Ordering number : EN5688C

SANYO Semiconductors
DATA SHEET

Monolithic Linear IC

LA1837 — For Home Stereo IC with Electronic Tuning Support Single-Chip IC

Overview

The LA1837 is a single-chip AM/FM IF and MPX IC that supports electronic tuning and was developed for use in home stereo systems. It is optimal for use in automatic station selection systems that use the SD and IF counting techniques.

Features

- On-chip MPX VCO (no external components required).
- Adjacent channel interference rejection function (third and fifth order).
- Supports both the SD and the IF counting techniques.
- The AM and FM SD sensitivities can be set independently.
- The AM and FM output levels can be set independently.
- Improved AM practical sensitivity and high-input distortion characteristics.

Functions

- AM : RF amplifier, mixer, oscillator, IF amplifier, detector AGC, oscillator buffer, S-meter, narrowband SD, IF buffer
- FM-IF : IF amplifier, quadrature detector, S-meter, Scurve detector, IF buffer output
- MPX : PLL stereo decoder, stereo display, forced mono, VCO stop, post amplifier, audio muting, adjacent channel interference rejection function

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		12	V
Allowable power dissipation	Pd max	Ta ≤ 70°C	550	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}		9	V
Operating supply voltage range	V_{CC} op		7 to 11	V

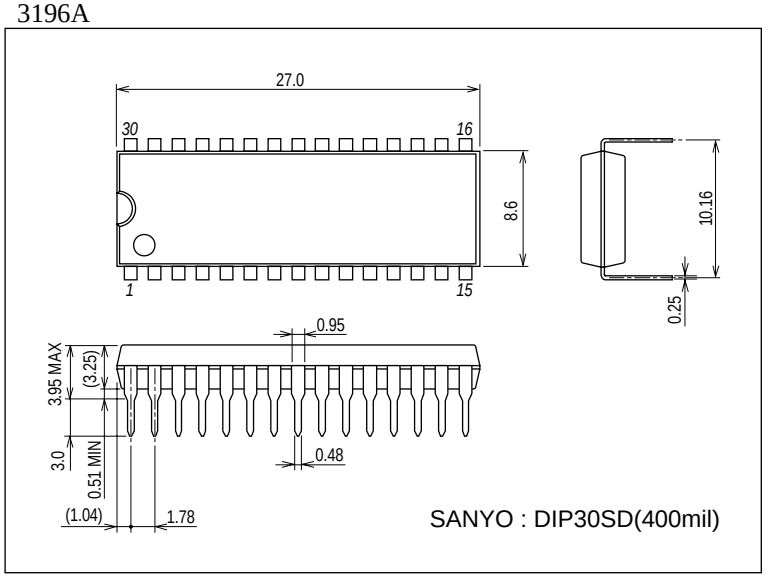
Electrical Characteristics at Ta = 25°C, V_{CC} = 9V, in the specified test circuit

