AUK Semiconductor

# SL5001P/2P

**TONE RINGER**

## Description

The oscillator frequencies can be adjusted over a wide range by selection of external components

## Features

- Designed telephone bell replacement
- Adjustable 2-frequency tone
- Low current drain
- Built-in hysteresis prevents false triggering and rotary dial "Chirp"
- External triggering ringer disable(5001P)
- Adjustable for reduced supply initiation current(5002P)

## Applications

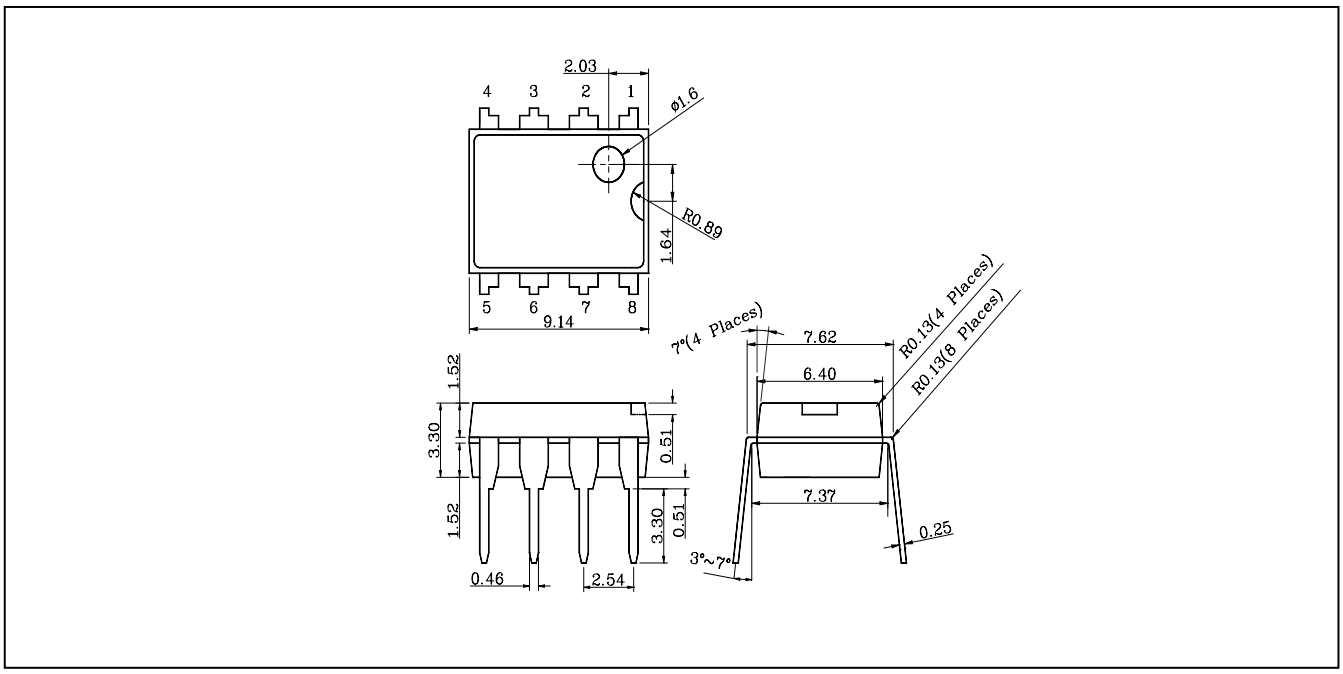
- Telephone tone ringers
- Alarms or other alerting devices
- Extension tone ringer modules

## Ordering Information

| Type NO. | Marking | Package Code |
|---|---|---|
| SL5001P | SL5001 | DIP8 |
| SL5002P | SL5002 | DIP8 |

