Ordering number : ENN6568

Monolithic Linear IC

LA1833N, 1833NM

System-on-Chip Tuner IC for Home Stereo Systems

Overview

The LA1833N/NM is an AM/FM IF and MPX system-on-chip IC that supports electronic tuning for home stereo systems. It is optimal for use in auto-seek systems that use SD (station detect) and IF counting in parallel.

Functions

- AM: RF amplifier, mixer, oscillator, IF amplifier, detector, AGC, SD, oscillator buffer, IF buffer, and stereo IF output
- FM IF: IF amplifier, quadrature detector, S meter, SD, S-curve detector, IF buffer
- MPX: PLL stereo decoder, stereo indicator, forced mono, VCO stop, audio muting, adjacent channel interference reduction function, pilot canceller

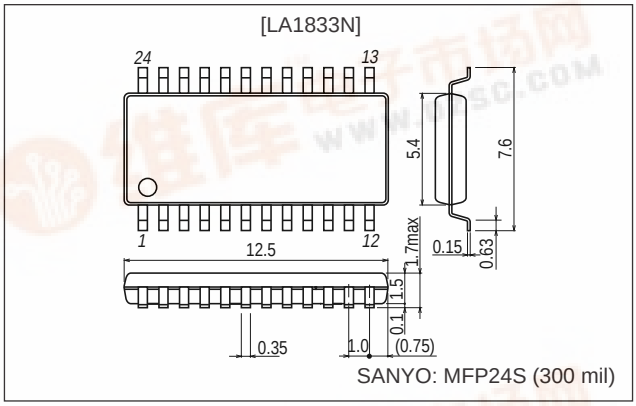
Features

- Improvements over the LA1832
  - — The MPX VCO circuit has been integrated on the same IC (no ceramic element required)
  - — Built-in adjacent channel interference reduction function (114 kHz, 190 kHz)
  - — Built-in pilot canceler function (19 kHz)
  - — AM and FM output levels can be set independently
  - — Improved FM reception characteristics (IF beating improved)
- Other features
  - — Pin arrangement nearly identical to that of the LA1832
  - — AM coil specifications can be the same as those used for the LA1832.
  - — ST operating dynamic range improved over that of the LA1833
  - — FM total harmonic distortion detuning characteristics and signal-to-noise ratio improved over those of the LA1833

Package Dimensions

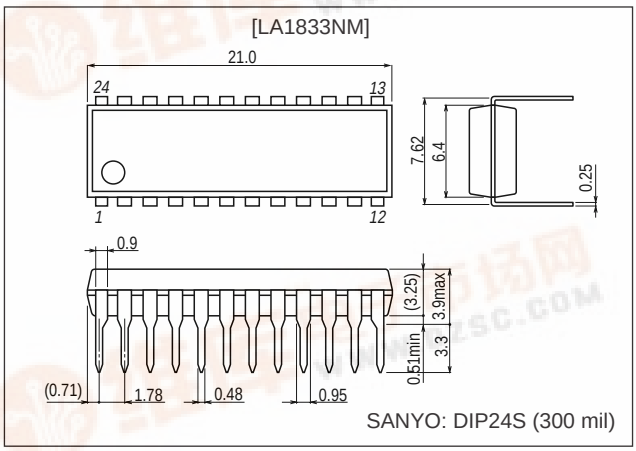
unit: mm

3112A-MFP24S



unit: mm

3067A-DIP24S



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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		9	V
Allowable power dissipation	Pd max	(LA1833N)	400	mW
		(LA1833NM) (Ta ≤ 45°C)	400	mW
		(LA1833NM) (Ta = 70°C)	270	mW
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–40 to +125	°C

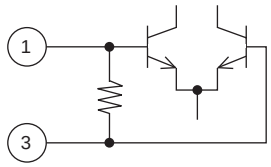
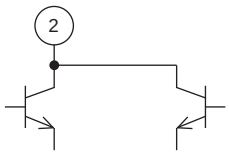
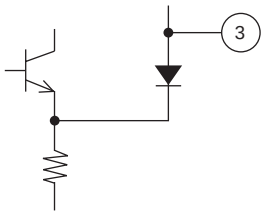
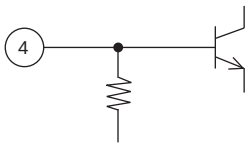
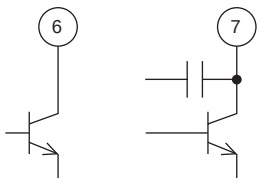
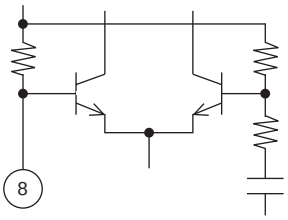
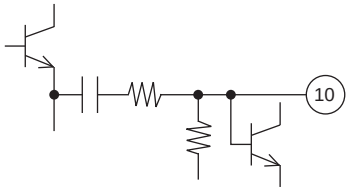
Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		5	V
Operating supply voltage range	V_{CC} op		4 to 8	V

