March 25, 2012



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%

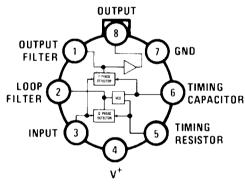
- High rejection of out of band signals and noise
- Immunity to false signals
- Highly stable center frequency
- Center frequency adjustable from 0.01 Hz to 500 kHz

Applications

- Touch tone decoding
- Precision oscillator
- Frequency monitoring and control
- Wide band FSK demodulation
- Ultrasonic controls
- Carrier current remote controls
- Communications paging decoders

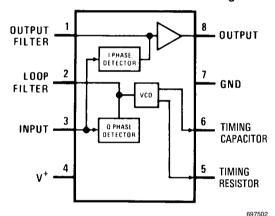
Connection Diagrams

Metal Can Package



Top View
Order Number LM567H or LM567CH
See NS Package Number H08C
OBSOLETE

Dual-In-Line and Small Outline Packages



Top View
Order Number LM567CM
See NS Package Number M08A
Order Number LM567CN
See NS Package Number N08E

Absolute Maximum Ratings (Note 1)

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

Supply Voltage Pin 9V Power Dissipation (Note 2) 1100 mW 15V V_3 -10V $V_4 + 0.5V$ 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 220°C Infrared (15 sec.)

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, $T_{\Delta} = 25^{\circ}\text{C}$, $V^{+} = 5\text{V}$

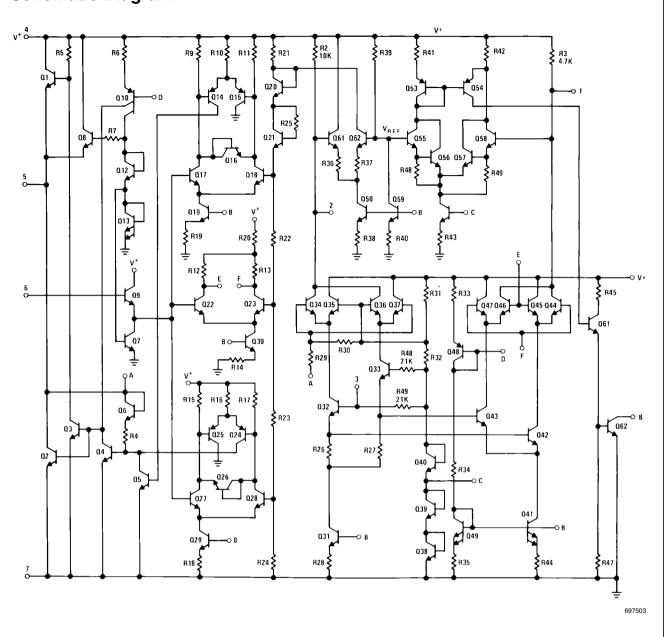
B	0	LM567			LM567C/LM567CM				
Parameters	Conditions	Min	Тур	Max	Min	Тур	Max	Units	
Power Supply Voltage Range		4.75	5.0	9.0	4.75	5.0	9.0	V	
Power Supply Current Quiescent	R _L = 20k		6	8		7	10	mA	
Power Supply Current Activated	R _L = 20k		11	13		12	15	mA	
Input Resistance		18	20		15	20		kΩ	
Smallest Detectable Input Voltage	$I_L = 100 \text{ mA}, f_i = f_o$		20	25		20	25	mVrms	
Largest No Output Input Voltage	$I_C = 100 \text{ mA}, f_i = f_o$	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	1.0 2.0		0.4	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	μΑ	
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: 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 guarantee specific performance limits. Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the Operating Ratings. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

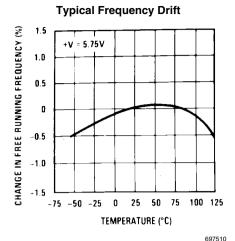
Note 2: The maximum junction temperature of the LM567 and LM567C is 150°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient or 45°C/W, junction to case. For the DIP the device must be derated based on a thermal 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

Note 3: Refer to RETS567X drawing for specifications of military LM567H version.

