



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 Ta = 25°C

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

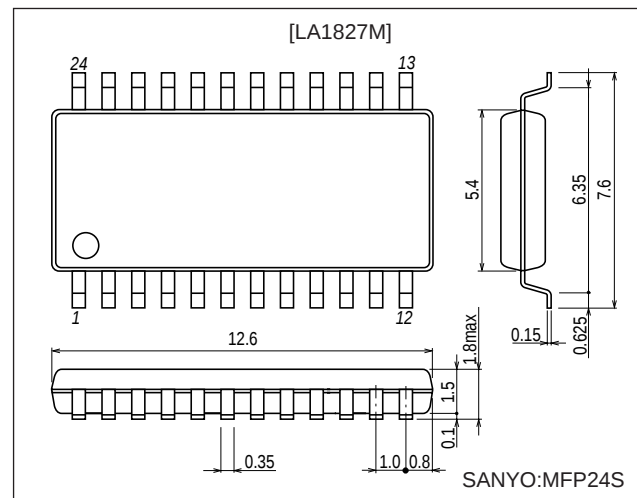
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Package Dimensions

unit:mm

3112-MFP24S



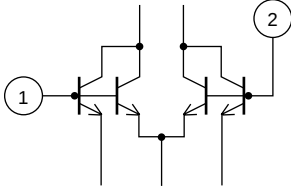
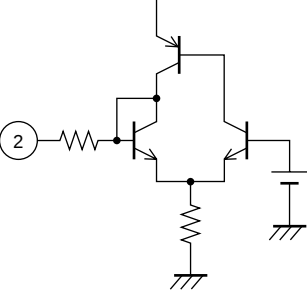
Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3.0	V
Operating supply voltage range	$V_{CC^{OP}}$		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**

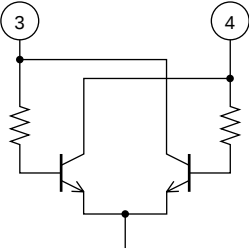
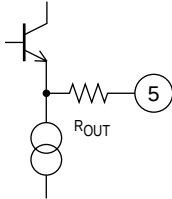
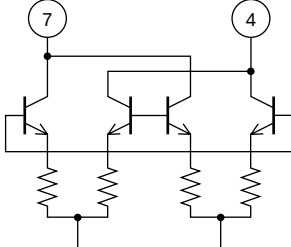
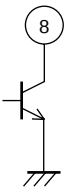
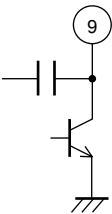
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[FM-FE characteristics]: fc = 98 MHz, fm = 1 kHz, 30% mod.						
Local oscillator voltage	V _{OSC}	No input, f _{OSC} =108.7 MHz, pin 20 output *Measured with FET buffer (-10 dB gain)	35	70	140	mVrms
3 dB sensitivity	3dB LS	60 dBμ, 30% mod. output,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

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	 A10836	AM antenna coil connected between pins 1 and 2 (reg)
2	Reg	1.2	1.2	 A10837	

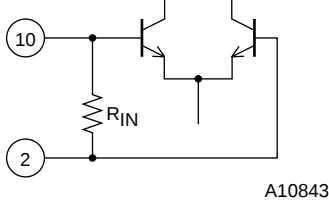
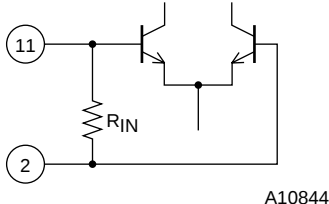
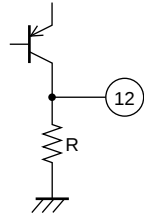
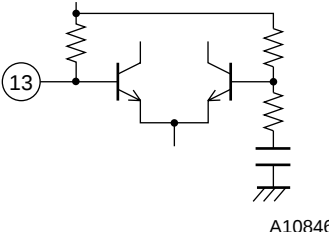
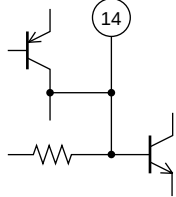
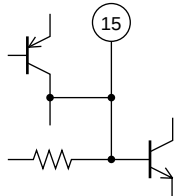
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
3	AM-OSC	3.0	3.0	 A10838	Oscillator coil connected between pins 3 and 4 (V_{CC1})
4	V_{CC1}	3.0	3.0		AM/FM-IN/MPX block V_{CC}
5	FM mixer output	1.4	1.2	 A10839	$R_{OUT} = 270\Omega$
6	GND1	0	0		AM/FM-IN/MPX section ground
7	AM mixer output	3.0	3.0	 A10840	Mixer coil connected between pins 7 and 4 (V_{CC1})
8	Tu-LED output	3.0	3.0	 A10841	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	 A10842	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.

