



# LA1828

## Single-Chip Tuner IC for Portable Radio /Cassette Recorders with Manual Tuning

### 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 (noceramic oscillator required)
- Reduced FM-FE oscillation level
- FM stereo indication and AM/FM tuning indication outputs can directly drive LEDs

### 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	$I_{LED}$	pins 8, 9	20	mA
Allowable power dissipation	$P_d max$	$T_a \leq 70^\circ\text{C}$	300	mW
Operating temperature	$T_{opr}$		-20 to +70	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +125	$^\circ\text{C}$

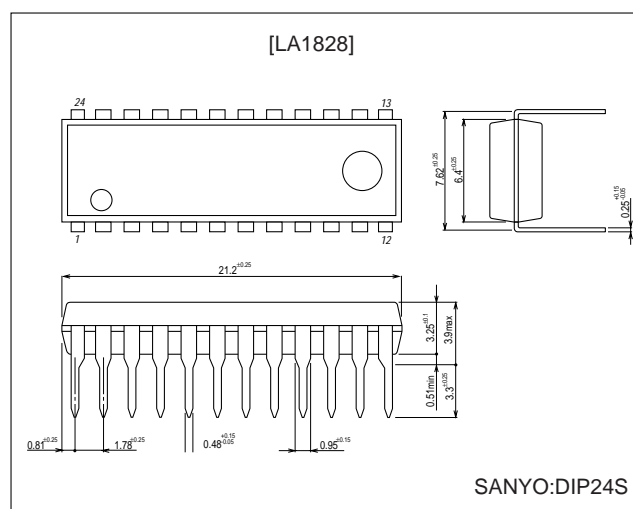
#### Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$		4.5	V
Operating supply voltage range	$V_{CCOP}$		2.5 to 6.0	V

### Package Dimensions

unit:mm

#### 3067-DIP24S

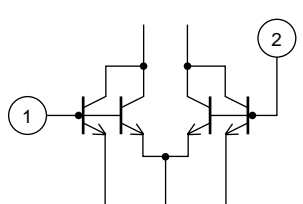
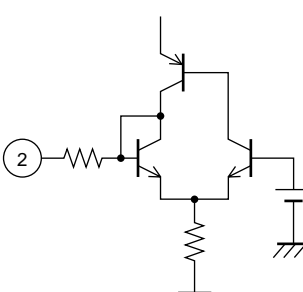


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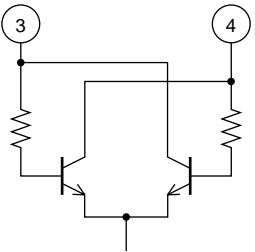
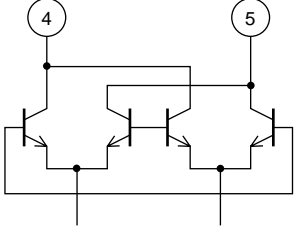
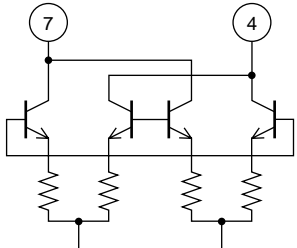
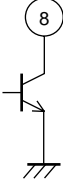
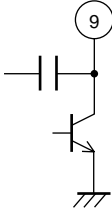
## Operating Characteristics at $T_a = 25^\circ\text{C}$ , $V_{cc} = 4.5\text{V}$ , in specified test circuit, using Yamaichi Electronics socket IC-179-2

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	$V_{OSC}$	$f_{OSC}=108.7\text{ MHz}$ , pin 20 output	40	80	160	mVrms
		*Measured with FET buffer (-10 dB gain)				
3 dB sensitivity	3dB LS	60 dB $\mu$ , 30% mod. output, -3 dB input		13		dB $\mu$
Effective sensitivity	Qs	Input for S/N = 30 dB		12		dB $\mu$
[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 $\mu$ , pin 16 output	130	190	260	mVrms
Signal-to-noise ratio	S/N	100 dB $\mu$ , pin 16 output	62	70		dB
Total harmonic distortion (mono)	THD	100 dB $\mu$ , pin 16 output		0.4	1.2	%
3 dB sensitivity	3 dB LS	100 dB $\mu$ , 100% mod.output, -3 dB input	21	32	42	dB $\mu$
TU-LED sensitivity	SD-ON			33		dB $\mu$
[FM-IF stereo characteristics]: $f_c = 10.7\text{ MHz}$ , $f_m = 1\text{ kHz}$ , L+R = 90%, pilot = 10%						
Separation	SEP	100 dB $\mu$ , L-mod, pin 16/pin 17 output	25	40		dB
ST-LED sensitivity	ST-ON	100 dB $\mu$ , pilot modulation for pin 8 voltage < 0.5V	1.5	3.5	6.3	%
Total harmonic distortion (main)	THD	100 dB $\mu$ , main modulation, pin 16 output		0.5	1.2	%
[AM characteristics]: $f_c = 1000\text{ kHz}$ , $f_m = 1\text{ kHz}$ , 30% mod.						
Quiescent current	$I_{CCO}$ (AM)	No input	5	8.5	15	mA
Demodulator output	$V_{O1}$	23 dB $\mu$ , pin 16 output	18	40	70	mVrms
	$V_{O2}$	80 dB $\mu$ , pin 16 output	50	85	130	mVrms
Signal-to-noise ratio	S/N1	23 dB $\mu$ , pin 16 output	15	20		dB
	S/N2	80 dB $\mu$ , pin 16 output	47	53		dB
Total harmonic distortion	THD1	80 dB $\mu$ , pin 16 output		0.5	1.3	%
	THD2	107 dB $\mu$ , pin 16 output		0.5	1.5	%
TU-LED sensitivity	SD-ON			26		dB $\mu$

