Features

- 3.8MHz Amateur Phone Band Receiver
- 100 KHz Tuning Range
- Wideband Hi-Fi AM mode reception
- Single Sideband mode with on board BFO
- Uses single chip TRF TA7642 IC
- Low impedance 8 ohm speaker output
- Main tuning with separate Bandspread
- RF Gain and AF Gain controls
- 9-12 VDC operation
- Varactor Diode tuning
- NE602 1st Mixer
- 455 KHz IF with ceramic filter
- TDA7052 audio amplifier IC
- On board 6 volt regulator

Description

The AMR75 is an experimental AM phone band receiver which makes use of a TDA7642 TRF receiver IC along with a conventional NE602 first mixer stage. The design provides a wide bandwidth Hi-Fi output which is suitable for listening to the AM groups that are popular on 75 meters. The radio was designed as a nostalgic callback to vacuum tube receivers of the 1950s with main tuning, band spread, 455 KHz IF, BFO, and plenty of audio output. This radio is called experimental since the builder may want to tailor the radio's performance by adjusting component values. Also the builder needs to supply a suitable enclosure or open chassis platform.

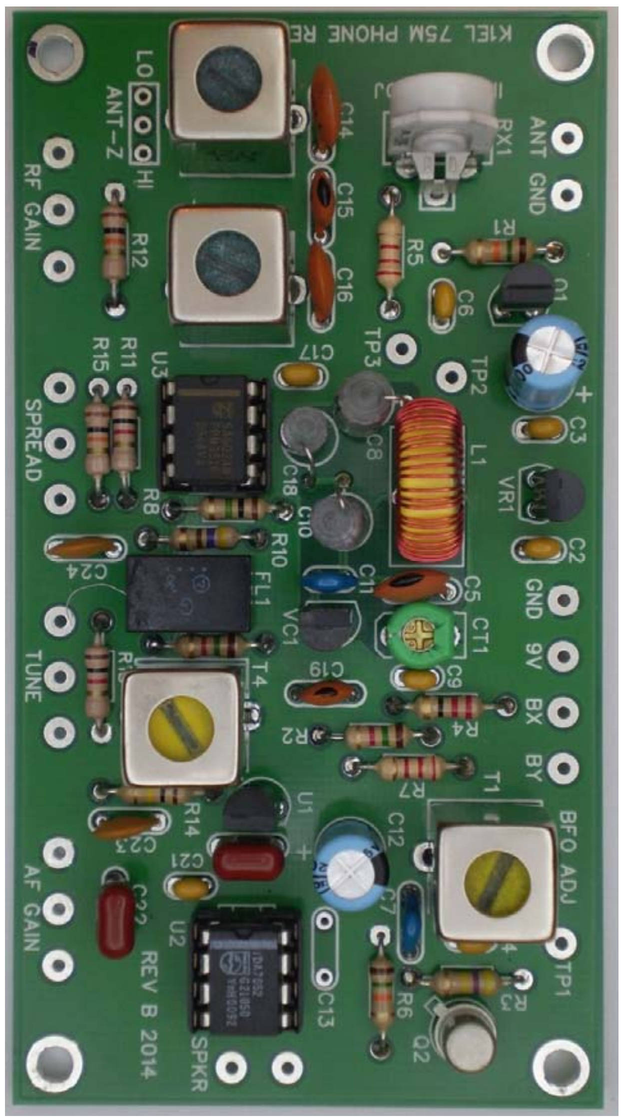


Figure 1 – Assembled AMR75 Board

Theory of Operation

This discussion will refer to the block diagram on page 3 and the schematics on page 4. We will start at the antenna input with a two stage input bandpass filter consisting of two 10.7 MHZ 42IF123 IF transformers that have been padded to resonate on the 75 meter band. An input impedance selector is provided to allow the radio to work with a tuned low impedance antenna, such as a dipole, or a high impedance antenna such a random length of wire. An NE602A is configured as a first mixer with an internal VFO oscillator. The oscillator is tuned with a varactor diode. The VFO frequency is determined by the DC voltage applied to the varactor which controls its capacitance. Two tuning controls are provided, a Main tuning control and a Bandspread tuning control. The Main tuning provides a coarse voltage adjustment to the varactor while the Bandspread allows a fine adjustment. The bandspread is useful in tuning SSB station when the BFO is enabled. The VFO operates at a frequency range of 4255 to 4405 KHz. When this is mixed with an incoming signal of 3800 KHz to 3950 kHz, the resulting mixing product is 455 KHz which is the radio's IF. This signal is passed through a 455 KHz ceramic filter which provides a 6 dB bandwidth at 4.5 KHz. This is coupled to a 455 KHz IF transformer which transforms the 2K ohm output impedance of the ceramic filter to the high impedance input of the TA7642 TRF receiver IC. The TA7642 is a complete AM radio on a single IC, providing gain stages, AGC, and an envelope detector. The IC is a three terminal device with input, ground, and output. The output bias voltage is fairly critical and is controlled by a dedicated bias regulator circuit that allows the voltage to be varied from 1.0V to 2.5V. The TA7642 is normally used as the main component in a tuned RF radio operating in the AM broadcast band. We are essentially using it as a fixed frequency radio at 455 KHz. The output of the TA7642 is baseband audio which is amplified by a TDA7052 audio output amplifier. This is a very capable amplifier which provides 1 watt of good sounding audio. To increase the capability of the receiver, a simple 455 KHz BFO oscillator is provided to allow SSB reception. A tiny amount of BFO energy is coupled into the signal path just after the 455 KHz ceramic filter. Note that this is old school SSB reception, both sidebands are presented and the user must tune in to the correct sideband to get proper reception. In addition, since this radio is designed for wide bandwidth reception, you may have a difficult time digging out SSB stations if the conditions are very crowded. But then this is primarily an AM phone receiver. It is possible to tune the receiver to the 80 meter CW band and use the BFO to copy CW, but that is an exercise left to the builder.

Block Diagram

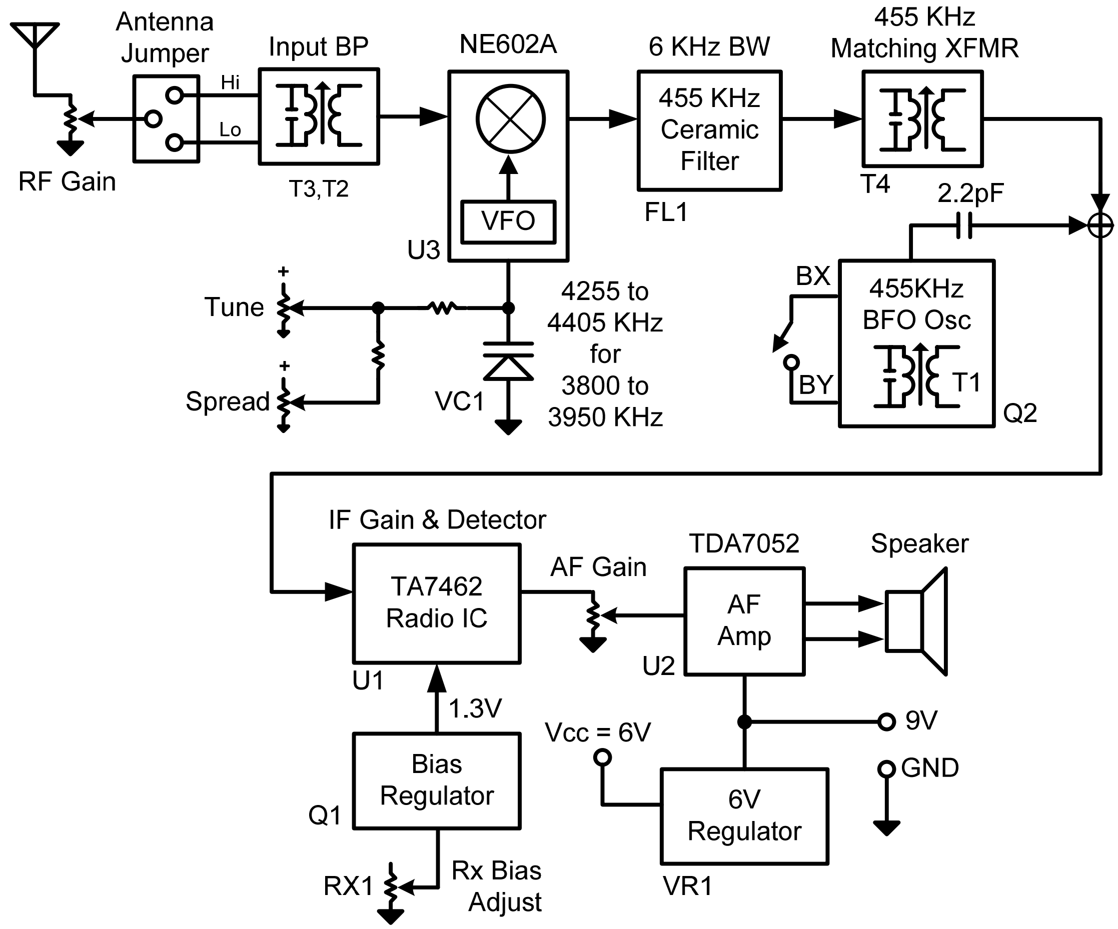
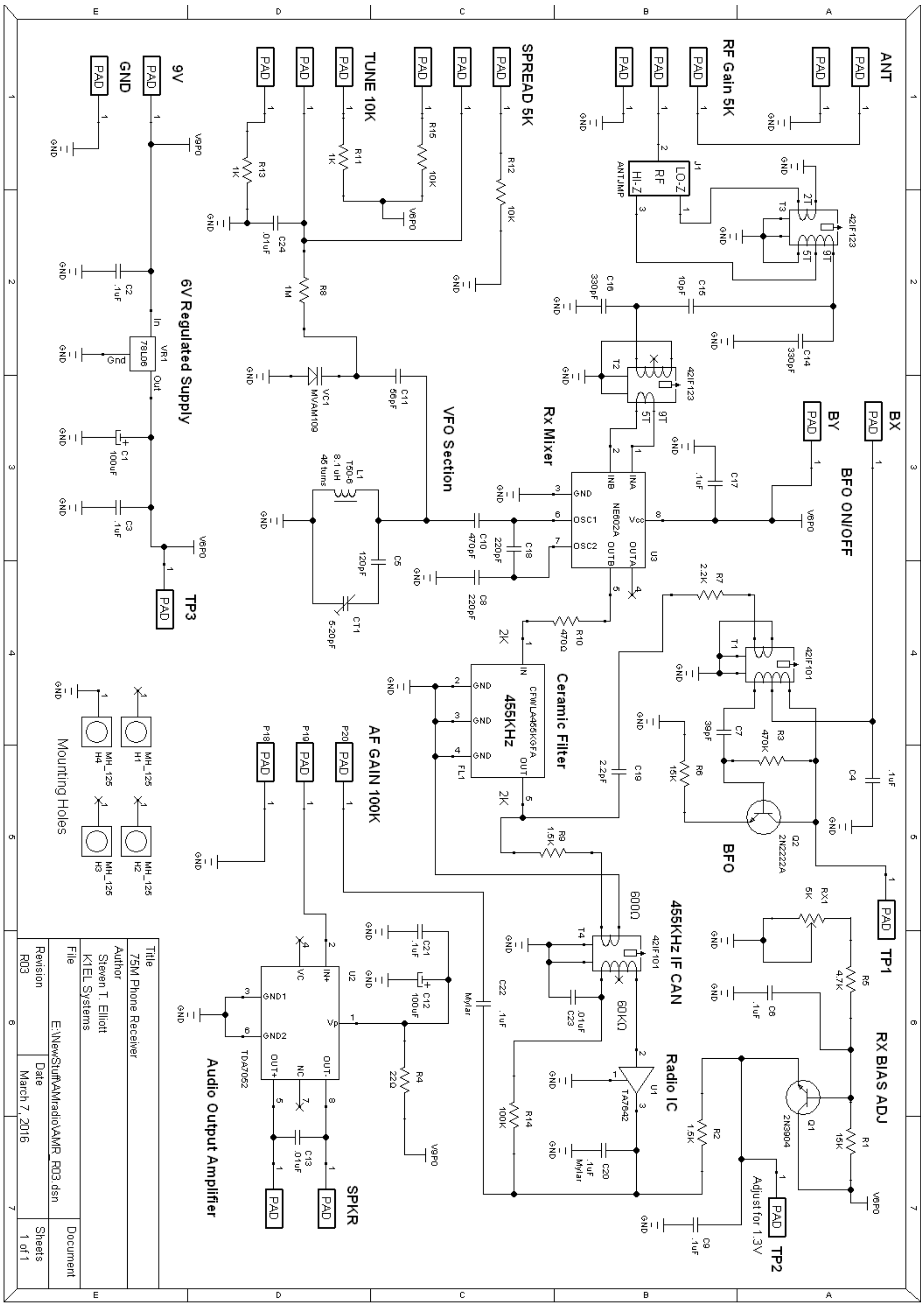