## Outline Dimensions

**unit : mm**

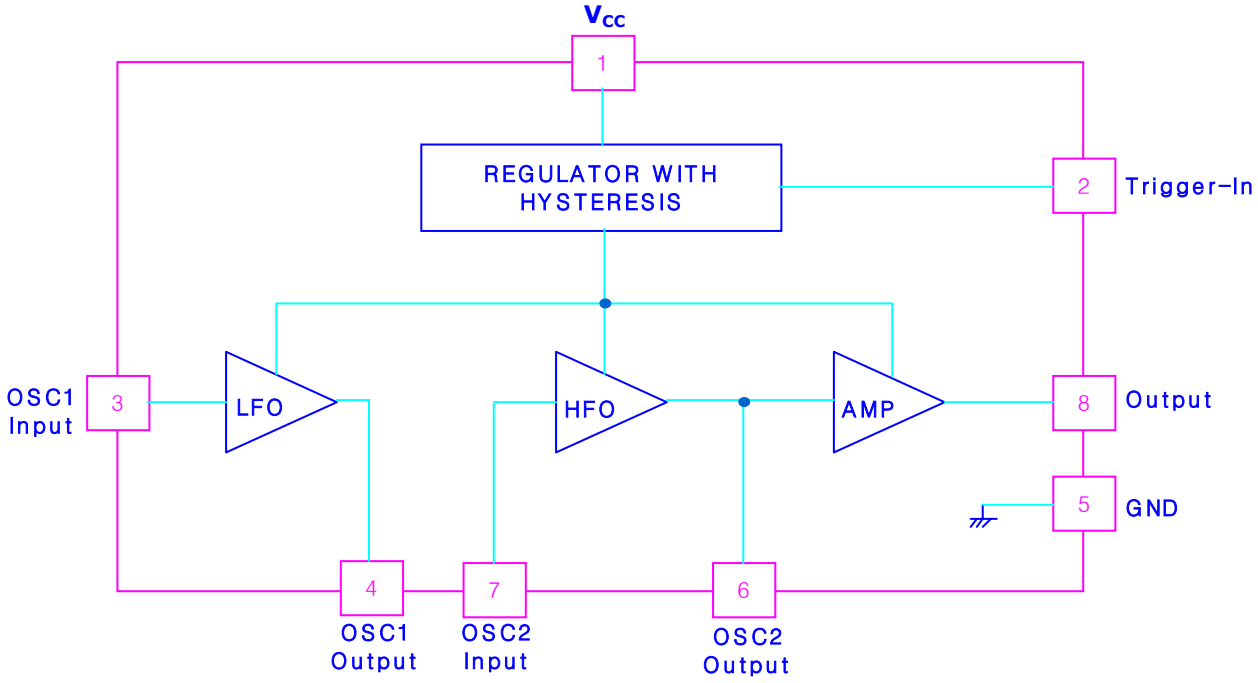


## Absolute Maximum Ratings

(Ta = 25°C)

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 30 | V |
| Power Dissipation | $P_D$ | 400 | mW |
| Operating Temperature | $T_{opr}$ | -45~+65 | °C |
| Storage Temperature | $T_{stg}$ | -65~+150 | °C |

## Block Diagram




LFO : Low Frequency OSC.
HFO : High Frequency OSC.
Pin 3,4 : Low Frequency Time Constant
Pin 6,7 : High Frequency Time Constant

* Regulator circuit has built-in hysteresis to prevent false triggering and rotary dial "Chirps"

## Electrical Characteristics

(Unless otherwise specified, Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating Supply Voltage | $V_{CC}$ | - | - | - | 29 | V |
| Initiation Supply Voltage | $V_{CC(INI)}$ | Trigger-In Open, No Load | 17 | 19 | 21 | V |
| Sustaining Voltage | $V_{SUS}$ | Trigger-In Open, No Load | 9.7 | 11 | 13 | V |
| Initiation Supply Current | $I_{CC(INI)}$ | $R_{SL}$ = 6.8KΩ(5002P) | 0.8 | 2.5 | 4.2 | mA |
| Sustaining Current | $I_{SUS}$ | $V_{CC}$=$V_{SUS}$, No Load | 0.7 | 1.2 | - | mA |
| Trigger Voltage | $V_{TR}$ | 5001P | 10.5 | 11 | - | V |
| Trigger Current | $I_{TR}$ | 5001P | 10 | 20 | 1000 | μA |
| Disable Voltage | $V_{DIS}$ | 5001P | - | 0.4 | 0.8 | V |
| Disable Current | $I_{DIS}$ | 5001P | -40 | -50 | - | μA |
| Output Voltage | $V_{OUT}$ | $V_{CC}$=21V, No Load | 17 | 19 | 21 | V |
| Oscillator Frequency Tolerance | $\Delta f_O$ | - | - | - | ±7 | % |

## Electrical Characteristics (continued)

1.Initiation supply voltage $V_{CC(INI)}$ must be exceeded to trigger oscillation.

