

AM-Receiver

Description

The U4240B is a bipolar integrated AM receiver circuit. It performs all the active functions and part of the filtering

required of the AM radio receiver. The device is designed for car radio and home receiver applications.

Features

- ESD protected
- IF output for stereo demodulator and stop signal generation
- AF preamplifier with simple filtering
- Controlled RF preamplifier
- Double balanced mixer
- Separate oscillator with amplitude control
- IF amplifier with gain control
- Balanced full-wave detector
- Audio preamplifier
- Internal AGC voltage
- Amplifier for field-strength indication
- Electronic standby ON/ OFF switch

Block Diagram

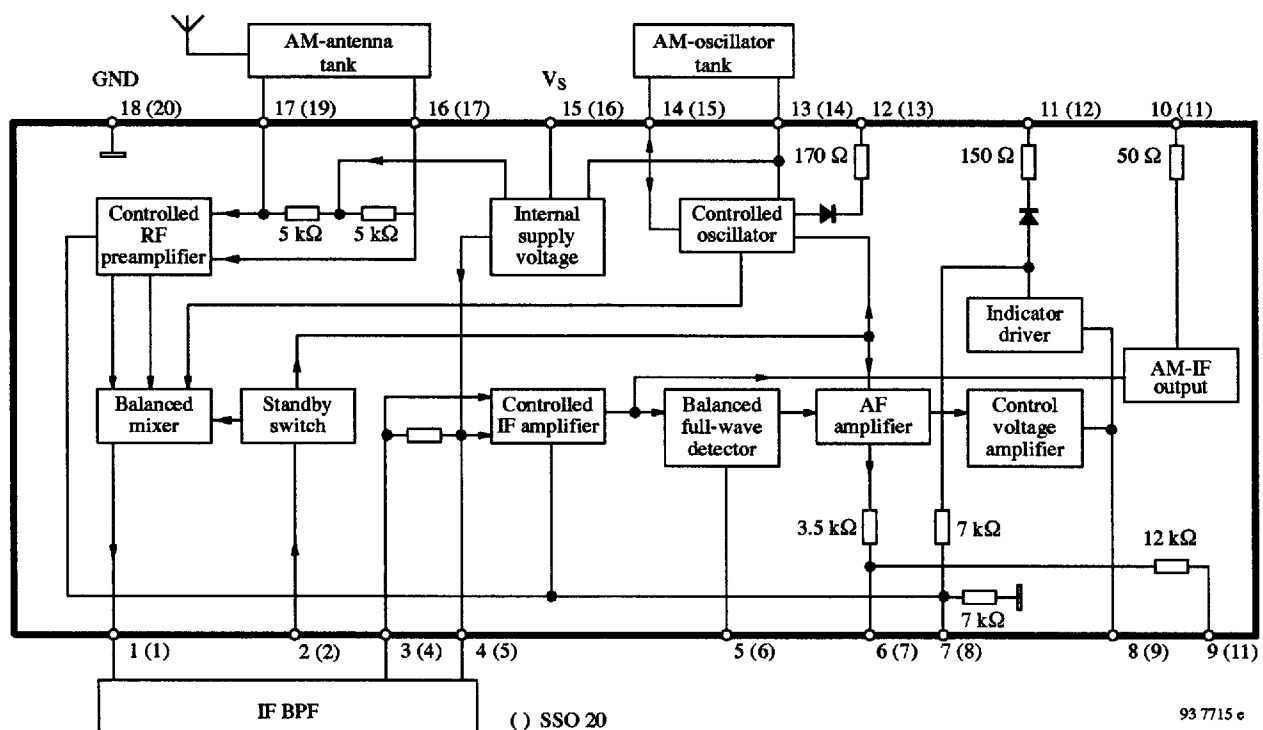
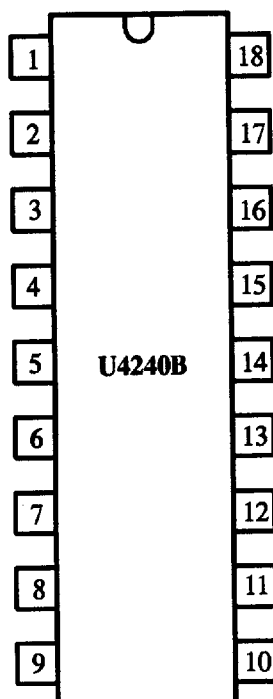


Figure 1.

