Ordering number : EN8271

LA1837M

Monolithic Linear IC

Single-Chip AM/FM Tuner IC for Home Stereo Systems

ON Semiconductor®

http://onsemi.com

Overview

The LA1837M is a single-chip AM/FM tuner IC that provides AM and FM IF and multiplex decoding circuits for electronic tuning and was developed for use in home stereo systems. It provides both SD and IF counting techniques for optimal implementation of automatic station selection.

Features

- On-chip MPX VCO circuit (no external components required).
- Adjacent channel interference rejection function (third order and fifth order).
- Supports both the SD and IF counting technique (built-in SD speedup function).
- The AM and FM SD sensitivity can be set independently.
- The AM and FM output levels can be set independently.
- Improved basic FM reception performance.

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, S curve detection, IF buffer output
- Multiplex stereo decoding: PLL stereo decoder, stereo indicator, forced monaural, VCO stop function, 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

*: Mounting board: 114.3×76.1×1.6mm glass epoxy board

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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		7.0 to 11.0	V

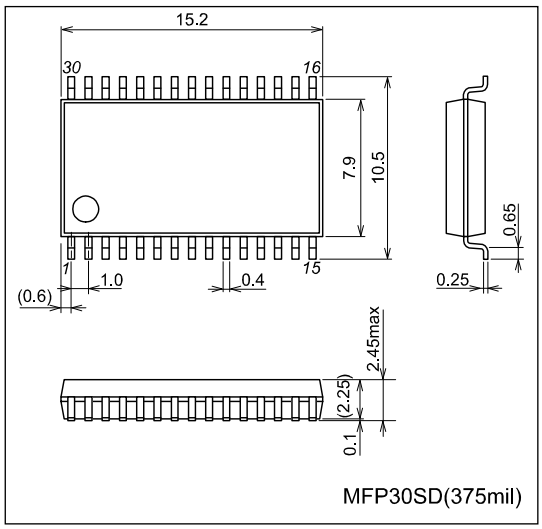
Electrical Characteristics at Ta = 25°C V_{CC} = 9.0V, in the specified circuit.

