



SANYO Semiconductors

DATA SHEET

LA1827M — Monolithic Linear IC For Portable Radio/Cassette Recorders Single-Chip Tuner IC

Overview

The LA1827M is a single-chip tuner IC for FM and AM with built-in MPX-VCO which requires no adjustment and no external parts.

Features

- Single-chip tuner with AM, FM-FE/FM-IF, MPX circuitry
- Built-in adjustment-free MPX-VCO (noceramic oscillator required)
- FM-DET, adjustment-free (using ceramic deicriminator)
- Reduced FM-FE oscillation level
- FM stereo indication and AM/FM tuning indication pins provided

Functions

- AM : RF amplifier, mixer, oscillator, IF amplifier, detector, AGC, tuning display output
- FM-FE : RF amplifier, mixer, oscillator
- FM-IF : IF amplifier, quadrature detector, signal strength meter, tuning display output
- MPX : PLL stereo decoder, stereo display output, forced mono, internal VCO

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V _{CC} max		7.0	V
Indicator drive current	I _{LED}		20	mA
Allowable power dissipation	P _d max	Ta ≤ 70°C	250	mW
Operating temperature	T _{opr}		-20 to +70	°C
Storage temperature	T _{stg}		-40 to +125	°C

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SANYO Semiconductor Co., Ltd.

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

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Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V _{CC}		3.0	V
Operating supply voltage range	V _{CC op}		1.8 to 6.0	V

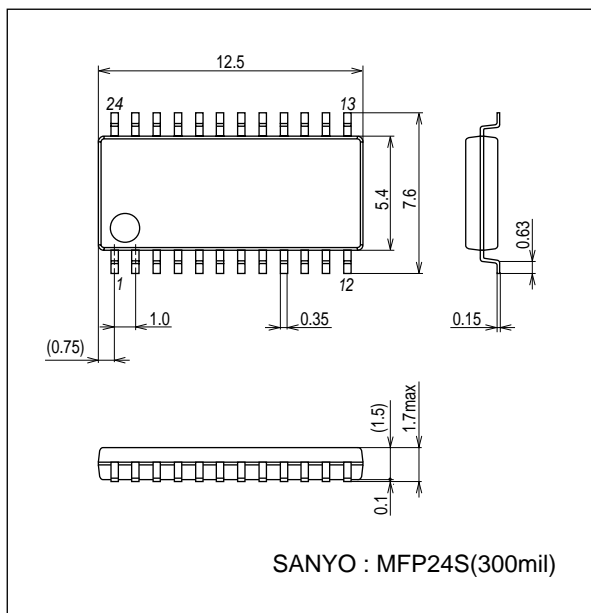
Electrical Characteristics at Ta = 25°C, V_{CC} = 3.0V, in specified test circuit, using Yamaichi Electronics socket IC-51-0242-543

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
FM-FE characteristics fc = 98MHz, fm = 1kHz, 30% mod.						
Local oscillator voltage	V _{OSC}	No input, f _{OSC} = 108.7MHz, pin 20 output *Measured with FET buffer (-10dB gain)	35	70	140	mVrms
3dB sensitivity	3dB LS	60dBμ, 30% mod. output, -3dB input		13		dBμ
Effective sensitivity	Qs	Input for S/N = 30dB		15		dBμ
FM-IF monaural characteristics fc = 10.7MHz, fm = 1kHz, 100% mod.						
Quiescent current	I _{CCO} (FM)	No input	8	16	23	mA
Demodulator output	V _O	100dBμ, pin 16 output	120	160	215	mVrms
Signal-to-noise ratio	S/N	100dBμ, pin 16 output	63	71		dB
Total harmonic distortion (mono)	THD	100dBμ, pin 16 output		0.5	1.5	%
3dB sensitivity	3dB LS	100dBμ, 100% mod. output, -3dB input		35	42	dBμ
TU-LED sensitivity	SD-ON	No modulation		45		dBμ
FM-IF stereo characteristics fc = 10.7MHz, fm = 1kHz, L + R = 90%, pilot = 10%						
Separation	SEP	100dBμ, L-mod, pin 16/pin 17 output	25	40		dB
ST-LED sensitivity	ST-ON	100dBμ, pilot modulation for pin 8 voltage < 0.5V	1.5	3.5	6.3	%
Total harmonic distortion (main)	THD	100dBμ, main modulation, pin 16 output		0.5	1.5	%
AM characteristics fc = 1000kHz, fm = 1kHz, 30% mod.						
Quiescent current	I _{CCO} (AM)	No input	4	7	12	mA
Demodulator output	V _{O1}	23dBμ, pin 16 output	12	25	40	mVrms
	V _{O2}	80dBμ, pin 16 output	52	78	117	mVrms
Signal-to-noise ratio	S/N1	23dBμ, pin 16 output	15	20		dB
	S/N2	80dBμ, pin 16 output	47	53		dB
Total harmonic distortion	THD	80dBμ, pin 16 output		0.5	1.5	%
TU-LED sensitivity	SD-ON	No modulation		30		dBμ