## Pin Description and Quiescent Voltage at $V_{cc} = 4.5\text{V}$

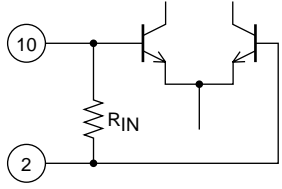
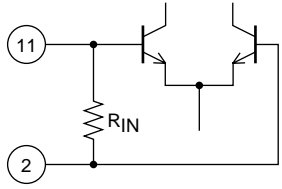
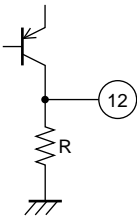
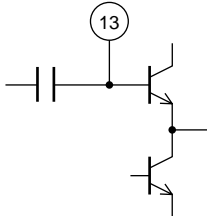
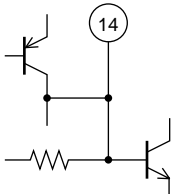
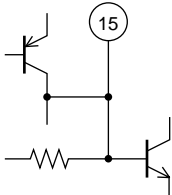
Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
1	AM RF input	1.3	1.3	 <p style="text-align: center;">A10247</p>	AM antenna coil connected between pins 1 and 2 (reg)
2	Reg	1.3	1.3	 <p style="text-align: center;">A10248</p>	$V_{reg}=1.3\text{V}$

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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
3	AM-OSC	4.5	4.5	 <p>A10249</p>	Oscillator coil connected between pins 3 and 4 ( $V_{CC1}$ )
4	$V_{CC1}$	4.5	4.5		AM/FM-IN/MPX block $V_{CC}$
5	FM mixer output	4.5	4.5	 <p>A10250</p>	Mixer coil connected between pins 5 and 4 ( $V_{CC1}$ )
6	GND1	0	0		AM/FM-IN/MPX section ground
7	AM mixer output	4.5	4.5	 <p>A10251</p>	Mixer coil connected between pins 7 and 4 ( $V_{CC1}$ )
8	Tu-LED output	4.5	4.5	 <p>A10252</p>	Active low Open-collector output can directly drive LED ( $I_C$ max = 20 mA)
9	ST-LED output and AM-IF output	4.5	4.5	 <p>A10253</p>	Active low Open-collector output can directly drive LED ( $I_C$ max = 20 mA) In AM operation, AM-IF signal (450 kHz) is output here.

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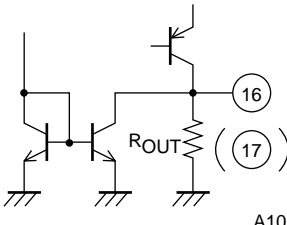
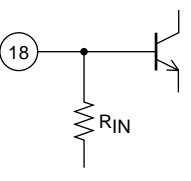
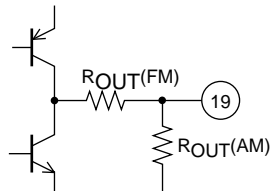
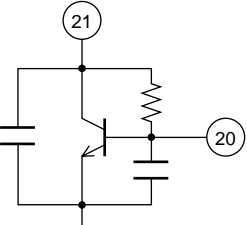
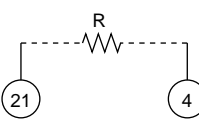
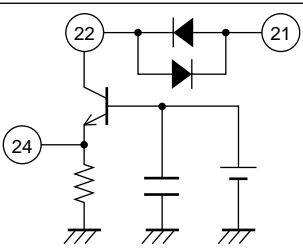
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
10	FM-IF input	1.3	1.3	 <p style="text-align: right;">A10254</p>	$R_{IN} = 330 \Omega$
11	AM-IF input	1.3	1.3	 <p style="text-align: right;">A10255</p>	$R_{IN} = 2 \text{ k}\Omega$
12	AM-AGC output and FM S meter output	0.7	0.2	 <p style="text-align: right;">A10256</p>	Internal load impedance $R = 16.6 \text{ k}\Omega$
13	FM detector	4.5	4.5	 <p style="text-align: right;">A10257</p>	Detector coil connected between pins 13 and 4 ( $V_{CC1}$ )
14	Pilot tone detector filter and forced mono switching	2.9	3.8	 <p style="text-align: right;">A10258</p>	Mono mode is forced on by connecting pin 14 to ground.
15	Phase comparator filter and AM/FM switching	0	3.8	 <p style="text-align: right;">A10259</p>	FM reception mode is enabled when pin 15 is open. AM reception mode is enabled when pin 15 is connected to ground.

