



LA1827M

Single-Chip Tuner IC for Portable Radio /Cassette Recorders

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.

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

Features

- Single-chip tuner with AM, FM-FE/FM-IF, MPX circuitry
- Built-in adjustment-free MPX-VCO (no ceramic oscillator required)
- FM-DET, adjustment-free (using ceramic discriminator)
- Reduced FM-FE oscillation level
- FM stereo indication and AM/FM tuning indication pins provided.

Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CCmax}		7.0	V
Indicator drive current	I_{LED}		20	mA
Allowable power dissipation	P_{dmax}	$T_a \leq 70^\circ\text{C}$	250	mW
Operating temperature	T_{opr}		-20 to +70	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +125	$^\circ\text{C}$

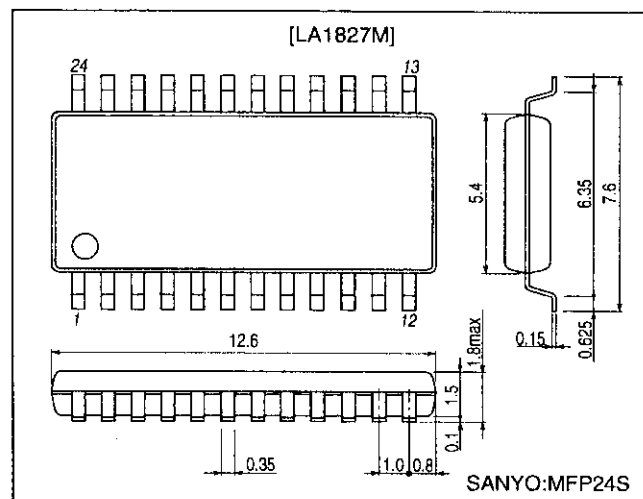
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Package Dimensions

unit:mm

3112-MFP24S



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Operating Conditions at $T_a = 25^\circ\text{C}$

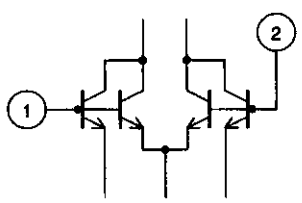
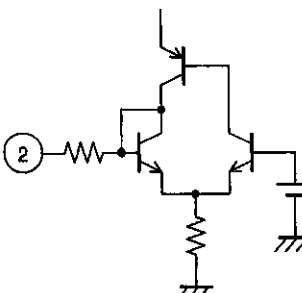
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3.0	V
Operating supply voltage range	$V_{CC(9P)}$		1.8 to 6.0	V

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 3.0\text{V}$,

in specified test circuit, using Yamaichi Electronics socket IC51-0242-543

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

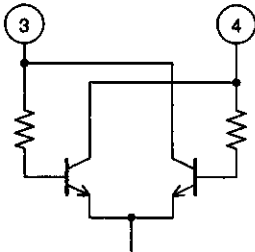
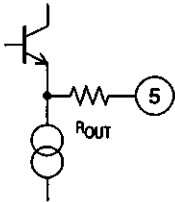
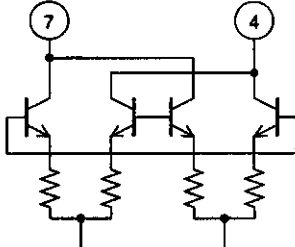

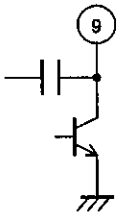
Pin Description and Quiescent Voltage at $V_{CC} = 3.0\text{V}$

Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
1	AM RF Input	1.2	1.2	 <p style="text-align: right;">A10836</p>	AM antenna coil connected between pins 1 and 2 (reg)
2	Reg	1.2	1.2	 <p style="text-align: right;">A10837</p>	

