

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

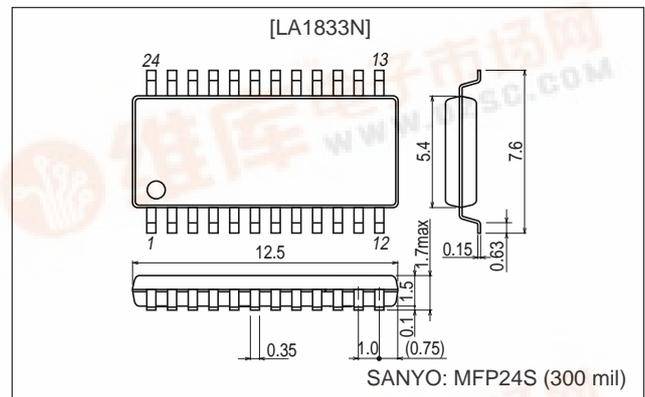
- Improvements over the LA1832
  - The MPX VCO circuit has been integrated on the same IC (no ceramic element required)
  - Built-in adjacent channel interference reduction function (114 kHz, 190 kHz)
  - Built-in pilot canceler function (19 kHz)
  - AM and FM output levels can be set independently
  - 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

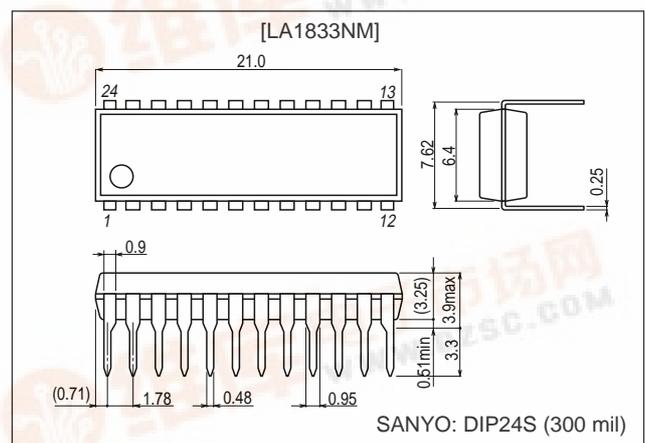
unit: mm

#### 3112A-MFP24S



unit: mm

#### 3067A-DIP24S



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## LA1833N, 1833NM

### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max		9	V
Allowable power dissipation	Pd max	(LA1833N)	400	mW
		(LA1833NM) ( $T_a \leq 45^\circ\text{C}$ )	400	mW
		(LA1833NM) ( $T_a = 70^\circ\text{C}$ )	270	mW
Operating temperature	Topr		-20 to +70	$^\circ\text{C}$
Storage temperature	Tstg		-40 to +125	$^\circ\text{C}$

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

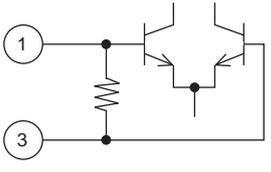
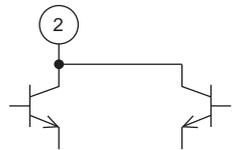
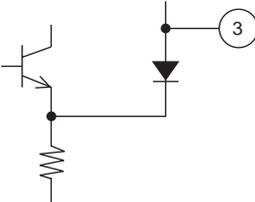
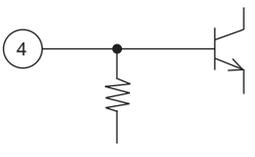
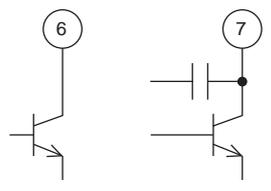
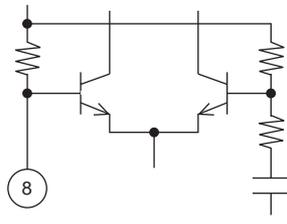
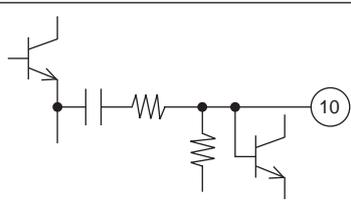
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$		5	V
Operating supply voltage range	$V_{CC}$ op		4 to 8	V

