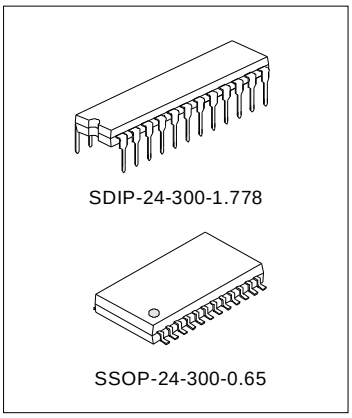
3V AM/FM+MPX TUNER IC(FOR DIGITAL TUNING SYSTEM)

DESCRIPTION

The SA2104/SA2104S are single-chip tuner ICs that incorporate FM/AM and MPX circuits, which are designed for portable radios and 3V headphone radios.

The SA2104/SA2104S are suitable for digital tuning system applications. FM local oscillation voltage is set up low relativity, for NEW FCC.



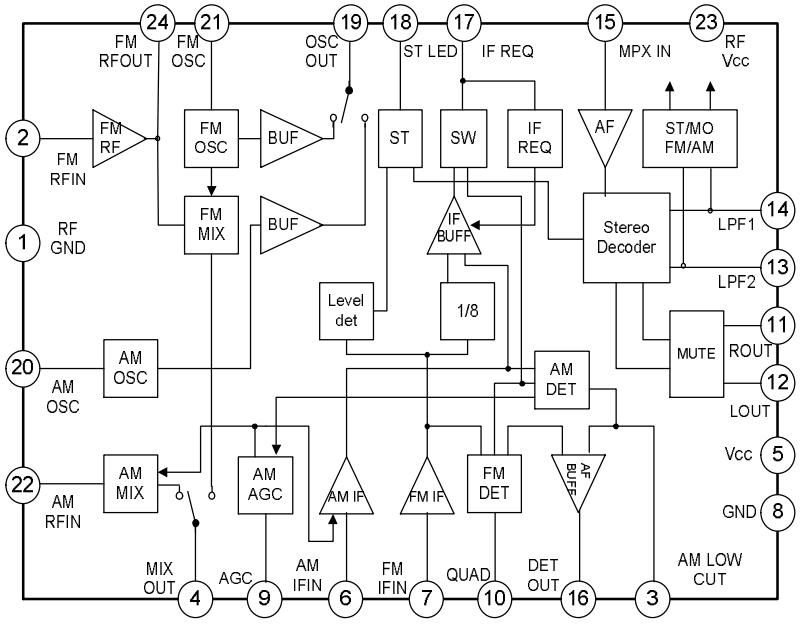
FEATURES

* Operating supply voltage range: V_{CC}=1.8~10V (T_{amb}=25°C)
* For NEW FCC
* FM/AM and MPX integrated in a single-chip.
* Build in FM/AM IF count buffer.
  FM: 1.3375MHz (1/8 dividing)
  AM: 450kHz
* Build in mute circuit for IF count output according to field strength.
* Build in FM MPX VCO circuit
* Build in FM/AM OSC buffer output for DTS applications.
* Build in AM low cut circuit
* Build in stereo indicator.
* Low supply current. (V_{CC}=3V, T_{amb}=25°C)
  I_{CCq} (FM)=11.0mA (Typ.)
  I_{CCq} (AM)=7.5mA (Typ.)

ORDERING INFORMATION

Part No.	Package
SA2104	SDIP-24-300-1.778
SA2104S	SSOP-24-300-0.65

BLOCK DIAGRAM



MAXIMUM RATINGS (T_{amb}=25°C)

Parameter		Symbol	Rating	Unit
Maximum Supply Voltage		V_{CC}	14	V
Indicator Drive Current		I_{LED}	10	mA
Indicator Voltage		V_{LED}	8	V
Power Dissipation	SA2104	P_D (note)	1200	mW
	SA2104S		500	
Operating Temperature		T_{opr}	-20~+70	°C
Storage Temperature		T_{stg}	-40~+125	°C

Note: Derated above Tamb=25°C in the proportion of 9.6mW/°C for SA2104 of 4mW/°C for SA2104S.

