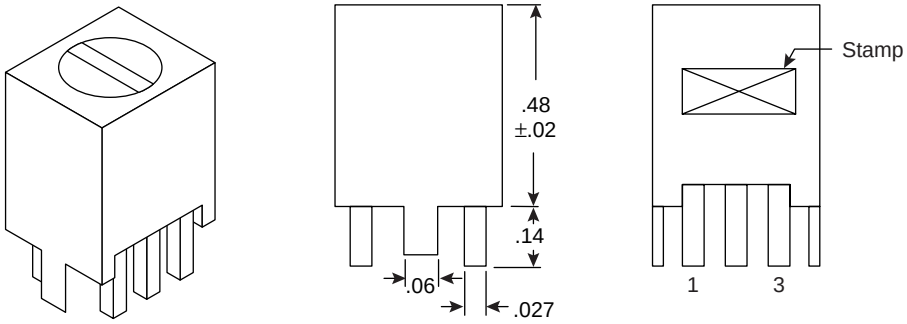
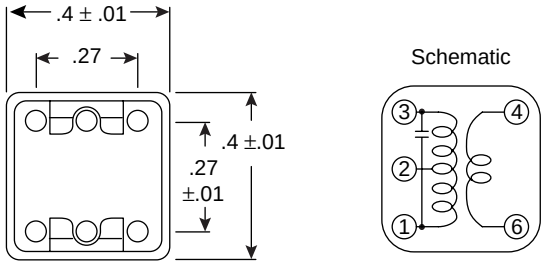


Dimensions (In.)



Specifications:

- Type: Sub-miniature
- Mounting: PC

Mouser Stock No.	Application (Typical) (IF)	Impedance		Unload Q Value	Tuning Capacitance	Inductance	Turns			Cap Color
		Pri.	Sec.				(1-2)	(2-3)	(4-6)	
Center Frequency: 455KHz ±3%										
42IF101	1st	60KΩ	600Ω	80±20%	180PF+5pF (ext.)	680uH	70	87	7	Yel
42IF102	2nd	30KΩ	500Ω	80±20%	180PF+5pF (ext.)	680uH	98	57	7	White
42IF103	3rd	20KΩ	6KΩ	75±20%	180PF+5pF (ext.)	680uH	103	50	27	Black
Center Frequency: 10.7MHz ±3%										
42IF122	2nd & 3rd	15KΩ	300Ω	80 min.	47PF+5pF (ext.)	4.5uH	7	7	1	Brown
42IF123	1st	25KΩ	4KΩ	95±20%	47PF+5pF (ext.)	4.5uH	5	9	2	Green
42IF129	2nd & 3rd	15KΩ	100Ω	100±20%	30PF	7.4uH	12	6	1	Black

National Semiconductor

LM3820 AM Radio System

General Description

The LM3820 is a 3-stage AM radio IC consisting of an RF amplifier, oscillator, mixer, IF amplifier, AGC detector, and zener regulator.

The device was originally designed for use in slug-tuned auto radio applications, but is also suitable for capacitor-tuned portable radios.

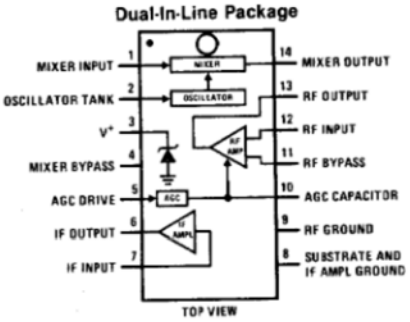
The LM3820 is an improved replacement for the LM1820.

Features

- Input protection diodes
- Good control on sensitivity
- Improved S/N and tweet
- Versatile building-block approach
- Gain-controlled RF stage
- Cascode IF amplifier
- Regulated supply
- Pin compatible with LM1820