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM Mono Characteristics: $f_c = 10.7\text{ MHz}$ , $f_m = 1\text{ kHz}$ ]						
Current drain	$I_{CCO-FM}$	No input	18	28	38	mA
Demodulator output	$V_{O-FM}$	100 dB $\mu$ , 100% mod. The pin 13 output	210	330	420	mVrms
Channel balance	C.B-mono	100 dB $\mu$ , 100% mod. The ratio (pin 13 output)/(pin 14 output)	-1.5	0	1.5	dB
Total harmonic distortion (mono)	THD-FM	100 dB $\mu$ , 100% mod. The pin 13 output		0.5	1.5	%
Signal-to-noise ratio	S/N-FM	100 dB $\mu$ , 100% mod. The pin 13 output	70	78		dB
AM rejection ratio	AMR	100 dB $\mu$ , AM = 30% mod. $f_m = 1\text{ kHz}$	45	63		dB
Input limiting voltage	-3dB $\mu$ . S	100 dB $\mu$ , 100% mod. The pin 13 output Referenced to the output, when the input is down by -3 dB		34	42	dB $\mu$
SD LED on sensitivity	SD-On-FM		32	42	52	dB $\mu$
IF counter buffer output	$V_{IFBuf-FM}$	100 dB $\mu$ , the pin 10 output	200	275	400	mVrms
Muting attenuation	Mute Att	100 dB $\mu$ , 100% mod. $f_m = 1\text{ kHz}$		76		dB
[Stereo Characteristics: $f_c = 10.7\text{ MHz}$ , 100 dB $\mu$ , $f_m = 1\text{ kHz}$ , 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	$f_s = 113\text{ kHz}$ , $V_s = 90\%$ , 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	$f_s = 189\text{ kHz}$ , $V_s = 90\%$ , 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 $\mu\text{s}$ , Pilot = 10%	38	44		dB
[AM Characteristics: $f_c = 1000\text{ kHz}$ , $f_m = 1\text{ kHz}$ ]						
Current drain	$I_{CCO-AM}$	No input	11	22	33	mA
Detector output	$V_{O-AM}$ (1)	23 dB $\mu$ , 30% modulation. The pin 13 output	40	80	160	mVrms
Detector output	$V_{O-AM}$ (2)	80 dB $\mu$ , 30% modulation. The pin 13 output	90	160	230	mVrms
Signal-to-noise ratio	S/N-AM (1)	23 dB $\mu$ , 30% modulation. The pin 13 output	16	21		dB
	S/N-AM (2)	80 dB $\mu$ , 30% modulation. The pin 13 output	48	54		dB
Total harmonic distortion	THD-AM (1)	80 dB $\mu$ , 30% modulation. The pin 13 output		0.4	1.1	%
	THD-AM (2)	100 dB $\mu$ , 30% modulation. The pin 13 output		0.5	1.3	%
SD LED on sensitivity	SD-On-AM		14	24	34	dB $\mu$
Local oscillator buffer output	$V_{OSC-AM}$	No input, the pin 24 output	140	200		mVrms
IF counter buffer output	$V_{IFBuf-AM}$	80 dB $\mu$ , no modulation, the pin 10 output	140	285	400	mVrms

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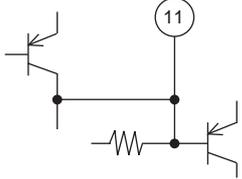
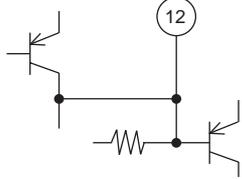
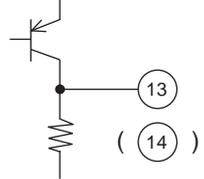
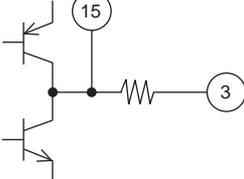
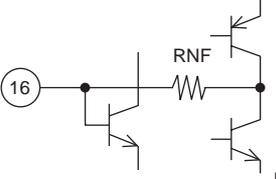
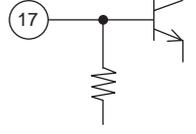
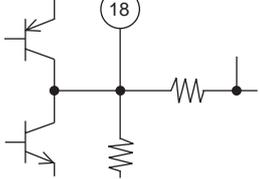
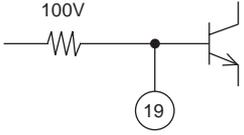
### Pin Descriptions

Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
1	FM IF input	Vreg	The input impedance, $r_i$ , is 330 $\Omega$	 <p style="text-align: right;">ILA00220</p>
2	AM MIX output	V <sub>CC</sub>	The mixer coil is connected between pins 2 and 9	 <p style="text-align: right;">ILA00221</p>
3	REG	2.1	Vreg = 2.1 V	 <p style="text-align: right;">ILA00222</p>
4	AM IF input	Vreg	The input impedance, $r_i$ , is 2 k $\Omega$	 <p style="text-align: right;">ILA00223</p>
5	GND	0		
6 7	Tu-LED ST-LED Also functions as the AM stereo IF output	V <sub>CC</sub>	These are active-low open-collector outputs. Set up the current flowing in to these pins to exceed 100 $\mu$ A.	 <p style="text-align: right;">ILA00224</p>
8	FM-DET	V <sub>CC</sub> - 2.1	Recommended ceramic discriminators FCD1070MA11UK2L (TDK) CDA10.7MG86N (Murata Mfg. Co., Ltd.)	 <p style="text-align: right;">ILA00225</p>
9	V <sub>CC</sub>	5.0		
10	AM/FM IF counter output Also functions as a control switch Also functions as the muting switch	0	V10 $\leq$ 0.5 V: Reception state (normal) 1.4 V $\leq$ V10 $\leq$ 2.2 V: Muting on state. V10 $\geq$ 3.5 V: Muting on and IF counter on (seek state).	 <p style="text-align: right;">ILA00226</p>

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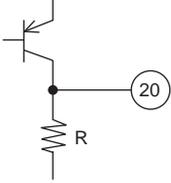
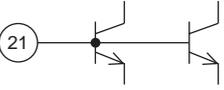
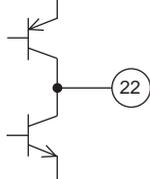
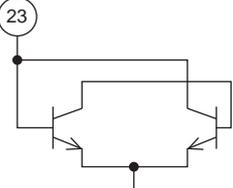
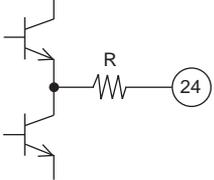
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Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
11	Phase comparator filter connection Also functions as the FM/AM switching input	$V_{CC} - 1.0$	The IC switches to AM mode if a current in excess of $200 \mu\text{A}$ flows from this pin	 <p style="text-align: right;">ILA00227</p>
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 $50 \mu\text{A}$ flows from this pin. The VCO circuit is stopped if a current in excess of $200 \mu\text{A}$ flows from this pin.	 <p style="text-align: right;">ILA00228</p>
13 14	Left output Right output	1.8	The output impedance, $r_o$ , is $3.3 \text{ k}\Omega$	 <p style="text-align: right;">ILA00229</p>
15	Pilot canceller output	Vreg		 <p style="text-align: right;">ILA00230</p>
16	Decoder input	Vreg	Inverting input $R_{NF} = 20 \text{ k}\Omega$	 <p style="text-align: right;">ILA00231</p>
17	PLL input	Vreg	The input impedance, $r_i$ , is $20 \text{ k}\Omega$	 <p style="text-align: right;">ILA00232</p>
18	FM demodulator output	Vreg	The output impedance, $r_o$ , is $2.3 \text{ k}\Omega$ . The separation can be adjusted by changing the value of the capacitor connected between this pin and ground.	 <p style="text-align: right;">ILA00233</p>
19	AM detector output	0 (FM) 1.5 (AM)	The output impedance, $r_o$ , is $10 \text{ k}\Omega$	 <p style="text-align: right;">ILA00234</p>

