

LM567/LM567C Tone Decoder

General 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.

Features

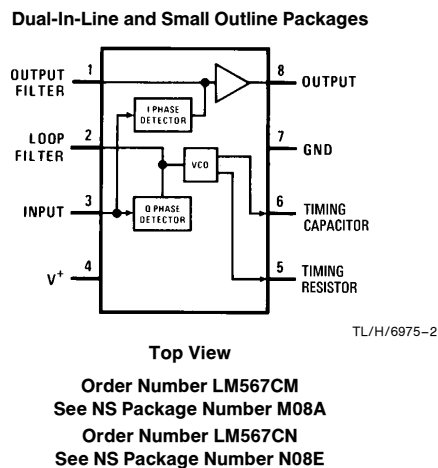
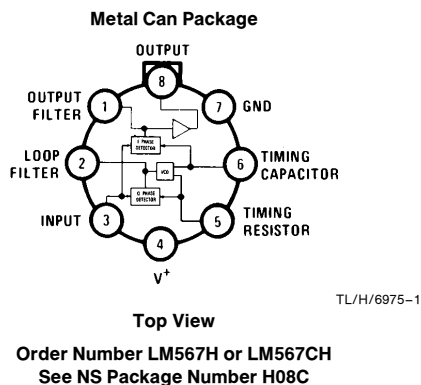
- 20 to 1 frequency range with an external resistor
- Logic compatible output with 100 mA current sinking capability

- 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
- Ultrasonic controls
- Carrier current remote controls
- Communications paging decoders

Connection Diagrams



Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage Pin	9V
Power Dissipation (Note 1)	1100 mW
V ₈	15V
V ₃	−10V
V ₃	V ₄ + 0.5V
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	
LM567H	−55°C to +125°C
LM567CH, LM567CM, LM567CN	0°C to +70°C

Soldering Information

Dual-In-Line Package	
Soldering (10 sec.)	260°C
Small Outline Package	
Vapor Phase (60 sec.)	215°C
Infrared (15 sec.)	220°C

See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.

