

# DBL 5001/2

## TONE RINGER

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

### FEATURES

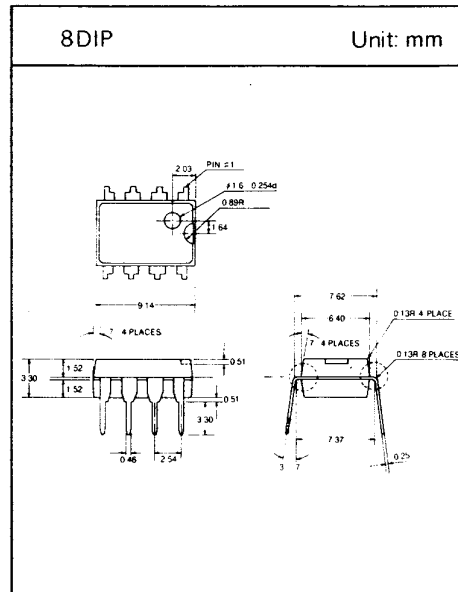
- Designed telephone bell replacement
- Adjustable 2-frequency tone
- Low current drain
- Built-in hysteresis prevents false triggering and rotary dial "Chirp"
- External triggering ringer disable(5001)
- Adjustable for reduced supply initiation current(5002)

### APPLICATIONS

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

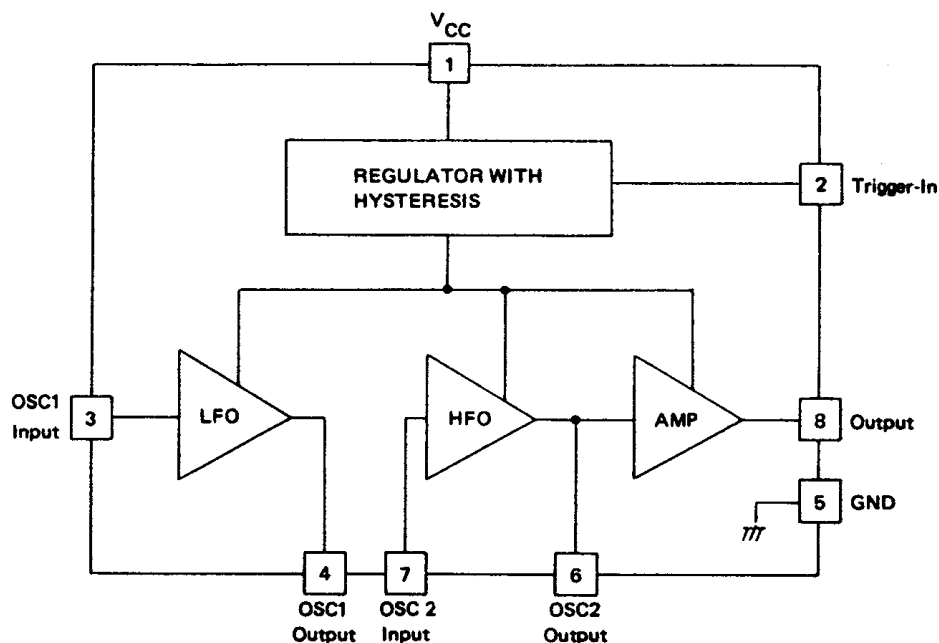
### MAXIMUM RATINGS

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



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## □ 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,  $T_a = 25^\circ\text{C}$ )

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	$I_{CC(INI)}$	$R_{SL} = 6.8\text{K}\Omega(5002)$	1.4	2.5	4.2	mA
Sustaining Current	$I_{SUS}$	$V_{CC} = V_{SUS}$ , No Load	0.7	1.2	—	mA
Trigger Voltage	$V_{TR}$	5001	10.5	11	—	V
Trigger Current	$I_{TR}$	5001	10	20	1000	$\mu\text{A}$
Disable Voltage	$V_{DIS}$	5001	—	0.4	0.8	V
Disable Current	$I_{DIS}$	5001	-40	-50	—	$\mu\text{A}$
Output Voltage	$V_{OUT}$	$V_{CC} = 21\text{V}$ , No Load	17	19	21	V
Oscillator Frequency Tolerance	$\Delta f_O$	—	—	—	$\pm 7$	%