Electrical Characteristics at V_{CC} = 5 V, in the specified test circuit

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM Mono Characteristics: fc = 10.7 MHz, fm = 1 kHz]						
Current drain	I_{CCO}-FM	No input	18	28	38	mA
Demodulator output	V_O-FM	100 dBμ, 100% mod. The pin 13 output	210	330	420	mVrms
Channel balance	C.B-mono	100 dBμ, 100% mod. The ratio (pin 13 output)/(pin 14 output)	–1.5	0	1.5	dB
Total harmonic distortion (mono)	THD-FM	100 dBμ, 100% mod. The pin 13 output		0.5	1.5	%
Signal-to-noise ratio	S/N-FM	100 dBμ, 100% mod. The pin 13 output	70	78		dB
AM rejection ratio	AMR	100 dBμ, AM = 30% mod. fm = 1 kHz	45	63		dB
Input limiting voltage	–3dBL. S	100 dBμ, 100% mod. The pin 13 output Referenced to the output, when the input is down by –3 dB		34	42	dBμ
SD LED on sensitivity	SD-On-FM		32	42	52	dBμ
IF counter buffer output	V_{IFBuff}-FM	100 dBμ, the pin 10 output	200	275	400	mVrms
Muting attenuation	Mute Att	100 dBμ, 100% mod. fm = 1 kHz		76		dB
[Stereo Characteristics: fc = 10.7 MHz, 100 dBμ, fm = 1 kHz, L + R = 90%, pilot = 10%]						
Separation	Sep	Left channel modulated, the ratio (pin 13 output)/(pin 14 output)	28	42		dB
Stereo on level	ST-on	The pilot modulation level such that V7 becomes less than 0.7 V	1.5	3.5	5.5	%
Total harmonic distortion (main)	THD-main	L + R modulation, the pin 13 output		0.7	1.5	%
Adjacent channel interference rejection ratio	Brej-3rd	fs = 113 kHz, Vs = 90%, Pilot = 10%; the pin 13 output with respect to an L – R modulated 1 kHz demodulator output		36		dB
Adjacent channel interference rejection ratio	Brej-5th	fs = 189 kHz, Vs = 90%, Pilot = 10%; the pin 13 output with respect to an L – R modulated 1 kHz demodulator output		41		dB
Carrier leakage	CL	L + R = 90%, De-emph asis 50 μs, Pilot = 10%	38	44		dB
[AM Characteristics: fc = 1000 kHz, fm = 1 kHz]						
Current drain	I_{CCO}-AM	No input	11	22	33	mA
Detector output	V_O-AM (1)	23 dBμ, 30% modulation. The pin 13 output	40	80	160	mVrms
Detector output	V_O-AM (2)	80 dBμ, 30% modulation. The pin 13 output	90	160	230	mVrms
Signal-to-noise ratio	S/N-AM (1)	23 dBμ, 30% modulation. The pin 13 output	16	21		dB
	S/N-AM (2)	80 dBμ, 30% modulation. The pin 13 output	48	54		dB
Total harmonic distortion	THD-AM (1)	80 dBμ, 30% modulation. The pin 13 output		0.4	1.1	%
	THD-AM (2)	100 dBμ, 30% modulation. The pin 13 output		0.5	1.3	%
SD LED on sensitivity	SD-On-AM		14	24	34	dBμ
Local oscillator buffer output	V_{OSC}-AM	No input, the pin 24 output	140	200		mVrms
IF counter buffer output	V_{IFBuff}-AM	80 dBμ, no modulation, the pin 10 output	140	285	400	mVrms

