

**LA1823**

## Single-Chip Tuner IC for Use in Radio Cassette Recorder

### Preliminary

#### Overview

The LA1823 is a single-chip tuner IC that incorporates FM/AM and MPX circuits and supports electronic tuning. 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.
- FM front-end : Local OSC voltage reduced.
- Adjustment free MPX-VCO  
: No ceramic resonator used.
- Adjustment free FM-DET  
: Using ceramic discriminator.
- Build in FM stereo indicator.
- Build in FM/AM IF count buffer.
- Build in AM OSC buffer.
- Package : DIP-24S.

#### Functions

- FM : RF amplifier, mixer, oscillator, IF amplifier, detector, signal meter, IF count buffer output.  
 AM : RF amplifier, mixer, oscillator (with ALC), oscillator buffer output, IF amplifier, detector, AGC, IF count buffer output.  
 MPX : PLL stereo decoder, stereo indicator, VCO on chip, forced monaural, Audio mute.

#### Specifications

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

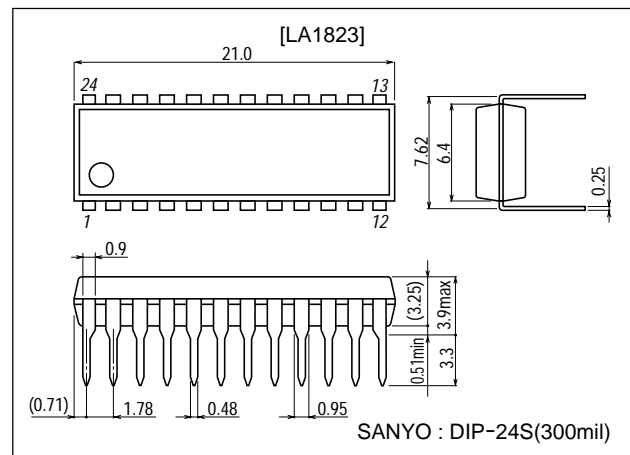
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\text{ max}}$		7.0	V
Indicator drive current	$I_{LED}$	Pin 8	20	mA
Allowable power dissipation	$P_{d\text{ max}}$	$T_a \leq 70\text{ }^\circ\text{C}$	300	mW
Operating temperature	$T_{opg}$		-20 to +70	$^\circ\text{C}$
Storage temperature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

##### 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	$V_{CC\text{ op}}$		1.8 to 6.0	V

#### Package Dimensions

unit : mm  
3067A



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**Operating Characteristics** at  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 4.5\text{ V}$ , in the specified test circuit using the IC59-2043-2 socket (Yamaichi Electric Co.,Ltd.)

## Quiescent supply current

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
FM-mode quiescent current	$I_{CC}(\text{FM})$	No input	10.0	15.0	20.0	mA
AM-mode quiescent current	$I_{CC}(\text{AM})$	No input	6.5	9.2	14.5	mA

## 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	
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		12		$\text{dB}\mu\text{V EMF}$
Local oscillator voltage	$V_{\text{OSC}}$	$f_{\text{osc}} = 108.7\text{ MHz}$ with FET buffer gain $\approx 0\text{ dB}$		100		mVrms

## 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	
Demodulation output	$V_O$	$V_{IN} = 100\text{ dB}\mu\text{V}$	135	180	240	mVrms
Signal-to-noise ratio	S/N	$V_{IN} = 100\text{ dB}\mu\text{V}$	63	72		dB
Total harmonic distortion (mono)	THD	$V_{IN} = 100\text{ dB}\mu\text{V}$		0.5	1.5	%
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	31	38	45	$\text{dB}\mu\text{V}$
IF count buffer on level	IF buff on	IF count buffer on	35	45	55	$\text{dB}\mu\text{V}$
IF count buffer output	$V_{\text{IF buff}}$	Test from pin 7 for $V_{IN} = 100\text{ dB}\mu\text{V}$ , no modulation	120	180	240	mVrms