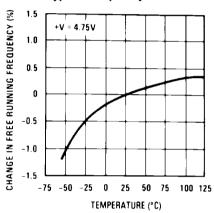
Schematic Diagram



Typical Performance Characteristics

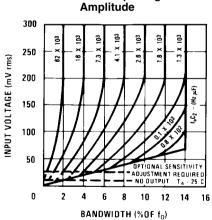


Typical Frequency Drift

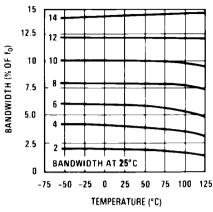


Bandwidth vs Input Signal

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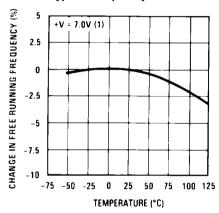


Typical Bandwidth Variation



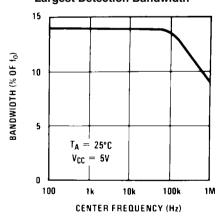
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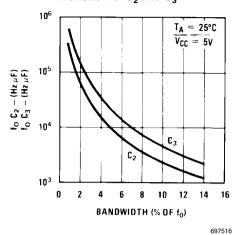


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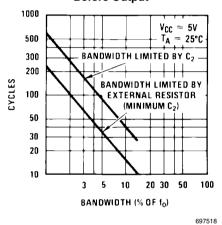
Largest Detection Bandwidth



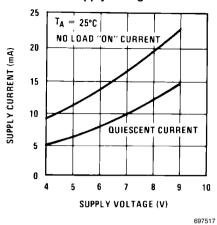
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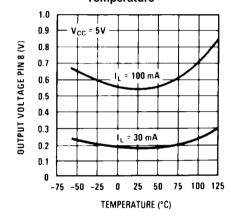
Greatest Number of Cycles Before Output



Typical Supply Current vs Supply Voltage



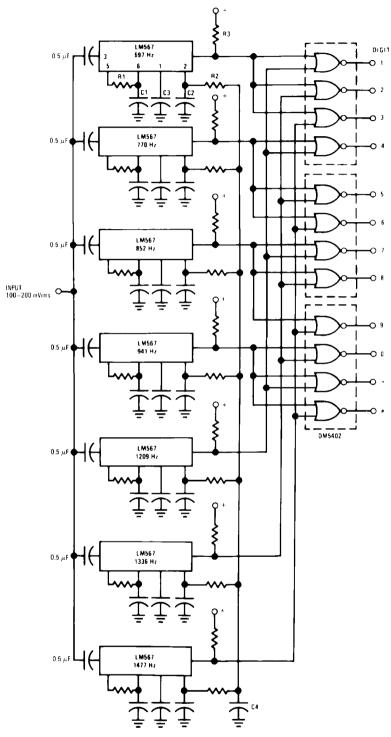
Typical Output Voltage vs Temperature



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Typical Applications

Touch-Tone Decoder

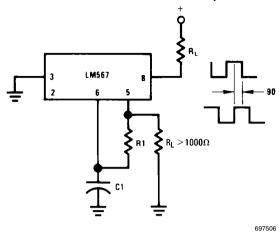


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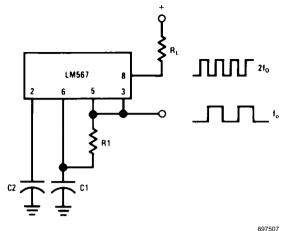
Component values (typ)

- 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

Oscillator with Quadrature Output

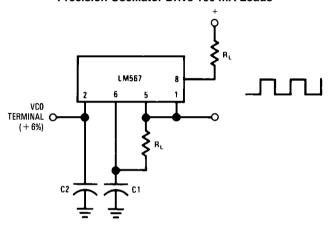


Oscillator with Double Frequency Output

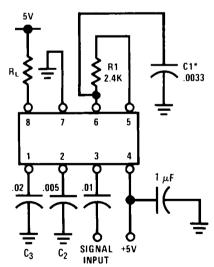


Connect Pin 3 to 2.8V to Invert Output

Precision Oscillator Drive 100 mA Loads



AC Test Circuit



697509

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

*Note: Adjust for $f_0 = 100 \text{ kHz}$.