Figure 2 – Assembled AMR75 Block Diagram

AMR75 Schematics



AMR75 Kit Parts List

R14	1	100K	Brown Black Yellow
R12, R15	2	10K	Brown Black Orange
R2, R9	2	1.5K	Brown Green Red
R1, R6	2	15K	Brown Green Orange
R11, R13	2	1K	Brown Black Red
R8	1	1M	Brown Black Green
R5	1	4.7K	Yellow Violet Red
R7	1	2.2K	Red Red Red
R4	1	22Ω	Red Red Black
R10	1	470Ω	Yellow Violet Brown
R3	1	470K	Yellow Violet Yellow
RX1	1	5K	5KΩ Trimmer Potentiometer
C13, C23, C24	3	.01uF	Ceramic Disk Cap
C3, C4, C6, C9, C17, C2, C21	7	.1uF	Multilayer Cap (.1” spacing)
C20, C22	2	.1uF	Mylar Cap(.2” spacing)
C1, C12	2	100uF	Electrolytic Cap
C5	1	120pF	Ceramic Disk Cap
C19	1	2.2pF	Ceramic Disk Cap
C15	1	10pF	Ceramic Disk Cap
C10	1	470pF	Polystyrene Cap
C8, C18	2	220pF	Polystyrene Cap
C14, C16	2	330pF	Ceramic Disk Cap
C7, C11	1	56pF	NPO Ceramic Disk Cap
CT1	1	5-20pF	Green Trimmer Cap
T1, T4	2	42IF101	IF Transformer (BFO, IF)
T2, T3	2	42IF123	IF Transformer (BPF)
Q1	1	2N3904	NPN TO92
Q2	1	2N2222A	NPN Metal Case
VR1	1	78L06	6 volt regulator (TO92)
VC1	1	MVAM109	Varactor Diode TO92
L1	1	T50-6	Toroid, 45 turns #28
U1	1	TA7642	Single Chip Radio IC TO92
U2	1	TDA7052	BTL AF Amplifier DIP8
U3	1	NE602A	Mixer/VFO IC DIP8
FL1	1	CFWLA455KGFA	Ceramic Filter
REXT1, REXT2	2	5K Potentiometer RF Gain, Spread	
REXT3	1	10K Pot AF Gain, Tune	
REXT4	1	100K Pot AF Gain with switch	
SK1, SK2	2	DIP 8 sockets	
Enameled Copper Wire	1	2.2 ft	
Insulated hook up wire	1	2.5 ft	

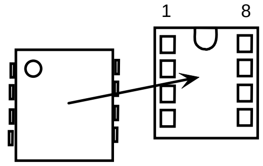
PCB Assembly

Install and test the 6 volt power supply
Install C2, VR1, C1 and C3. Observe polarity for C1, long lead goes in square hole.

Attach power leads to the 9V and GND pads and attach them to a suitable power supply. 9V is optimal but any voltage from 8V to 12V will work. Make sure that the **plus** lead goes to the 9V pad. Turn on the power supply and you should see approx. 6V at TP3 then remove power.

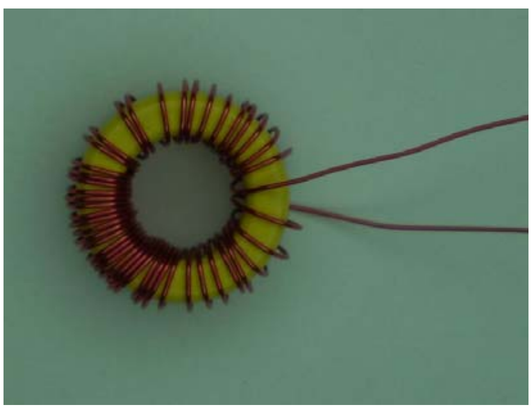
Install Input Bandpass filter
Install and solder T2, T3, C14, C15 and C16

Install Mixer/VFO
Install an 8 pin socket at U3. Next install C17, C18, C10, C8, C11, VC1, C5, then U3.

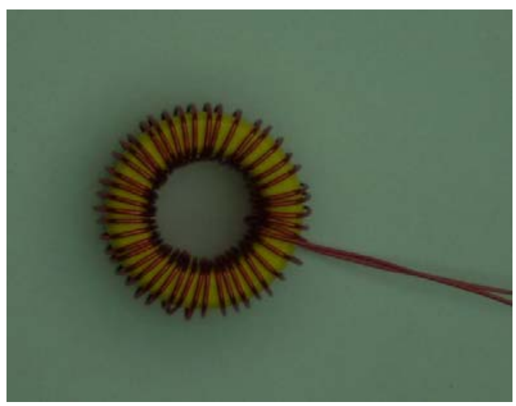


Install CT1 as shown in the pictures on page 10. Note that there is a squared side and a rounded side, orient CT1 so that the squared end is away from VC1.

Wind and install L1
Wind 42 turns of enameled copper wire on the yellow T50-6 core. The measured length is 2 feet 5 inches which includes an extra 1" at each end for leads. Count each pass through the core as one winding. When done verify the turns count while evenly spreading the turns around the core. Finished inductance should be approx. 8.1 uH. Coat the completed toroid with a thin layer of clear fingernail polish. After this dries, carefully remove the varnish from the toroid leads with fine sandpaper or the edge of a sharp knife and then tin the leads. To install L1 into the board, I first place a small dab of RTV glue on the PC board and then route the leads though pads so that the wound toroid sits on the glue. I let this set and then turn the board over and solder the leads.



After initial winding



After evenly spreading windings

Install Ceramic Filter and IF transformer
R10, FL1, R9 T4, and C23

Install RX Bias Regulator Circuit
RX1, R5, C6, R1, Q1, R2, and C9
NOTE: In the pictures, R5 is shown as 2.2K, we have changed this value to 4.7K.

Install the Single Chip Radio Circuit
U1, C20, R14, and C22

Adjust U1 Bias Voltage
Apply power and adjust RX1 so that there is 1.3V at TP2 then remove power

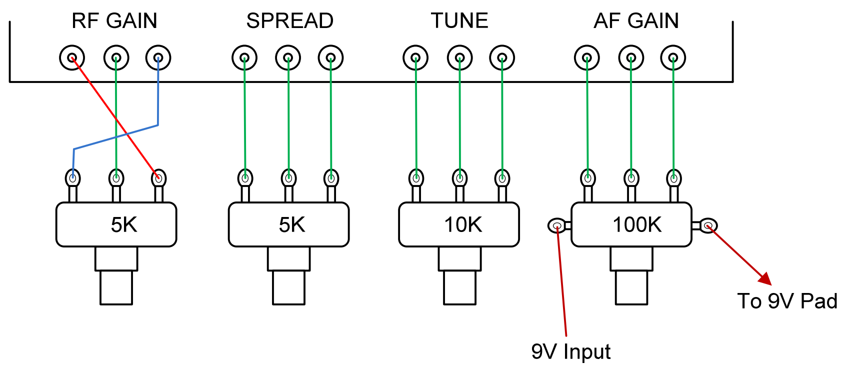
Install Audio Amplifier Circuit
Install an 8 pin socket at U2. Then install R4, C12, C21, C13 and U2 Observe polarity for C12, long lead goes in square hole.

Test AF amplifier
Attach a speaker to the SPKR and GND pads. Apply power to the board set the AF pot to half scale and touch the pot's middle pad; you should hear a loud 60 Hz hum in the speaker.

Install BFO Circuit
Q2, T1, C4, R3, C7, R6, and C19

Antenna Impedance Jumper
If the receiver is to be used with a resonant antenna, such as a dipole cut for 3.8 MHz (recommended), install a jumper wire between LO and the center hole of the three position ANT-Z location. Otherwise, install jumper between HI and center hole for a random length non-resonant antenna.

Control Wiring
The length of wires used to connect the front panel controls will depend on how you build up the receiver. Enough wire is included in the kit to cover a wide range of options. Cut six wires for the central two controls (TUNE and SPREAD) then cut six more, longer wires for the RF and AF gain controls. The end control wires are slightly longer to result in a good looking wire harness. Attach a 5K potentiometer to the RF GAIN pads and a second 5K potentiometer to the SPREAD pads. Next, attach the 10K potentiometer to the TUNE pads and the 100K potentiometer to the AF GAIN pads. The 100K AF gain control has a built in on/off switch. This is wired in series with the input power lead and the pad marked 9V on the PC board.



VFO Calibration
This procedure requires a calibrated general coverage receiver. Set the main tuning knob and bandspread controls to midscale. Set your receiver to 4.305 MHz and connect a length of wire to the test receiver's antenna input. Route this wire so that it runs close to, but does not touch, the AMR75 board. Apply power up the AMR75 and adjust the CT1 trimmer so that you hear a zero beat on the receiver. Use a plastic screwdriver for best results. A small metal jeweler's screwdriver can work but note the screwdriver will influence the frequency and it might take several trials to get the frequency correct. The radio is now tuned close to the center of the 75 meter AM phone band (3850 KHz). You should get a range of at least 50 KHz to each end of the tuning range.

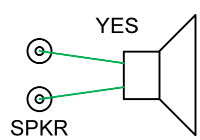
Alternate VFO Calibration Procedure

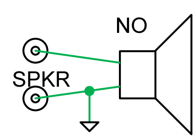
This procedure uses a signal generator to set the AMR75 VFO. Set the signal generator to 4305 KHz and couple its output to the AMR75 antenna input through a 100 pF capacitor. Attach a speaker to the AM75. We will follow the same procedure outlined above with the exception that we will be listening for a signal from the AMR75 as we adjust CT1. Make sure you have turned the RF gain control fully clockwise and the AF gain to mid-position.