2.Sustaining voltage ($V_{SUS}$) is the supply voltage required to maintain oscillation.

3.Trigger voltage ($V_{TR}$) and trigger current($I_{TR}$) are the conditions applied to trigger in to start oscillation for $V_{SUS} \leq V_{CC} \leq V_{CC(INI)}$ .

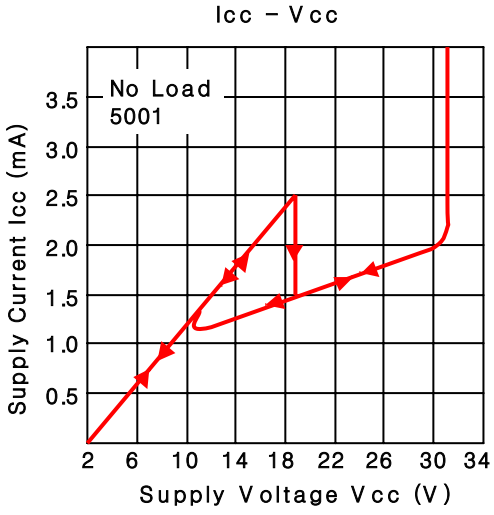
4.Disable voltage ($V_{DIS}$) and disable current($I_{DIS}$) are the conditions applied to trigger in to inhibit oscillation for $V_{CC(INI)} < V_{CC}$

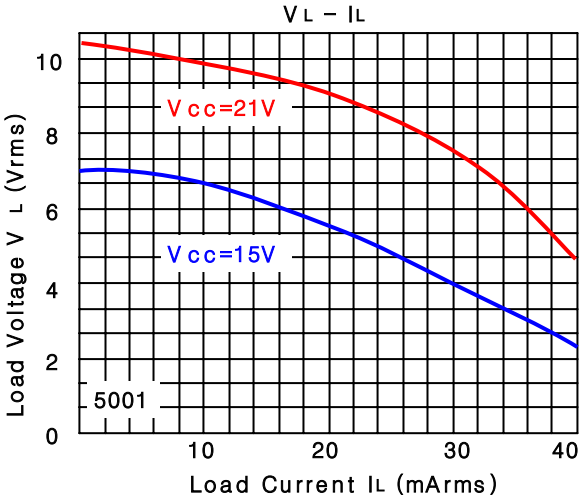
5.Trigger current must be limited to this value externally.

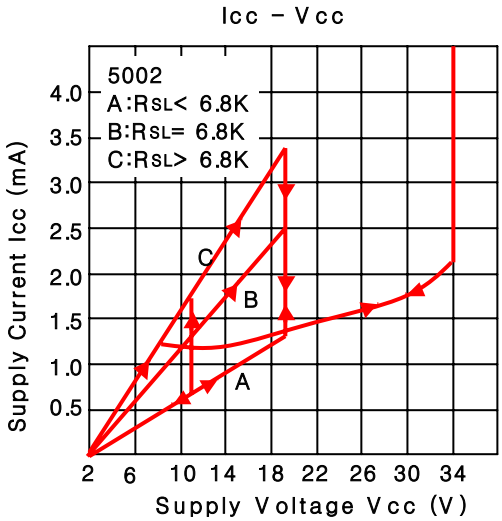
6.Oscillator frequencies are given by equations :