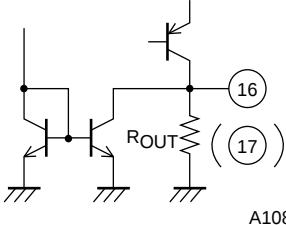
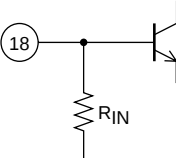
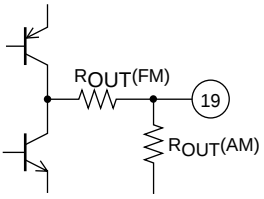
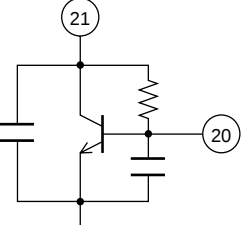
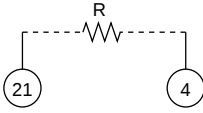
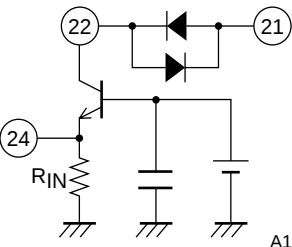
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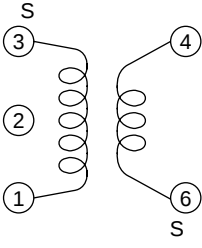
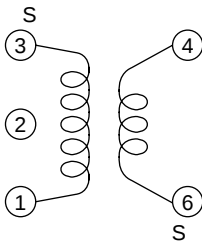
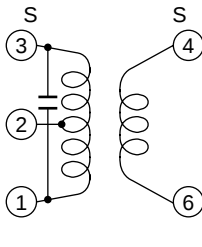
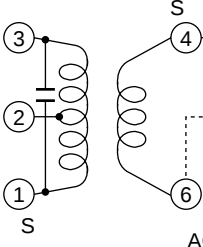
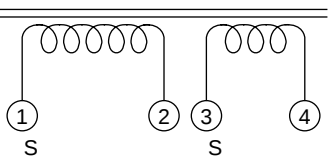
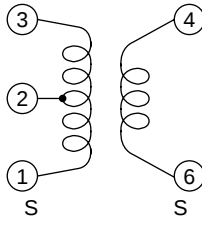
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
10	FM-IF input	1.2	1.2	 A10843	$R_{IN} = 330 \Omega$
11	AM-IF input	1.2	1.2	 A10844	$R_{IN} = 2 \text{ k}\Omega$
12	AM-AGC output and FM signal meter output	0.5	0.1	 A10845	Internal load resistance $R = 16.6 \text{ k}\Omega$
13	FM detector	2.4	2.2	 A10846	Recommened ceramic discriminator CDF107F-AE-019 (Toko) CDA10.7MG83 (Murata)
14	Pilot tone detector filter and forced mono switching	1.7	2.3	 A10847	Mono mode is forced on by connecting pin 14 to ground.
15	Phase comparator filter and AM/FM switching	0	2.3	 A10848	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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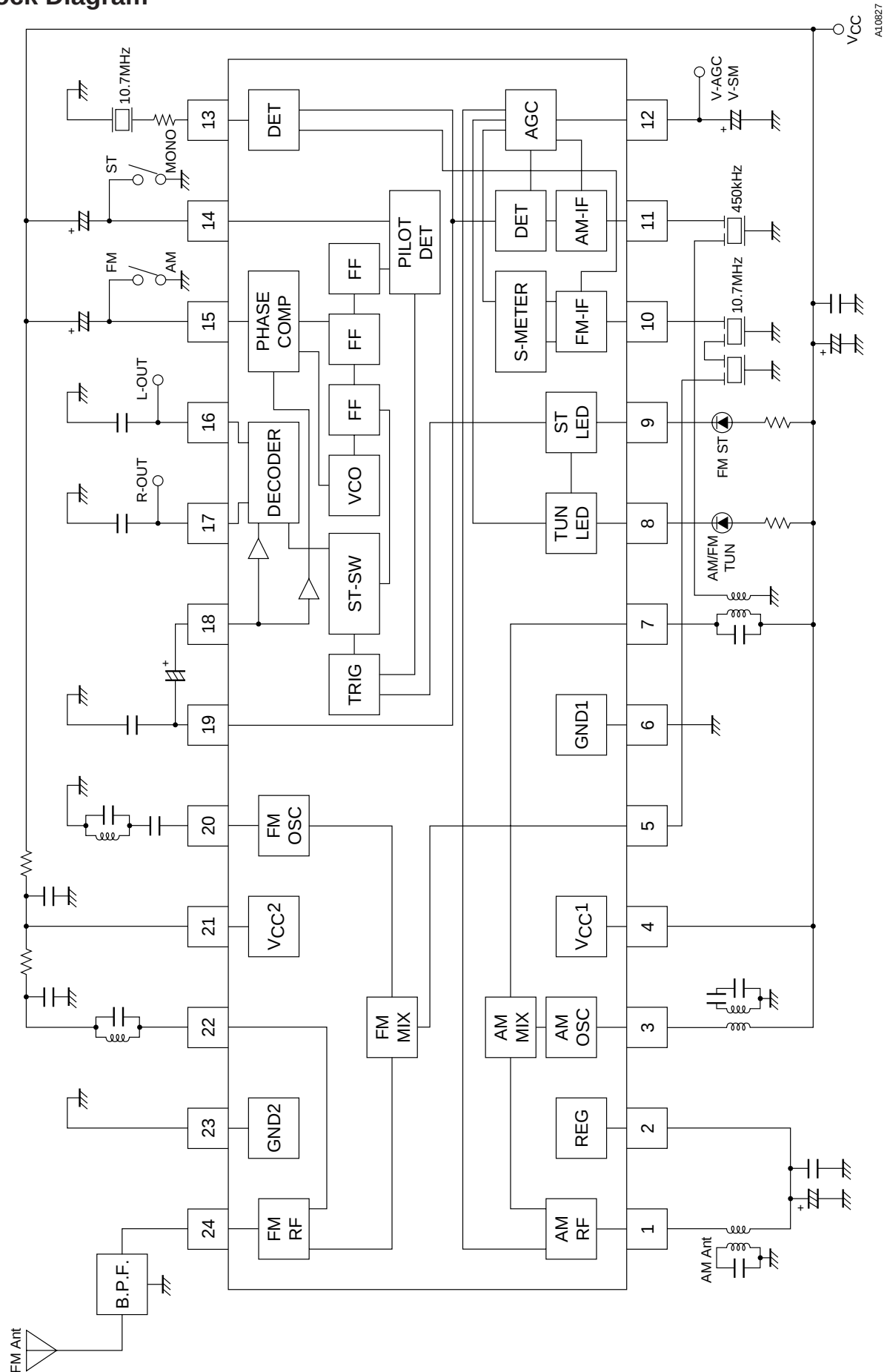
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
16 17	L output R output	1.2	1.2	 A10849	$R_{OUT} = 7.5 \text{ k}\Omega$
18	MPX input	1.2	1.2	 A10850	$R_{IN} = 50 \text{ k}\Omega$
19	FM detector output and AM detector output	0.4	1.2	 A10851	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	 A10852	Colpitts oscillator circuit FM oscillator coil is connected to pin 20.
21	V_{CC2}	3.0	2.9	 A10853	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	 A10854	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