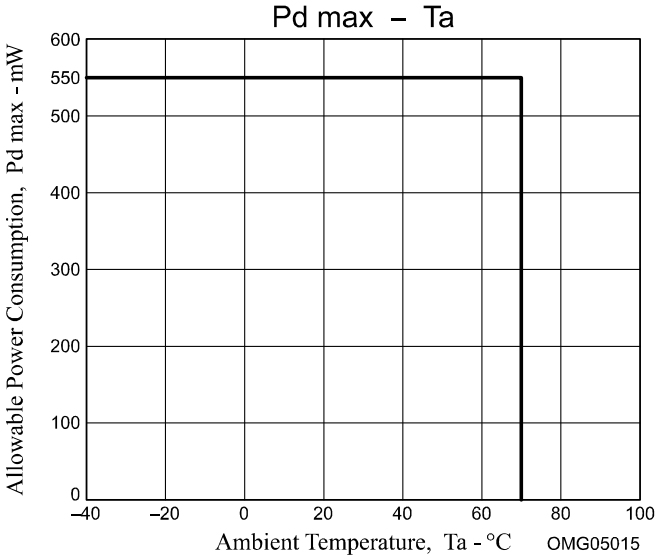
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM Mono Characteristics] fc = 10.7MHz, fm = 1kHz, with the coil adjusted so that V_{AFC} - V_{REG} = 0V.						
Current drain	I_{CCO-FM}	No input	18	31	44	mA
Demodulator output	V_{OFM}	100dBμ, 100% mod, pin 16 output	730	1100	1460	mVrms
Channel balance	C.B-mono	100dBμ, 100% mod, pin 16 output / pin 17 output	-1.5	0	+1.5	dB
Total harmonic distortion (mono)	$THD_{FM}1$	100dBμ, 100% mod, pin 16 output		0.3	1.3	%
	$THD_{FM}2$	100dBμ, 200% mod, pin 16 output		1.0	5.0	%
Signal-to-noise ratio	S/N_{FM}	100dBμ, 100% mod, pin 16 output	72	80		dB
AM rejection ratio	AMR	100dBμ, AM 30% mod, pin 16 output	45	65		dB
Input limiting voltage	-3dBL.S	Referenced to 100dBμ, 100% mod, the input for output is -3dB down.	26	32	38	dBμ
LED on sensitivity	SD_{ON-FM}		51	60	69	dBμ
LED on bandwidth	SD_{BW}	100dBμ	85	120	170	kHz
IF counter buffer output	$V_{IFBUFF-FM}$	100dBμ, pin 13 output	80	120	160	mVrms
S-meter output	$V_{SM\ FM}1$	0dBμ, pin 11 output	0	0.1	0.5	V
	$V_{SM\ FM}2$	100dBμ, pin 11 output	3.6	4.3	5.0	V
Muting attenuation	Mute Alt	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: L	SepL	Lmod. pin 16 output / pin 17 output	30	45		dB
Separation: R	SepR	Rmod. pin 17 output / pin 16 output	30	45		dB
Stereo on level	ST_{ON}	The pilot mod such that V7 < 0.7V	1.3	2.7	5.0	%
Stereo off level	ST_{OFF}	The pilot mod such that V7 > 4.5V		1.5		%
Total harmonic distortion (main)	THD main	L+R mod. Pin 16 output		0.3	1.3	%
Adjacent channel interference rejection ratio	Brej-3rd	fs = 113kHz, Vs = 90%, Pilot = 10% Pin 16 output, versus L-R mod. 1kHz demodulator output		40		dB
	Brej-5th	fs = 189kHz, Vs = 90%, Pilot = 10% Pin 16 output, versus L-R mod. 1kHz demodulator output		40		dB
[AM Characteristics]						
Current drain	IC_{CO-AM}	No input	15	25	35	mA
Output detector	$V_{OAM}1$	23dBμ, 30% mod, pin 16 output	100	180	360	mVrms
	$V_{OAM}2$	80dBμ, 30% mod, pin 16 output	200	320	500	mVrms
Signal-to-noise ratio	$S/N_{AM}1$	23dBμ, 30% mod, pin 16 output	18	22		dB
	$S/N_{AM}2$	80dBμ, 30% mod, pin 16 output	49	55		dB
Total harmonic distortion	$THD_{AM}1$	80dBμ, 30% mod, pin 16 output		0.4	1.2	%
	$THD_{AM}2$	80dBμ, 80% mod, pin 16 output		1.0	4.0	%
LED-ON sensitivity	SD_{On-AM}		17	27	37	dBμ
Oscillator buffer output	V_{OSC-AM}	No input, pin 30 output	110	160	220	mVrms
IF counter buffer output	$V_{IFBuff-AM}$	80dBμ, non-mod, pin 13 output	160	220	300	mVrms
ST IF output	$V_{STIF-AM}$	80dBμ, non-mod, pin 7 output	16	34	48	mVrms
S-meter output	V_{SM-AM}	0dBμ, non-mod	0	0	0.2	V

