

**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.

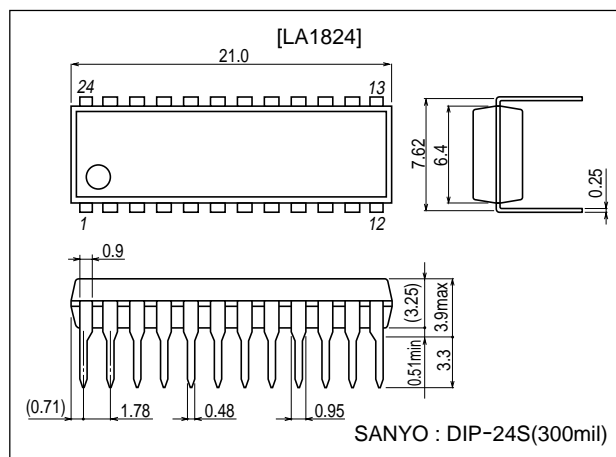
AM : RF amplifier, mixer, oscillator (with ALC), IF amplifier, detector, AGC, tuning indicator.

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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11201 RM (IM) No.6855-1/10

# LA1824

**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	-	$\text{dB}\mu\text{V}$

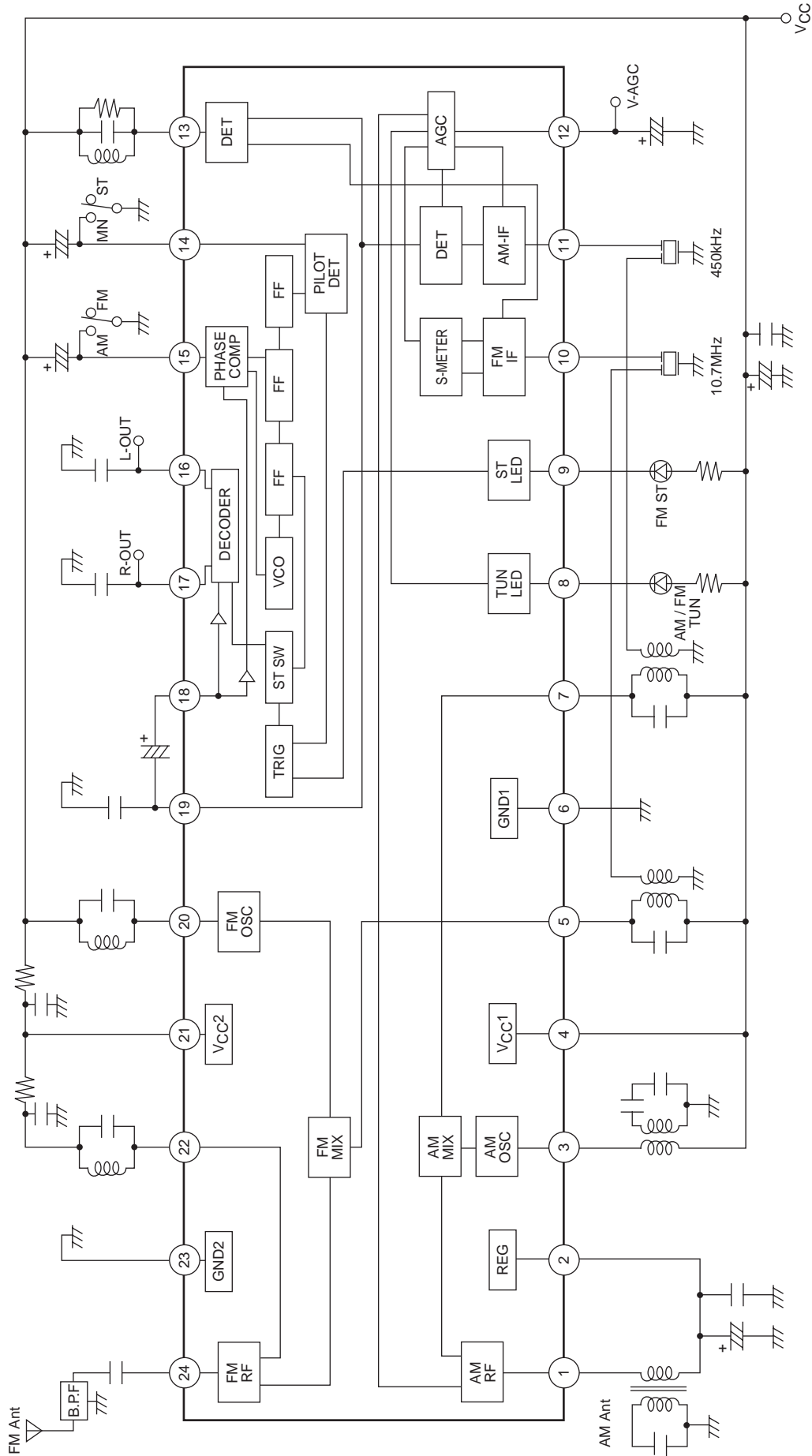
**FM IF characteristics (stereo)** at  $f_c = 10.7\text{ MHz}$ ,  $f_m = 1\text{ kHz}$ ,  $L + R = 90\%$ ,  $\text{Pilot} = 10\%$

