



## 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.

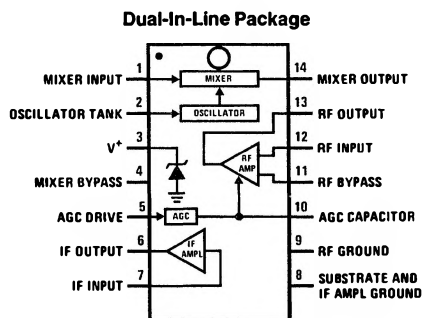
The device was originally designed for use in slug-tuned auto radio applications, but is also suitable for capacitor-tuned portable radios.

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

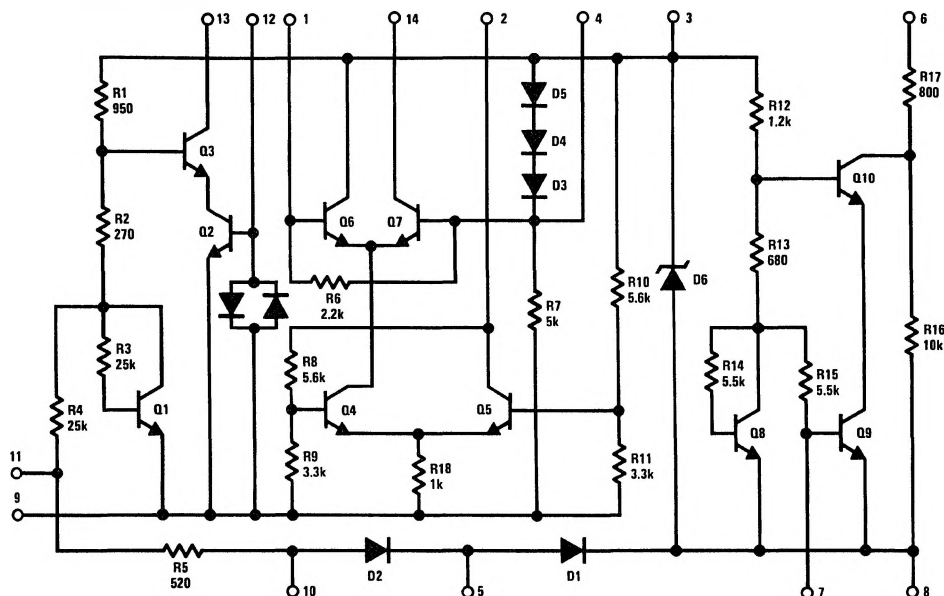
### Connection Diagram



TL/H/7967-1

Order Number LM3820N  
See NS Package Number N14A

### Circuit Schematic



TL/H/7967-2

### Absolute Maximum Ratings

**If Military/Aerospace specified devices are required, contact the National Semiconductor Sales Office/Distributors for availability and specifications.**

|                            |         |
|----------------------------|---------|
| Power Dissipation (Note 1) | 1200 mW |
| Supply Voltage             | 16V     |