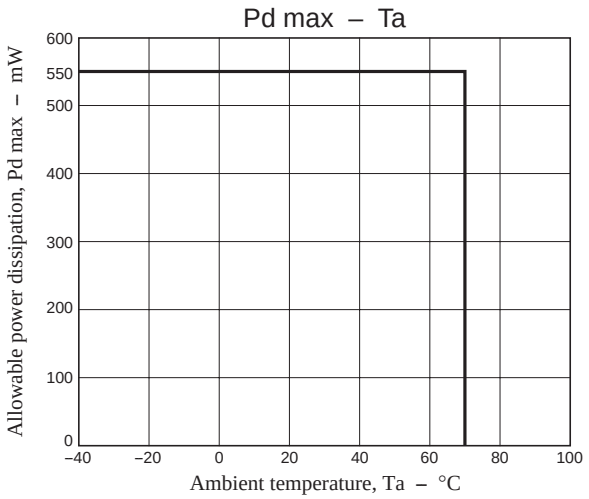
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
FM Mono characteristics fc = 10.7MHz, fm = 1kHz, with the coil adjusted so that V_{AFC} - V_{REG} = 0V						
Current drain	I_{CCO-FM}	With no input	18	31	44	mA
Demodulation output	V_{OFM}	100dBμ, 100% mod. The pin 16 output	730	1100	1460	mVrms
Channel balance	C.B-mono	100dBμ, 100% mod. The pin 16 output/pin 17 output	-1.5	0	+1.5	dB
Total harmonic distortion (mono)	$THD_{FM(1)}$	100dBμ, 100% mod. The pin 16 output		0.3	1.3	%
	$THD_{FM(2)}$	100dBμ, 100% mod. The pin 16 output		1.0	5	%
Signal-to-noise ratio	S/N_{FM}	100dBμ, 100% mod. The pin 16 output	72	80		dB
AM rejection ratio	AMR	100dBμ, 100% mod. The pin 16 output	45	65		dB
Limiting input voltage	-3dBL.S.	100dBμ, 100% mod. Referenced to the output. The input such that the output is down –3 dB.	26	32	38	dBμ
LED sensitivity	SD_{On-FM}		51	60	69	dBμ
LED bandwidth	SD_{BW}	100dBμ	85	120	170	kHz
IF count buffer output	$V_{IFBuff-FM}$	100dBμ, The pin 13 output	80	120	160	mVrms
S-meter output	$V_{SM-FM(1)}$	0dBμ, The pin 11 output	0	0.1	0.5	V
	$V_{SM-FM(2)}$	100dBμ, The pin 11 output	3.6	4.3	5.0	V
Muting attenuation	Mute-Att	100dBμ, 100% mod. The pin 16 output	75	85		dB
FM stereo characteristics fc = 10.7MHz, 100dBμ, fm = 1kHz, L + R = 90%, pilot = 10%						
Separation (left)	Sep_L	L mod. The pin 16 output/pin 17 output	30	45		dB
Separation (right)	Sep_R	R mod. The pin 17 output/pin 16 output	30	45		dB
Stereo on level	ST_{ON}	The pilot modulation such that V7 is under 0.7V.	1.3	2.7	5	%
Stereo off level	ST_{OFF}	The pilot modulation such that V7 is over 4.5V.		1.5		%
Total harmonic distortion (main)	THD-main	L + R mod. The pin 16 output		0.3	1.3	%
Adjacent channel interference rejection ratio	Brej-3rd	fs = 113kHz, V_S = 90%, Pilot = 10%, The pin 16 output vs. the L-R mod. 1kHz demodulated output		40		dB
	Brej-5th	fs = 189kHz, V_S = 90%, Pilot = 10%, The pin 16 output vs. the L-R mod. 1kHz demodulated output		40		dB
AM characteristics fc = 1000kHz, fm = 1kHz						
Current drain	I_{CCO-AM}	With no input	15	25	35	mA
Detector output	$V_{OAM(1)}$	23dBμ, 30% mod. The pin 16 output	100	180	360	mVrms
	$V_{OAM(2)}$	80dBμ, 30% mod. The pin 16 output	200	320	500	mVrms
Signal-to-noise ratio	$S/N_{AM(1)}$	23dBμ, 30% mod. The pin 16 output	18	22		dB
	$S/N_{AM(2)}$	80dBμ, 30% mod. The pin 16 output	49	55		dB
Total harmonic distortion (mono)	$THD_{AM(1)}$	80dBμ, 30% mod. The pin 16 output		0.4	1.2	%
	$THD_{AM(2)}$	80dBμ, 80% mod. The pin 16 output		1.0	4.0	%
LED sensitivity	SD_{On-AM}		17	27	37	dBμ
Local oscillator buffer output	V_{OSC-AM}	With no input. The pin 30 output	110	160	220	mVrms
IF counter buffer output	$V_{IFBuff-AM}$	80dBμ, no modulation. The pin 13 output	160	220	300	mVrms
ST-IF output	$V_{STIF-AM}$	80dBμ, no modulation. The pin 7 output	16	34	48	mVrms
S-merer output	V_{SM-AM}	0dBμ, no modulation.	0	0	0.2	V

