Ordering number : EN5888

Monolithic linear IC

LA1838

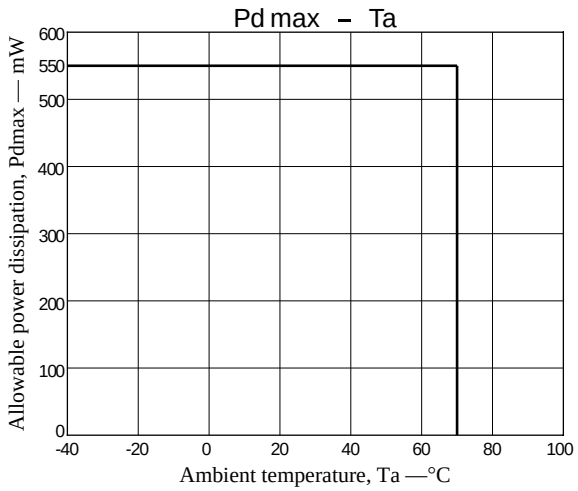
Single-Chip Home Stereo IC with Electronic Tuning Support

Overview

The LA1838 is designed for use in home stereo systems and is a single-chip tuner IC that provides electronic tuning functions for AM, FM IF, and MPX reception. It is optimal for use in products that adopt an automatic tuning system based on an IF count.

Functions

- AM: RF amplifier, mixer, oscillator, IF amplifier, detector, AGC, oscillator buffer, S-meter, narrow-band SD, IF buffer
- FM IF: IF amplifier, quadrature detector, S-meter, SD (signal detection), S-curve detection, IF buffer output
- MPX: PLL stereo decoder, stereo display, forced monaural, VCO stop, post amplifier, audio muting, adjacent channel interference rejection function



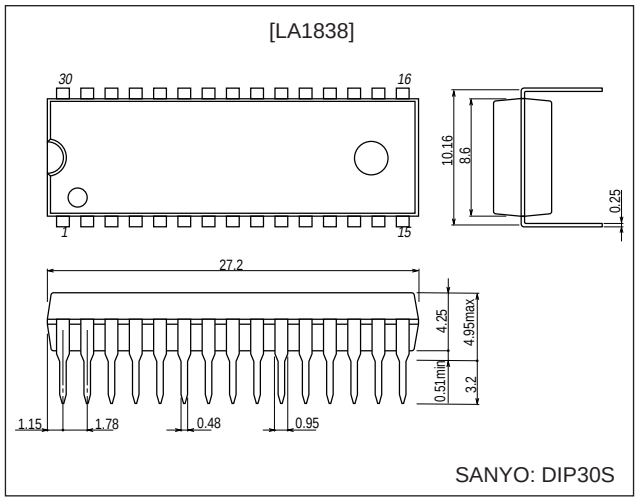
Features

- Integrated MPX VCO (External components are no longer required.)
- Built-in adjacent channel interference rejection function (third and fifth order)
- Adjustment-free FM detector circuit (Uses a ceramic discriminator.)
- The AM and FM SD sensitivities can be set independently.
- The AM and FM output levels can be set independently.
- Improved useable AM sensitivity and strong field distortion characteristics.