Package Dimensions

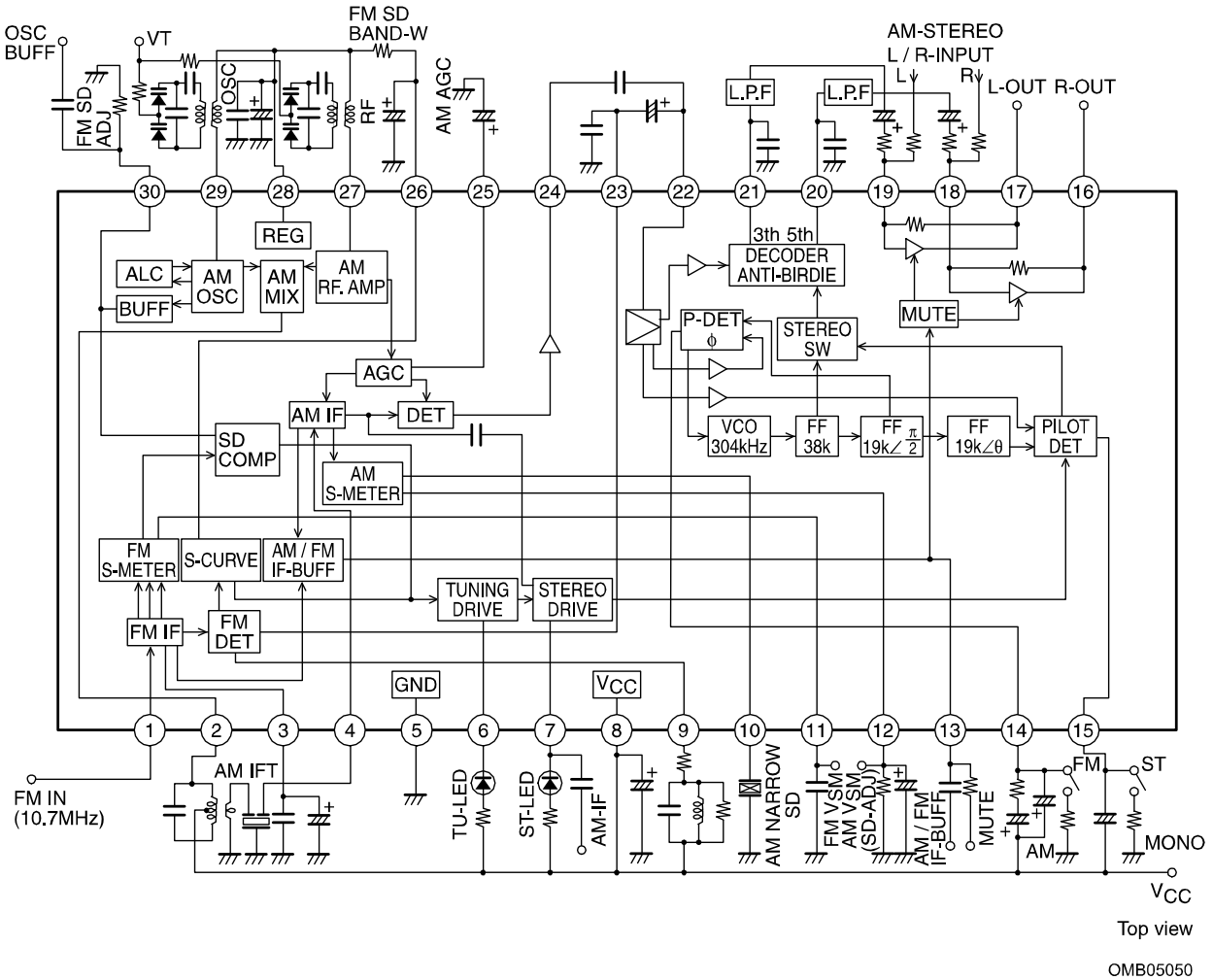
unit : mm

3073C





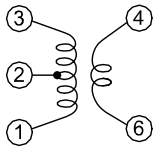
Block Diagram



Coil Specifications

• AM oscillator (for the DUT)

HW-50425 (Mitsumi Electric Co., Ltd.)

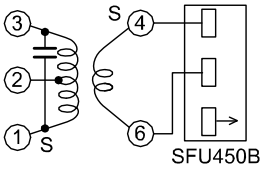


③-② 2T
④-⑥ 9T
②-① 86T
$Q_O \geq 80$
L=270mH

OMP05179

• IFT

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



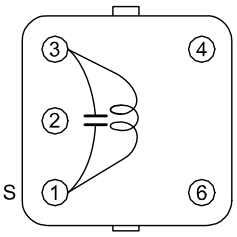
YD-1073

OMP05180

①-② 58T
④-⑥ 7T
②-③ 94T
f_O=450kHz
Q_O=110
With 180pF internal capacitance
With an SFU450B attached.

• FM-DET

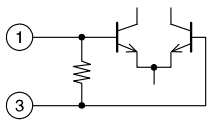
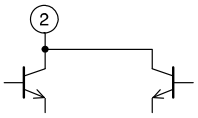
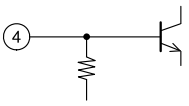
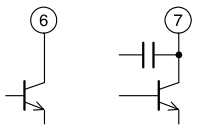
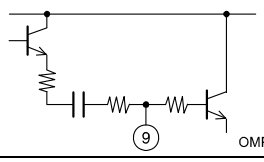
600BEAS-9715Z (Toko Electric Corporation)



③-① 22T
f=10.7MHz
Q_O=40
With 82pF internal capacitance

OMP05181

Pin Function

Pin No.	Pin	Pin voltage	Equivalent circuit	Pin function
1	FM IF input	Vreg	 OMP05156	Input impedance r_i = 330 Ω
2	AM mixer output	V_{CC}	 OMP05157	Connect the mixer coil between this pin and V_{CC}.
3	FM IF input bypass	Vreg	See pin 1	Also used for the multiplex regulator filter
4	AM IF input	Vreg	 OMP05158	Input impedance r_i = 2 kΩ
5	GND	0V		
6 7	TU-LED, ST-LED, AM - IF output	V_{CC} V_{CC}	 OMP05159	Active low Open collector AM stereo IF output (pin 7) This pin must be set up with an influx current under 150µA.
8		V_{CC}		
9	FM detector	V_{CC}	 OMP05160	Recommended detector coil 600BEAS-9715Z (The Toko Electric Corporation)