Package Dimensions

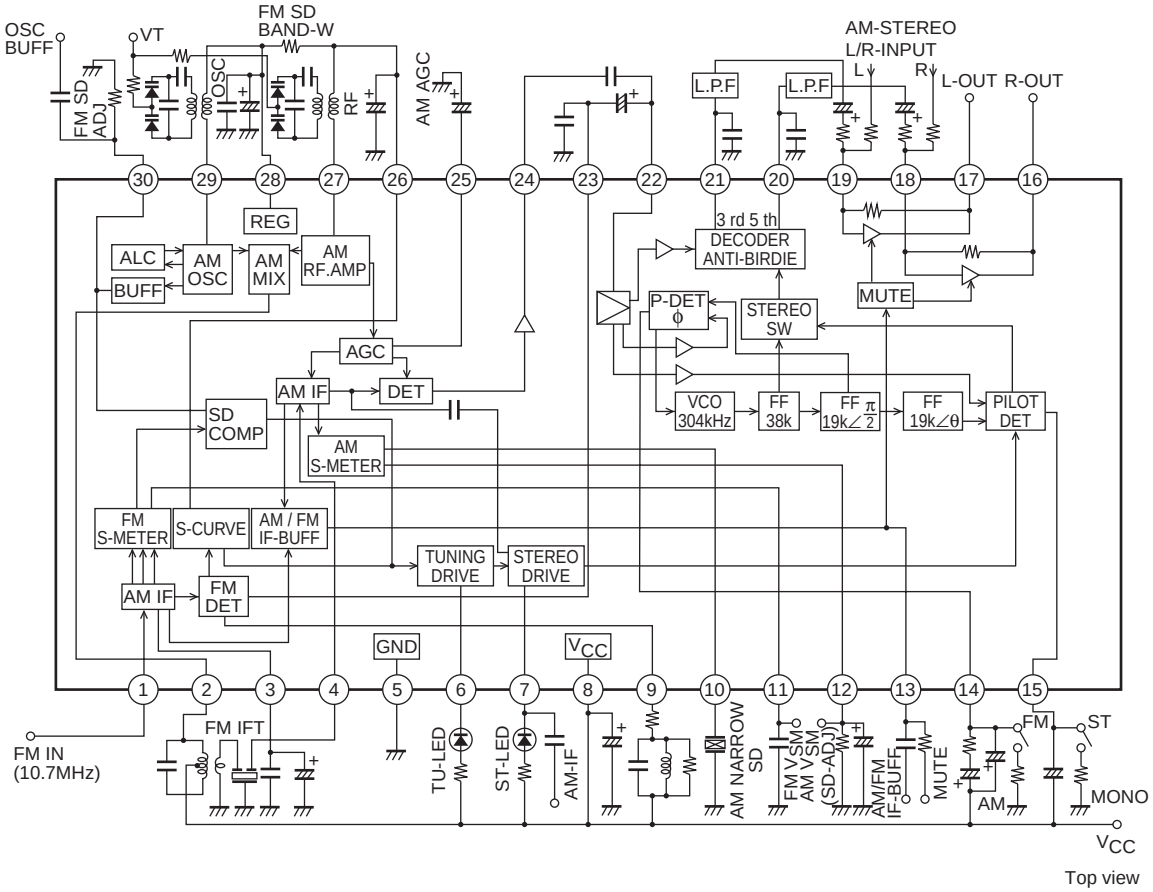
unit : mm (typ)

