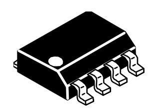
Telephone Tone Ringer Bipolar Linear/I^2L

Features

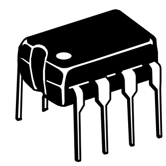
- Complete Telephone Bell Replacement Circuit with Minimum External Components
- On-Chip Diode Bridge and Transient Protection
- Direct Drive for Piezoelectric Transducers
- Push Pull Output Stage for Greater Output Power Capability
- Base Frequency Options
  - 34017A-1: 1.0 kHz
  - 34017A-2: 2.0 kHz
  - 34017A-3: 500 Hz
- Input Impedance Signature Meets Bell and EIA Standards
- Rejects Rotary Dial Transient

34017A

TELEPHONE TONE RINGER
BIPOLAR LINEAR/I^2



D SUFFIX
98A42564B
8-LEAD SOIC



P SUFFIX
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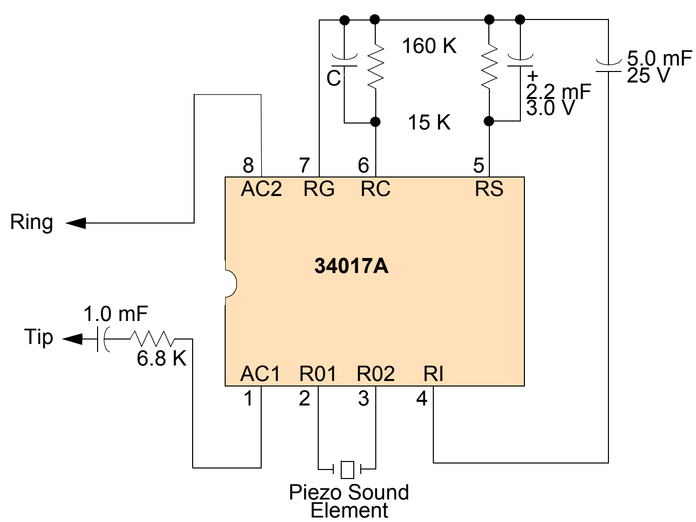
8-LEAD DIP

ORDERING INFORMATION		
Device	**Temperature Range (T_A)**	**Package**
MC34017AD/DR2	-20°C to 60°C	8 SOIC
MC34017AP		8 Plastic DIP



34017A-1: C=1000 pF
34017A-2: C=500 pF
34017A-3: C=2000 pF

This device contains 97 active transistors and 79 gates

Figure 1. 34017A Simplified Application Diagram

There are no disclaimers required on the Final publication of a data sheet.