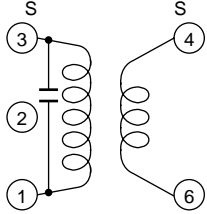
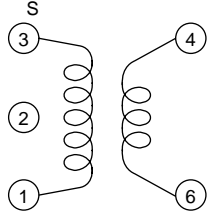
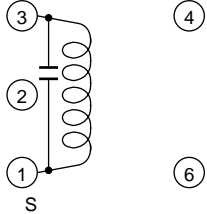
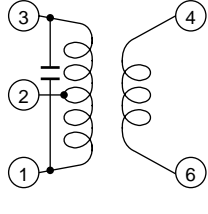
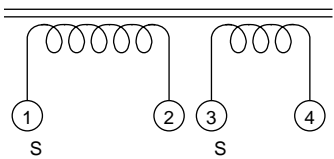
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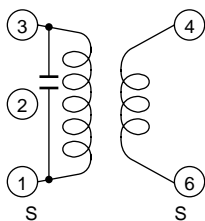
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Pin number	Function	Quiescent voltage (V)		Equivalent circuit	Remarks
		AM	FM		
16 17	L output R output	1.4	1.4	 <p style="text-align: right;">A10260</p>	$R_{OUT} = 7.5 \text{ k}\Omega$
18	MPX input	1.3	1.3	 <p style="text-align: right;">A10261</p>	$R_{IN} = 50 \text{ k}\Omega$
19	FM detector output and AM detector output	0.5	1.5	 <p style="text-align: right;">A10262</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	4.5	4.4	 <p style="text-align: right;">A10263</p>	Colpitts oscillator circuit FM oscillator coil connected to pin 20.
21	$V_{CC2}$	4.5	4.4	 <p style="text-align: right;">A10264</p>	FM-FE block $V_{CC}$ Power is supplied from pin 4 ( $V_{CC1}$ ) via external resistor ( $10 \Omega$ ).
22 24	FM-RF output FM-RF input	4.5 0	4.4 1.0	 <p style="text-align: right;">A10265</p>	FM RF coil 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-Mix: SA-165 (Sumida)</p>  <p>④ - ⑥ 2T ③ - ① 12T 0.12 UEW <math>f_0 = 10.7</math> MHz <math>Q_0 \geq 50</math> With 100 pF internal capacitor</p> <p>A10395</p>	<p>• AM-OSC: SA-181 (Sumida)</p>  <p>⑥ - ④ 37T ③ - ① 74T 0.06 UEW <math>f_0 = 796</math> kHz <math>Q_0 \geq 80</math> <math>L = 140</math> <math>\mu</math>H</p> <p>A10269</p>
<p>• FM-Det: SA-1134 (Sumida)</p>  <p>① - ③ 12T 0.10 UEW <math>f_0 = 10.7</math> MHz <math>Q_0 \geq 70</math> With 82 pF internal capacitor</p> <p>A10267</p>	<p>• AM-IFT: SA-1136 (Sumida)</p>  <p>③ - ② 122T ④ - ⑥ 9T ② - ① 62T 0.06 UEW <math>f_0 = 450</math> kHz <math>Q_0 \geq 65</math> With 180 pF internal capacitor</p> <p>A10270</p>
<p>• FM-IF filter: SFE10.7MS2 (Murata)</p>	<p>• AM-IF filter: SFU450B (Murata)</p>
<p>• Poly-varicon: FT-2217 (Toko) or PVC-22KTL (Mitsumi)</p>	
<p>• MW bar antenna: TYA-1005 (Mitsumi)</p>  <p>① - ② 68T ③ - ④ 9T <math>f_0 = 796</math> kHz <math>Q_0 \geq 230</math> <math>L = 260</math> <math>\mu</math>H</p> <p>A10394</p>	