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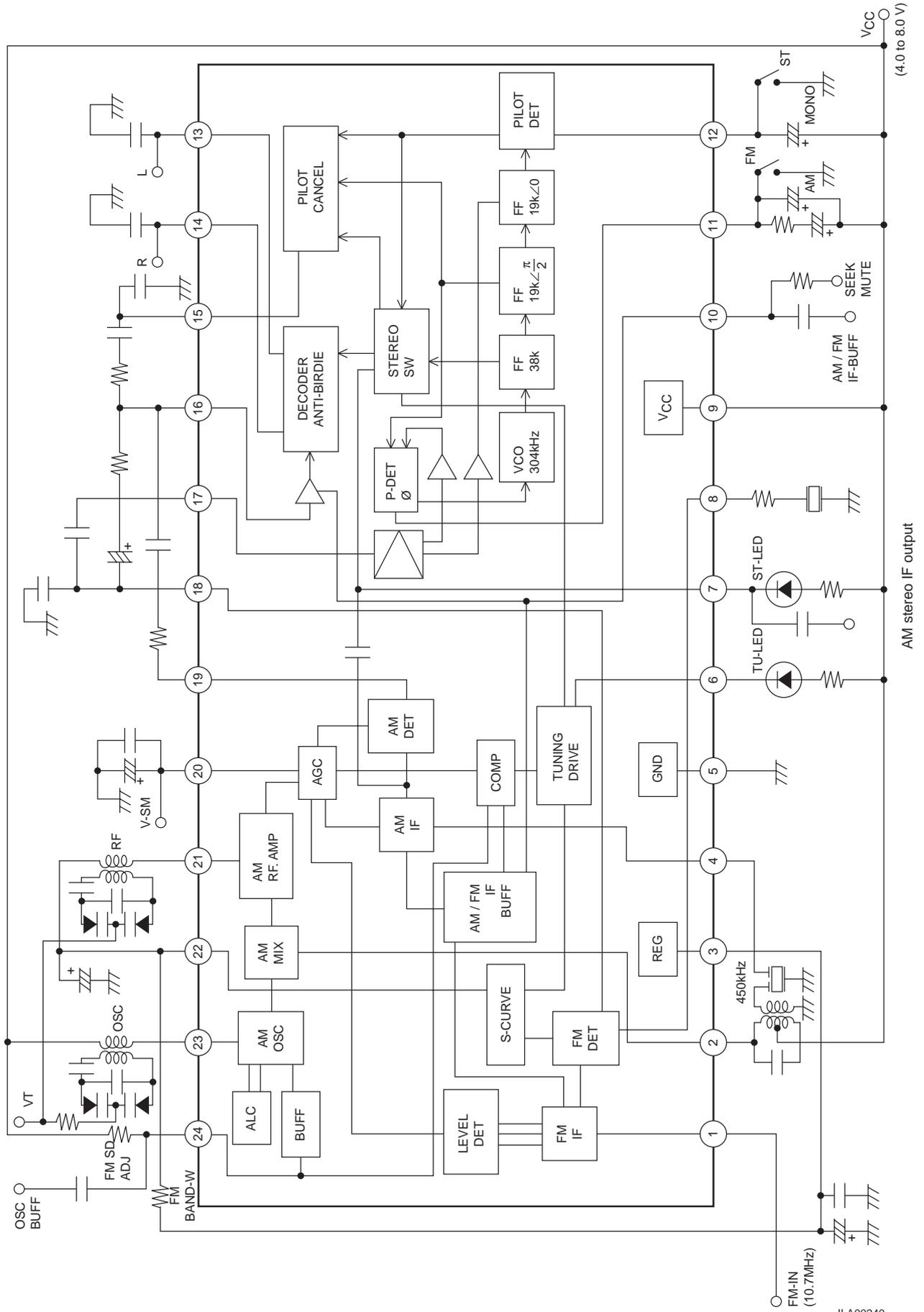
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Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
20	S meter Also functions as the AM AGC	0.2 (FM) 0.9 (AM)	Internal load resistor $R = 13.9 \text{ k}\Omega$ . The SD response speed during seek operations is set by the value of the external capacitor connected to pin 20.	 <p style="text-align: right;">ILA00235</p>
21	AM RF-IN	Vreg	Pin 21 and pin 22 (the AFC voltage) are used at the same potential	 <p style="text-align: right;">ILA00236</p>
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.	 <p style="text-align: right;">ILA00237</p>
23	OSC	V <sub>CC</sub>	The oscillator coil is connected between pin 23 and pin 9 (the V <sub>CC</sub> voltage). Note: The oscillator coil impedance (secondary side) must be at least 5 kΩ.	 <p style="text-align: right;">ILA00238</p>
24	Oscillator buffer Also functions as the FM SD adjustment	V <sub>CC</sub> - 1.4	The FM SD sensitivity can be adjusted with an external resistor on pin 24. $R = 200 \Omega$ Note: The resistance of the pin 24 external resistor must be at least 3.3 kΩ.	 <p style="text-align: right;">ILA00239</p>