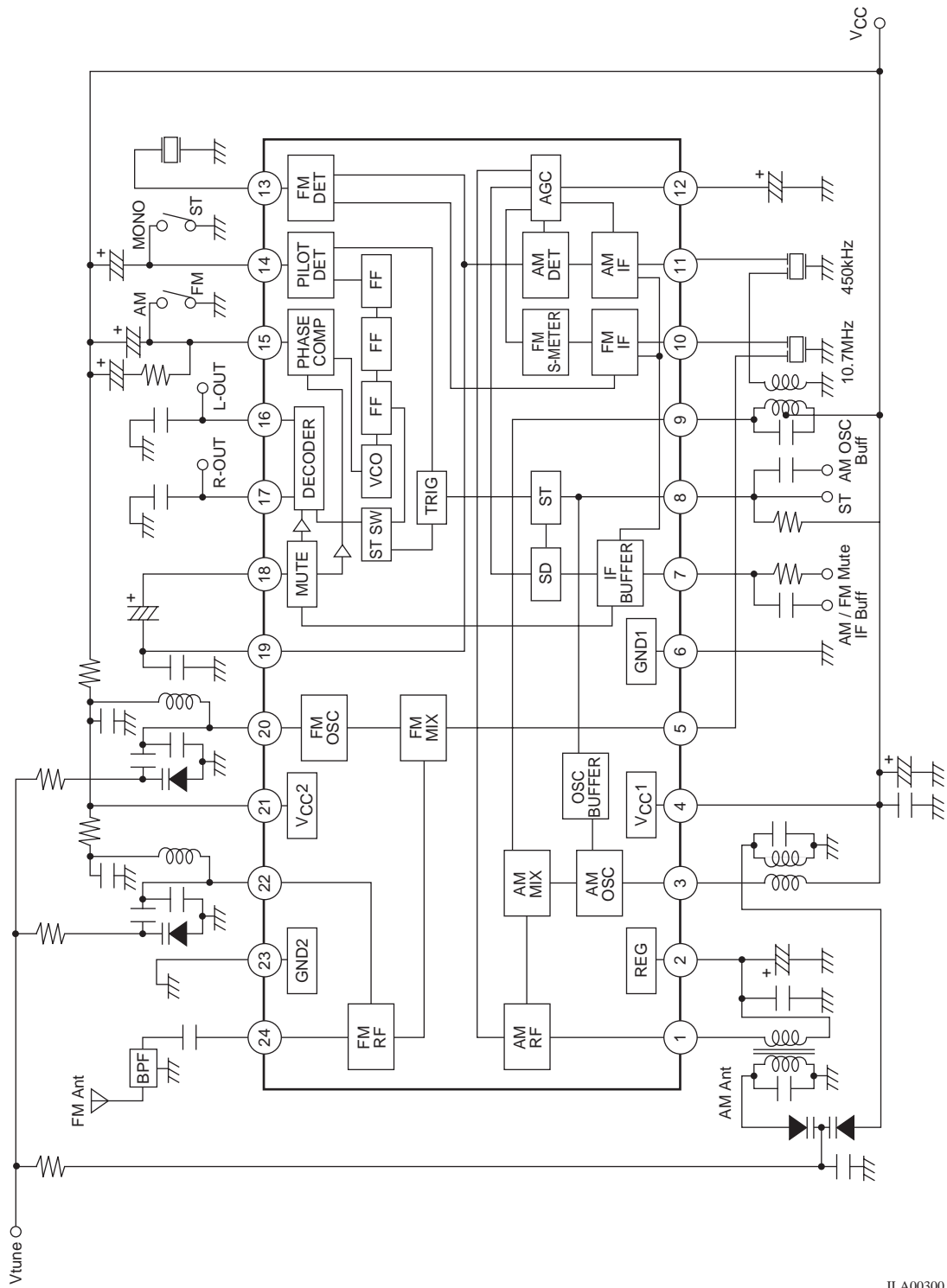
## FM IF characteristics (stereo) at $f_c = 10.7\text{ MHz}$ , $f_m = 1\text{ kHz}$ , $75\text{ kHz dev}$ , $L + R = 90\%$ , $\text{PILOT} = 10\%$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Separation	SEP	$V_{IN} = 100\text{ dB}\mu\text{V}$	25	40		dB
Stereo on level	ST-ON	$V_{IN} = 100\text{ dB}\mu\text{V}$ , Pilot modulation	2.4	3.5	7.2	%
Total harmonic distortion (main)	THD	$V_{IN} = 100\text{ dB}\mu\text{V}$		0.5	1.7	%

## AM characteristics at $f_c = 1\text{ MHz}$ , $f_m = 1\text{ kHz}$ , $\text{mod} = 30\%$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Detector output	$V_O(1)$	$V_{IN} = 23\text{ dB}\mu\text{V}$	17	30	53	mVrms
	$V_O(2)$	$V_{IN} = 80\text{ dB}\mu\text{V}$	50	75	120	mVrms
Signal-to-noise ratio	S/N(1)	$V_{IN} = 23\text{ dB}\mu\text{V}$	15	20		dB
	S/N(2)	$V_{IN} = 80\text{ dB}\mu\text{V}$	47	54		dB
Total harmonic distortion	THD	$V_{IN} = 80\text{ dB}\mu\text{V}$		0.5	1.5	%
OSC buffer output	$V_{\text{OSC buff}}$	Test from pin 8 for no input	80	100	160	mVrms
IF count buffer on level	IF buff on	IF count buffer on	15	25	32	$\text{dB}\mu\text{V}$
IF count buffer output	$V_{\text{IF buff}}$	Test from pin 7 for $V_{IN} = 80\text{ dB}\mu\text{V}$ , no modulation	110	180	220	mVrms

