

## LM567/LM567C Tone Decoder

### DESCRIPTION

The LM567 and LM567C are general purpose tone decoders designed to provide a saturated transistor switch to ground when an input signal is present within the passband. The circuit consists of an I and Q detector driven by a voltage controlled oscillator which determines the center frequency of the decoder. External components are used to independently set center frequency, bandwidth and output delay.

### 1FEATURES

- 20 to 1 Frequency Range with an External Resistor
- Logic Compatible Output with 100 mA Current Sinking Capability
- Bandwidth Adjustable from 0 to 14%
- High Rejection of Out of Band Signals and Noise
- Immunity to False Signals
- Highly Stable Center Frequency
- Center Frequency Adjustable from 0.01 Hz to 500 kHz

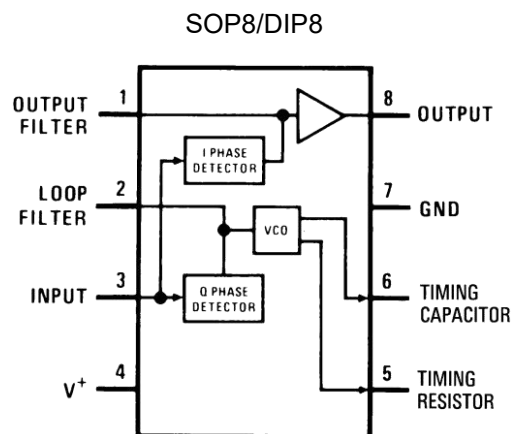
### APPLICATIONS

- Touch Tone Decoding
- Precision Oscillator
- Frequency Monitoring and Control
- Wide Band FSK Demodulation
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### Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM567PG	DIP8	LM567	TUBE	2000pcs/Box
LM567CPG	DIP8	LM567C	TUBE	2000pcs/Box
LM567DRG	SOP8	LM567	REEL	2500pcs/Reel
LM567CDRG	SOP8	LM567C	REEL	2500pcs/Reel

### CONNECTION DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Supply Voltage Pin	9V
Power Dissipation <sup>(4)</sup>	1100 mW
V <sub>8</sub>	15V
V <sub>3</sub>	-10V
V <sub>3</sub>	V <sub>4</sub> + 0.5V
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	0°C to +70°C
Soldering Information	
PDIP Package	
Soldering (10 sec.)	260°C
SOIC Package	
Vapor Phase (60 sec.)	215°C
Infrared (15 sec.)	220°C

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which ensure specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not ensured for parameters where no limit is given, however, the typical value is a good indication of device performance.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
- (3) The maximum junction temperature of the LM567 and LM567C is 150°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient or 45°C/W, junction to case. For the DIP the device must be derated based on a thermal resistance of 110°C/W, junction to ambient. For the SOIC package, the device must be derated based on a thermal resistance of 160°C/W, junction to ambient.