INTERNAL BLOCK DIAGRAM

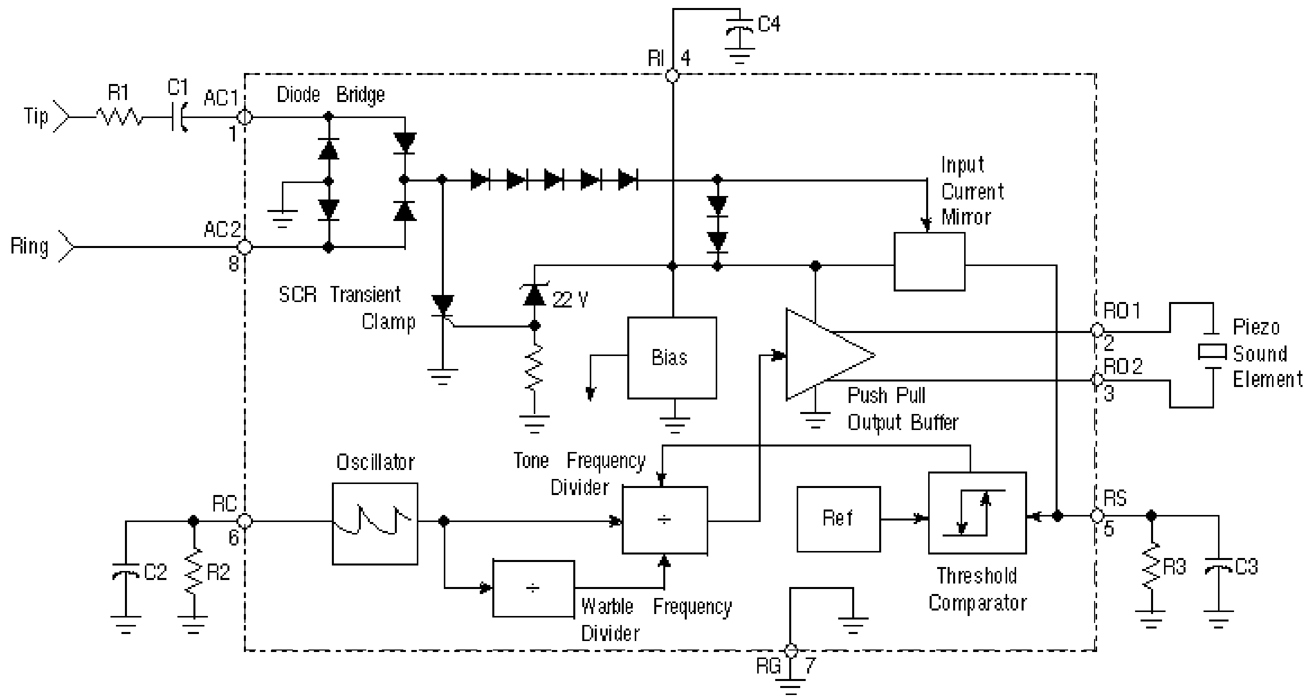


Figure 2. 34017A Simplified Internal Block Diagram

TERMINAL CONNECTIONS

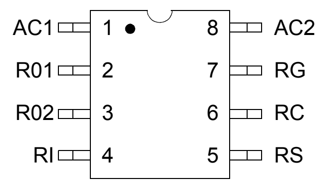


Figure 3. 34017A Terminal Connections

Table 1. 34017A Terminal Definitions

Terminal Number	Terminal Name	Terminal Function	Formal Name	Definition
1, 8	AC1, AC2			The input terminals to the full-wave diode bridge. The AC ringing signal from the telephone line energizes the ringer through this bridge.
5	RS			The input of the threshold comparator to which diode bridge current is mirrored and sensed through an external resistor (R3). Nominal threshold is 1.2 V. This Terminal internally clamps at 1.5 V.
4	RI			The positive supply terminal for the oscillator, frequency divider, and output buffer circuits.
2, 3	RO1, RO2			The tone ringer output terminals through which the sound element is driven.
7	RG			The negative terminal of the diode bridge and the negative supply terminal of the tone generating circuitry.
6	RC			The oscillator terminal for the external resistor and capacitor which control the tone ringer frequencies (R2, C2).

MAXIMUM RATINGS

Table 2. Maximum Ratings

All voltages are with respect to RG, Terminal 7, unless otherwise noted. ESD voltage data is available upon request.

Rating	Symbol	Value	Unit
Operating AC Input Current (Terminals 1, 8)	–	20	mA, RMS
Transient Input Current (Terminals 1, 8) (T < 2.0 ms)	V_{IN}	±300	mA, peak
Voltage Applied at RC (Terminal 6)	V_{RC}	5.0	V
Voltage Applied at RS (Terminal 5)	V_{RS}	5.0	V
Voltage Applied to Outputs (Terminals 2, 3)	V_O	-2.0 to V_{RI}	V
Power Dissipation (@ 25°C)	P_D	1.0	W
Operating Ambient Temperature	T_A	-20 to 60	°C
Storage Temperature	T_{STG}	-65 to 150	°C

STATIC ELECTRICAL CHARACTERISTICS

Table 3. Static Electrical Characteristics

Typical values noted reflect the approximate parameter mean at T_A = 25°C under nominal conditions unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
Ringing Start Voltage $V_{START} = V_I$ at Ring Start $V_I > 0$ (Test 1a) $V_I < 0$ (Test 1b)	V_{START} (+) V_{START} (–)	34 -34	37.5 -37.5	41 -41	V_{DC}
Ringing Stop Voltage (Test 1c) $V_{STOP} = V_I$ at Ring Stop 34017A-1 34017A-2 34017A-3	V_{STOP}	14 12 14	16 14 16	22 20 22	V_{DC}
Output Frequencies (V_I = 50 V) (Test 1d) 34017A-1 High Tone Low Tone Warble Tone 34017A-2 High Tone Low Tone Warble Tone 34017A-3 High Tone Low Tone Warble Tone	f_H f_L f_W f_H f_L f_W f_H f_L f_W	937 752 11.5 1874 1504 11.5 937 752 23	1010 808 12.5 2020 1616 12.5 1010 808 25	1083 868 14 2166 1736 14 1083 868 28	Hz
Output Voltage (V_I = 50 V) (Test 6)	V_O	34	37	43	V_{PP}
Output Short – Circuit Current (Test 2)	I_{RO1}, I_{RO2}	35	60	80	m_{APP}
Input Diode Voltage (I_I = 5.0 mA) (Test 3)	V_D	5.4	6.2	6.8	V_{DC}
Input Voltage – SCR OFF (I_I = 30 mA) (Test 4a)	V_{OFF}	30	38	43	V_{DC}
Input Voltage – SCR ON (I_I = 100 mA) (Test 4b)	V_{ON}	3.2	4.1	6.0	V_{DC}
RS Clamp Voltage (V_I = 50 V) (Test 5)	V_{CLAMP}	1.3	1.5	1.8	V_{DC}

APPLICATION CIRCUIT PERFORMANCE

Refer to Typical Application.