Block Diagram



ILA00300



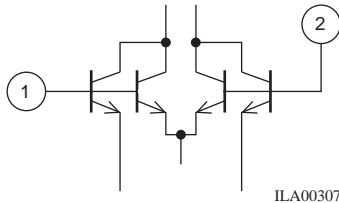
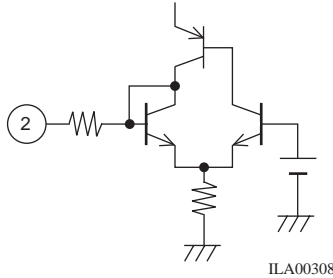
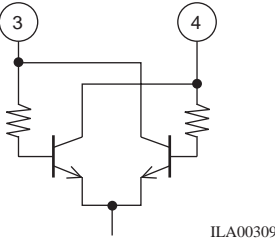
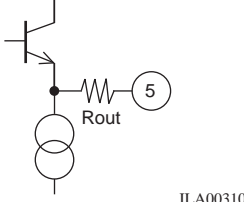
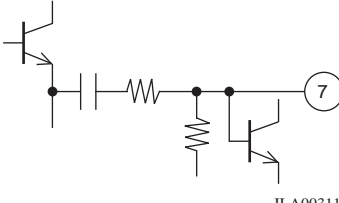
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## Coil specifications (bottom view)

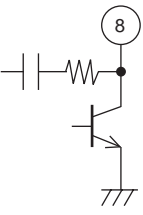
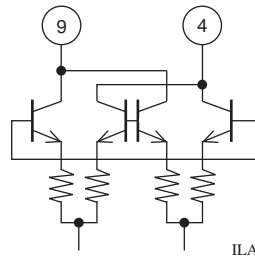
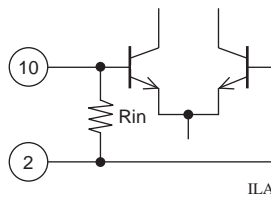
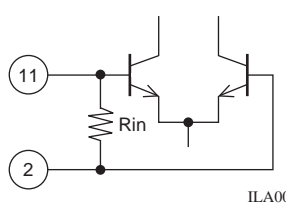
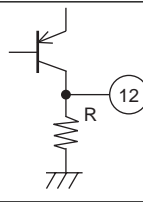
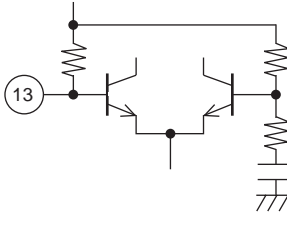
• FM-BPF : SA-309 (Sumida) 88 MHz to 108 MHz	
• FM-RF : SA-149 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 4.5 T	
• FM-OSC : SA-151 (Sumida) 3.6 mm diameter, air core, 0.6 mm wire, 3.5 T	
• FM-IF filter, discriminator : SK107M1-AE-10, CDF107F-AE-029 (Toko) SFE10.7MA5, CDA10.7MG1-A (Murata) : tentative	
<p>• AM-OSC : SA-181 (Sumida)</p> <p style="text-align: center;">ILA00302</p>	<p>: L7BRS-3132AQ (Toko)</p> <p style="text-align: center;">ILA00302</p>
<p>• AM-MIX : SA-1136 (Sumida)</p> <p style="text-align: center;">ILA00304</p>	<p>: PCFAZ-082 (Toko)</p> <p style="text-align: center;">ILA00305</p>
• AM-IF filter : SFU450B (Murata)	
• MW Bar-antenna : C8E-A0105 (Toko)	
<p style="text-align: center;">ILA00306</p>	<p>1-2 67 T 3-4 9 T fo = 796 kHz Qu = 180 min L = 260μH</p>