## ELECTRICAL CHARACTERISTICS

AC Test Circuit, TA = 25°C, V+ = 5V

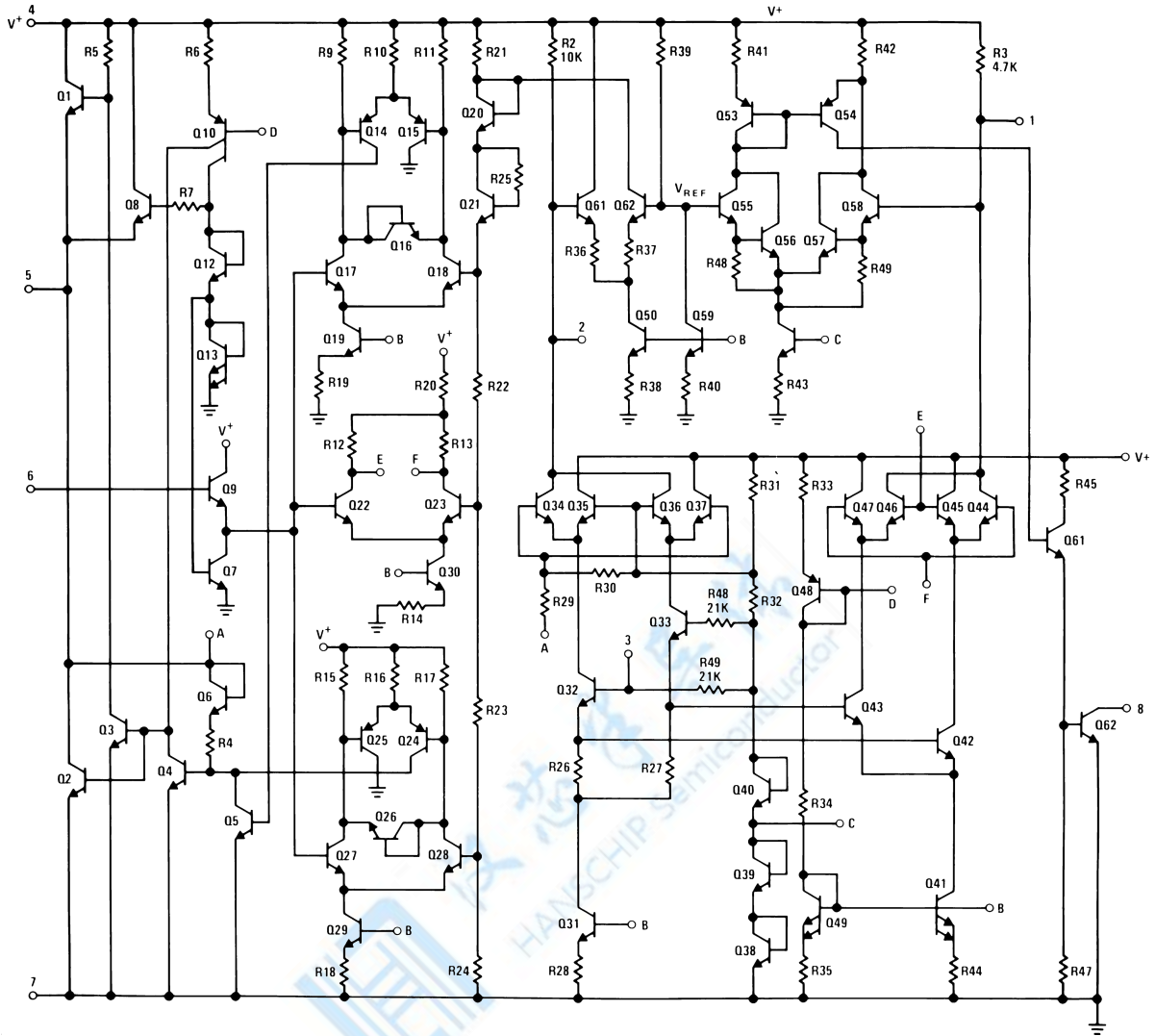
Parameters	Conditions	LM567			LM567C			Units
		Min	Typ	Max	Min	Typ	Max	
Power Supply Voltage Range		4.75	5.0	9.0	4.75	5.0	9.0	V
Power Supply Current Quiescent	R <sub>L</sub> = 20k		6	8		7	10	mA
Power Supply Current Activated	R <sub>L</sub> = 20k		11	13		12	15	mA
Input Resistance		18	20		15	20		kΩ
Smallest Detectable Input Voltage	I <sub>L</sub> = 100 mA, f <sub>i</sub> = f <sub>o</sub>		20	25		20	25	mVrms
Largest No Output Input Voltage	I <sub>c</sub> = 100 mA, f <sub>i</sub> = f <sub>o</sub>	10	15		10	15		mVrms
Largest Simultaneous Outband Signal to Inband Signal Ratio			6			6		dB
Minimum Input Signal to Wideband Noise Ratio	B <sub>n</sub> = 140 kHz		-6			-6		dB
Largest Detection Bandwidth		12	14	16	10	14	18	% of f <sub>o</sub>
Largest Detection Bandwidth Skew			1	2		2	3	% of f <sub>o</sub>
Largest Detection Bandwidth Variation with Temperature			±0.1			±0.1		%/°C
Largest Detection Bandwidth Variation with Supply Voltage	4.75–6.75V		±1	±2		±1	±5	%V
Highest Center Frequency		100	500		100	500		kHz