IF Adjustment and Input BPF Calibration
Connect the speaker to the AMR75 and then connect an antenna to the AMR75 antenna input. Set the RF gain control fully clockwise and set the AF gain mid-position. Set the bandspread control to midscale. Turn the main tuning pot fully counterclockwise and return about 20% clockwise. Adjust T2 and then T4 for a peak in band noise,. Now turn the main tuning pot fully clockwise and return about 20% counterclockwise. Peak T3 for maximum noise.

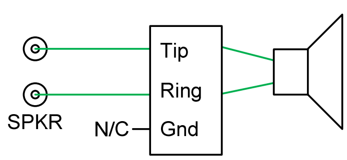
BFO Calibration
Attach an on/off switch (not supplied) to the BX and BY pads and set it to the off position. The best way to adjust the BFO is to tune to the center of a carrier in AM mode. You don't have to be exactly on center but get as close as you can. Now turn on the BFO switch and carefully adjust T1 for a zero beat note. Once you get to zero beat turn the adjustment clockwise so that you get about a 2 KHz beat note. As mentioned this is not a critical adjustment, as long as you are reasonably close it will work fine.
If there are any SSB stations on the band try tuning one in to get the feel for how it works. Since this is not a single signal receiver, you will be able to tune in both sidebands of an SSB phone transmission. Only one will be intelligible, the lower sideband. Since receiver bandwidth is fairly wide, about 5 KHz, you may hear other stations that are higher or lower in frequency bleed through.

Speaker Connection – IMPORTANT !
Neither of the TDA7052 audio amplifiers outputs should be connected to ground. A speaker or headphones are connected between the two outputs. This can be a problem if you decide to put the radio into a metal enclosure that is connected to power supply ground. You must choose a speaker connection that is isolated from ground unlike most 1/8" or 1/4" connectors.





A regular stereo jack and plug can be wired in such a way to isolate the speaker connections from ground. This allows the jack to be mounted on a grounded enclosure. The speaker connections use the tip and ring connections only, the ground (sleeve) is left unconnected.



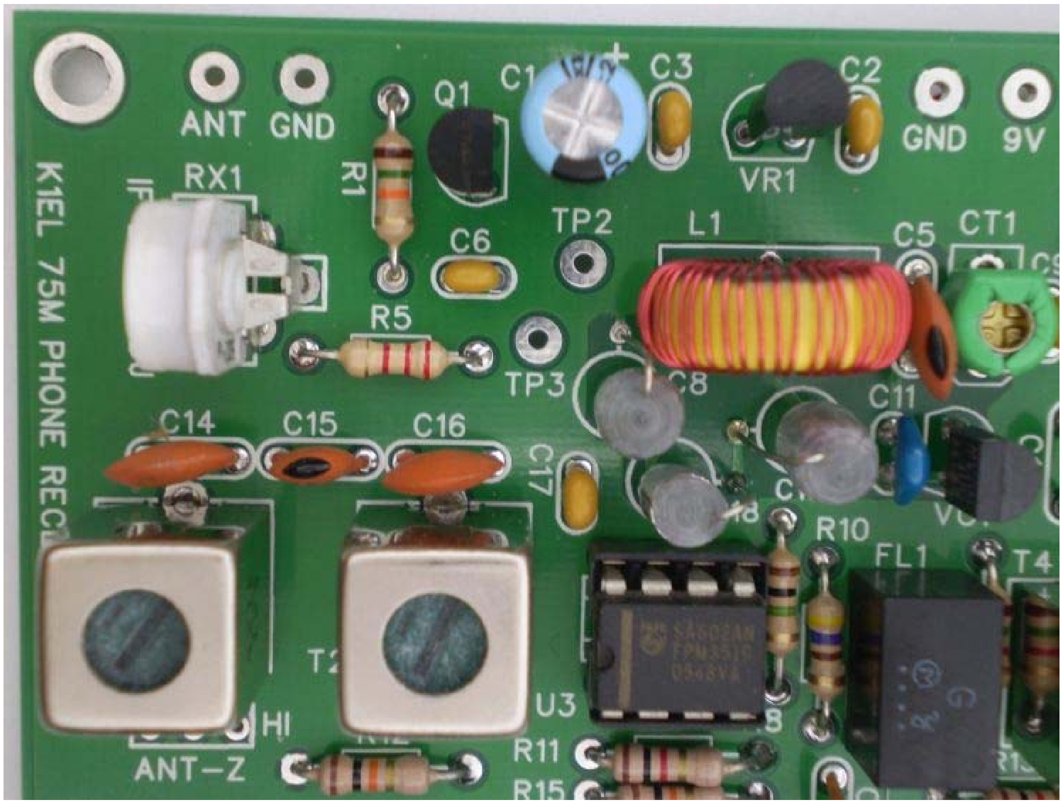
Stereo Connector

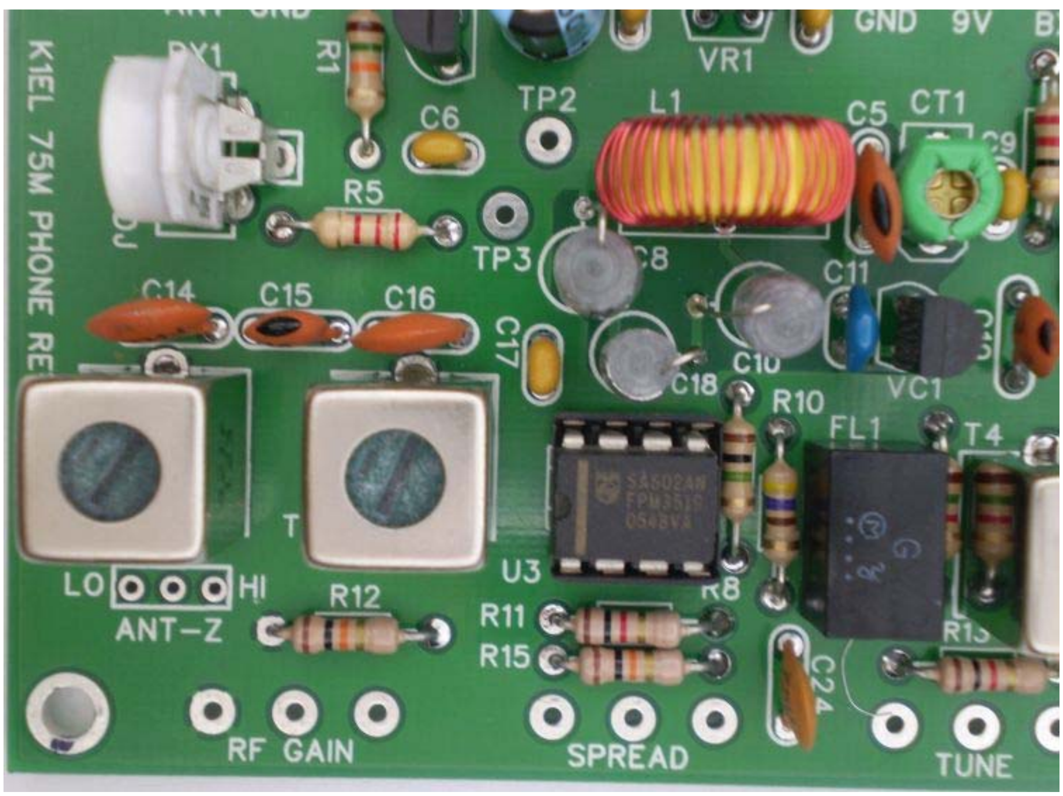
General Operational Notes

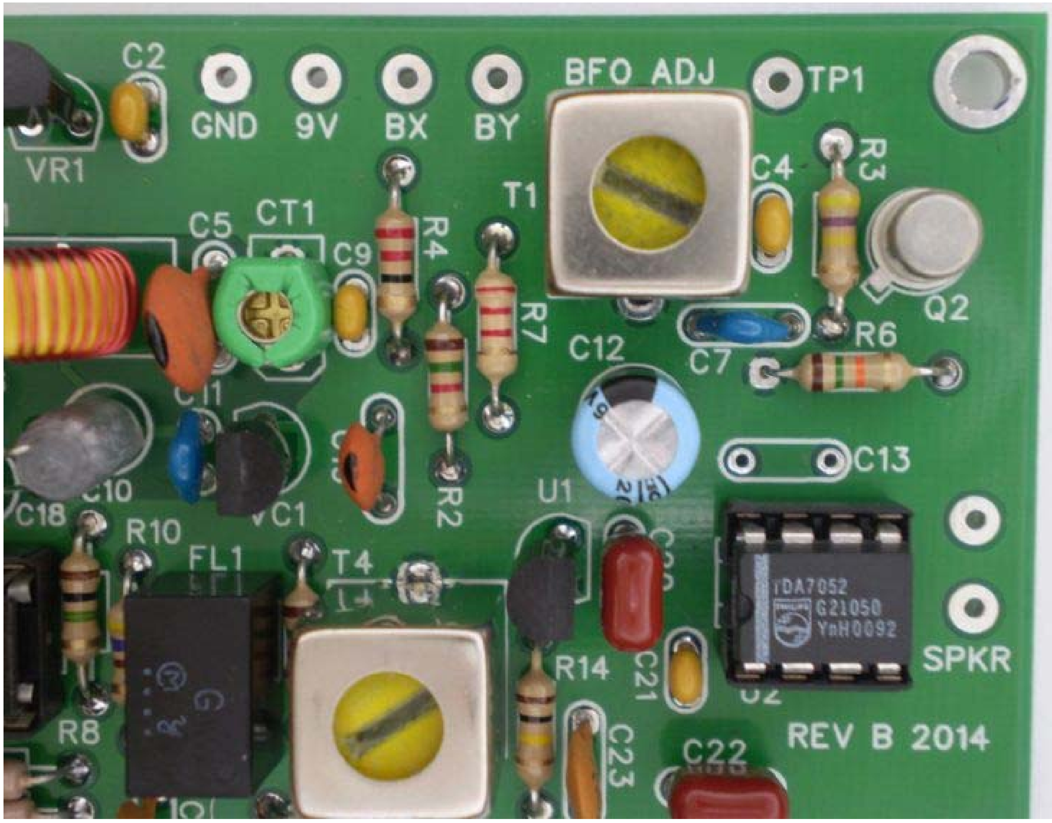
This receiver has a surplus of gain. This will become apparent when band conditions are good. You will find that you rarely have to turn the RF gain control all the way up, particularly for SSB stations. If you are finding that signals are distorted, try backing off on the RF gain control. If you only want to use AM mode, don’t bother with a BFO switch, the BFO circuit is disabled when the switch is disconnected.