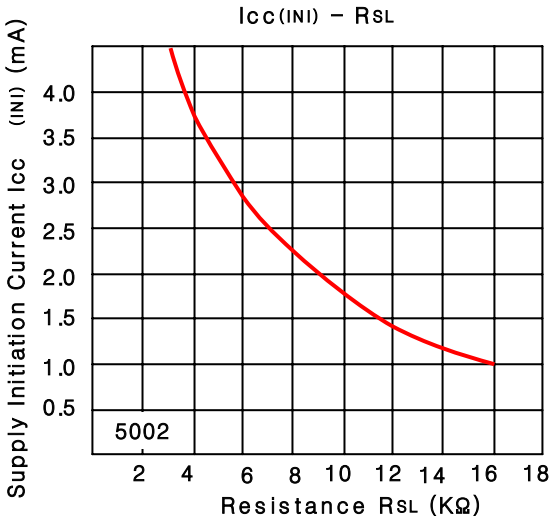
- $f_L$ = 1/(1.234RC) where R is the resistance connected between pins 3 and 4, and C is the capacitance connected between pin 3 and ground.
- $f_{H1}$ = 1/(1.515RC) where R is the resistance connected between pins 6 and 7, and C is capacitance connected between pin 6 and ground.
  Norminal rate ($f_{HA}$) is the HFO when the output of LFO is high
- $f_{H2}$ = 1.25$f_{H1}$, higher rate($f_{H2}$) is the HFO when the output of LFO is low.