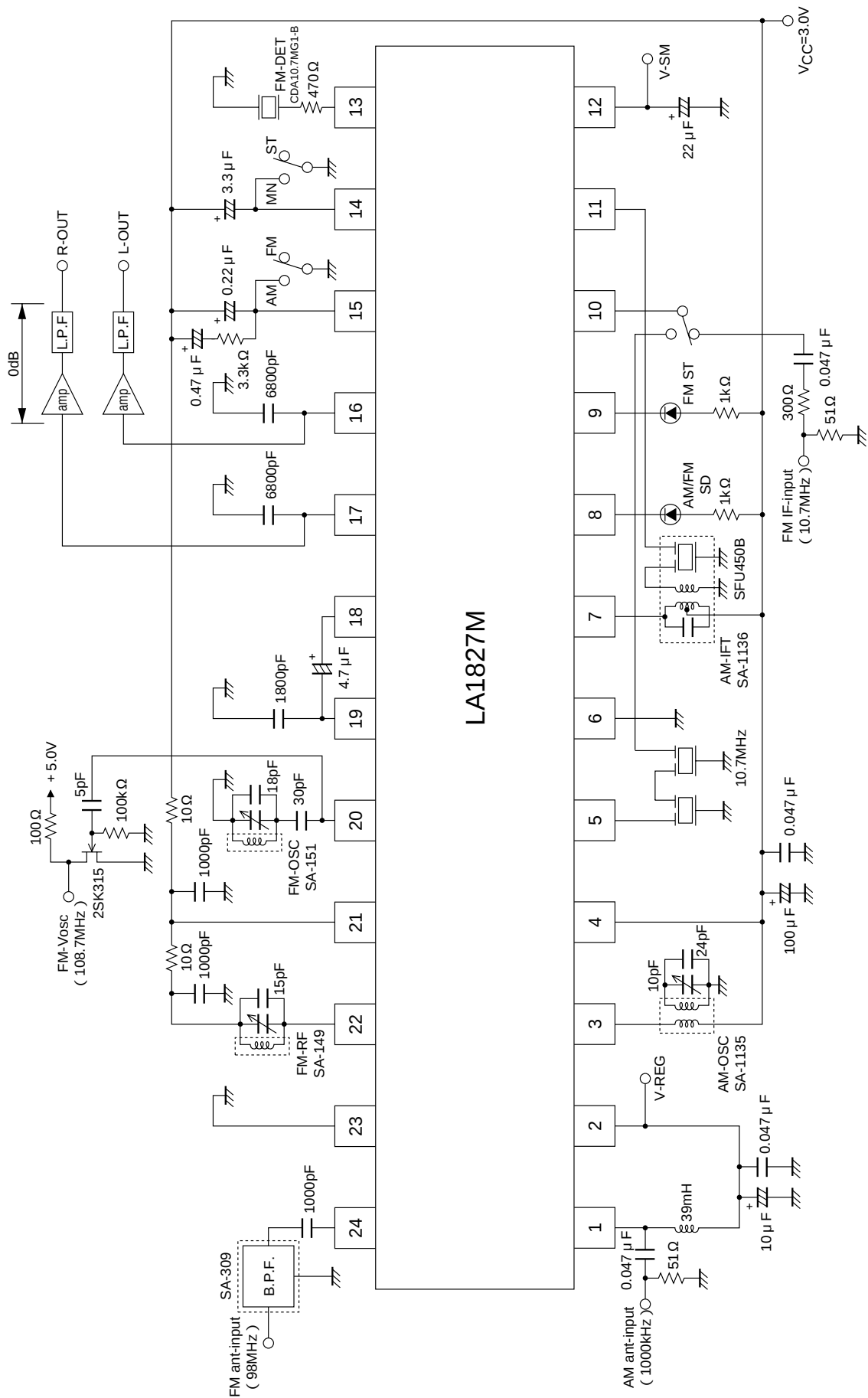
Coil specifications (bottom view)