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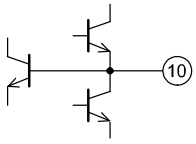
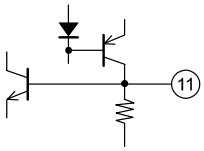
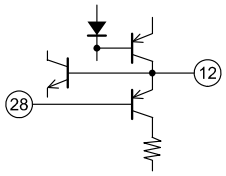
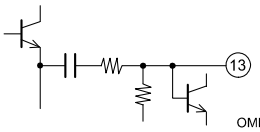
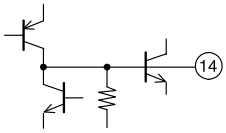
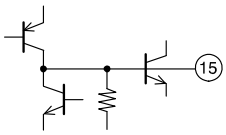
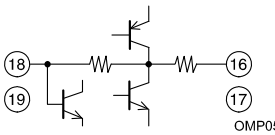
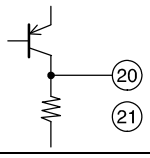
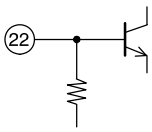
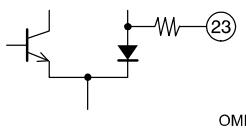
Pin No.	Pin	Pin voltage	Equivalent circuit	Pin function
10	AM narrow band ceramic filter connection	1.3V	 OMP05161	Recommended narrow band ceramic filter BFU450C4N (Murata Mfg. Co., Ltd.) When the narrow band SD function is not used, bypass this circuit by connecting a 50Ω resistor and a 0.047μF capacitor in series.
11	FM S-meter output	0V	 OMP05162	R_L = 8kΩ
12	AM S-meter output, AM SD sensitivity adjustment	0V (AM)	 OMP05163	The AM SD sensitivity can be adjusted with an external resistor between this pin and ground.
13	AM/FM IF buffer output, Output control switch (muting switch)	0V	 OMP05164	V13 ≤ 0.5V: Reception state 1.4V ≤ V13 ≤ 2.2V: IF buffer output on V13 ≥ 3.5V: IF buffer output and muting on
14	Phase comparator low-pass filter (FM/AM switching)	V_{CC}-1.4 (FM) 0V (AM)	 OMP05166	The IC switches to AM mode when this pin is connected to ground through a resistor. 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 monaural) (VCO stop)	V_{CC}-1.0	 OMP05167	When a current of over 50μA is sourced by this pin, the IC switches to forced monaural mode. The VCO is stopped if this pin is connected to ground. The resistor value limits are the same as for pin 14.
16 17 18 19	Post amplifier I/O	Verg Verg	 OMP05168	Output impedance r_o = 200Ω Pin 16: right output, pin 17: left output Inverting input pins Pin 18: right input, pin 19: left input R_NF = 33kΩ
20 21	Multiplex output	3.5V 3.5V	 OMP05169	Output impedance r_o = 3.3kΩ Pin 20: Right channel deemphasis Pin 21: Left channel deemphasis
22	Multiplex input	2.9V	 OMP05170	Input impedance r_i = 20kΩ
23	FM demodulated output	2.8V (FM) 2.8V (AM)	 OMP05171	Output impedance r_o = 3.0kΩ The separation can be adjusted with an external capacitor connected between this pin and ground. The VOsub/VOmain ratio is set to be approximately 0dB.

