

**LA1824**

Single Chip Tuner IC for Use in Radio/Cassette Products with Manual Tuning

Preliminary

Overview

The LA1824 is a single-chip tuner IC that incorporates FM/AM and MPX circuits.

The built-in MPX-VCO allows this IC to be adjustment free and to require no external components.

Features

- FM, AM and MPX integrated in a single-chip.
- Adjustment free MPX-VCO
: No ceramic resonator used.
- FM front-end : Local OSC voltage reduced.
- FM stereo and FM/AM tuning indicator output provided.
- Package : DIP-24S.

Functions

FM : RF amplifier, mixer, oscillator, IF amplifier, detector, signal meter, tuning indicator.

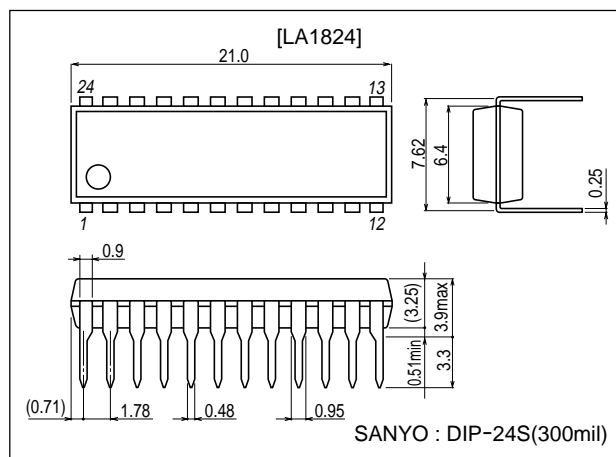
AM : RF amplifier, mixer, oscillator (with ALC), IF amplifier, detector, AGC, tuning indicator.

MPX : PLL stereo decoder, stereo indicator, VCO on chip, forced monaural.

Package Dimensions

unit : mm

3067A



Specifications

Maximum Ratings at $T_a = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		7.0	V
Indicator drive current	I_{LED}	Pin 8, 9	20	mA
Allowable power dissipation	$P_{d\text{ max}}$	$T_a \leq 70\text{ }^{\circ}\text{C}$	300	mW
Operation temperature	T_{opg}		-20 to +70	$^{\circ}\text{C}$
Ambient temperature	T_{stg}		-40 to +125	$^{\circ}\text{C}$

Recommended Operating Conditions at $T_a = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		4.5	V
Operation supply voltage range	$V_{CC\text{ op}}$		2.5 to 6.0	V

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Operating Characteristics at $T_a = 25\text{ }^{\circ}\text{C}$, $V_{CC} = 4.5\text{ V}$, in the specified test using
the IC179-2 socket (Yamaichi Electric Co.,Ltd.)

FM front-end characteristics at $f_c = 98\text{ MHz}$, $f_m = 1\text{ kHz}$, 22.5 kHz dev

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Local oscillator voltage	V_{OSC}	No input, $f_{osc} = 108.7\text{ MHz}$, the pin 20 output with FET buffer gain $\approx -10\text{ dB}$	15	30	60	mVrms
Input limiting voltage	3 dB L.S.	Referenced to $V_{IN} = 60\text{ dB}\mu\text{V}$ EMF, 22.5 kHz dev , a 3 dB down input	-	13	-	$\text{dB}\mu\text{V EMF}$
Quieting sensitivity	Q.S.	30 dB quieting sensitivity	-	12	-	$\text{dB}\mu\text{V EMF}$

FM IF characteristics (monaural) at $f_c = 10.7\text{ MHz}$, $f_m = 1\text{ kHz}$, 75 kHz dev

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	$I_{CC}(\text{FM})$	No input	7.0	13.7	20	mA
Demodulation output	V_O	$V_{IN} = 100\text{ dB}\mu\text{V}$, the pin 16 output	130	190	260	mVrms
Signal-to-noise ratio	S/N	$V_{IN} = 100\text{ dB}\mu\text{V}$, the pin 16 output	62	70	-	dB
Total harmonic distortion (mono)	THD	$V_{IN} = 100\text{ dB}\mu\text{V}$, the pin 16 output	-	0.4	1.2	%
Input limiting voltage	3 dB L.S.	Referenced to $V_{IN} = 100\text{ dB}\mu\text{V}$, 75 kHz dev , a 3 dB down input	21	32	42	$\text{dB}\mu\text{V}$
Station detector sensitivity	SD-ON	No mod, an input level great enough to turn on the station detector	-	33	-	$\text{dB}\mu\text{V}$