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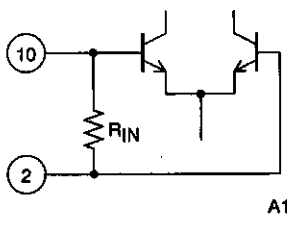
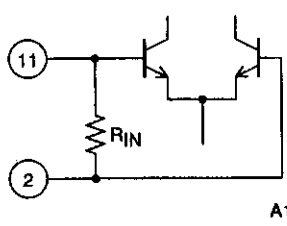
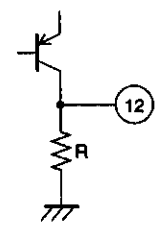
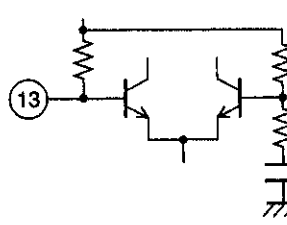
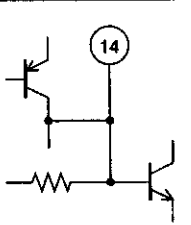
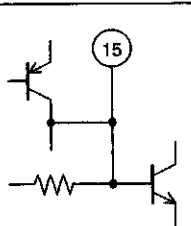
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
3	AM-OSC	3.0	3.0	 <p>A10838</p>	Oscillator coil connected between pins 3 and 4 (V_{CC1})
4	V_{CC1}	3.0	3.0		AM/FM-IN/MPX block V_{CC}
5	FM mixer output	1.4	1.2	 <p>A10839</p>	$R_{OUT} = 270\Omega$
6	GND1	0	0		AM/FM-IN/MPX section ground
7	AM mixer output	3.0	3.0	 <p>A10840</p>	Mixer coil connected between pins 7 and 4 (V_{CC1})
8	Tu-LED output	3.0	3.0	 <p>A10841</p>	Active low Open-collector output can directly drive LED ($I_C \text{ max} = 20 \text{ mA}$)
9	ST-LED output and AM-IF output	3.0	3.0	 <p>A10842</p>	Active low Open-collector output can directly drive LED ($I_C \text{ max} = 20 \text{ mA}$) In AM operation, AM-IF signal (450 kHz) is output here.

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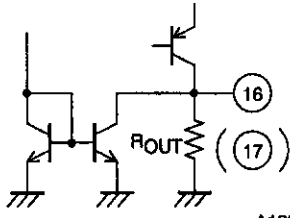
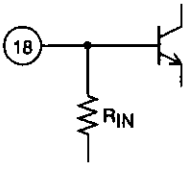
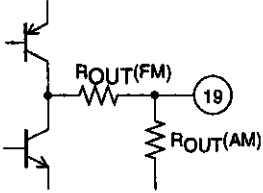
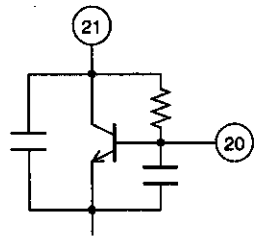
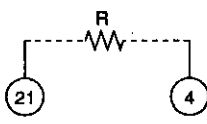
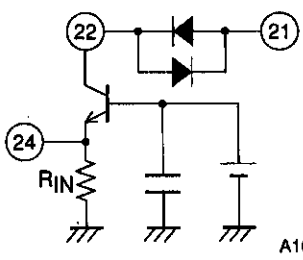
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
10	FM-IF input	1.2	1.2	 <p>A10843</p>	$R_{IN} = 330 \Omega$
11	AM-IF input	1.2	1.2	 <p>A10844</p>	$R_{IN} = 2 \text{ k}\Omega$
12	AM-AGC output and FM signal meter output	0.5	0.1	 <p>A10845</p>	Internal load resistance $R = 16.6 \text{ k}\Omega$
13	FM detector	2.4	2.2	 <p>A10846</p>	Reccomended ceramic discriminator CDF107F-AE-019 (Toko) CDA10.7MG83 (Murata)
14	Pilot tone detector filter and forced mono switching	1.7	2.3	 <p>A10847</p>	Mono mode is forced on by connecting pin 14 to ground.
15	Phase comparator filter and AM/FM switching	0	2.3	 <p>A10848</p>	FM reception mode is enabled when pin 15 is open. AM reception mode is enabled when pin 15 is connected to ground.