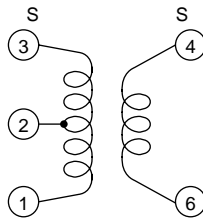
• FM-Mix: YT-30224 (Mitsumi) for DUT



A10266

⑥ - ④ 2T  
 ① - ③ 8T  
 0.12 UEW  
 $f_0 = 10.7 \text{ MHz}$   
 $Q_0 = 80$   
 With 150 pF  
 internal capacitor

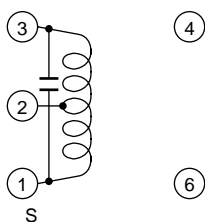
• AM-OSC: HW-50425 (Mitsumi) for DUT



A10271

③ - ② 2T  
 ④ - ⑥ 9T  
 ② - ① 86T  
 $Q_0 \geq 80$   
 $L = 270 \mu\text{H}$

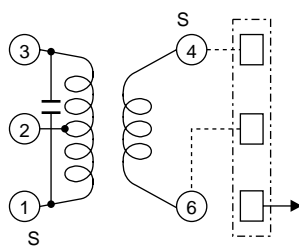
• FM-Det: YT-30103 (Mitsumi) for DUT



A10268

① - ③ 10T  
 $f_0 = 10.7 \text{ MHz}$   
 $Q_0 = 90$   
 With 82 pF  
 internal capacitor