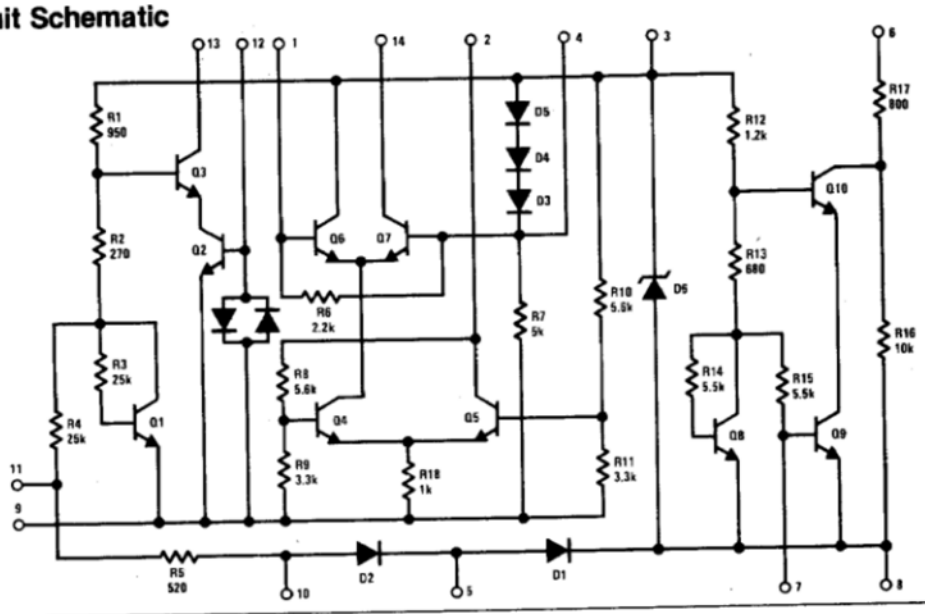
Connection Diagram

Dual-In-Line Package



Order Number LM3820N
See NS Package N14A

Circuit Schematic



Absolute Maximum Ratings

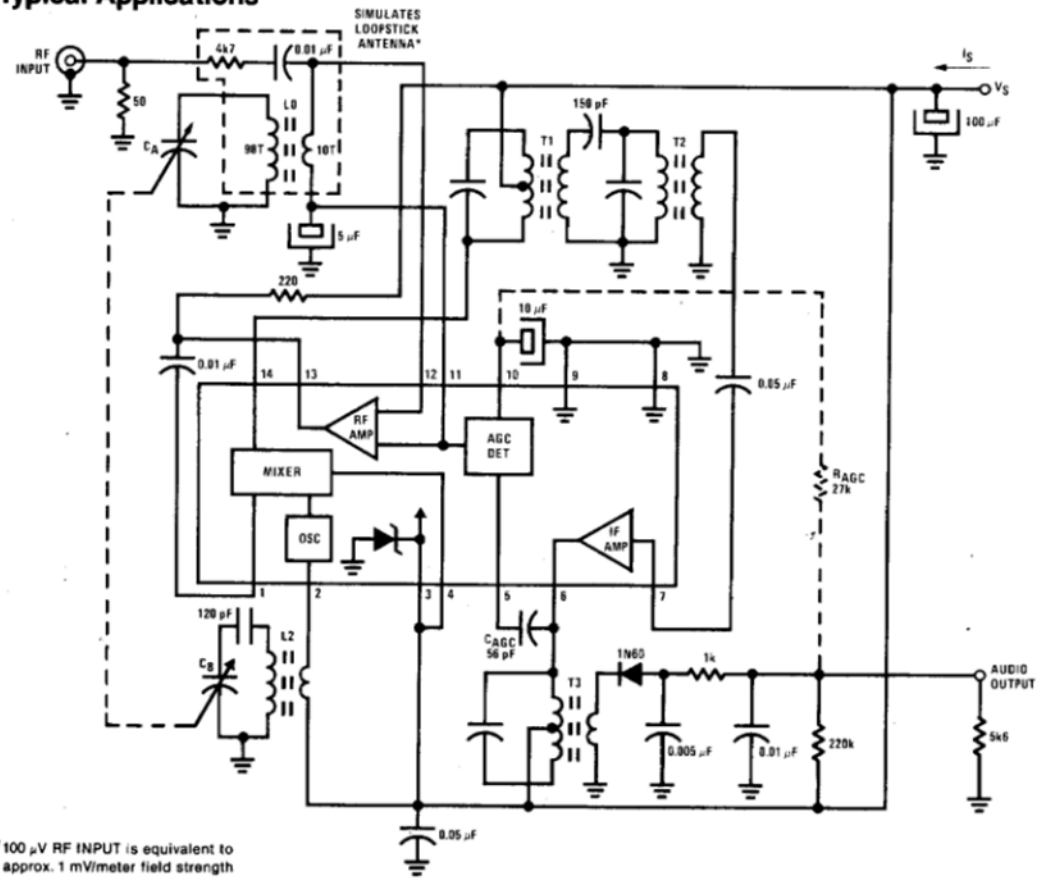
Power Dissipation (Note 1)	700 mW	Operating Temperature Range	−25 °C to 85 °C
Supply Voltage	16V	Storage Temperature Range	−65 °C to 150 °C
Current into Supply Terminal (Pin 3)	35 mA	Lead Temperature (Soldering, 10 seconds)	300 °C