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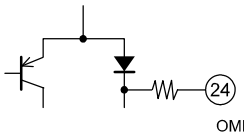
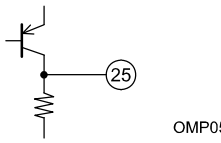
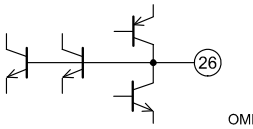
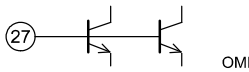
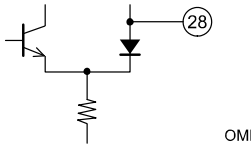
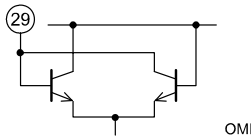
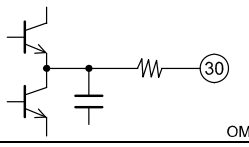
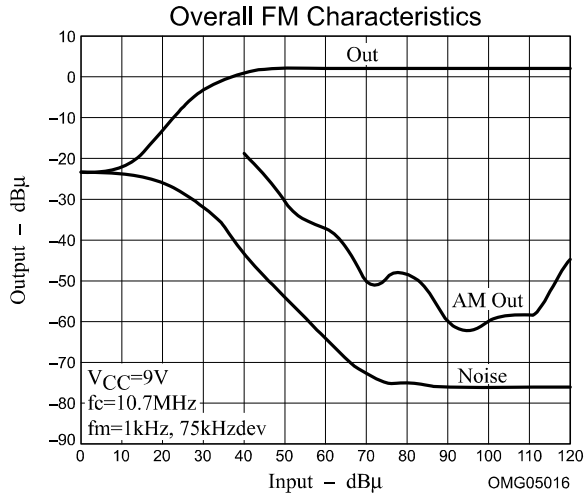
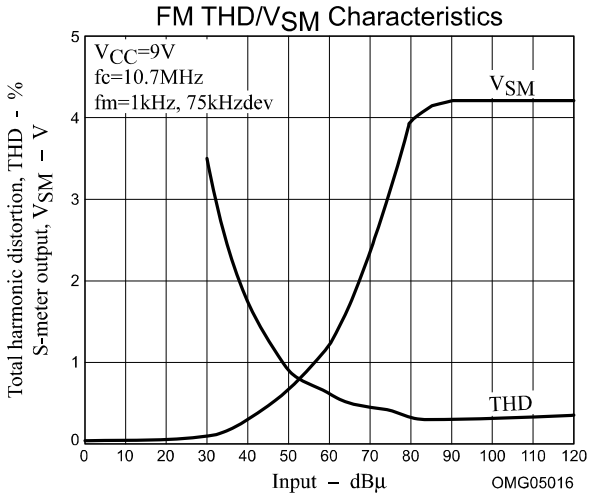
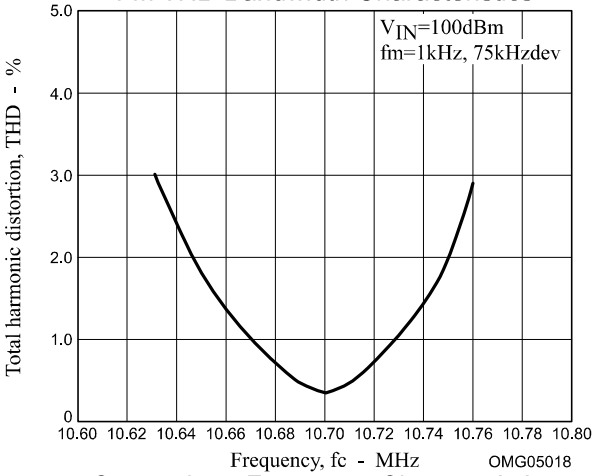
Pin No.	Pin	Pin voltage	Equivalent circuit	Pin function
24	AM detector output	0V (FM) 0.5V (AM)		Output impedance r_o = 3.3kΩ The AM frequency characteristics can be adjusted with an RC circuit connected between pin 22 and ground.
25	AM AGC	0V (FM) 0.5V (AM)		Internal load resistance R = 11kΩ
26	AFC	Vreg		The FM SD bandwidth can be adjusted with an external resistor connected between this pin and pin 28.
27	AM RF input	Vreg		This pin must be held at the same potential as pin 28
28	REG	Vreg		Vreg = 3.6V
29	OSC	Vreg		Connect the 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 adjusted with an external resistor connected between this pin and ground. Output impedance r_o = 20Ω