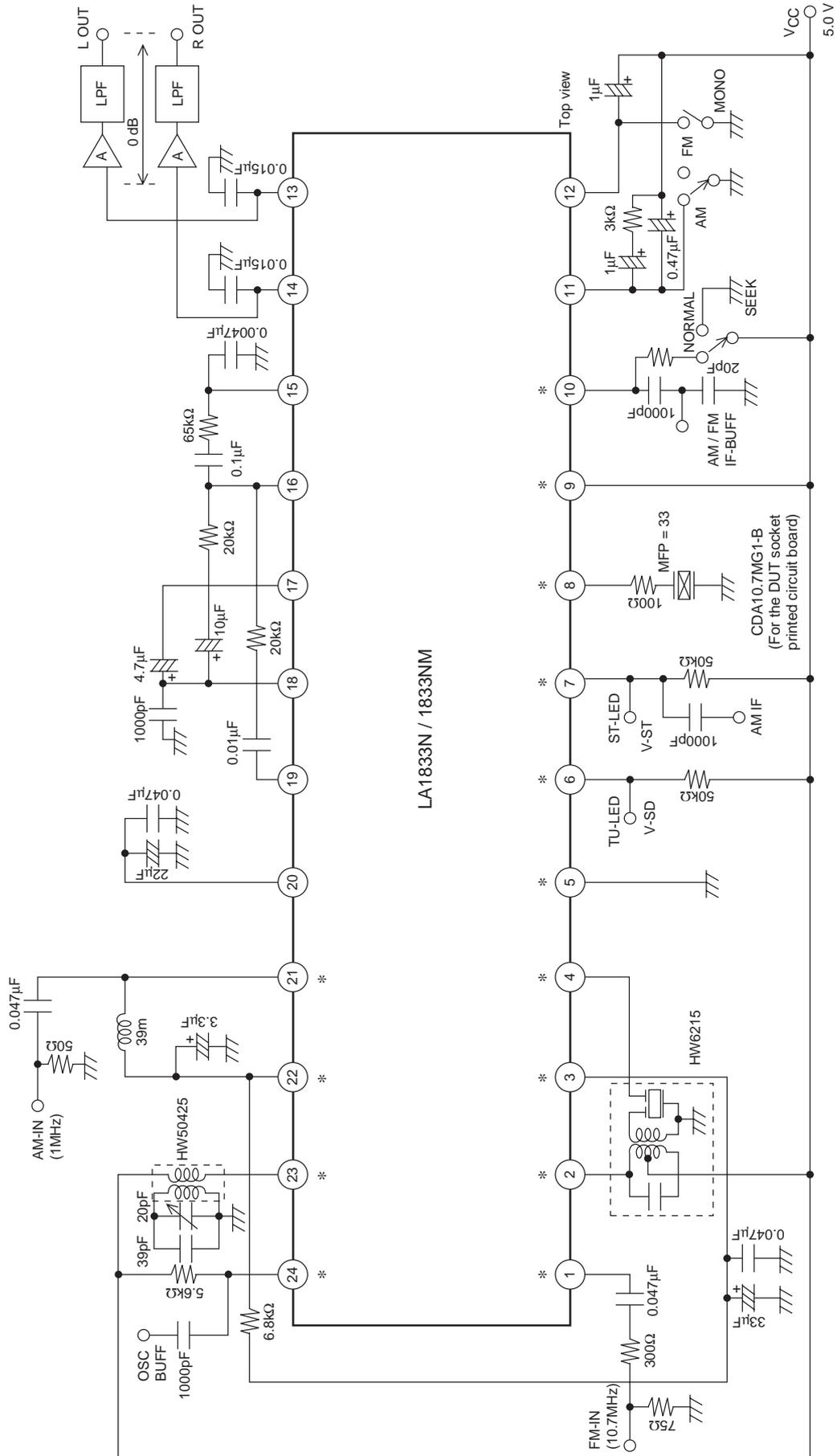
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Block Diagram