Electrical Characteristics (*Figure 1*, $T_A = 25\,°C$, $V_S = 6V$ unless noted)

Parameter	Conditions	Min	Typ	Max	Units
Supply Current (I_S)	No RF Input	12	18	24	mA
Internal Zener Voltage (V_Z)		7.0	7.5	8.0	V
Input Sensitivity	f = 1 MHz, 30% Mod 400 Hz Measure RF Input Level for 10 mV Audio Output with Tuning Peaked	15	35	70	μV
Signal to Noise Ratio	f = 1 MHz, 30% Mod 1 kHz (S + N)/N at Audio Output with 100 μV RF Input	22	28	—	dB
Overload Distortion	f = 1 MHz, 90% Mod 1 kHz THD at Audio Output with 30 mV RF Input	—	6	10	%

Note 1: Above $T_A = 25\,°C$, derate based on $T_{J(MAX)} = 150\,°C$ and $\theta_{JA} = 180\,°C/W$

Typical Applications



* 100 μV RF INPUT is equivalent to approx. 1 mV/meter field strength

: See Applications Information for coil specifications

FIGURE 1. Capacitor-Tuned Test Fixture

Applications Information

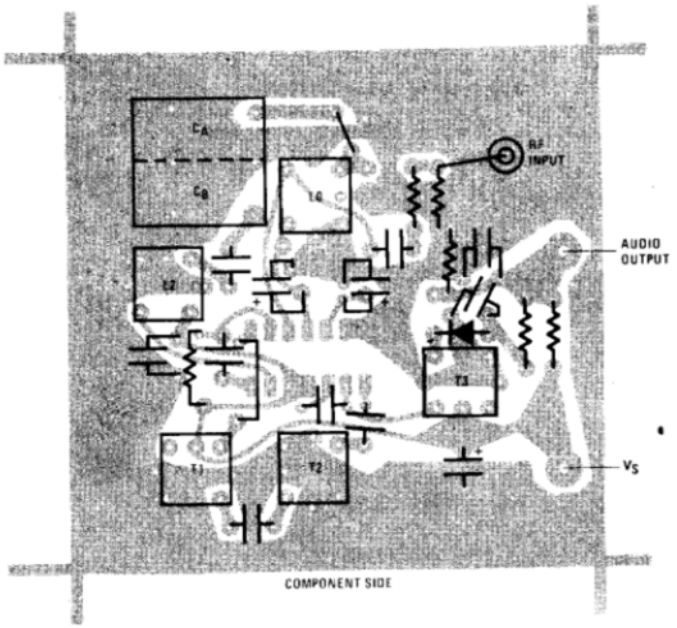
The circuit shown in *Figure 1* is recommended as a starting point for portable radio designs. Loopstick antenna L1 is used in place of L0, and the RF amplifier is used with a resistor load to drive the mixer. A double tuned circuit at the output of the mixer provides selectivity, while the remainder of the gain is provided by the IF section, which is matched to the diode through a unity turns ratio transformer. R_{AGC} may be used in place of C_{AGC} to bypass the internal AGC detector and provide more recovered audio.

An AM automobile radio design is shown in *Figure 2*. Tuning of both the input and the output of the RF amplifier and the mixer is accomplished with variable inductors. Better selectivity is obtained through the use of double tuned interstage transformers. Input circuits are inductively tuned to prevent microphonics and provide a linear tuning motion to facilitate push-button operation.

