



# 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.

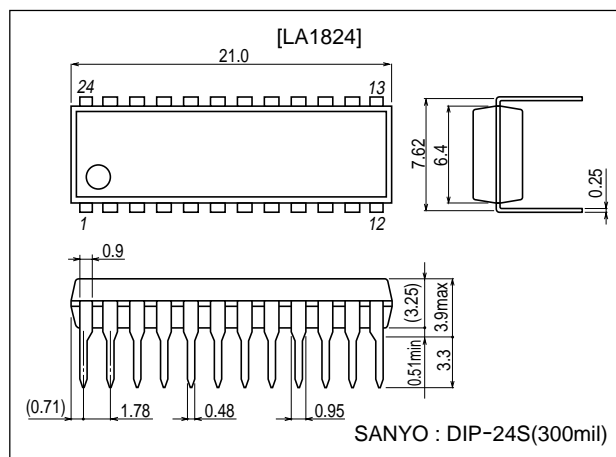
AM : RF amplifier, mixer, oscillator (with ALC), IF amplifier, detector, AGC, tuning indicator.

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

#### Package Dimensions

unit : mm

3067A



#### Specifications

##### Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	VCC max		7.0	V
Indicator drive current	I <sub>LED</sub>	Pin 8, 9	20	mA
Allowable power dissipation	Pd max	Ta ≤ 70 °C	300	mW
Operation temperature	Topg		-20 to +70	°C
Ambient temperature	Tstg		-40 to +125	°C

##### Recommended Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	VCC		4.5	V
Operation supply voltage range	VCC 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  $f_c = 98\text{ MHz}$ ,  $f_m = 1\text{ kHz}$ ,  $22.5\text{ kHz dev}$

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, $22.5\text{ kHz dev}$ , 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  $f_c = 10.7\text{ MHz}$ ,  $f_m = 1\text{ kHz}$ ,  $75\text{ kHz dev}$

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 $V_{IN} = 100\text{ dB}\mu\text{V}$ , $75\text{ kHz dev}$ , 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	-	$\text{dB}\mu\text{V}$