# LA1833N, 1833NM

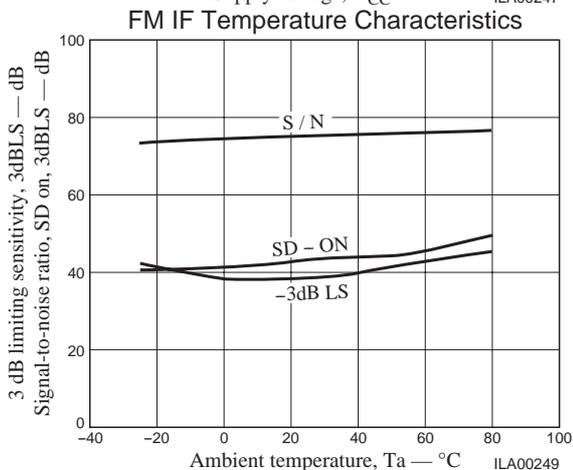
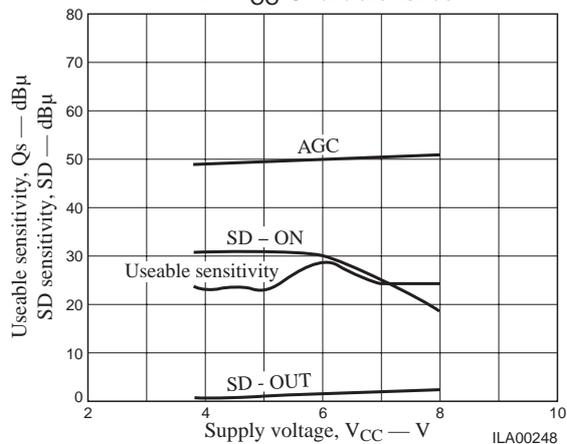
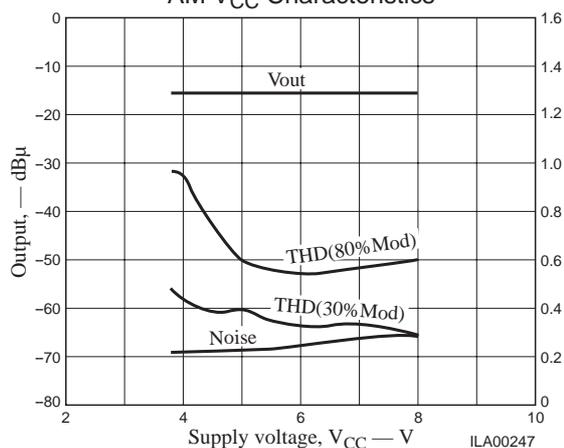
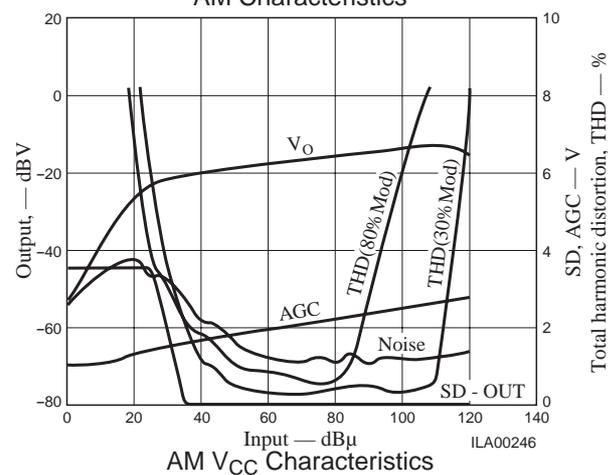
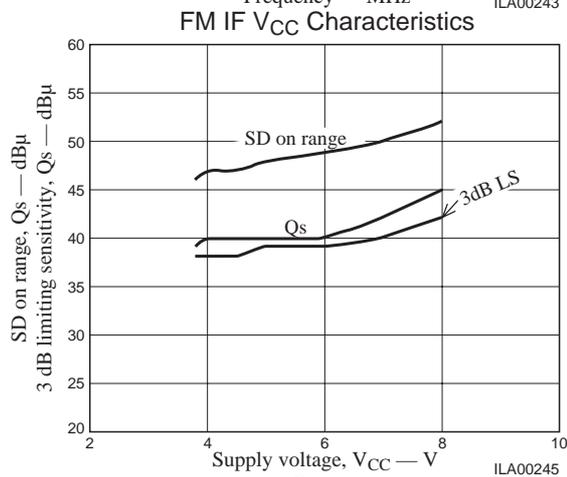
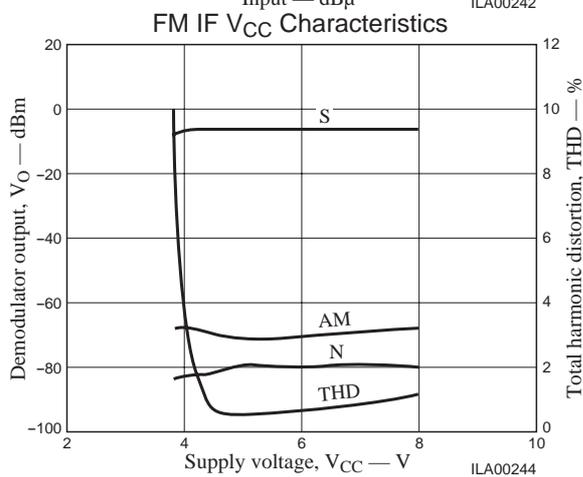
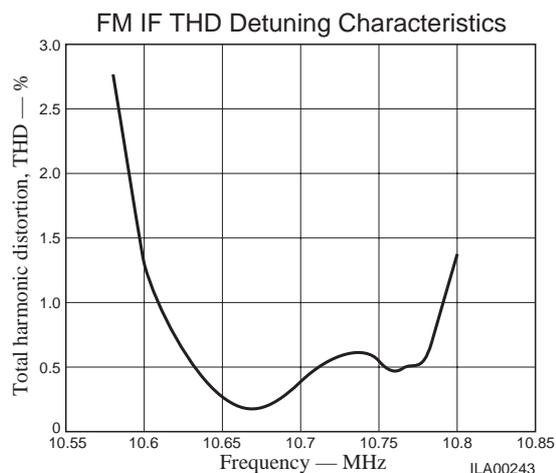
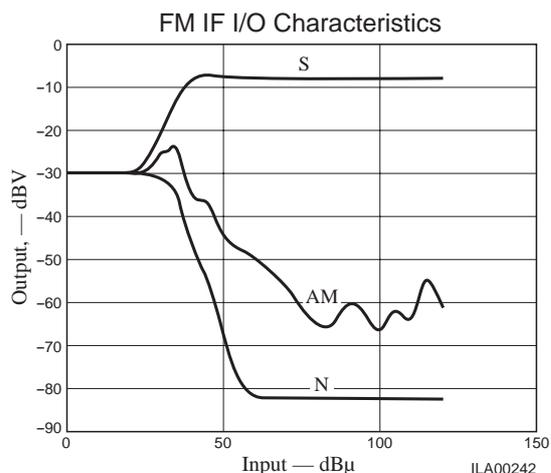
## Test Circuit