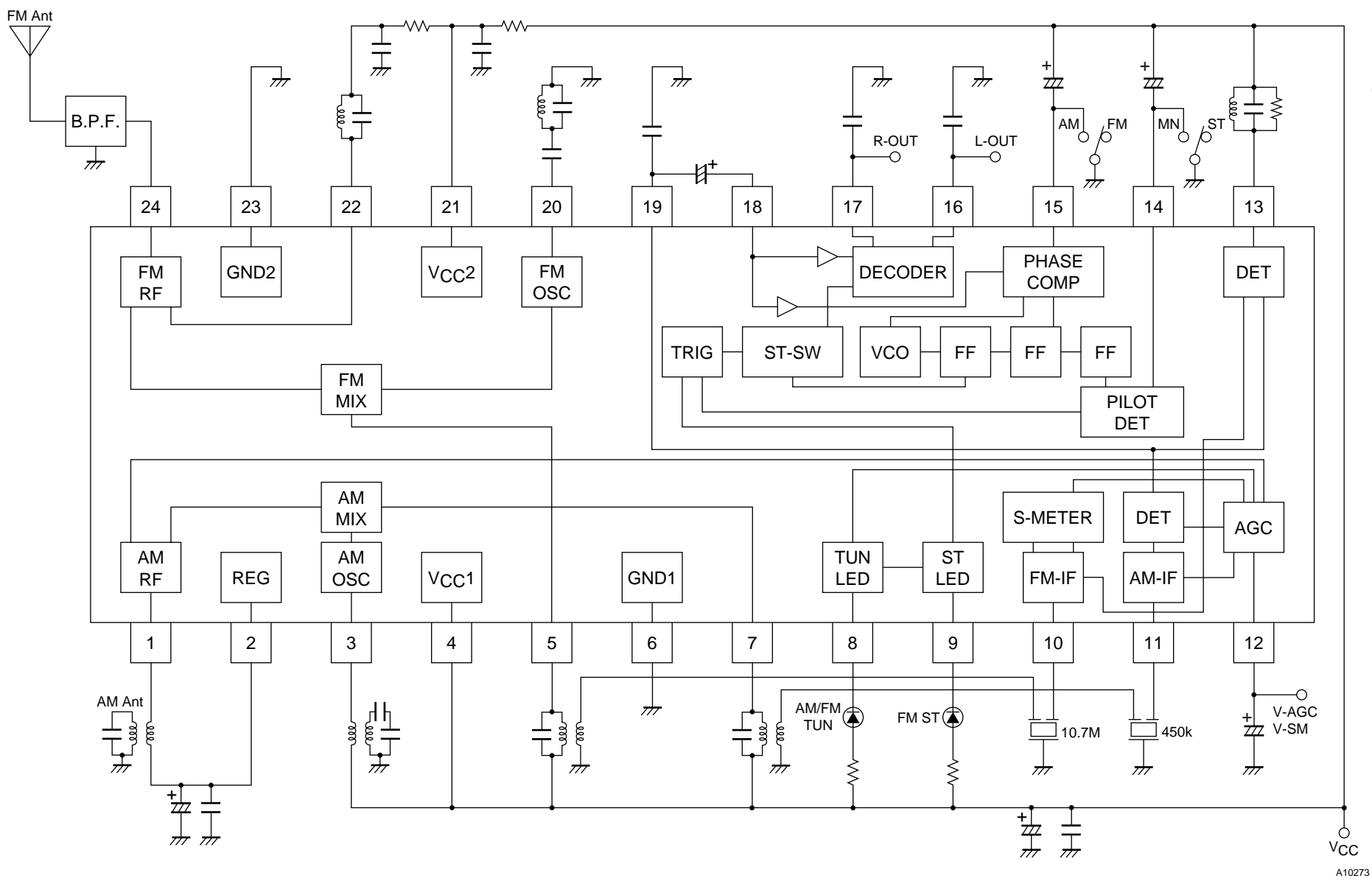
• AM-IFT: YD-1073-1 (Mitsumi) for DUT



A10272

① - ② 58T  
 ④ - ⑥ 7T  
 ② - ③ 94T  
 $f_0 = 450 \text{ kHz}$   
 With 180 pF  
 internal capacitor

