

**SANYO****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

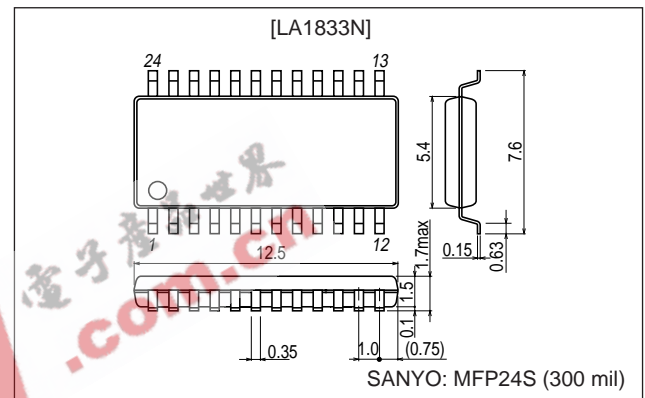
**Features**

- 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

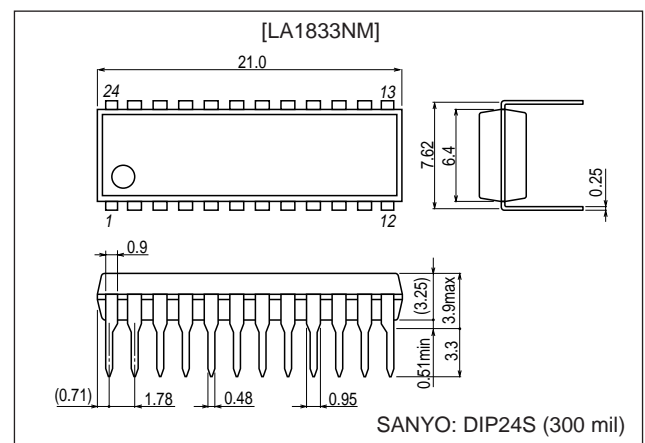
— FM total harmonic distortion detuning characteristics and signal-to-noise ratio improved over those of the LA1833

**Package Dimensions**

unit: mm

**3112A-MFP24S**

unit: mm

**3067A-DIP24S**

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**SANYO Electric Co.,Ltd. Semiconductor Company**

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## 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	$P_d$ 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	$T_{opr}$		$-20$ to $+70$	$^\circ\text{C}$
Storage temperature	$T_{stg}$		$-40$ to $+125$	$^\circ\text{C}$

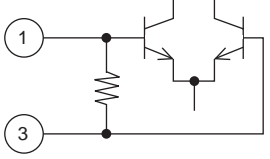
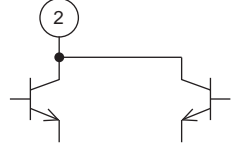
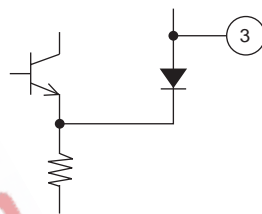
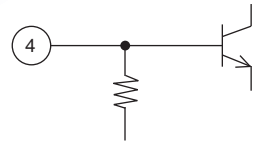
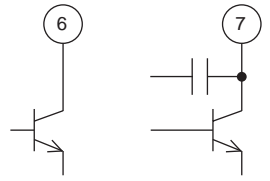
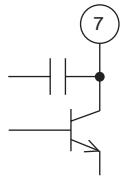
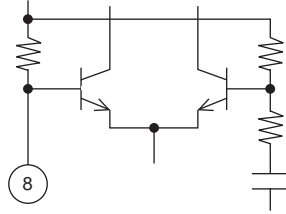
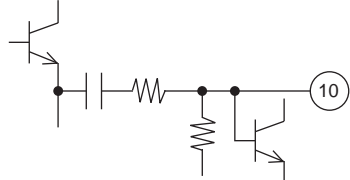
### Operating Conditions at $T_a = 25^\circ\text{C}$