Pin Descriptions

Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
1	FM IF input	Vreg	The input impedance, r_i, is 330 Ω	 ILA00220
2	AM MIX output	V_{CC}	The mixer coil is connected between pins 2 and 9	 ILA00221
3	REG	2.1	Vreg = 2.1 V	 ILA00222
4	AM IF input	Vreg	The input impedance, ri, is 2 kΩ	 ILA00223
5	GND	0		
6 7	Tu-LED ST-LED Also functions as the AM stereo IF output	V_{CC}	These are active-low open-collector outputs. Set up the current flowing in to these pins to exceed 100 µA.	 ILA00224
8	FM-DET	V_{CC} – 2.1	Recommended ceramic discriminators FCD1070MA11UK2L (TDK) CDA10.7MG86N (Murata Mfg. Co., Ltd.)	 ILA00225
9	V_{CC}	5.0		
10	AM/FM IF counter output Also functions as a control switch Also functions as the muting switch	0	V10 ≤ 0.5 V: Reception state (normal) 1.4 V ≤ V10 ≤ 2.2 V: Muting on state. V10 ≥ 3.5 V: Muting on and IF counter on (seek state).	 ILA00226

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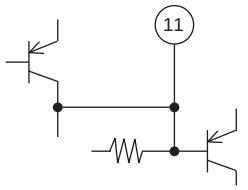
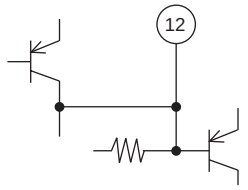
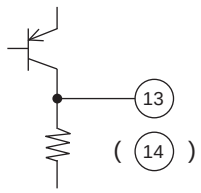
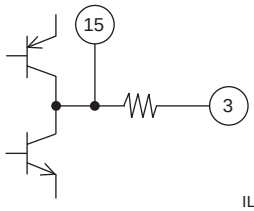
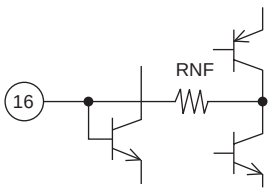
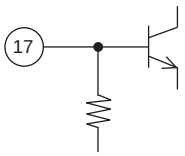
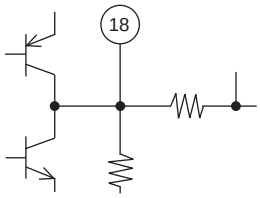
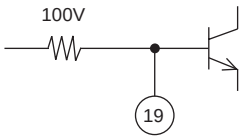
Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
11	Phase comparator filter connection Also functions as the FM/AM switching input	V_{CC} – 1.0	The IC switches to AM mode if a current in excess of 200 µA flows from this pin	 ILA00227
12	Pilot detector filter connection Also functions as the forced mono setting Also functions as the VCO stop control	V_{CC} – 1.0	The IC switches to forced mono mode if a current in excess of 50 µA flows from this pin. The VCO circuit is stopped if a current in excess of 200 µA flows from this pin.	 ILA00228
13 14	Left output Right output	1.8	The output impedance, r_o, is 3.3 kΩ	 ILA00229
15	Pilot canceller output	Vreg		 ILA00230
16	Decoder input	Vreg	Inverting input RNF = 20 kΩ	 ILA00231
17	PLL input	Vreg	The input impedance, r_i, is 20 kΩ	 ILA00232
18	FM demodulator output	Vreg	The output impedance, r_o, is 2.3 kΩ. The separation can be adjusted by changing the value of the capacitor connected between this pin and ground.	 ILA00233
19	AM detector output	0 (FM) 1.5 (AM)	The output impedance, r_o, is 10 kΩ	 ILA00234