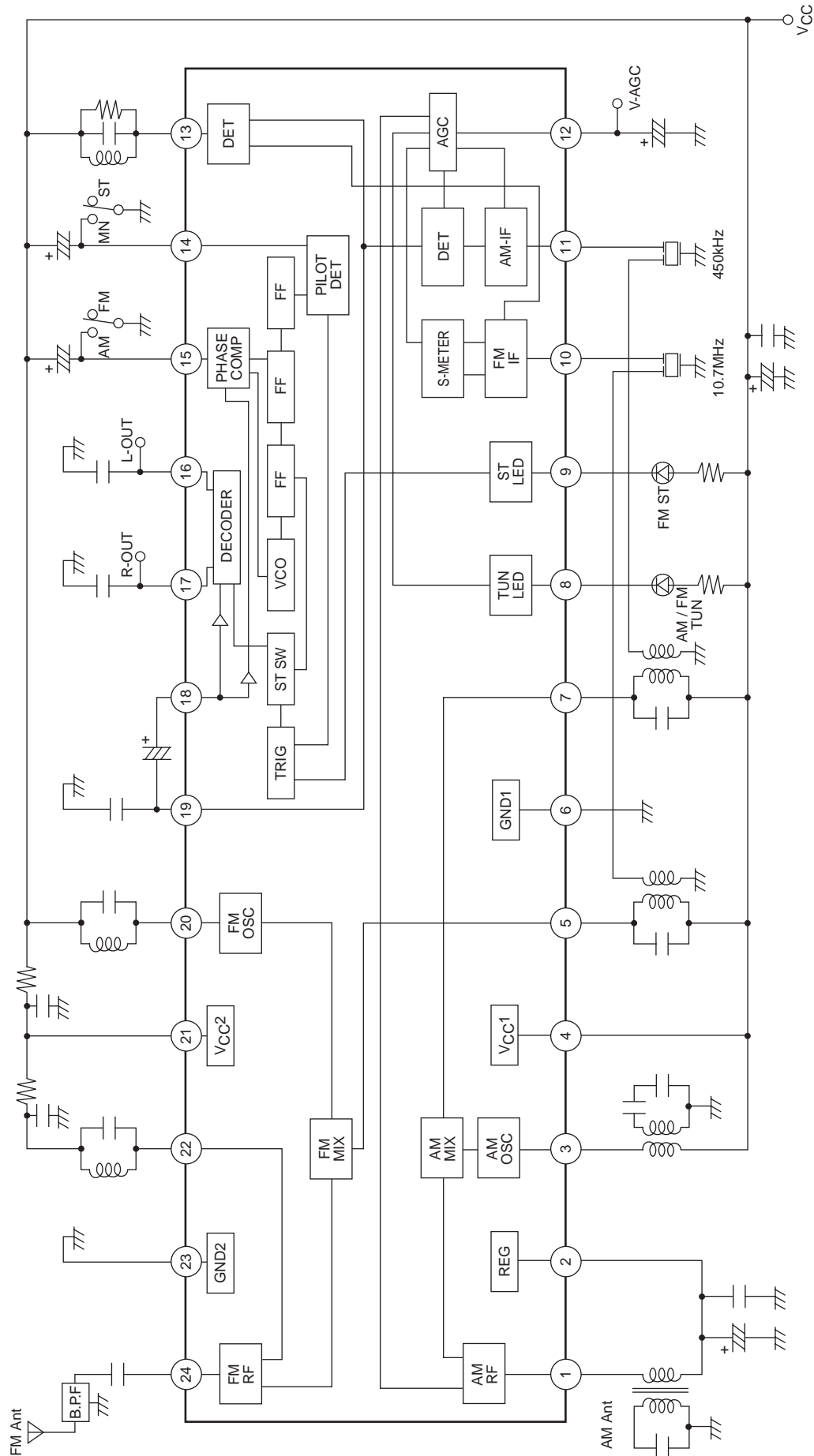
FM IF characteristics (stereo) at $f_c = 10.7\text{ MHz}$, $f_m = 1\text{ kHz}$, $L + R = 90\%$, Pilot = 10 %