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, T_{amb}=25°C, V_{CC}=3V, F/E : f=98 MHz, fm=1 kHz ,FM IF : f=10.7 MHz, Δf =±22.5 kHz, fm= 1 kHz . AM : f=1 MHz, MOD=30%, fm=1 kHz. MPX: fm=1kHz)

Parameter		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Quiescent Current		$I_{CC(FM)}$	V_{IN}=0, FM mode	--	11.0	18	mA
		$I_{CC(AM)}$	V_{IN}=0, AM mode	--	7.5	14	
F/E	Input Limiting Voltage	$V_{in(lim)}$	V_{IN}=60 dBμV EMF -3dB limiting	--	10	--	dBμV EMF
	Local OSC BUFFER OUTPUT Voltage	V_{OSC} (buff) FM	FOSC=108.7MHz	23	35	--	mVrms
FM IF	Input Limiting Voltage	$V_{in(lim)}$ IF	V_{IN}=80dBμV EMF -3dB limiting	35	38	47	dBμV EMF
	Recovered Output Voltage	V_{OD}	V_{IN}=80dBμV EMF	200	270	300	mVrms
	Signal To Noise Ratio	S/N	V_{IN}=80dBμV EMF	--	75	--	dB
	Total Harmonic Distortion	THD	V_{IN}=80dBμV EMF	--	0.3	--	%
	AM Rejection Ration	AMR	V_{IN}=80dBμV EMF	--	60	--	dB
	IF Count Output Frequency	f_{IF} (FM)	V_{IN}=80dBμV EMF SW7: ON	1.3373	1.3375	1.3377	MHz
	IF Count Output Voltage	V_{IF} (FM)	V_{IN}=80dBμV EMF SW7: ON	200	260	--	mVp-p
	IF Count Output Sensitivity	IF sens (FM)	SW7: ON	40	45	50	dBμV EMF
AM	Gain	GV	V_{IN}=27dBμV EMF	20	38	70	mVrms
	Recovered Output Voltage	V_{OD}	V_{IN}=60dBμV EMF	60	90	120	mVrms
	Signal To Noise Ratio	S/N	V_{IN}=60dBμV EMF	--	41	--	dB
	Total Harmonic Distortion	THD	V_{IN}=60dBμV EMF	--	0.7	--	%
	Local OSC Buffer Output Voltage	V_{OSC} (buff) AM	fOSC=1.45MHz	44	66	--	mVrms
	IF Count Output Voltage	V_{IF} (AM)	V_{IN}=60dBμV EMF, SW7: ON	200	250	--	mVp-p
	IF Count Output Sensitivity	IF sens (AM)	SW7: ON	38	43	48	dBμV EMF

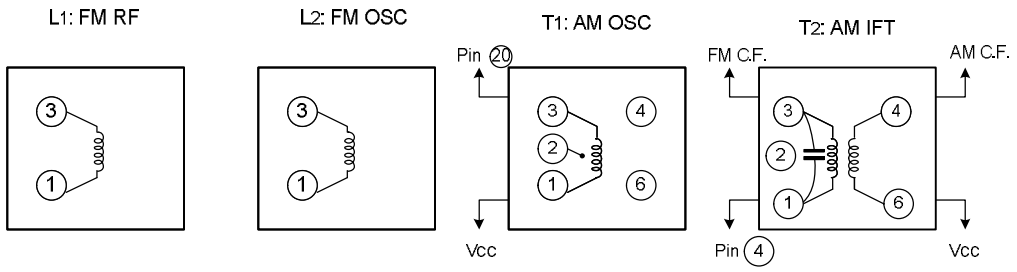
(TO be continued)

(Continued)