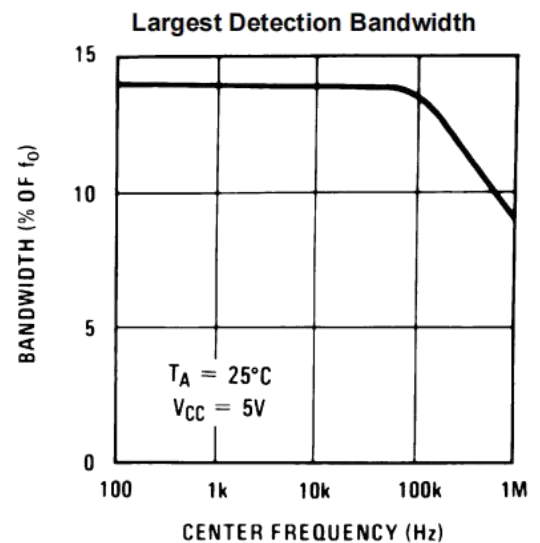
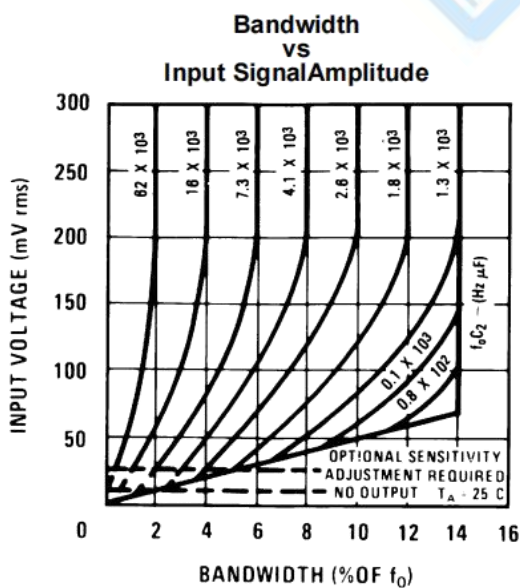
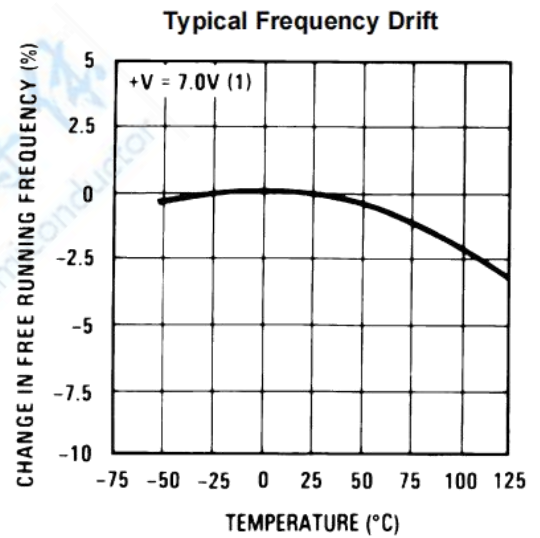
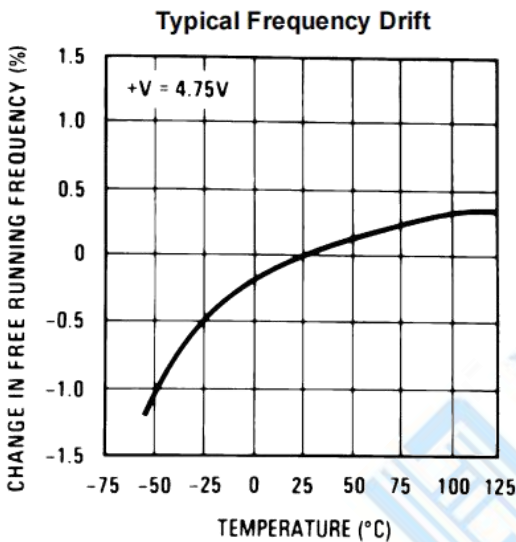
