

## **SANYO Semiconductors**

# DATA SHEET

**LA1837M** —

**Monolithic Linear IC** 

An ON Semiconductor Company

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

#### 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 $Ta = 25^{\circ}C$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> 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

<sup>\*:</sup> Mounting board: 114.3×76.1×1.6mm glass epoxy board

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# LA1837M

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

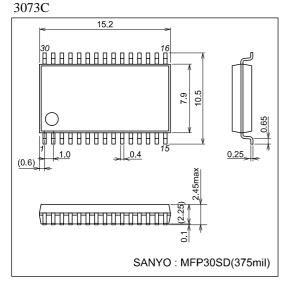
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	VCC		9	V
Operating supply voltage range	V <sub>CC</sub> op		7.0 to 11.0	V

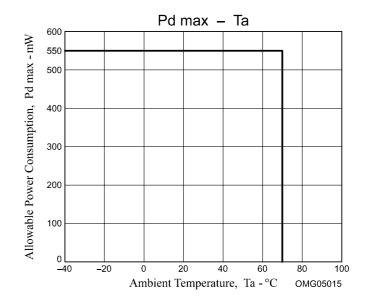
# **Electrical Characteristics** at $Ta=25^{\circ}C\ V_{CC}=9.0V$ , in the specified circuit.

Parameter	Symbol	Conditions	Ratings			Unit		
	,		min	typ	max	Unit		
[FM Mono Characteristics	[FM Mono Characteristics] fc = 10.7MHz, fm = 1kHz, with the coil adjusted so that VAFC - VREG = 0V.							
Current drain	ICCO-FM	No input	18	31	44	mA		
Demodulator output	VOFM	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	THD <sub>FM</sub> 1	100dBµ, 100% mod, pin 16 output		0.3	1.3	%		
distortion (mono)	THD <sub>FM</sub> 2	100dBµ, 200% mod, pin 16 output		1.0	5.0	%		
Signal-to-noise ratio	S/N <sub>FM</sub>	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 <sub>ON-FM</sub>		51	60	69	dBμ		
LED on bandwidth	SD <sub>BW</sub>	100dBµ	85	120	170	kHz		
IF counter buffer output	VIFBUFF-FM	100dBμ, pin 13 output	80	120	160	mVrms		
S-meter output	V <sub>SM FM</sub> 1	0dBμ, pin 11 output	0	0.1	0.5	V		
	V <sub>SM FM</sub> 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 Characteristic	cs] fc = 10.7MHz, 1	00dBμ, 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	STON	The pilot mod such that V7 < 0.7V	1.3	2.7	5.0	%		
Stereo off level	STOFF	The pilot mod such that V7 > 4.5V		1.5		%		
Total harmonic	THD main	L+R mod. Pin 16 output		0.3	1.3	%		
distortion (main)	Desi Ord	f- 440H- V- 000/ Bilet 400/		40		-ID		
Adjacent channel interference rejection	Brej-3rd	fs = 113kHz, Vs = 90%, Pilot = 10% Pin 16 output, versus L-R mod. 1kHz demodulator output		40		dB		
ratio	Brej-5th	fs = 189kHz, Vs = 90%, Pilot = 10%		40		dB		
	, , ,	Pin 16 output, versus L-R mod. 1kHz demodulator output						
[AM Characteristics]								
Current drain	IC <sub>CO-AM</sub>	No input	15	25	35	mA		
Output detector	V <sub>OAM</sub> 1	23dBµ, 30% mod, pin 16 output	100	180	360	mVrms		
	V <sub>OAM</sub> 2	80dBµ, 30% mod, pin 16 output	200	320	500	mVrms		
Signal-to-noise ratio	S/N AM1	23dBµ, 30% mod, pin 16 output	18	22		dB		
	S/N <sub>AM</sub> 2	80dBμ, 30% mod, pin 16 output	49	55		dB		
Total harmonic	THD <sub>AM</sub> 1	80dBµ, 30% mod, pin 16 output		0.4	1.2	%		
distortion	THD <sub>AM</sub> 2	80dBµ, 80% mod, pin 16 output		1.0	4.0	%		
LED-ON sensitivity	SD <sub>On-AM</sub>		17	27	37	dΒμ		
Oscillator buffer output	V <sub>OSC-AM</sub>	No input, pin 30 output	110	160	220	mVrms		
IF counter buffer output	VIFBuff-AM	80dBμ, non-mod, pin 13 output	160	220	300	mVrms		
ST IF output	VSTIF-AM	80dBμ, non-mod, pin 7 output	16	34	48	mVrms		
S-meter output	V <sub>SM-AM</sub>	0dBµ, non-mod	0	0	0.2	V		

