

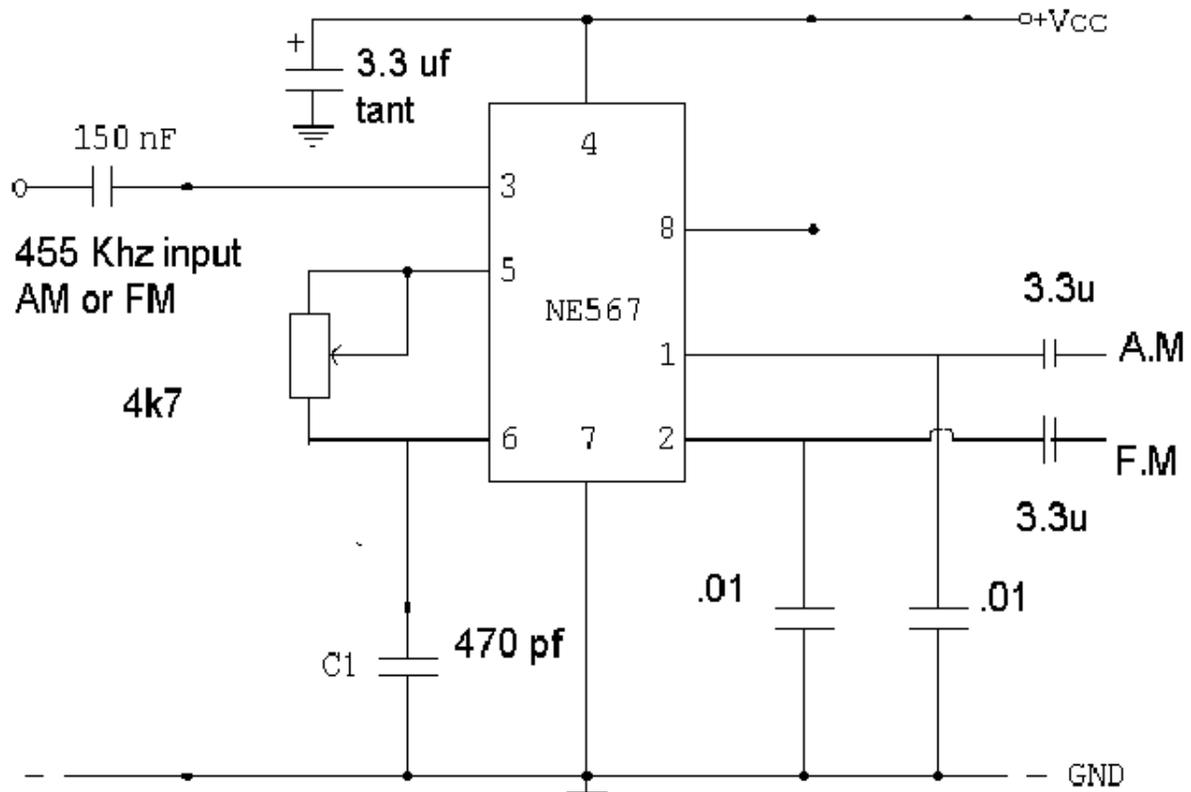
From: [http://www.amalgamate2000.com/radio-hobbies/radio/ne567\\_tone\\_decoder\\_as\\_am\\_fm\\_de.htm](http://www.amalgamate2000.com/radio-hobbies/radio/ne567_tone_decoder_as_am_fm_de.htm)

### **NE567 Tone Decoder as AM FM demodulator at 455 KHz**

The Ne567 tone decoder IC is a phase lock loop designed for detection of audio tones , it is very useful and has been around almost as long as the NE555 . in order to detect tones within its adjustable capture range ,it uses a synchronous demodulation technique where the VCO output is fed to the second on board balanced mixer in quadrature ( actually 80 degrees ) but that minor error doesnt prevent it from performing its desired function very well . Thus it has a Synchronous detector for AM ! The ic is rated up to 500 KHz . and being a synchronous demodulator and a PLL there is no reason why it shouldn't demodulate Frequency modulated signals and Amplitude modulated signals .

In order to work at 455 KHz, the Correct resistor and capacitor need to be chosen , 470 pf and a 4.7 K ohm variable enable tuning either side of the wanted VCO frequency , the only two other variables to choose are the filter capacitors for the FM loop and the output of the synchronous demodulator. Because we are not interested in the Lock function of the ic at the moment, the values will be somewhat different than those suggested by the I.C designer . For a dedicated FM only demodulator , there is no reason why the correct lock range capacitor be used on the synchronous detector to enable an Audio mute function simultaneously to Frequency demodulation . I built up a simple double sided etch PC board and made an operational circuit , the FM loop capacitor was a 470 pf bypass and the AM detector was .01 uf , the v+ rail was 6 volts via a 3 terminal regulator . The VCO was set to 455 KHz and the fm audio output was connected to my usual amplified computer speakers , these are not the most sensitive audio amp but 10's of millivolts of audio input yield audio loud enough to hear on the work bench .

I connected the 50 ohm source from the signal generator directly to the capacitor input of the NE567 , this is a rather large mismatch as the input impedance of the 567 is 25 k ohms ( more about this later) I connected the audio amp input to the Demodulated fm output pin 1 , and punched up 455 KHz , FM , 2.5KHz Dev at 1 KHz tone , and then ramped the RF output amplitude up from -100 dbm until I heard sound from the speakers ..