Pin Description



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DIP 18	DIP 20	Function
1	1	Mixer output
2	2	Standby switch
3	4	IF amplifier input
4	5	V _{REF}
5	6	Low pass filtering
6	7	AF output
7, 8	8, 9	AGC time constant
9	10	Low pass filtered AF output
10	11	IF output
11	12	Field strength indicator
12	13	Oscillator output
13	14	Oscillator tank reference output
14	15	Oscillator tank input
15	16	V _S
16, 17	17, 19	RF input
18	20	GND
	3, 18	Not connected

Controlled RF Preamplifier, Pin 7

The RF preamplifier is built up differentially in order to achieve the best possible large signal handling capability. Special care was taken to reduce the input stage noise.

Balanced Mixer, Pin 1

The mixer is a double balanced type with a single ended output.

Controlled Oscillator, Pins 13 and 14

The oscillator employs temperature compensation, simple varicap and coil connection. The amplitude of the oscillator is controlled to low values, in order to support AM varactor diodes. The LO-buffer supports the U428xBM PLL-family.

Controlled IF Amplifier, Pin 3

The IF amplifier consists of two controlled gain cells coupled by capacitive means. Internal band pass filtering reduces higher order products and THD.

AM-IF Output, Pin 10

For AM stereo application and for stop signal generation by IF counting Pin 10 provides a non limited but amplitude controlled IF signal of about 280 mV.

Balanced Full-Wave Detector, Pin 5

The detector consists of a Gilbert cell that multiplies the limited carrier signal with the IF output signal and therefore employs a full wave rectification. Second or higher order products at the output are internally low pass filtered.

AF Amplifier, Pin 6

The AF amplifier has two different outputs. They provide different output resistances for simplifying applications. For a high end application Pin 6 provides a 3.5 kΩ output resistor to support a second order low pass filter. Pin 9 provides additional 12 kΩ for a simple first order low pass filter.

AGC, Pin 8

The AGC block generates the AGC voltage that is to be smoothed at Pin 8. The capacitor at Pin 8 defines the time constant. The voltage at Pin 8 is buffered to control the internal gain stages with different delay. The control voltage is available at Pin 11 (field strength indication).

Standby Switch, Pin 2

The whole circuit can be powered down by the standby switch. This mode can be achieved by a dc voltage higher than 3.5 V at Pin 2.

Absolute Maximum Ratings

Reference point Pin 18, unless otherwise specified

Parameters	Symbol	Value	Unit
Supply voltage	Pin 15 V_S	12	V
Input voltage	Pin 2 V_2	12	V
	Pins 16 and 17 IV_{16-17I}	12	
	Pins 16 and 17 V_{16}, V_{17}	VS	
Input current	Pins 16 and 17 I_{16}, I_{17}	200	mA
Ambient temperature range	T_{amb}	-30 to +85	°C
Storage temperature range	T_{stg}	-55 to +150	°C
Junction temperature	T_j	125	°C
Electrostatic handling (MIL Standard 883 C) except Pin 10	$\pm V_{ESD}$	2000	V