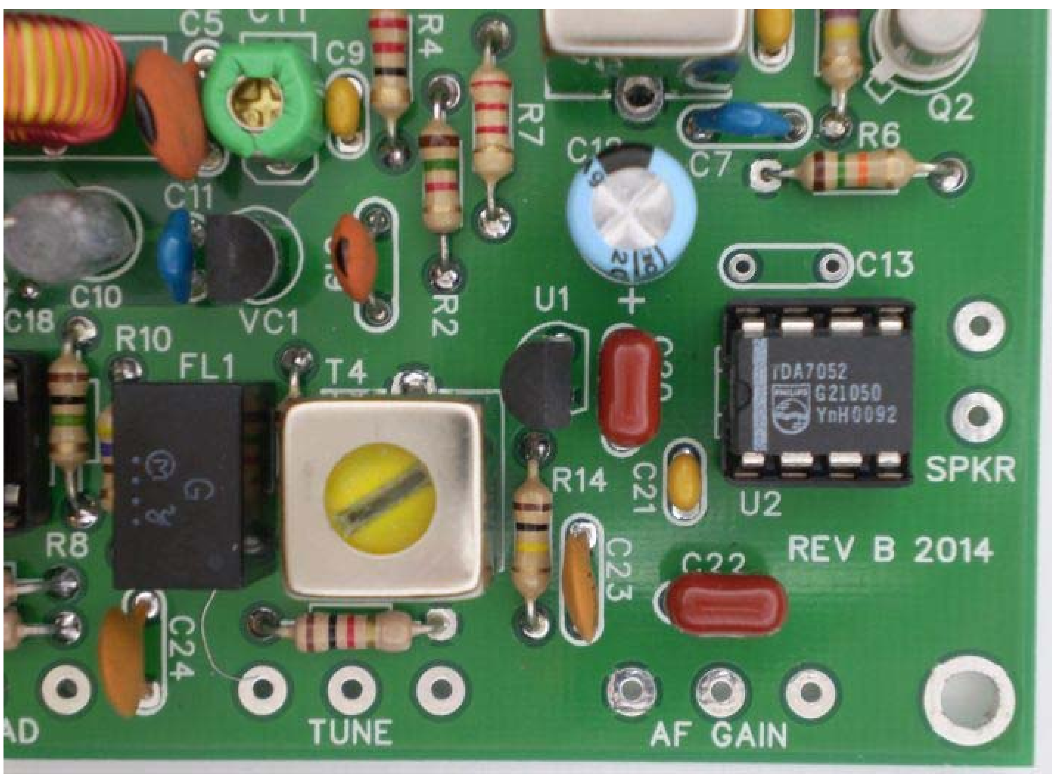
When tuning around the band, generally set the bandspread control set to mid position, this provides a good range of fine tuning when you find a station. Larger knobs on the tuning and spread controls are a good idea with calibration marks on the front panel as a tuning aid. Remember to set the spread control to center when you are determining the calibration points. A center detent pot for the spread would be a nice option if you have one.

Close Up Photos of an Assembled AMR75 PC Board






C2
GND
9V
BX
BY
BFO ADJ
TP1
VR1
C5
CT1
C9
R4
T1
C4
R3
R7
Q2
C12
C7
R6
C11
C13
C10
C18
R10
VC1
R2
U1
FL1
T4
TDA7052
R14
C21
SPKR
R8
C23
C22
REV B 2014


C5
C9
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VC1
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U1
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SPKR
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C23
C22
REV B 2014
C24
TUNE
AF GAIN

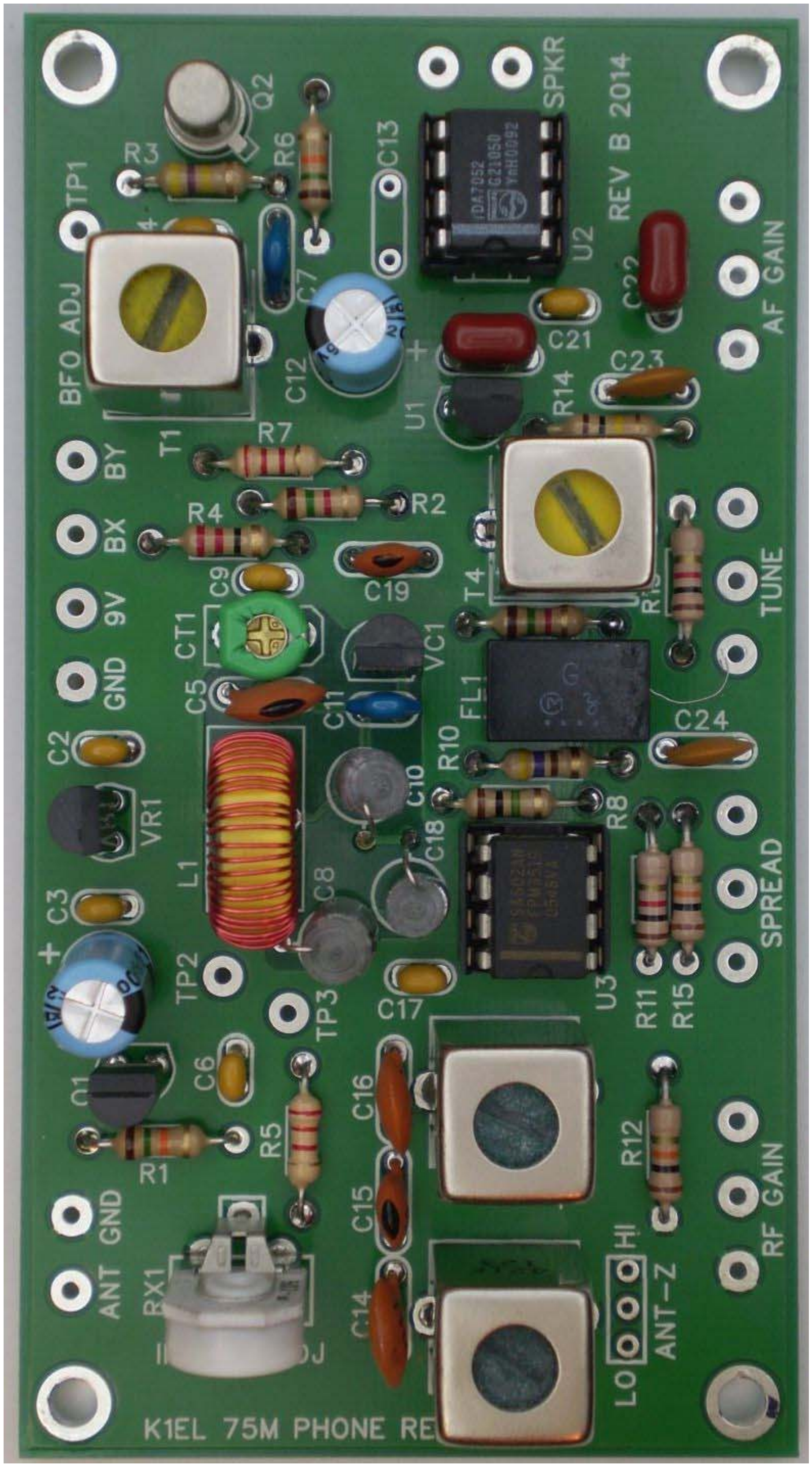


Figure 3 – Assembled AMR75 Board Close Up

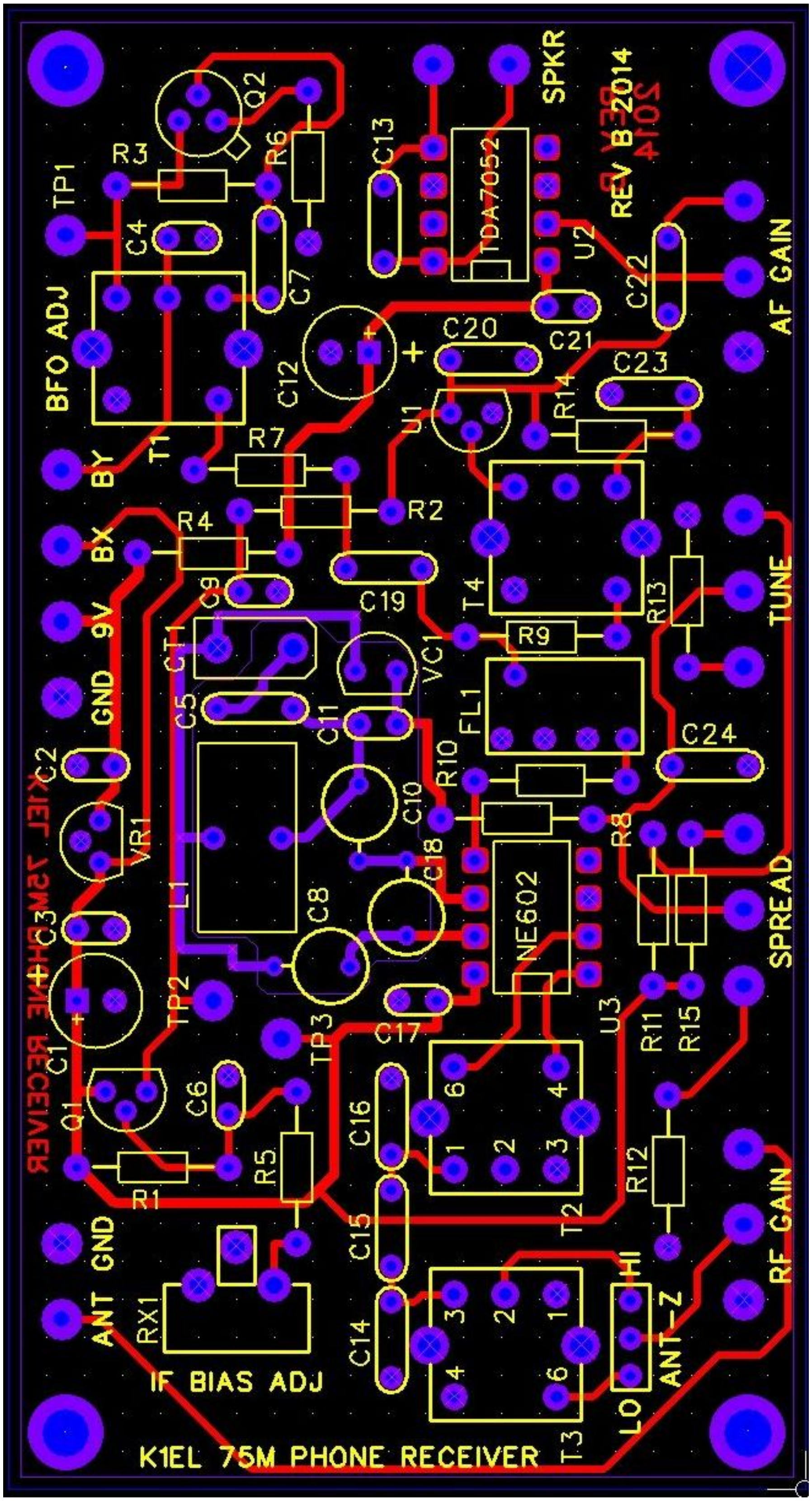


Figure 4 – Printed Circuit Board Image

Contact Information

The AMR75 Kit is fully guaranteed; if you are not satisfied please return the kit for a full refund.

Questions will be handled by e-mail via: k1el.kitsinfo@gmail.com

Watch the Hamcrafters Website for latest updates and new product offerings: http://www.hamcrafters.com

Revision History

3-16-2015	AMR75	Rev A.1 Original Release
11-11-2015	AMR75	Rev A.2 Updates and Corrections
3-7-2016	AMR75	Rev A.3 Updated PCB images, removed R120, R5 is now 4.7K

Index

Appendix A - Kit Construction Hints

1. Find a good workspace.

It is essential that you have a good place to work on your kit,

You will need room to spread out your parts and have access to tools. Good lighting and ventilation is essential. A magnifying glass or hood is highly recommended.

2. Have the proper tools.

At a bare minimum you will need:

Small side cutters, flush cutters are a plus.

Small needle nosed pliers

Small flat blade & Philips head screw drivers

A good quality, 40-60Watt, temperature controlled Soldering Iron. The price has come down on these, you can buy a Weller WLC100 40W adjustable soldering station for $40 on Amazon.

3. Read the Instructions First.

Read through the assembly instructions completely and have everything on hand before you start. Carefully inventory the kit parts, make sure you have everything.