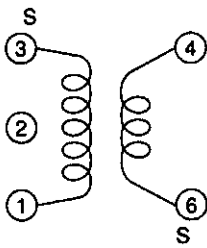
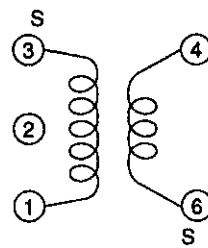
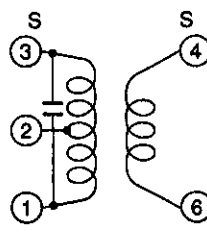
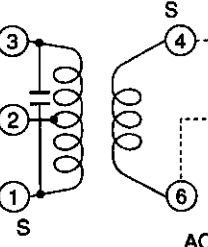
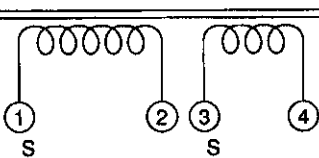
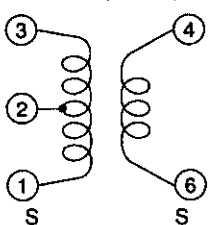
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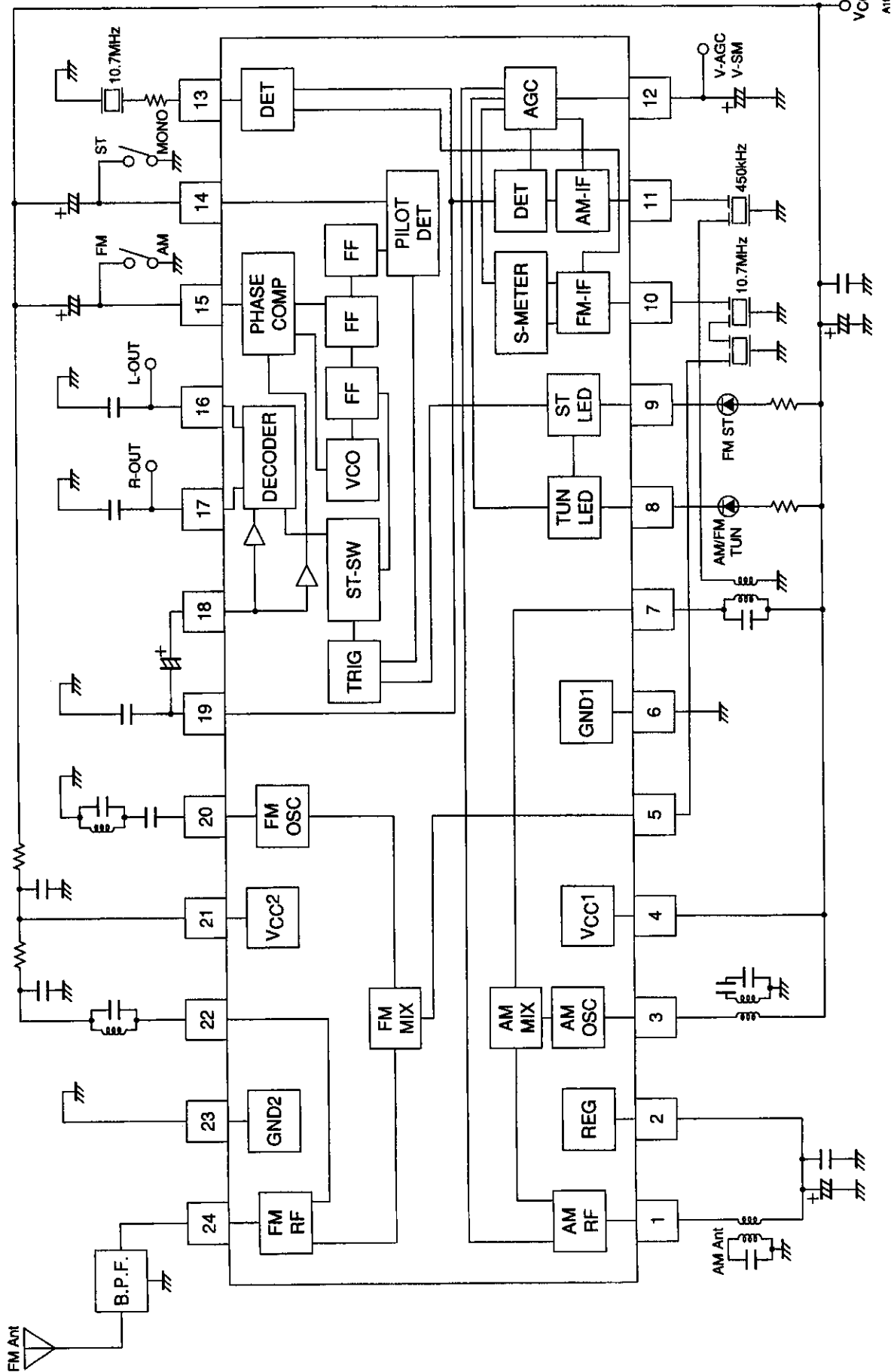
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
16 17	L output R output	1.2	1.2	 <p>A10849</p>	$R_{OUT} = 7.5 \text{ k}\Omega$
18	MPX input	1.2	1.2	 <p>A10850</p>	$R_{IN} = 50 \text{ k}\Omega$
19	FM detector output and AM detector output	0.4	1.2	 <p>A10851</p>	Output impedance AM: $R_{OUT} = 50 \text{ k}\Omega$ 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	 <p>A10852</p>	Colpitts oscillator circuit FM oscillator coil is connected to pin 20.
21	V_{CC2}	3.0	2.9	 <p>A10853</p>	FM-FE block V_{CC} Power is supplied from pin 4 (V_{CC1}) via external resistor (10Ω).
22 24	FM-RF output FM-RF input	3.0 0	2.9 0.8	 <p>A10854</p>	FM RF coil is connected between pins 22 and 21 (V_{CC2}). $R_{IN} = 1.8 \text{ k}\Omega$
23	GND2	0	0		FM-FE block ground