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	100	K/W

Electrical Characteristics

 $V_S = 8.5$ V, reference point Pin 18, $f_{iRF} = 1$ MHz, $R_G = 50 \Omega$, $f_{mod} = 0.4$ kHz, $m = 30\%$, $f_{IF} = 460$ kHz, $T_{amb} = 25^\circ\text{C}$, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply Pin 15						
Supply voltage		V_S	7.5		12	V
Supply current	without load: $I_L = 0$ (Pin 13)	I_S		23	30	mA
RF preamplifier						
DC input voltages	Pins 16 and 17	V_i		$V_S/2$		V
Input impedance	$V_{iRF} < 300 \mu\text{V}$, Pins 16, 17	R_i		5.5		k Ω
		C_i		25		pF
	$V_{iRF} > 10$ mV Pins 16, 17	R_i		80		k Ω
		C_i		22		pF
Maximum RF input voltage	Pins 16 and 17	V_i		2.5		V_{DD}
Mixer output Pin 1						
Output impedance		R_o	500			k Ω
		C_o		6.0		pF
Conversion conductance	I_{oIF}/V_{iRF}	S_M			6.5	mA/V
Oscillator						
Frequency range	Pin 14	f_{osc}	0.6		60	MHz
Oscillator circuit impedance range	Pin 14	Z_{Losc}	0.5		200	k Ω
Controlled oscillator amplitude	Pin 14	V_{osc}		130	160	mV
DC output voltage	$I_L = 0$ Pin 13	V_o		$6 V_{BE}$ (4.2V)		V
Output load current range	Pin 13	$-I_j$	0		20	mA

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Oscillator frequency output, $R_{L10} = 2.2 \text{ k}\Omega$ Pin 12						
Output voltage		V_O		320		mV _{pp}
DC output voltage		V_O		0.9		V
Output resistance		R_O		170		Ω
Output current		I_O			3	mA _p
IF amplifier and demodulator						
DC input voltages	Pins 3 and 4	V_i		2		V
Input impedance	Pins 3	R_i	2.4	3	3.9	k Ω
		C_i		7		pF
Maximum IF input voltage	m = 80%, d = 3%, Pin 3	V_i		55		mV
IF output voltage, without load	$V_i = 10 \text{ mV}$ (Pin 3/4) Pin 10	V_o	230	280	340	mV
IF output resistance	Pin 10	R_o		50		Ω
Control range	$\Delta V_{oAF} = 6 \text{ dB}$	ΔV_i		50		dB
Audio output voltage, without load	$V_i = 1 \text{ mV}$ (Pin 3/4) Pins 6 and 9	V_o		310		mV
Audio output resistance	Pin 6	R_o	2.9	3.5	4.2	k Ω
	Pin 9		9	12	15	
Field strength indication Pin 11						
DC indicator voltages	$R_{L11} = 2.7 \text{ k}\Omega$, $V_i = 0$	V_o		100		mV
	$R_{L11} = 2.7 \text{ k}\Omega$, $V_i = 500 \text{ mV}$		2.5	2.8	3.1	V
Output current capability		I_o	2.0			mA
Output resistance	$-I_o = 0.5 \text{ mA}$	R_o		150		Ω
Reverse voltage at the output	AM switch OFF, $\pm I_o \leq 1 \mu\text{A}$	V_o		6		V
Standby switch Pin 2						
Switching voltage		V_I		4 V _{BE} (2.75)		V
Required control voltage	AM-ON AM-OFF	V_I $V_I^{1)}$	3.5		2	V
Input current	AM-ON, $V_2 = 0$	$-I_I$			200	μA
	AM-OFF, $V_2 = 12 \text{ V}^{1)}$	$\pm I_I$			10	