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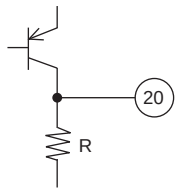
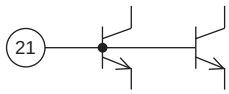
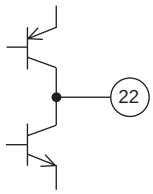
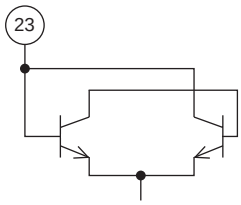
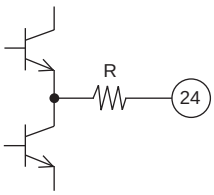
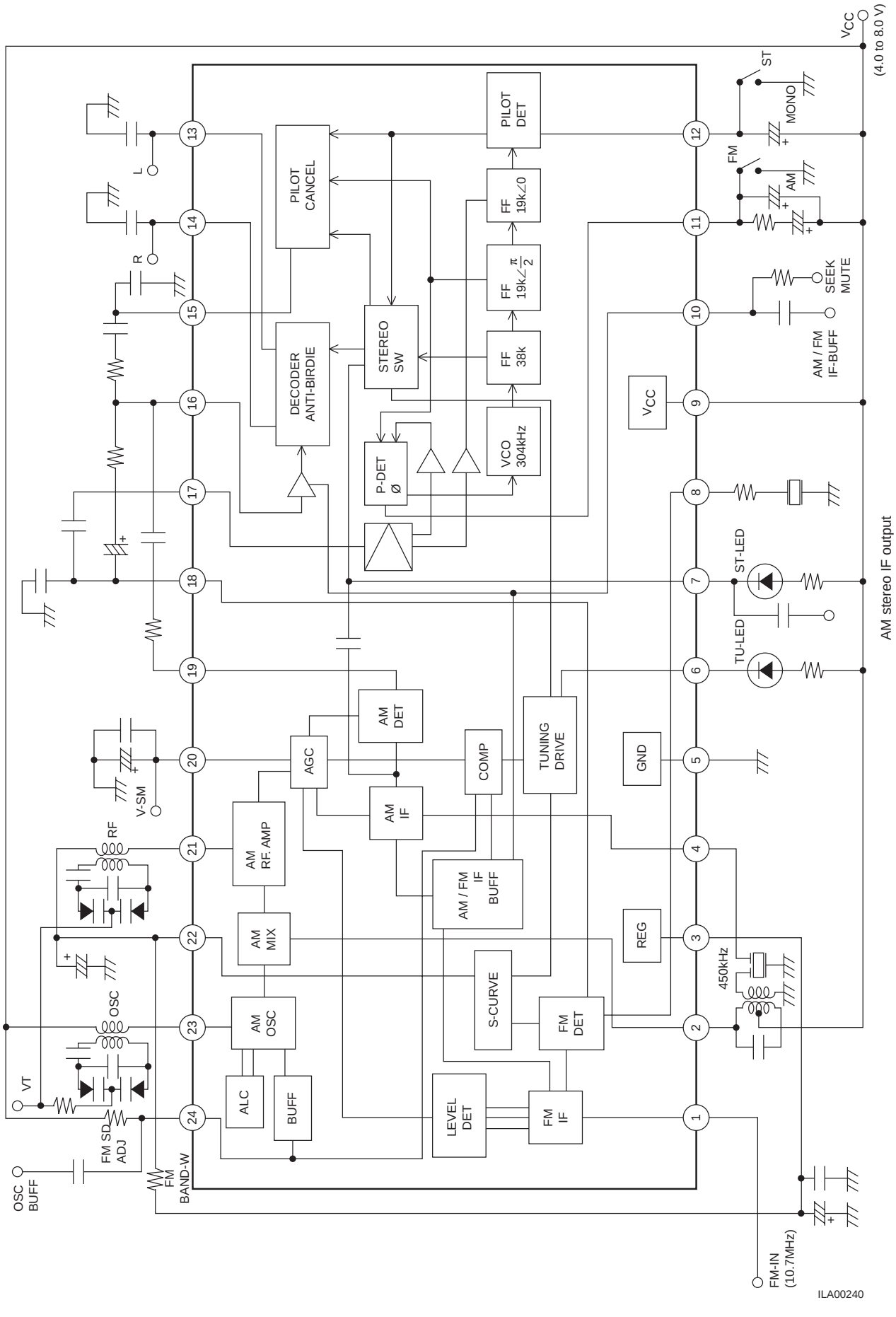
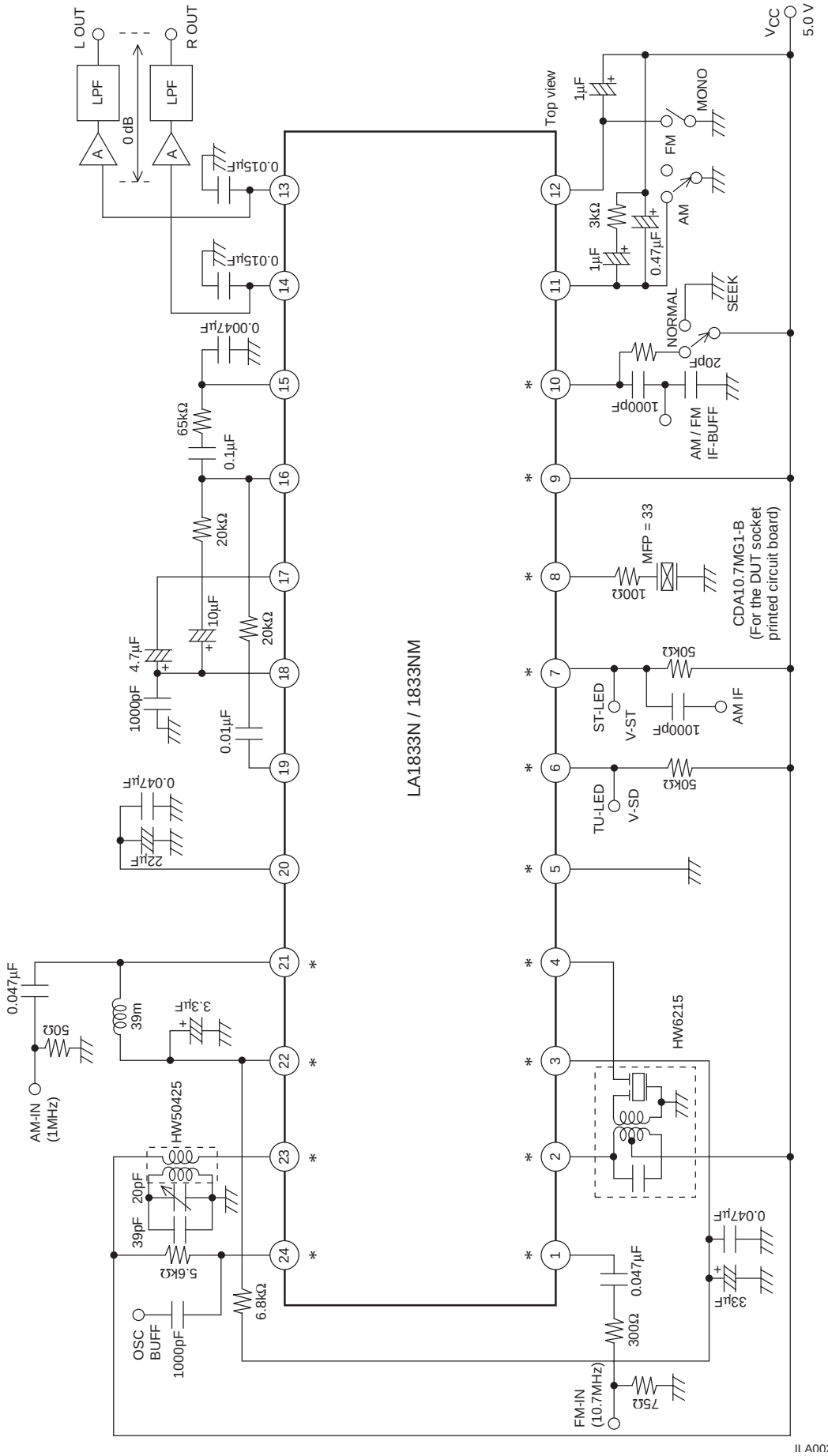
Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
20	S meter Also functions as the AM AGC	0.2 (FM) 0.9 (AM)	Internal load resistor R = 13.9 kΩ. The SD response speed during seek operations is set by the value of the external capacitor connected to pin 20.	 ILA00235
21	AM RF-IN	Vreg	Pin 21 and pin 22 (the AFC voltage) are used at the same potential	 ILA00236
22	AFC	Vreg	The FM SD bandwidth can be adjusted by an external resistor connected between pin 22 and pin 3 (the regulator voltage). Note: A bandwidth of 180 kHz or higher is appropriate for the FM SD bandwidth.	 ILA00237
23	OSC	V_{CC}	The oscillator coil is connected between pin 23 and pin 9 (the V_{CC} voltage). Note: The oscillator coil impedance (secondary side) must be at least 5 kΩ.	 ILA00238
24	Oscillator buffer Also functions as the FM SD adjustment	V_{CC} – 1.4	The FM SD sensitivity can be adjusted with an external resistor on pin 24. R = 200 Ω Note: The resistance of the pin 24 external resistor must be at least 3.3 kΩ.	 ILA00239