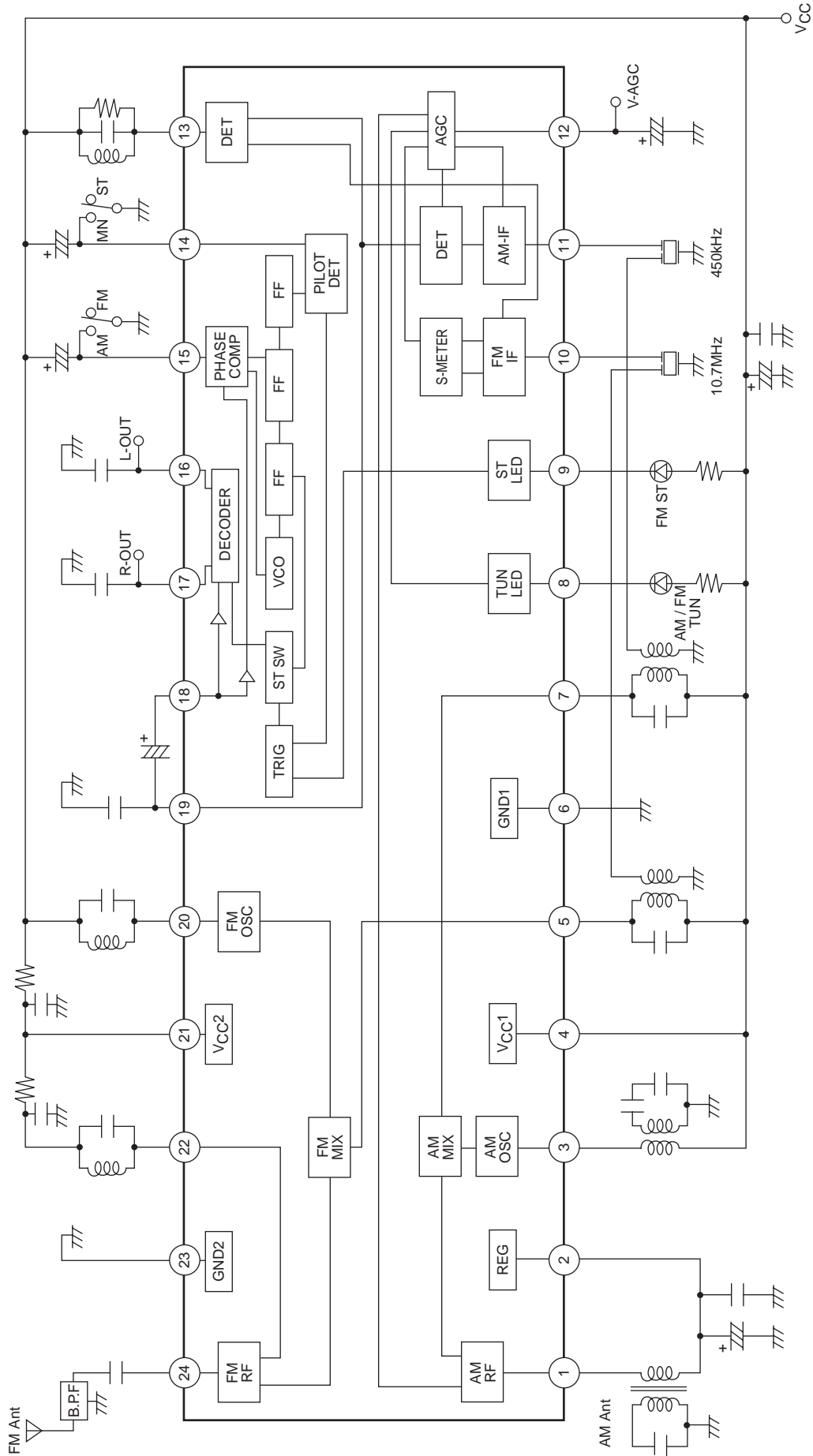
**FM IF characteristics (stereo)** at  $f_c = 10.7\text{ MHz}$ ,  $f_m = 1\text{ kHz}$ ,  $L + R = 90\%$ ,  $\text{Pilot} = 10\%$