Electrical Characteristics

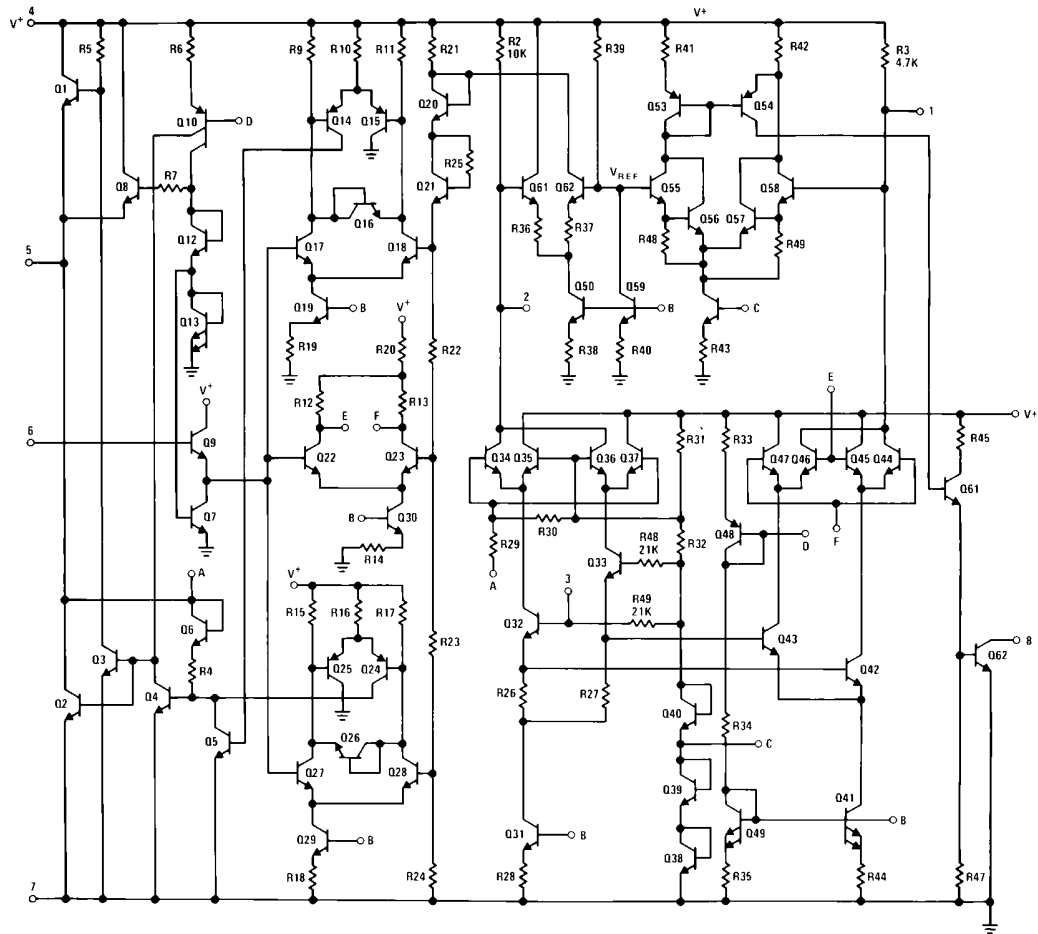
AC Test Circuit, T_A = 25°C, V⁺ = 5V

Parameters	Conditions	LM567			LM567C/LM567CM			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 _L = 20k		6	8		7	10	mA
Power Supply Current Activated	R _L = 20k		11	13		12	15	mA
Input Resistance		18	20		15	20		kΩ
Smallest Detectable Input Voltage	I _L = 100 mA, f _i = f _o		20	25		20	25	mVrms
Largest No Output Input Voltage	I _C = 100 mA, f _i = f _o	10	15		10	15		mVrms
Largest Simultaneous Outband Signal to Inband Signal Ratio			6			6		dB
Minimum Input Signal to Wideband Noise Ratio	B _n = 140 kHz		−6			−6		dB
Largest Detection Bandwidth		12	14	16	10	14	18	% of f _o
Largest Detection Bandwidth Skew			1	2		2	3	% of f _o
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
Center Frequency Stability (4.75–5.75V)	0 < T _A < 70 −55 < T _A < +125		35 ± 60 35 ± 140			35 ± 60 35 ± 140		ppm/°C ppm/°C
Center Frequency Shift with Supply Voltage	4.75V – 6.75V 4.75V – 9V		0.5 0.6	1.0 2.0		0.4 0.6	2.0 2.0	%/V %/V
Fastest ON-OFF Cycling Rate			f _o /20			f _o /20		
Output Leakage Current	V ₈ = 15V		0.01	25		0.01	25	μA
Output Saturation Voltage	e _i = 25 mV, I ₈ = 30 mA e _i = 25 mV, I ₈ = 100 mA		0.2 0.6	0.4 1.0		0.2 0.6	0.4 1.0	V
Output Fall Time			30			30		ns
Output Rise Time			150			150		ns

Note 1: 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 Small Outline package, the device must be derated based on a thermal resistance of 160°C/W, junction to ambient.