1) or open input

Operating Conditions

$V_S = 8.5 \text{ V}$, $f_{iRF} = 1 \text{ MHz}$, $f_{mod} = 0.4 \text{ kHz}$, $m = 30\%$, $T_{amb} = 25^\circ\text{C}$, reference point Pin 18 (fig. 2) unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
RF input voltage	$(S+N)/N = 6 \text{ dB} = 26 \text{ dB}$ $= 46 \text{ dB}$	V_{iRF}		1.5 15 150		μV
RF input for AGC operation		V_{iRF}		30		μV
Control range with ref. to $V_{iRF} = 500 \text{ mV}$	$\Delta V_{oAF} = 6 \text{ dB}$	ΔV_{iRF}		87		dB
Maximum RF input voltage	$d = 3\%$, $m = 80\%$ $d = 3\%$, $m = 30\%$ $d = 10\%$, $m = 30\%$	V_{iRF}		0.5 0.7 0.9		V
Audio output voltage	$V_i = 1 \text{ mV}$ Pin 6 $V_i = 4 \mu\text{V}$, $m = 0.8$	V_{oAF}		310 75		mV
RF input voltage	$V_{oAF} = 60 \text{ mV}$	V_{iRF}	2	5.5	9	μV
Total distortion of audio output voltage	$m = 80\%$, $V_i = 1 \text{ mV}$ $m = 30\%$, $V_i = 500 \text{ mV}$	d		0.7 0.9		%
Signal plus noise to noise ratio of audio output voltage	$V_i = 100 \text{ mV}$	$(S+N)/N$		56		dB
IF bandwidth (-3 dB)		B_{IF}		4.6		kHz
IF selectivity	$\Delta f = \pm 9 \text{ kHz}$ $\Delta f = \pm 36 \text{ kHz}$	S_{IF}		30 60		dB