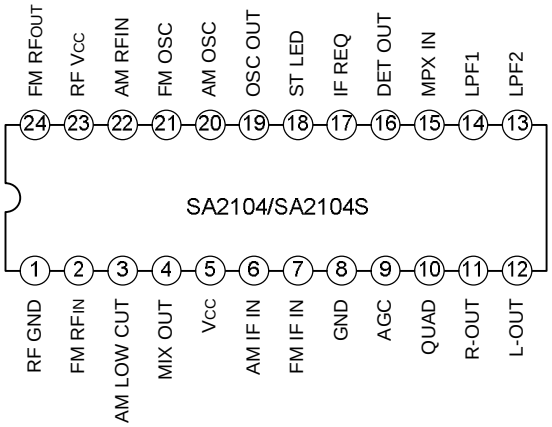
Parameter			Symbol	Test Condition		Min.	Typ.	Max.	Unit
Pin (17) Output Resistance			R17	FM mode		--	0.75	--	kΩ
				AM mode		--	15.5	--	
MPX	Input Resistance		RIN	--		--	55	--	kΩ
	Output Resistance		ROUT	--		--	5	--	kΩ
	Max. Composite Signal Input Voltage		Vin MAX (Stereo)	L+R=90%, P=10%, SW3: LPF ON fm=1kHz, THD=3%		--	700	--	mVrms
	Separation		Sep	L+R=180mVrms, P=20mVrms SW3: LPF ON	fm=100Hz	--	44	--	dB
					fm=1kHz	35	44	--	
					fm=10kHz	--	44	--	
	Total Harmonic Distortion	Monaural	THD (Monaural)	Vin=200mVrms		--	0.3	--	%
		Stereo	THD (Stereo)	L+R=180mVrms, P=20mVrms SW3: LPF ON		--	0.3	--	
	Voltage Gain		GV	Vin=200mVrms		-2.7	-1.2	0.2	dB
	Channel Balance		C.B.	Vin=200mVrms		-1.5	0	1.5	dB
	Stereo LED Sensitivity	ON	VL (ON)	Pilot input(19KHZ)		--	10	14	mVrms
		OFF	VL (OFF)			5	8	--	
	Stereo LED Hysteresis		VH	To LED turn off from LED turn on		--	2	--	mVrms
	Capture Range		C.R.	P=15mVrms		--	±8	--	%
	Signal To Noise Ratio		S/N	Vin=200mVrms		--	80	--	dB
Muting Attenuation			MUTE	Vin=200mVrms		--	80	--	dB

COIL DATA

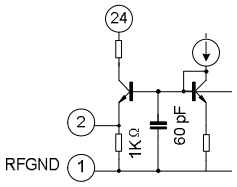
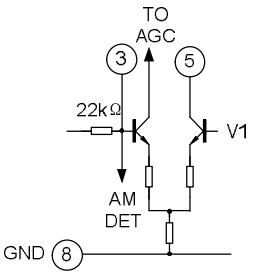
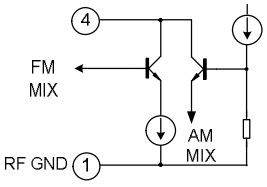
Coil No.	Test Freq.	L (μH)	Co (pF)	Qo	Turns					Wire (mm∅)
					1-2	2-3	1-3	1-4	4-6	
L1 FM RF	100MHz	--	--	79	--	--	--	$2\frac{1}{2}$	--	0.16UEW
L2 FM OSC	100MHz	--	--	76	--	--	--	2	--	0.16UEW
T1 AM OSC	796kHz	268	--	65	19	95	--	--	--	0.05UEW
T2 AM IFT	455kHz	--	470	60	--	--	109	--	7	0.05UEW



PIN CONFIGURATION



PIN DESCRIPTIONS AND QUIESCENT VOLTAGE

Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
1	RF GND	GND for FM OSC stage	--	0	0
2	FM-RFin	FM-RF input pin.		0	0.8
3	AM LOW CUT	AM low frequency cut down pin		1.0	--
4	MIX OUT	AM/FM mixer output pin.		3.0	0.5
5	VCC	VCC for AM, FM IF, FM MPX stage	--	3.0	3.0

(To be continued)

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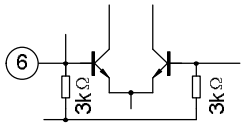
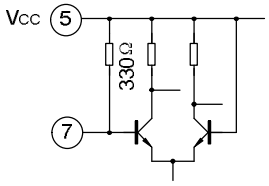
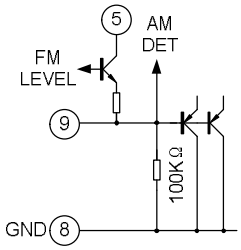
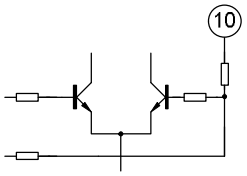
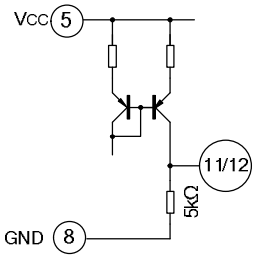
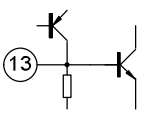
Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
6	AMIF IN	AMIF input pin.		2.3	2.5
7	FMIF IN	FMIF input.		3.0	3.0
8	GND	GND for AM, FM IF, FM MPX stage.	--	0	0
9	AGC	Auto gain control pin.		0	0
10	QUAD	FM Quad		2.5	2.2
11 12	R-OUT L-OUT	Right/Left channel output port.		1.2	1.2
13	LPF2	LPF terminal for phase detector Bias terminal for AM/FM SW circuit V13=GND→AM V13=OPEN→FM		0	2.2