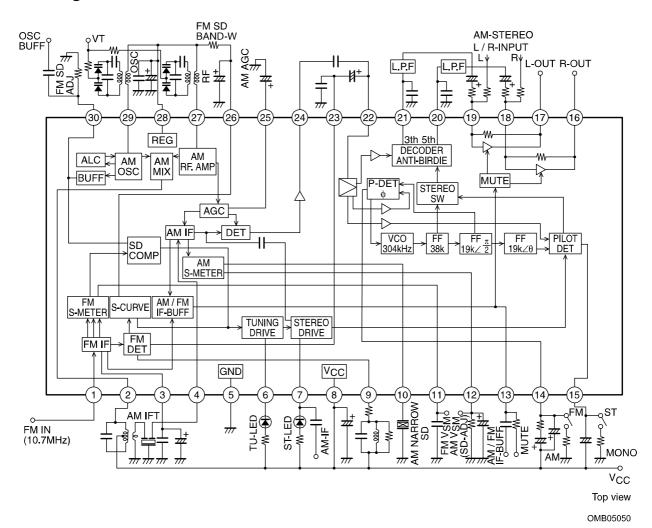
## **Package Dimensions**

unit : mm





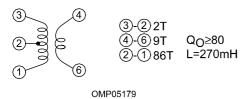
## **Block Diagram**



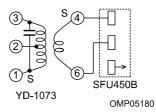
## **LA1837M**

## **Coil Specifications**

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

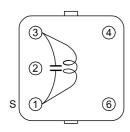


• IFT YD-1073-1 (Mitsumi Electric Co., Ltd.)



 $\bigcirc$  1-2 58T  $\bigcirc$  4-6 7T  $\bigcirc$  -3 94T  $\bigcirc$  10-450kHz  $\bigcirc$  0-110 With 180pF internal capacitance With an SFU450B attached.

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



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

## **Pin Function**

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

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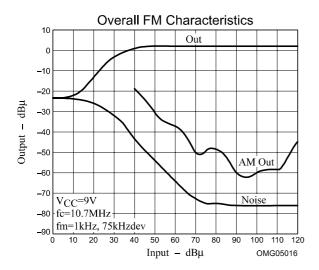
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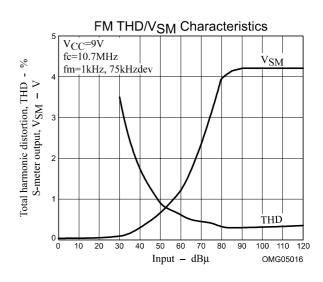
Pin No.	Pin	Pin voltage	Equivalent circuit	Pin function
10	AM narrow band ceramic filter connection	1.3V	(10) OMP05161	Recommended narrow band ceramic filter BFU450C4N (Murata Mfg. Co., Ltd.) When the narrow band SD function is not used, bypass this circuit by connecting a $50\Omega$ resistor and a $0.047\mu\text{F}$ capacitor in series.
11	FM S-meter output	OV	(11) OMP05162	$R_L = 8k\Omega$
12	AM S-meter output, AM SD sensitivity adjustment	OV (AM)	(28) (12) (28) (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)	OV	(3) OMP05164	V13 $\leq$ 0.5V: Reception state 1.4V $\leq$ V13 $\leq$ 2.2V: IF buffer output on V13 $\geq$ 3.5V: IF buffer output and muting on
14	Phase comparator low-pass filter (FM/AM switching)	V <sub>CC</sub> -1.4 (FM) 0V (AM)	0MP05166	The IC switches to AM mode when this pin is connected to ground through a resistor. Resistor value limits: $2.7k\Omega$ (when $V_{CC} = 7V$ ) $3.9k\Omega$ (8V) $5.1k\Omega$ (9V) $6.2k\Omega$ (10V) $7.5k\Omega$ (11V)
15	Pilot detector low-pass filter (Forced monaural) (VCO stop)	V <sub>CC</sub> -1.0	(15) 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	(18) W (16) (17) OMP05168	Output impedance $r_0 = 200\Omega$ Pin 16: right output, pin 17: left output Inverting input pins Pin 18: right input, pin 19: left input $R_NF = 33k\Omega$
20 21	Multiplex output	3.5V 3.5V	20 20 21 OMP05169	Output impedance $r_0$ = 3.3k $\Omega$ Pin 20: Right channel deemphasis Pin 21: Left channel deemphasis
22	Multiplex input	2.9V	(22) OMP05170	Input impedance $r_i$ = $20k\Omega$
23	FM demodulated output	2.8V (FM) 2.8V (AM)	OMP05171	Output impedance $r_0=3.0 k\Omega$ 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.