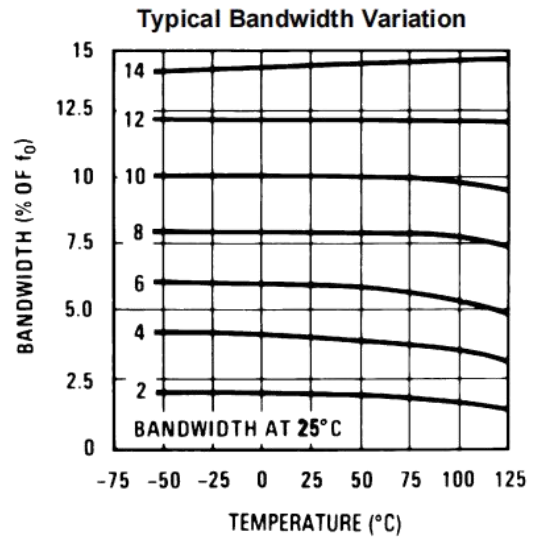
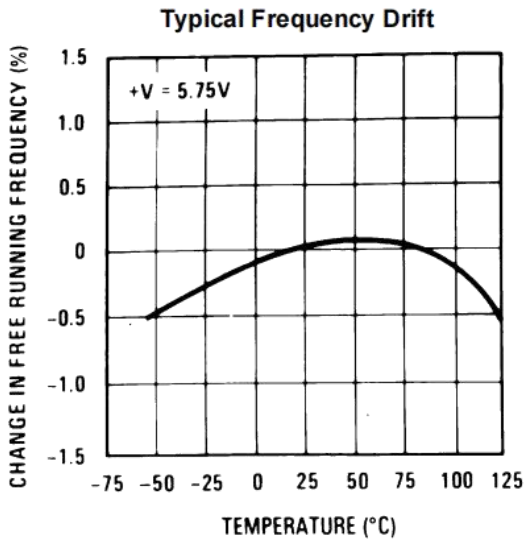
**ELECTRICAL CHARACTERISTICS (continued)**