NE567 Test Circuit 455Khz +6 v rail

I tested the PLL at 5 KHz and 2.5 KHz deviation, and measured the audio output level with the oscilloscope in high impedance (~1 meg) mode. The NE567 requires a minimum of -35 dBm across 50 ohms to achieve reliable lock. I noticed the value of the filter capacitor has an influence on the broadband noise appearing from that pin (2), in this test I had a 470 Pf, I noticed the rise in apparent level on the oscilloscope, with increases in the input level for FM it should remain the same, but I suspect not having an adequate low pass audio filter network, allowed the broadband noise to increase. Subjectively I did not detect an increase in the loudness of the demodulated signal as the input level stepped up..

Input Level	5.0 KHz	2.5 KHz
-35 dBm	58 mV	29 mV
-30	59	31
-25	62	32
-20	64	35
-15	66	36
-10	67	37
-5	72	40

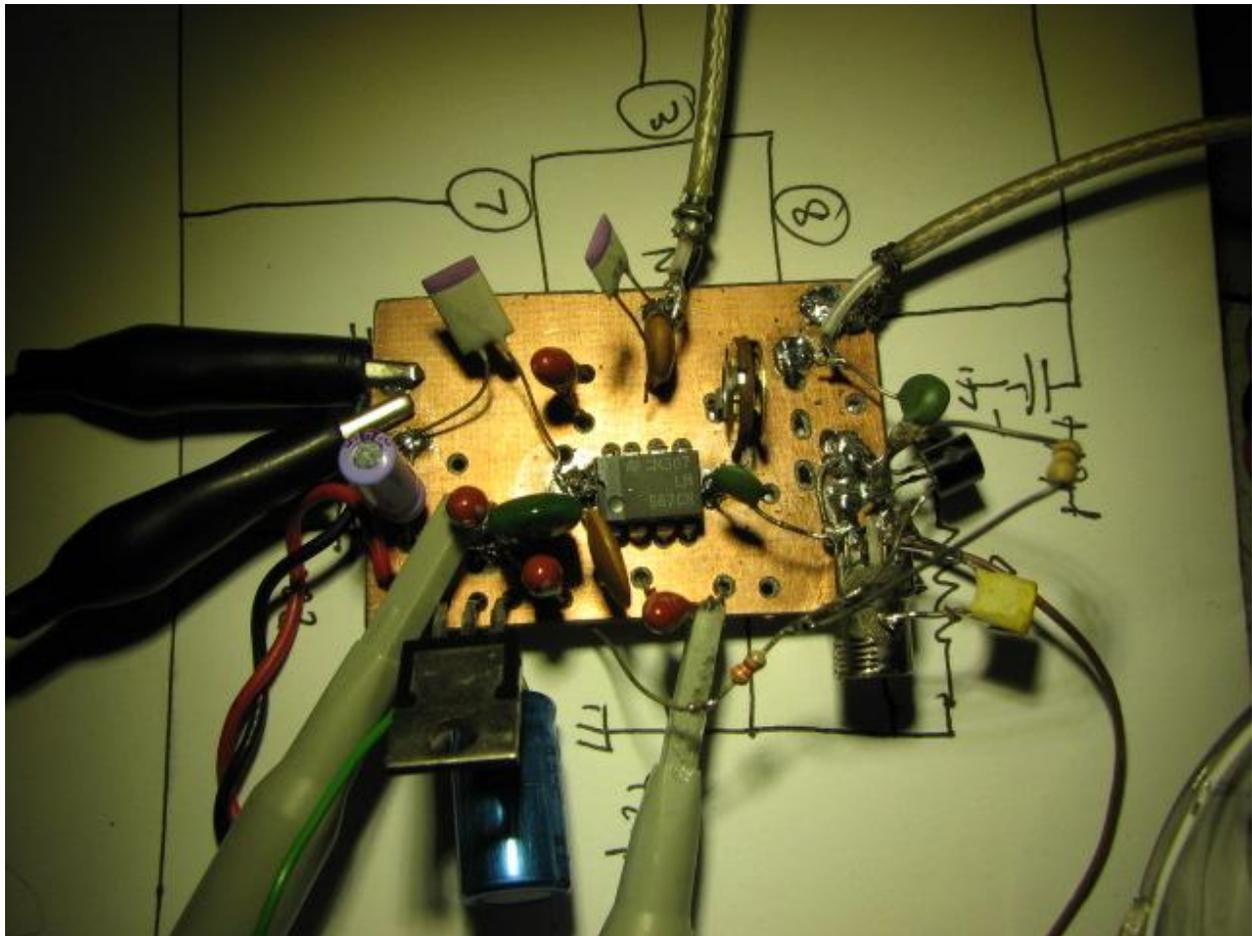
As a matter of interest I connected the input to the NE567 pll to the tracking output of the spectrum Analyser ( at -20 dbm) and connected to the input of the analyser a capacity probe placed very close to the VCO components to look at the VCO frequency, I manually adjusted the VCO pot ( 4K7) for

maximum frequency and looked at the flat plateau ( lock range) on the screen this NE567 at +6v rail would go to a centre frequency of 1200Khz and sweep +/- 350 Khz . considerably higher than the 500 Khz advertised in the data sheet !

The next test was 455 Khz ,1 Khz tone , AM 80% modulation over a range of input levels and look at the audio output level from the synchronous demodulator (pin 1 )

-40 dBm	44 mV	
-35	77	Clean sounding and looks correct on scope
-30	130	
-25	233	
-20	320	
-15	350	1 Khz tone starting to sound slightly distorted
-10	305	sine wave shows distortion and sounds it
-5	195	sine wave shows more distortion and sounds worse

There is quite a wide dynamic range over which the synch demodulation sounds very clean and in a normal radio receiver the levels would be chosen to be held by the AGC in the receiver



There is a large mismatch between the 50 ohm signal source at 455 KHz and the 25Kohm input impedance of the ne567 , I placed an interstage transformer in the circuit with the low impedance ends