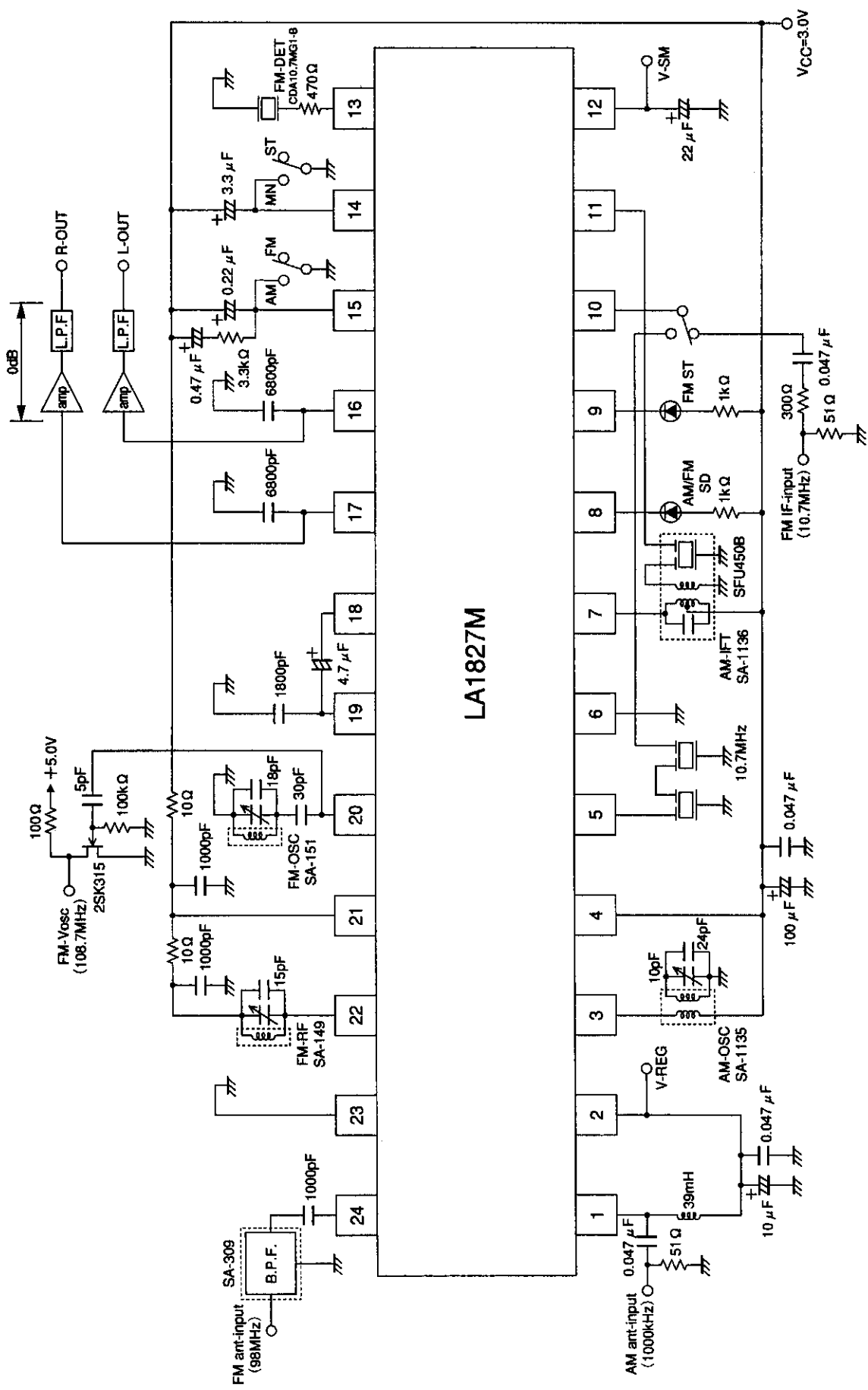
Coil specifications (bottom view)