• FM-BPF: SA-309 (Sumida) 88 to 108 MHz	
• FM-RF: SA-149 (Sumida) 3.6 mm dia., air core, 0.6 mm wire, 4 1/2 T	
• FM-OSC: SA-151 (Sumida) 3.6 mm dia., air core, 0.6 mm wire, 3 1/2 T	
• FM-IF filter, discriminator: SK107M1-AE-10, CDF107F-AE-019, Rs=510Ω (Toko) SEF10, 7MA5, CDA10.7MG83, Rs=470Ω (Murata)	
• AM-OSC: SA-181 (Sumida)  ⑥ - ④ 37T ③ - ① 74T 0.06 UEW $f_0 = 796 \text{ kHz}$ $Q_0 \geq 80$ $L = 140 \mu\text{H}$ A10830	• L7BRS-3132AQ (Toko)  ③ - ① 64T ⑥ - ④ 32T 0.06 2UEW $f_0 = 796 \text{ kHz}$ $Q_0 \geq 65$ $L = 140 \mu\text{H}$ A10831
• AM-IFT: SA-1136 (Sumida)  ③ - ② 122T ④ - ⑤ 9T ② - ① 62T 0.06UEW $f_0 = 450 \text{ kHz}$ $Q_0 \geq 65$ With 180 pF internal capacitor A10832	• PCFAZ-082 (Toko)  ① - ② 47T ② - ③ 100T ④ - ⑤ 12T $f_0 = 450 \text{ kHz}$ With 180 pF internal capacitor With AM-IF filter ACFA-450L08 A10833
• AM-IF filter: SFU450B (Murata)	
• Poly-varicon: FT-2217 (Toko) PVC-22KTL (Mitsumi)	• MW Bar- antenna: TYA-1005 (Mitsumi)  ① - ② 68T ③ - ④ 9T $f_0 = 796 \text{ kHz}$ $Q_0 \geq 230$ $L = 260 \mu\text{H}$ A10834
For DUT PCB	
• FM-Discriminator: CDA10.7 MG1-B (Murata)	• AM-OSC: SA-1135 (Sumida)  ⑥ - ④ 11T ① - ② 99T ② - ③ 3T 0.06UEW $f_0 = 796 \text{ kHz}$ $Q_0 \geq 80$ $L = 270 \mu\text{H}$ A10835