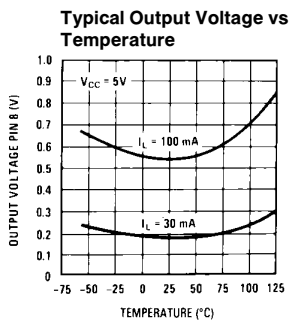
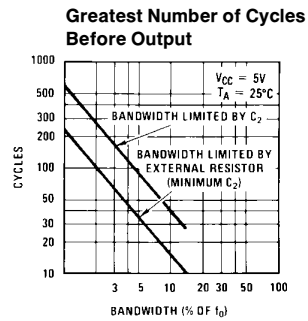
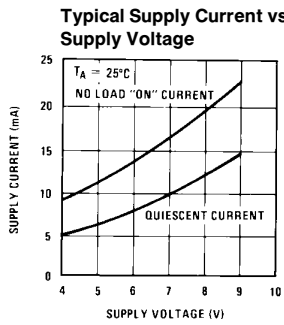
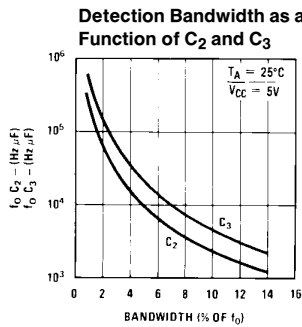
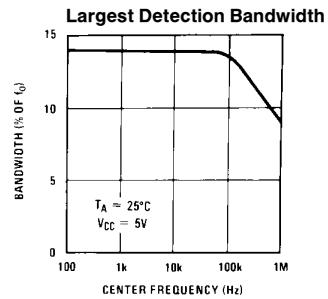
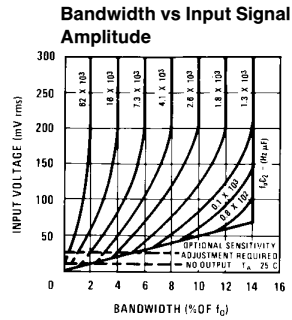
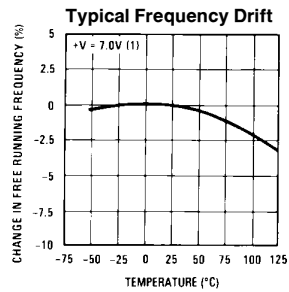
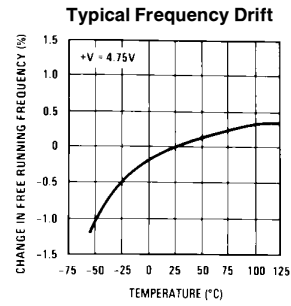
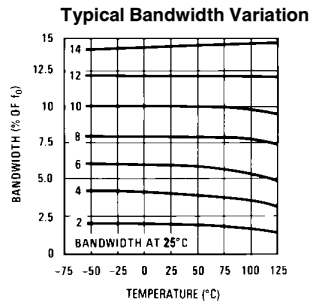
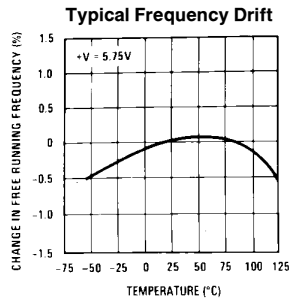
Note 2: Refer to RETS567X drawing for specifications of military LM567H version.