Package Dimensions

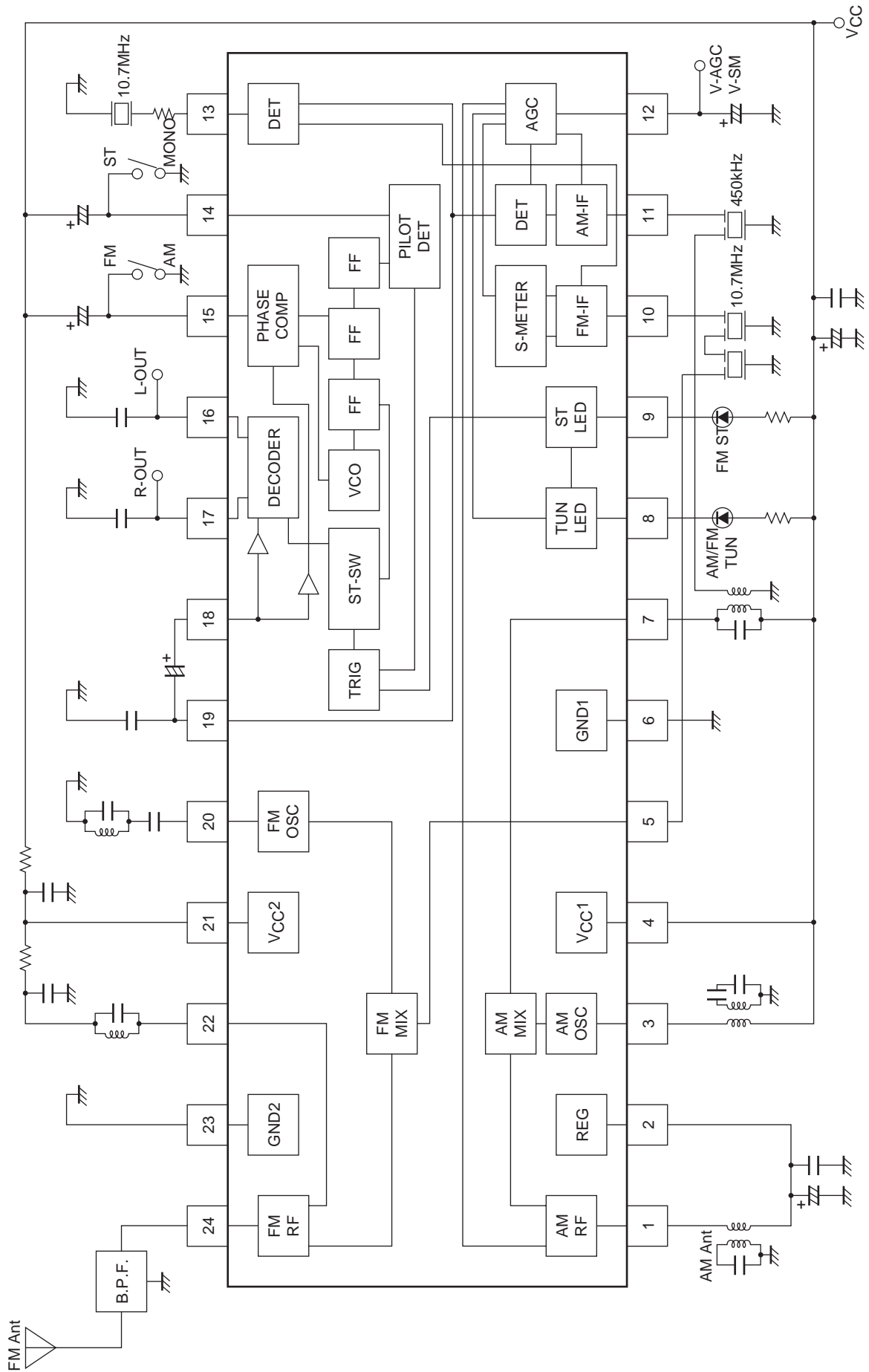
unit : mm (typ)