Block Diagram

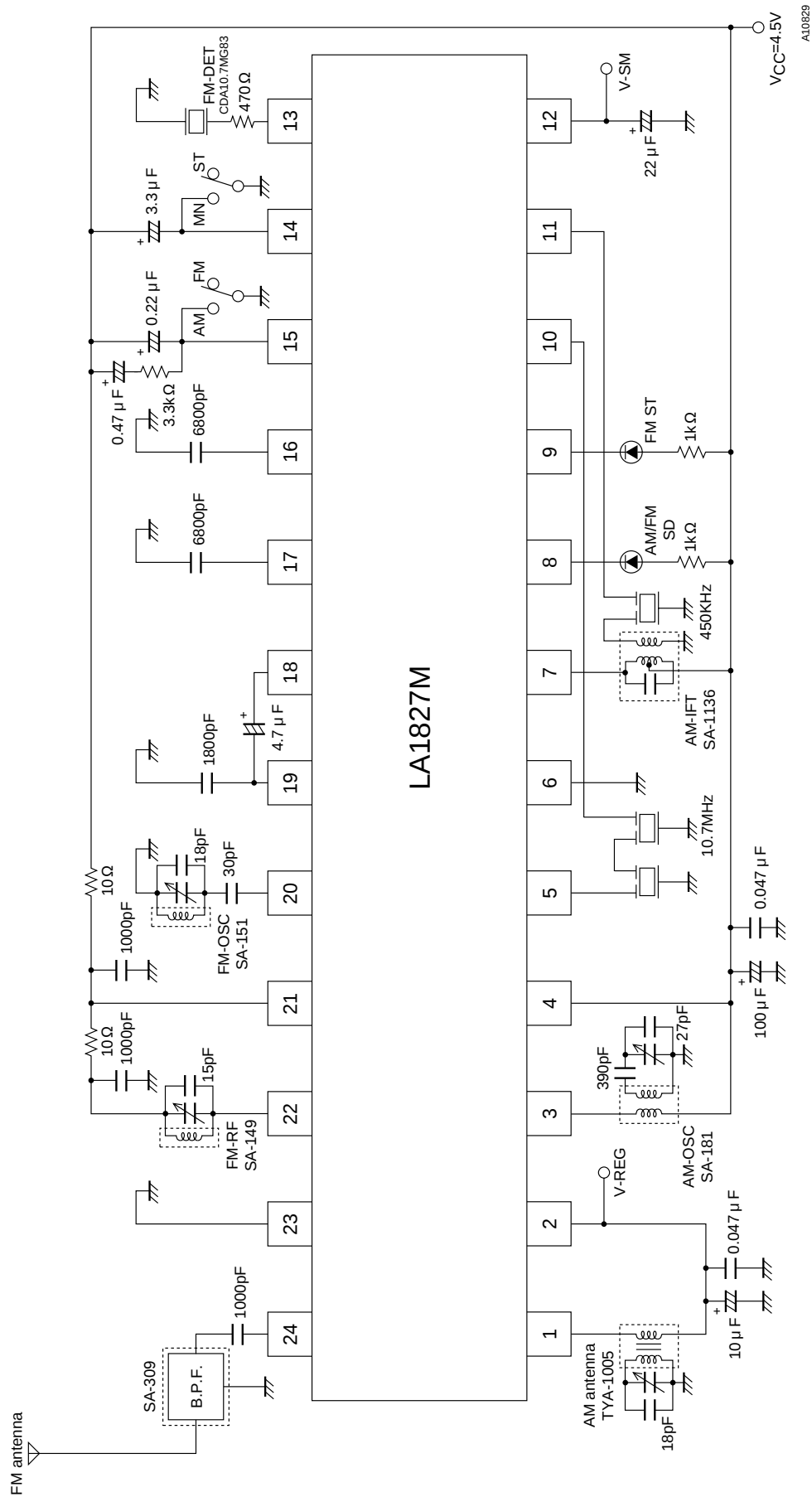


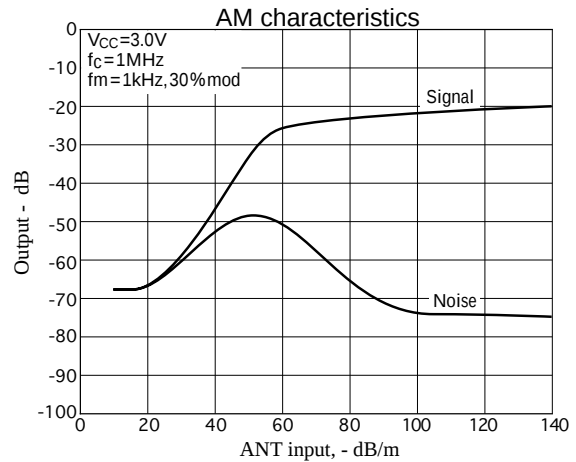
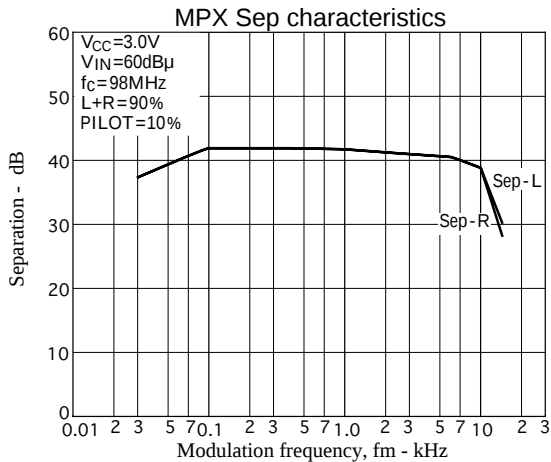
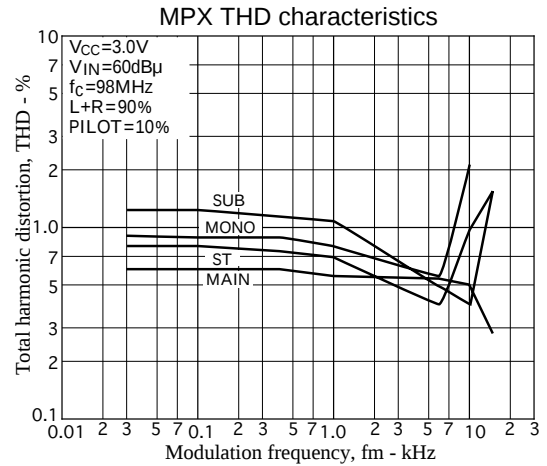