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Separation	SEP	$V_{IN} = 100\text{ dB}\mu\text{V}$, L modulation, the pin 16 output/the pin 17 output	25	40	-	dB
Stereo on level	ST-ON	$V_{IN} = 100\text{ dB}\mu\text{V}$, the pilot modulation search that $V_8 < 0.5\text{ V}$	1.5	3.5	6.3	%
Total harmonic distortion (main)	THD	$V_{IN} = 100\text{ dB}\mu\text{V}$, Main modulation, the pin 16 output	-	0.5	1.2	%

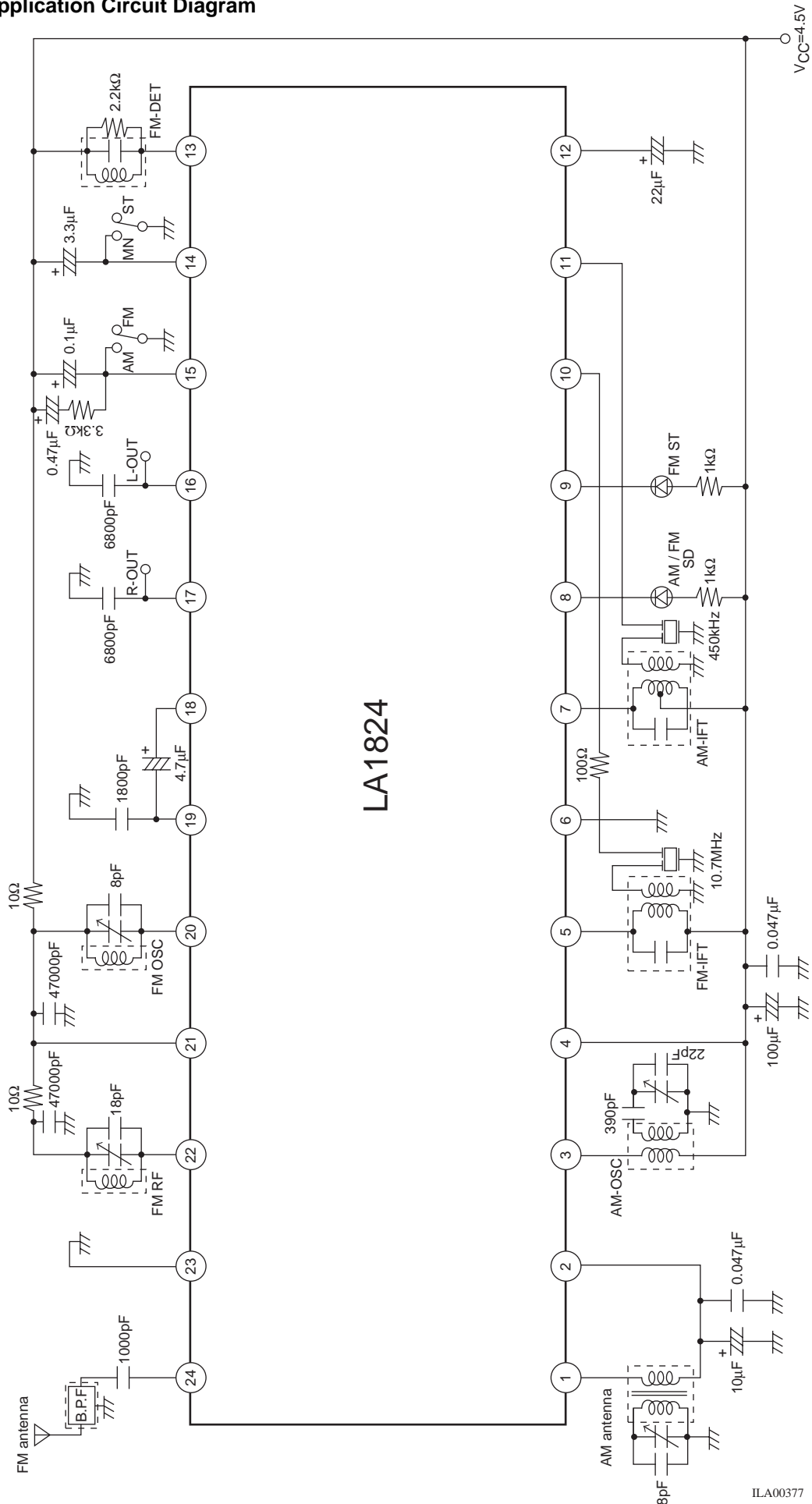
AM characteristics at $f_c = 1000\text{ kHz}$, $f_m = 1\text{ kHz}$, 30 % modulation