Schematic Diagram



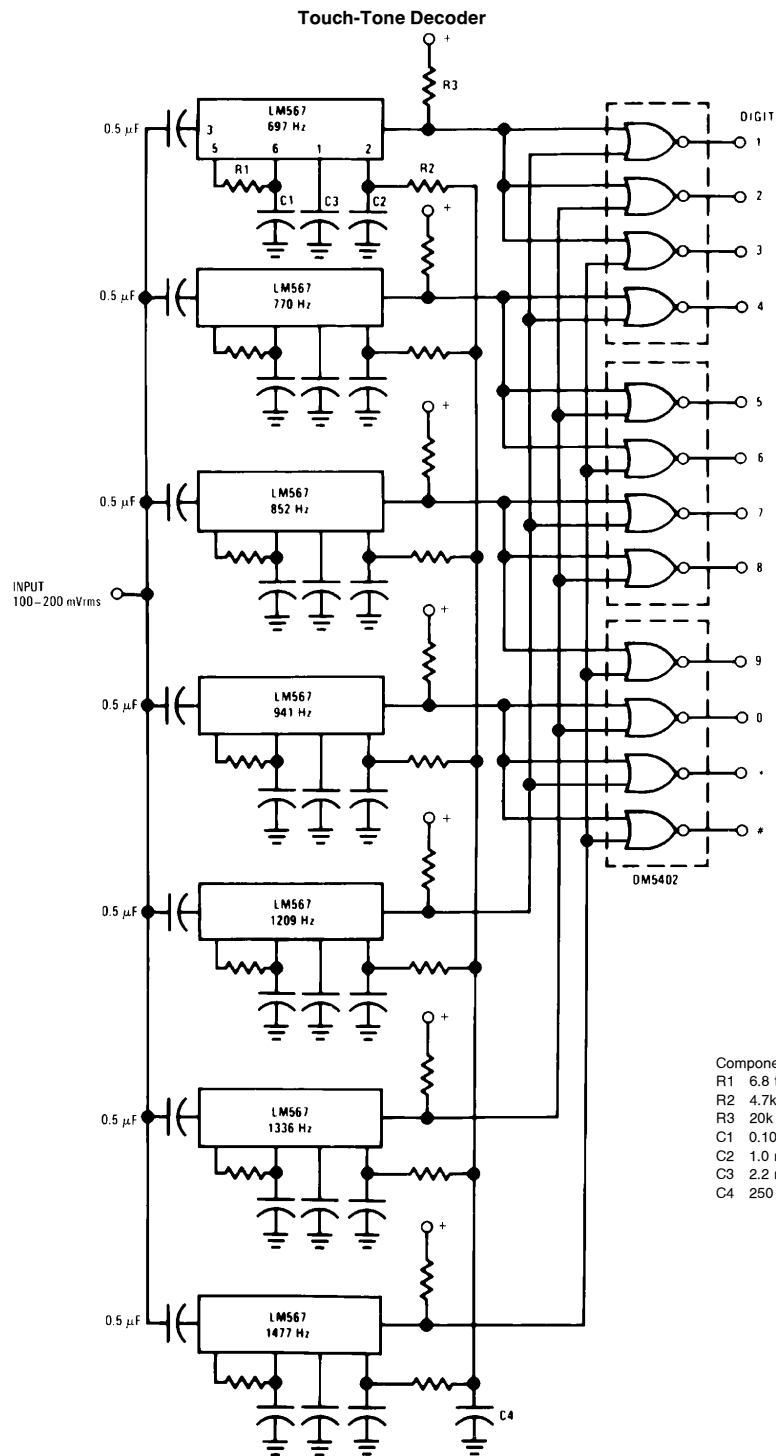
TL/H/6975-3

Typical Performance Characteristics



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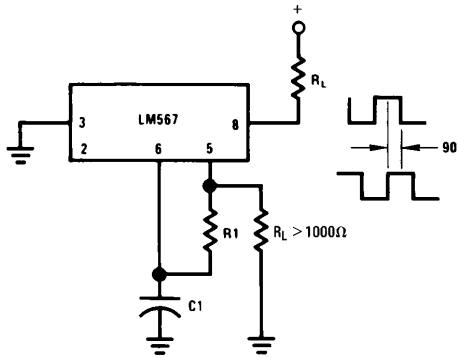
Typical Applications



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Typical Applications (Continued)

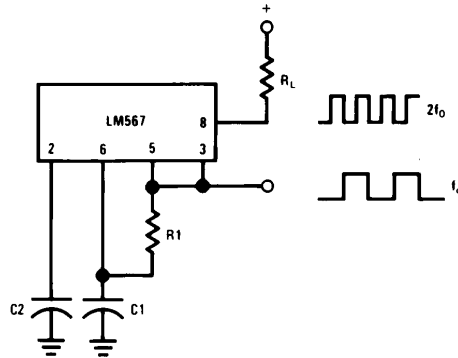
Oscillator with Quadrature Output



Connect Pin 3 to 2.8V to Invert Output

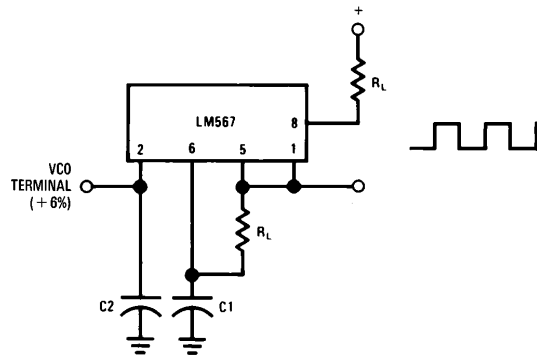
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Oscillator with Double Frequency Output



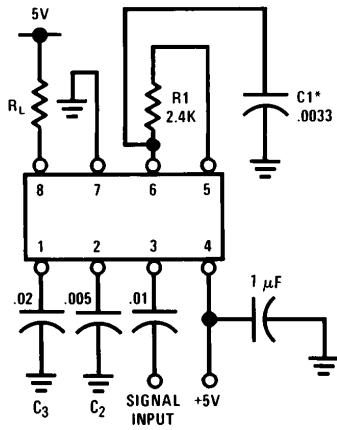
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Precision Oscillator Drive 100 mA Loads



TL/H/6975-8

AC Test Circuit



TL/H/6975-9

$f_i = 100 \text{ kHz} + 5V$
*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 (μF)