

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.

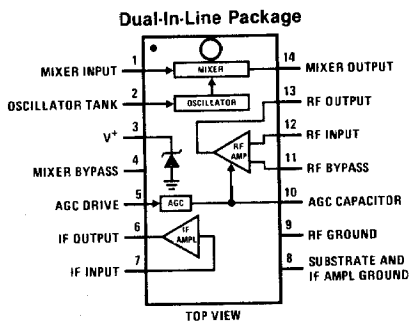
The device was originally designed for use in slug-tuned auto radio applications, but is also suitable for capacitor-tuned portable radios.

The LM3820 is an improved replacement for the LM1820.

Features

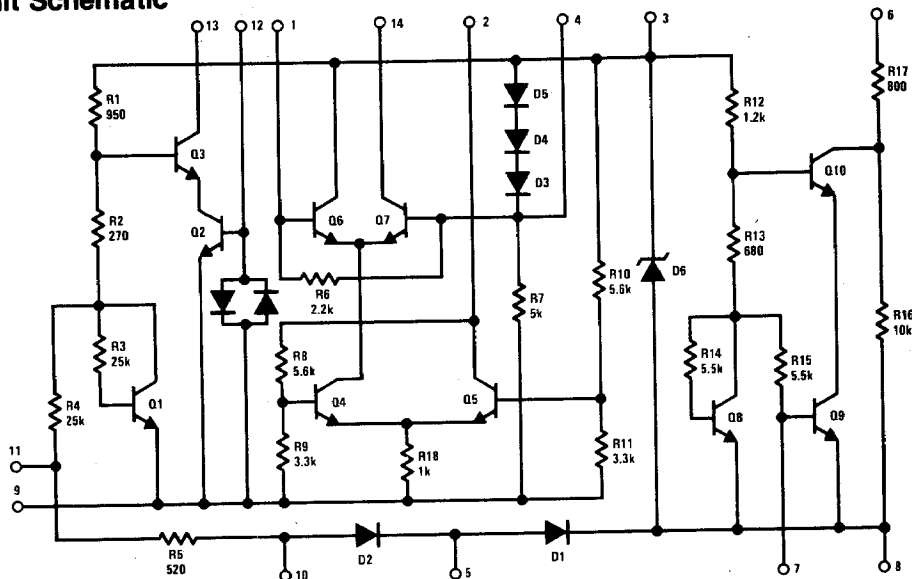
- Input protection diodes
- Good control on sensitivity
- Improved S/N and tweet
- Versatile building-block approach
- Gain-controlled RF stage
- Cascode IF amplifier
- Regulated supply
- Pin compatible with LM1820