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	$V_{IFBurr-FM}$	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 $\mu$ 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	$V_{IFBurr-AM}$	80 dB $\mu$ , no modulation, the pin 10 output	140	285	400	mVrms

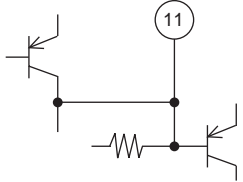
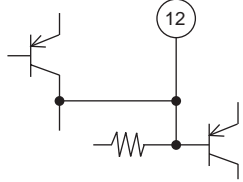
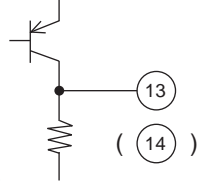
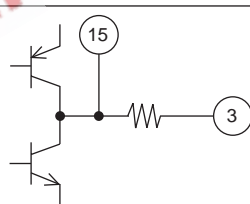
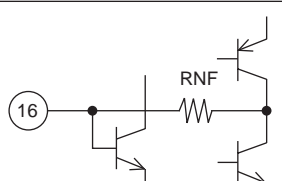
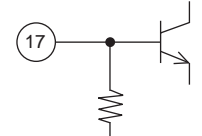
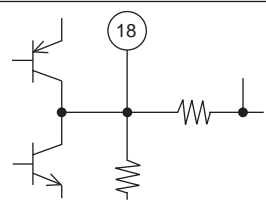
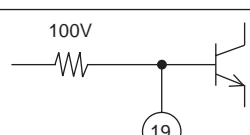
## Pin Descriptions

Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
1	FM IF input	Vreg	The input impedance, $r_i$ , is 330 $\Omega$	 ILA00220
2	AM MIX output	V <sub>CC</sub>	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, $r_i$ , is 2 k $\Omega$	 ILA00223
5	GND	0		
6	Tu-LED	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.	 ILA00224
7	ST-LED Also functions as the AM stereo IF output			 ILA00224
8	FM-DET	V <sub>CC</sub> - 2.1	Recommended ceramic discriminators FCD1070MA11UK2L (TDK) CDA10.7MG86N (Murata Mfg. Co., Ltd.)	 ILA00225
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).	 ILA00226

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# LA1833N, 1833NM

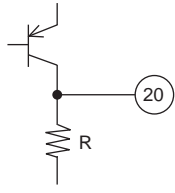
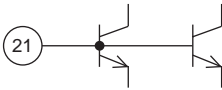
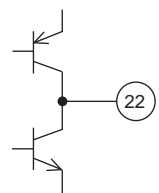
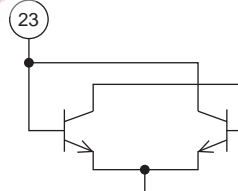
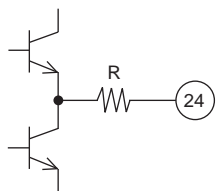
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Pin No.	Pin	Voltage (V)	Functional description	Equivalent circuit
11	Phase comparator filter connection Also functions as the FM/AM switching input	$V_{CC} - 1.0$	The IC switches to AM mode if a current in excess of 200 $\mu A$ flows from this pin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

