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.

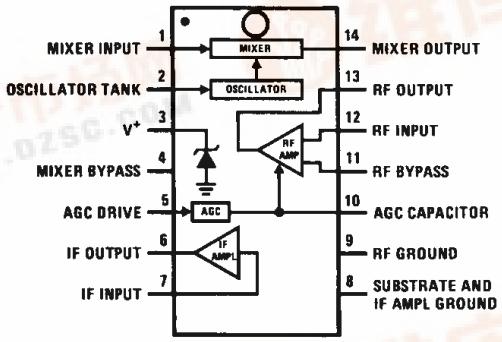
The LM3820 is an improved replacement for the LM1820.

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

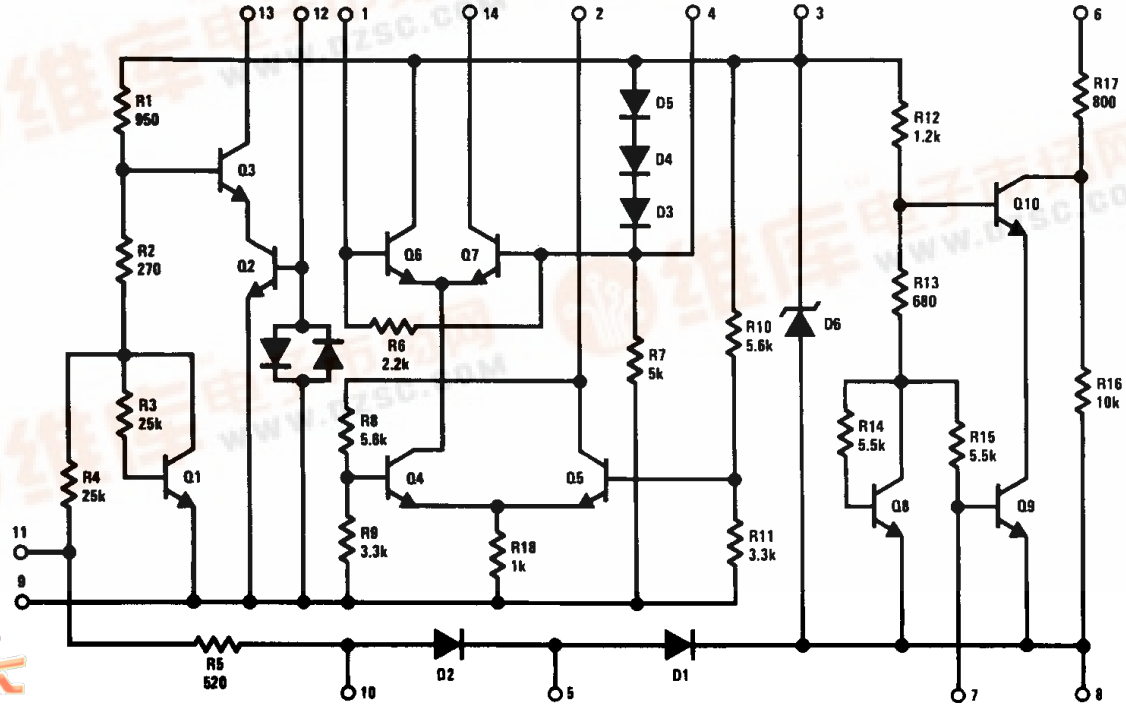
Dual-In-Line Package



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, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