Characteristic	Typ	Unit
Output Tone Frequencies 34017A-1 34017A-2 34017A-3 Warble Frequencies	 808/1010 1616/2020 404/505 12.5	Hz
Output Voltage ($V_I \geq 60\ V_{RMS}$, 20 Hz)	37	V_{PP}
Output Duty Cycle	50	%
Ringing Start Input Voltage (20 Hz)	36	V_{RMS}
Ringing Stop Input Voltage (20 Hz)	21	V_{RMS}
Maximum AC Input Voltage (≤ 68 Hz)	150	V_{RMS}
Impedance When Ringing $V_I = 40\ V_{RMS}$, 15 Hz $V_I = 130\ V_{RMS}$, 23 Hz	 >16 12	kΩ
Impedance When Not Ringing $V_I = 10\ V_{RMS}$, 24 Hz $V_I = 2.5\ V_{RMS}$, 24 Hz $V_I = 10\ V_{RMS}$, 5.0 Hz $V_I = 3.0\ V_{RMS}$, 200 to 3200 Hz	 28 > 1.0 55 > 200	 kΩ MΩ kΩ kΩ
Maximum Transient Input Voltage (T ≤ 2.0 ms)	1500	V
Ringer Equivalence Class A Class B	 0.5 0.9	 – –

TYPICAL APPLICATIONS

INTRODUCTION

The 34017A Tone Ringer derives its power supply by rectifying the AC ringing signal. It uses this power to activate a tone generator and drive a piezo-ceramic transducer. The tone generation circuitry includes a relaxation oscillator and frequency dividers which produce high and low frequency tones as well as the tone warble frequency. The relaxation oscillator frequency f_O is set by resistor R2 and capacitor C2 connected to Terminal RC. The oscillator will operate with f_O from 1.0 kHz to 10 kHz with the proper choice of external components (see Figure 2).

The frequency of the tone ringer output signal at RO1 and RO2 alternates between $f_O/4$ to $f_O/5$. The warble rate at which the frequency changes is $f_O/320$ for the 34017A-1, $f_O/640$ for the 34017A-2 and $f_O/160$ for the 34017A-3. With a 4.0 kHz oscillator frequency, the 34017A-1 produces 800 Hz and 1000 Hz tones with a 12.5 Hz warble rate. The 34017A-2 generates 1600 Hz and 2000 Hz tones with a similar 12.5 Hz warble frequency from an 8.0 kHz oscillator frequency. The 34017A-3 will produce 400 Hz and 500 Hz tones with a 12.5 Hz warble rate from a 2.0 kHz oscillator frequency. The tone ringer output circuit can source or sink 20 mA with an output voltage swing of 37 V peak-to-peak. Volume control is readily implemented by adding a variable resistance in series with the piezo transducer.

Input signal detection circuitry activates the tone ringer output when the AC line voltage exceeds programmed threshold level. Resistor R3 determines the ringing signal amplitude at which an output signal at RO1 and RO2 will be generated. The AC ringing signal is rectified by the internal diode bridge. The rectified input signal produces a voltage across R3 which is referenced to RG. The voltage across resistor R3 is filtered by capacitor C3 at the input to the threshold circuit.

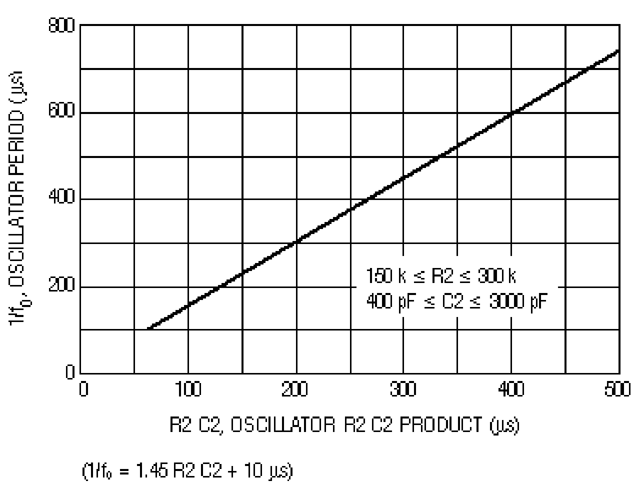


Figure 4. Oscillator Period ($1/f_O$) versus Oscillator R2 C2 Product

When the voltage on capacitor C3 exceeds 1.2 V, the threshold comparator enables the tone ringer output. Line transients produced by pulse dialing telephones do not charge capacitor C3 sufficiently to activate the tone ringer output.