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	$I_{CC}(\text{AM})$	No input	5.0	8.5	15	mA
Detector output	$V_O(1)$	$V_{IN} = 23\text{ dB}\mu\text{V}$, the pin 16 output	18	40	70	mVrms
	$V_O(2)$	$V_{IN} = 80\text{ dB}\mu\text{V}$, the pin 16 output	50	85	130	mVrms
Signal-to-noise ratio	S/N(1)	$V_{IN} = 23\text{ dB}\mu\text{V}$, the pin 16 output	15	20	-	dB
	S/N(2)	$V_{IN} = 80\text{ dB}\mu\text{V}$, the pin 16 output	47	53	-	dB
Total harmonic distortion	THD(1)	$V_{IN} = 80\text{ dB}\mu\text{V}$, the pin 16 output	-	0.5	1.3	%
	THD(2)	$V_{IN} = 107\text{ dB}\mu\text{V}$, the pin 16 output	-	0.5	1.5	%
Station detector sensitivity	SD-ON	No mod, an input level great enough to turn on the station detector	-	26	-	$\text{dB}\mu\text{V}$

Block Diagram



Sample Application Circuit Diagram



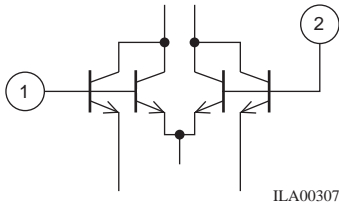
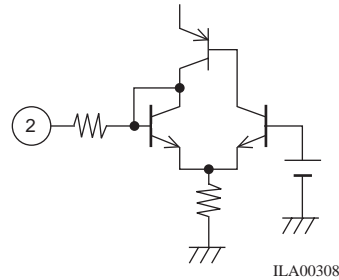
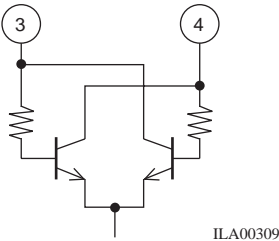
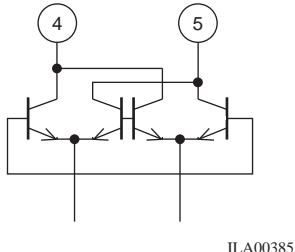
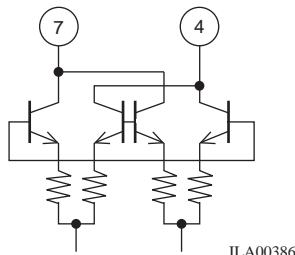
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Coil specifications (bottom view)