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

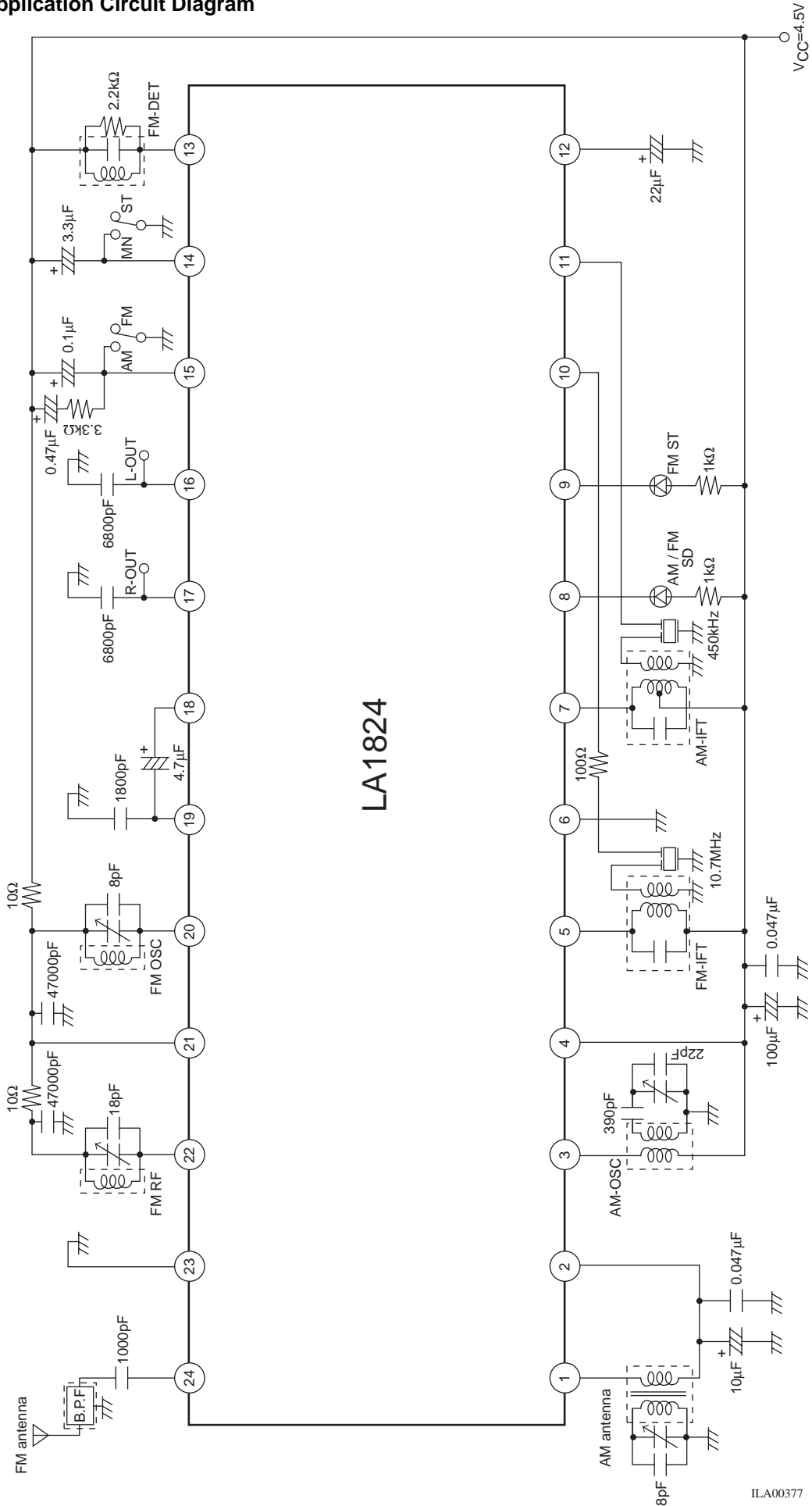
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	$I_{CC}(\text{AM})$	No input	5.0	8.5	15	mA
Detector output	$V_O(1)$	$V_{IN} = 23\text{ dB}\mu\text{V}$ , the pin 16 output	18	40	70	mVrms
	$V_O(2)$	$V_{IN} = 80\text{ dB}\mu\text{V}$ , the pin 16 output	50	85	130	mVrms
Signal-to-noise 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



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## Sample Application Circuit Diagram



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ILA00377

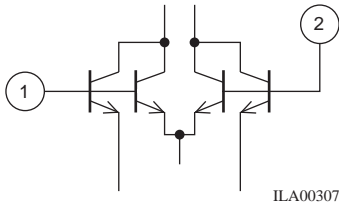
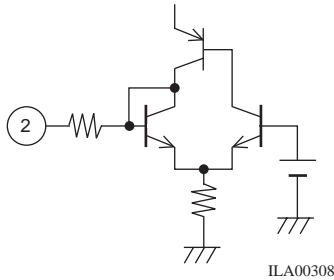
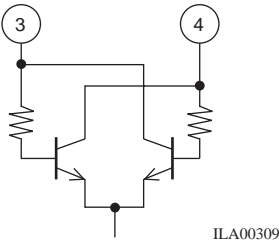
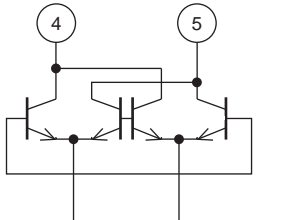
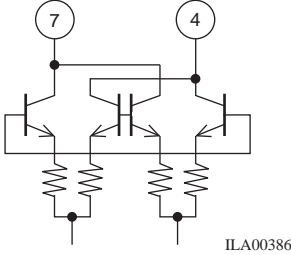
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## Coil specifications (bottom view)