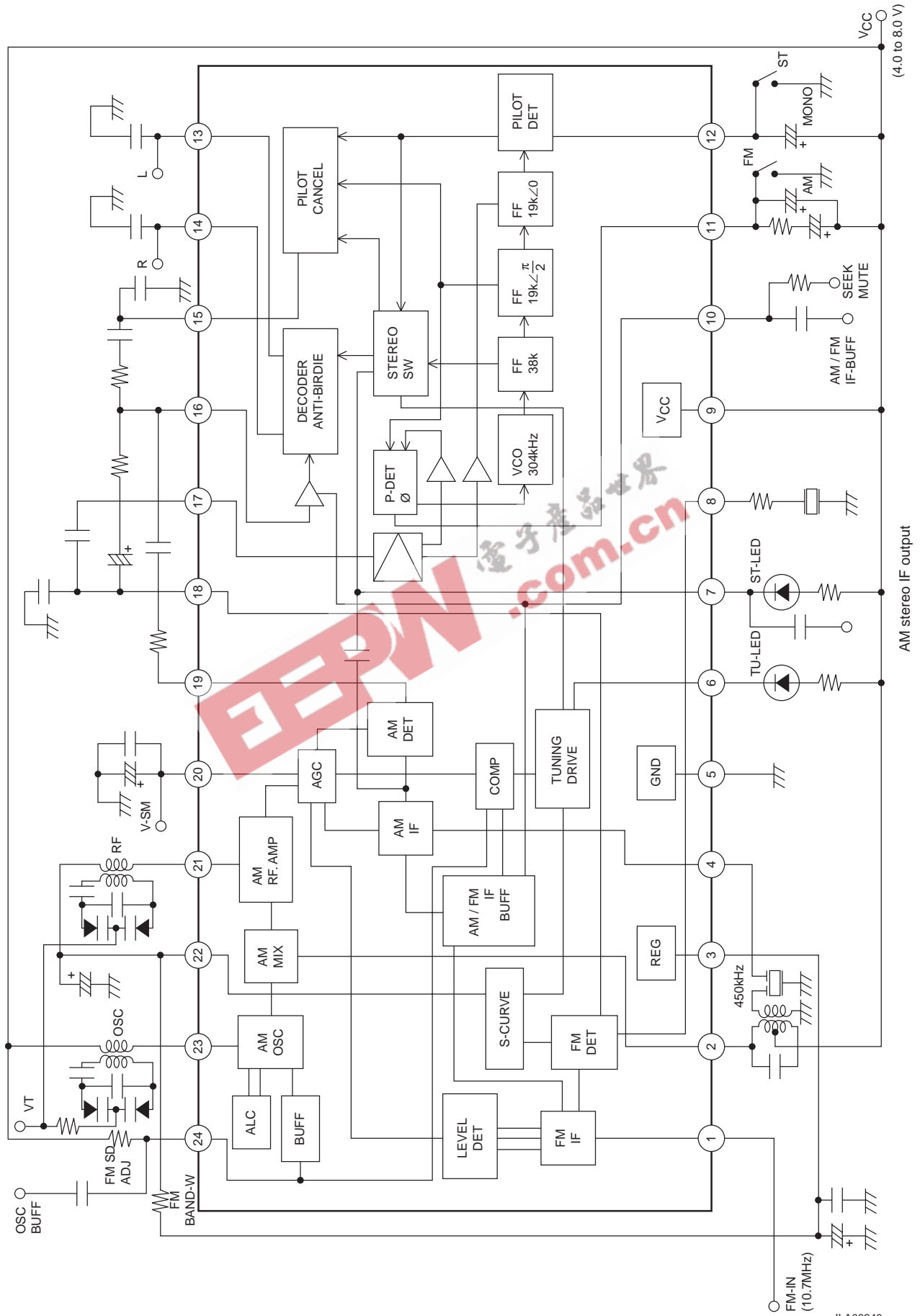
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# LA1833N, 1833NM

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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.	 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 $5 \text{ k}\Omega$ .	 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. $R = 200 \text{ }\Omega$ Note: The resistance of the pin 24 external resistor must be at least $3.3 \text{ k}\Omega$ .	 ILA00239