(To be continued)

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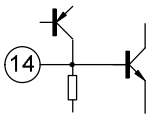
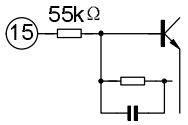
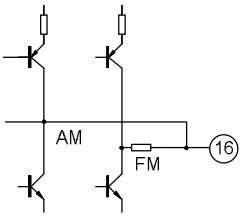
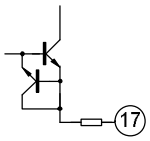
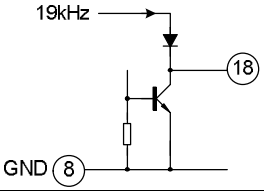
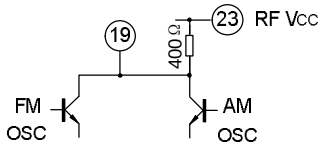
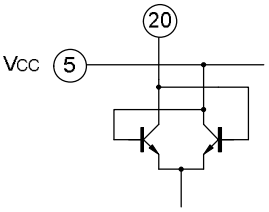
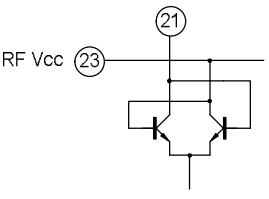
Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
14	LPF1	LPF terminal for synchronous detector VCO stop terminal V14=GND→VCO STOP		0.7	2.4
15	MPX IN	MPX input pin.		0.7	0.7
16	DET OUT	FM/AM detector output pin.		1.0	0.9
17	IF REQ	AM/FM IF output pin.		--	--
18	ST LED	Stereo indicator.		--	--
19	OSC OUT	AM/FM oscillator output pin.		2.8	2.7
20	AM OSC	AM oscillator input pin.		3.0	3.0
21	FM OSC	FM oscillator input pin.		3.0	3.0

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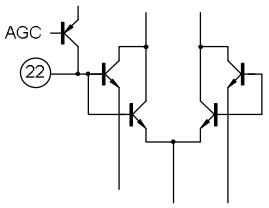
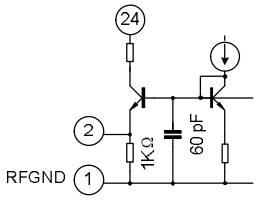
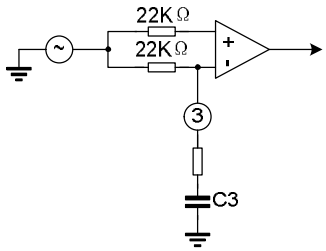
Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
22	AM RF IN	AM RF input pin.		3.0	3.0
23	RF Vcc	(Vcc for FM OSC stage)	--	3.0	3.0
24	FM RF OUT	FM RF output pin.		3.0	3.0

FUNCTION DESCRIPTION

Application note:

1. AM low-cut circuit



When pin3 is open, no AF signal can pass through the AMP stage because of the common mode.

When the value of C3 that connected to pin3 is over 1uF, all AF signal can pass through the AMP stage.

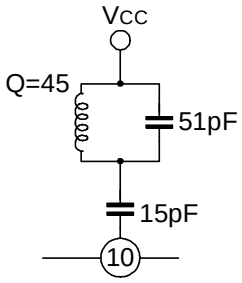
The cut-off frequency fL is determined by the internal resistance 22kΩ (Typ.) and the external capacitor C3 as below:

$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^{3} \times C3} \text{ (Hz)}$$

It is possible to reduce the recovered output level at AM mode, by additional resistance between the pin (3) and GND line.