## Typical Performance Characteristics



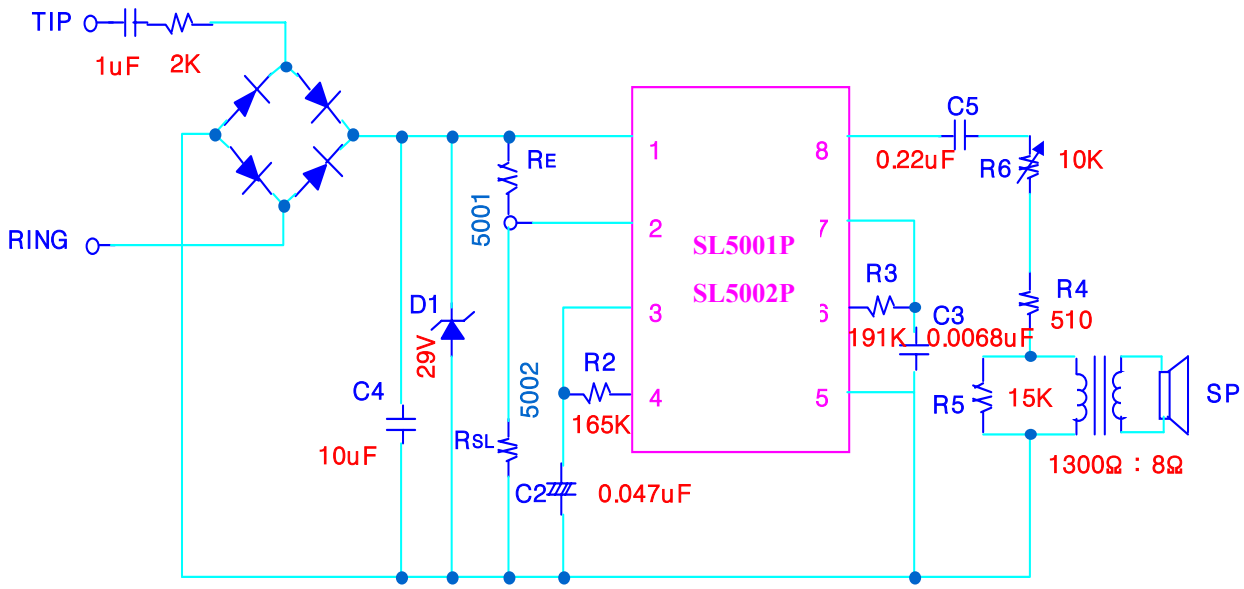



## Application Circuit And Information

1.Typical Tone Ringer



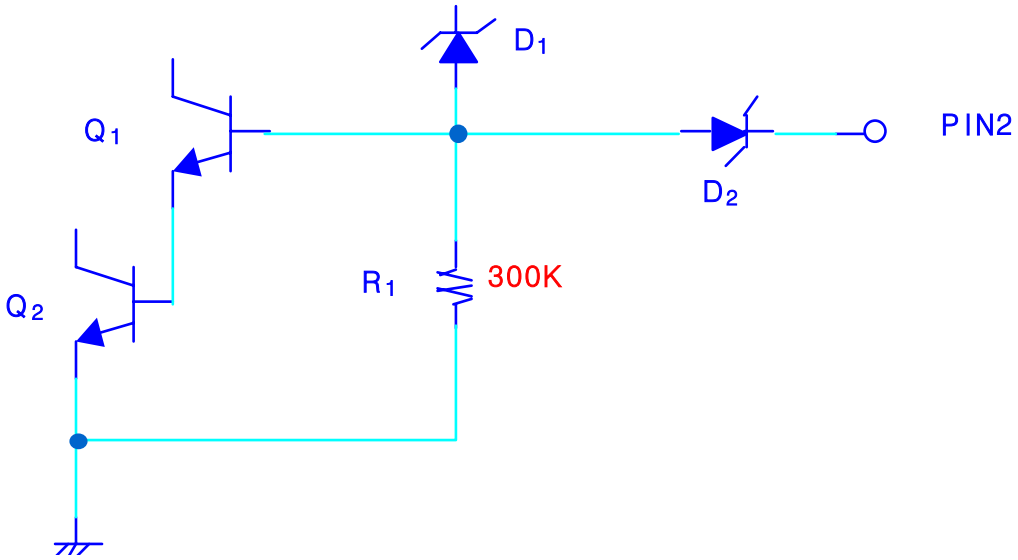

The AC ringing voltage appears across the TIP and RING inputs of the circuit and is attenuated by capacitor($C_1$) and resistor ($R_1$). $C_1$ also provides isolation from DC voltages(48V) on the line. After full wave rectification by the bridge, the waveform is filtered by capacitor($C_4$) to provide a DC supply for Tone Ringer chip. As this voltage exceeds the initiation voltage $V_{CC(INI)}$ oscillation starts. With the components shown, the output frequency chops between $f_{H1}$ and $f_{H2}$ at a $f_L$ rate. The loudspeaker load is coupled through a 1300Ω to 8Ω transformer. To prevent DC power supply regulation problems due to high source impedance of the telephone line and coupling components $C_1$ and $R_1$, while the output impedance of the 5001P circuit is quite low, the load impedance must be kept fairly high. The output coupling capacitor ($C_5$) is required with transformer coupled loads. The variable resistor ($R_6$) is used to adjust the audio amplitude and resistor ($R_4$) is a current limiting resistor. Resistor $R_5$ is a quenching resistor used to limit back emf generated by the inductive load when ringing stops. When driving a piezo-ceramic transducer type load, the coupling capacitor ($C_5$) is not required. However, a current limiting resistor is required as is a 29V zener diode in parallel with the transducer. This diode limits the voltage transients than can be generated by mechanical shocking of piezo-ceramic transducer.

In the 5002P circuit, the initiation supply current $I_{CC(INI)}$ can be changed by using external resistor($R_{SL}$). The resistor ($R_{SL}$) is connected to GND from pin2. As this initiation voltage remains constant independent of $R_{SL}$, the supply initiation current $f_{CC(INI)}$ varies inversely with $R_{SL}$. Thus, increasing the value of $R_{SL}$ will decrease the amount of AC ringing current required to trigger the device. $R_{SL}$ can also be used to compensated for smaller AC line

## Application Circuit And Information (continued)

coupling capacitors which can be used to alter the ringer equivalence number of a tone ringer circuit $I_{CC}$-$V_{CC}$(5002P) graph in typical performance characteristic illustrates the variation of supply current with supply voltage. Curve B(RSL=6.8kΩ) shows the $I_{CC}$-$V_{CC}$ characteristic for 5001P circuit Tone Ringer. Curve A is a plot with $R_{SL}$< 6.8 KΩ and shows a increase in the current drawn up to the initiation voltage $V_{CC(INI)}$. The $I_{CC}$-$V_{CC}$ characteristic after initiation remains unchanged. Curve C shows the effect of increasing RSL above 6.8 KΩ. Initiation current decreases but again current after triggering is unchanged.