Package Dimensions

unit: mm

3061-DIP30S



SANYO Electric Co.,Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

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

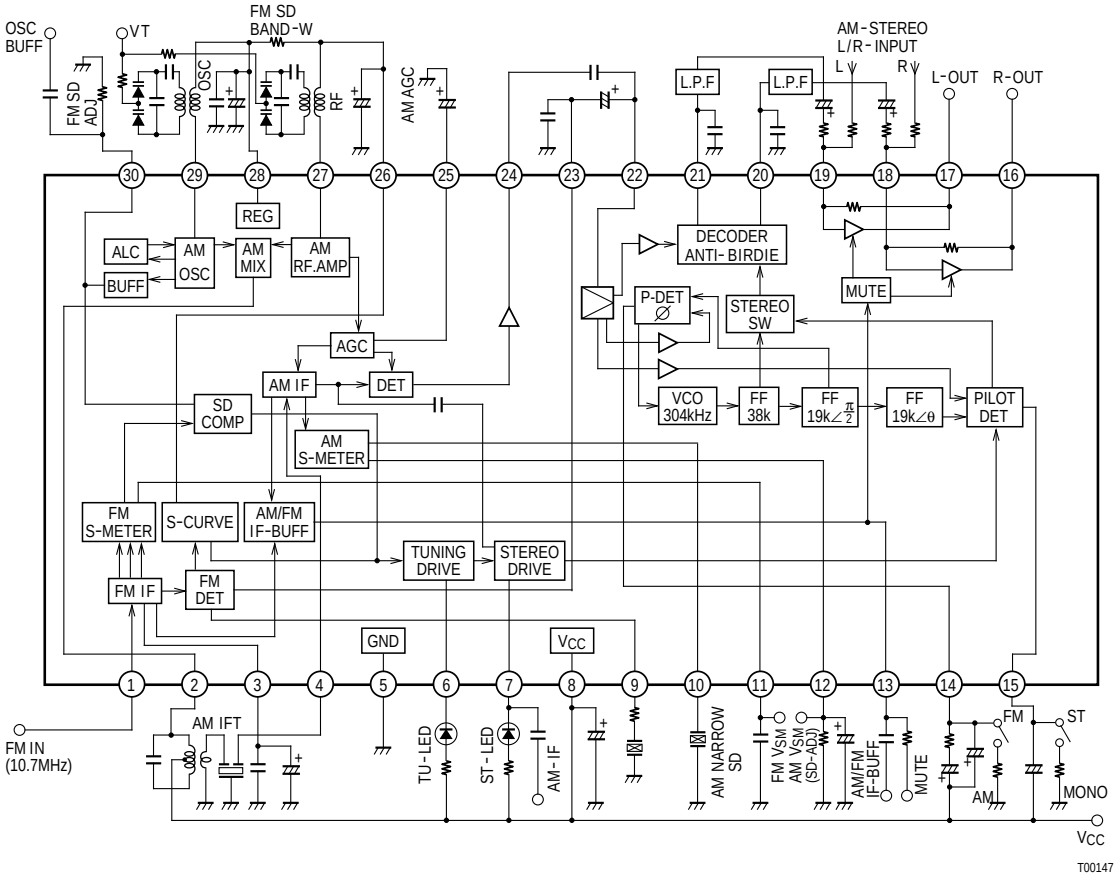
Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		9	V
Operating supply voltage range	V_{CC}op		7 to 11	V