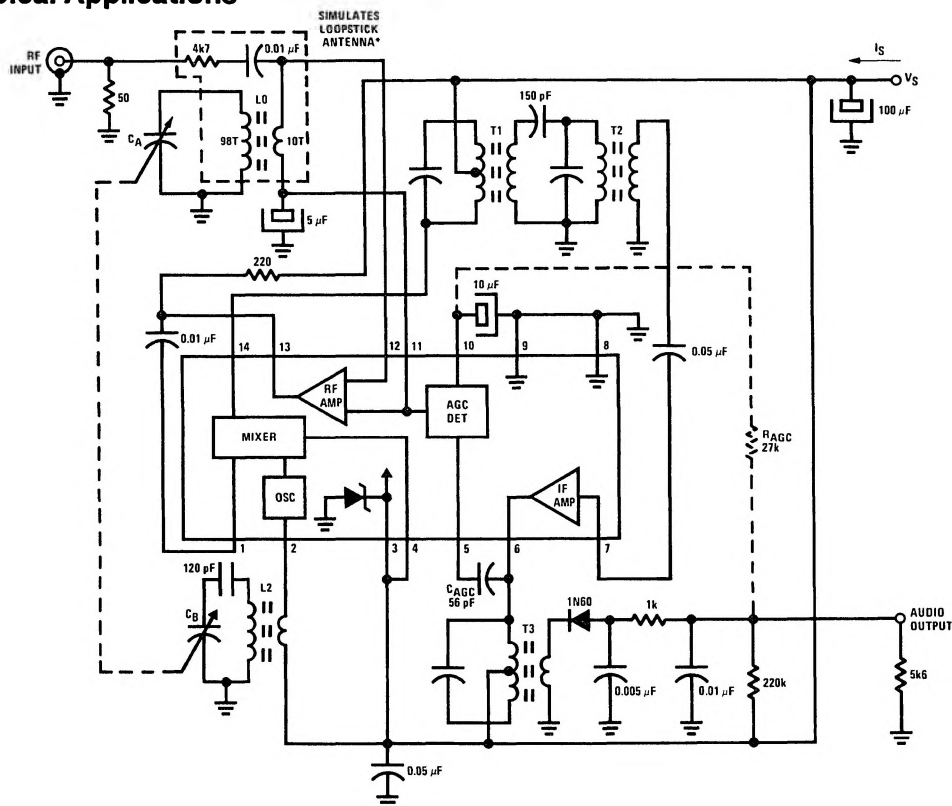
|                                       |                 |
|---------------------------------------|-----------------|
| Current into Supply Terminal (Pin 3)  | 35 mA           |
| Operating Temperature Range           | -25°C to +85°C  |
| Storage Temperature Range             | -65°C to +150°C |
| Lead Temperature (Soldering, 10 sec.) | 260°C           |

### Electrical Characteristics

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

**Note 1:** Above  $T_A = 25^\circ\text{C}$ , derate based on  $T_{J(\text{Max})} = 150^\circ\text{C}$  and  $\theta_{JA} = 100^\circ\text{C/W}$ .

## Typical Applications



\*100  $\mu$ V RF INPUT is equivalent to approx. 1 mV/meter field strength. See Applications Information for coil specifications.

TL/H/7967-3

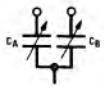
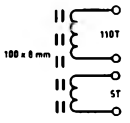
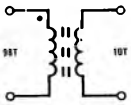
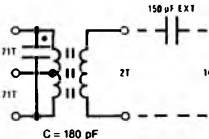
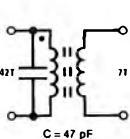
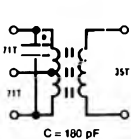
**FIGURE 1. Capacitor-Tuned Test Fixture**

## 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<sub>AGC</sub> may be used in place of C<sub>AGC</sub> to bypass the internal AGC detector and provide more recovered audio.

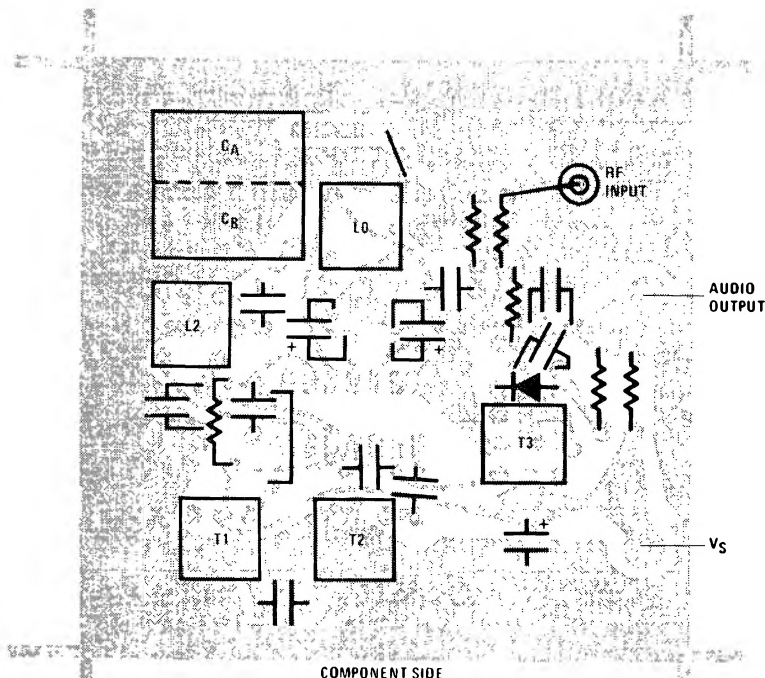
An AM automobile radio design is shown in *Figure 2*. Tuning of both the input and the output of the RF amplifier and the mixer is accomplished with variable inductors. Better selectivity is obtained through the use of double tuned interstage transformers. Input circuits are inductively tuned to prevent 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><math>C_A = 140 \text{ pF}</math><br/><math>C_B = 60 \text{ pF}</math></p> |    |  <p><math>L = 650 \mu\text{H}</math><br/><math>Q_u \approx 250</math></p> |        |  <p><math>L = 360 \mu\text{H}</math><br/><math>Q_u \approx 110</math></p> |
| T1 | AM 1st IF   | T2 | AM 2nd IF  | T3     | AM 3rd IF  |
|    | 455 kHz   |    | 455 kHz  |        | 455 kHz  |
|    |  <p><math>C = 180 \text{ pF}</math><br/><math>Q_u \approx 140</math></p>       |    |  <p><math>C = 47 \text{ pF}</math><br/><math>Q_u \approx 120</math></p>   |        |  <p><math>C = 180 \text{ pF}</math><br/><math>Q_u \approx 140</math></p>  |