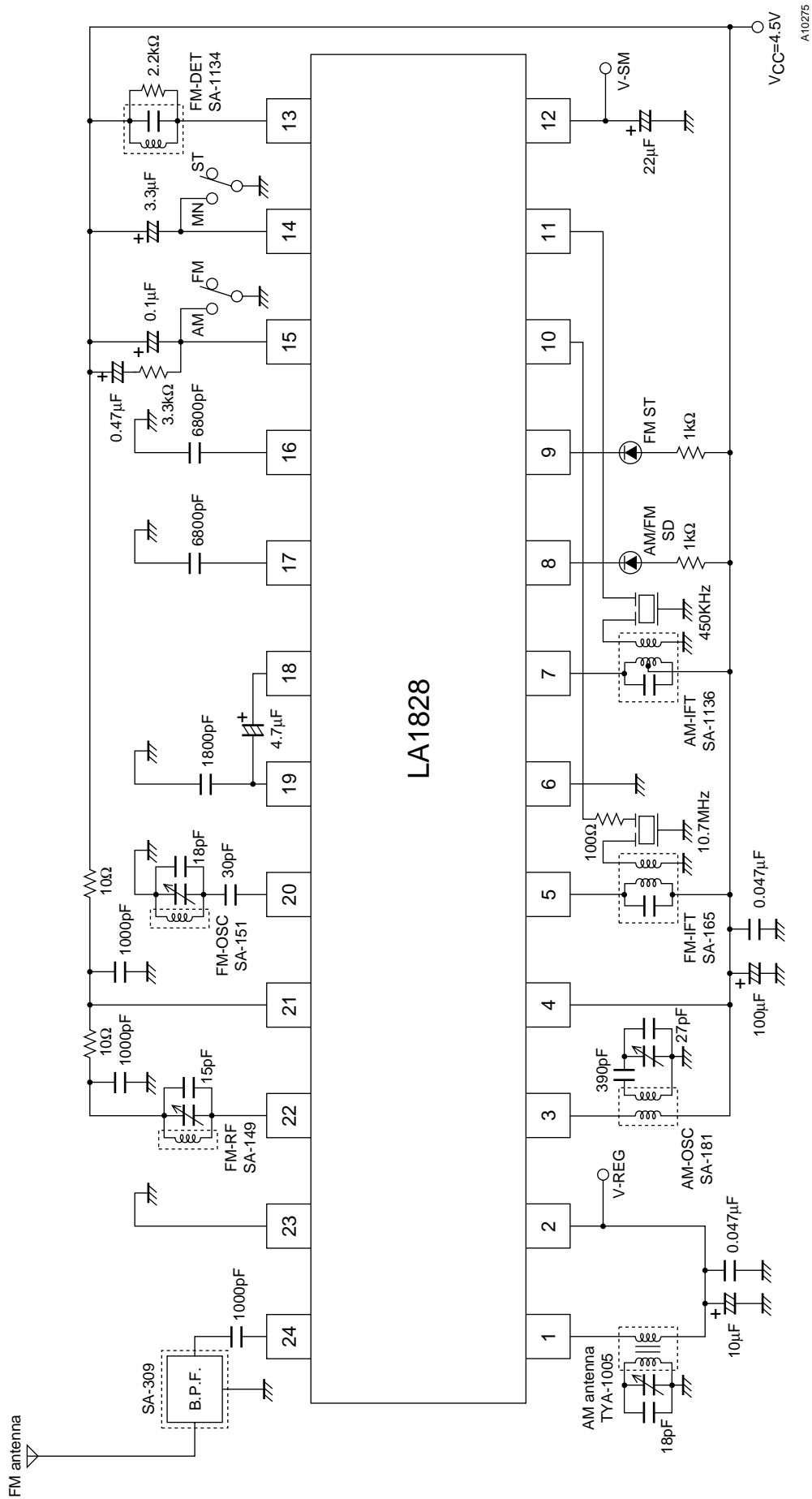
Block Diagram



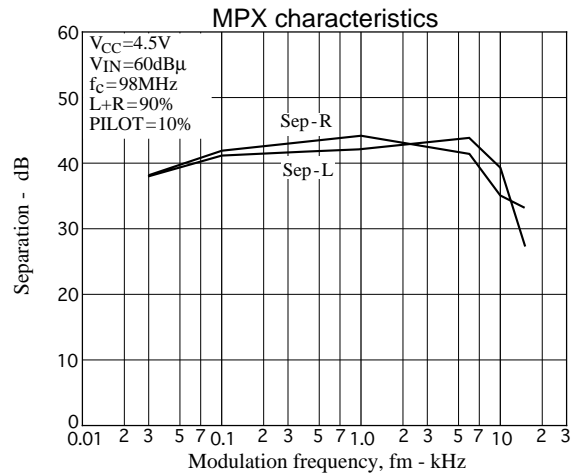
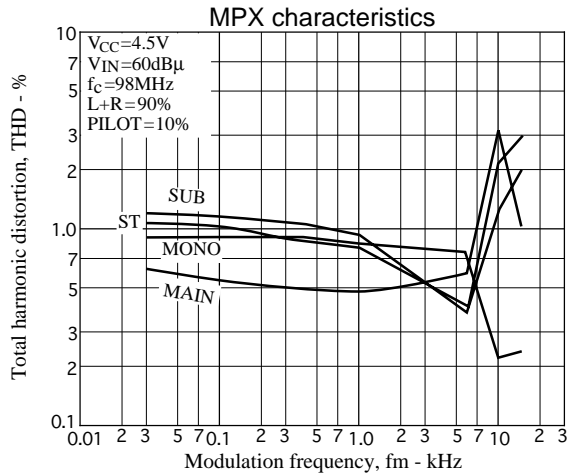
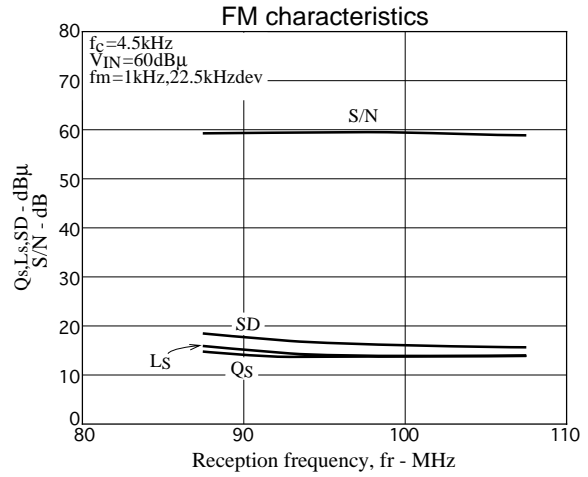