Capacitors C1 and C4 and resistor R1 determine the 10 V, 24 Hz signature test impedance. C4 also provides filtering for the output stage power supply to prevent droop in the square wave output signal. Six diodes in series with the rectifying bridge provide the necessary non-linearity for the 2.5 V, 24 Hz signature tests.

An internal shunt voltage regulator between the RI and RG terminals provides DC voltage to power the output stage, oscillator, and frequency dividers. The DC voltage at RI is limited to approximately 22 V in regulation. To protect the IC from telephone line transients, an SCR is triggered when the regulator current exceeds 50 mA. The SCR diverts current from the shunt regulator and reduces the power dissipation within the IC.

External Components

R1	Line Input Register	R1 affects the tone ringer input impedance. It also influences ringing threshold voltage and limits current from line transients. Range: 2.0 to 10 kΩ.
C1	Line Input Capacitor	C1 AC couples the tone ringer to the telephone line and controls ringer input impedance at low frequencies. Range: 0.4 to 2.0 µF.
R2	Oscillator Resistor	Range: 150 to 300 kΩ.
C2	Oscillator Capacitor	Range: 400 to 3000 pF.
R3	Input Current Sense Resistor	R3 controls the ringing threshold voltage. Increasing R3 decreases the ring-start voltage. Range: 5.0 to 18 kΩ.
C3	Ringing Threshold Filter Capacitor	C3 filters the AC voltage across R3 at the input of the ringing threshold comparator. It also provides dialer transient rejection. Range: 0.5 to 5.0 µF.
C4	Ringer Supply Capacitor	C4 filters supply voltage for the tone generating circuits. It also provides an AC current path for the 10 V_{RMS} ringer signature impedance. (Range: 1.0 to 10 µF).

This paragraph is boilerplate - you may add to it but, can not change wording. You may change numeric values

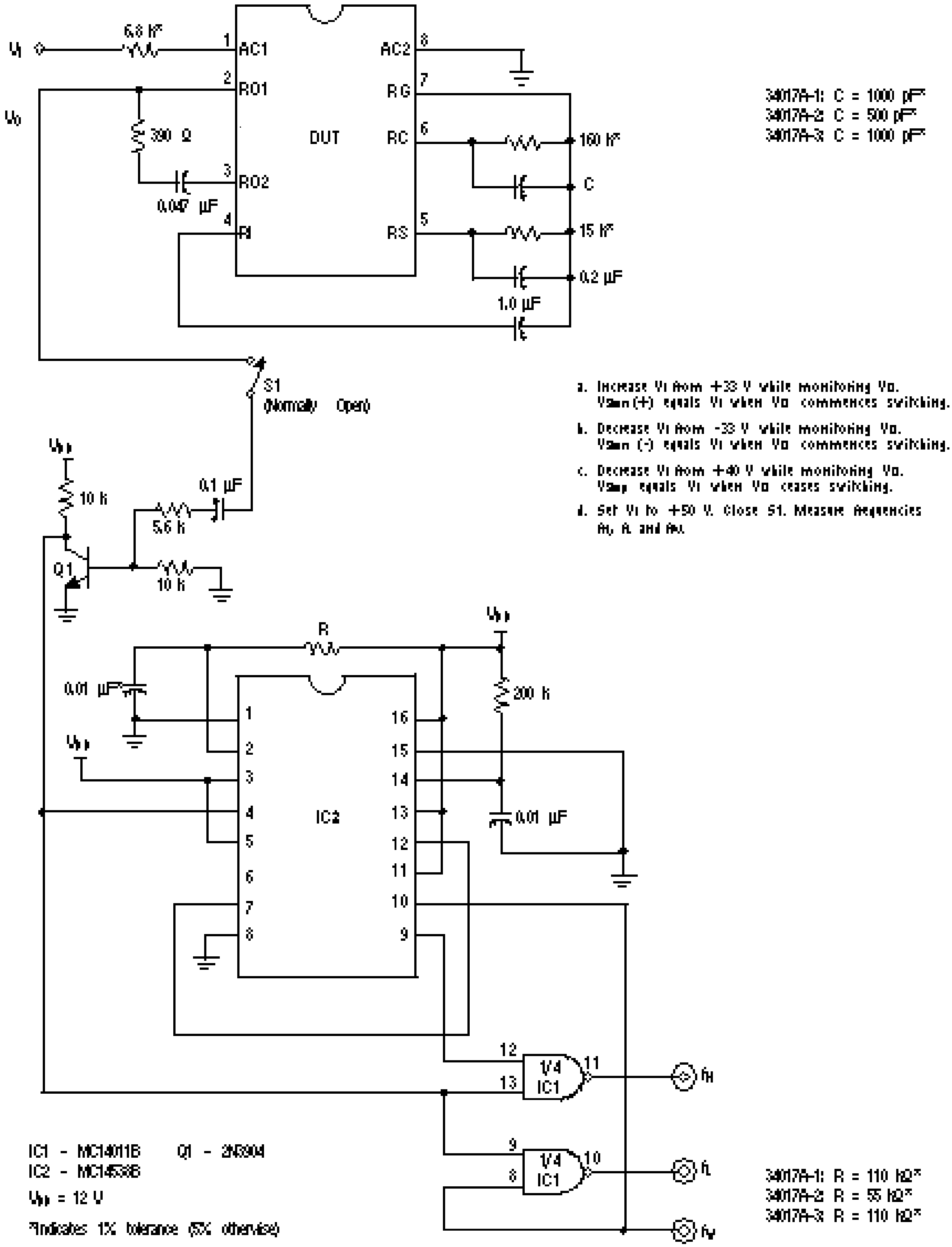
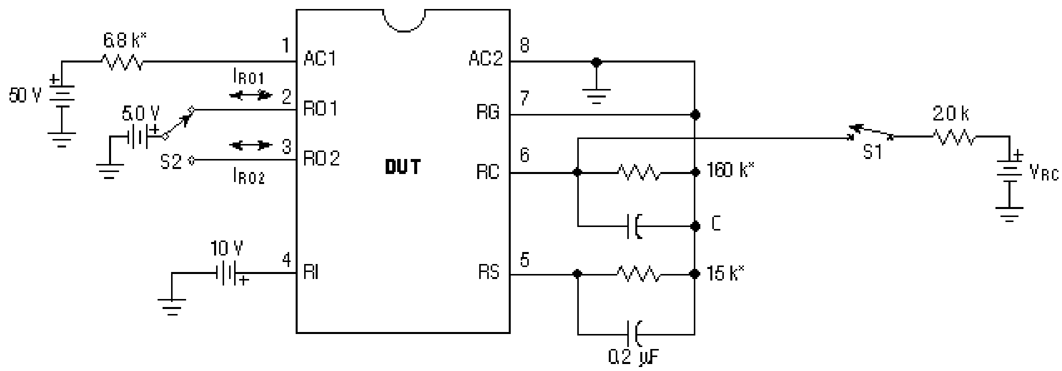