<p>• FM-BPF: SA-309 (Sumida) 88 to 108 MHz</p>	
<p>• FM-RF: SA-149 (Sumida) 3.6 mm dia., air core, 0.6 mm wire, 4 1/2 T</p>	
<p>• FM-OSC: SA-151 (Sumida) 3.6 mm dia., air core, 0.6 mm wire, 3 1/2 T</p>	
<p>• FM-IF filter, discriminator: SK107M1-AE-10, CDF107F-AE-019, $R_s=510\Omega$ (Toko) SEF10, 7MA5, CDA10.7MG83, $R_s=470\Omega$ (Murata)</p>	
<p>• AM-OSC: SA-181 (Sumida)</p>  <p>③ - ④ 37T ③ - ① 74T 0.06 UEW $f_0 = 796$ kHz $Q_0 \geq 80$ $L = 140\mu\text{H}$</p> <p>A10830</p>	<p>• L7BRS-3132AQ (Toko)</p>  <p>③ - ① 64T ③ - ④ 32T 0.06 2UEW $f_0 = 796$ kHz $Q_0 \geq 65$ $L = 140\mu\text{H}$</p> <p>A10831</p>
<p>• AM-IFT: SA-1136 (Sumida)</p>  <p>③ - ② 122T ④ - ⑥ 9T ② - ① 62T 0.06UEW $f_0 = 450$ kHz $Q_0 \geq 65$ With 180 pF internal capacitor</p> <p>A10832</p>	<p>• PCFAZ-082 (Toko)</p>  <p>① - ② 47T ② - ③ 100T ④ - ⑥ 12T $f_0 = 450$ kHz With 180 pF internal capacitor With AM-IF filter</p> <p>ACFA-450L08 A10833</p>
<p>• AM-IF filter: SFU450B (Murata)</p>	
<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 $f_0 = 796$ kHz $Q_0 \geq 230$ $L = 280\mu\text{H}$</p> <p>A10834</p>
<p>For DUT PCB</p>	
<p>• FM-Discriminator: CDA10.7 MG1-B (Murata)</p>	<p>• AM-OSC: SA-1135 (Sumida)</p>  <p>③ - ④ 11T ① - ② 99T ② - ③ 3T 0.06UEW $f_0 = 796$ kHz $Q_0 \geq 80$ $L = 270\mu\text{H}$</p> <p>A10835</p>