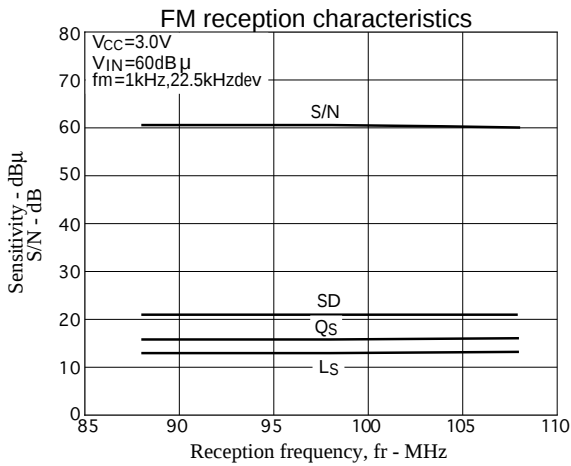
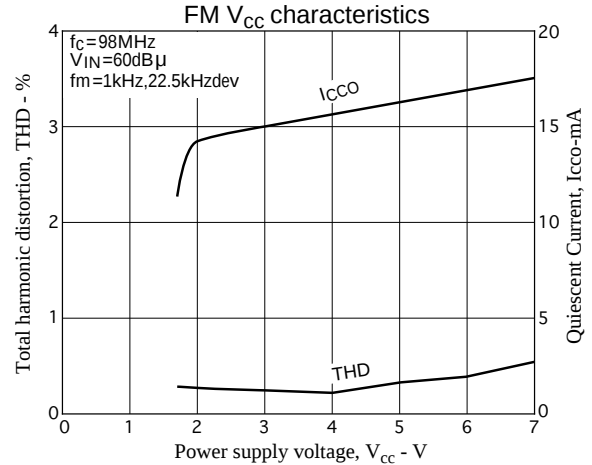
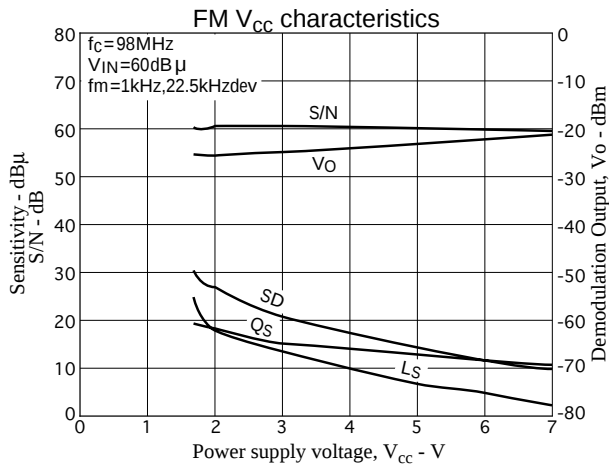
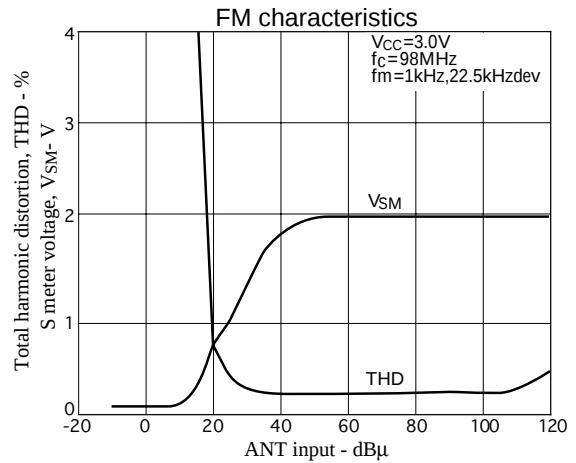