Coil specifications for *Figure 1* are as follows:

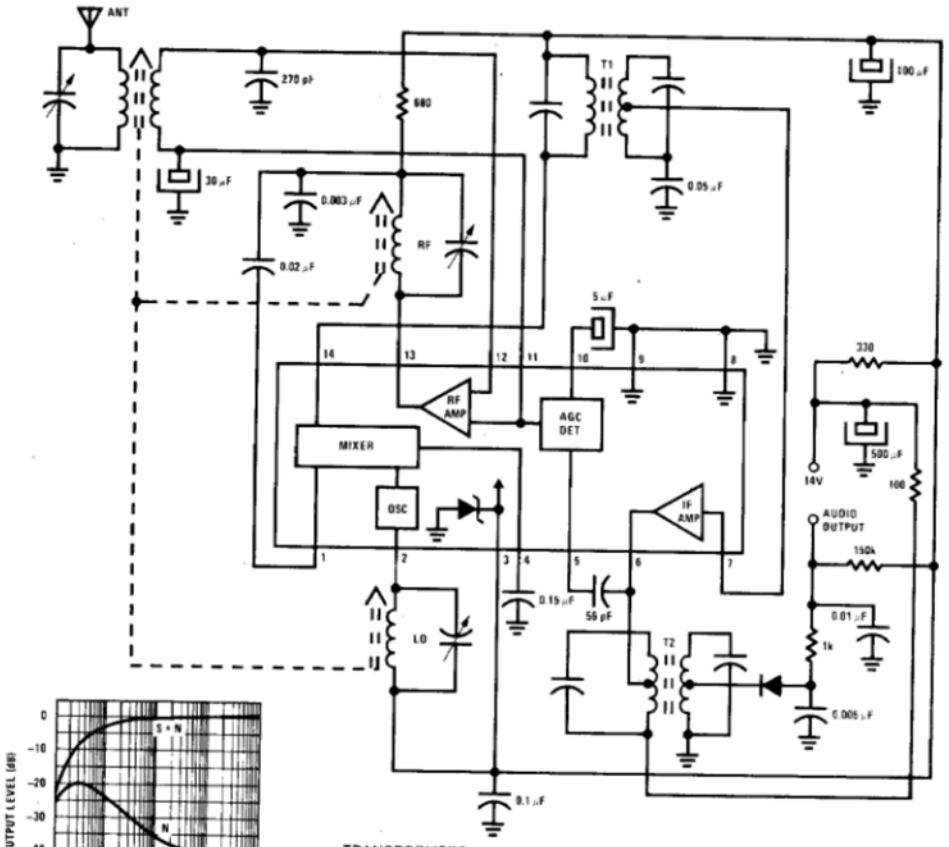
VC	AM PVC	L1	AM ANT	L0, L2	AM OSC
			525 kHz-1650 kHz		980 kHz-2105 kHz
C_A = 140 pF C_B = 80 pF		100 x 8 mm 118T 5T L = 650 µH Qu = 250		58T 10T L = 360 µH Qu = 110	

T1	AM 1st IF	T2	AM 2nd IF	T3	AM 3rd IF
	455 kHz		455 kHz		455 kHz
21T 11T 2T C = 180 pF Qu = 140		150 pF EXT 142T 7T C = 47 pF Qu = 120		21T 11T 3T C = 180 pF Qu = 140	



PCB Layout for *Figure 1* Circuit

Typical Applications (Continued)



TRANSFORMERS

T1: C = 130 pF primary & secondary
primary to secondary tap ratio—30:1
Q = 60
coupling—critical

T2: C = 130 pF primary & secondary
primary tap ratio—8.5:1
secondary tap ratio—8.5:1
Q = 60
coupling—critical

FIGURE 2. Slug-Tuned Auto Radio

Low Cost AM Radio System using LM3820 and LM386

National Semiconductor
Linear Brief 29
Elias S. Papanicolaou

INTRODUCTION

The majority of linear integrated circuits being produced today is in the field of op amps, comparators and regulators. This has come about for the reason that these types of devices can take advantage of the well matched characteristics of monolithic components. However, in recent years the monolithic integrated circuit has found its place in communication systems such as radios and televisions. The basic philosophy in this area, and the consumer industry as a whole, has mainly been cost reduction over discrete counterparts, improved performance and higher reliability.

An integrated circuit which meets the above criteria is the LM3820 AM-RADIO SYSTEM, designed primarily for superheterodyne AM receiver applications utilizing an RF-amplifier stage ahead of the mixer-oscillator. However, this linear brief describes how the LM3820 and LM386 can be incorporated in the design of a conventional low cost AM-radio without an RF-amplifier stage.

RADIO DESCRIPTION

The block diagram of the radio is depicted in *Figure 1*. A complete schematic is shown in *Figure 2*. The building blocks for the Mixer-Oscillator, the two IF stages, and the AGC section, are contributed by the LM3820. Power output of 1/4W into an 8Ω speaker is obtained by the LM386, the gain of which is externally set to 200. The LM3820 is operated from a 6V supply, that is, below the voltage of zener diode D6, see *Figure 3*.