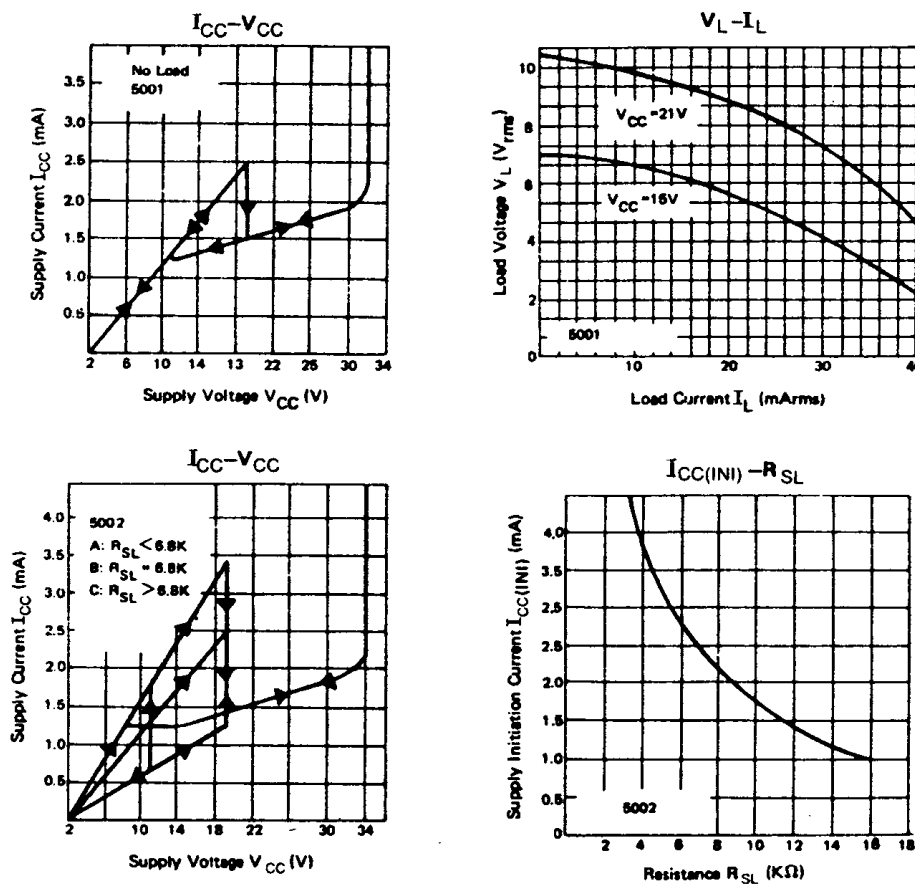
## □ ELECTRICAL CHARACTERISTICS (continued)

- \*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

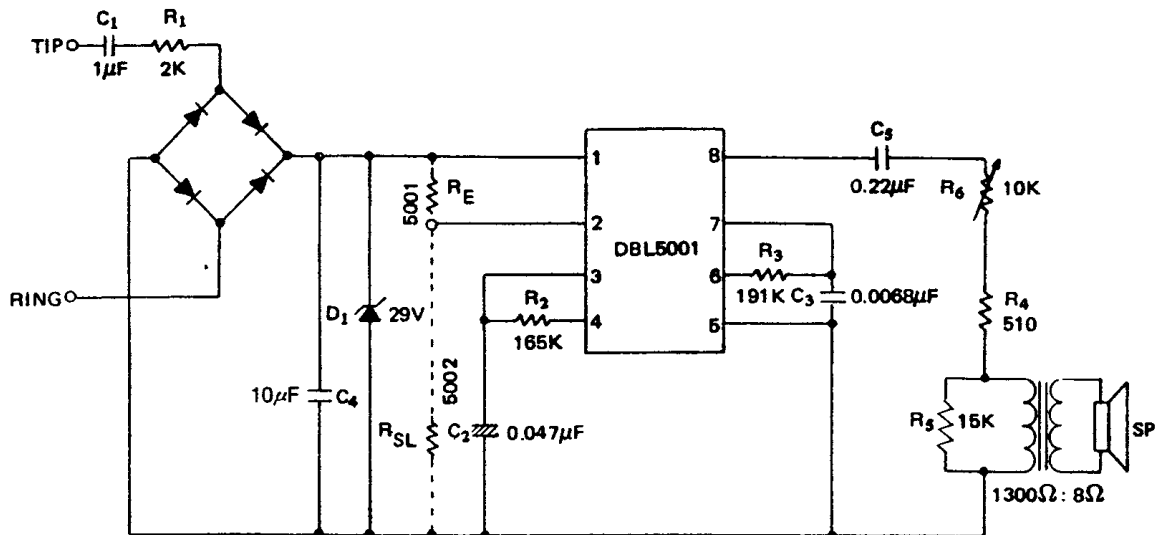
  - $f_{H2} = 1.25f_{H1}$  , higher rate ( $f_{H2}$ ) is the HFO when the output of LFO is low.