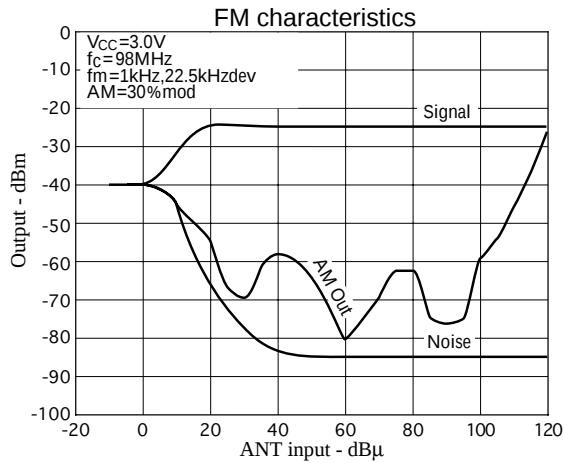
Test Circuit



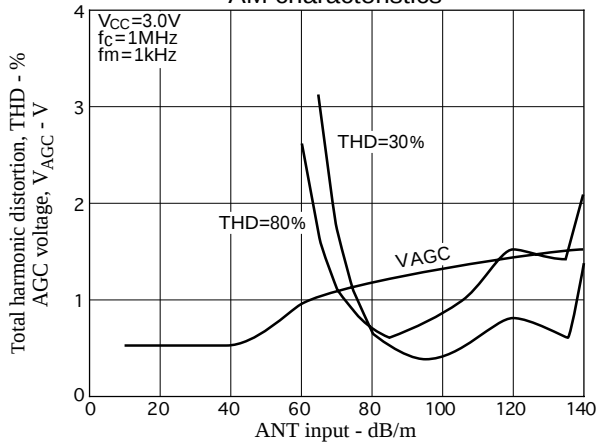
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Sample Application Circuit