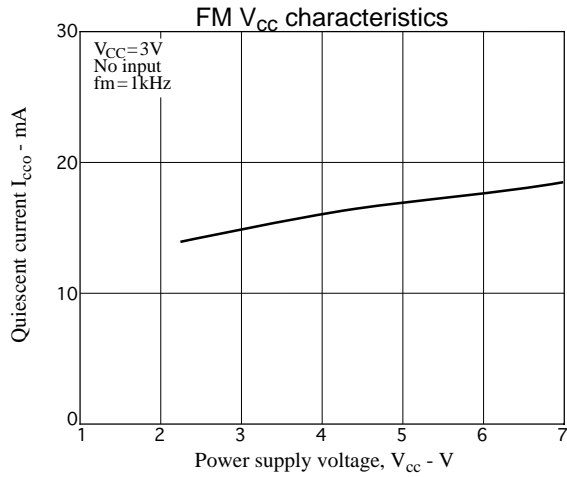
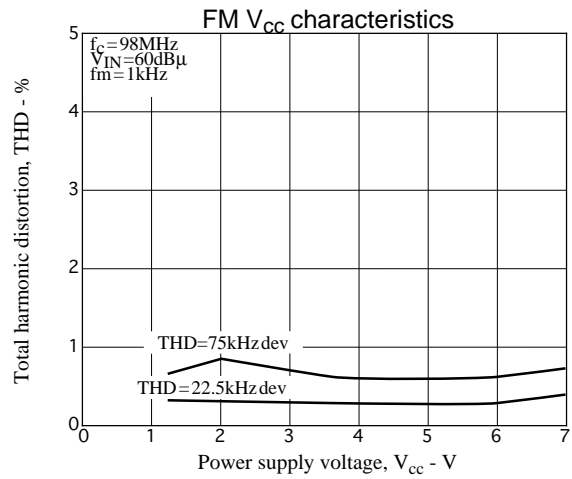
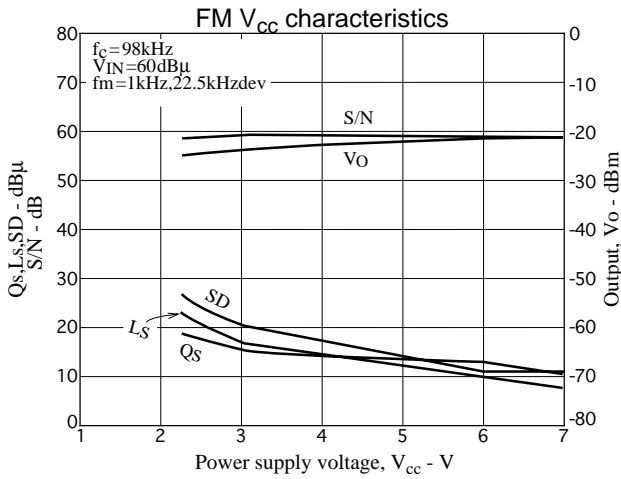
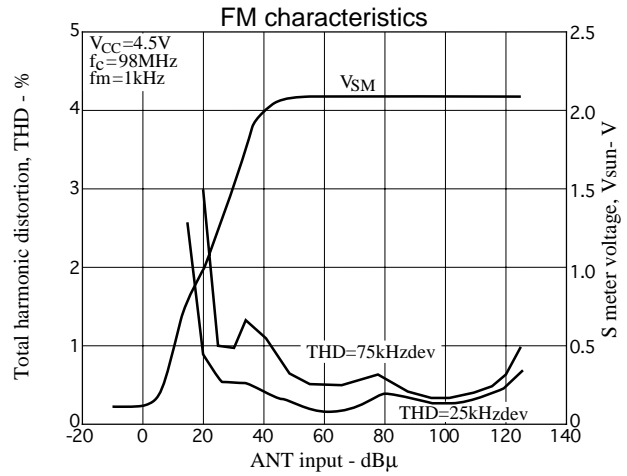
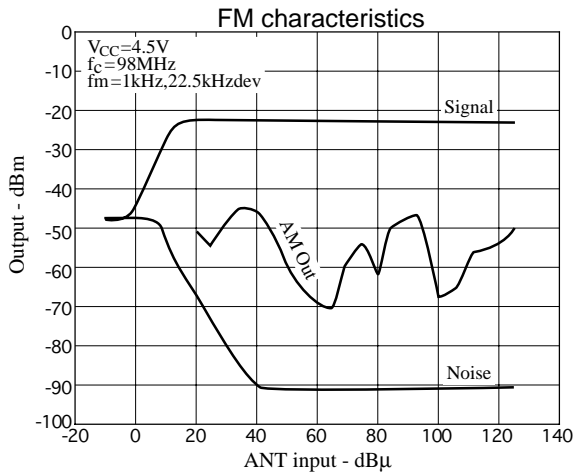