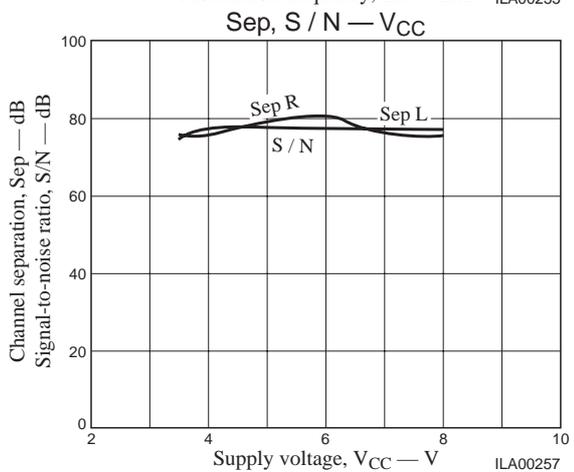
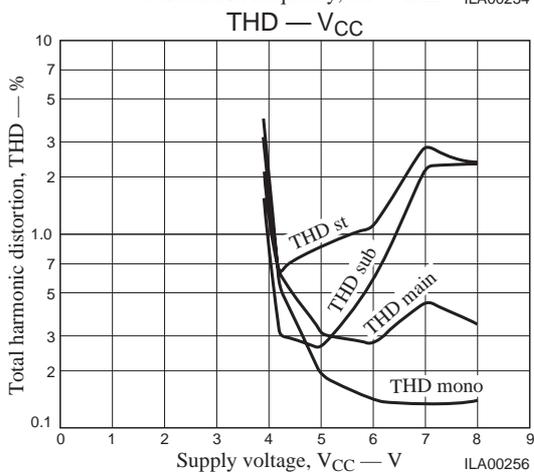
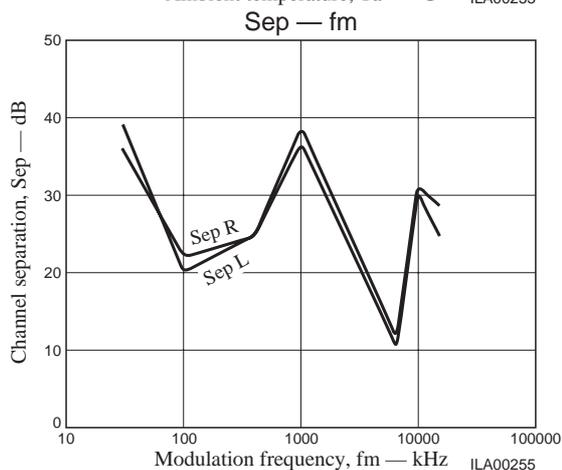
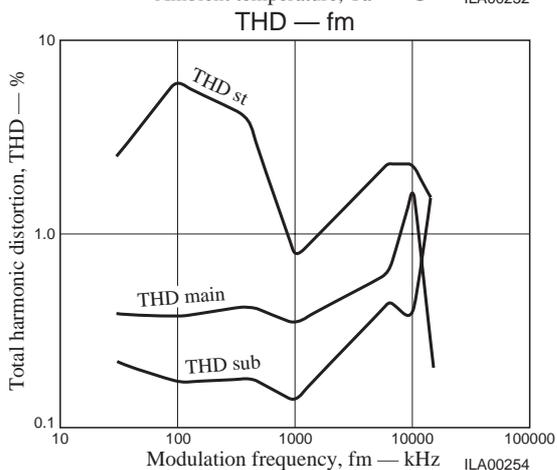
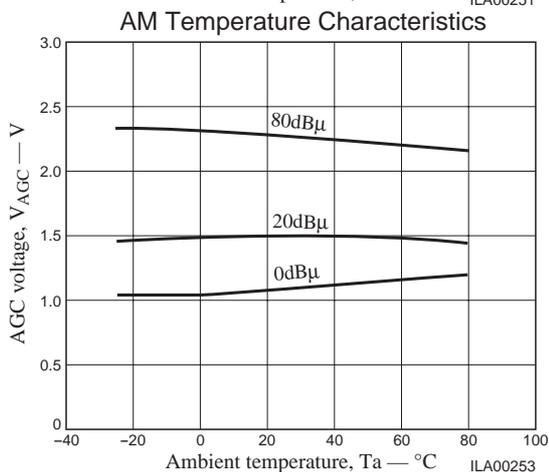
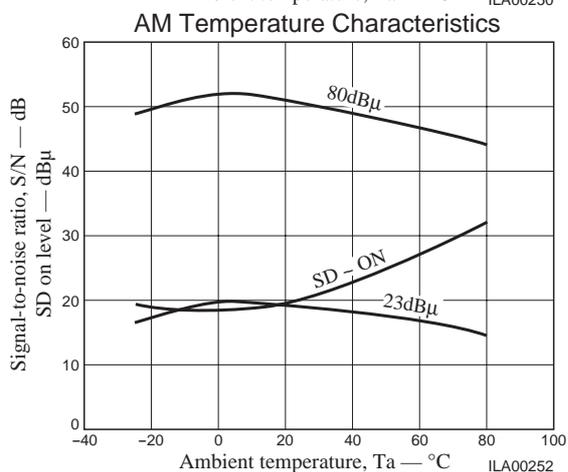
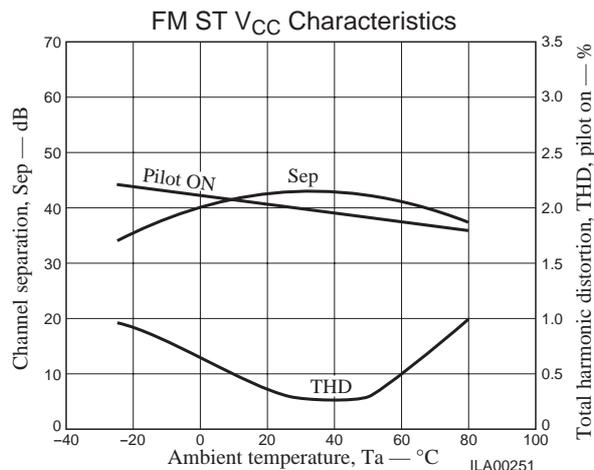
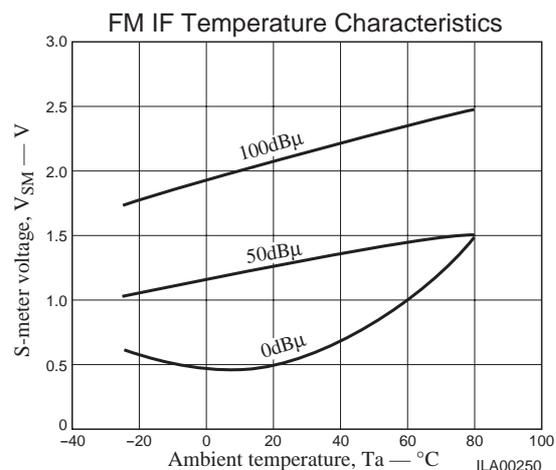
The places that differ with the LA1833 are (1) the value of the pin 8 resistor and (2) the circuits in the vicinity of pins 17 and 18.