3196A

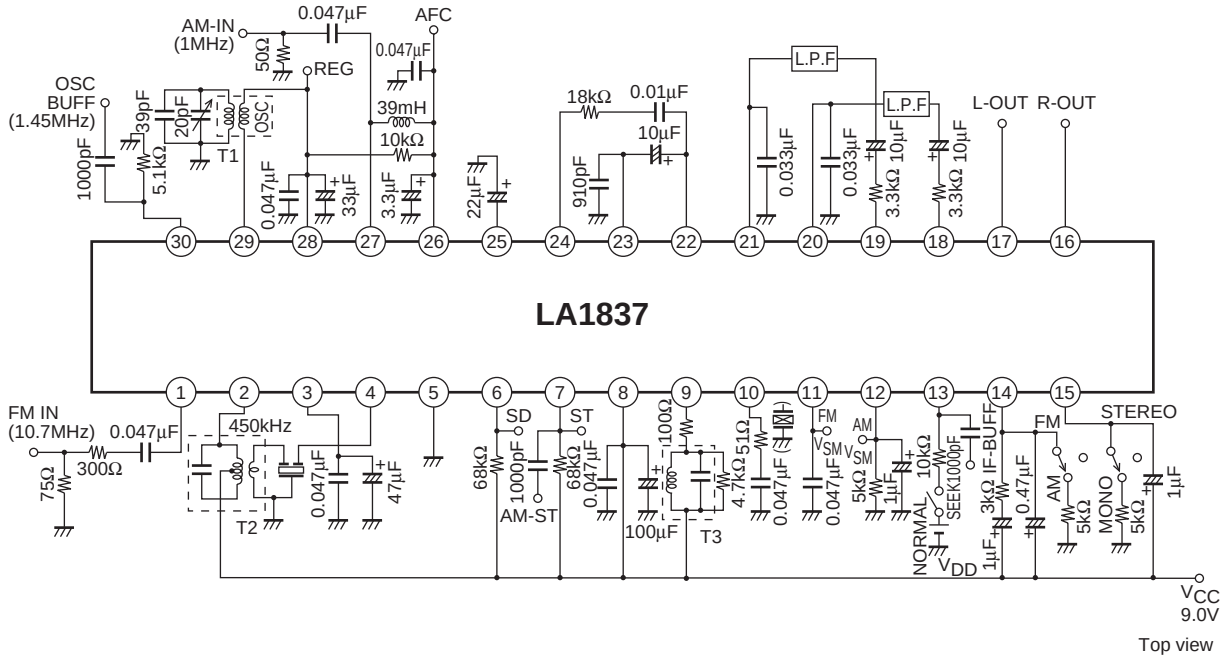




Block Diagram

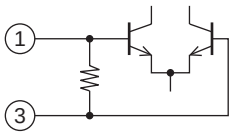
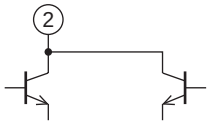
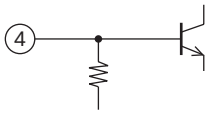
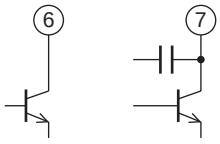
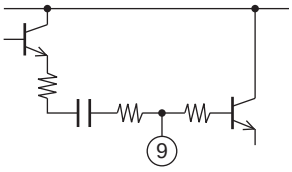
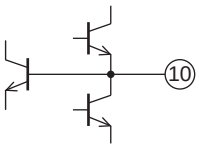


Test Circuit



Top view

Pin Functions

Pin No.	Pin function	Pin voltage (V)	Pin description	Equivalent circuit
1	FM IF input	Vreg	Input impedance r_i = 330Ω	
2	AM mixer output	V_{CC}	Connect the mixer coil between this pin and V_{CC}.	
3	FM IF input bypass	Vreg	Also functions as the MPX regulator filter.	See pin 1.
4	AM IF input	Vreg	Input impedance r_i = 2kΩ	
5	GND	0V		
6 7	TU-LED ST-LED AM-IF output	V_{CC} V_{CC}	Active low Open collector output AM stereo IF output (pin 7) The current input must not exceed 150µA.	
8	V_{CC}	V_{CC}		
9	FM detector	V_{CC}	Recommended detector coil : 600BEAS-9715Z (The Toko Electric Corporation)	
10	AM narrow band CF connection	1.3V	Recommended narrow band CF: BFU450 C4N (Murata Mfg. Co., Ltd.) If the narrow band SD is not used, bypass this circuit with a 50Ω resistor and a 0.047µF capacitor connected in series.	

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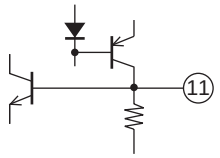
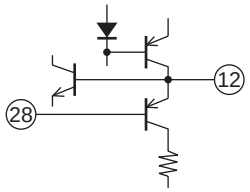
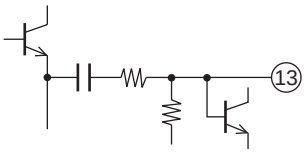
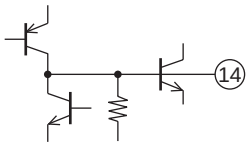
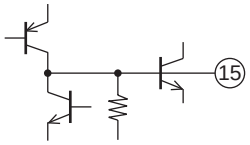
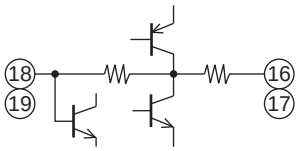
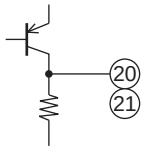
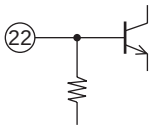
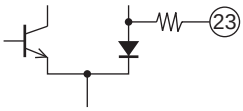
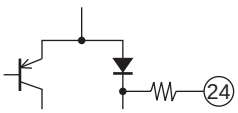
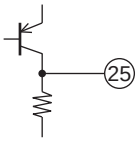
Pin No.	Pin function	Pin voltage (V)	Pin description	Equivalent circuit
11	FM-S-meter output	0V	R_L = 8kΩ	
12	AM S-meter output AM SD sensitivity adjustment	0V (AM)	The AM SD sensitivity is adjusted with the value of the external resistor connected between this pin and ground.	
13	AM and FM IF buffer output, output control switch (mute switch)	0V	V13 ≤ 0.5 V : Reception state 1.4 V ≤ V13 ≤ 2.2 V : IF buffer output turned on V13 ≥ 3.5 V : IF buffer output and muting are turned on	
14	Phase comparator low-pass filter (FM/AM switching)	V_{CC}-1.4 (FM) 0V (AM)	Connecting this pin to ground through a resistor sets the IC to AM mode. Resistor value limits : 2.7kΩ (when V_{CC} = 7V) 3.9kΩ (8V) 5.1kΩ (9V) 6.2kΩ (10V) 7.5kΩ (11V)	
15	Pilot detector low-pass filter (forced mono) (VCO stop)	V_{CC}-1.0	If a current of 50μA or greater flows from this pin, the system is forced to mono. Connecting this pin to ground stops the VCO. The resistor limit values are the same as for pin 14.	
16 17 18 19	Post amplifier input and output	Vreg Vreg	Output impedance r_o = 200Ω Pin 16 : right output, pin 17 : left output Inverting inputs Pin 18 : right input, pin 19 : left input R_{NF} = 33kΩ	
20 21	MOX output	3.5V 3.5V	Output impedance r_o = 3.3kΩ Pin 20 : right de-emphasis Pin 21 : left de-emphasis	
22	MPX input	2.9V	Input impedance r_i = 20kΩ	
23	FM demodulator output	2.8V (FM) 2.8V (AM)	Output impedance r_o = 3.0kΩ The separation can be modified by inserting a capacitor between this pin and ground. Set V_O sub/V_O main to be about 0 dB.	
24	AM detector output	0V (FM) 0.5V (AM)	Output impedance r_o = 3.3kΩ The AM frequency characteristics can be modified by adjusting the time constants of the circuits between this pin and pin 22, and between this pin and ground.	
25	AM AGC	0V (FM) 0.5V (AM)	The built-in load resistor R = 11kΩ.	