## Block Diagram

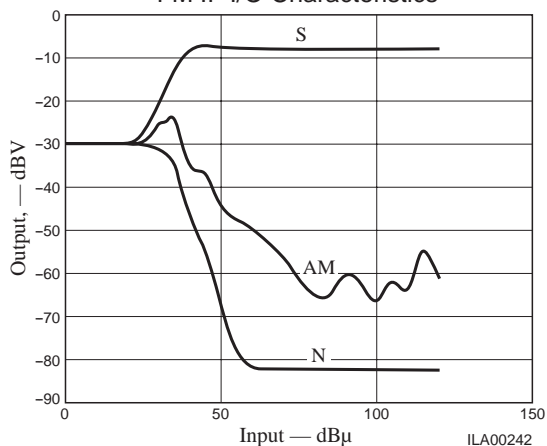


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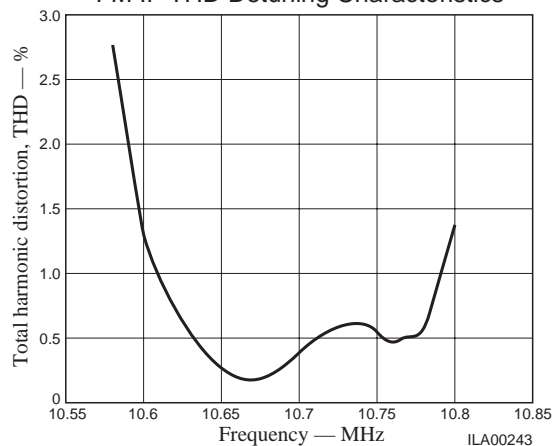
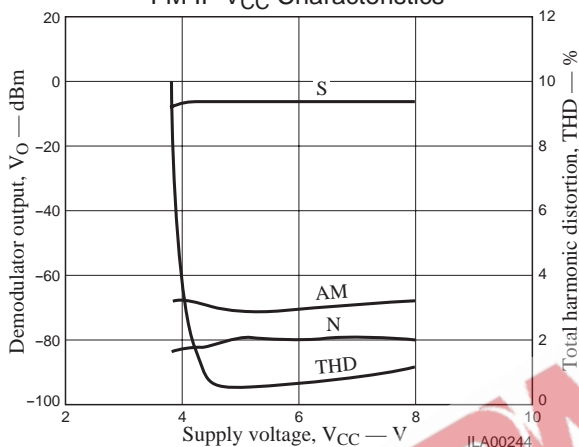
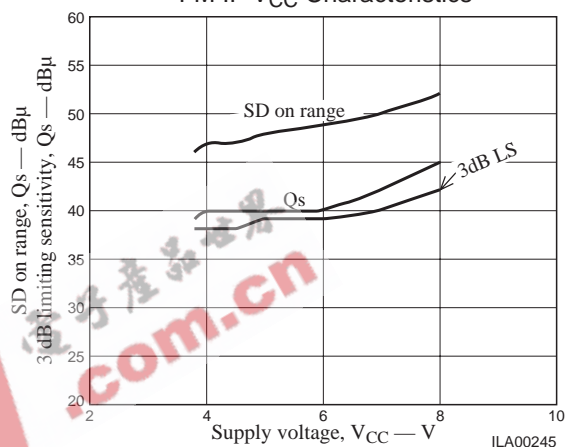