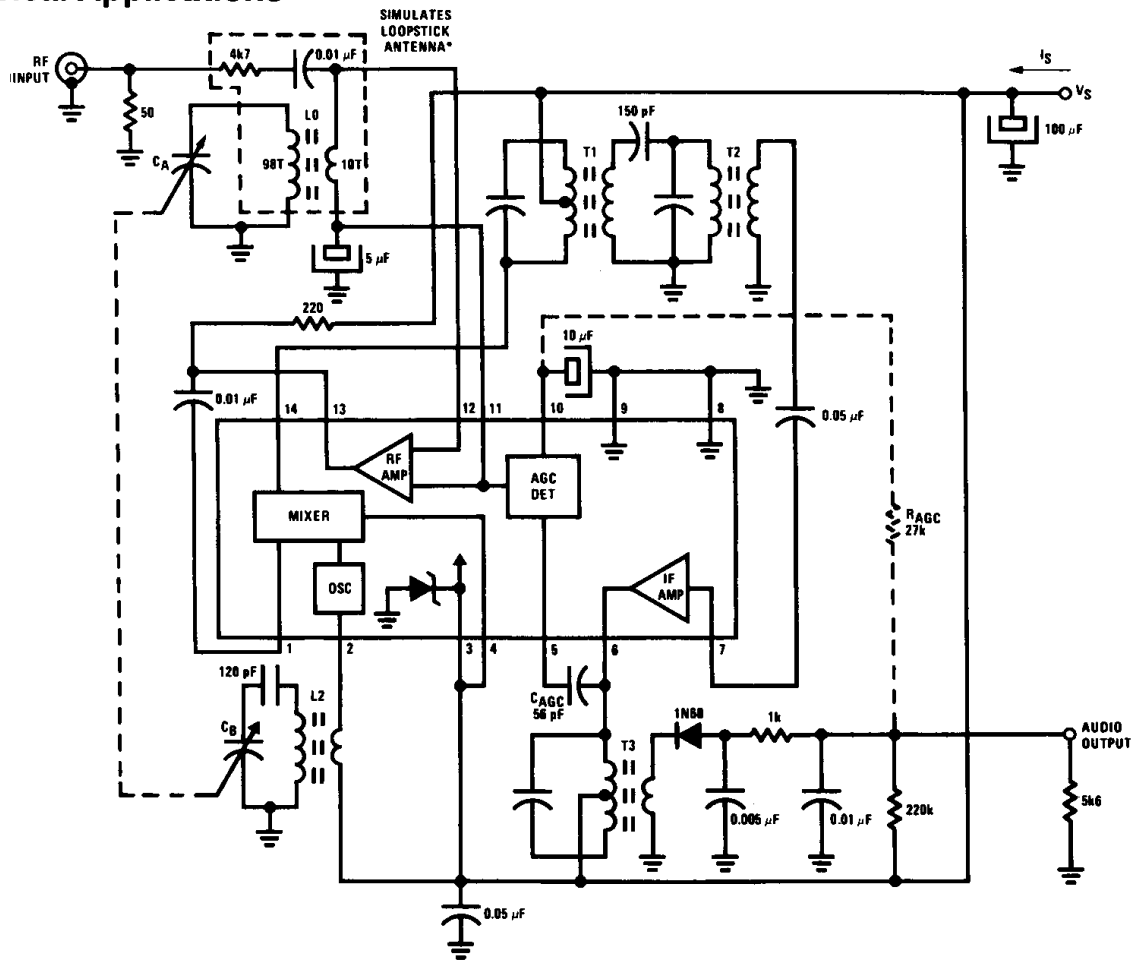
Power Dissipation (Note 1)	1200 mW
Supply Voltage	16V
Current into Supply Terminal (Pin 3)	35 mA
Operating Temperature Range	−25°C to +85°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_S	Supply Current	No RF Input	12	18	24	mA
V_Z	Internal Zener Voltage		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} = 100 °C/W.

Typical Applications



*100 μV 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_{AGC} may be used in place of C_{AGC} to bypass the internal AGC detector and provide more recovered audio.

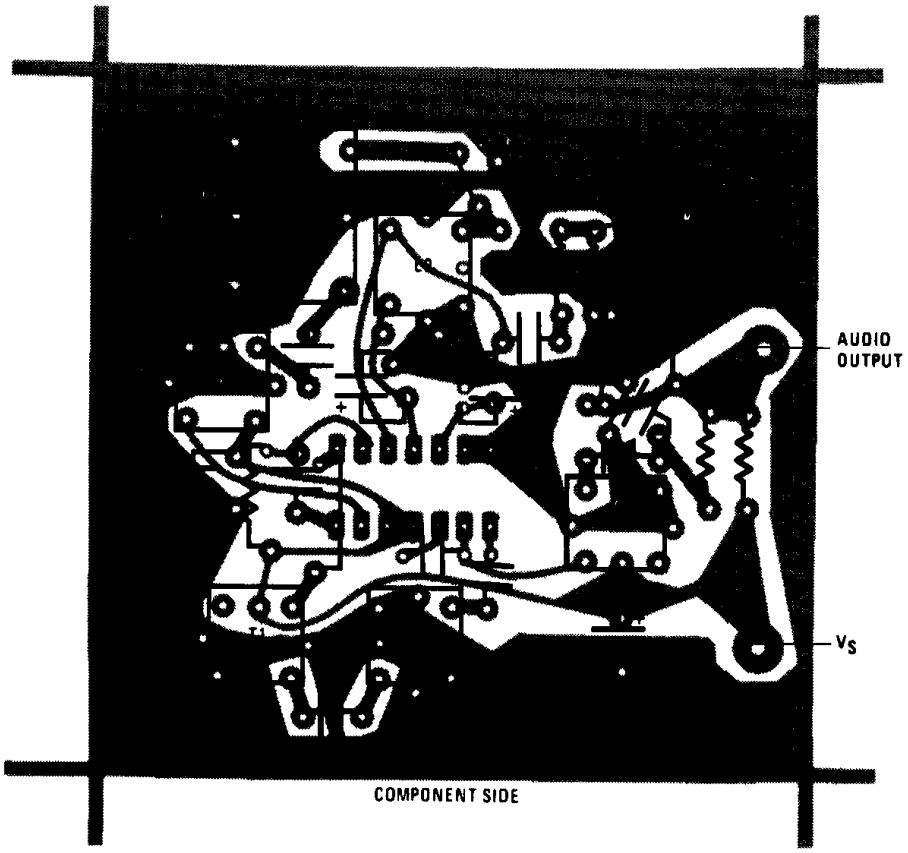
An AM automobile radio design is shown in *Figure 2*. Tuning of both the input and the output of the RF amplifier and the mixer is accomplished with variable inductors. Better selectivity is obtained through the use of double tuned interstage transformers. Input circuits are inductively tuned to prevent 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 = 60 pF		100 x 8 mm, 110T, 5T L = 650 µH Qu = 250		98T, 10T L = 360 µH Qu = 110	
T1	**AM 1st IF**	**T2**	**AM 2nd IF**	**T3**	**AM 3rd IF**
	455 kHz		**455 kHz**		**455 kHz**
71T, 71T, 2T, 150 pF EXT, 142T, 7T C = 180 pF Qu = 140		C = 47 pF Qu = 120		71T, 71T, 35T C = 180 pF Qu = 140	