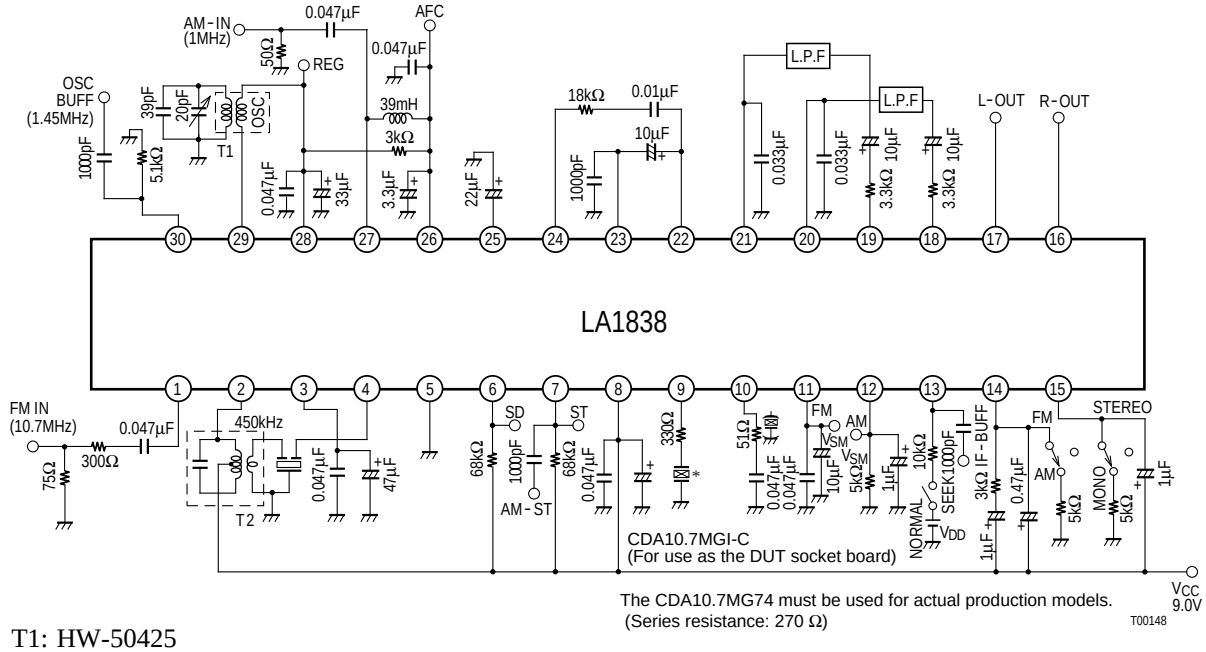
Operating Characteristics at Ta = 25°C, V_{CC} = 9 V, in the specified test circuit.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM Mono Characteristics] fc = 10.7 MHz, fm = 1 kHz						
Current drain	I_{CCO-FM}	With no input signal	18	31	44	mA
Demodulator output	V_{OFM}	100 dBμ, 100% modulation, the pin 16 output	730	1100	1460	mVrms
Channel balance	C.B-mono	100 dBμ, 100% modulation, the pin 16 output/the pin 17 output	–1.5	0	+1.5	dB
Total harmonic distortion (mono)	THD_{FM}	100 dBμ, 100% modulation, the pin 16 output		0.3	1.5	%
Signal-to-noise ratio	S/N_{FM}	100 dBμ, 100% modulation, the pin 16 output	70	77		dB
AM rejection ratio	AMR	100 dBμ, AM 30% modulation, the pin 16 output	40	55		dB
Input limiting voltage	–3dBL.S	100 dBμ, 100% modulation, referenced to the output, the input when the output is down by –3 dB	26	32	38	dBμ
LED indicator on sensitivity	SD_{On-FM}		47	57	67	dBμ
LED indicator on bandwidth	SD_{BW}	100 dBμ	130	210	300	kHz
IF counter buffer output	$V_{IFBuff-FM}$	100 dBμ, the pin 13 output	80	120	160	mVrms
S-meter output	V_{SM-FM1}	0 dBμ, the pin 11 output	0	0.1	0.5	V
	V_{SM-FM2}	100 dBμ, the pin 11 output	3.6	4.3	5.0	V
Mute attenuation	Mute-Att	100 dBμ, 100% modulation, the pin 16 output	75	85		dB
[FM Stereo Characteristics] fc = 10.7 MHz, fm = 1 kHz, L + R = 90%, Pilot = 10%, 100 dBμ						
Separation (left)	Sep_L	Left channel modulated. The pin 16 output/the pin 17 output	30	45		dB
Separation (right)	Sep_R	Right channel modulated. The pin 17 output/the pin 16 output	30	45		dB
Stereo on level	ST_{ON}	The pilot modulation such that V7 falls under 0.7 V	1.3	2.7	5	%
Stereo off level	ST_{OFF}	The pilot modulation such that V7 rises to over 4.5 V		1.5		%
Total harmonic distortion (main)	THD-main	Left + right modulation. The pin 16 output.		0.3	1.5	%
Adjacent channel rejection ratio	Brej-3rd	fs = 113 kHz, Vs = 90%, pilot = 10% The left - right modulation 1 kHz demodulated output with respect to the pin 16 output		40		dB
	Brej-5th	fs = 189 kHz, Vs = 90%, pilot = 10% The left - right modulation 1 kHz demodulated output with respect to the pin 16 output		40		dB
[AM Characteristics] fc = 1000 kHz, fm = 1 kHz						
Current drain	I_{CCO-AM}	With no input signal	15	25	35	mA
Detector output	V_{OAM1}	23 dBμ, 30% modulation, the pin 16 output	100	180	360	mVrms
	V_{OAM2}	80 dBμ, 30% modulation, the pin 16 output	200	320	500	mVrms
Signal-to-noise ratio	S/N_{AM1}	23 dBμ, 30% modulation, the pin 16 output	18	22		dB
	S/N_{AM2}	80 dBμ, 30% modulation, the pin 16 output	49	55		dB
Total harmonic distortion	THD_{AM1}	80 dBμ, 30% modulation, the pin 16 output		0.4	1.2	%
	THD_{AM2}	80 dBμ, 80% modulation, the pin 16 output		1.0	4.0	%
LED indicator on sensitivity	SD_{On-AM}		17	27	37	dBμ
Local oscillator buffer output	V_{OSC-AM}	With no input signal, the pin 30 output	110	160	220	mVrms
IF counter buffer output	$V_{IFBuff-AM}$	80 dBμ, 100% modulation, the pin 13 output	160	220	300	mVrms
ST - IF output	$V_{STIF-AM}$	80 dBμ, 100% modulation, the pin 7 output	16	34	48	mVrms
S-meter output	V_{SM-AM}	0 dBμ, 100% modulation	0	0	0.2	V