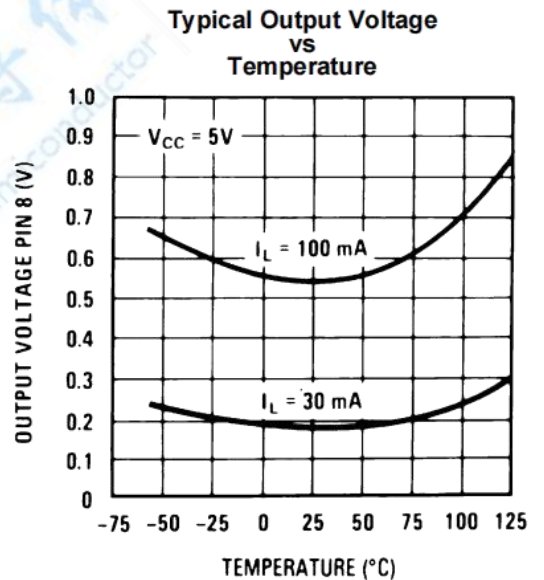
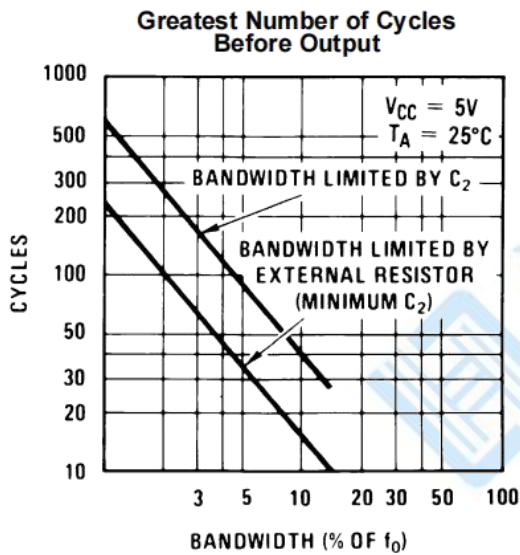
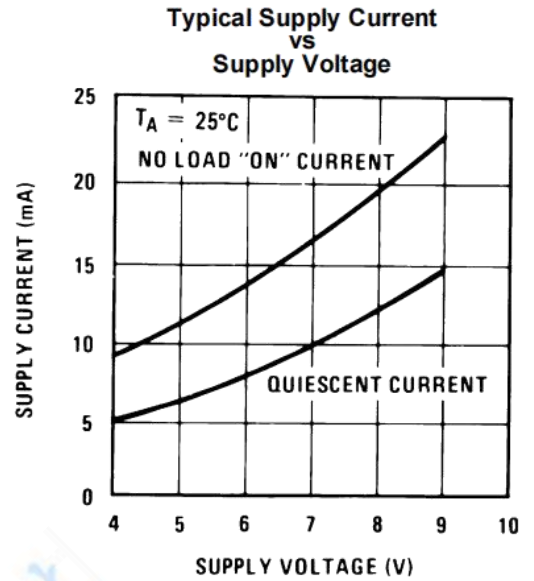
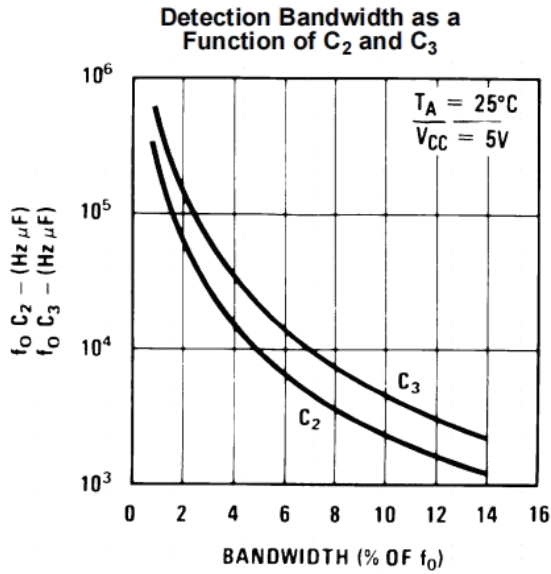
 AC Test Circuit,  $T_A = 25^\circ\text{C}$ ,  $V_+ = 5\text{V}$ 