Test Circuit

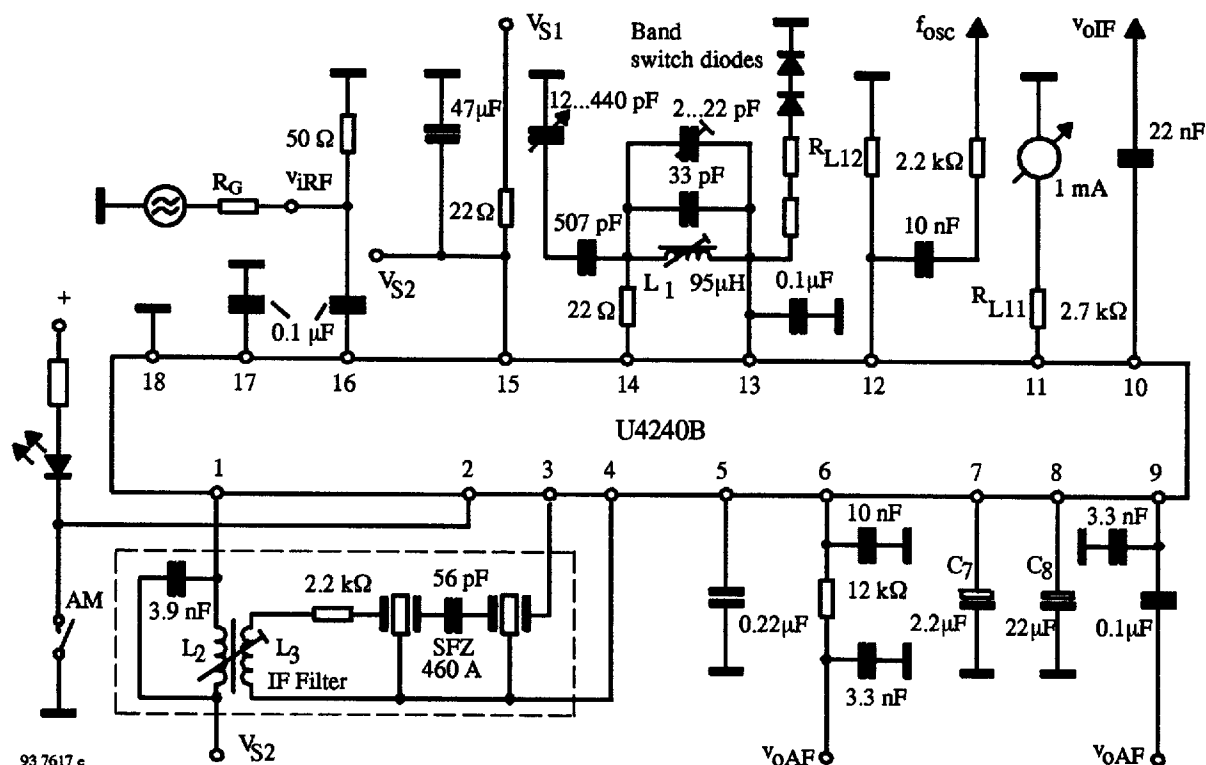
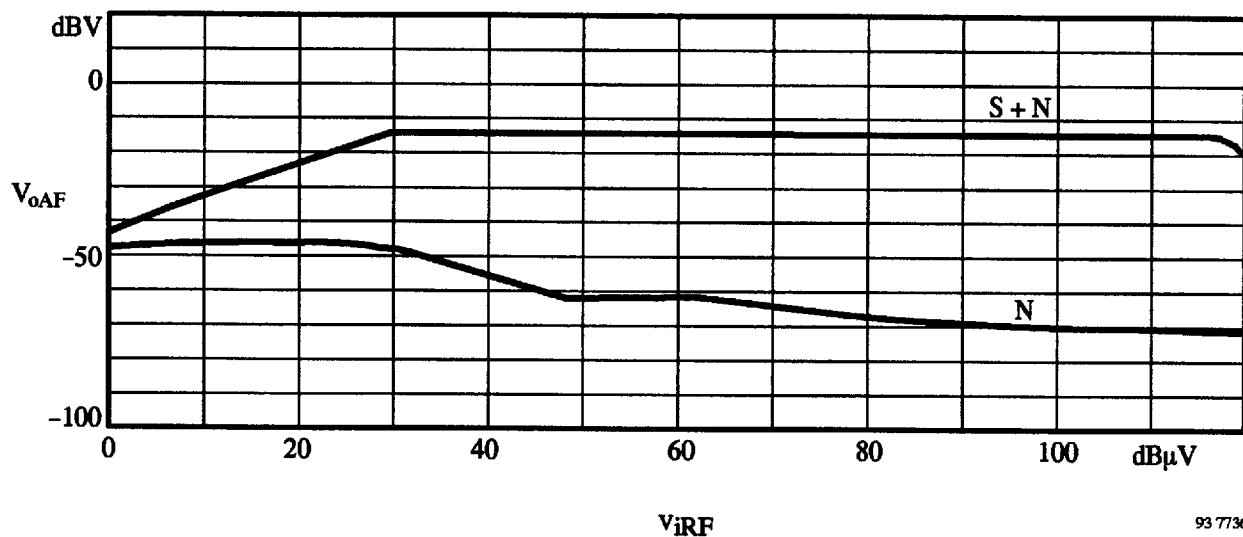
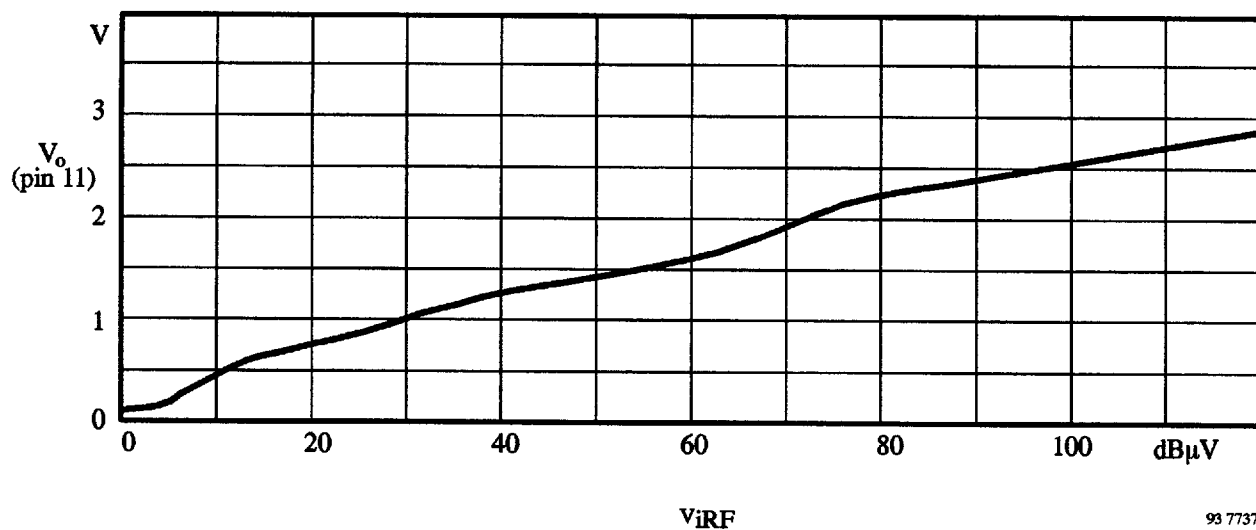