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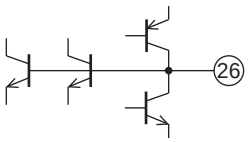
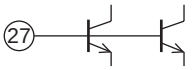
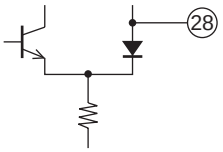
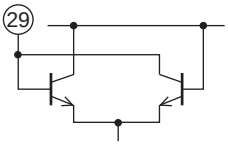
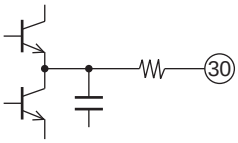
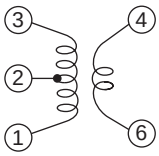
Pin No.	Pin function	Pin voltage (V)	Pin description	Equivalent circuit
26	AFC	Vreg	The FM SD bandwidth can be modified with the external resistor connected between this pin and pin 28.	
27	AM RF input	Vreg	Use this pin at the same potential as pin 28.	
28	REG	Vreg	Vreg = 3.6V	
29	OSC	Vreg	Use an oscillator coil between this pin and pin 28.	
30	Oscillator buffer output, FM SD sensitivity adjustment	1.6V (FM) 1.3V (AM)	The FM SD sensitivity can be modified with the external resistor connected between this pin and ground. Output impedance r_o = 20Ω	

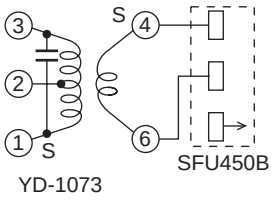
Coil specifications (bottom view)

•AM oscillator (for the DUT)
HW-50425 (Mitsumi Electric Co., Ltd.)



3-2 2T
4-6 9T
2-1 86T
Qo ≥ 80
L = 270μH

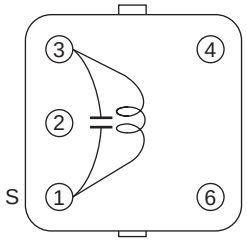
•IFT
YD-1073-1 (Mitsumi Electric Co., Ltd.)



YD-1073

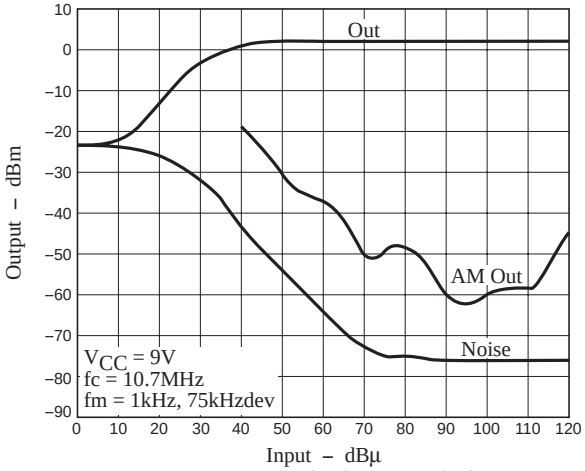
1-2 58T
4-6 7T
2-3 94T
fo = 450kHz
Qo = 110
Includes an internal 180pF capacitor.
SFU450B included.