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

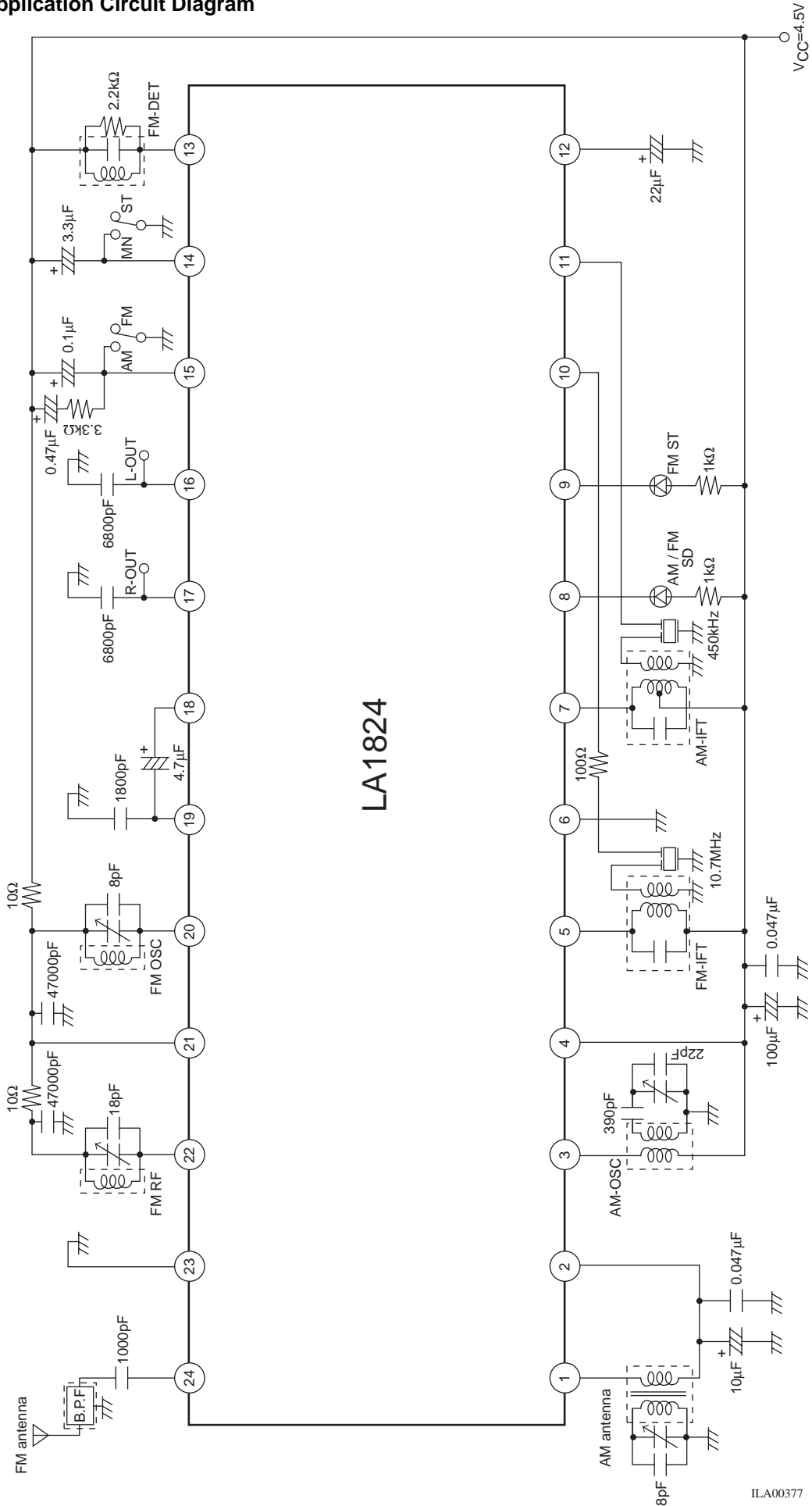
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	$I_{CC}(\text{AM})$	No input	5.0	8.5	15	mA
Detector output	$V_O(1)$	$V_{IN} = 23\text{ dB}\mu\text{V}$ , the pin 16 output	18	40	70	mVrms
	$V_O(2)$	$V_{IN} = 80\text{ dB}\mu\text{V}$ , the pin 16 output	50	85	130	mVrms
Signal-to-noise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