Block Diagram

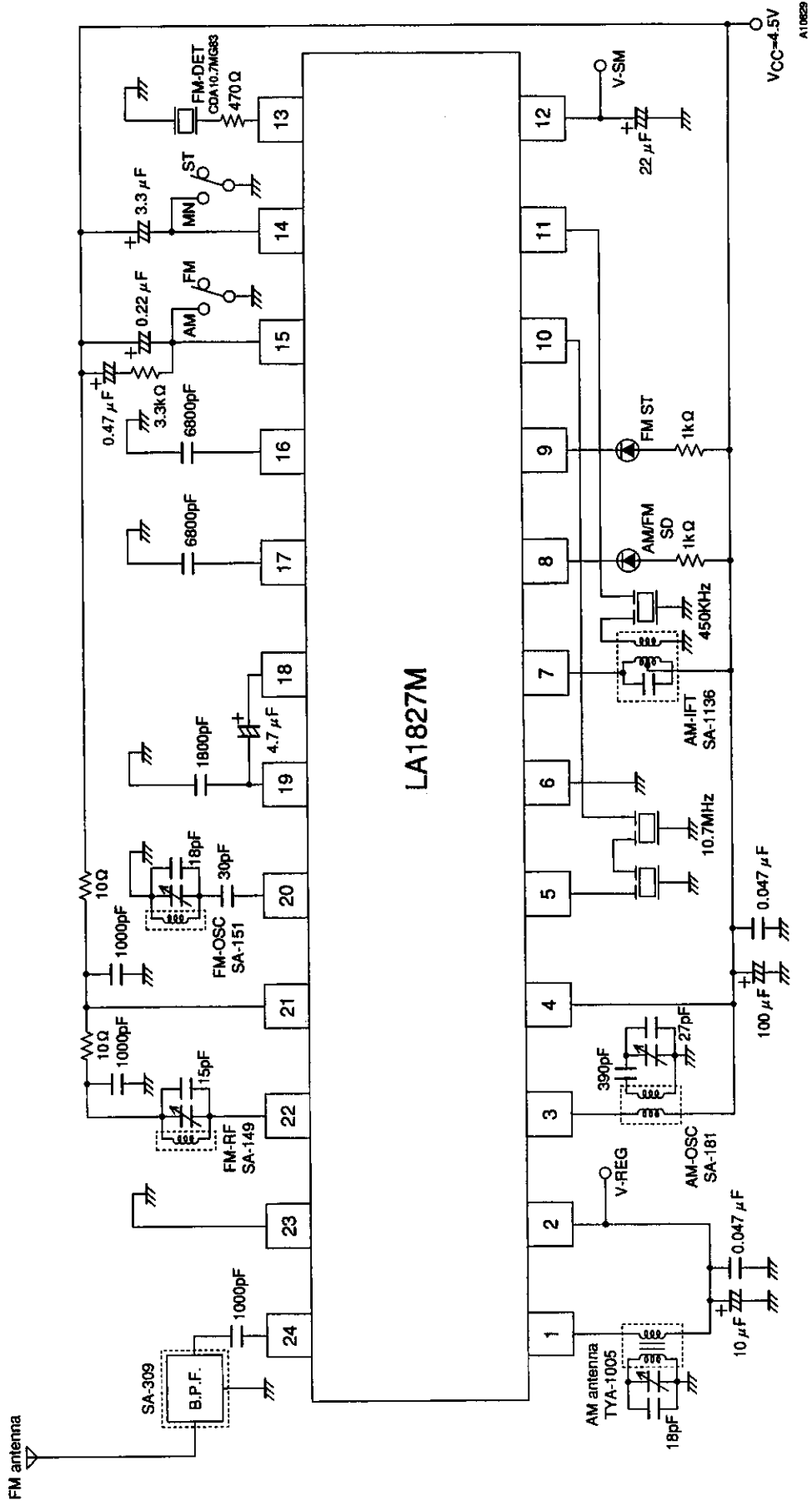


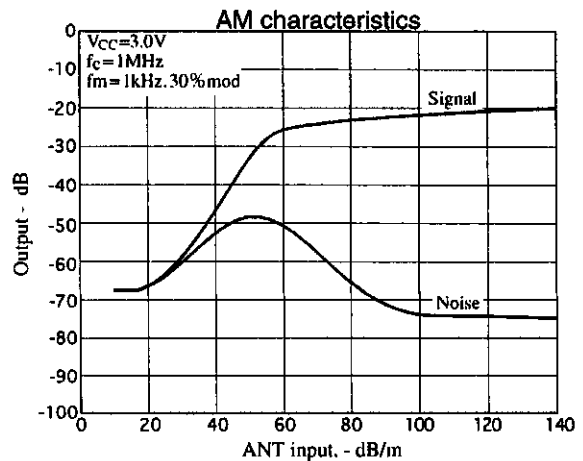
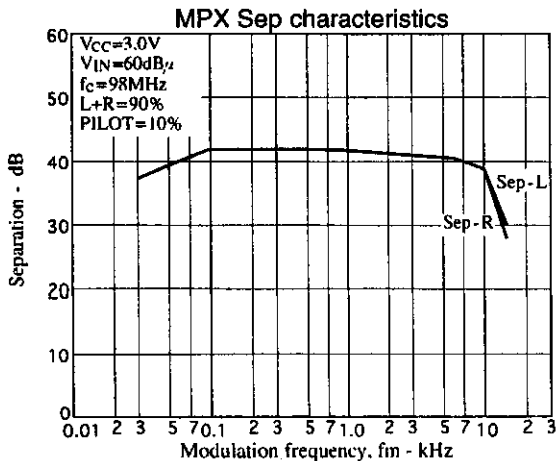
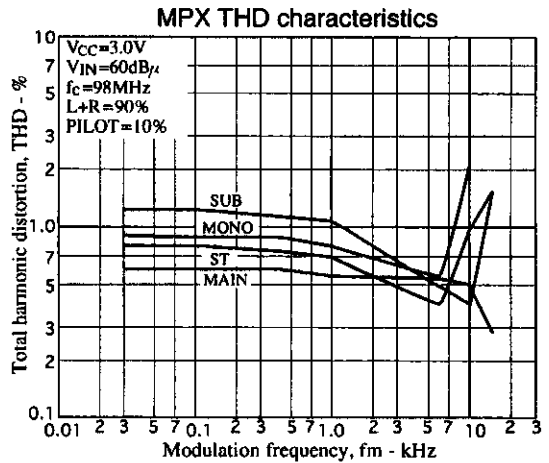