3112B

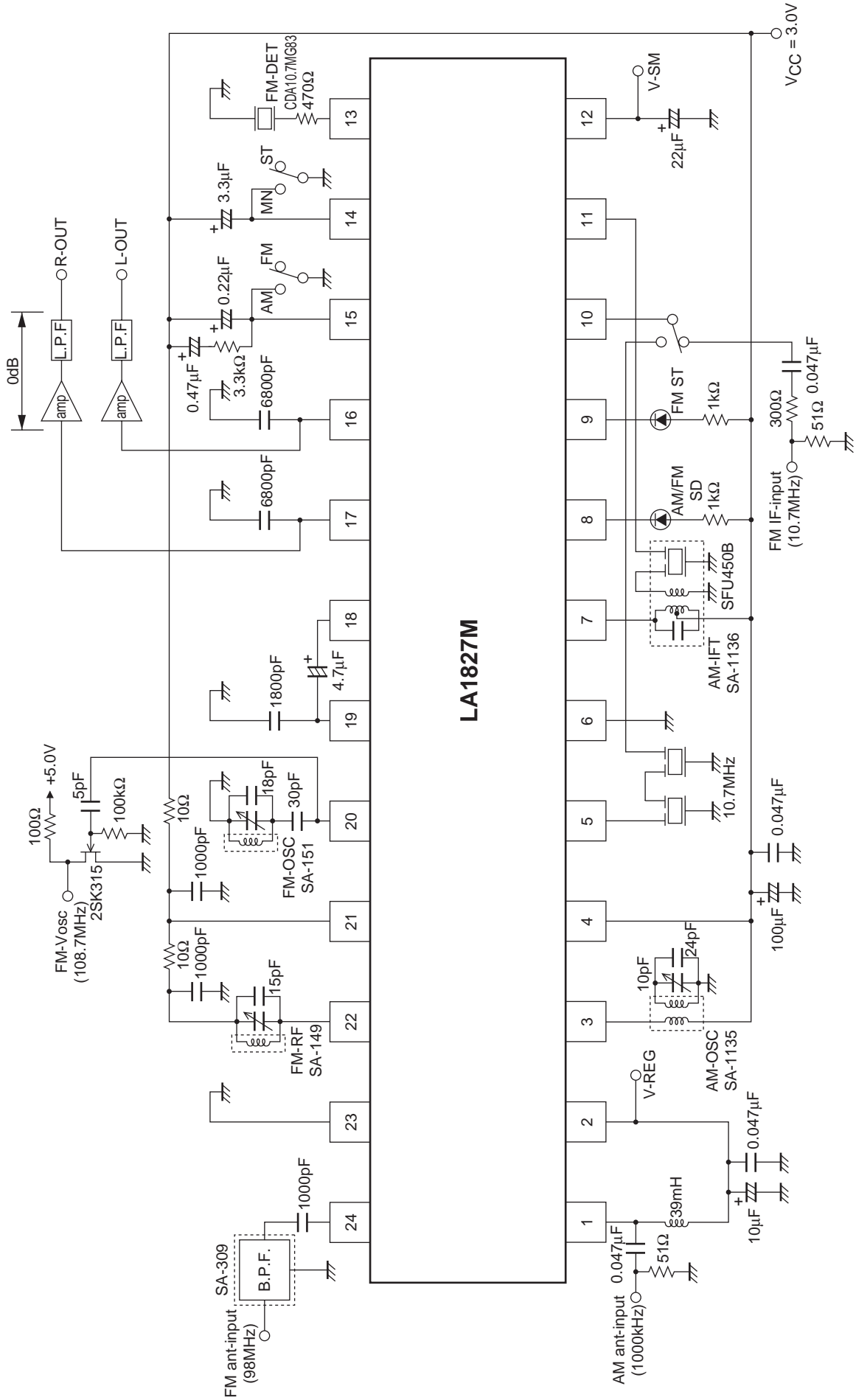


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Block Diagram

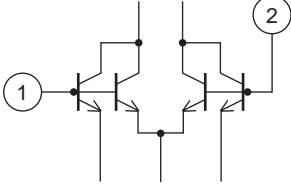
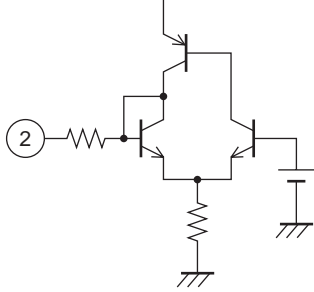
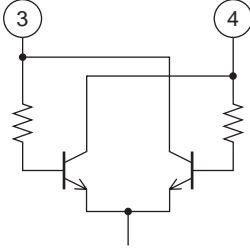
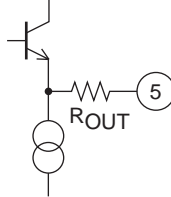
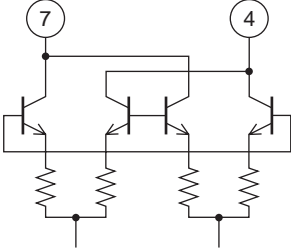
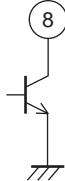


Test Circuit



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Pin Description and Quiescent Voltage at $V_{CC} = 3.0V$

Pin No.	Pin function	Quiescent voltage (V)		Description	Equivalent circuit
		AM	FM		
1	AM RF input	1.2	1.2	AM antenna coil connected between pins 1 and 2 (reg).	
2	Reg	1.2	1.2		
3	AM-OSC	3.0	3.0	Oscillator coil connected between pins 3 and 4 (V_{CC1}).	
4	V_{CC1}	3.0	3.0	AM/FM-IN/MPX block V_{CC}	
5	FM mixer output	1.4	1.2	$R_{OUT} = 270\Omega$	
6	GND1	0	0	AM/FM-IN/MPX section ground	
7	AM mixer output	3.0	3.0	Mixer coil connected between pins 7 and 4 (V_{CC1}).	
8	Tu-LED output	3.0	3.0	Active low Open-collector output can directly drive LED ($I_C \text{ max} = 20\text{mA}$)	

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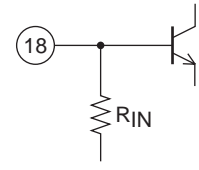