## □ TYPICAL PERFORMANCE CHARACTERISTICS



## □ APPLICATION CIRCUITS AND INFORMATION

### 1. Typical Tone Ringer



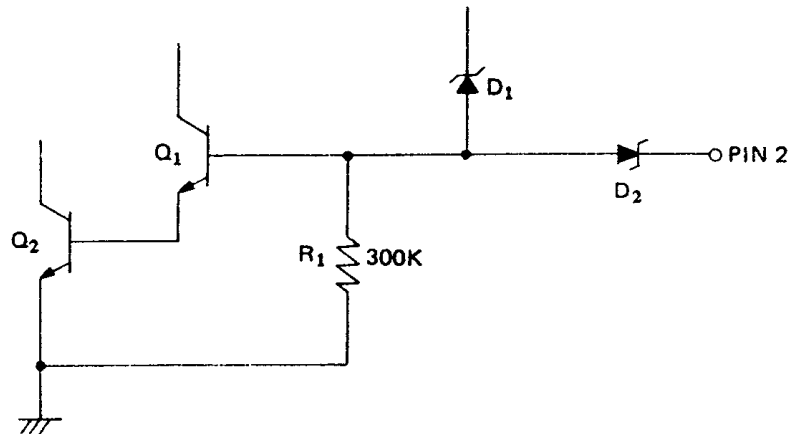
The AC ringing voltage appears across the TIP and RING inputs of the circuit and is attenuated by capacitor ( $C_1$ ) and resistor ( $R_1$ ).  $C_1$  also provides isolation from DC voltages (48V) on the line. After full wave rectification by the bridge, the waveform is filtered by capacitor ( $C_4$ ) 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  $1300\Omega$  to  $8\Omega$  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 5001 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 that can be generated by mechanical shocking of piezo-ceramic transducer.

In the 5002 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 pin 2. As this initiation voltage remains constant independent of  $R_{SL}$ , the supply initiation current  $I_{CC(INI)}$  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 compensate for smaller AC line coupling capacitors which can be used to alter the ringer equivalence number of a tone ringer circuit  $I_{CC}-V_{CC}$  (5002) graph in typical performance characteristic illustrates the variation of supply current with supply voltage. Curve B ( $R_{SL} = 6.8K\Omega$ ) shows the  $I_{CC}-V_{CC}$  characteristic for 5001 circuit Tone Ringer. Curve A is a plot with  $R_{SL} < 6.8K\Omega$  and shows an 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  $R_{SL}$  above  $6.8K\Omega$ . Initiation current decreases but again current after triggering is unchanged.

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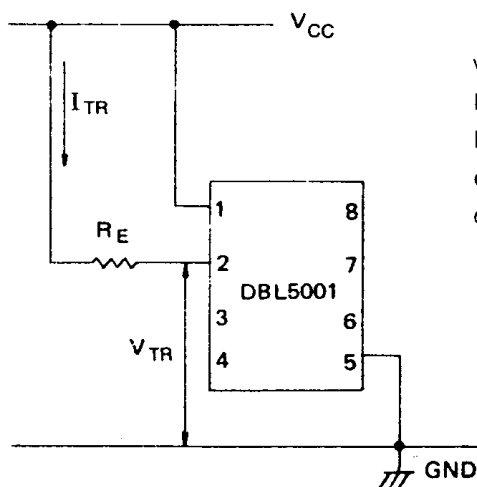
## APPLICATION CIRCUITS AND INFORMATION(continued)

### 2. Pin 2 Input Equivalent Circuit(5001)



Usually pin 2 is used at an open state, but in the 5001 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 ring 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  $Q_2$  to conduct. This continues until  $V_{CC}$  is taken below the minimum sustaining voltage ( $V_{SUS}$ ).