4. Follow the assembly instructions in order.

Although not always obvious, the order in which parts are installed is important and should be followed. Sometimes individual sections are completed and tested in order or there may be a mechanical clearance considerations.

5. Keep your Workplace Clean and Orderly.

Nothing spoils a kit building experience more than lost parts. Second to that are stray bits of dirt and metal that get on a printed circuit board assembly. Our PC boards are nicely plating and accept solder easily. There is no need to use solder flux or to clean the board with steel wool before starting.

6. Take your time.

There is no need to rush, enjoy the process and the difference will show in the end result. Moving too quickly or working when you are tired often leads to big mistakes which could be difficult if not impossible to fix.

Appendix B - Note About Safety

Burns to your skin can be very painful and can lead to serious injury.

Burns to your eyes can be catastrophic.

Toxic fumes can cause serious harm.

Flying objects such as wire ends etc. can cause painful and serious injuries.

When building your kit please remember that Soldering Irons and Solder are used at High Temperatures!

Soldering Irons can remain hot for many minutes after being turned off. Never touch the tip to see if it is hot. Place the tip on a wet pad to test for temperature.

Wear safety glasses to protect your eyes from flying objects.

Appendix C - Soldering Basics

1. Insert component leads into PCB holes and bend them back slightly to hold the part in place. You can either trim the lead now or wait till after the joint is soldered. I usually install several parts at one time and then solder and trim multiple leads in groups.

2. Place a hot and clean iron tip against both the lead and pad as in Fig. C1.

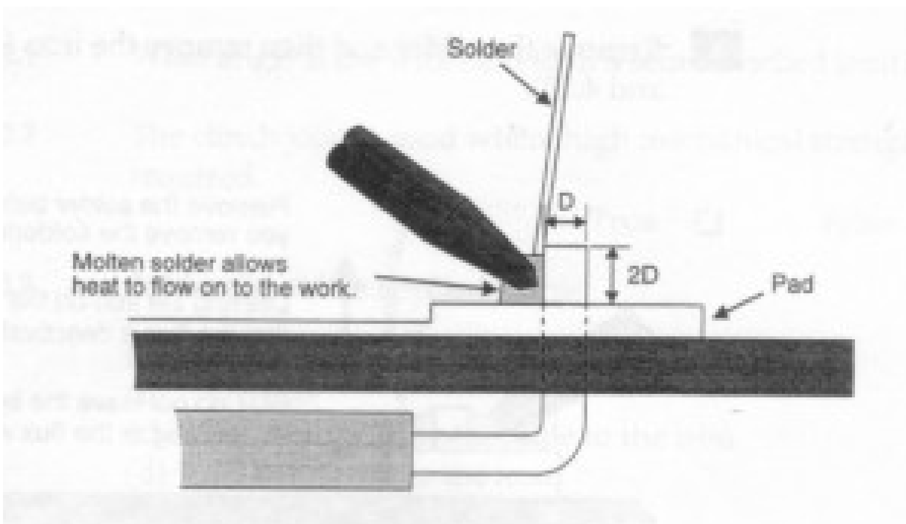


Fig. C1 - Form a heat bridge

3. Create a heat bridge between the lead, the PCB pad and the iron by placing a small amount of solder on the tip.

4. Apply solder around the outside edge of the pad as in Fig. C2. If the pad and lead are at the correct temperature, the solder will flow around the connection.

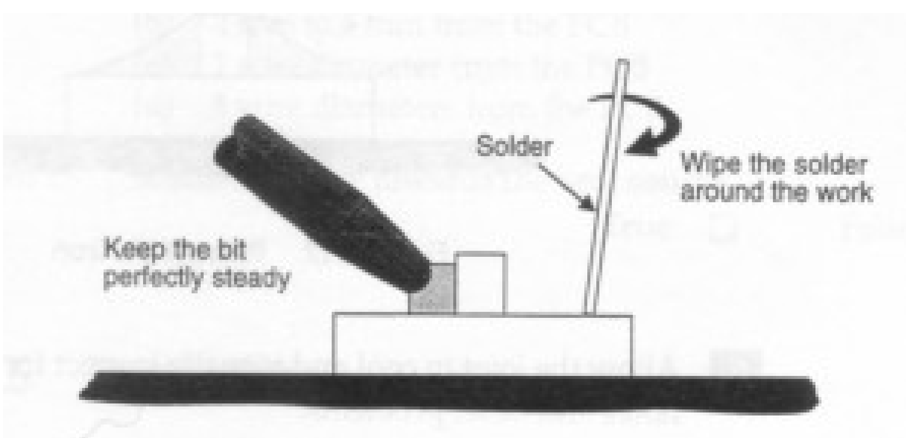


Fig. C2 - Spread solder around the work

5. Remove the solder and then remove the iron:

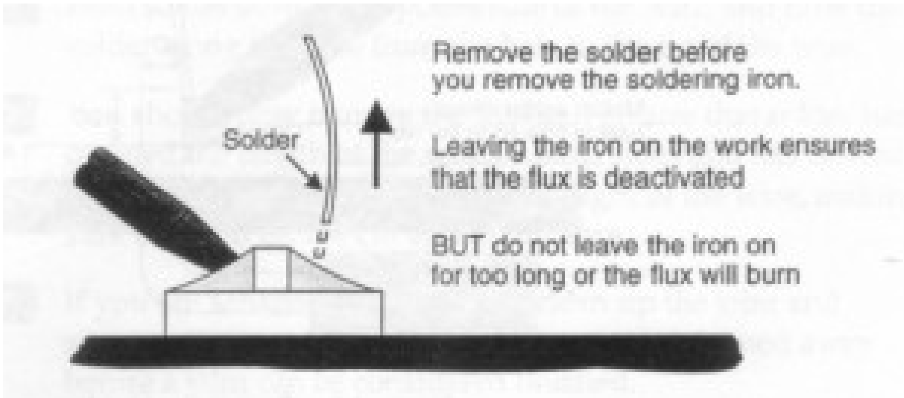


Fig C3 - Remove the solder

6. Allow the joint to cool and visually inspect for defects or other problems. You should have a solder joint with a bright shiny finish and a profile like that shown in Fig. C4.

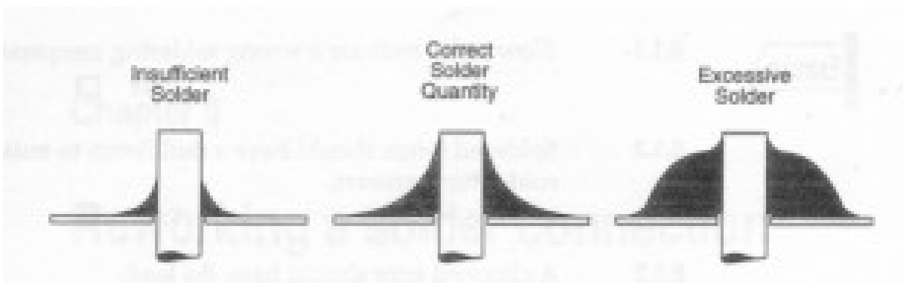


Fig. C4 - Solder quantity comparison

Double-balanced mixer and oscillator | NE/SA602A

DESCRIPTION

The NE/SA602A is a low-power VHF monolithic double-balanced mixer with input amplifier, on-board oscillator, and voltage regulator. It is intended for high performance, low power communication systems. The guaranteed parameters of the SA602A make this device particularly well suited for cellular radio applications. The mixer is a "Gilbert cell" multiplier configuration which typically provides 18dB of gain at 45MHz. The oscillator will operate to 200MHz. It can be configured as a crystal oscillator, a tuned tank oscillator, or a buffer for an external LO. For higher frequencies the LO input may be externally driven. The noise figure at 45MHz is typically less than 5dB. The gain, intercept performance, low-power and noise characteristics make the NE/SA602A a superior choice for high-performance battery operated equipment. It is available in an 8-lead dual in-line plastic package and an 8-lead SO (surface-mount miniature package).

FEATURES

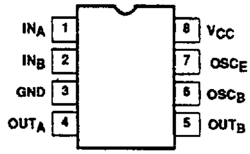
- Low current consumption: 2.4mA typical
- Excellent noise figure: <4.7dB typical at 45MHz
- High operating frequency
- Excellent gain, intercept and sensitivity
- Low external parts count; suitable for crystal/ceramic filters
- SA602A meets cellular radio specifications

APPLICATIONS

- Cellular radio mixer/oscillator
- Portable radio
- VHF transceivers
- RF data links
- HF/VHF frequency conversion
- Instrumentation frequency conversion
- Broadband LANs

PIN CONFIGURATION

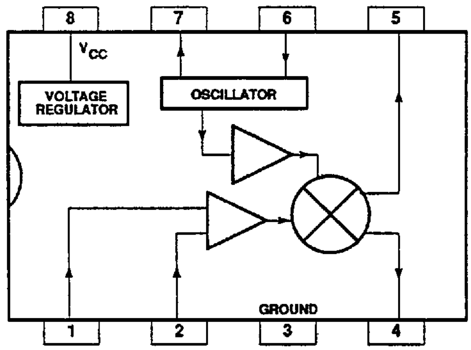
F, D and N Packages



ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
8-Pin Plastic DIP	0 to +70°C	NE602AN
8-Pin Plastic SO (Surface-mount)	0 to +70°C	NE602AD
8-Pin Cerdip	0 to +70°C	NE602AFE
8-Pin Plastic DIP	–40 to +85°C	SA602AN
8-Pin Plastic SO (Surface-mount)	–40 to +85°C	SA602AD
8-Pin Cerdip	–40 to +85°C	SA602AFE

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER		RATING	UNITS
V_{CC}	Maximum operating voltage		9	V
T_{STG}	Storage temperature range		−65 to +150	°C
T_A	Operating ambient temperature range	NE602A	0 to +70	°C
		SA602A	−40 to +85	°C
θ_{JA}	Thermal impedance	D package	90	°C/W
		N package	75	°C/W

AC/DC ELECTRICAL CHARACTERISTICS V_{CC} = +6V, T_A = 25°C; unless otherwise stated

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNITS
			NE/SA602A			
			MIN	TYP	MAX	
V_{CC}	Power supply voltage range		4.5		8.0	V
	DC current drain			2.4	2.8	mA
f_{IN}	Input signal frequency			500		MHz
f_{OSC}	Oscillator frequency			200		MHz
	Noise figure at 45MHz			5.0	5.5	dB
	Third–order intercept point	RF_{IN} = −45dBm: f_1 = 45.0MHz f_2 = 45.06MHz		−13	−15	dBm
	Conversion gain at 45MHz		14	17		dB
R_{IN}	RF input resistance		1.5			kΩ
C_{IN}	RF input capacitance			3	3.5	pF
	Mixer output resistance	(Pin 4 or 5)		1.5		kΩ

DESCRIPTION OF OPERATION

The NE/SA602A is a Gilbert cell, an oscillator/buffer, and a temperature compensated bias network as shown in the equivalent circuit. The Gilbert cell is a differential amplifier (Pins 1 and 2) which drives a balanced switching cell. The differential input stage provides gain and determines the noise figure and signal handling performance of the system.

The NE/SA602A is designed for optimum low power performance. When used with the SA604 as a 45MHz cellular radio second IF and demodulator, the SA602A is capable of receiving −119dBm signals with a 12dB S/N ratio. Third–order intercept is typically −13dBm (that is approximately +5dBm output intercept because of the RF gain). The system designer must be cognizant of this large signal limitation. When designing LANs or other closed systems where transmission levels are high, and small–signal or signal–to–noise issues are not critical, the input to the NE602A should be appropriately scaled.