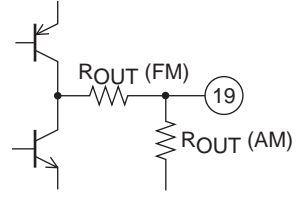
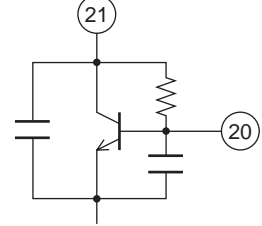
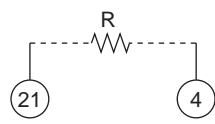
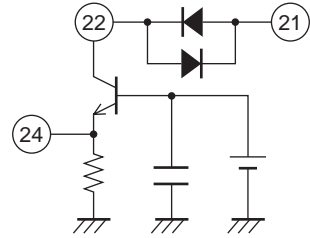
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Pin No.	Pin function	Quiescent voltage (V)		Description	Equivalent circuit
		AM	FM		
9	ST-LED output and AM-IF output	3.0	3.0	Active low Open-collector output can directly drive LED ($I_C \text{ max} = 20\text{mA}$) In AM operation, AM-IF signal (450kHz) is output here.	
10	FM-IF input	1.2	1.2	$R_{IN} = 330\Omega$	
11	AM-IF input	1.2	1.2	$R_{IN} = 2k\Omega$	
12	AM-AGC output and FM S meter output	0.5	0.1	Internal load resistance $R = 16.6k\Omega$	
13	FM detector	2.4	2.2	Recommended ceramic discriminator CDF107F-AE-019 (Toko) CDA10.7MG83 (Murata)	
14	Pilot tone detector filter and forced mono switching	1.7	2.3	Mono mode is forced on by connecting pin 14 to ground.	
15	Phase comparator filter and AM/FM switching	0	2.3	FM reception mode is enabled when pin 15 is open. AM reception mode is enabled when pin 15 is connected to ground.	
16 17	L output R output	1.2	1.2	$R_{OUT} = 7.5k\Omega$	