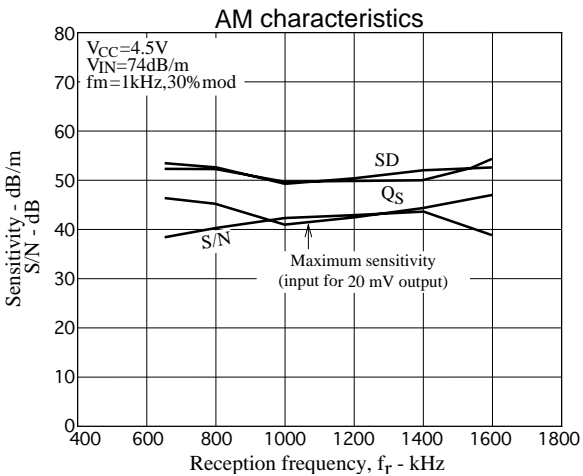
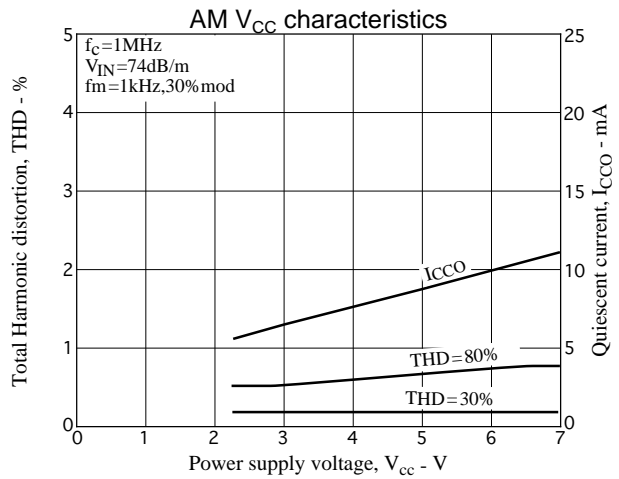
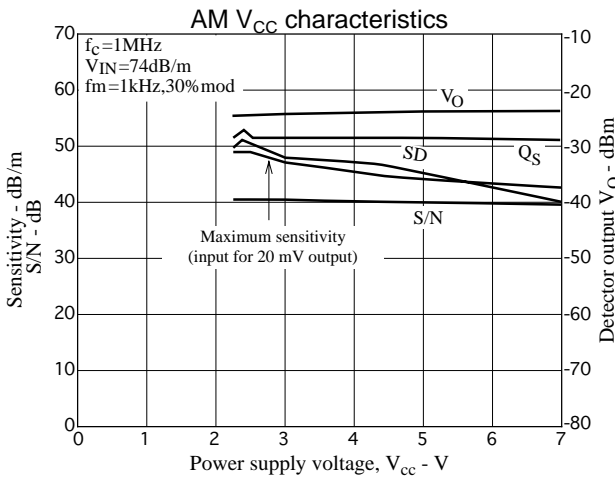
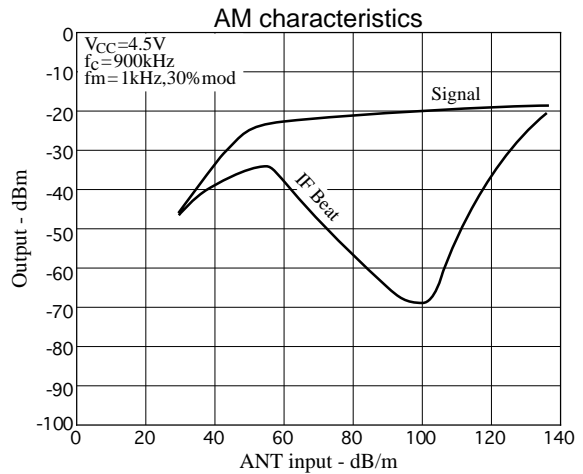
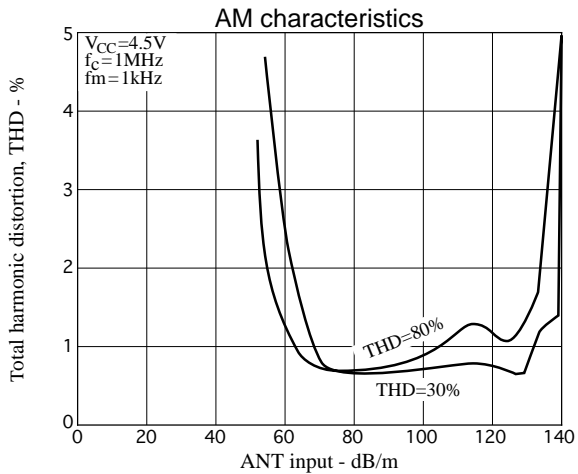
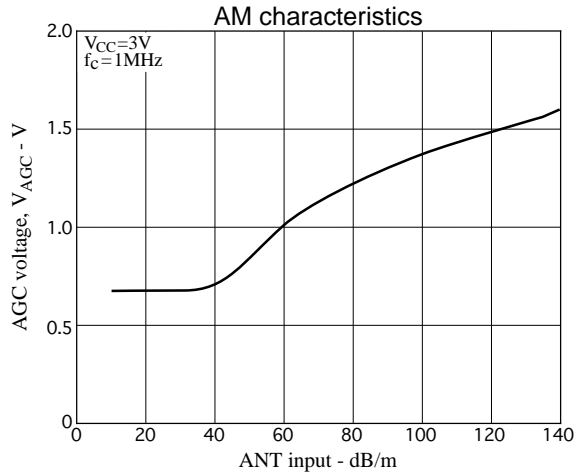
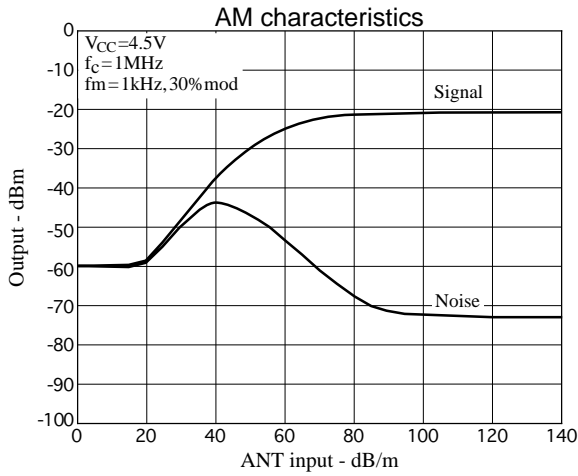


Sample Application Circuit



A10275





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