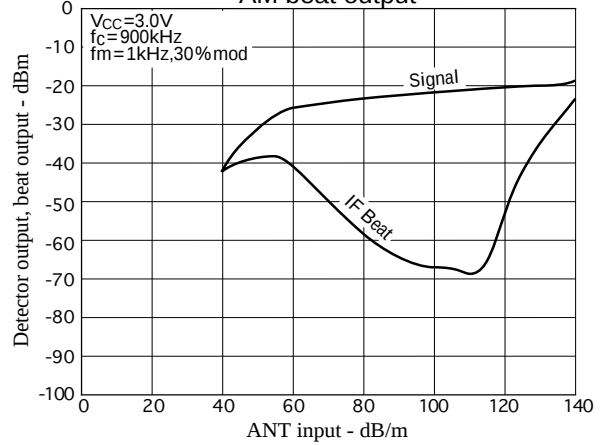
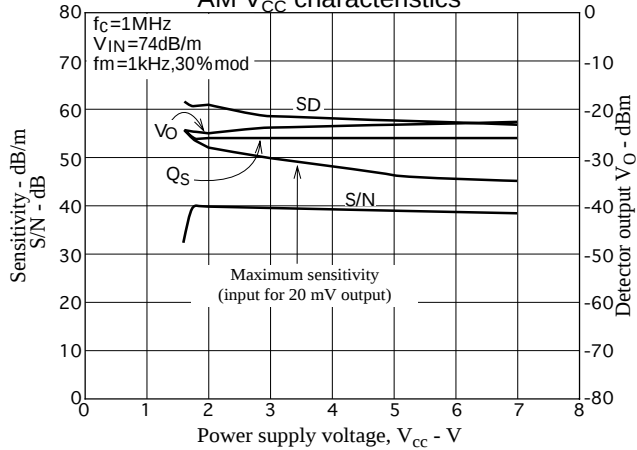
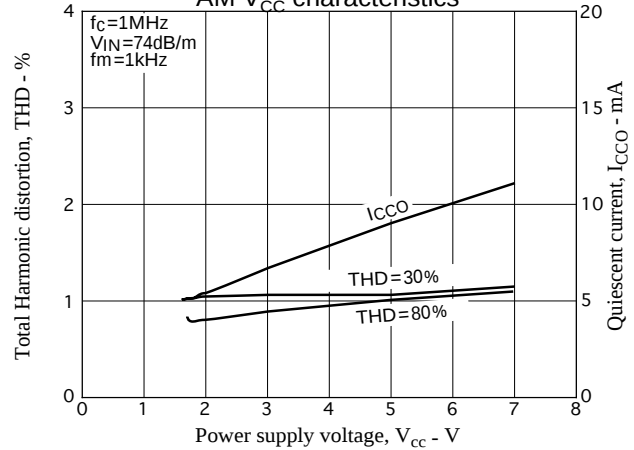




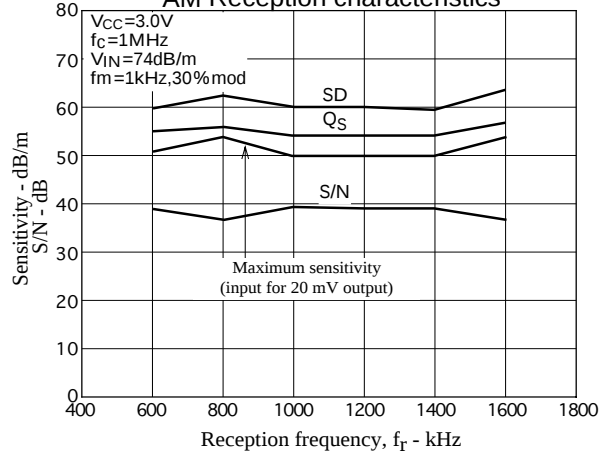
AM characteristics



AM beat output

AM V_{CC} characteristicsAM V_{CC} characteristics

AM Reception characteristics



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