Block Diagram



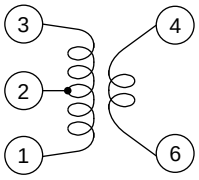
AC Test Circuit



T1: HW-50425
T2: YD-1073-1

Coil Specifications

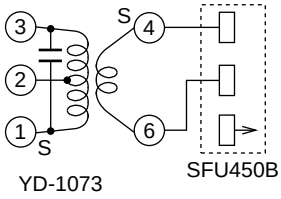
- AM oscillator (for the DUT)
  HW-50425 (Mitsumi)



A10633

③ - ② 2T
④ - ⑥ 9T
② - ① 86T
$Q_O \geq 80$
L = 270 µH

- IFT
  YD-1073-1 (Mitsumi)

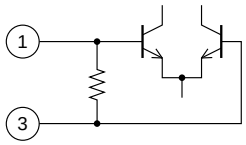
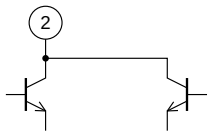
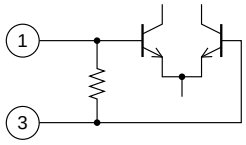
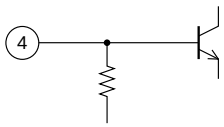
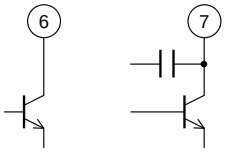
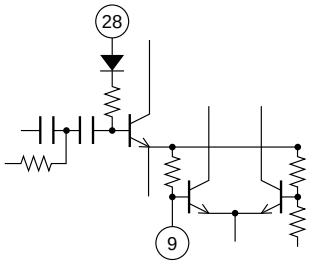


A10634

② - ① 58T
④ - ⑥ 7T
② - ③ 94T
f_O = 450 kHz
Q_O = 110

A 180-pF capacitor is built in
With an external SFU450B

Pin Functions

Pin No.	Pin function	Pin voltage	Notes	Equivalent circuit
1	FM IF input	Vreg	Input impedance r_i = 330 Ω	 A10635
2	AM mixer output	V_{CC}	Connect the mixer coil between this pin and V_{CC}	 A10636
3	FM IF input bypass	Vreg	Also used for the MPX regulator filter	 A10635
4	AM IF input	Vreg	Input impedance r_i = 2 kΩ	 A10637
5	GND	0 V		
6 7	TU-LED ST-LED, AF-IF output	V_{CC} V_{CC}	Active low Open collector AM stereo IF output (pin 7) The influx current must be held under 150 µA.	 A10638
8	V_{CC}	V_{CC}		
9	FM detector	Vreg – 1.4	The CDA10.7 MG74 (Murata Mfg. Co., Ltd.) is recommended as the ceramic discriminator. A device with a series resistance of 270 Ω must be used.	 A10639