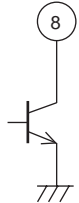
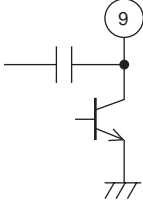
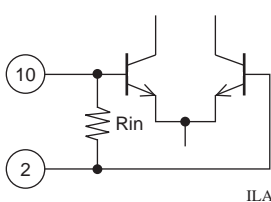
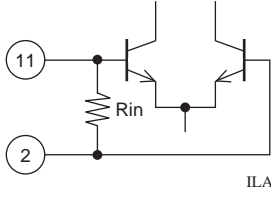
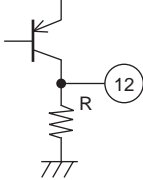
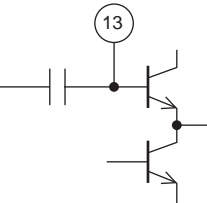
• FM-BPF : SA-309 (Sumida) 88 MHz to 108 MHz	
• FM-RF : SA-149 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 4.5 T	
• FM-OSC : SA-151 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 3.5 T	
<p>• FM-MIX : SA-165 (Sumida)</p> <p style="text-align: center;">ILA00378</p>	<p>: A119ACS-19458X (Toko)</p> <p style="text-align: center;">ILA00382</p>
<p>4-6 2 T 3-1 12 T 0.12UEW <math>f_o = 10.7</math> MHz <math>Q_o \geq 50</math> 100 pF internal</p>	<p>3-1 10 T 4-6 2 T 0.1-2UEW <math>f_o = 10.7</math> MHz <math>Q_o \geq 60</math> 100 pF internal</p>
<p>• FM-DET : SA-1134 (Sumida)</p> <p style="text-align: center;">ILA00379</p>	<p>: A119ACS-19459Z (Toko)</p> <p style="text-align: center;">ILA00379</p>
<p>1-3 12 T 0.10UEW <math>f_o = 10.7</math> MHz <math>Q_o \geq 70</math> 82 pF internal</p>	<p>1-3 11 T 0.1-2UEW <math>f_o = 10.7</math> MHz <math>Q_o \geq 70</math> 82 pF internal</p>
<p>• AM-OSC : SA-181 (Sumida)</p> <p style="text-align: center;">ILA00380</p>	<p>: L7BRS-3132AQ (Toko)</p> <p style="text-align: center;">ILA00380</p>
<p>6-4 37 T 3-1 74 T 0.06UEW <math>f_o = 796</math> kHz <math>Q_o \geq 80</math> <math>L = 140</math> <math>\mu</math>H</p>	<p>3-1 64 T 6-4 32 T 0.06-2UEW <math>f_o = 796</math> kHz <math>Q_o \geq 65</math> <math>L = 140</math> <math>\mu</math>H</p>
<p>• AM-MIX : SA-1136 (Sumida)</p> <p style="text-align: center;">ILA00381</p>	<p>: PCFAZ-082 (Toko)</p> <p style="text-align: center;">ACFA-450L08 ILA00383</p>
<p>3-2 122 T 4-6 9 T 2-1 62 T 0.06UEW <math>f_o = 450</math> kHz, <math>Q_o \geq 65</math> 180 pF internal</p>	<p>1-2 47 T 2-3 100 T 4-6 12 T <math>f_o = 450</math> kHz 180 pF internal With AM-IF filter</p>
• FM-IF filter : SFE10.7MS2 (Murata)	
• AM-IF filter : SFU450B (Murata)	
• Poly-varicon : FT-2217 (Toko)	
• MW Bar-antenna : C8E-A0105 (Toko)	
<p style="text-align: center;">ILA00384</p>	<p>1-2 67 T 3-4 9 T <math>f_o = 796</math> kHz <math>Q_u = 180</math> min <math>L = 260</math> <math>\mu</math>H</p>

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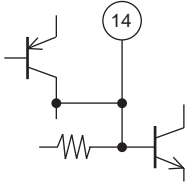
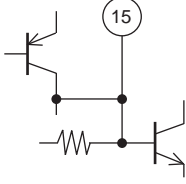
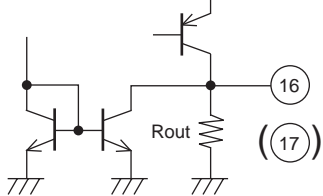
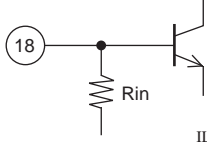
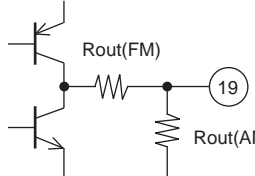
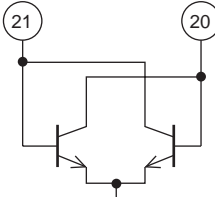
## Pin Descriptions and Quiescent Voltage at $V_{CC} = 4.5\text{ V}$