2. FM detection circuit

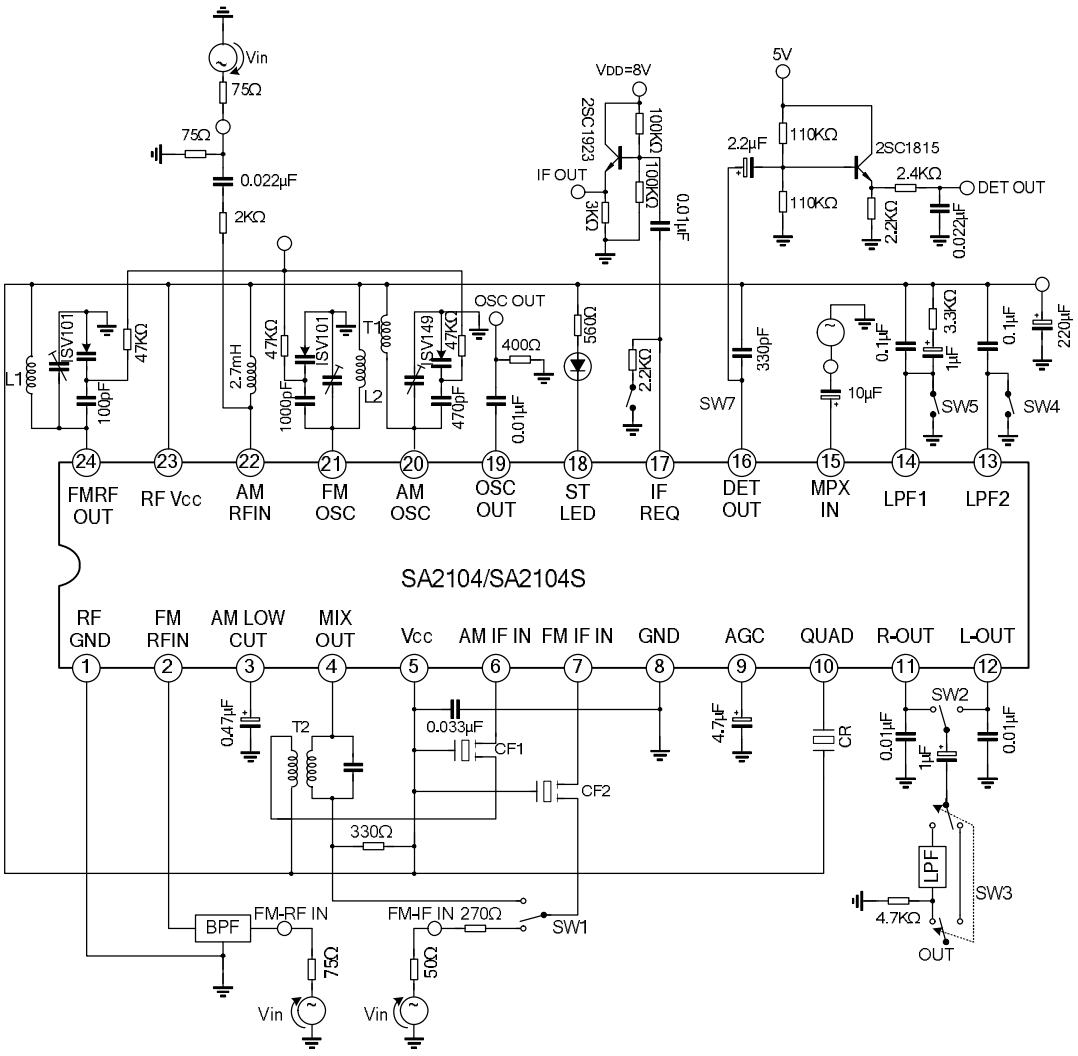
Recommended circuit and recommended coil are as follows. (Test frequency is 10.7M)



3. FM/AM switch and forced monaural switch.

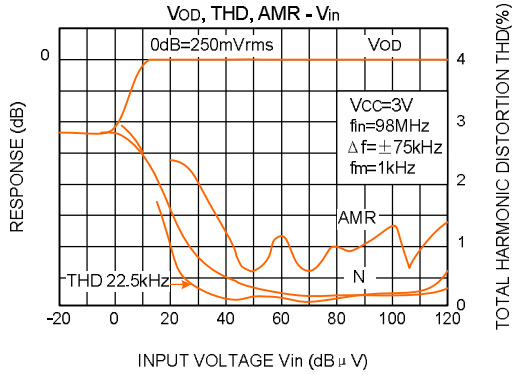
mode	Vpin13	Vpin14
AM	LOW (Vth=0.2V(Typ.), Ith 30μA(Typ.))	/
FM	OPEN	/
STEREO	/	OPEN
FORCED MONAURAL	/	LOW(Vth=0.2V(Typ.), Ith 30μA(Typ.))