Block Diagram



ILA00240

Test Circuit

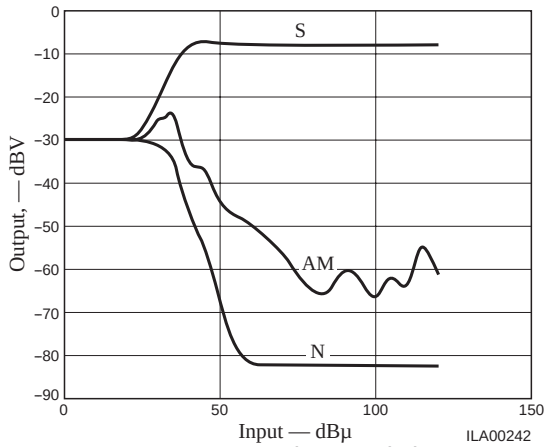


The places that differ with the LA1833 are (1) the value of the pin 8 resistor and (2) the circuits in the vicinity of pins 17 and 18.

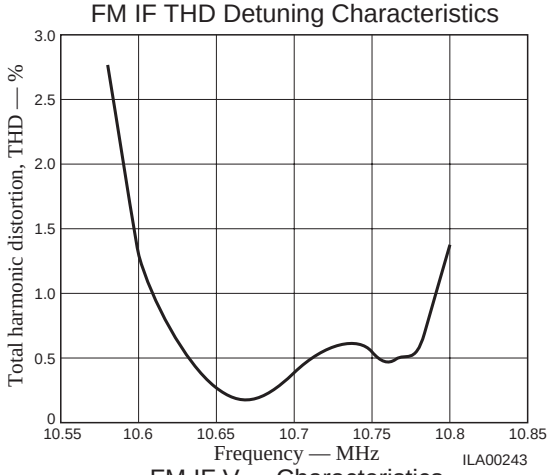
*: Pins with the same functionality as those on the LA1832.