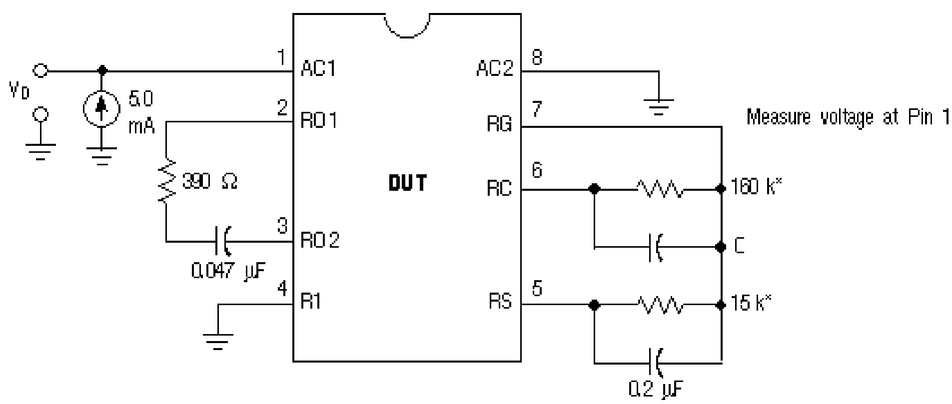
Figure 5. Test One



34017A-1: C = 1000 pF*
34017A-2 C = 500 pF*
34017A-3 C = 1000 pF*
*Indicates 1% tolerance (5% otherwise)

With V_{RC} = 4.0 V, close S1. Switch S2 to Pin 2 and measure current at Pin 2 (I_{O1}). Repeatedly switch V_{RC} between 4.0 V and 0 V until Pin 2 current changes polarity. Measure the opposite polarity current (I_{O2}).
Calculate: $I_{RO1} = |I_{O1}| + |I_{O2}|$.
Switch S2 to Pin 3 and repeat.
Calculate: $I_{RO2} = |I_{O1}| + |I_{O2}|$.