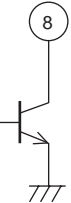
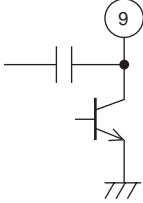
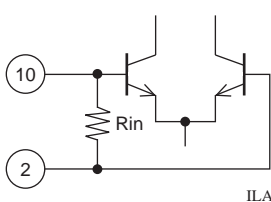
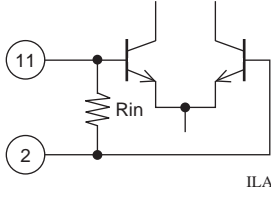
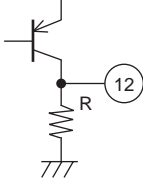
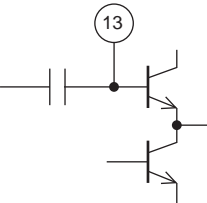
• FM-BPF : SA-309 (Sumida) 88 MHz to 108 MHz		
• FM-RF : SA-149 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 4.5 T		
• FM-OSC : SA-151 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 3.5 T		
<p>• FM-MIX : SA-165 (Sumida)</p> <p>ILA00378</p>	<p>4-6 2 T 3-1 12 T 0.12UEW $f_o = 10.7 \text{ MHz}$ $Q_o \geq 50$ 100 pF internal</p>	<p>: A119ACS-19458X (Toko)</p> <p>ILA00382</p>
<p>• FM-DET : SA-1134 (Sumida)</p> <p>ILA00379</p>	<p>1-3 12 T 0.10UEW $f_o = 10.7 \text{ MHz}$ $Q_o \geq 70$ 82 pF internal</p>	<p>: A119ACS-19459Z (Toko)</p> <p>ILA00379</p>
<p>• AM-OSC : SA-181 (Sumida)</p> <p>ILA00380</p>	<p>6-4 37 T 3-1 74 T 0.06UEW $f_o = 796 \text{ kHz}$ $Q_o \geq 80$ $L = 140 \mu\text{H}$</p>	<p>: L7BRS-3132AQ (Toko)</p> <p>ILA00380</p>
<p>• AM-MIX : SA-1136 (Sumida)</p> <p>ILA00381</p>	<p>3-2 122 T 4-6 9 T 2-1 62 T 0.06UEW $f_o = 450 \text{ kHz}$, $Q_o \geq 65$ 180 pF internal</p>	<p>: PCFAZ-082 (Toko)</p> <p>ACFA-450L08 ILA00383</p>
• FM-IF filter : SFE10.7MS2 (Murata)		
• AM-IF filter : SFU450B (Murata)		
• Poly-varicon : FT-2217 (Toko)		
<p>• MW Bar-antenna : C8E-A0105 (Toko)</p> <p>ILA00384</p>		

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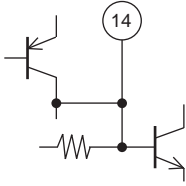
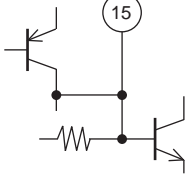
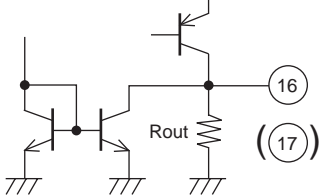
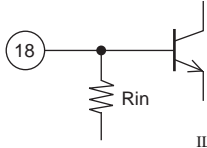
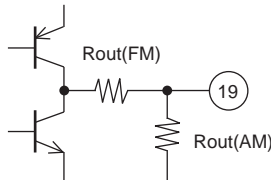
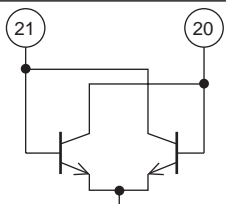
Pin Descriptions and Quiescent Voltage at $V_{CC} = 4.5\text{ V}$

Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
1	AM-RF input	1.3	1.3		Connect the AM antenna coil between this pin and pin 2 (Reg)
2	Reg	1.3	1.3		
3	AM-OSC	4.5	4.5		Connect the AM oscillator coil between this pin and pin 4 (VCC1)
4	VCC1	4.5	4.5		AM/FM-IF/MPX block VCC
5	FM-MIX output	4.5	4.5		Connect the FM mixer coil between this pin and pin 4 (VCC1)
6	GND1	0	0		AM/FM-IF/MPX block GND
7	AM-MIX output	4.5	4.5		Connect the AM mixer coil between this pin and pin 4 (VCC1)