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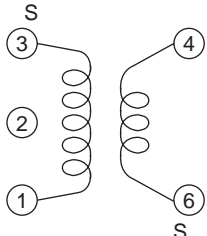
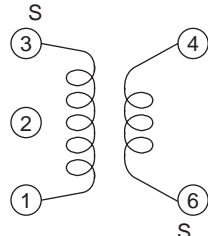
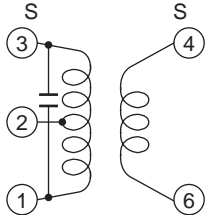
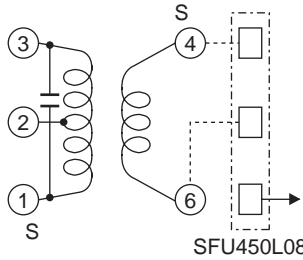
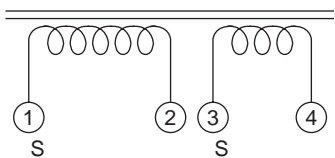
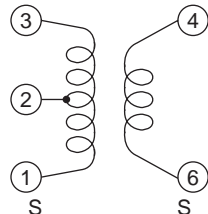
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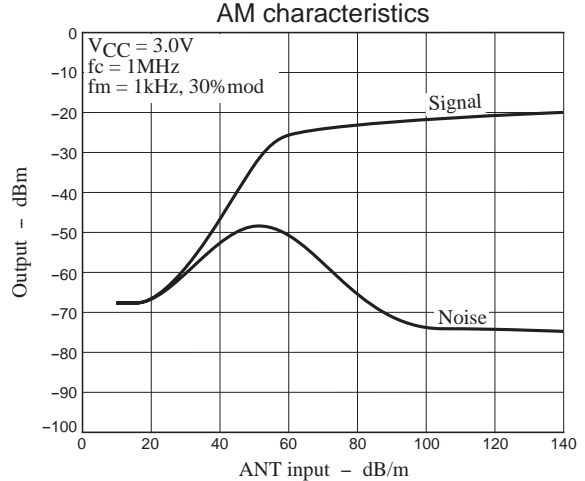
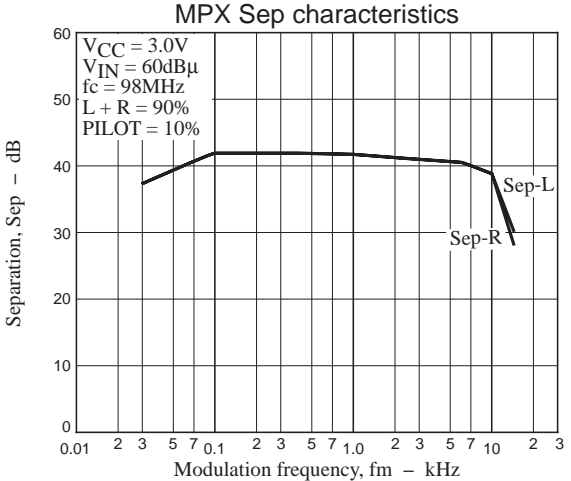
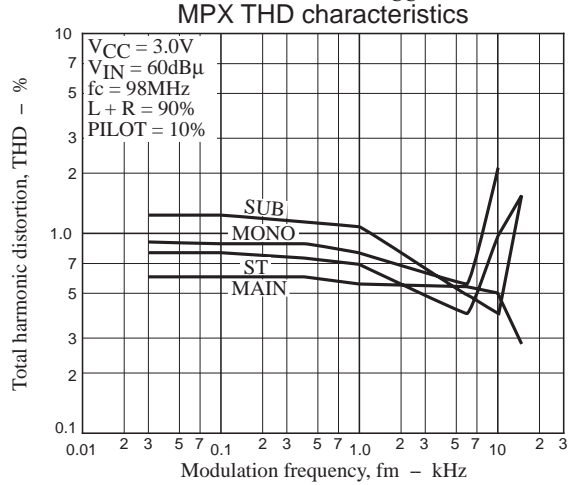
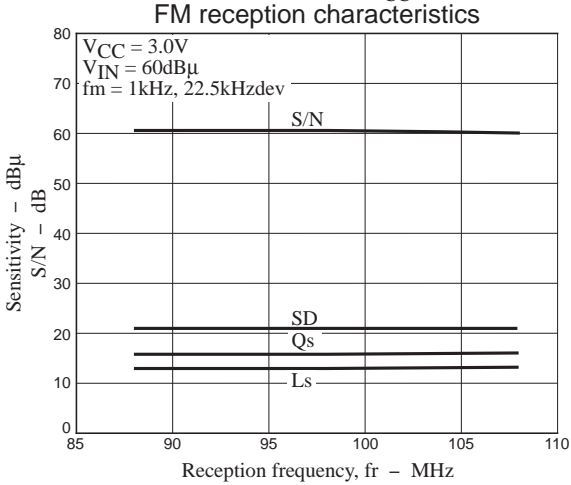
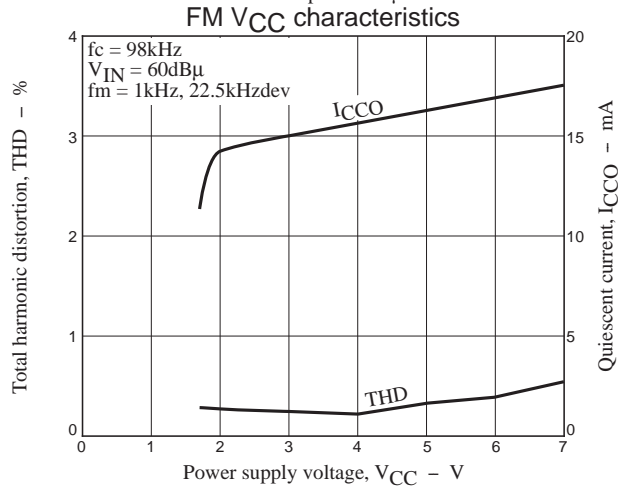
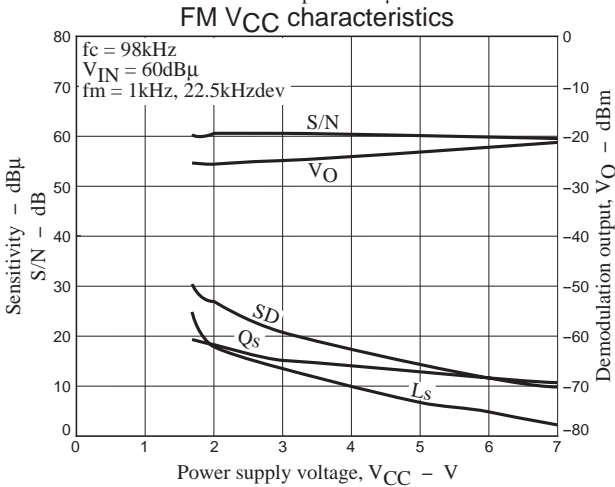
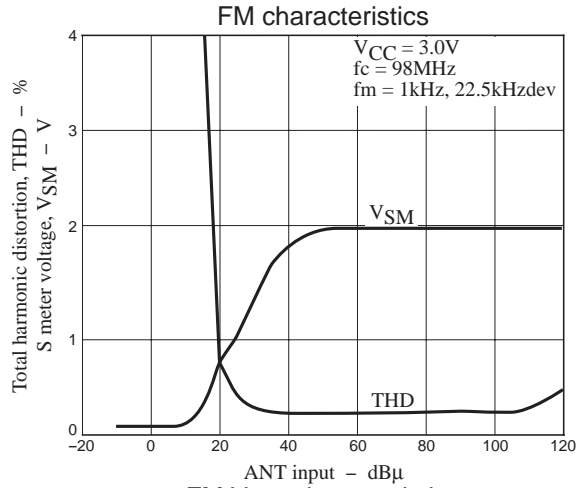
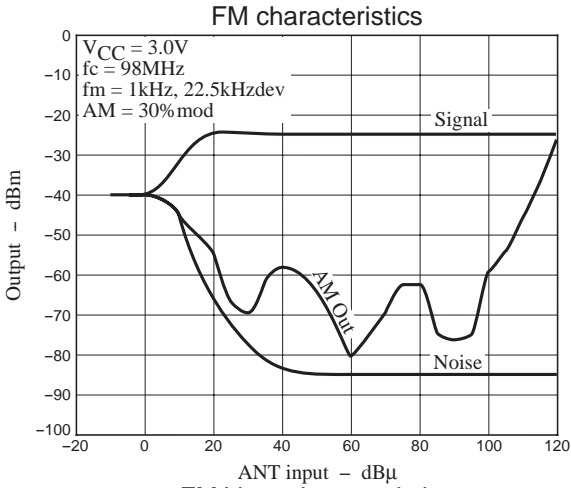
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Pin No.	Pin function	Quiescent voltage (V)		Description	Equivalent circuit
		AM	FM		
18	MPX input	1.2	1.2	$R_{IN} = 50k\Omega$	
19	FM detector output and AM detector output	0.4	1.2	Output impedance AM : $R_{OUT} = 50k\Omega$ FM : $R_{OUT} = 500\Omega$ Capacitance between pin 19 and ground should be optimized for the best separation characteristics.	
20	FM-OSC	3.0	2.9	Colpitts oscillator circuit FM oscillator coil is connected to pin 20.	
21	V _{CC2}	3.0	2.9	FM-FE block V _{CC} Power is supplied from pin 4 (V _{CC1}) via external resistor (10Ω).	
22	FM-RF output	3.0	2.9	FM RF coil is connected between pins 22 and 21 (V _{CC2}).	
24	FM-RF input	0	0.8	$R_{IN} = 1.8k\Omega$	
23	GND2	0	0	FM-FE block ground	