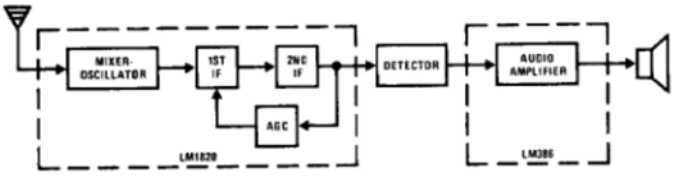


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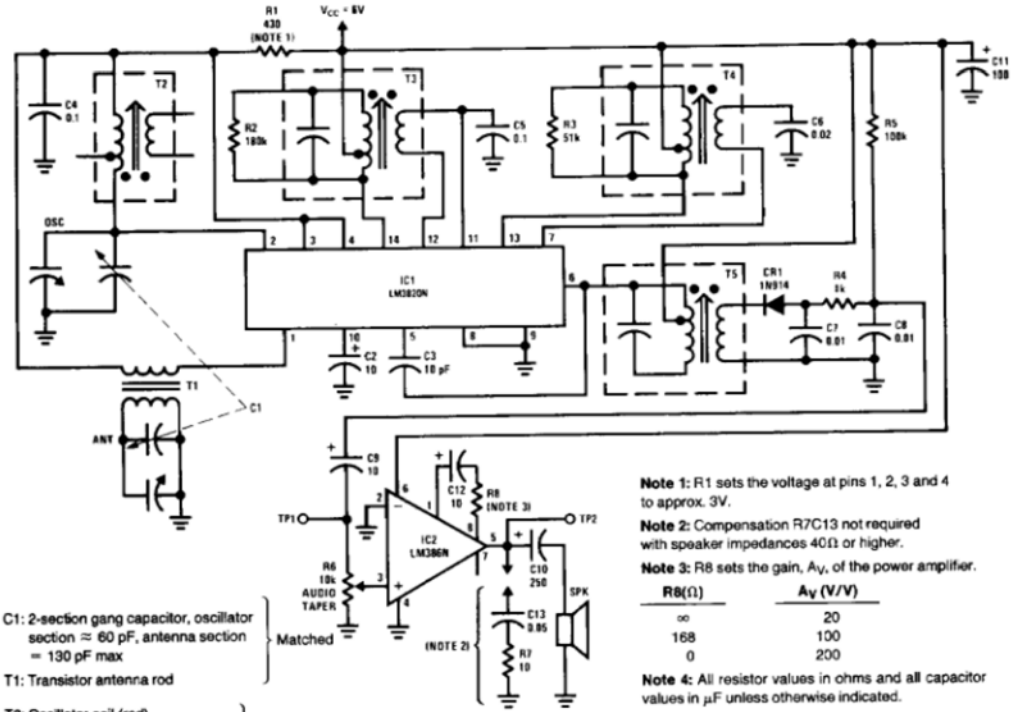
FIGURE 1. Radio Block Diagram



Note 1: R1 sets the voltage at pins 1, 2, 3 and 4 to approx. 3V.

Note 2: Compensation R7C13 not required with speaker impedances 40Ω or higher.

Note 3: R8 sets the gain, A_V, of the power amplifier.

R8(Ω)	A_V (V/V)
∞	20
168	100
0	200

Note 4: All resistor values in ohms and all capacitor values in μF unless otherwise indicated.

TL/H/8732–2

C1: 2-section gang capacitor, oscillator section ≈ 60 pF, antenna section = 130 pF max
T1: Transistor antenna rod
} Matched

T2: Oscillator coil (red)
T3: 455 kHz IF transformer (yellow)
T3: 455 kHz IF transformer (white)
T3: 455 kHz IF transformer (black)
} (Radio Shack) Archer #273-1383

FIGURE 2. Radio Schematic

Pins 1, 2, 3 and 4 are biased from the same supply through a 430Ω dropping resistor. This reduces the total current consumption to approximately 10 mA making the operation from a 6V battery feasible. The dc return of pin 1 and 4 to pin 3 improves component count and prevents transistor Q4 in the oscillator section from saturating. Large swings are preserved by returning the collectors at pins 14, 13 and 6 to V_{CC} via the primary windings of transformers T3, T4 and T5 respectively. For better linearity, detector diode 1N914 is biased slightly in the forward direction. Radio performance concerning distortion, AGC, sensitivity and signal-to-noise is shown in *Figure 4*. These data are taken with the radio laid out as shown in *Figure 5*.