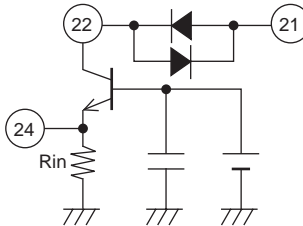
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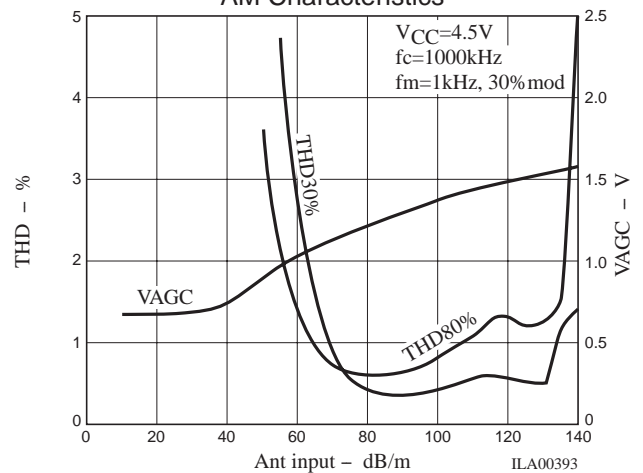
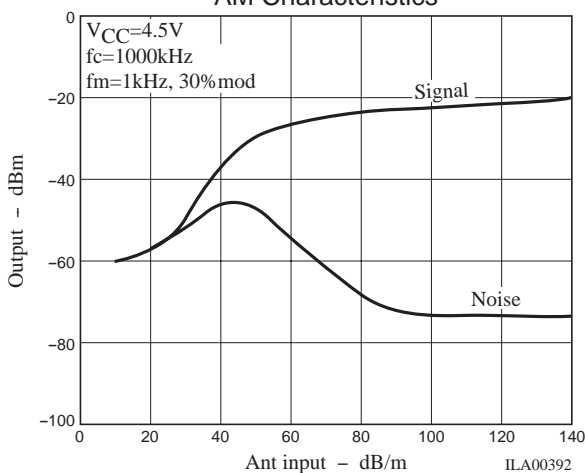
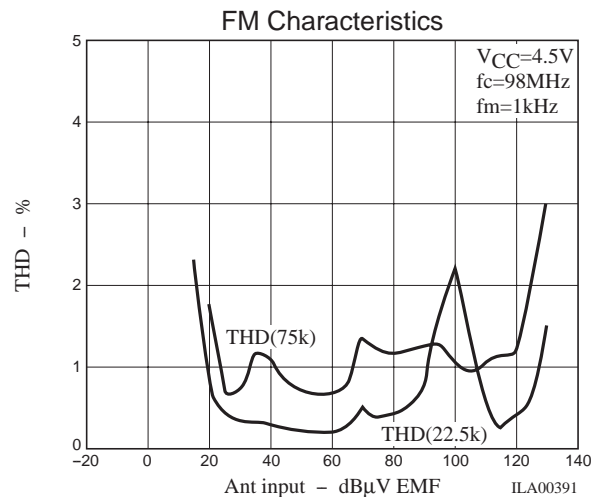
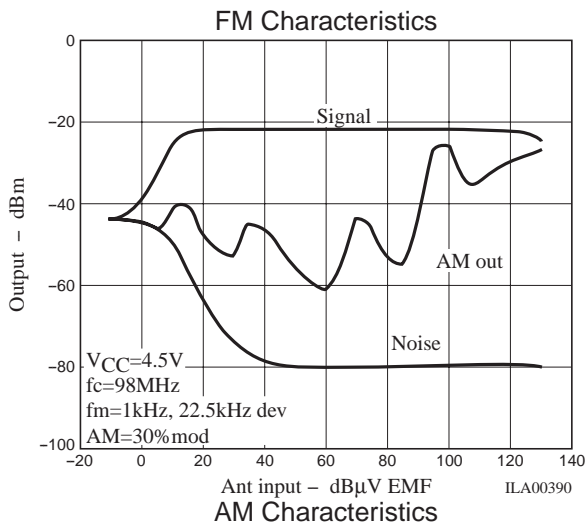
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
8	Tuning indicator	4.5	4.5	 ILA00387	Active-low Open-collector output can directly drive LED ($I_C \text{ max} = 20 \text{ mA}$)
9	Stereo indicator and AM IF output	4.5	4.5	 ILA00388	Active-low Open-collector output can directly drive LED ($I_C \text{ max} = 20 \text{ mA}$) AM-IF signal is output in AM mode
10	FM-IF input	1.3	1.3	 ILA00314	$R_{in} = 330 \Omega$
11	AM-IF input	1.3	1.3	 ILA00315	$R_{in} = 2 \text{ k}\Omega$
12	AM-AGC output and FM signal meter output	0.7	0.2	 ILA00316	Internal load resistance $R = 16.6 \text{ k}\Omega$
13	FM-DET	4.5	4.5	 ILA00317	Connect the FM detector coil between this pin and pin 4 (VCC1)