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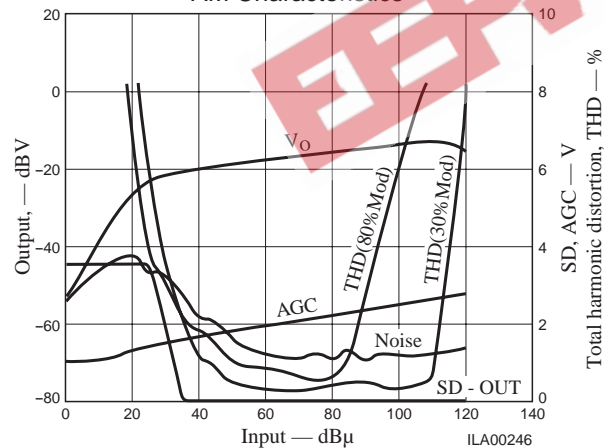
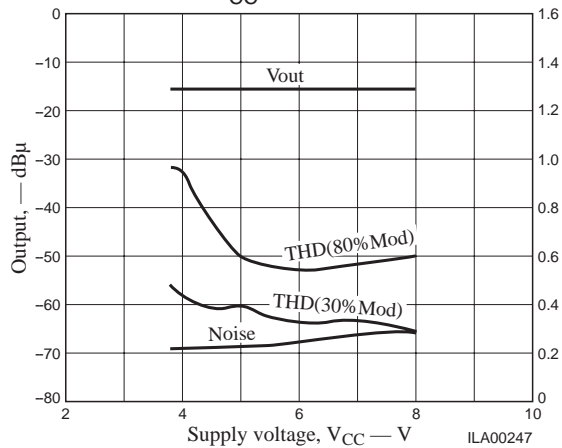
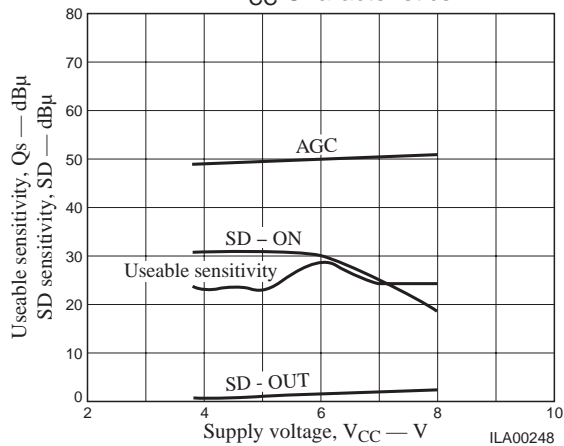
FM IF I/O Characteristics