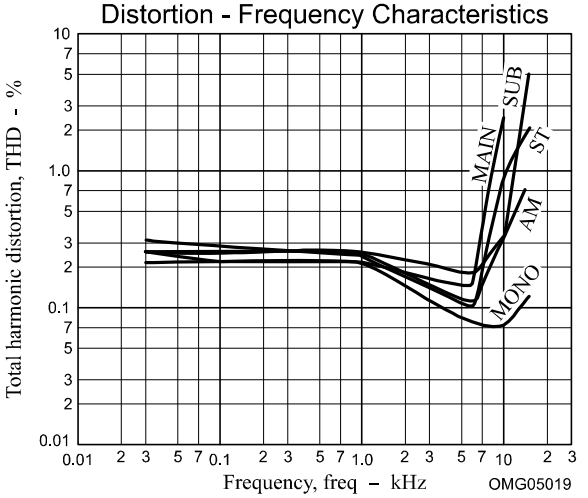




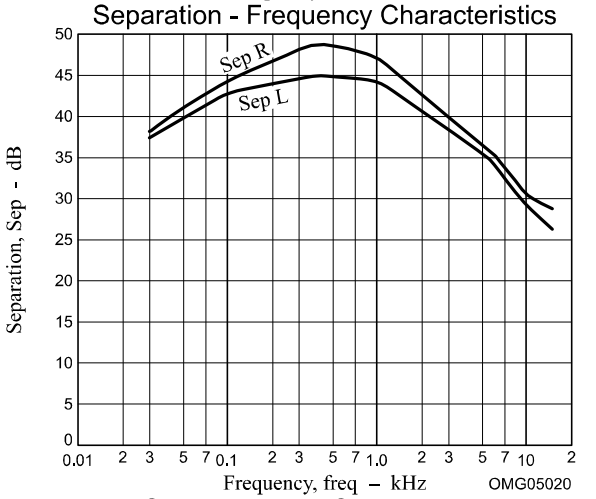
FM THD Bandwidth Characteristics



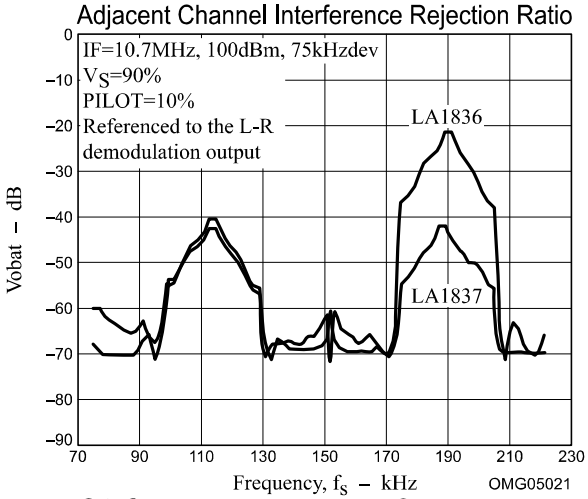
Distortion - Frequency Characteristics



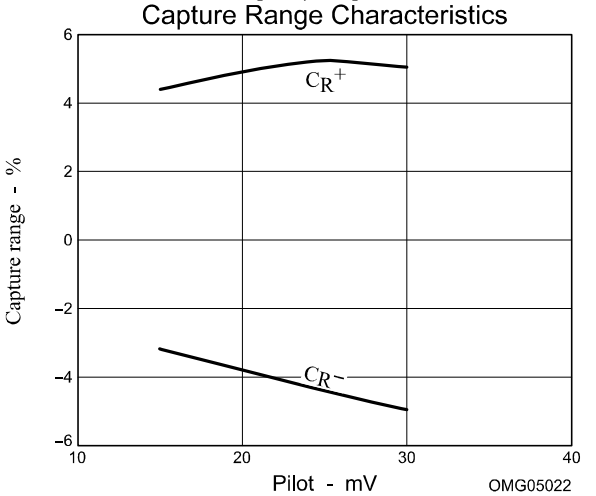
Separation - Frequency Characteristics



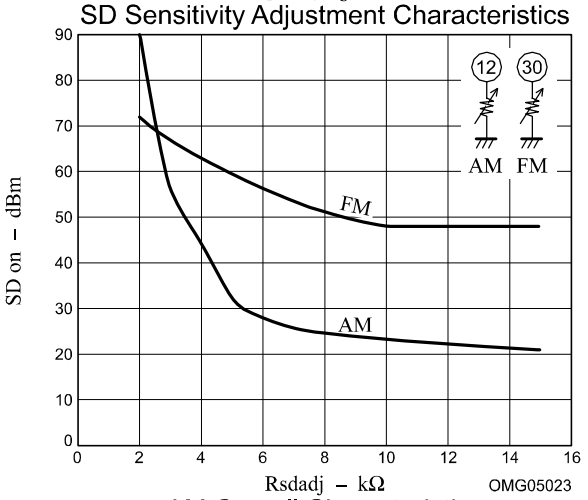
Adjacent Channel Interference Rejection Ratio