Connection Diagram



Order Number LM3820N
See NS Package N14A

Circuit Schematic



Absolute Maximum Ratings

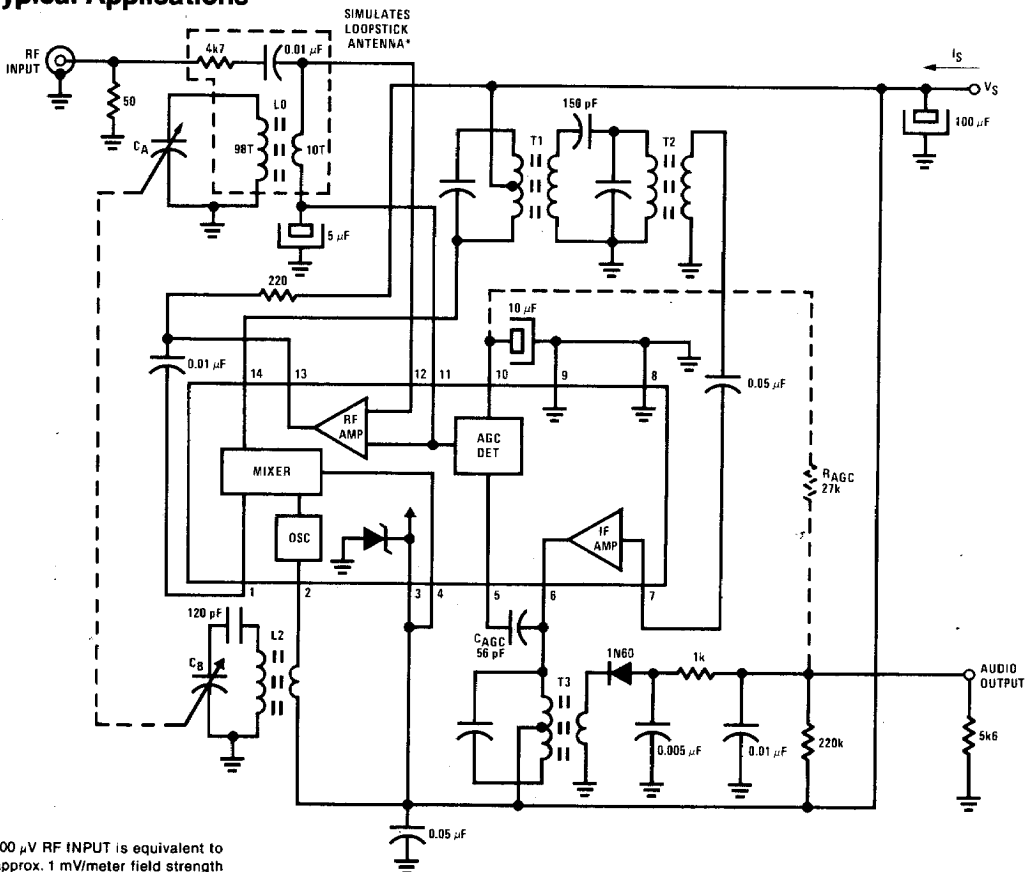
Power Dissipation (Note 1)	700 mW	Operating Temperature Range	- 25 °C to 85 °C
Supply Voltage	16V	Storage Temperature Range	- 65 °C to 150 °C
Current into Supply Terminal (Pin 3)	35 mA	Lead Temperature (Soldering, 10 seconds)	300 °C

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 θ_{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

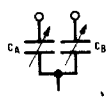
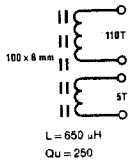
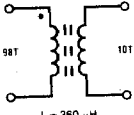
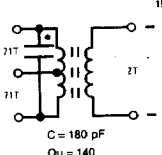
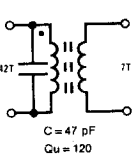
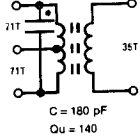
FIGURE 1. Capacitor-Tuned Test Fixture

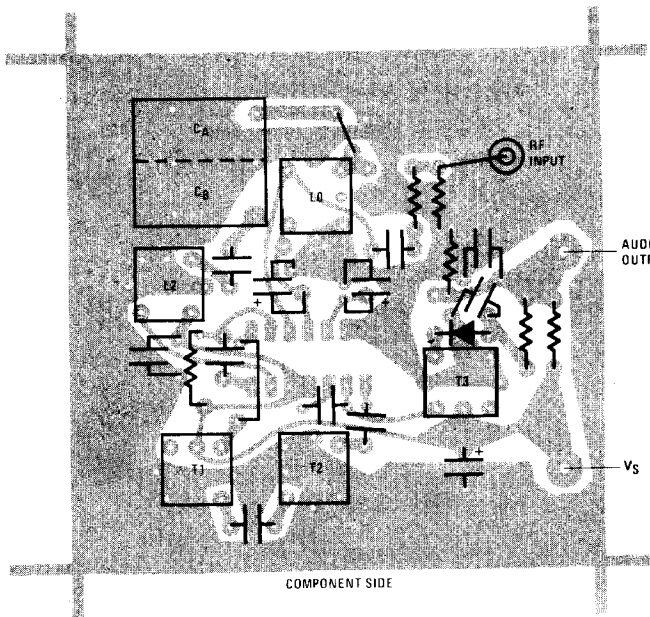
Applications Information

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
	 <p>C_A = 140 pF C_B = 80 pF</p>		 <p>L = 650 μH Qu = 250</p>		 <p>L = 360 μH Qu = 110</p>
T1	AM 1st IF	T2	AM 2nd IF	T3	AM 3rd IF
	455 kHz		455 kHz		455 kHz
	 <p>C = 180 pF Qu = 140</p>	 <p>C = 47 pF Qu = 120</p>	 <p>C = 180 pF Qu = 140</p>		