Figure 6. Test Two



34017A-1: C = 1000 pF*
34017A-2 C = 500 pF*
34017A-3 C = 1000 pF*

*Indicates 1% tolerance (5% otherwise)

Figure 7. Test Three

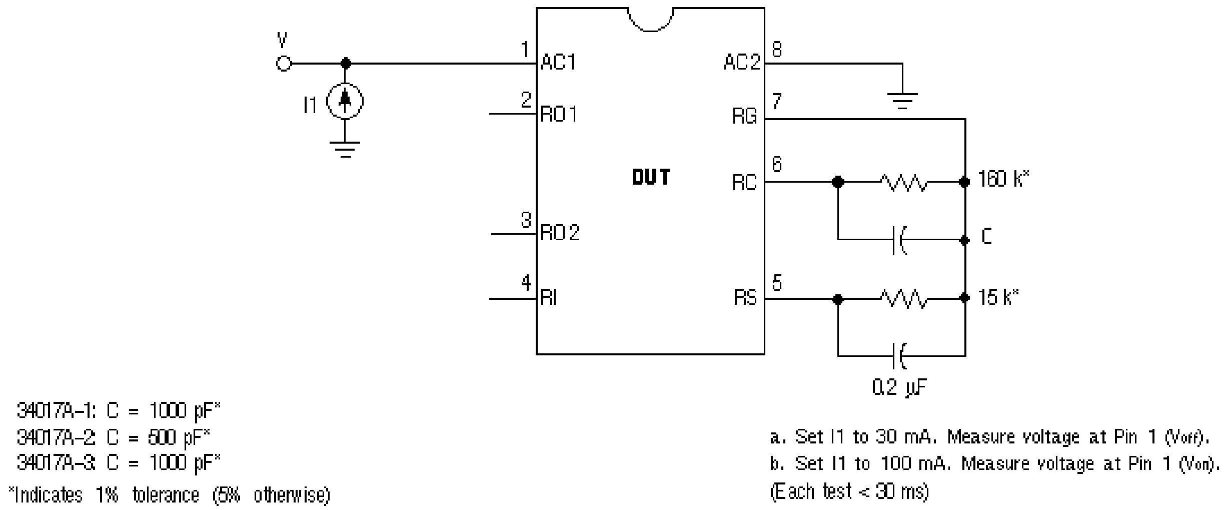


Figure 8. Test Four

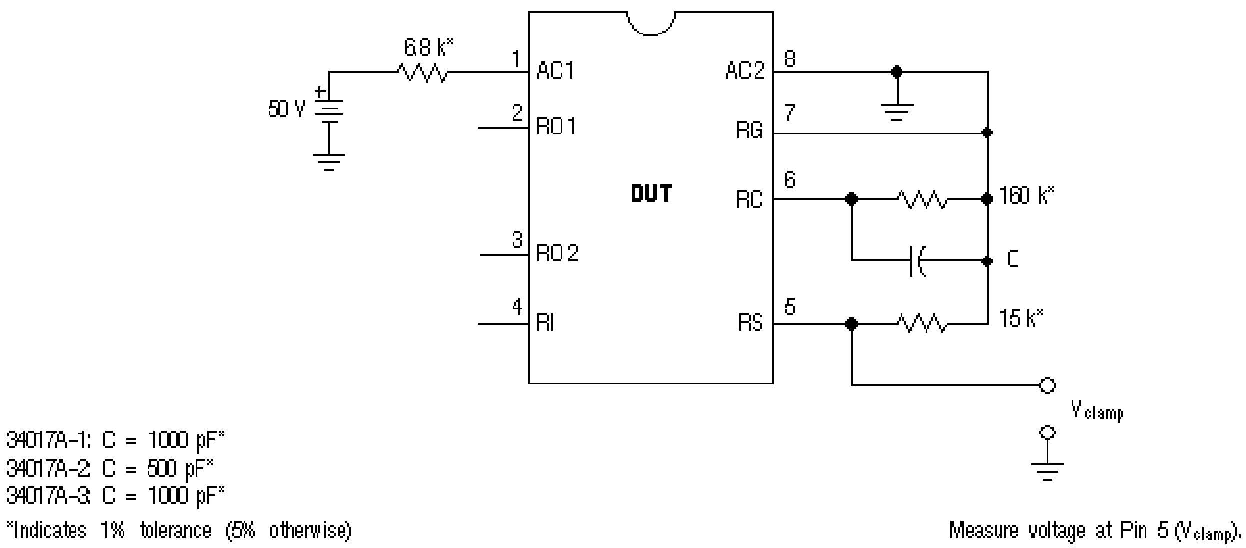
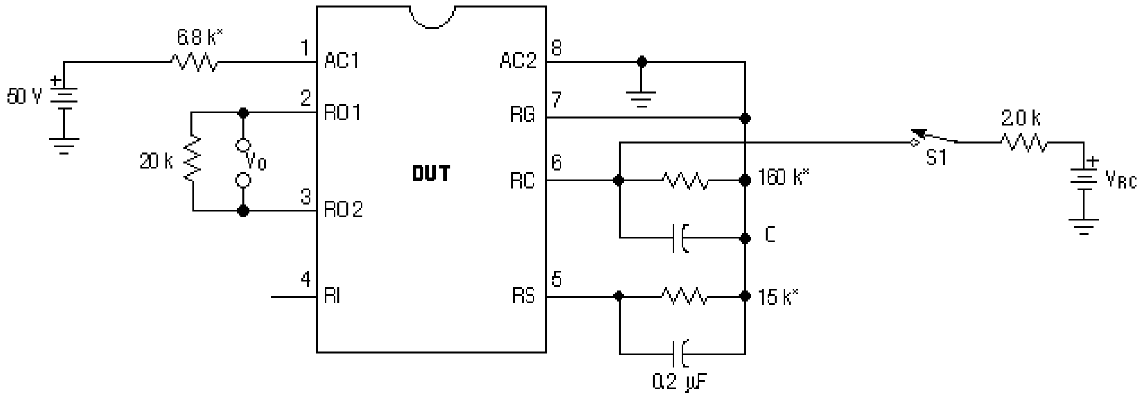