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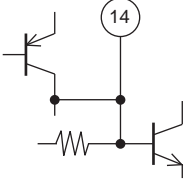
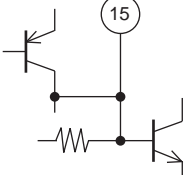
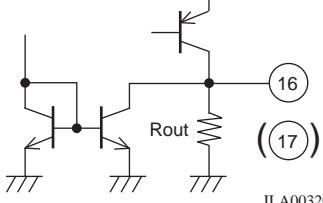
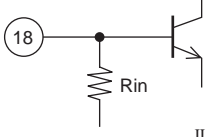
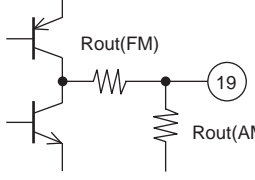
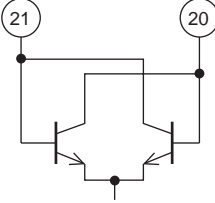
## Pin Descriptions and Quiescent Voltage at $V_{CC} = 4.5\text{ V}$

Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
1	AM-RF input	1.2	1.2		Connect the AM antenna coil between this pin and pin 2 (Reg)
2	Reg	1.2	1.2		
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	2.4	2.2		$R_{out} = 270\ \Omega$
6	GND1	0	0		AM/FM-IF/MPX block ground
7	IF buffer output and mute switch	4.5	4.5		$V_7 \geq 1.3\text{ V}$ : IF buffer output and muting on

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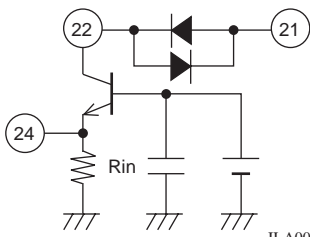
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
8	Stereo indicator, AM-oscillator buffer output	4.5	4.5	 <p style="text-align: right;">ILA00312</p>	Active-low Open-collector output  AM oscillator signal is output in AM mode
9	AM-MIX output	4.5	4.5	 <p style="text-align: right;">ILA00313</p>	Connect the AM mixer coil between this pin and pin 4 (VCC1)
10	FM-IF input	1.2	1.2	 <p style="text-align: right;">ILA00314</p>	Rin = 330 Ω
11	AM-IF input	1.2	1.2	 <p style="text-align: right;">ILA00315</p>	Rin = 2 kΩ
12	AM-AGC output and FM signal meter output	0.4	0.1	 <p style="text-align: right;">ILA00316</p>	Internal load resistance R = 16.6 kΩ
13	FM-DET	3.9	3.7	 <p style="text-align: right;">ILA00317</p>	Recommended ceramic discriminator : CDF107F-AE-029 (Toko) CDA10.7MG** (Murata)