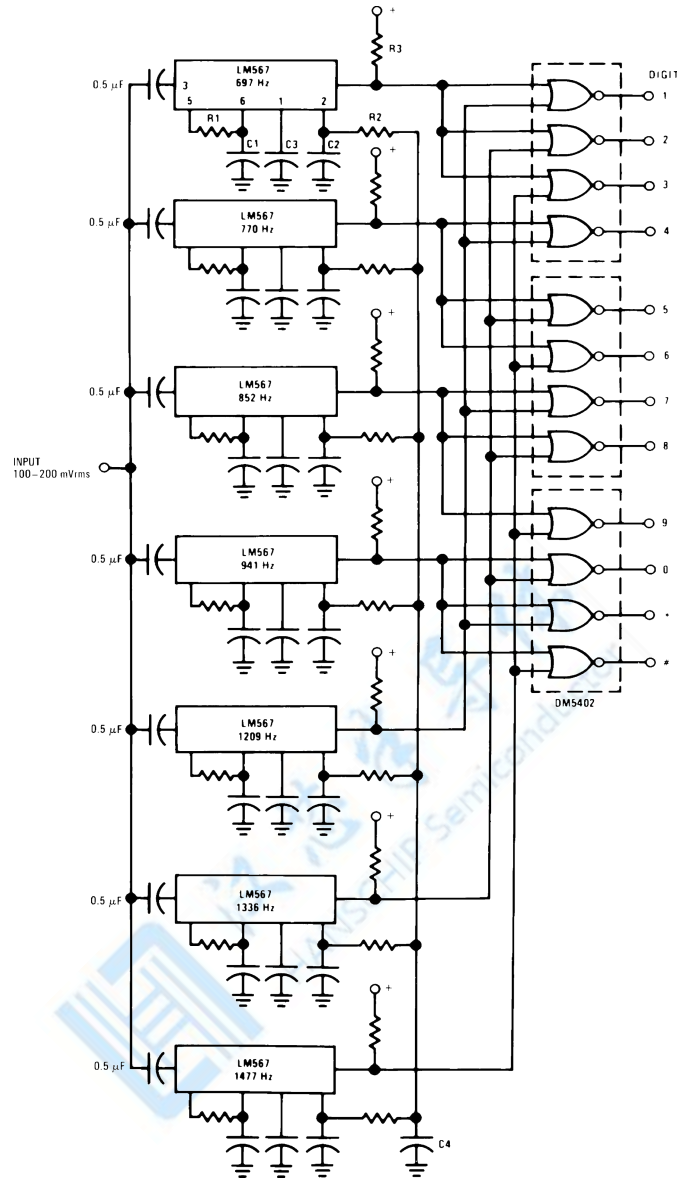
Parameters	Conditions	LM567			LM567C			Units
		Min	Typ	Max	Min	Typ	Max	
Center Frequency Stability (4.75–5.75V)	$0 < T_A < 70$		$35 \pm 60$			$35 \pm 60$		ppm/ $^\circ\text{C}$
	$-55 < T_A < +125$		$35 \pm 140$			$35 \pm 140$		ppm/ $^\circ\text{C}$
Center Frequency Shift with Supply Voltage	4.75V–6.75V		0.5	1.0		0.4	2.0	%/V
	4.75V–9V			2.0			2.0	%/V
Fastest ON-OFF Cycling Rate			$f_o/20$			$f_o/20$		
Output Leakage Current	$V_B = 15\text{V}$		0.01	25		0.01	25	$\mu\text{A}$
Output Saturation Voltage	$e_i = 25\text{ mV}$ , $I_B = 30\text{ mA}$		0.2	0.4		0.2	0.4	V
	$e_i = 25\text{ mV}$ , $I_B = 100\text{ mA}$		0.6	1.0		0.6	1.0	
Output Fall Time			30			30		ns
Output Rise Time			150			150		ns