ILA00241

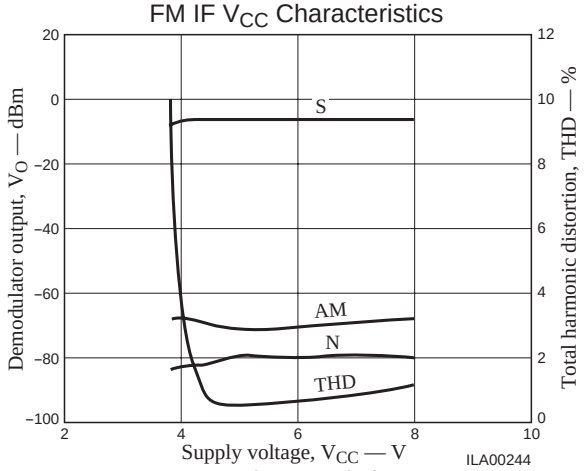
FM IF I/O Characteristics



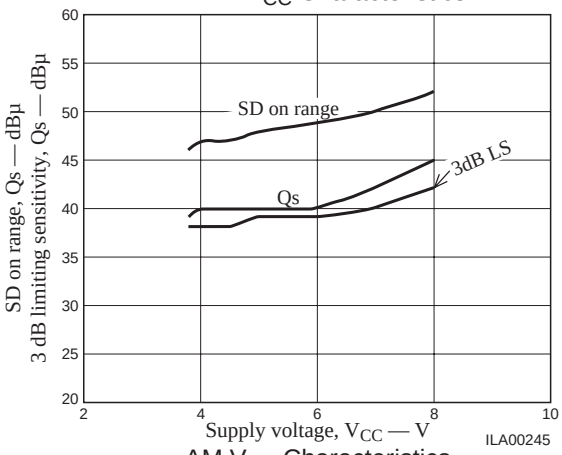
FM IF THD Detuning Characteristics



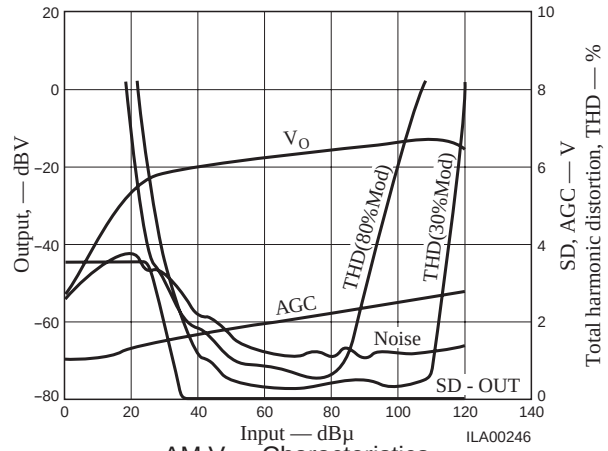
FM IF V_{CC} Characteristics



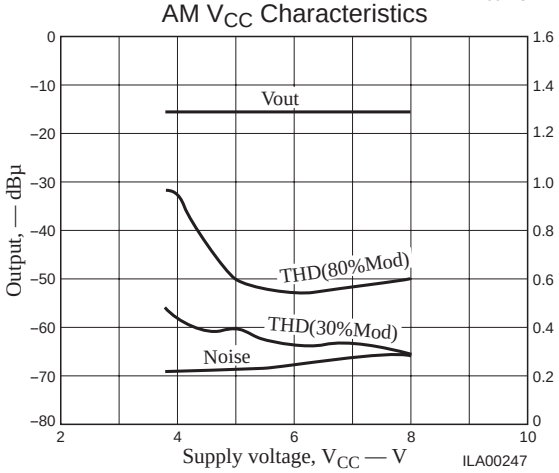
FM IF V_{CC} Characteristics



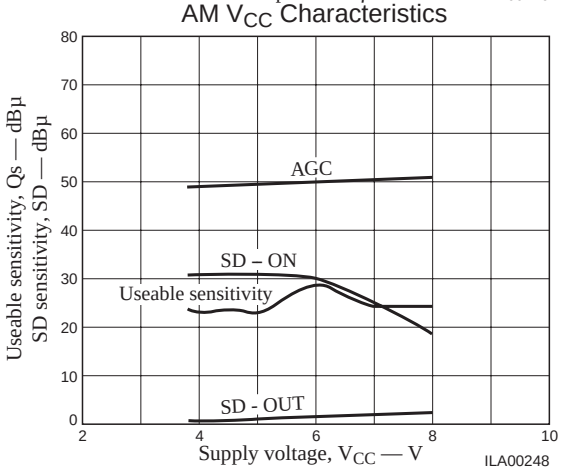
AM Characteristics



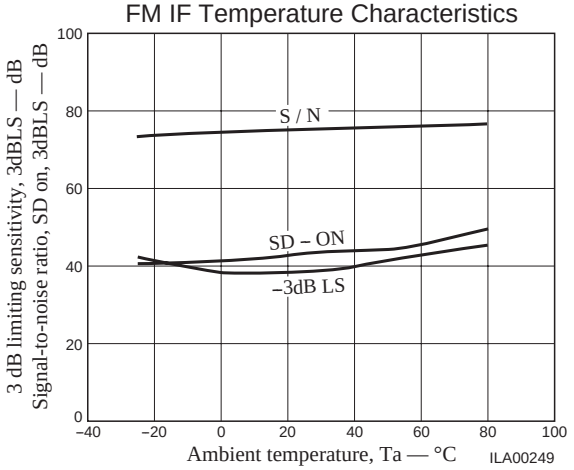
AM V_{CC} Characteristics



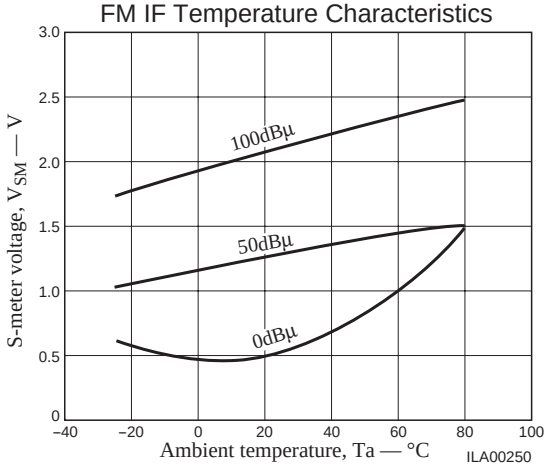