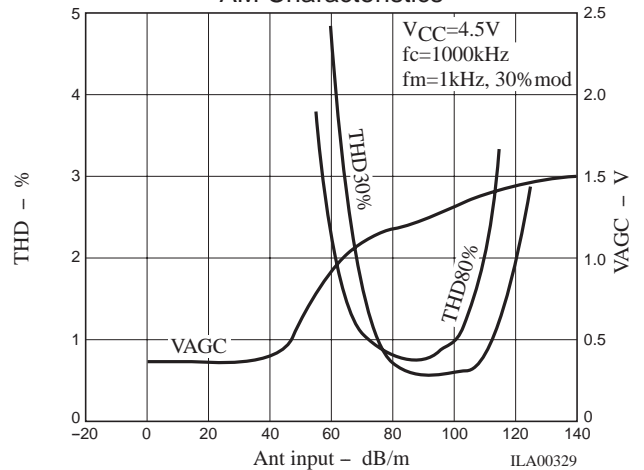
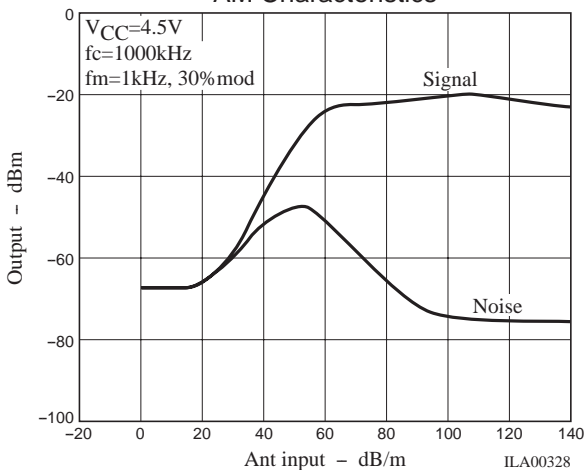
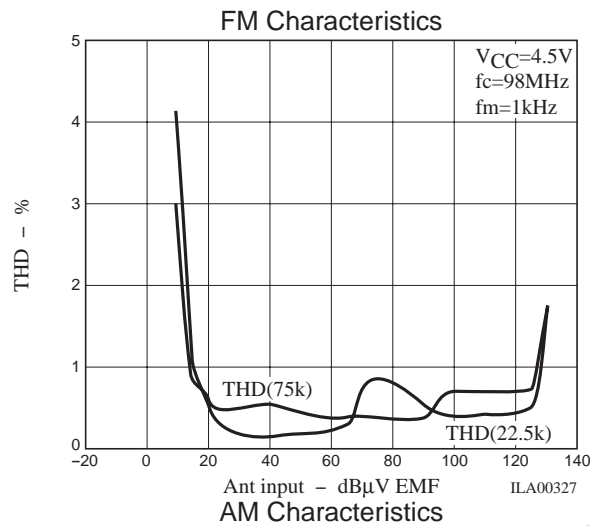
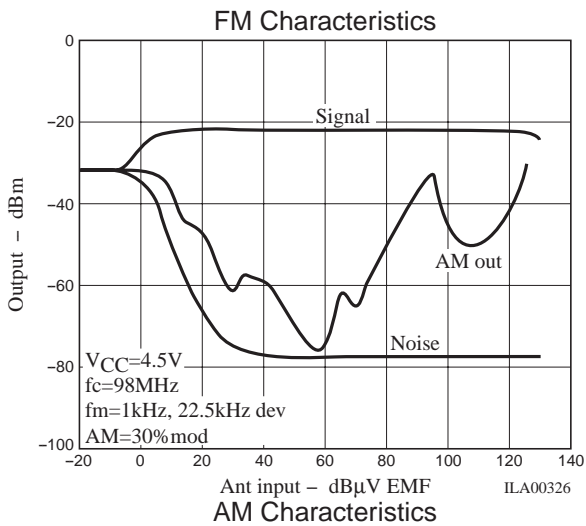
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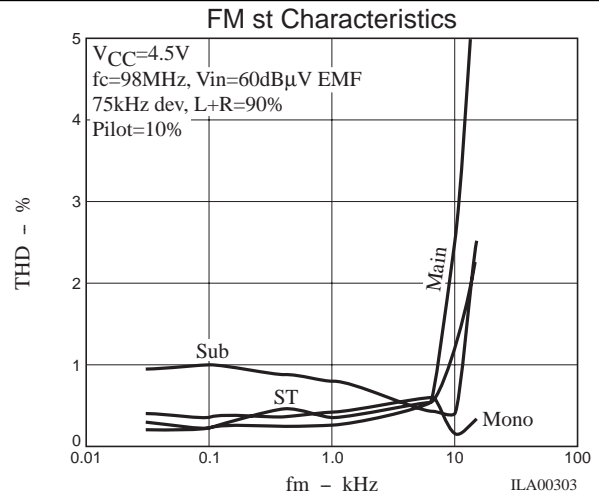
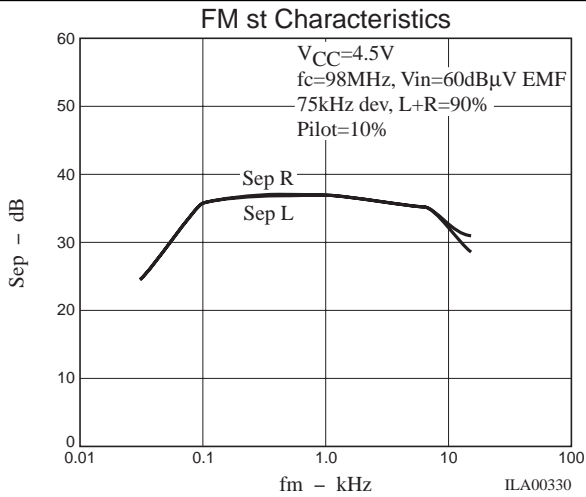
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
14	Pilot detector filter (forced mono)	2.9	3.8	 ILA00318	Forced monaural mode when pin 14 is connected to ground
15	Phase comparator filter (AM/FM switch)	0	3.8	 ILA00319	FM mode is when pin 15 is open, and AM mode is when pin 15 is connected to ground
16 17	L output R output	1.2	1.2	 ILA00320	$R_{out} = 7.5 \text{ k}\Omega$
18	MPX input	1.2	1.2	 ILA00321	$R_{in} = 50 \text{ k}\Omega$
19	AM/FM detector output	0.3	1.0	 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)



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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
21	VCC2	4.5	4.4	 <p>ILA00324</p>	FM-FE block VCC  Power is supplied from pin 4 (VCC1) via external resistor (10 Ω)
22	FM-RF output	4.5	4.4	 <p>ILA00325</p>	Connect the FM-RF coil between this pin and pin 21 (VCC2)  Rin = 1.8 kΩ
24	FM-RF input	0	0.9		
23	GND2	0	0		FM-FE block ground





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