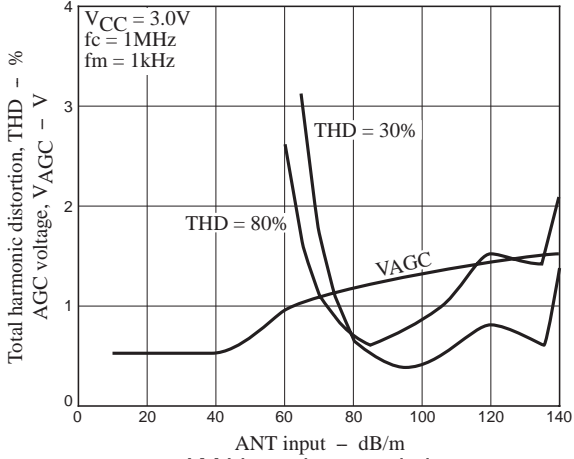
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Coil specifications (bottom view)

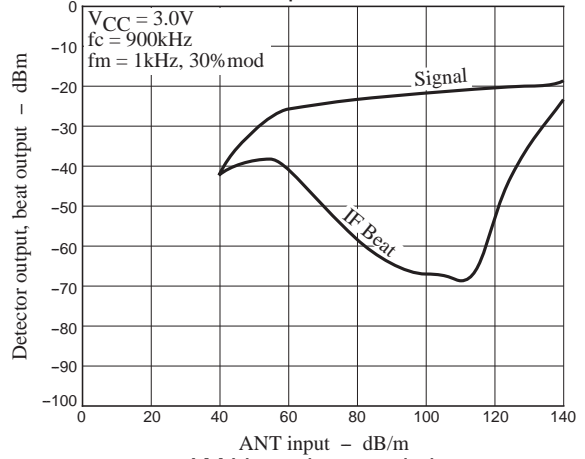
•FM-BPF : SA-309 (Sumida) 88 to 108MHz	
•FM-RF : SA-149 (Sumida) 3.6mm dia., air core, 0.6mm wire, 4 1/2 T	
•FM-OSC : SA-151 (Sumida) 3.6mm dia., air core, 0.6mm wire, 3 1/2 T	
•FM-IF filter, discriminator : SK107M1-AE-10, CDF107F-AE-019, $R_s = 510\Omega$ (Toko) SFE10.7MA5, CDA10.7MG83, $R_s = 470\Omega$ (Murata)	
<p>•AM-OSC : SA-181 (Sumida)</p>  <p>6-4 37T 3-1 74T 0.06UEW $f_o = 796\text{kHz}$ $Q_o \geq 80$ $L = 140\mu\text{H}$</p>	<p>•L7BRS-3132AQ (Toko)</p>  <p>3-1 64T 6-4 32T 0.06 2UEW $f_o = 796\text{kHz}$ $Q_o \geq 65$ $L = 140\mu\text{H}$</p>
<p>•AM-IFT : SA-1136 (Sumida)</p>  <p>3-2 122T 4-6 9T 2-1 62T 0.06UEW $f_o = 450\text{kHz}$ $Q_o \geq 65$ With 180pF internal capacitor</p>	<p>•PCFAZ-082 (Toko)</p>  <p>1-2 47T 2-3 100T 4-6 12T $f_o = 450\text{kHz}$ With 180pF internal capacitor With AM-IF filter</p>
•AM-IF filter : SFU450B (Murata)	
<p>•Poly-varicon : FT-2217 (Toko) PVC-22KTL (Mitsumi)</p>	<p>•MW bar antenna : TYA-1005 (Mitsumi)</p>  <p>1-2 68T 3-4 9T $f_o = 796\text{kHz}$ $Q_o \geq 230$ $L = 260\mu\text{H}$</p>
For DUT PCB	
<p>•FM-Discriminator : CDA10.7MG1-B (Murata)</p>	<p>•AM-OSC : SA-1135 (Sumida)</p>  <p>1-2 58T 4-6 7T 2-3 94T 0.06UEW $f_o = 796\text{kHz}$ $Q_o \geq 80$ $L = 270\mu\text{H}$</p>