PCB Layout for *Figure 1* Circuit

Typical Applications (Continued)

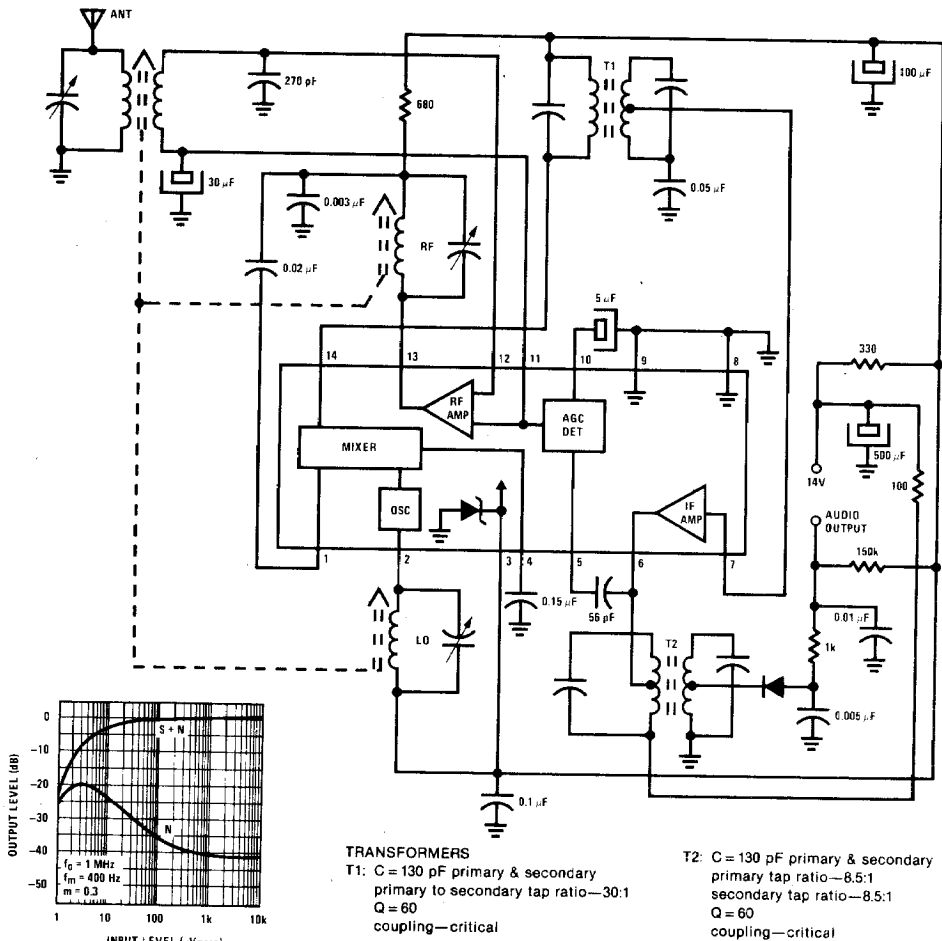
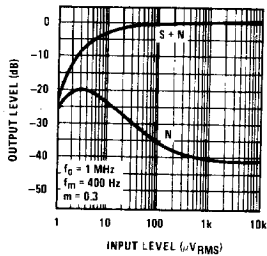


FIGURE 2. Slug-Tuned Auto Radio



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.