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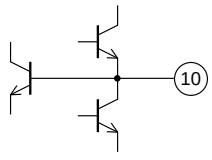
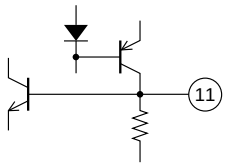
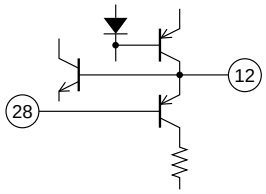
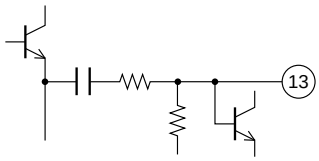
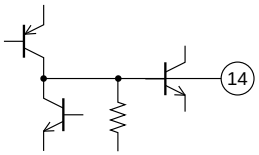
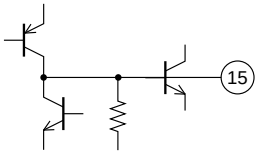
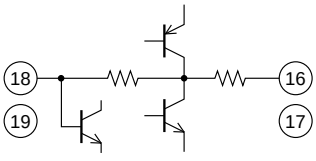
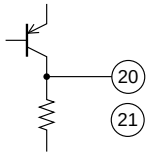
Pin No.	Pin function	Pin voltage	Notes	Equivalent circuit
10	AM narrow band CF connection	1.3 V	Recommended narrow band CF: BFU450 C4N (Murata Mfg. Co., Ltd.) When the narrow band SD function is not used, bypass this circuit with a 50 Ω resistor and a 0.047 µF capacitor in series.	 A10640
11	FM S-meter output	0 V	R_L = 8 kΩ	 A10641
12	AM S-meter output	0 V (AM)	The AM SD sensitivity is adjusted with an external resistor connected between this pin and ground	 A10642
13	AM/FM IF buffer output, Output control switch (mute switch)	0 V	V13 ≤ 0.5 V: Reception state 1.4 V ≤ V13 ≤ 2.2 V: IF buffer output on V13 ≥ 3.5 V: IF buffer output and muting on	 A10643
14	Phase comparator low-pass filter (AM/FM switching)	V_{CC} – 1.4 (FM) 0 V (AM)	The device operates in AM mode when this pin is connected to ground through a resistor. Limit values for the resistor: 2.7 kΩ (When V_{CC} = 7 V) 3.9 kΩ (8 V), 5.1 kΩ (9 V) 6.2 kΩ (10 V), 7.5 kΩ (11 V)	 A10644
15	Pilot detector low-pass filter (Forced mono) (VCO stop)	V_{CC} – 1.0	The device is forced to monaural when a current of over 50 µA flows from this pin. The VCO is stopped if this pin is connected to ground. The limit values for the resistor are the same as those for pin 14.	 A10645
16 17 18 19	Post-amplifier inputs and outputs	Vreg Vreg	Output impedance r_o = 200 Ω Pin 16: Right output, pin 17: Left output Inverting input pins Pin 18: Right input, pin 19: Left input R_{NF} = 33 kΩ	 A10646