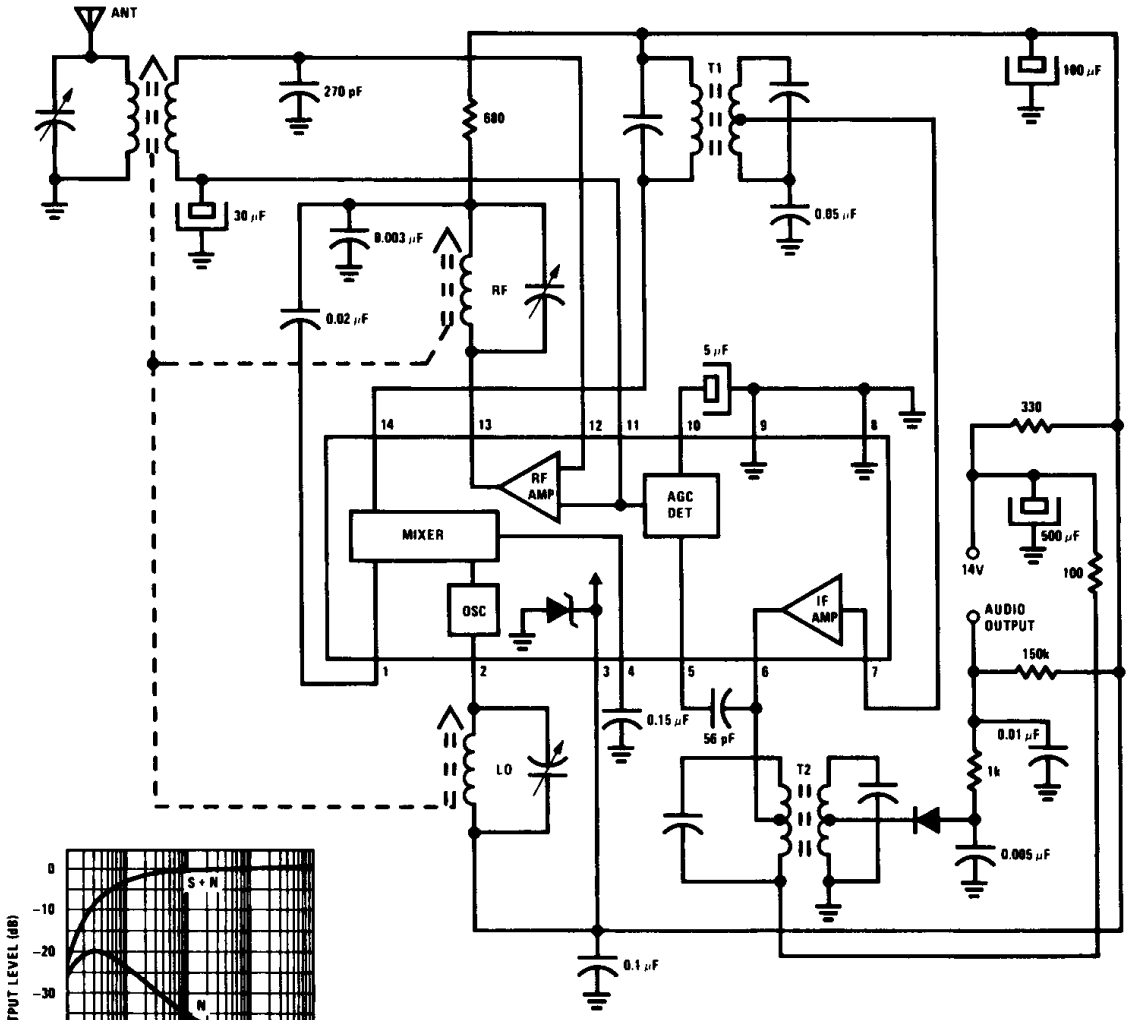
TL/H/7967–4

PCB Layout for *Figure 1* Circuit



TL/H/7967–5

Applications Information (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

TL/H/7967–6

FIGURE 2. Slug-Tuned Auto Radio

Schematic Reference	Toko* Part Number
L0, L2	RWO-6A6255
T1	RRC-3A6426N
T2	RRC-3A6427A
T3	RZC-1A6425A

*Toko America
1250 Feehanville Drive
Mount Prospect, IL 60056
(312) 297-0070

FIGURE 3. Representative Part Numbers for the Coils of *Figure 1*