TEST CIRCUIT

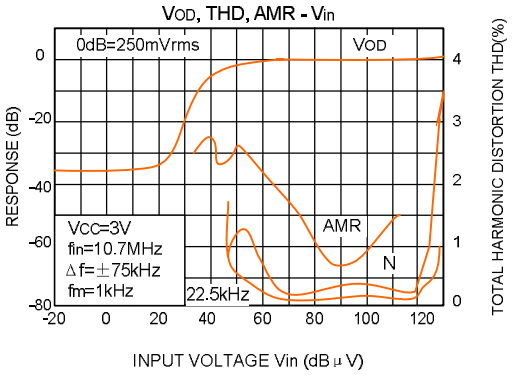


ELECTRICAL CHARACTERISTICS CURVES

FMFE



FM (IF)



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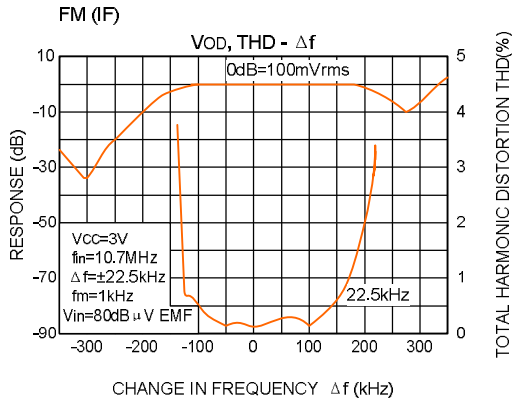
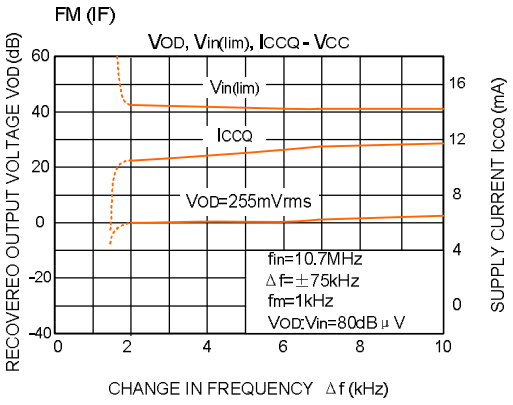
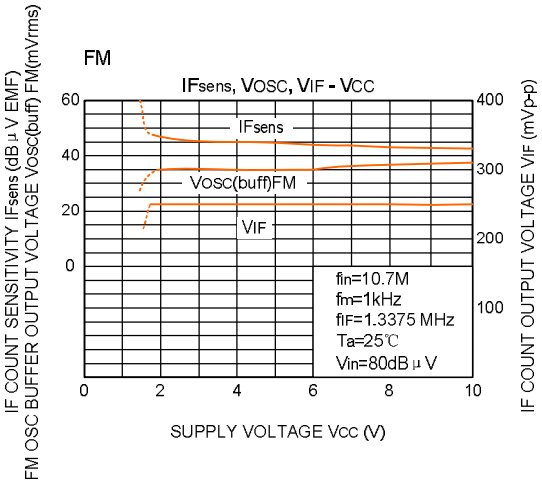


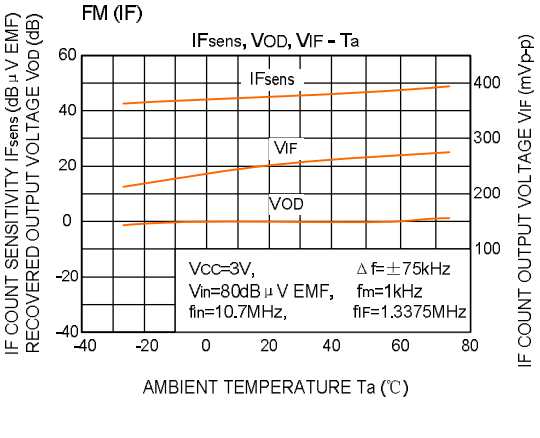
FM (IF)