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

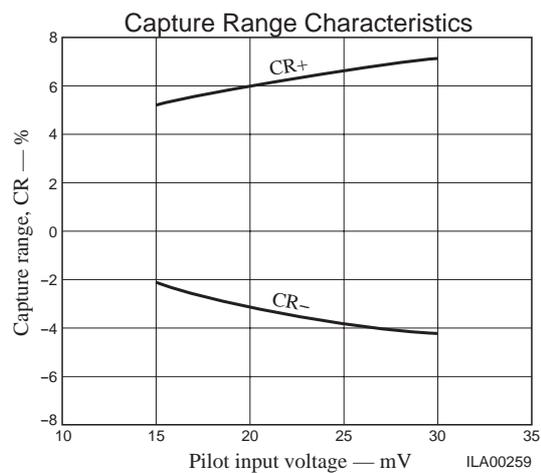
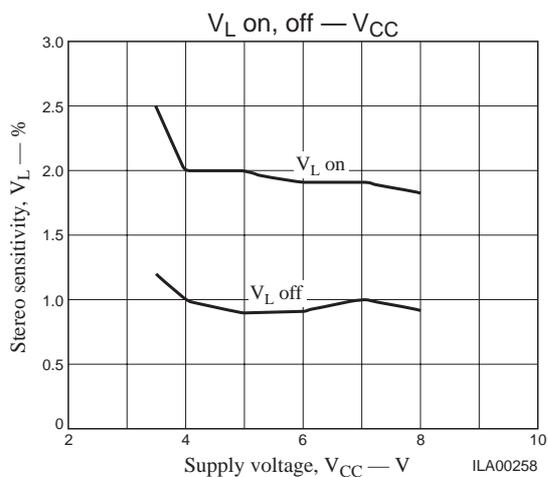
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