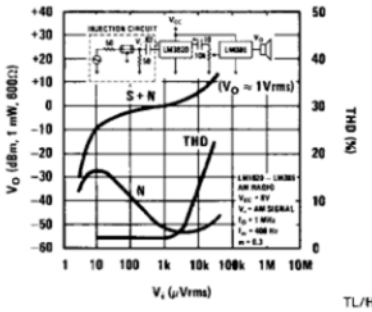


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FIGURE 4. Radio Performance Plots

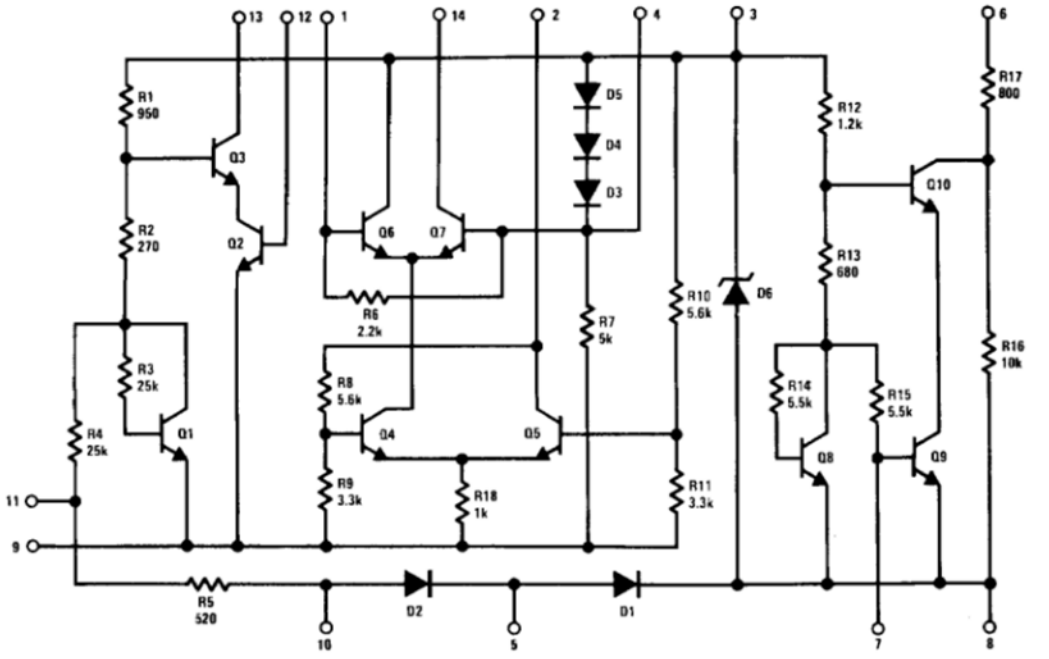

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FIGURE 3. LM3820 Schematic

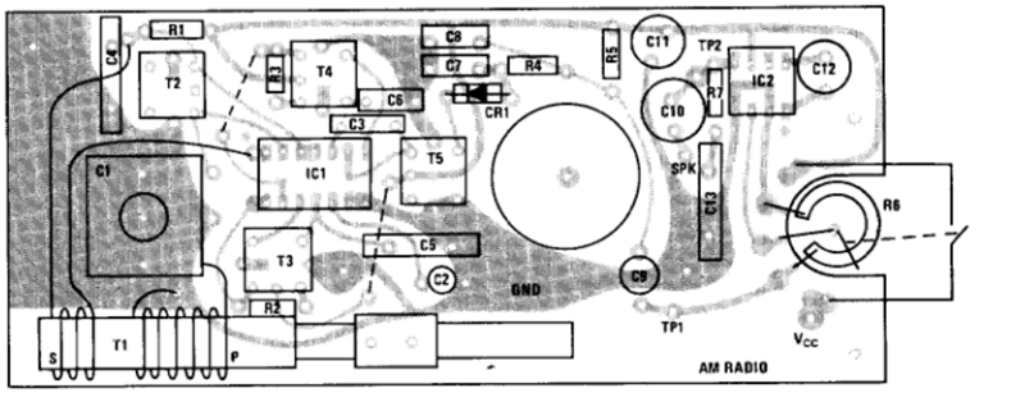

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FIGURE 5. Typical Printed Circuit Board Radio Layout (Bottom View) (Not Shown Full Size)