Besides excellent low power performance well into VHF, the NE/SA602A is designed to be flexible. The input, RF mixer output and oscillator ports can support a variety of configurations provided the designer understands certain constraints, which will be explained here.

The RF inputs (Pins 1 and 2) are biased internally. They are symmetrical. The equivalent AC input impedance is approximately 1.5k || 3pF through 50MHz. Pins 1 and 2 can be used interchangeably, but they should not be DC biased externally. Figure 3 shows three typical input configurations.

The mixer outputs (Pins 4 and 5) are also internally biased. Each output is connected to the internal positive supply by a 1.5kΩ resistor. This permits direct output termination yet allows for balanced output as well. Figure 4 shows three single ended output configurations and a balanced output.

The oscillator is capable of sustaining oscillation beyond 200MHz in crystal or tuned tank configurations. The upper limit of operation is determined by tank "Q" and required drive levels. The higher the "Q" of the tank or the smaller the required drive, the higher the permissible oscillation frequency. If the required LO is beyond oscillation limits, or the system calls for an external LO, the external signal can be injected at Pin 6 through a DC blocking capacitor. External LO should be at least 200mV$_{P-P}$.

Figure 5 shows several proven oscillator circuits. Figure 5a is appropriate for cellular radio. As shown, an overtone mode of operation is utilized. Capacitor C3 and inductor L1 suppress oscillation at the crystal fundamental frequency. In the fundamental mode, the suppression network is omitted.

Figure 6 shows a Colpitts varactor tuned tank oscillator suitable for synthesizer–controlled applications. It is important to buffer the output of this circuit to assure that switching spikes from the first counter or prescaler do not end up in the oscillator spectrum. The dual–gate MOSFET provides optimum isolation with low current. The FET offers good isolation, simplicity, and low current, while the bipolar transistors provide the simple solution for non–critical applications. The resistive divider in the emitter–follower circuit should be chosen to provide the minimum input signal which will assure correct system operation.

When operated above 100MHz, the oscillator may not start if the Q of the tank is too low. A 22kΩ resistor from Pin 7 to ground will increase the DC bias current of the oscillator transistor.

This improves the AC operating characteristic of the transistor and should help the oscillator to start. A 22kΩ resistor will not upset the other DC biasing internal to the device, but smaller resistance values should be avoided.

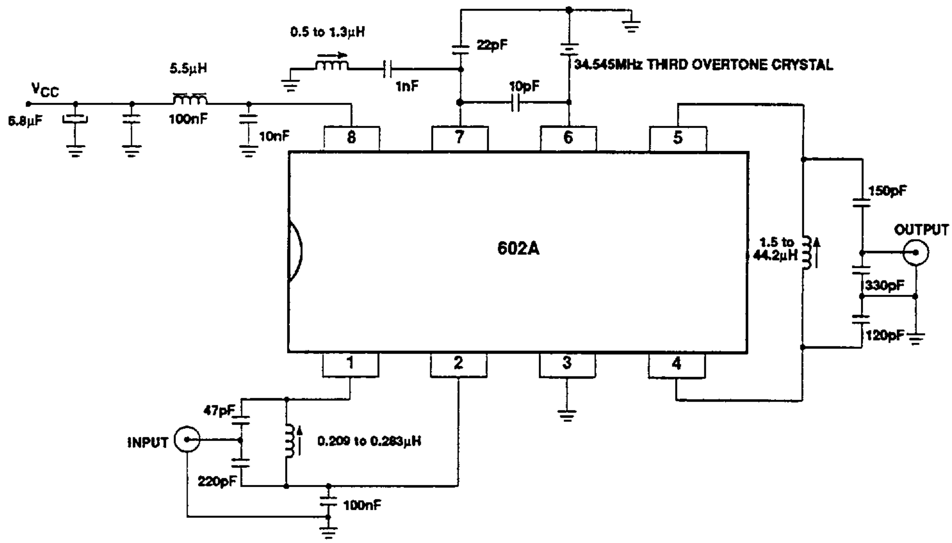


Figure 1. Test Configuration

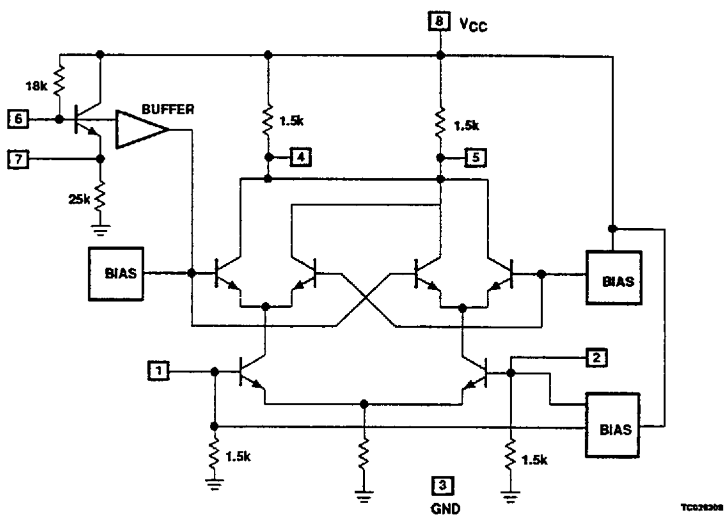
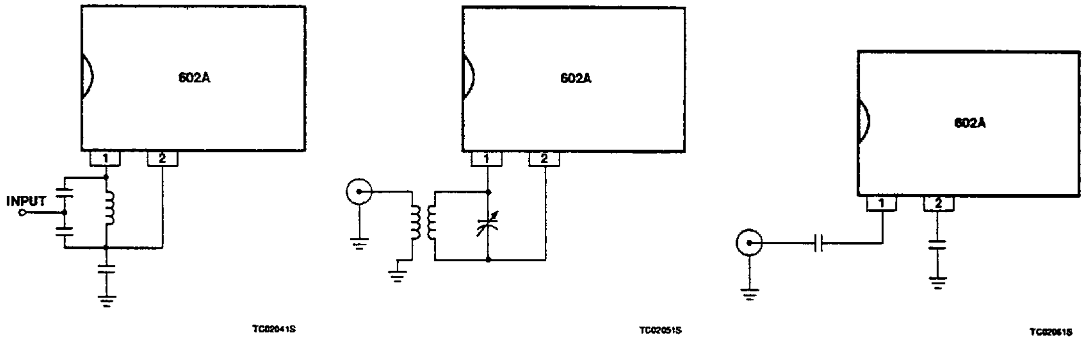


Figure 2. Equivalent Circuit

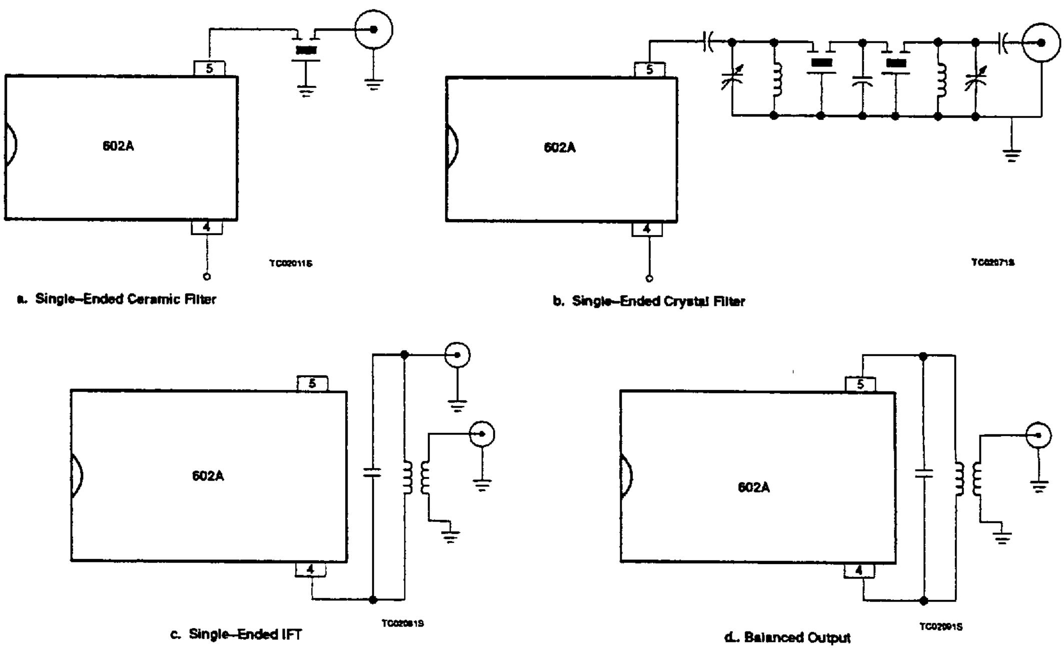


a. Single–Ended Tuned Input

b. Balanced Input (For Attenuation of Second–Order Products)

c. Single–Ended Untuned Input

Figure 3. Input Configuration



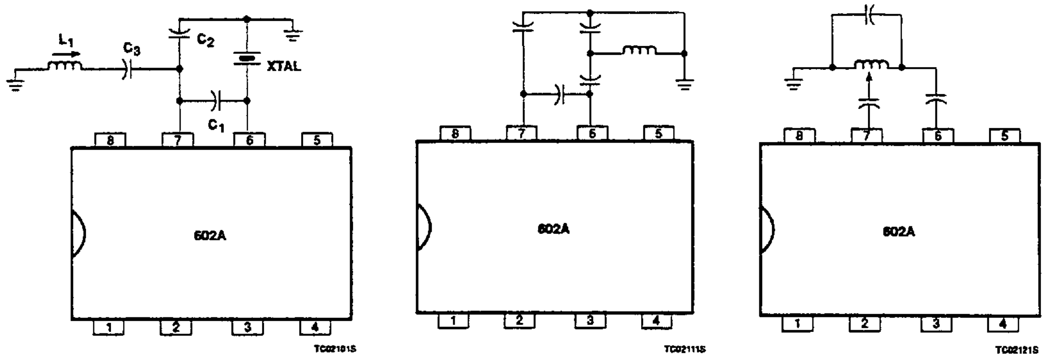
a. Single–Ended Ceramic Filter

b. Single–Ended Crystal Filter

c. Single–Ended IFT

d. Balanced Output

Figure 4. Output Configuration



a. Colpitts Crystal Oscillator (Overtone Mode)