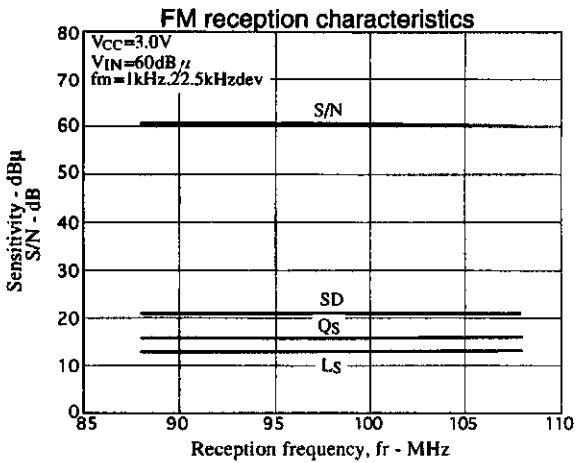
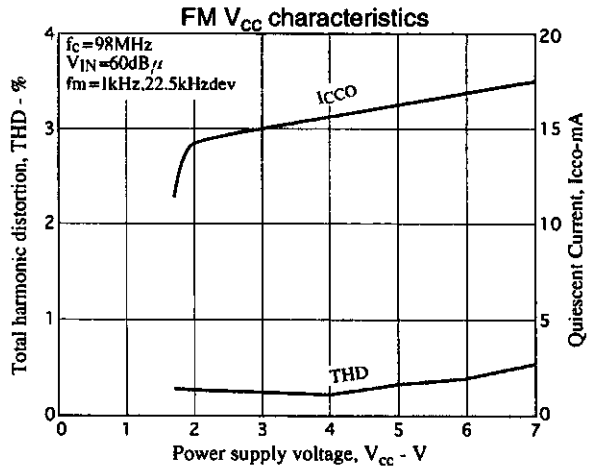
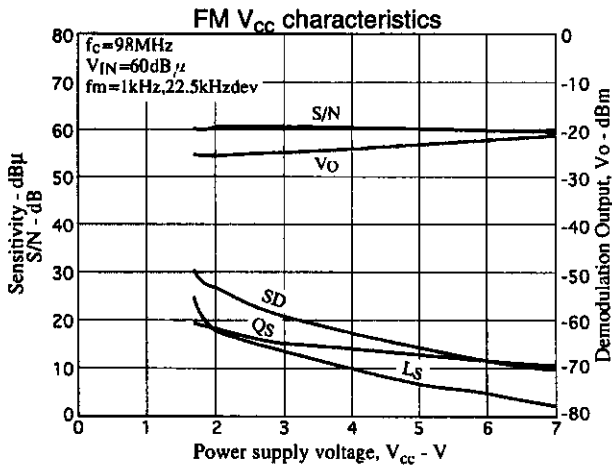
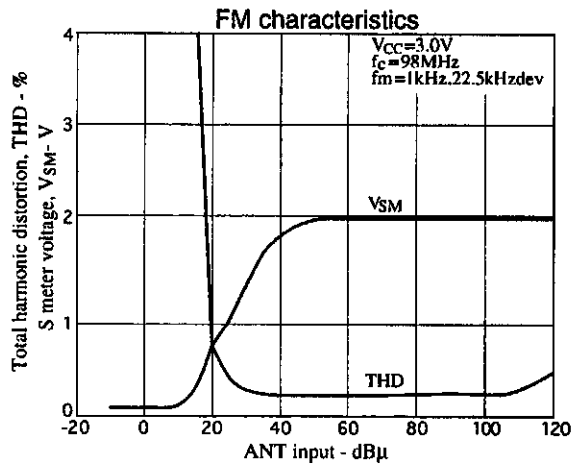
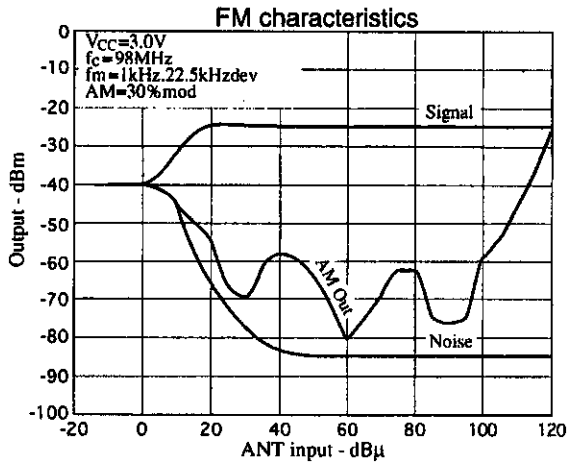
Test Circuit