AM V_{CC} Characteristics



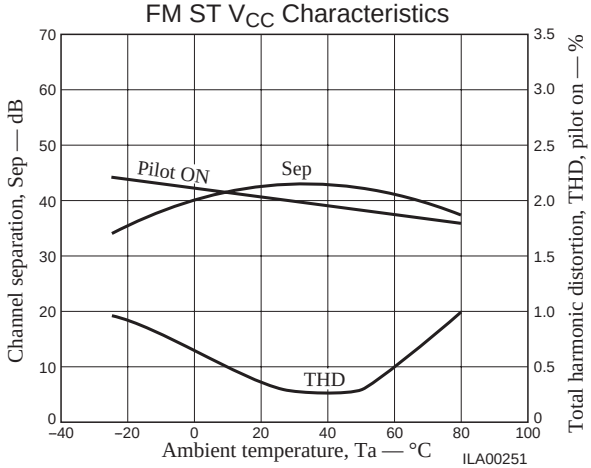
FM IF Temperature Characteristics



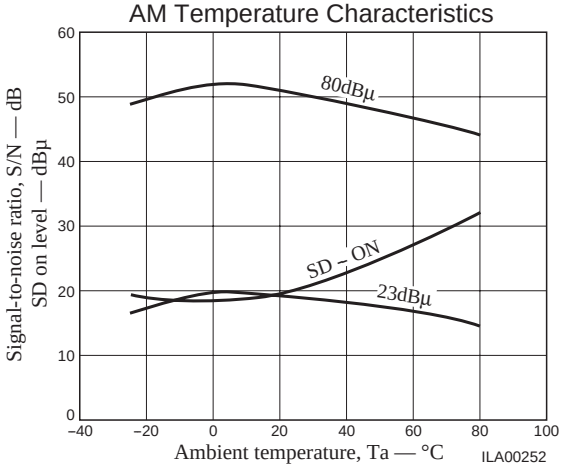
FM IF Temperature Characteristics



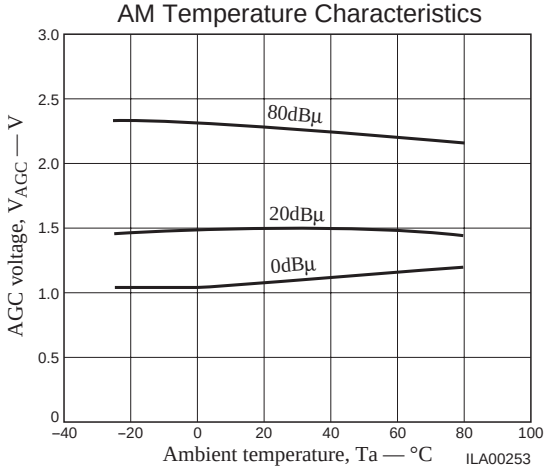
FM ST V_{CC} Characteristics



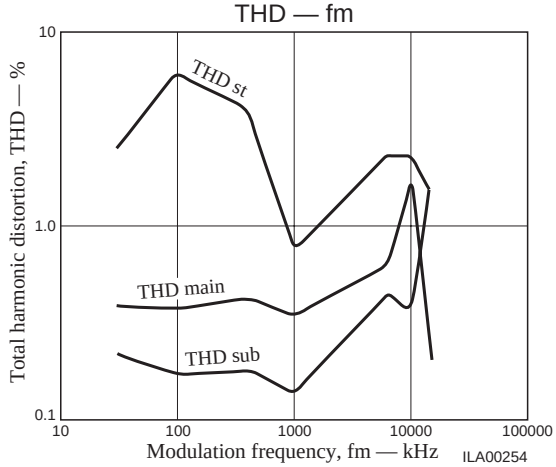
AM Temperature Characteristics



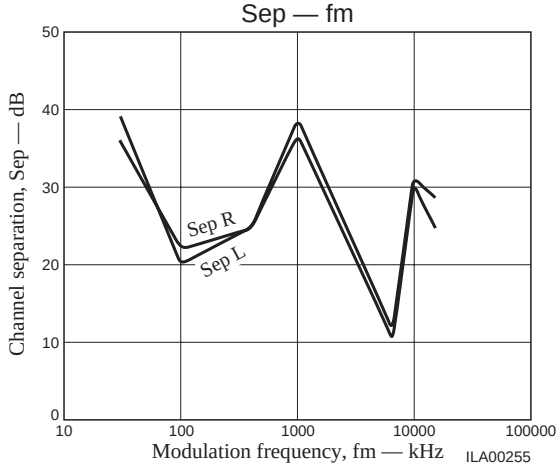
AM Temperature Characteristics



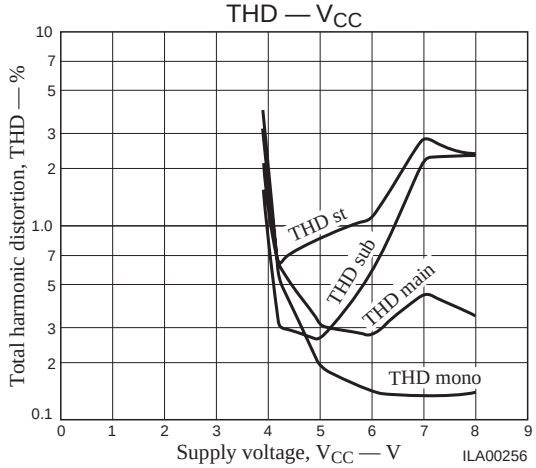
THD — fm



Sep — fm



THD — V_{CC}



Sep, S / N — V_{CC}