b. Colpitts L/C Tank Oscillator

c. Hartley L/C Tank Oscillator

Figure 5. Oscillator Circuits

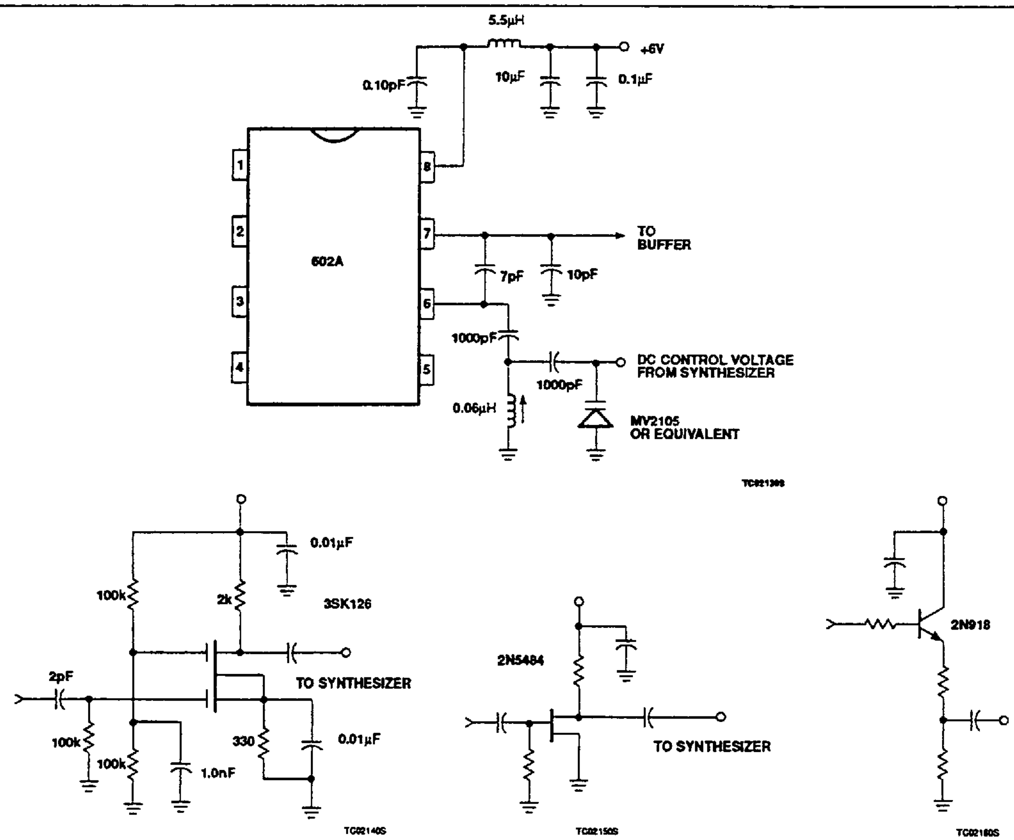


Figure 6. Colpitts Oscillator Suitable for Synthesizer Applications and Typical Buffers

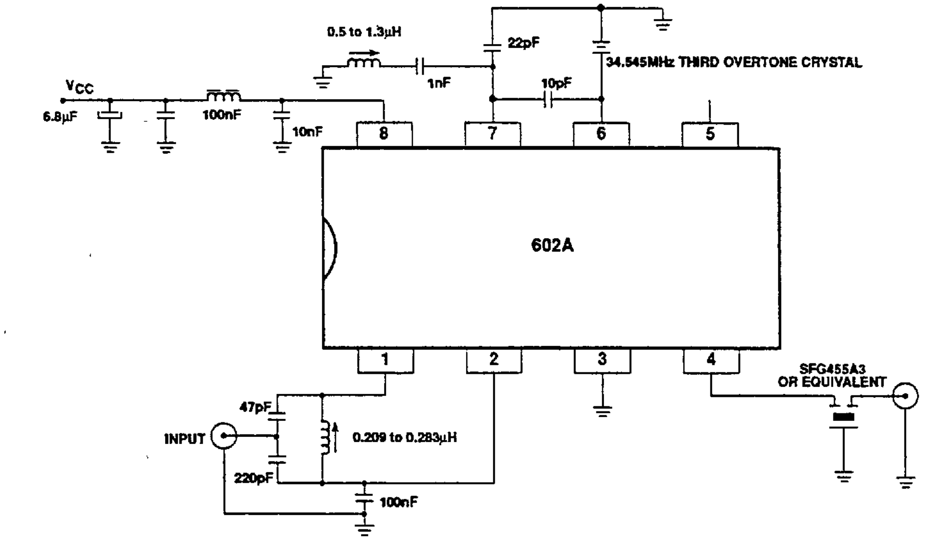


Figure 7. Typical Application for Cellular Radio

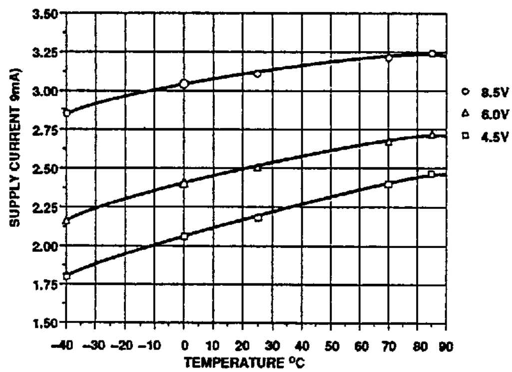


Figure 8. I_{CC} vs Supply Voltage

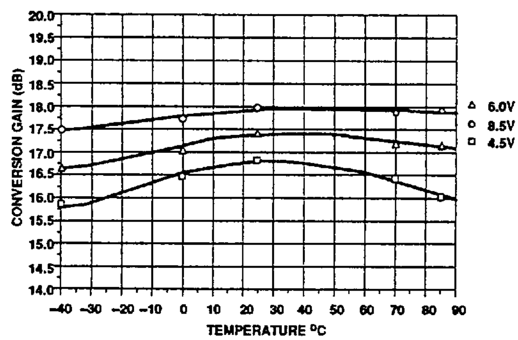


Figure 9. Conversion Gain vs Supply Voltage

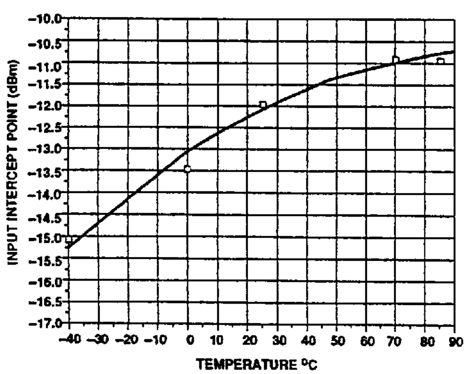


Figure 10. Third–Order Intercept Point

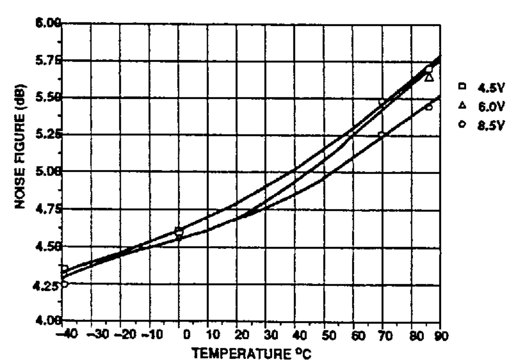


Figure 11. Noise Figure

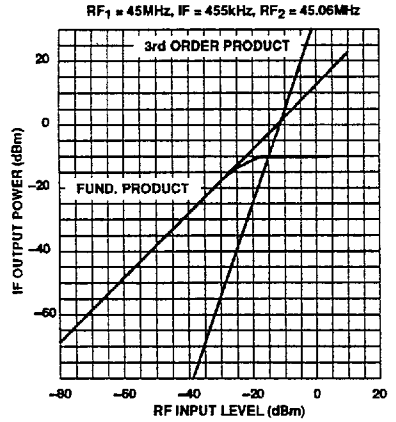


Figure 12. Third–Order Intercept and Compression

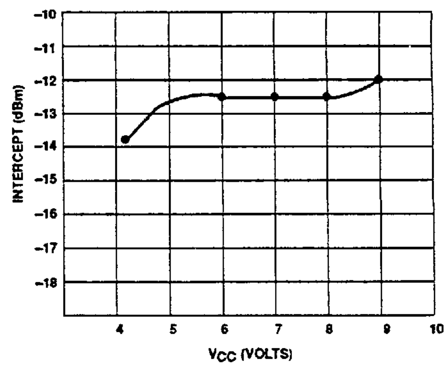
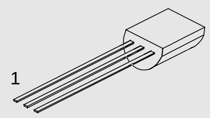


Figure 13. Input Third–Order Intermod Point vs V_{CC}

ONE CHIP AM RADIO CIRCUIT



TO-92

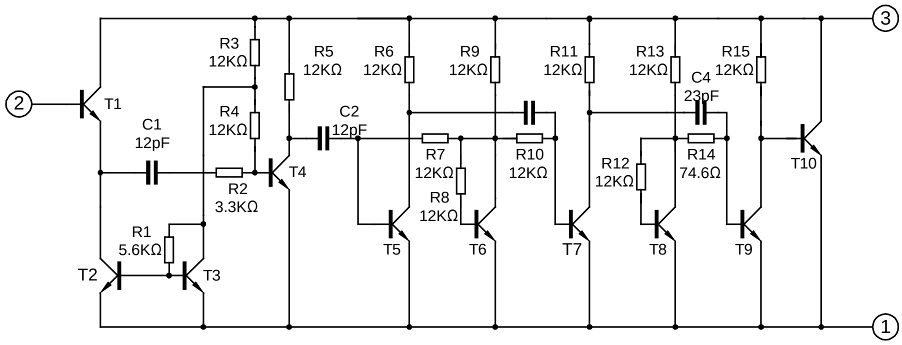
DESCRIPTION

The TA7642 is suitable for low voltage portable Radio, cassette system and other wireless AM system. The package of UTC7642 is TO-92.

FEATURES

*Low operating voltage: Down to V_{CC}=1.3V
*Low Quiescent Current:I_{CCO}=0.2mA
*Low external component required.

EQUIVALENT CIRCUIT



ABSOLUTE MAXIMUM RATINGS（Tested at Ta=25°C,unless otherwise specified）

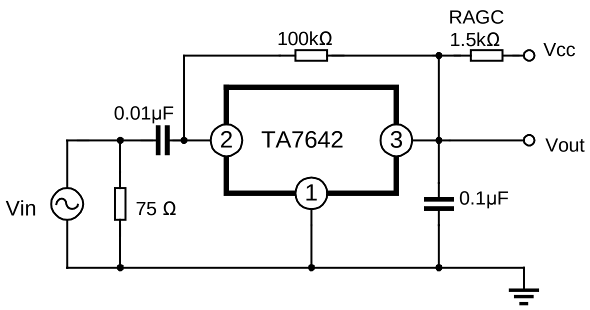
Parameters	Symbols	Min.	Max.	Unit
Supply Voltage	V_{CC}		6	V
Operating Temperature	Topr	-10	60	°C
Storage temperature	T_{STG}	-55	150	°C

ELECTRICAL CHARACTERISTICS

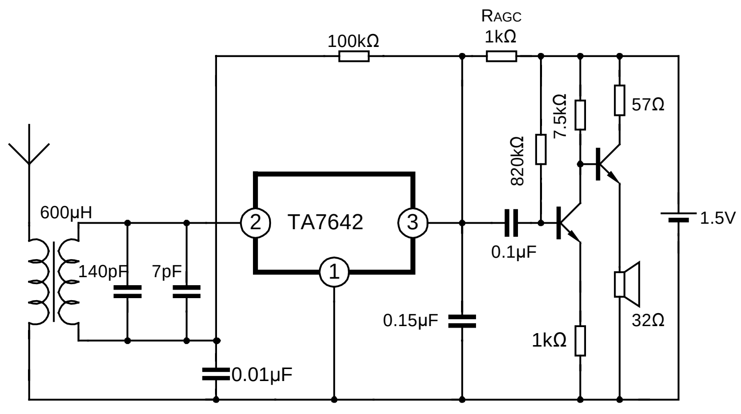
(Tested at Ta=25°C,V_{CC}=1.3V,fm=1kHz,f_O=1MHz,MOD=30%,unless other specified)

Parameters	Symbols	Test conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}		1.2	1.3	1.6	V
Quiescent Current	I_{CCQ}	V_I=0	0.14	0.20	0.30	mA
Input Resistance	R_I		—	3	—	MΩ
Maximum sensitivity	SM	V_{OD}=3mV	—	600	—	µV
Detector Output Voltage	V_{OD}	V_I=10mV	5	15	30	mV
The Range of AGC	ΔA		—	30	—	dB

TEST CIRCUIT



APPLICATION CIRCUIT



INTEGRATED CIRCUITS

DATA SHEET

TDA7052
1 W BTL mono audio amplifier

Product specification
File under Integrated Circuits, IC01

July 1994

Philips Semiconductors

PHILIPS

1 W BTL mono audio amplifier TDA7052

GENERAL DESCRIPTION

The TDA7052 is a mono output amplifier in a 8-lead dual-in-line (DIL) plastic package. The device is designed for battery-fed portable audio applications.