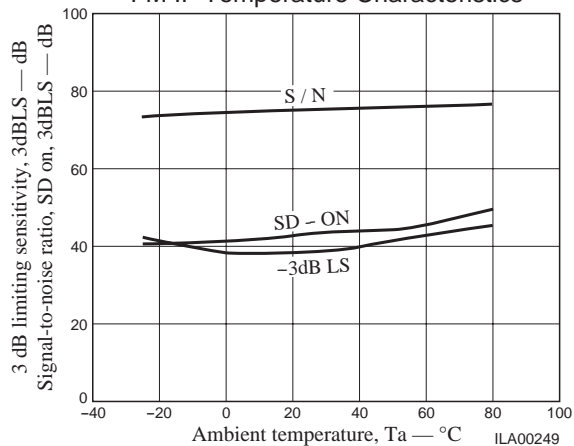
FM IF THD Detuning Characteristics

FM IF  $V_{CC}$  CharacteristicsFM IF  $V_{CC}$  Characteristics

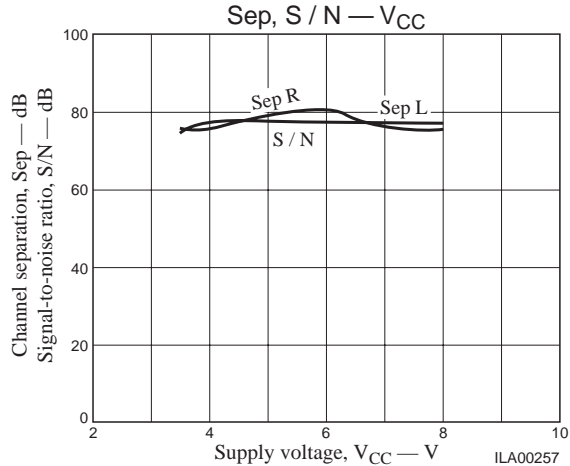
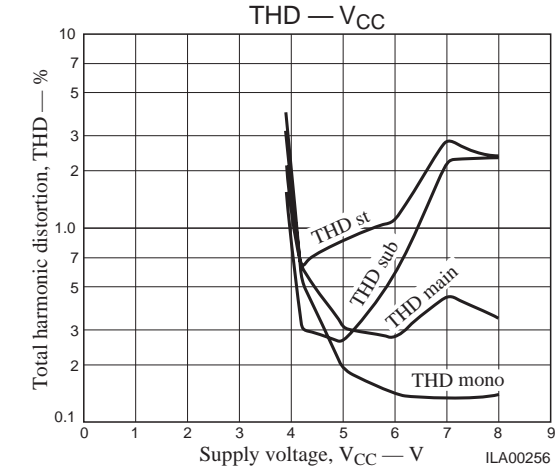
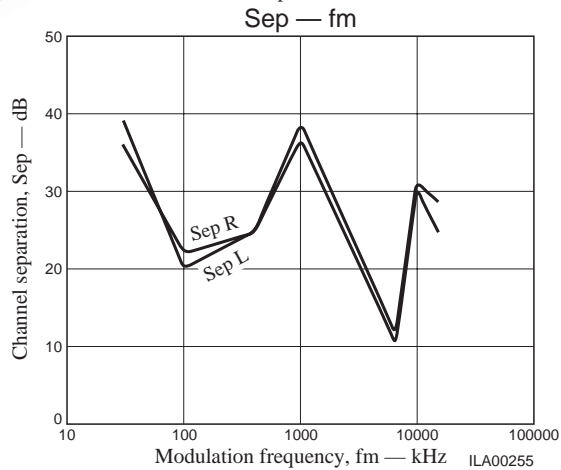
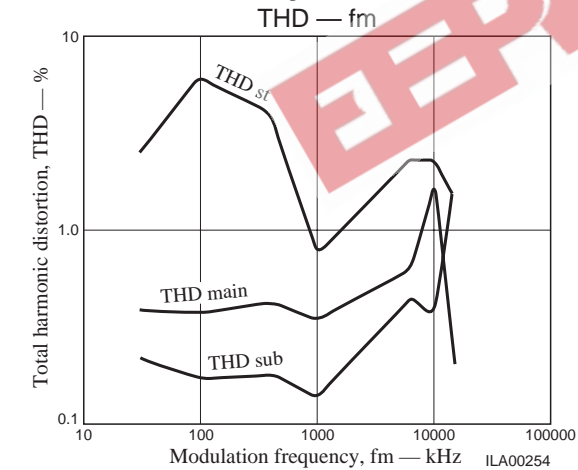
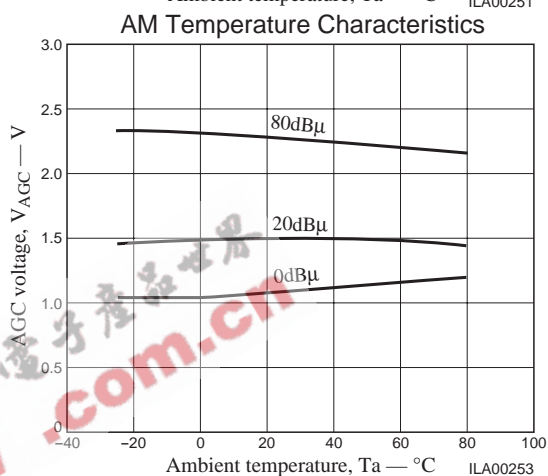
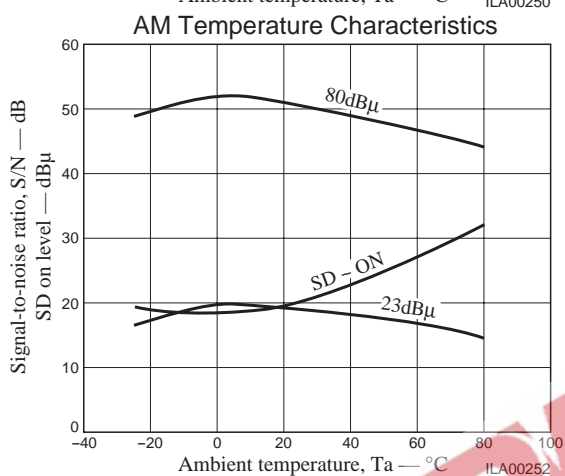
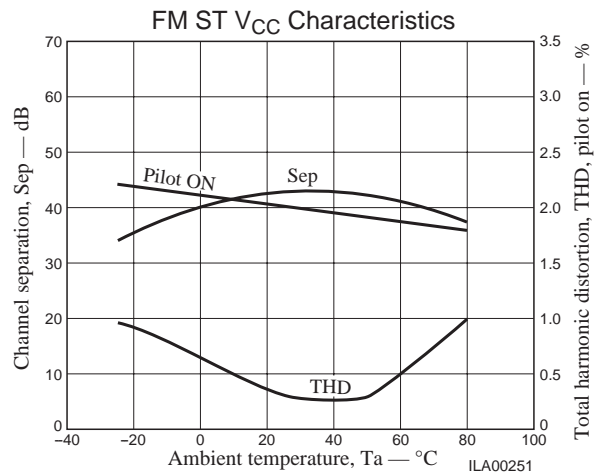
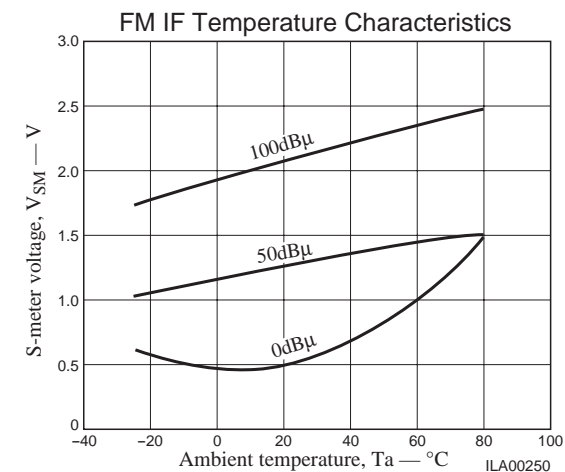
AM Characteristics