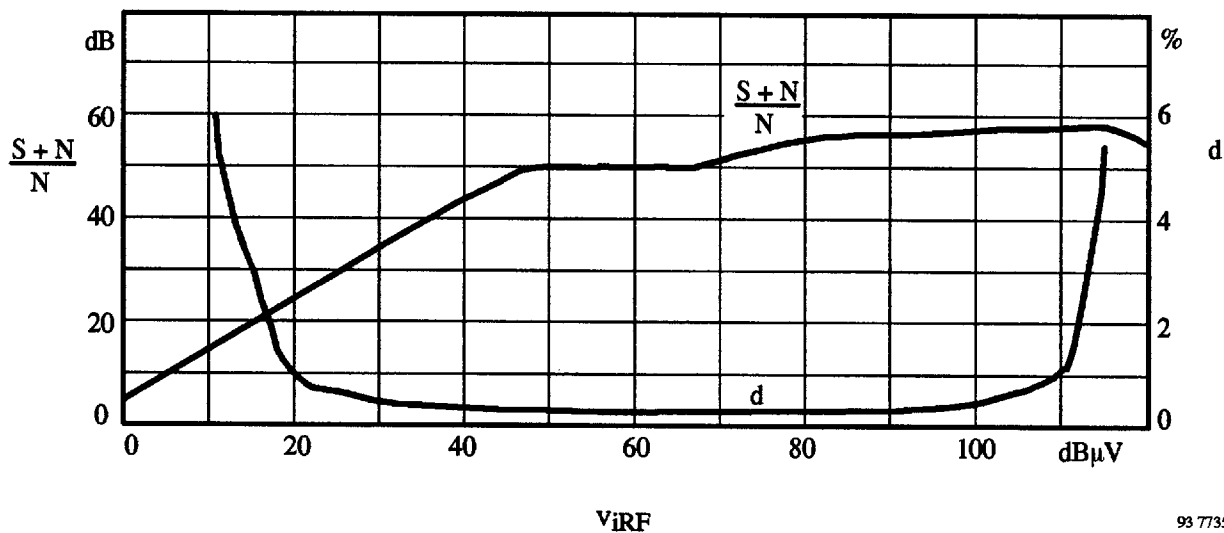
Figure 2.



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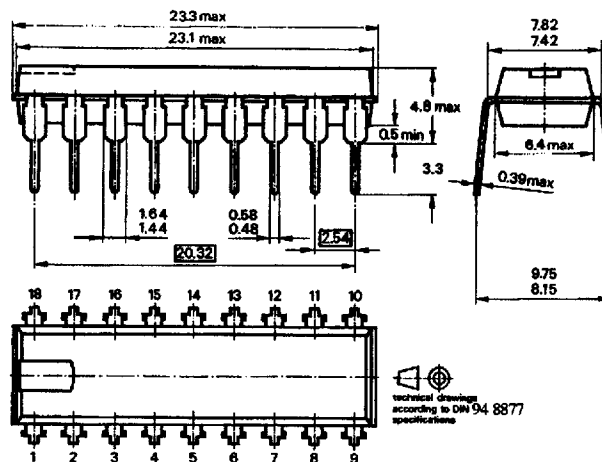
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Ordering and Package Information

Extended type number	Package
U4240B-A	18 pin DIP plastic
U4240B-AFS	SSO 20 plastic

Dimensions in mm

Package: DIP 18



Technical drawing according to DIN 94 8877 specifications

Package: SSO 20