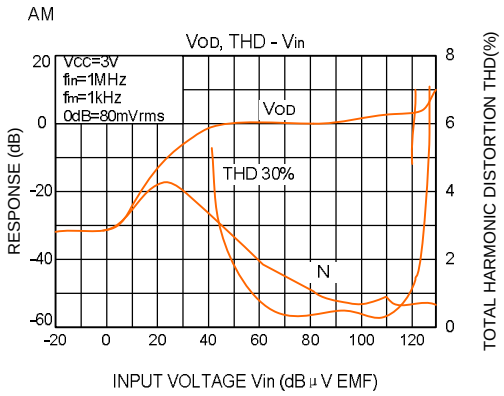
FM

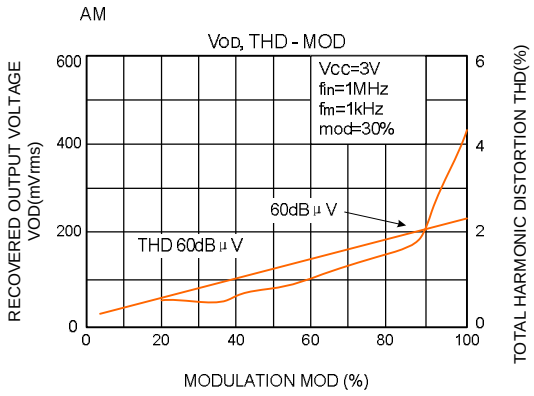


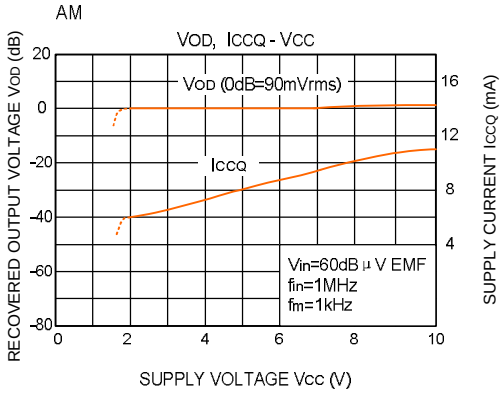
FM (IF)

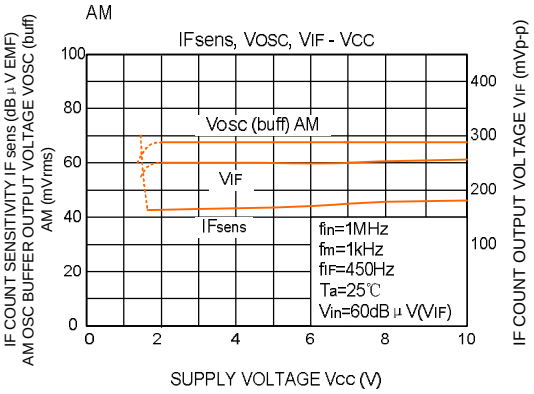


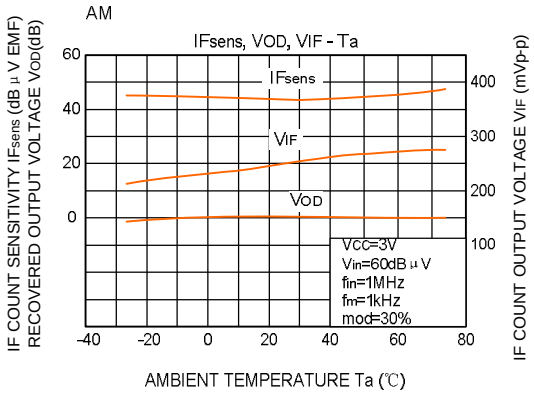
ELECTRICAL CHARACTERISTICS CURVES (Continued)