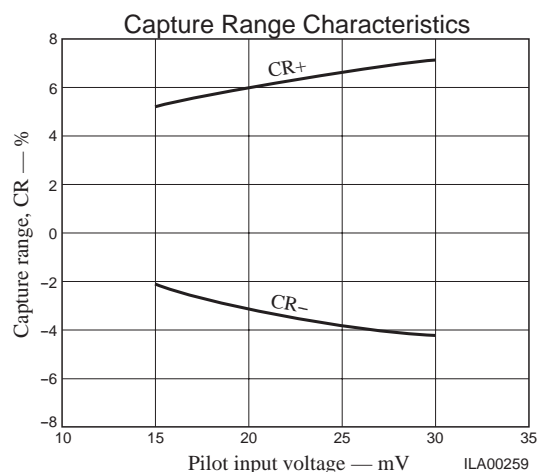
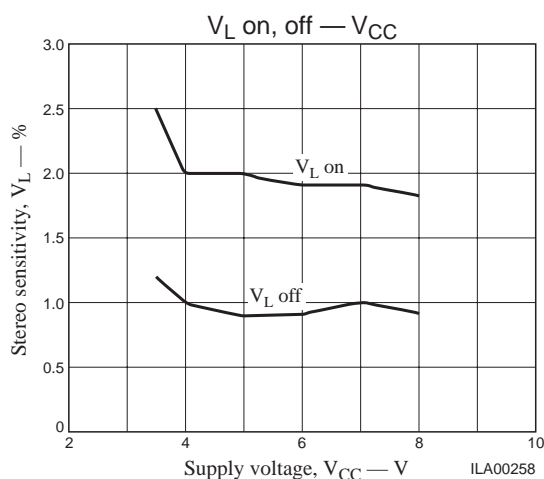
AM  $V_{CC}$  CharacteristicsAM  $V_{CC}$  Characteristics

FM IF Temperature Characteristics









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