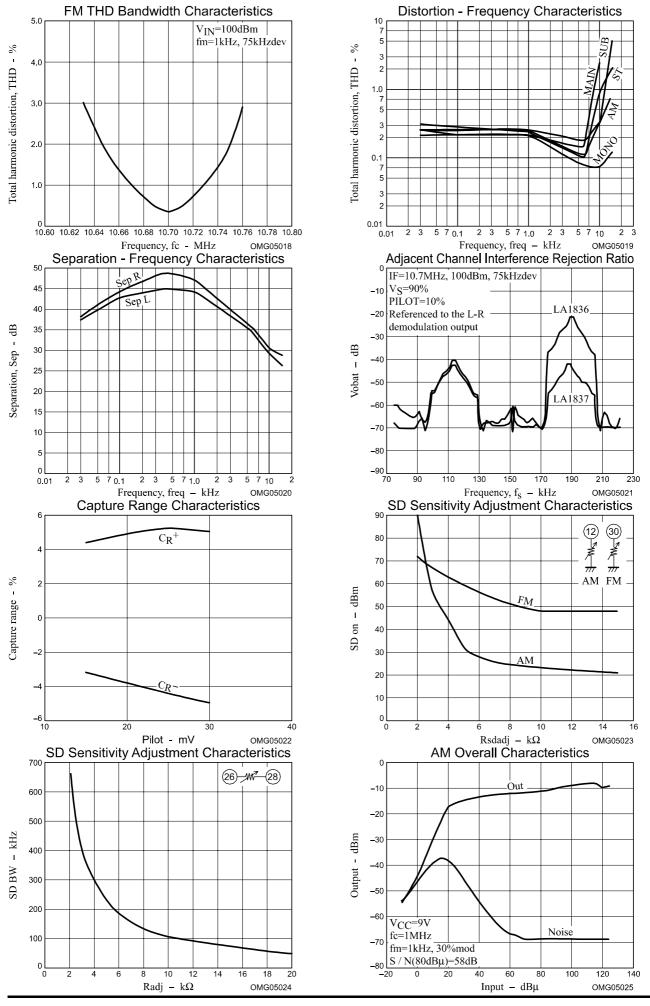
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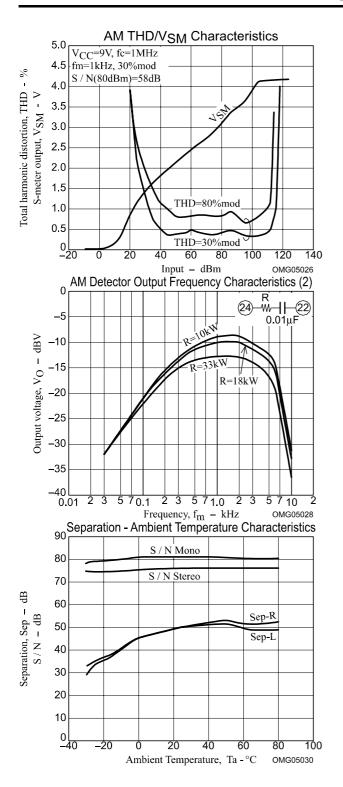
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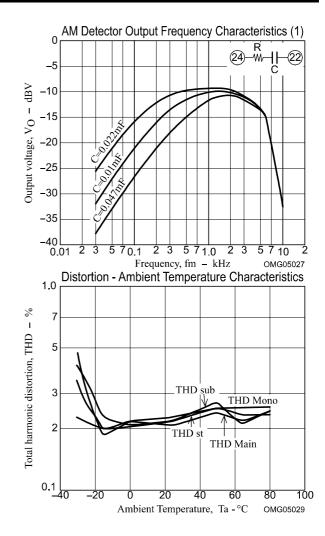
Pin No.	Pin	Pin voltage	Equivalent circuit	Pin function
24	AM detector output	0V (FM) 0.5V (AM)	W—24 OMP05172	Output impedance $r_0=3.3 k\Omega$ The AM frequency characteristics can be adjusted with an RC circuit connected between pin 22 and ground.
25	AM AGC	0V (FM) 0.5V (AM)	25) S OMP05173	Internal load resistance R = $11k\Omega$
26	AFC	Vreg	26) OMP05174	The FM SD bandwidth can be adjusted with an external resistor connected between this pin and pin 28.
27	AM RF input	Vreg	(27)   OMP05175	This pin must be held at the same potential as pin 28
28	REG	Vreg	Q8) OMP05176	Vreg = 3.6V
29	osc	Vreg	(29 OMP05177	Connect the oscillator coil between this pin and pin 28.
30	Oscillator buffer output, FM SD sensitivity adjustment	1.6V (FM) 1.3V (AM)	W 30 OMP05177	The FM SD sensitivity can be adjusted with an external resistor connected between this pin and ground. Output impedance $\rm r_0$ = $20\Omega$



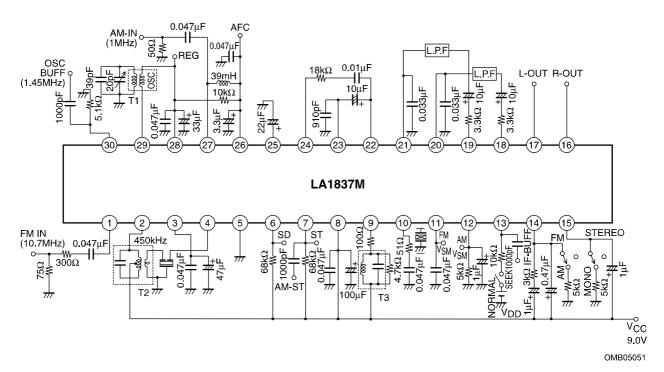








## **Test Circuit**



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