20 21	MPS outputs	3.5 V 3.5 V	Output impedance r_o = 3.3 kΩ Pin 20: Right deemphasis Pin 21: Left deemphasis	 A10647

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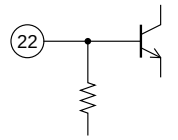
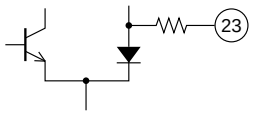
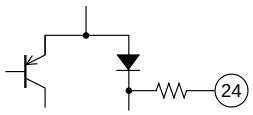
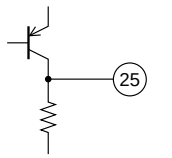
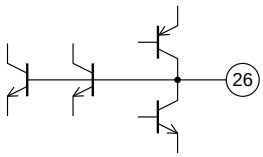
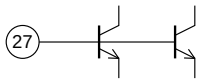
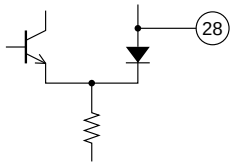
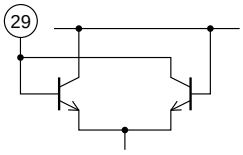
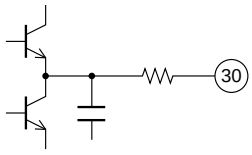
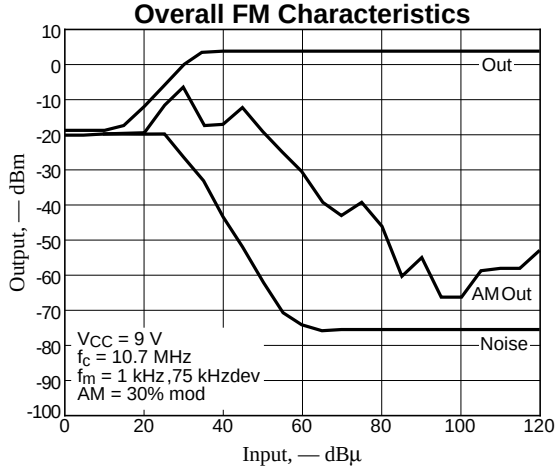
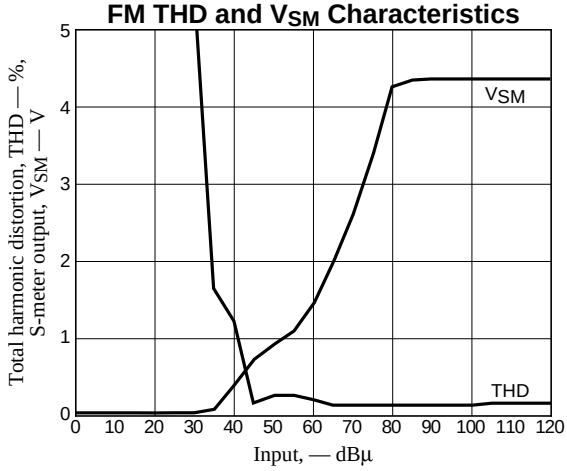
Pin No.	Pin function	Pin voltage	Notes	Equivalent circuit
22	MPX input	2.9 V	Input impedance r_i = 20 kΩ	 A10648
23	FM demodulator output	2.8 V (FM) 2.8 V (AM)	Output impedance r_o = 3.0 kΩ The channel separation can be adjusted with an external capacitor connected between this pin and ground. The V_O sub/V_O main ratio is set to be about 0 dB.	 A10649
24	AM detector output	0 V (FM) 0.5 V (AM)	Output impedance r_o = 3.3 kΩ The AM frequency characteristics can be adjusted by modifying the time constant of the circuit connected between this pin and pin 22 and between this pin and ground.	 A10650
25	AM AGC	0 V (FM) 0.5 V (AM)	The resistance of the built-in resistor R is 11 kΩ	 A10651
26	AFC	Vreg	The FM SD bandwidth can be adjusted with the external resistor connected between this pin and pin 28	 A10652
27	AM RF input	Vreg	Must be used at the same potential as pin 28	 A10653
28	REG	Vreg	Vreg = 3.6 V	 A10654
29	OSC	Vreg	Connect the oscillator coil between this pin and pin 28	 A10655
30	Oscillator buffer output, FM SD sensitivity adjustment	1.6 V (FM) 1.3 V (AM)	The FM SD sensitivity can be adjusted with an external resistor connected between this pin and ground. Output impedance r_o = 200 Ω	 A10656