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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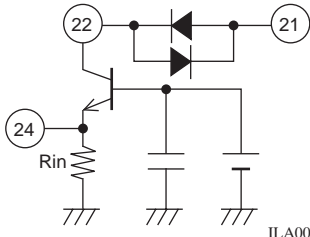
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
8	Tuning indicator	4.5	4.5	 ILA00387	Active-low  Open-collector output can directly drive LED ( $I_C \text{ max} = 20 \text{ mA}$ )
9	Stereo indicator and AM IF output	4.5	4.5	 ILA00388	Active-low  Open-collector output can 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)

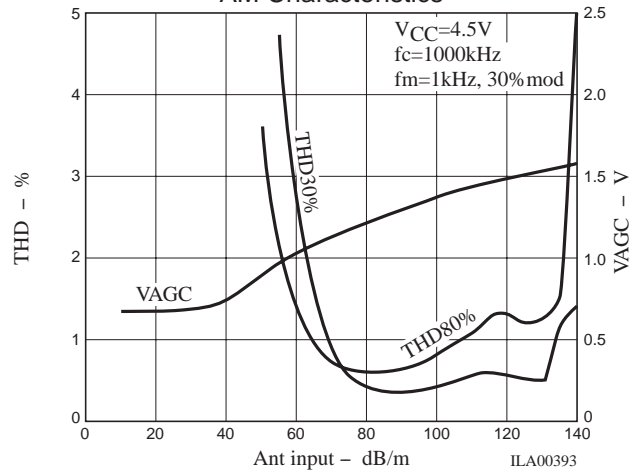
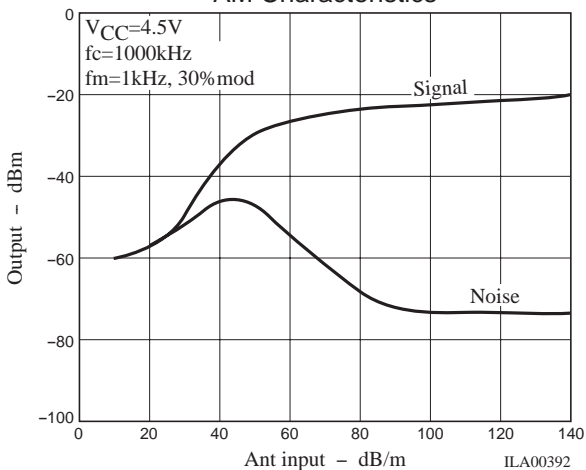
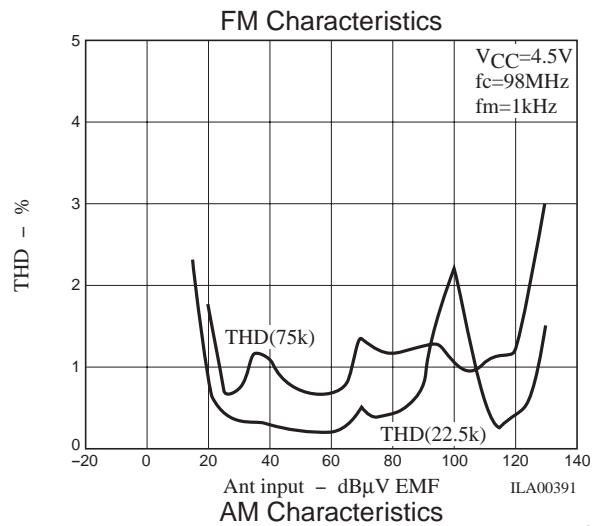
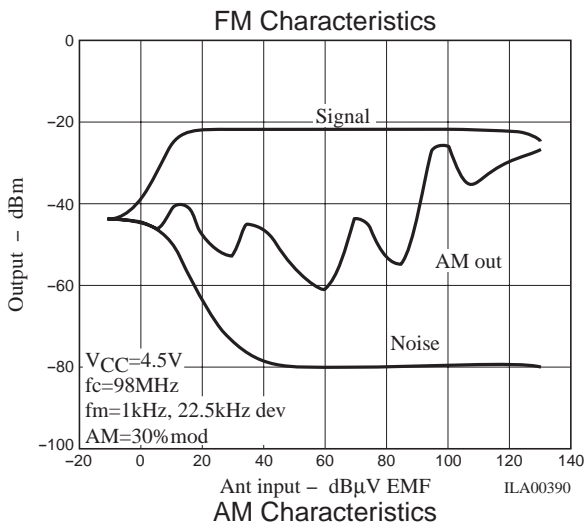
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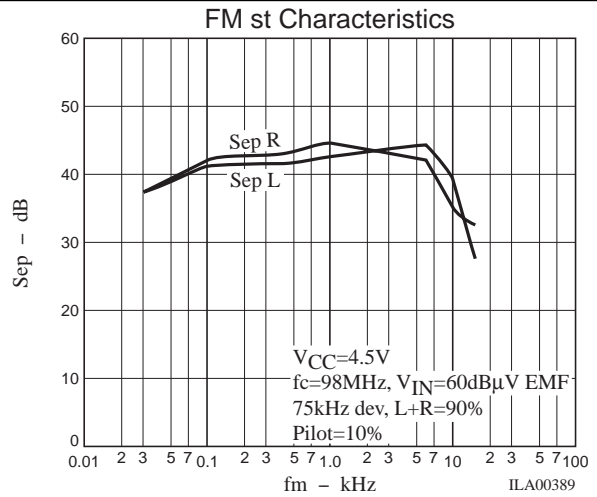
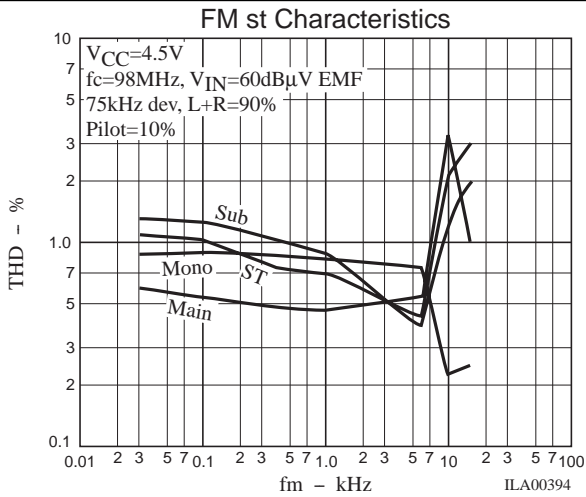
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
14	Pilot detector filter (forced mono)	2.9	3.8	 <p style="text-align: right;">ILA00318</p>	Forced monaural mode when pin 14 is connected to ground
15	Phase comparator filter (AM/FM switch)	0	3.8	 <p style="text-align: right;">ILA00319</p>	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	 <p style="text-align: right;">ILA00320</p>	$R_{out} = 7.5 \text{ k}\Omega$
18	MPX input	1.3	1.3	 <p style="text-align: right;">ILA00321</p>	$R_{in} = 50 \text{ k}\Omega$
19	AM/FM detector output	0.5	1.5	 <p style="text-align: right;">ILA00322</p>	<p>Output impedance            AM : <math>R_{out} = 50 \text{ k}\Omega</math>            FM : <math>R_{out} = 500 \Omega</math></p> <p>The channel separation can be adjusted with an external capacitor connected between this pin and ground</p>
20	FM-OSC	4.5	4.4	 <p style="text-align: right;">ILA00323</p>	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	 <p style="text-align: center;">ILA00324</p>	FM-FE block VCC  Power is supplied pin 4 (VCC1) via external resistor (10 Ω)
22	FM-RF output	4.5	4.4	 <p style="text-align: center;">ILA00325</p>	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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