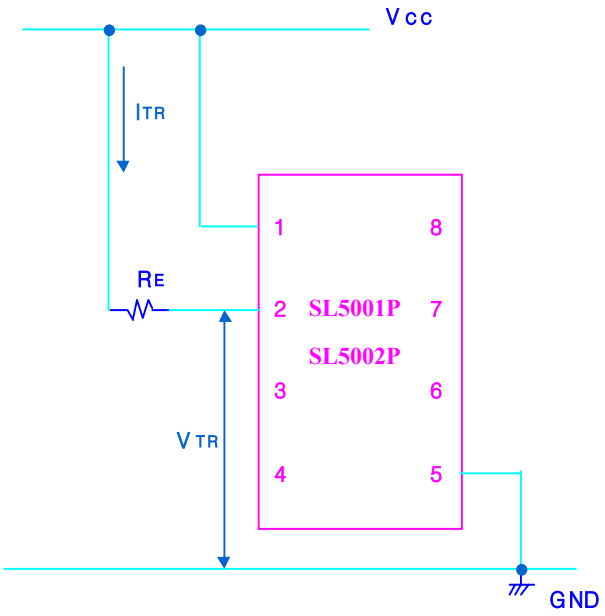
2. Pin 2 Input Equivalent Circuit(5001P)




Usually pin 2 is used at an open state, but in the 5001P circuit the trigger in terminal may be used to externally trigger oscillation for voltage in the range $V_{SUS} \leq V_{CC} \leq V_{CC(INI)}$ or disable ringer operation. The ringer circuit can only oscillate when $Q_1$ and $Q_2$ are conducting. Normally when supply voltage $V_{CC}$ exceeds the supply initiation voltage $V_{CC(INI)}$ base Current flows into $Q_1$ via $D_1$ causing $Q_1$ and $Q_2$ conduct. This continues until $V_{CC}$ is taken below the minimum sustaining voltage ($V_{SUS}$).

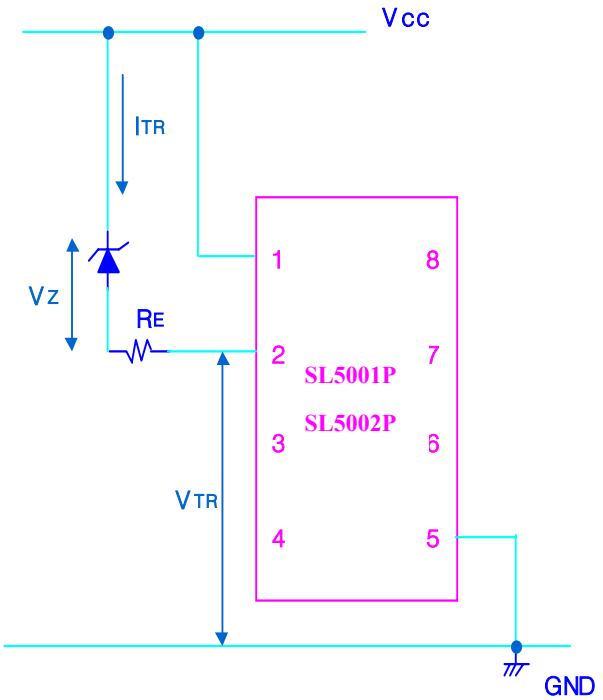
## Application Circuits And Information (continued)

3. Enabling Oscillation of the 5001P circuit for Supply Voltages less than $V_{CC(INI)}$.




The 5001P Circuit can oscillate when powered from supply voltages in the range $V_{SUS} \leq V_{CC} \leq V_{CC(INI)}$. Oscillation is ensured by forcing a current $I_{TR}$(10uA≤ ITR≤ 1mA) into pin2 should be exceeded $V_{TR}$ by the sum of zener voltage of $D_3$ the VBE of $Q_1$ and the VBE of $Q_2$(Typ. 11V). The required current drive can be provided by connecting a resistor $R_E$(20kΩ ≤ RE≤ ($V_{CC}$-11)/10MΩ ) between pin1 and $V_{CC}$.