# LA1824

## Sample Application Circuit Diagram



LA1824

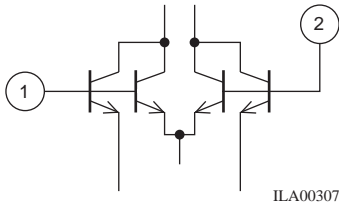
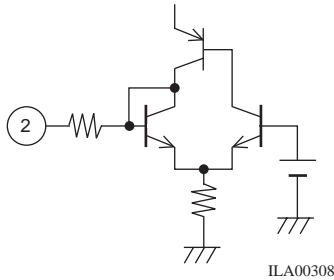
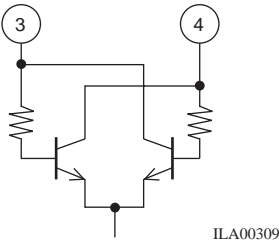
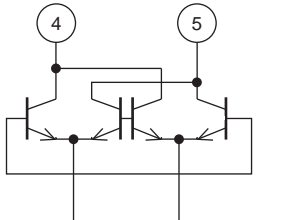
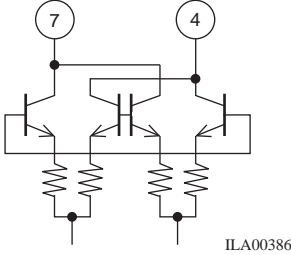
ILA00377

**Coil specifications (bottom view)**

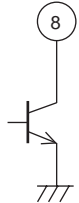
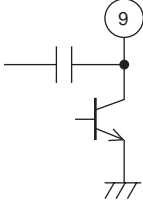
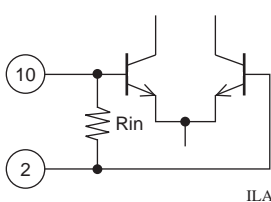
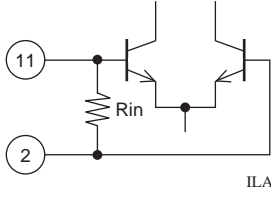
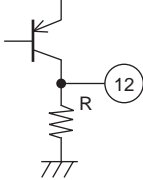
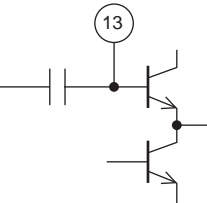
<p>• FM-BPF : SA-309 (Sumida) 88 MHz to 108 MHz</p>	
<p>• FM-RF : SA-149 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 4.5 T</p>	
<p>• FM-OSC : SA-151 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 3.5 T</p>	
<p>• FM-MIX : SA-165 (Sumida)</p> <p>ILA00378</p>	<p>: A119ACS-19458X (Toko)</p> <p>ILA00382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