**SCHEMATIC DIAGRAM**


**TYPICAL PERFORMANCE CHARACTERISTICS**


**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**


**TYPICAL APPLICATIONS**


Component values (typ)

R1 6.8 to 15k

R2 4.7k

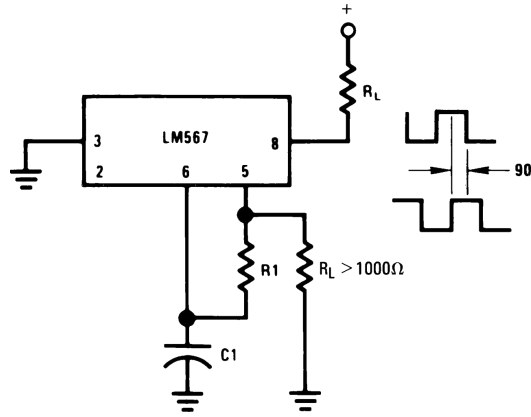
R3 20k

C1 0.10 mfd

C2 1.0 mfd 6V

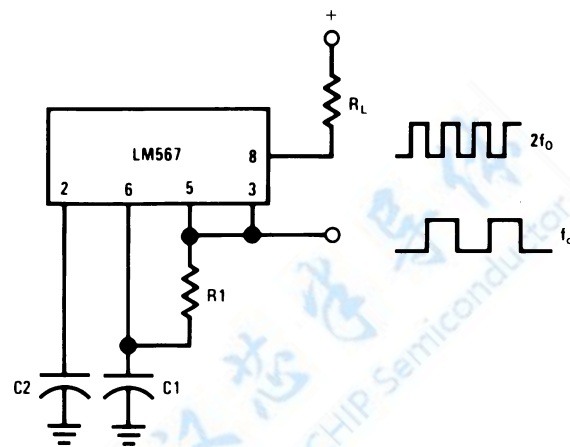
C3 2.2 mfd 6V

C4 250 mfd 6V

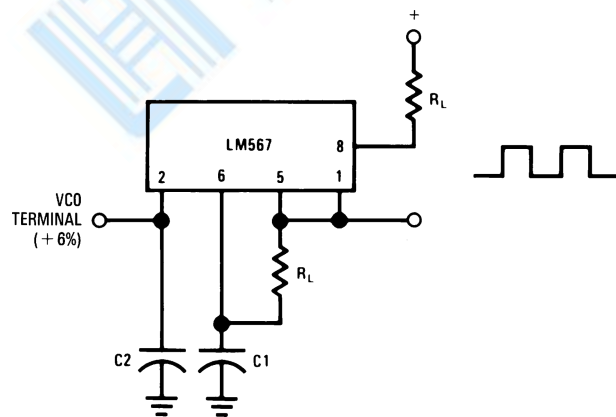


Connect Pin 3 to 2.8V to Invert Output

**Figure 14. Oscillator with Quadrature Output**

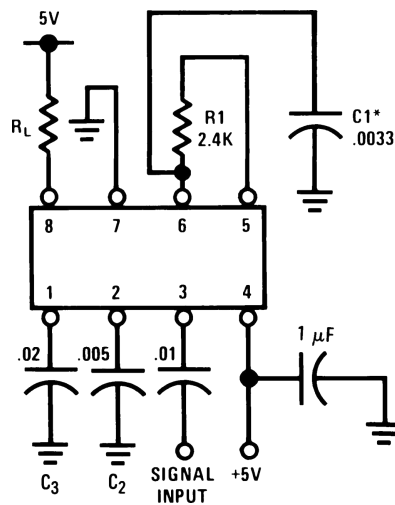


**Figure 15. Oscillator with Double Frequency Output**



**Figure 16. Precision Oscillator Drive 100 mA Loads**



**AC TEST CIRCUIT**


$f_i = 100 \text{ kHz} + 5V$

\*Note: Adjust for  $f_o = 100 \text{ kHz}$ .

**APPLICATIONS INFORMATION**

The center frequency of the tone decoder is equal to the free running frequency of the VCO. This is given by

$$f_o \cong \frac{1}{1.1 R_1 C_1}$$

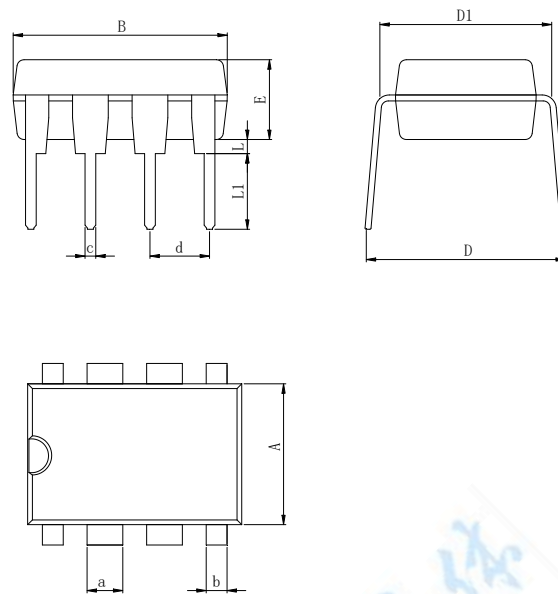
The bandwidth of the filter may be found from the approximation