Figure 9. Test Five



34017A-1: C = 1000 pF*
34017A-2 C = 500 pF*
34017A-3 C = 1000 pF*
*Indicates 1% tolerance (5% otherwise)

With V_{RC} = 4.0 V, close S1. Measure dc voltage between Pins 2 and 3 (V_{O1}). Repeatedly switch V_{RC} between 4.0 V and 0 V until Pins 2 and 3 change state. Measure the new voltage between Pins 2 and 3 (V_{O2}).
Calculate: $V_O = |V_{O1}| + |V_{O2}|$.

Figure 10. Test Six

PACKAGING

PACKAGING DIMENSIONS

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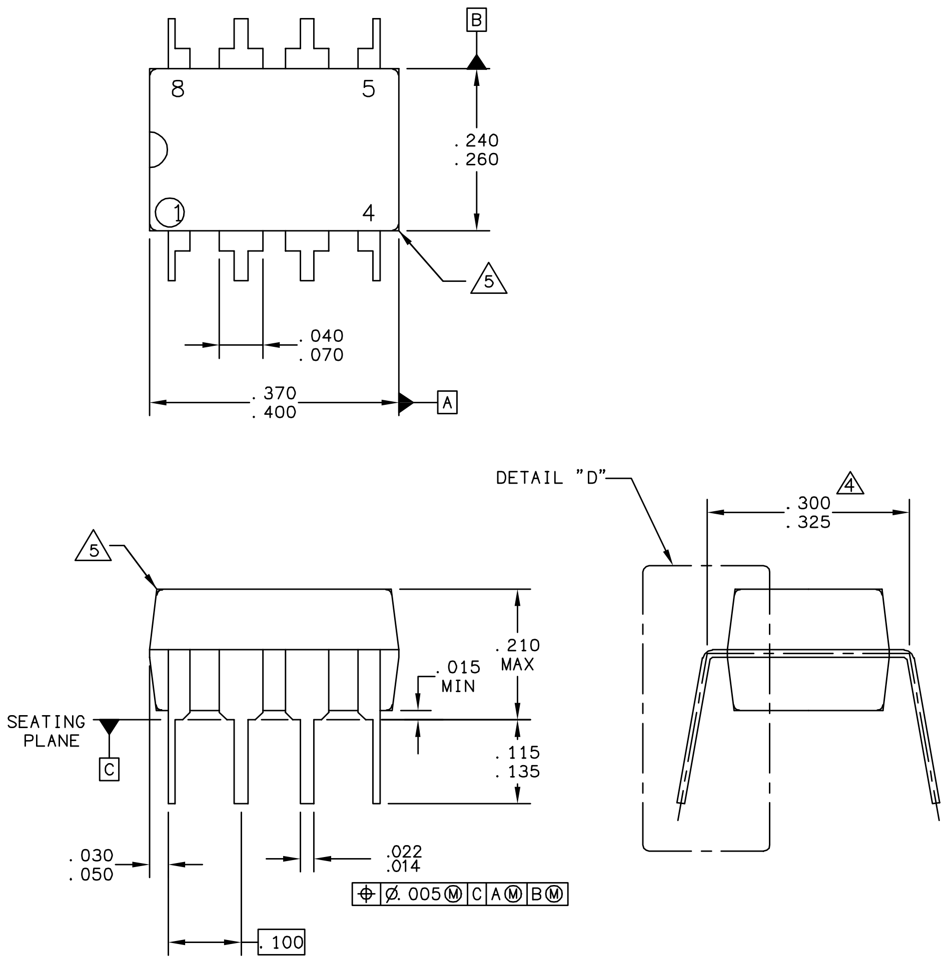