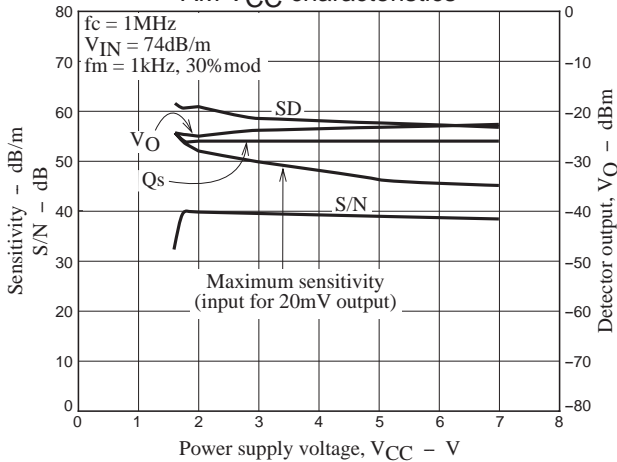
AM characteristics



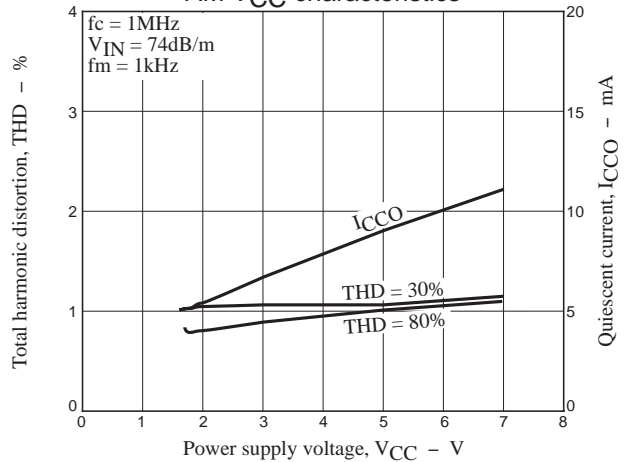
AM beat output characteristics



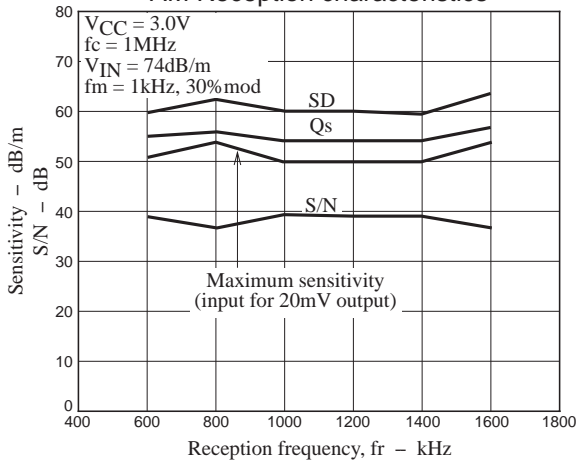
AM V_{CC} characteristics



AM V_{CC} characteristics



AM Reception characteristics



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