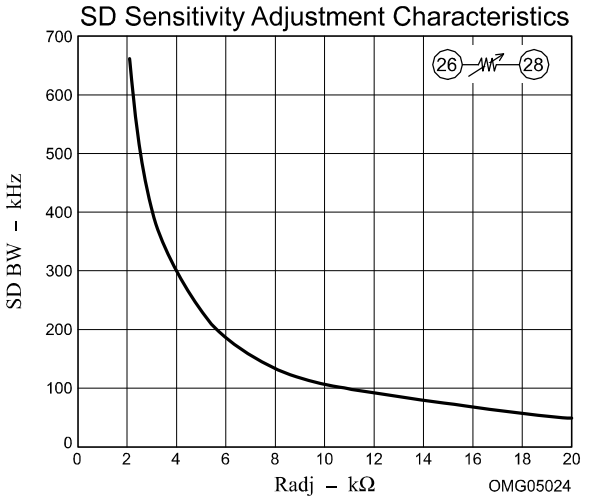
Capture Range Characteristics



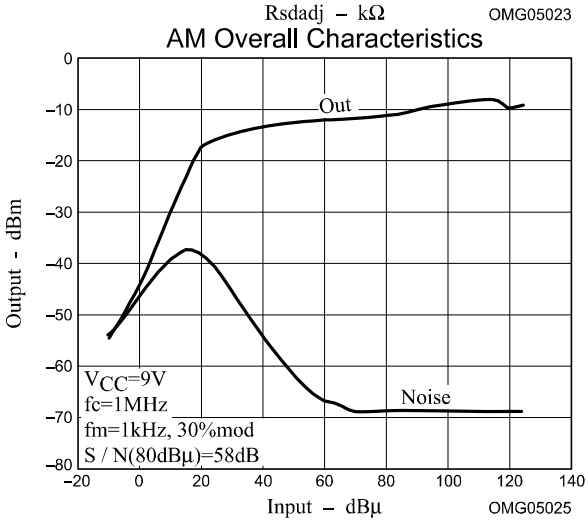
SD Sensitivity Adjustment Characteristics



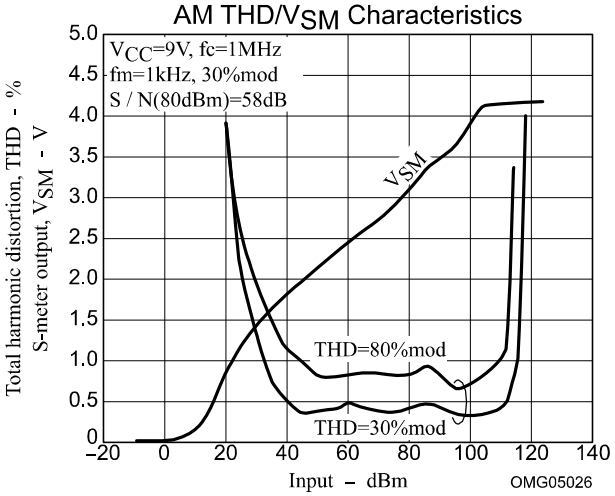
SD Sensitivity Adjustment Characteristics



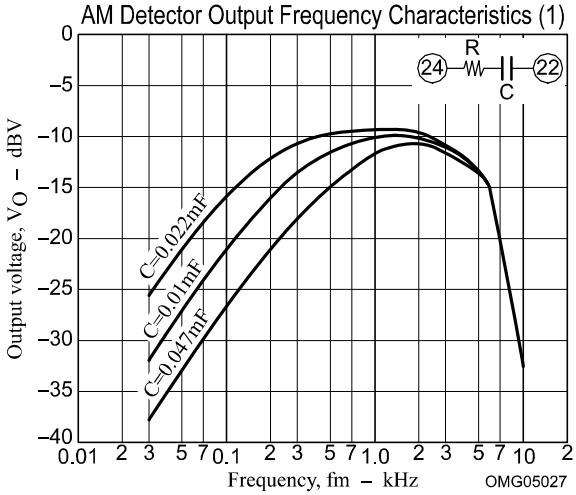
AM Overall Characteristics



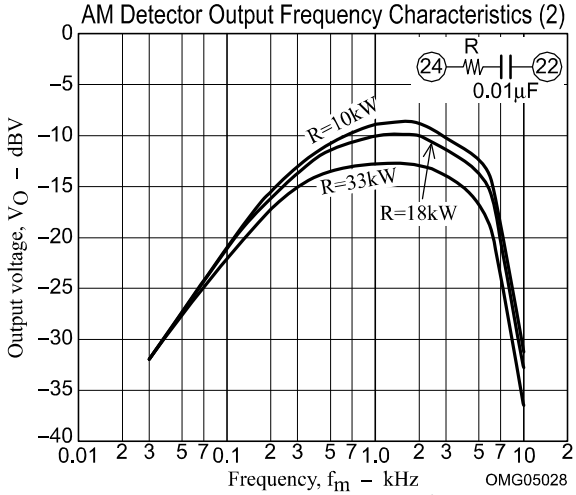
AM THD/V_{SM} Characteristics



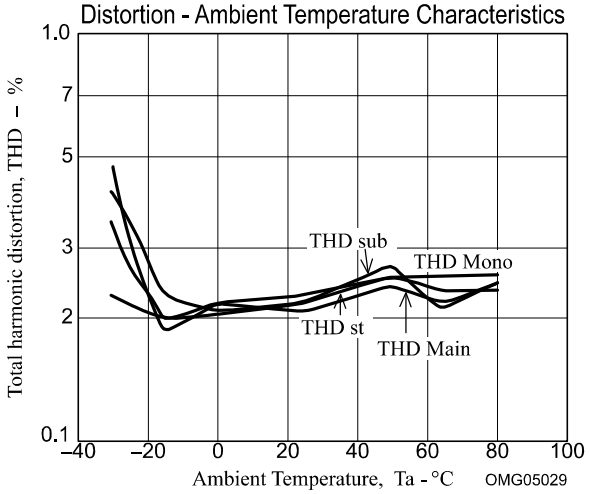
AM Detector Output Frequency Characteristics (1)