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

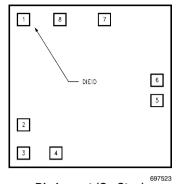
BW = 1070
$$\sqrt{\frac{V_i}{f_o C_2}}$$
 in % of f_o

Where:

V_i = Input voltage (volts rms), V_i ≤ 200mV

 C_2 = Capacitance at Pin 2(µF)

LM567C MDC MWC Tone Decoder



Die Layout (C - Step)

Die/Wafer Characteristics

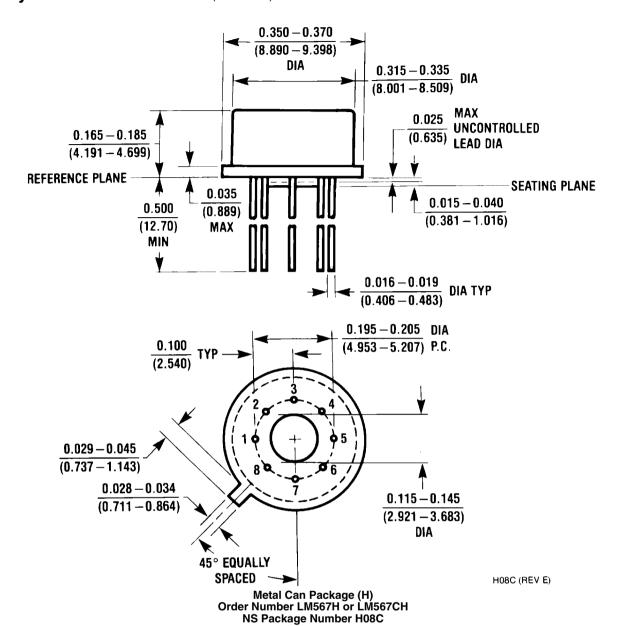
Fabrication Attributes		General Die Information			
Physical Die Identification	LM567C	Bond Pad Opening Size (min)	91μm x 91μm		
Die Step	С	Bond Pad Metalization	0.5% COPPER_BAL. ALUMINUM		
Physical Attributes		Passivation	VOM NITRIDE		
Wafer Diameter	150mm	Back Side Metal	BARE BACK		
Dise Size (Drawn)	1600µm x 1626µm 63.0mils x 64.0mils	Back Side Connection	Floating		
Thickness	406µm Nominal				
Min Pitch	198µm Nominal				

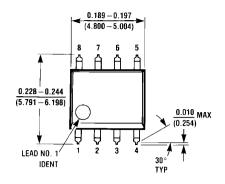
Special Assembly Requirements:
Note: Actual die size is rounded to the nearest micron.

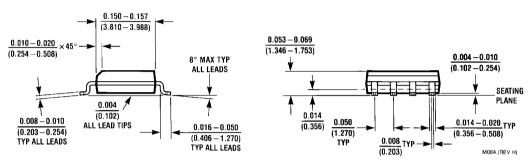
		Die Bond Pad Co	ordinate Location	s (C - Step)			
(Referenced to die center, coordinates in μm) NC = No Connection, N.U. = Not Used							
SIGNAL NAME PA	PAD# NUMBER	X/Y COORDINATES		PAD SIZE			
		Х	Υ	Х		Y	
OUTPUT FILTER	1	-673	686	91	х	91	
LOOP FILTER	2	-673	-419	91	х	91	
INPUT	3	-673	-686	91	х	91	
V+	4	-356	-686	91	х	91	
TIMING RES	5	673	-122	91	Х	91	
TIMING CAP	6	673	76	91	х	91	
GND	7	178	686	117	х	91	
OUTPUT	8	-318	679	117	х	104	

IN U.S.A	
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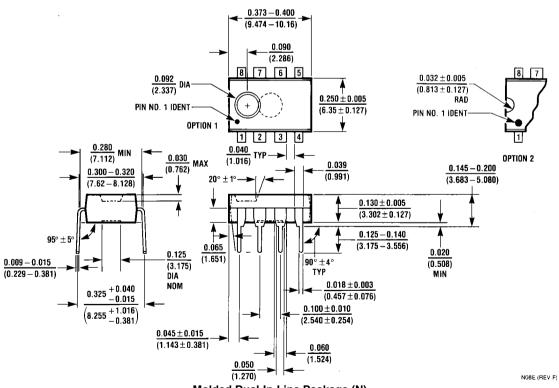
Physical Dimensions inches (millimeters) unless otherwise noted







Small Outline Package (M) Order Number LM567CM NS Package Number M08A



Molded Dual-In-Line Package (N) Order Number LM567CN NS Package Number N08E

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