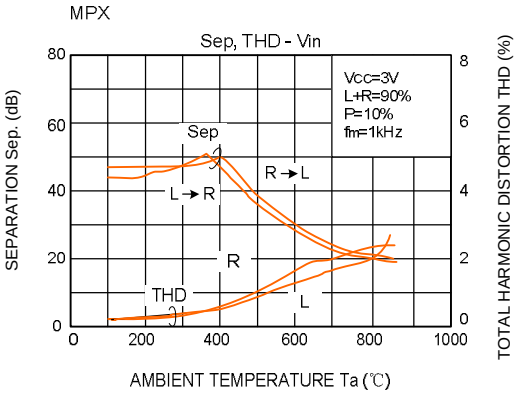






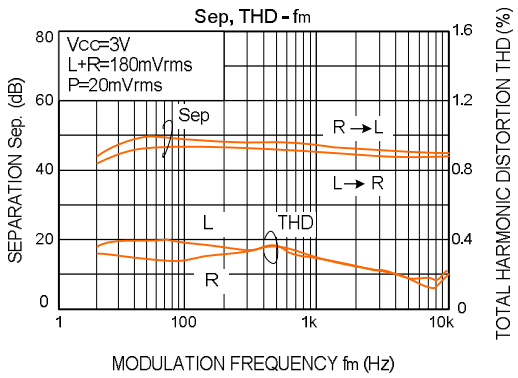






CHARACTERISTICS CURVES (Continued)

MPX



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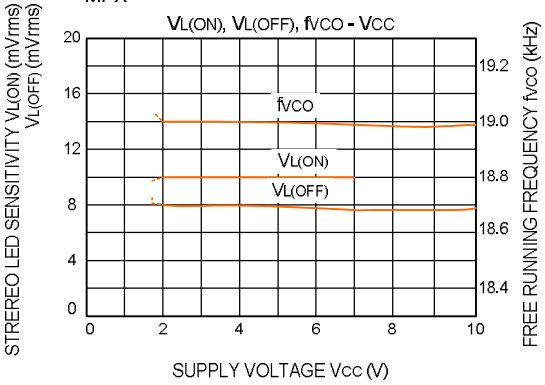
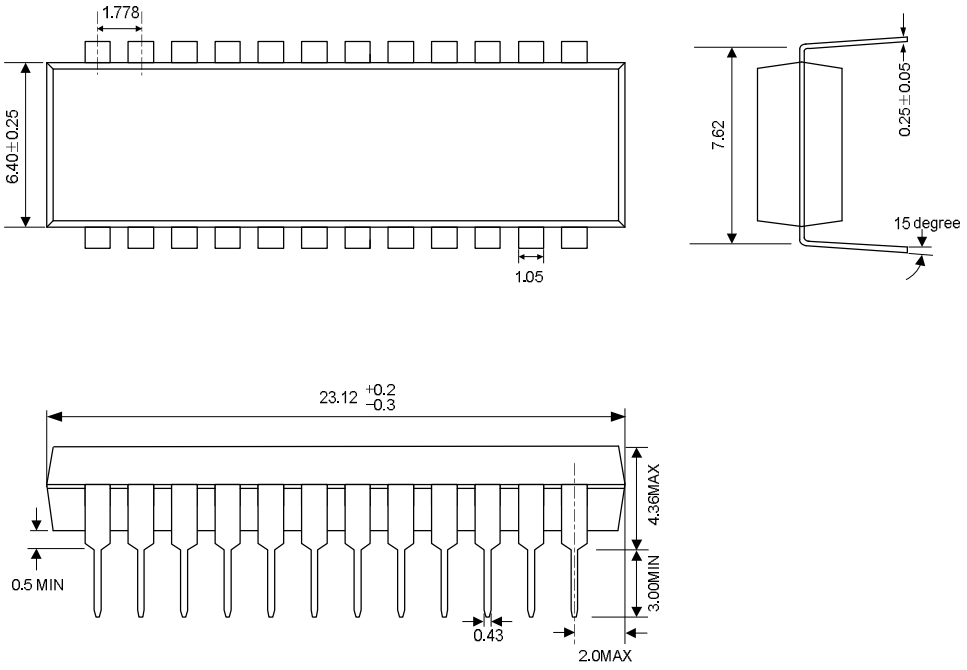


PACKAGE OUTLINE

SDIP-24-300-1.778 UNIT: mm



SSOP-24-300-0.65 UNIT: mm