•FM detector
600BEAS-9715Z (The Toko Electric Corporation)

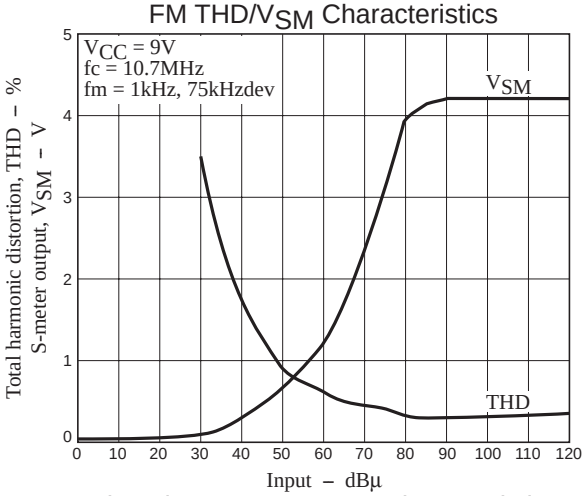


3-1 22T
f = 10.7MHz
Qo = 40
Includes an internal 82pF capacitor.

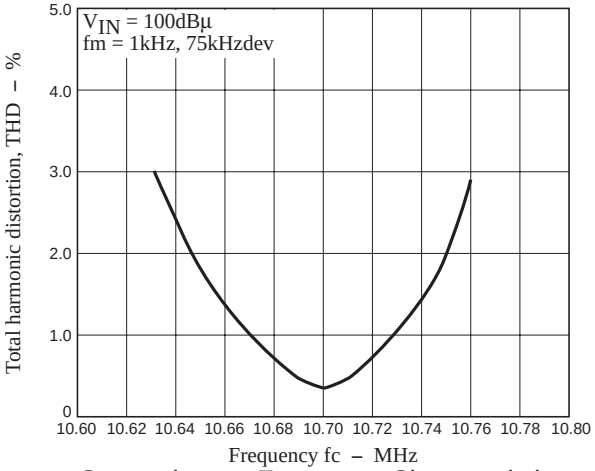
Overall FM Characteristics



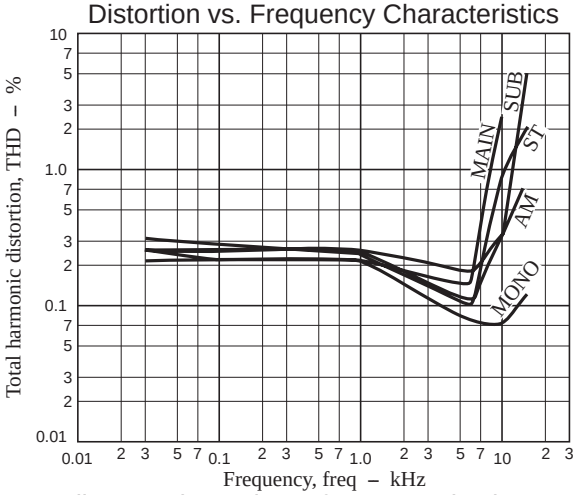
FM THD/V_{SM} Characteristics



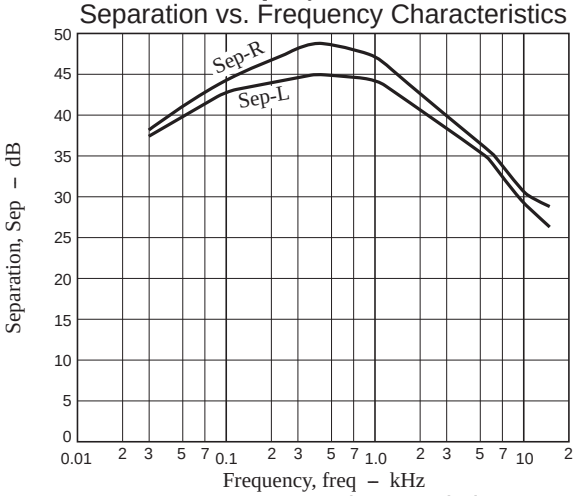
FM THD Band Characteristics