PCB Layout for *Figure 1* Circuit

TL/H/7967-4



TL/H/7967-5

## Applications Information (Continued)

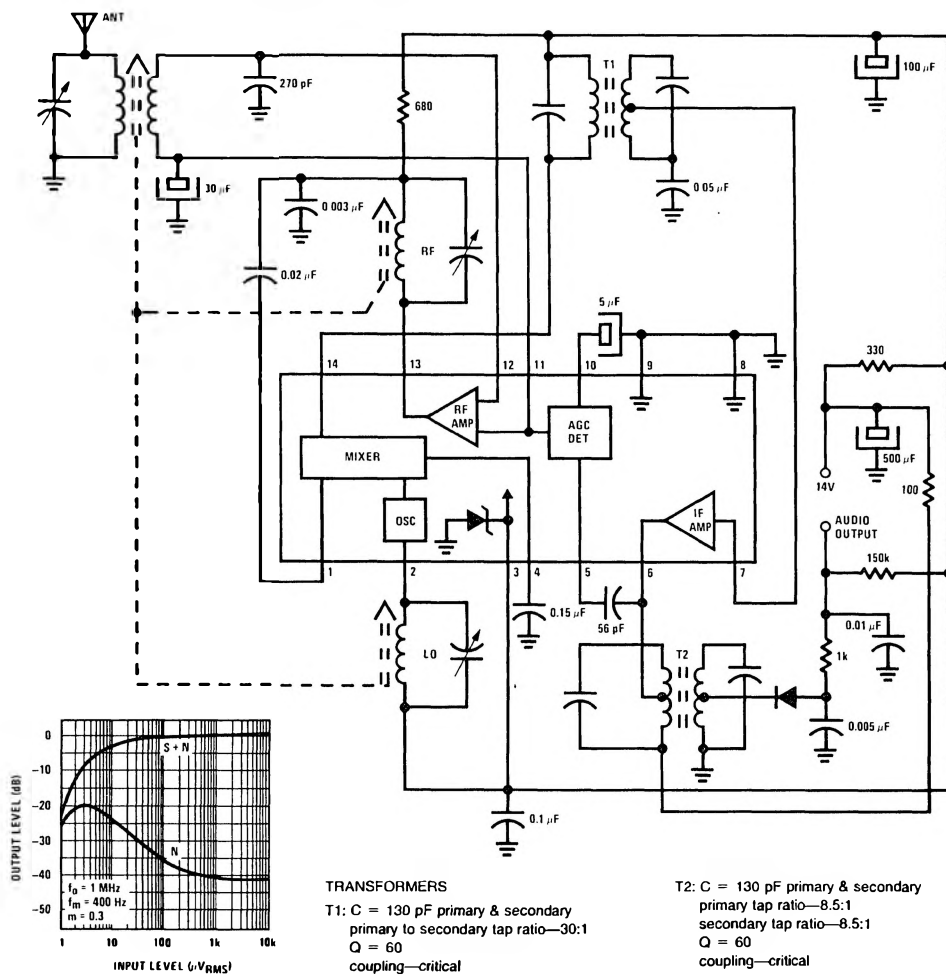


FIGURE 2. Slug-Tuned Auto Radio

TL/H/7967-6