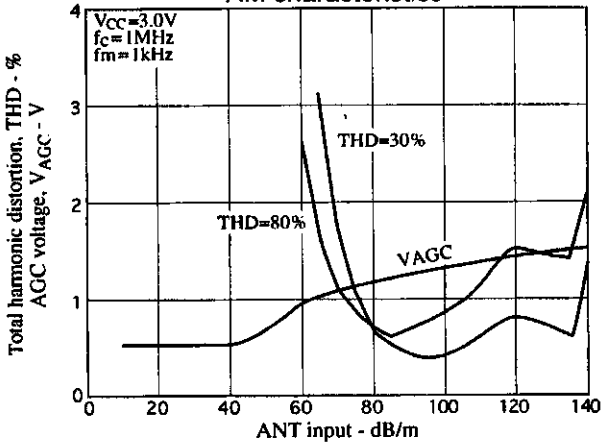
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Sample Application Circuit

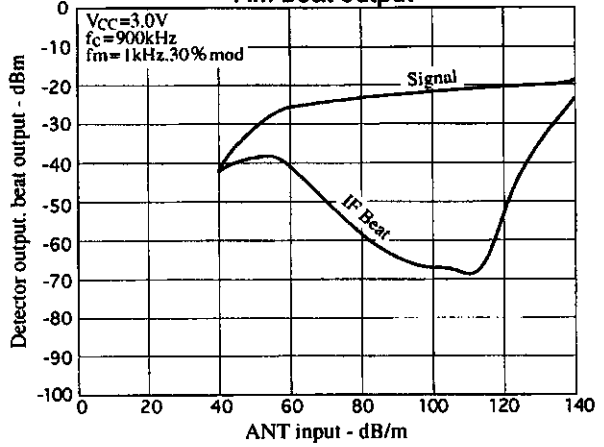




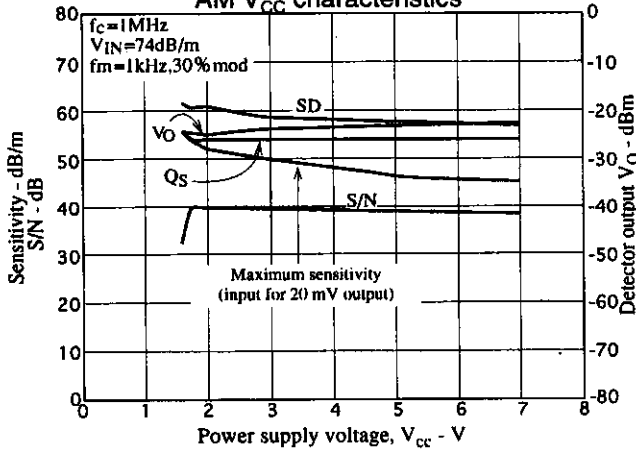
AM characteristics



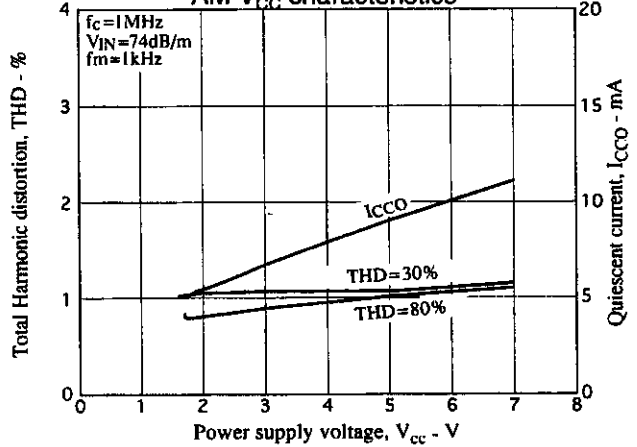
AM beat output



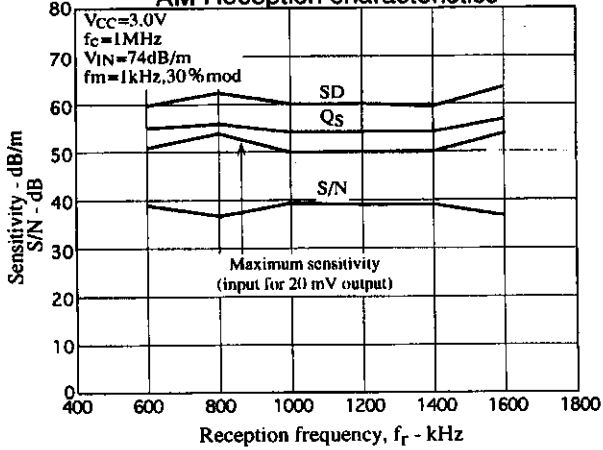
AM V_{CC} characteristics



AM V_{CC} characteristics



AM Reception characteristics



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