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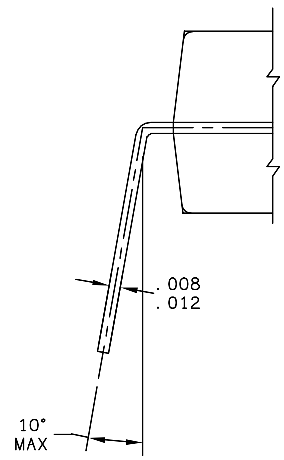

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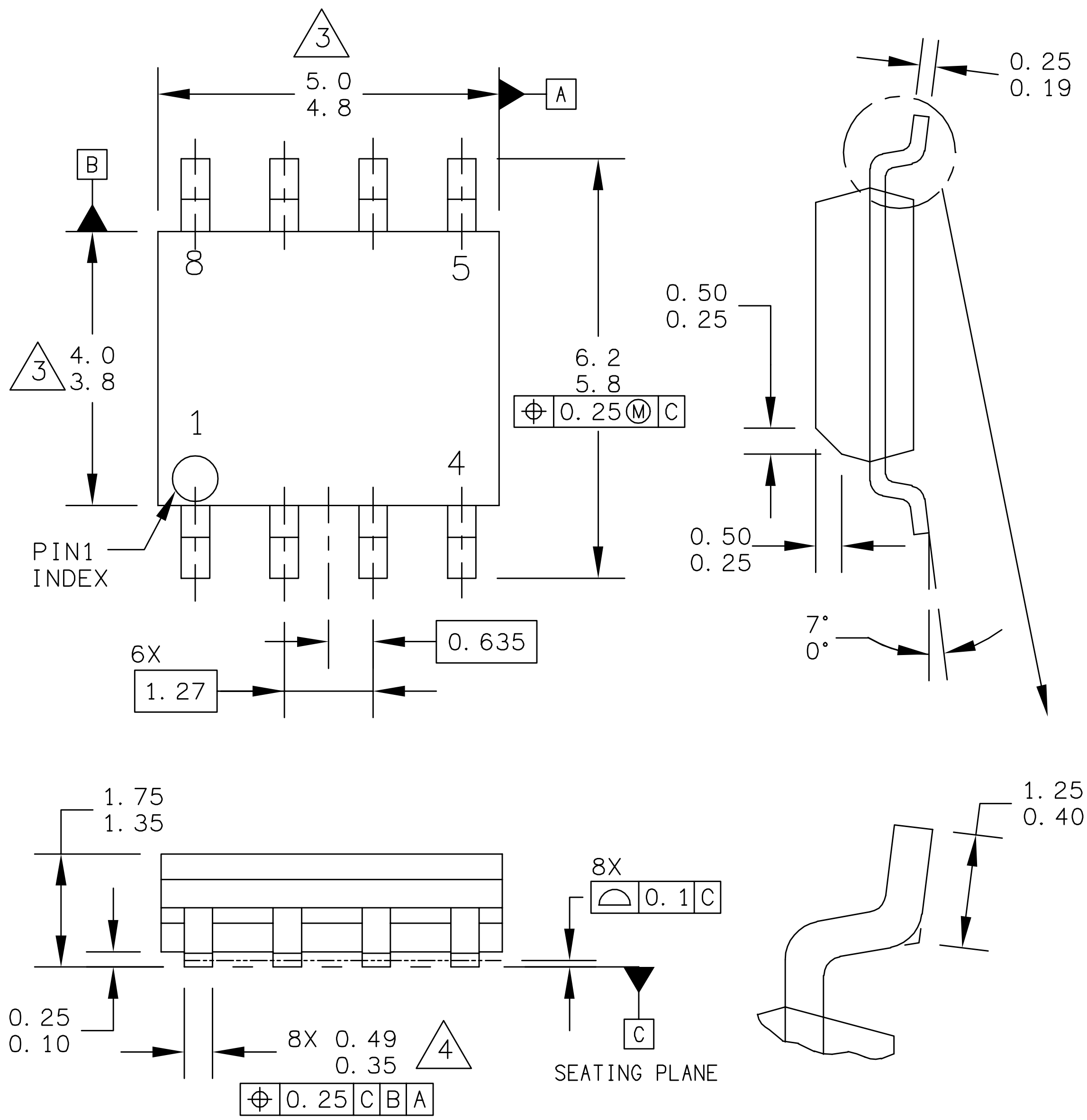

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REVISION HISTORY

REVISION	DATE	DESCRIPTION OF CHANGES
3.0	3/2006	• Implemented Revision History page • Converted to Freescale format

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