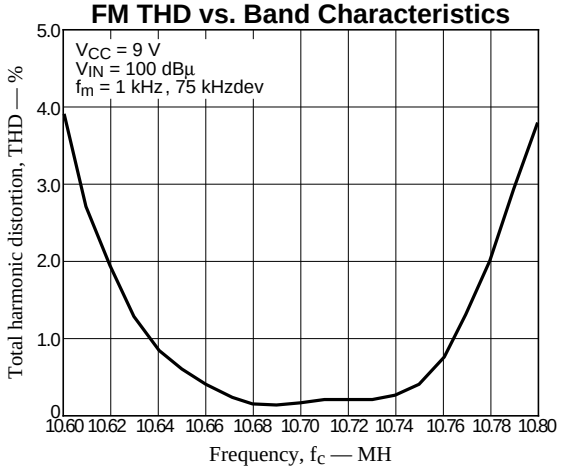
Overall FM Characteristics



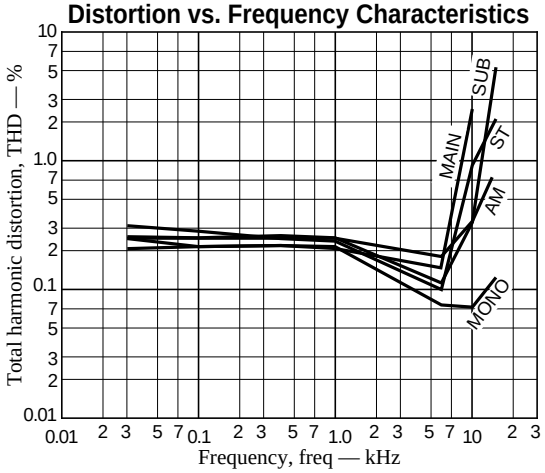
FM THD and V_{SM} Characteristics



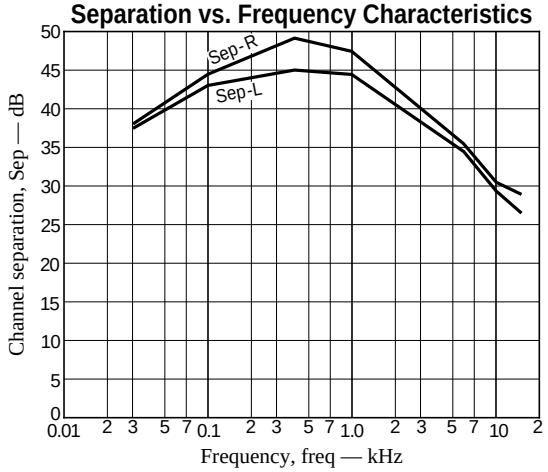
FM THD vs. Band Characteristics



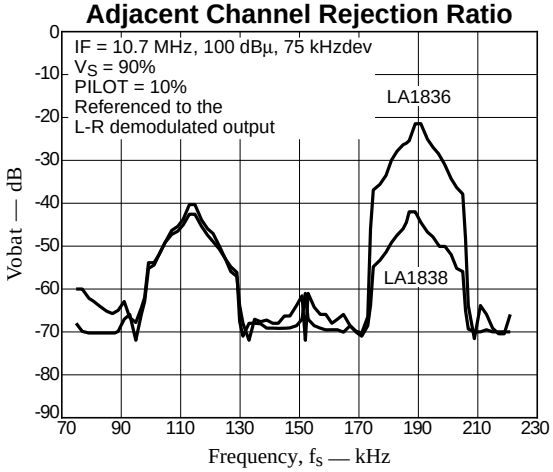
Distortion vs. Frequency Characteristics



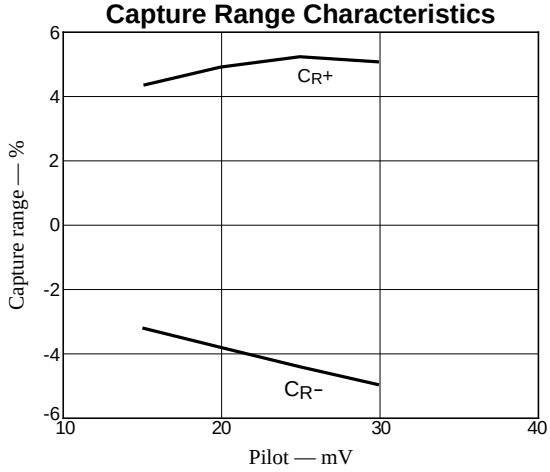
Separation vs. Frequency Characteristics