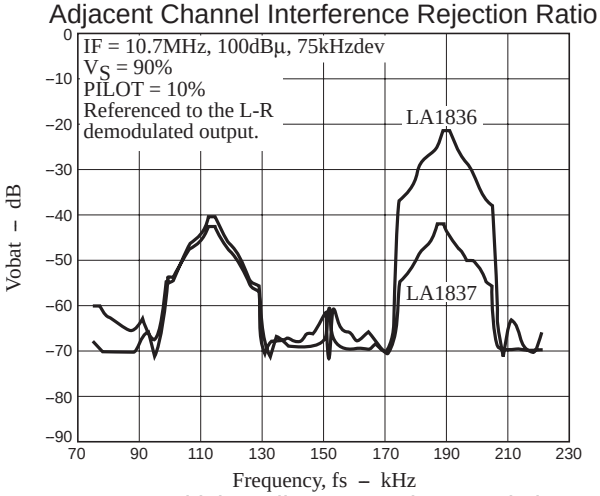
Distortion vs. Frequency Characteristics



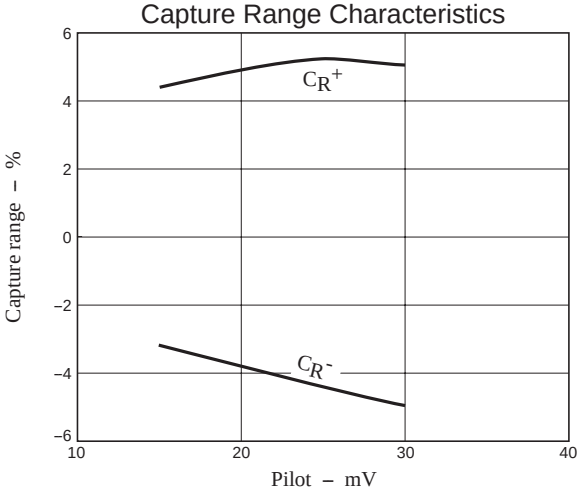
Separation vs. Frequency Characteristics



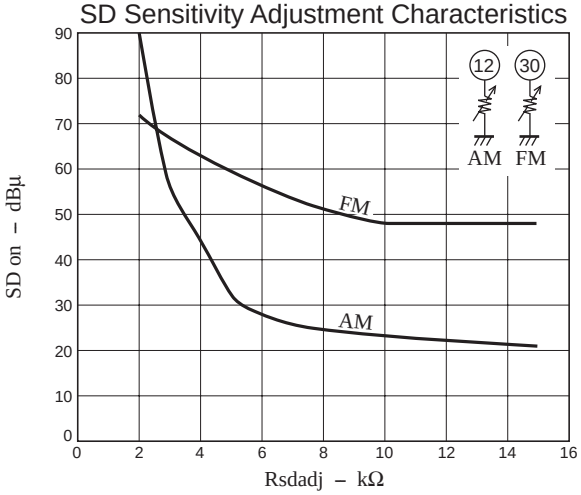
Adjacent Channel Interference Rejection Ratio



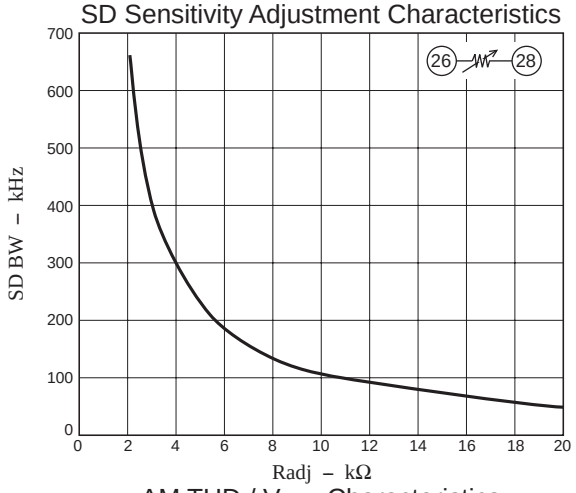
Capture Range Characteristics



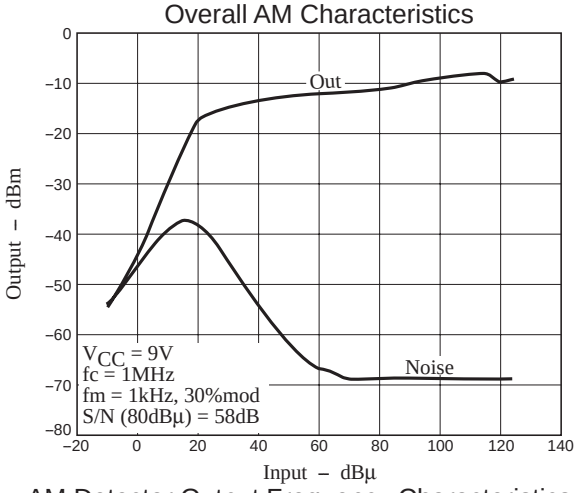
SD Sensitivity Adjustment Characteristics