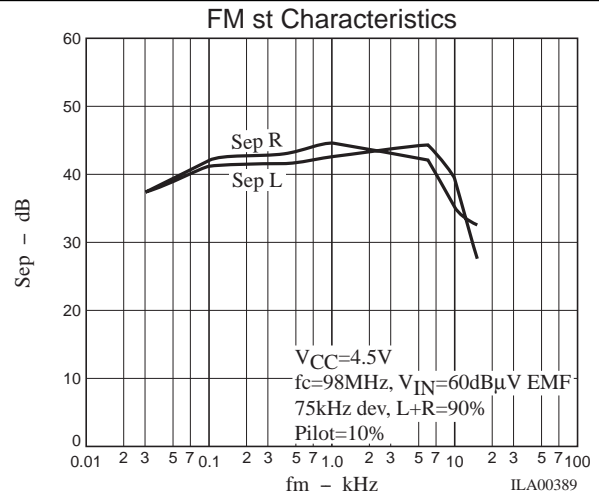
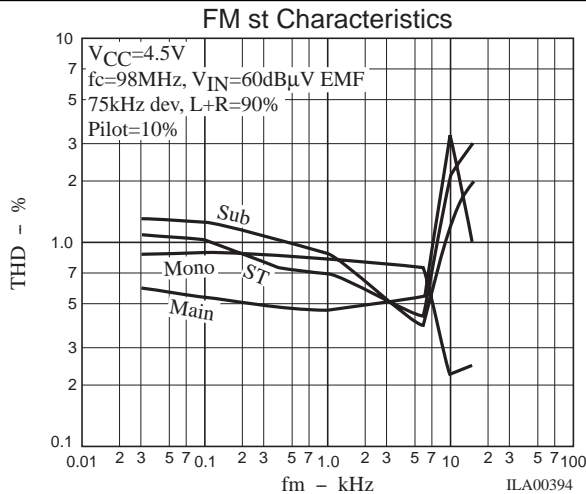
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
14	Pilot detector filter (forced mono)	2.9	3.8	 ILA00318	Forced monaural mode when pin 14 is connected to ground
15	Phase comparator filter (AM/FM switch)	0	3.8	 ILA00319	FM mode is when pin 15 is open, and AM mode is when pin 15 is connected to ground
16 17	L output R output	1.4	1.4	 ILA00320	Rout = 7.5 kΩ
18	MPX input	1.3	1.3	 ILA00321	Rin = 50 kΩ
19	AM/FM detector output	0.5	1.5	 ILA00322	Output impedance AM : Rout = 50 kΩ FM : Rout = 500 Ω The channel separation can be adjusted with an external capacitor connected between this pin and ground
20	FM-OSC	4.5	4.4	 ILA00323	Connect the FM oscillator coil between this pin and pin 21 (VCC2)

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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
21	VCC2	4.5	4.4	 ILA00324	FM-FE block VCC Power is supplied pin 4 (VCC1) via external resistor (10 Ω)
22	FM-RF output	4.5	4.4	 ILA00325	Connect the FM-RF coil between this pin and pin 21 (VCC2) Rin = 500 Ω
24	FM-RF input	0	1.0		
23	GND2	0	0		FM-FE block ground





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