulse Width} \]

\[ t_w(\text{out}) = 420 \text{ ms} \] at \[ V_{CC} = 5 \text{ V} \]

\[ C_{ext} = 60 \text{ pF} \]
\[ R_T = 10 \text{ k}\Omega \] (External)

\[ T_A = 25^\circ C \]

Figure 3

Schmitt Trigger Threshold Voltage

vs FREE-AIR TEMPERATURE

\[ V_T - \text{Schmitt Trigger Threshold Voltage - V} \]

\[ V_{CC} = 5 \text{ V} \]

\[ V_T^+ - \text{Positive-Going Threshold} \]
\[ V_T^- - \text{Negative-Going Threshold} \]

Figure 4

†Data for temperatures below 0°C and above 70°C are applicable for SN74121.
TYPICAL CHARACTERISTICS (continued)

VARIATION IN OUTPUT PULSE WIDTH
VS FREE-AIR TEMPERATURE

-1.0%
-0.5%
0%
+0.5%
+1.0%

\[ V_{CC} = 5 \text{ V} \]
\[ C_T = 60 \text{ pF} \]
\[ R_T = 10 \text{ k}\Omega \]
\[ t_{w(out)} = 420 \text{ ms} \]
\[ \theta_T = 25^\circ \text{C} \]

FIGURE 5

OUTPUT PULSE WIDTH
VS TIMING RESISTOR VALUE

FIGURE 6

OUTPUT PULSE WIDTH
VS EXTERNAL CAPACITANCE

\[ V_{CC} = 5 \text{ V} \]
\[ T_A = 25^\circ \text{C} \]
\[ C_{ext} = 1 \text{ nF} \]
\[ C_{ext} = 5 \text{ nF} \]
\[ C_{ext} = 10 \text{ nF} \]

FIGURE 7

NOTE 5: These values of resistance exceed the maximum recommended use over the full temperature range of the SN54121.

\(^\dagger\)Data for temperatures below 0\(^\circ\)C and above 70\(^\circ\)C are applicable for SN54121.
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