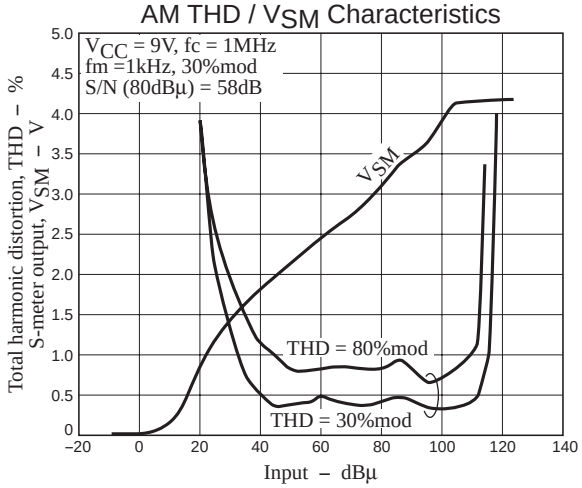
SD Sensitivity Adjustment Characteristics



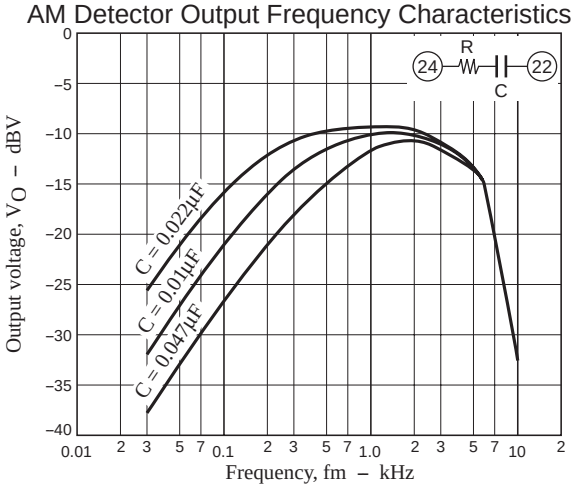
Overall AM Characteristics



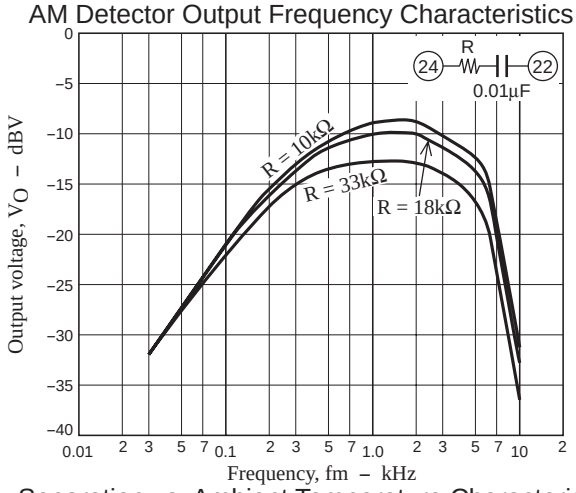
AM THD / V_{SM} Characteristics



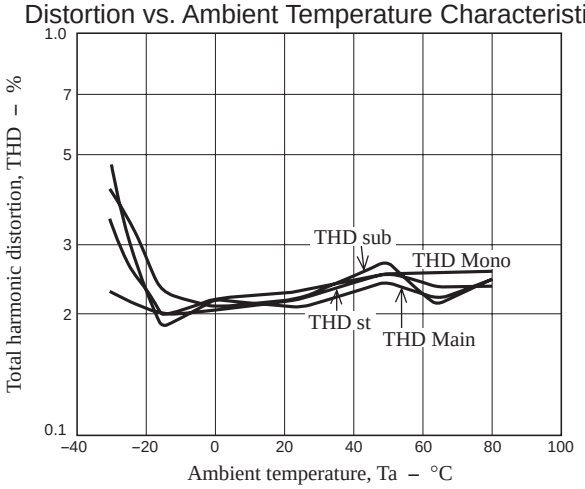
AM Detector Output Frequency Characteristics (1)



AM Detector Output Frequency Characteristics (2)



Distortion vs. Ambient Temperature Characteristics



Separation vs. Ambient Temperature Characteristics