# LA1824

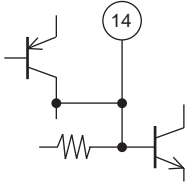
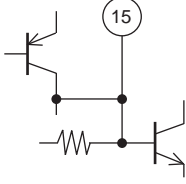
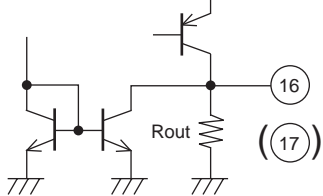
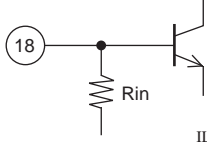
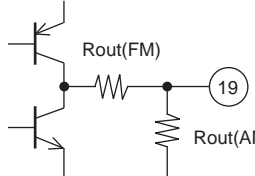
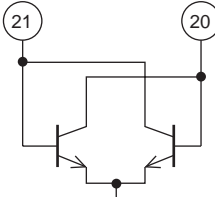
## Pin Descriptions and Quiescent Voltage at $V_{CC} = 4.5\text{ V}$

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)

## LA1824


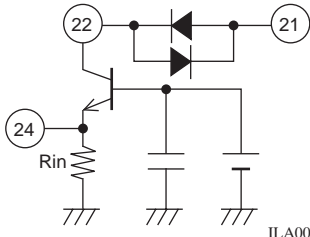
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
8	Tuning indicator	4.5	4.5	 ILA00387	Active-low  Open-collector output can directly drive LED ( $I_C \text{ max} = 20 \text{ mA}$ )
9	Stereo indicator and AM IF output	4.5	4.5	 ILA00388	Active-low  Open-collector output can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