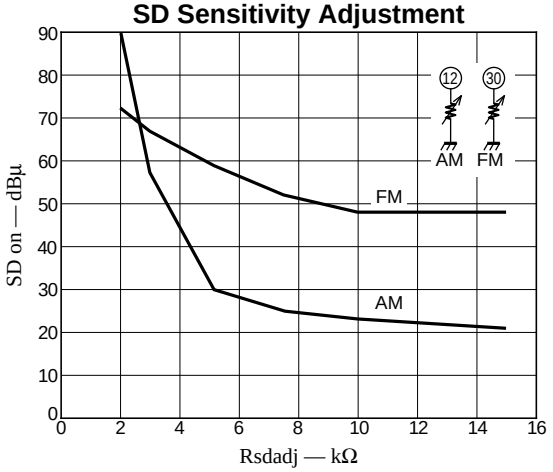
Adjacent Channel Rejection Ratio



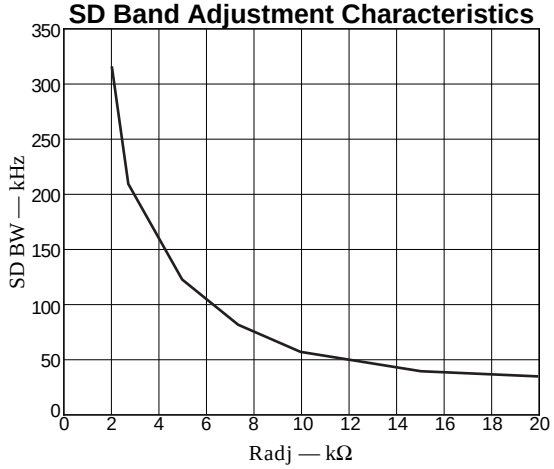
Capture Range Characteristics



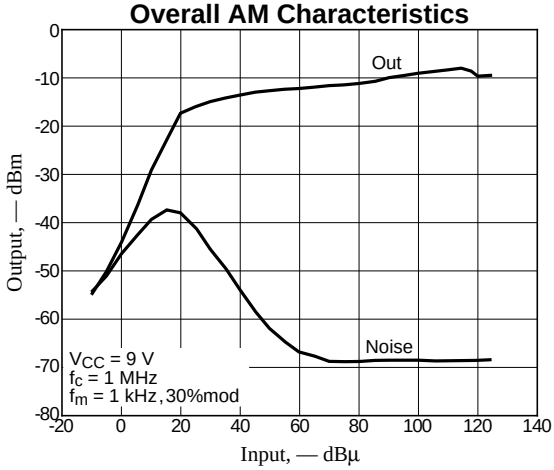
SD Sensitivity Adjustment



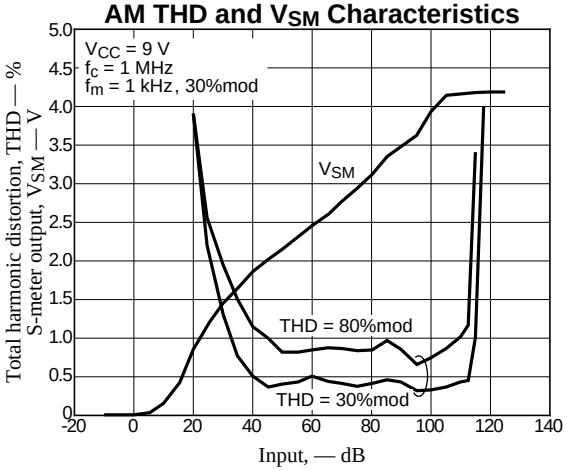
SD Band Adjustment Characteristics



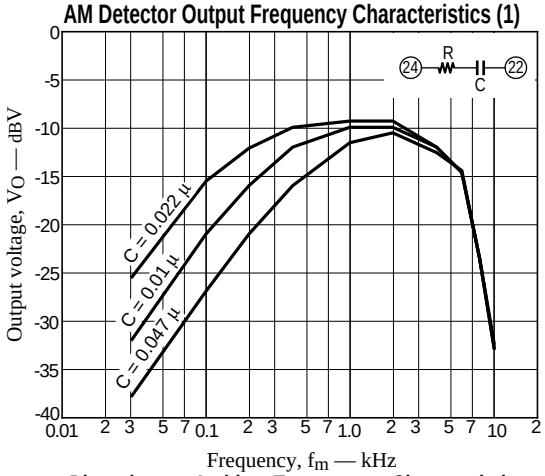
Overall AM Characteristics



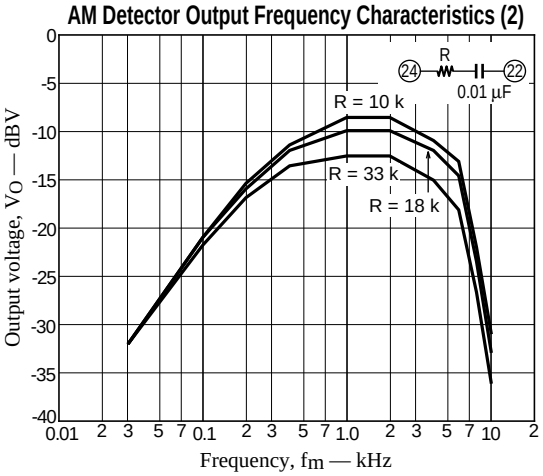
AM THD and V_{SM} Characteristics



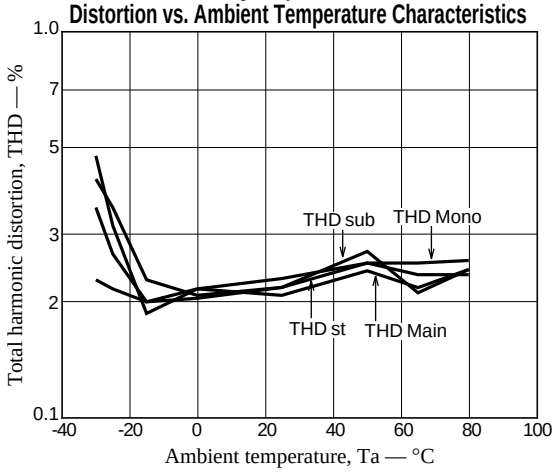
AM Detector Output Frequency Characteristics (1)



AM Detector Output Frequency Characteristics (2)



Distortion vs. Ambient Temperature Characteristics



Separation vs. Ambient Temperature Characteristics