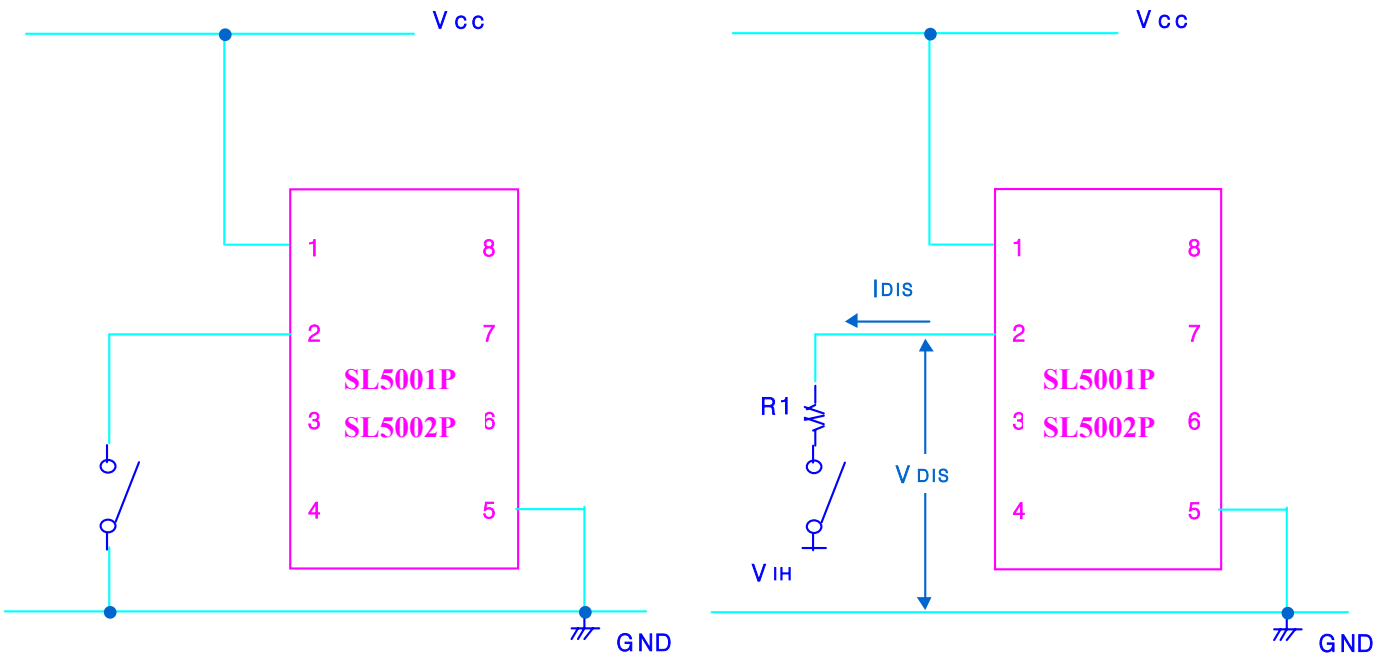
4. Reducing the Effective Value of $V_{CC(INI)}$ for the 5001P circuit




To operate the 5001P circuit from a DC 12V supply, $R_E$ should be typically 50kΩ. This operation can also be used to reduce the effective value of the $V_{CC(INI)}$, by inserting a zener diode in series with $R_E$. Then, this initiating voltage $V_{CC(INI)}$ is $V_{IR}$ + $V_Z$ + 10$R_E$

## Application Circuit And Information (continued)

5. Inhibiting Oscillation of the 5001P circuit




When the 5001P circuit is oscillating , this circuit may be inhibited for voltage in the range $V_{CC(INI)} < V_{CC} \leq V_{CC(MAX)}$ by sinking the current from $D_1$, starving $Q_1$ of base current. This is achieved by either grounding pin2 or applying a voltage $V_{IH}$ via a resistor $R_1$ to pin2

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