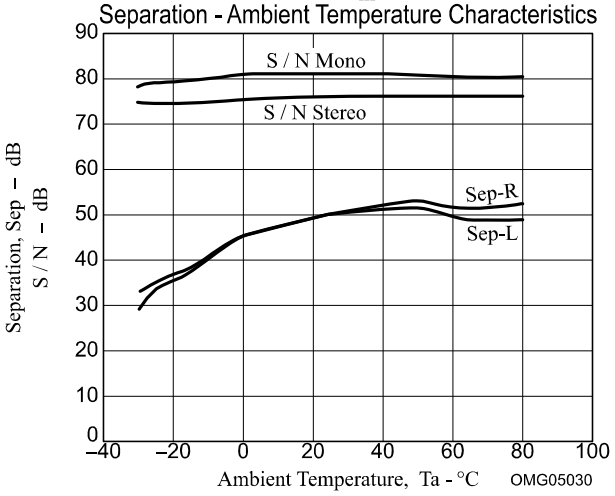
AM Detector Output Frequency Characteristics (2)



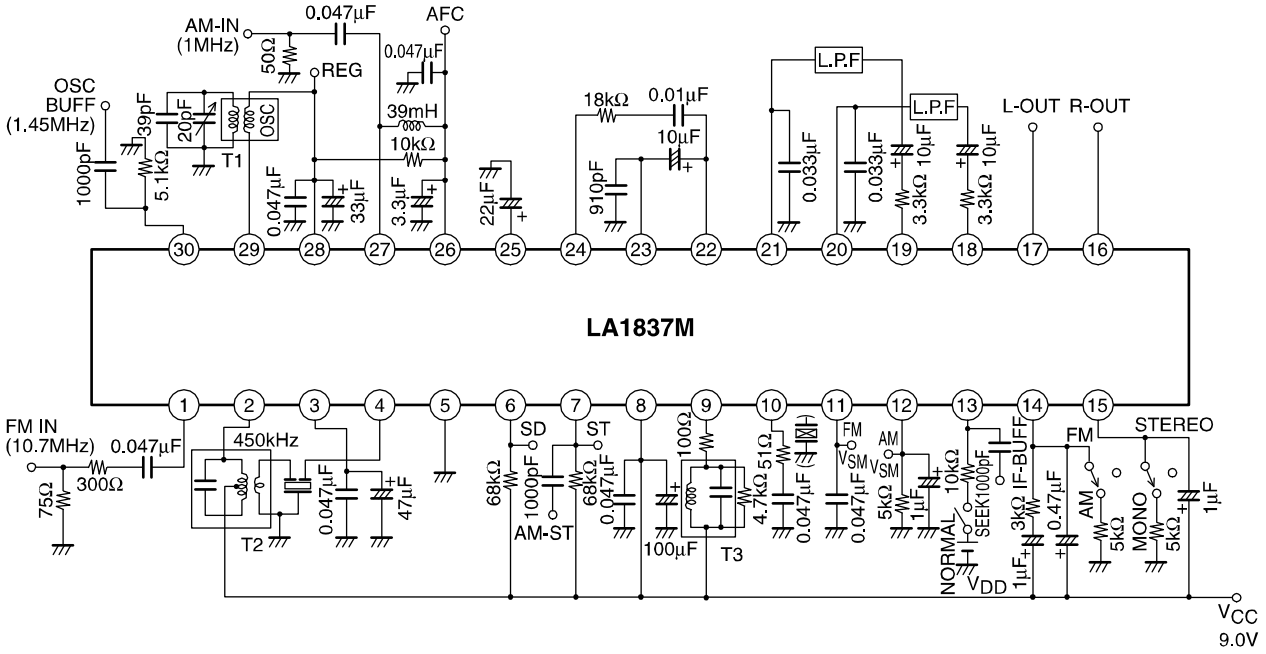
Distortion - Ambient Temperature Characteristics



Separation - Ambient Temperature Characteristics



Test Circuit



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