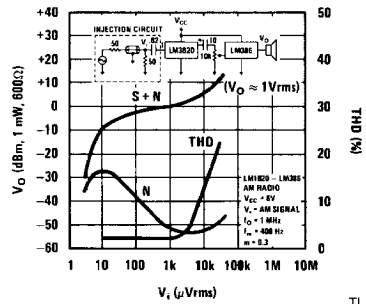


FIGURE 4. Radio Performance Plots

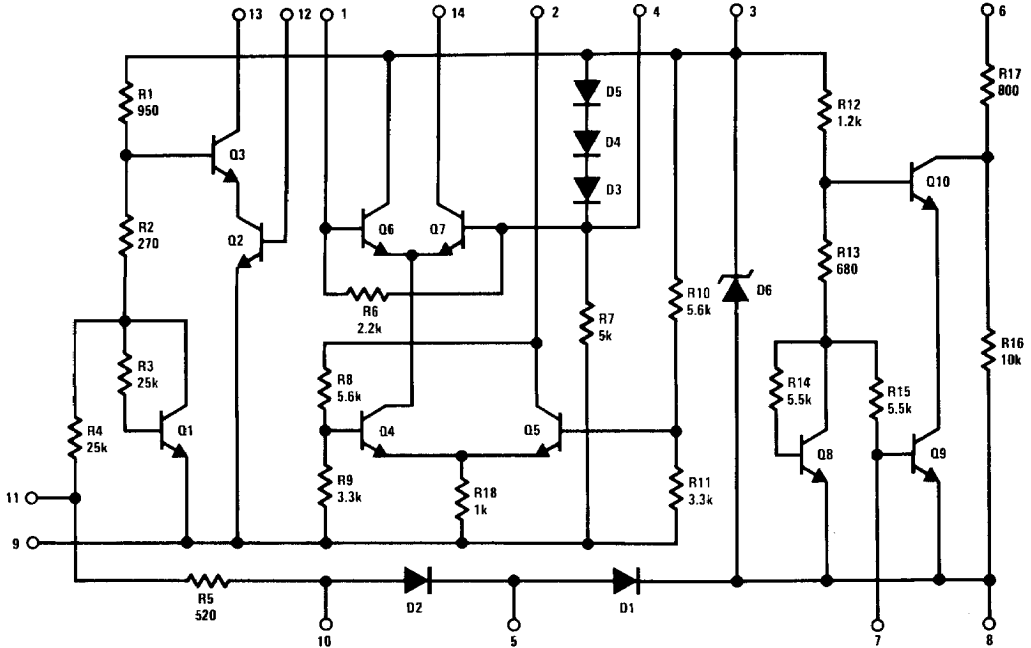


FIGURE 3. LM3820 Schematic

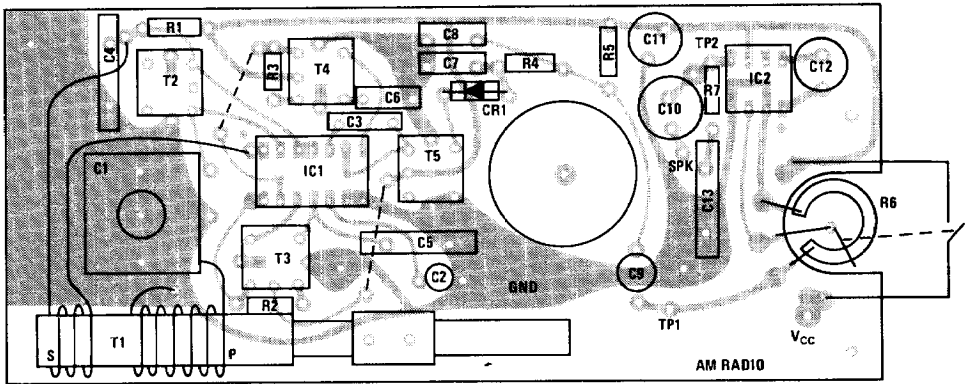


FIGURE 5. Typical Printed Circuit Board Radio Layout (Bottom View) (Not Shown Full Size)

TL/H/8732-5