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

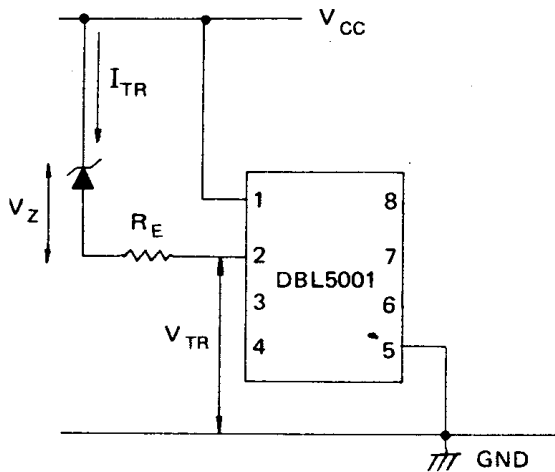


The 5001 Circuit can oscillate when powered from supply voltages in the range  $V_{SUS} \leq V_{CC} \leq V_{CC(INI)}$ . Oscillation is ensured by forcing a current  $I_{TR}$  ( $10\mu A \leq I_{TR} \leq 1mA$ ) into pin 2. This current should be exceeded  $V_{TR}$  by the sum of zener voltage of  $D_3$ , the  $V_{BE}$  of  $Q_1$ , and the  $V_{BE}$  of  $Q_2$  (Typ. 11V). The required current drive can be provided by connecting a resistor  $R_E$  ( $20K\Omega \leq R_E \leq (V_{CC} - 11)/10M\Omega$ ) between pin 1 and  $V_{CC}$ .

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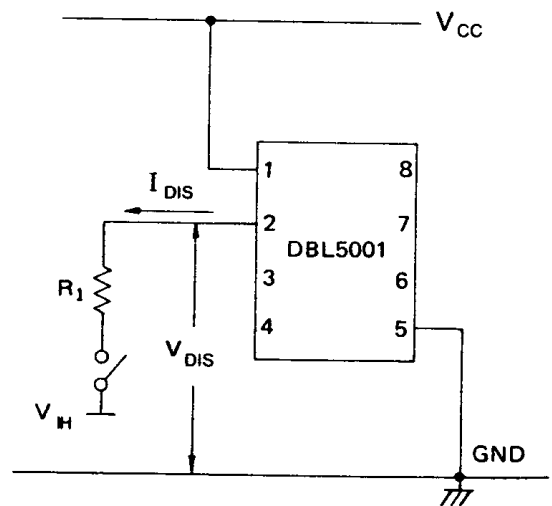
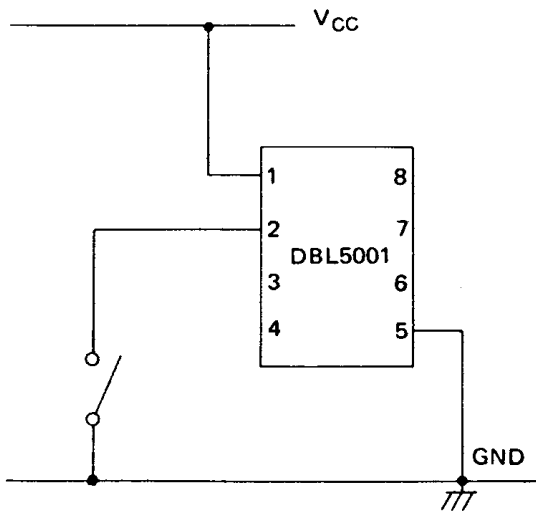
## □ APPLICATION CIRCUITS AND INFORMATION(continued)

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



To operate the 5001 circuit from a DC 12V supply,  $R_E$  should be typically  $50K\Omega$ . 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  $V_{IR} + V_Z + 10R_E$ .

### 5. Inhibiting Oscillation of the 5001 circuit.



When the 5001 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 pin 2 or applying a voltage  $V_{IH}$  via a resistor  $R_1$  to pin 2.