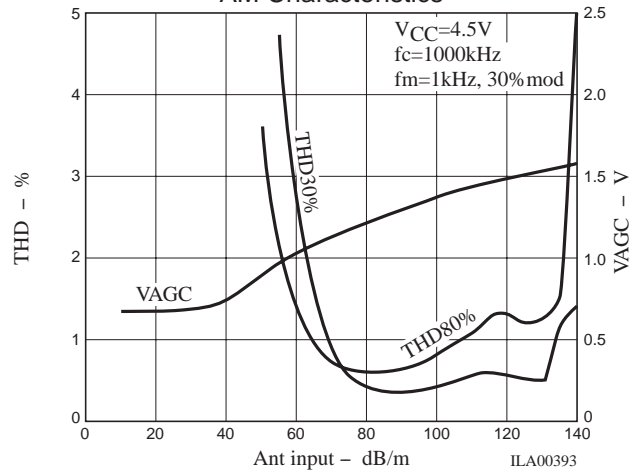
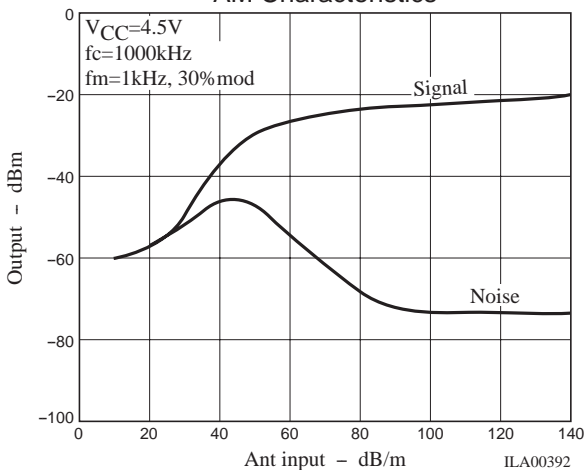
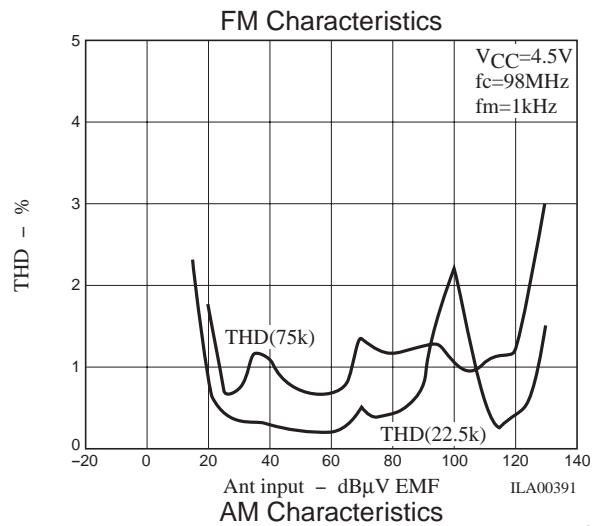
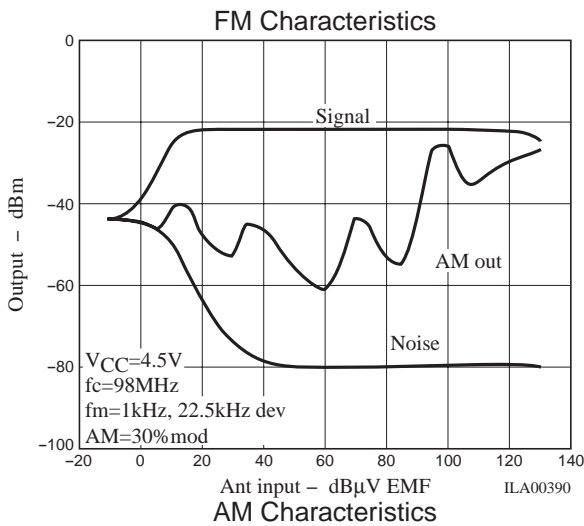
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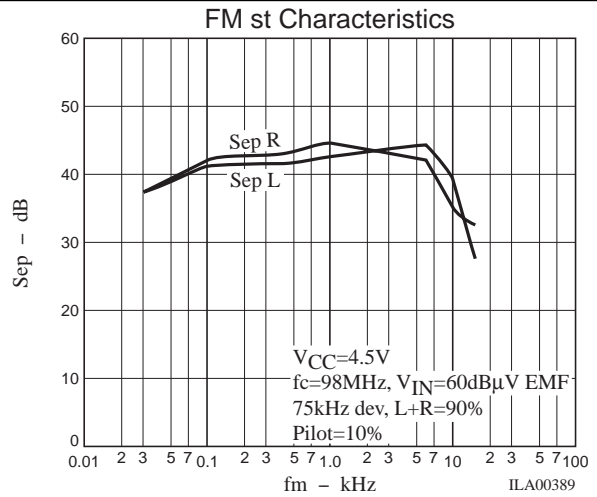
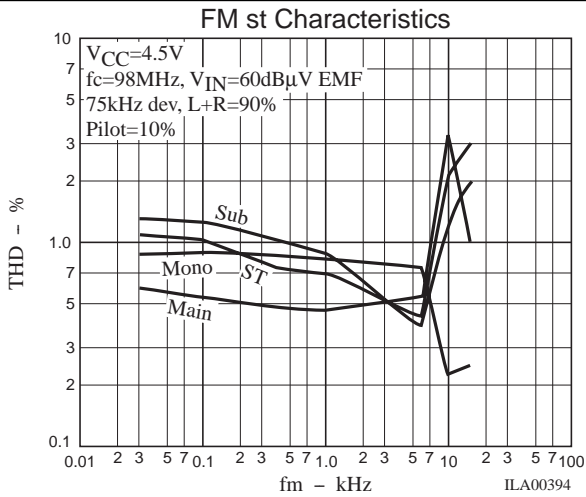
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
14	Pilot detector filter (forced mono)	2.9	3.8	 ILA00318	Forced monaural mode when pin 14 is connected to ground
15	Phase comparator filter (AM/FM switch)	0	3.8	 ILA00319	FM mode is when pin 15 is open, and AM mode is when pin 15 is connected to ground
16 17	L output R output	1.4	1.4	 ILA00320	$R_{out} = 7.5 \text{ k}\Omega$
18	MPX input	1.3	1.3	 ILA00321	$R_{in} = 50 \text{ k}\Omega$
19	AM/FM detector output	0.5	1.5	 ILA00322	Output impedance AM : $R_{out} = 50 \text{ k}\Omega$ FM : $R_{out} = 500 \Omega$  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)



# LA1824

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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