$$BW = 1070 \sqrt{\frac{V_i}{f_o C_2}} \text{ in \% of } f_o$$

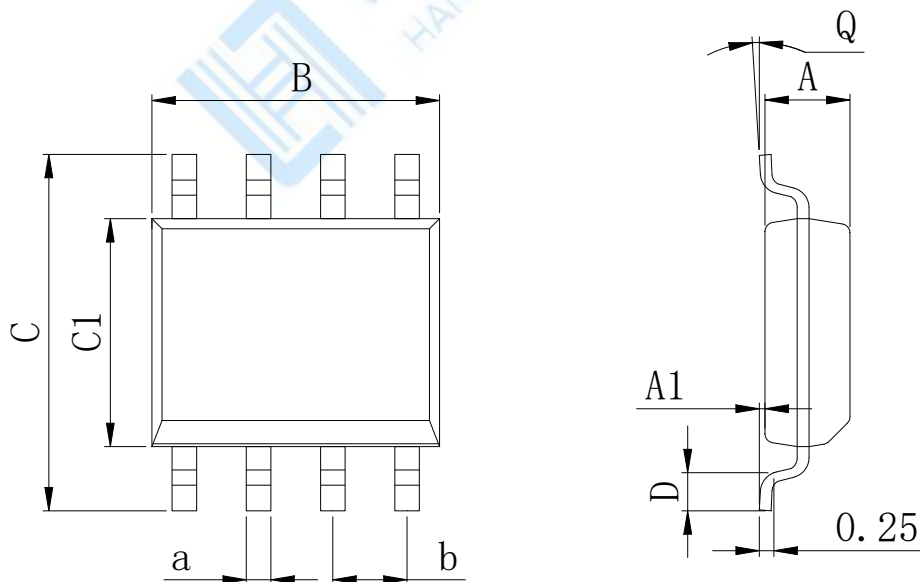
where

$V_i$  = Input voltage (volts rms),  $V_i \leq 200\text{mV}$

$C_2$  = Capacitance at Pin 2( $\mu\text{F}$ )

**Physical Dimensions**
**DIP8**

**Dimensions In Millimeters(DIP8L)**

Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	9.00	8.40	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	9.50	9.00	7.82	3.55	0.70	3.60	1.55	0.90	0.50	

**SOP8 (150mil)**

**Dimensions In Millimeters(SOP8)**

Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	4.90	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	5.10	6.20	4.00	0.80	8°	0.45	

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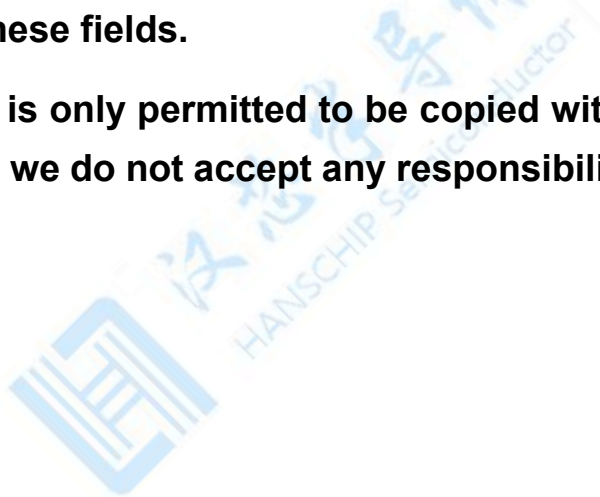
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