Features:

- No external components
- No switch-on or switch-off clicks
- Good overall stability
- Low power consumption
- No external heatsink required
- Short-circuit proof

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	Supply voltage range		3	6	18	V
I_{tot}	Total quiescent current	$R_L = \infty$	–	4	8	mA
G_v	Voltage gain		38	39	40	dB
P_o	Output power	THD = 10%; 8 Ω	–	1,2	–	W
THD	Total harmonic distortion	P_o = 0,1 W	–	0,2	1,0	%

PACKAGE OUTLINE

8-lead DIL; plastic (SOT97); SOT97-1; 1996 August 21.

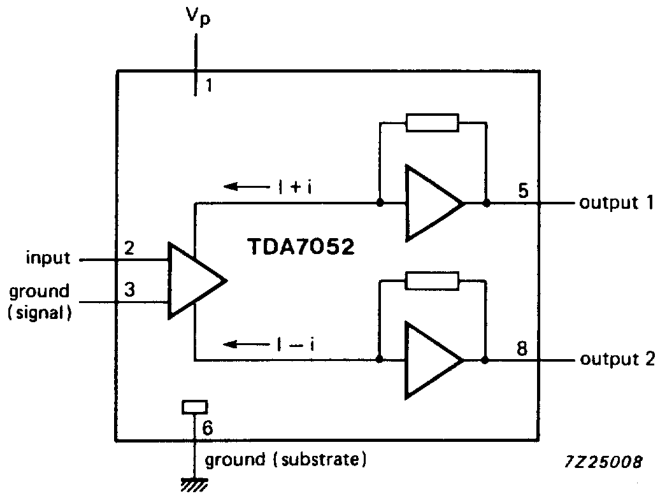


Fig.1 Block diagram.

PINNING

1	V_P	supply voltage	5	OUT1	output1
2	IN	input	6	GND2	ground (substrate)
3	GND1	ground (signal)	7	n.c.	not connected
4	n.c.	not connected	8	OUT2	output2

FUNCTIONAL DESCRIPTION

The TDA7052 is a mono output amplifier designed for battery-fed portable audio applications, such as tape recorders and radios.

The gain is fixed internally at 40 dB. A large number of tape recorders and radios are still designed for mono sound, plus a space-saving trend by reduction of the number of battery cells. This means a decrease in supply voltage which results in an reduction of output power. To compensate for this reduction, the TDA7052 uses the Bridge-Tied-Load principle (BTL) which can deliver an output power of 1,2 W (THD = 10%) into an 8 Ω load with a power supply of 6 V. The load can be short-circuited at each signal excursion.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	Supply voltage	–	18	V
I_{OSM}	Non-repetitive peak output current	–	1,5	A
P_{tot}	Total power dissipation	see Fig. 2		
T_c	Crystal temperature	–	150	°C
T_{stg}	Storage temperature range	–55	+150	°C

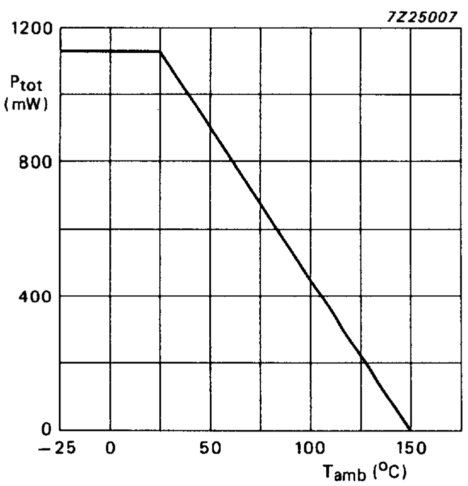


Fig.2 Power derating curve.

POWER DISSIPATION

Assume V_P = 6 V; R_L = 8 Ω; T_{amb} = 50 °C maximum.

The maximum sinewave dissipation is 0,9 W.

$$R_{th\ j\text{-}a} = \frac{150 - 50}{0,9} \approx 110 \text{ K/W}.$$

Where $R_{th\ j\text{-}a}$ of the package is 110 K/W, so no external heatsink is required.

CHARACTERISTICS

V_P = 6 V; R_L = 8 Ω; f = 1 kHz; T_{amb} = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	Supply voltage range		3	6	18	V
I_{tot}	Total quiscent current	$R_L = \infty$	–	4	8	mA
G_v	Voltage gain		38	39	40	dB
P_o	Output power	THD = 10%	–	1,2	–	W
	Noise output voltage (RMS value)					
$V_{no(rms)}$		note 1	–	150	300	μV
$V_{no(rms)}$		note 2	–	60	–	μV
f_r	Frequency response		–	20 Hz to 20 kHz	–	Hz
SVRR	Supply voltage ripple rejection	note 3	40	50	–	dB
	DC output offset voltage					
ΔV_{5-8}	pin 5 to 8	R_S = 5 k Ω	–	–	100	mV
THD	Total harmonic distortion	P_O = 0,1 W	–	0,2	1,0	%
$\|Z_I\|$	Input impedance		–	100	–	kΩ
I_{bias}	Input bias current		–	100	300	nA

Notes to the characteristics

1. The unweighted RMS noise output voltage is measured at a bandwidth of 60 Hz to 15 kHz with a source impedance (R_S) of 5 kΩ.
2. The RMS noise output voltage is measured at a bandwidth of 5 kHz with a source impedance of 0 Ω and a frequency of 500 kHz. With a practical load (R = 8 Ω; L = 200 μH) the noise output current is only 100 nA.
3. Ripple rejection is measured at the output with a source impedance of 0 Ω and a frequency between 100 Hz and 10 kHz. The ripple voltage = 200 mV (RMS value) is applied to the positive supply rail.

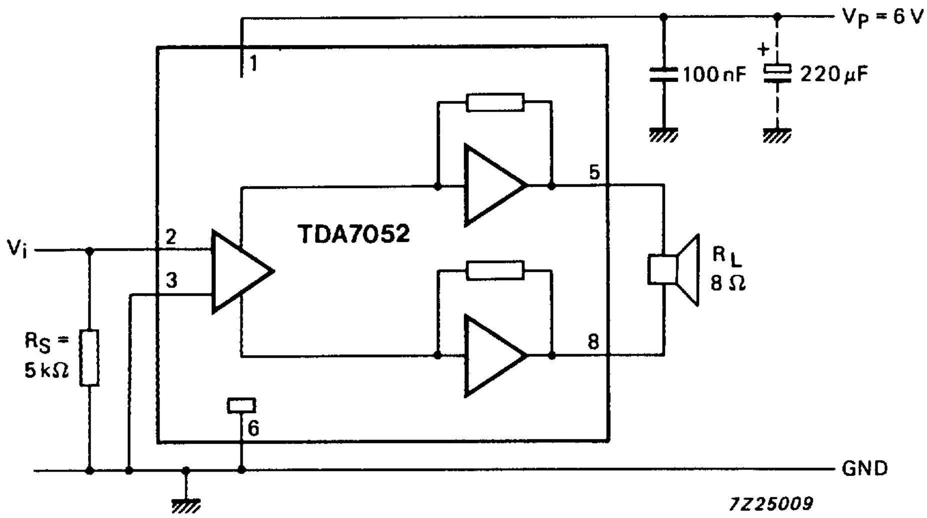
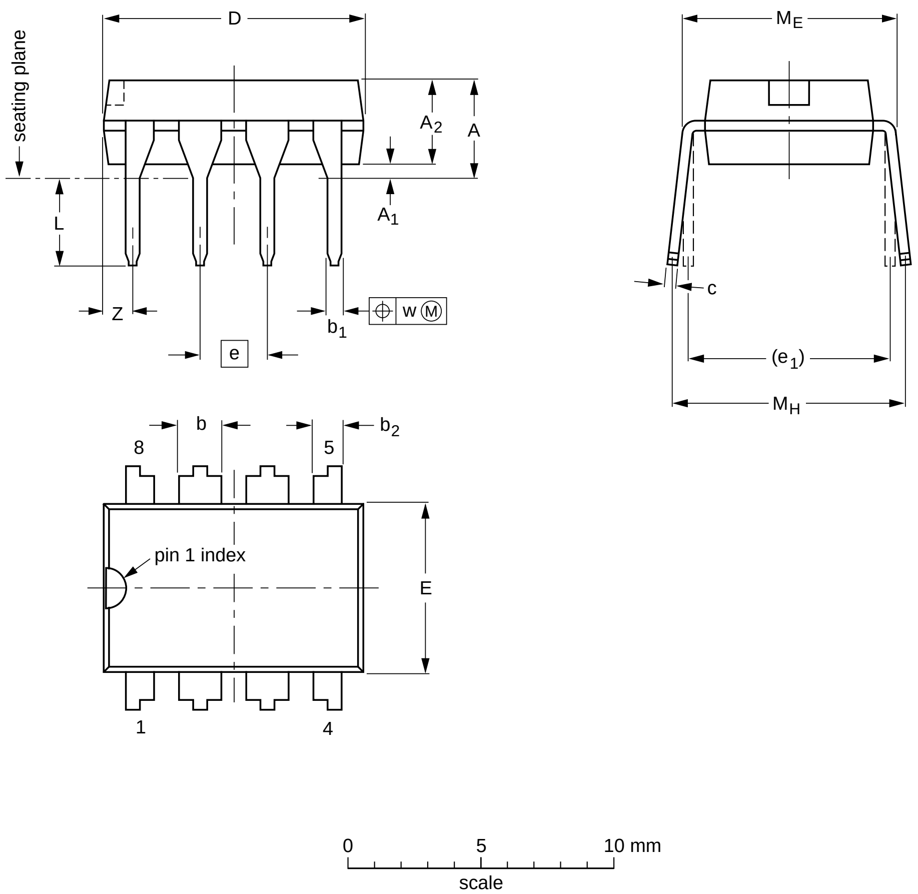


Fig.3 Application diagram.

PACKAGE OUTLINE

DIP8: plastic dual in-line package; 8 leads (300 mil) **SOT97-1**

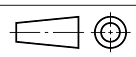


DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.14	0.53 0.38	1.07 0.89	0.36 0.23	9.8 9.2	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	1.15
inches	0.17	0.020	0.13	0.068 0.045	0.021 0.015	0.042 0.035	0.014 0.009	0.39 0.36	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.045

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT97-1	050G01	MO-001AN				~~92-11-17~~ 95-02-04

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.