

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

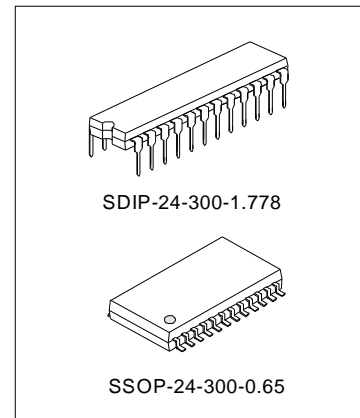
DESCRIPTION

The SA2104C/SA2104CS are single-chip tuner ICs that incorporate FM/AM and MPX circuits, which are designed for portable radios and 3V headphone radios.

The SA2104C/SA2104CS are suitable for digital tuning system applications. FM local oscillation voltage is set up low relativity, for NEW FCC.

FEATURES

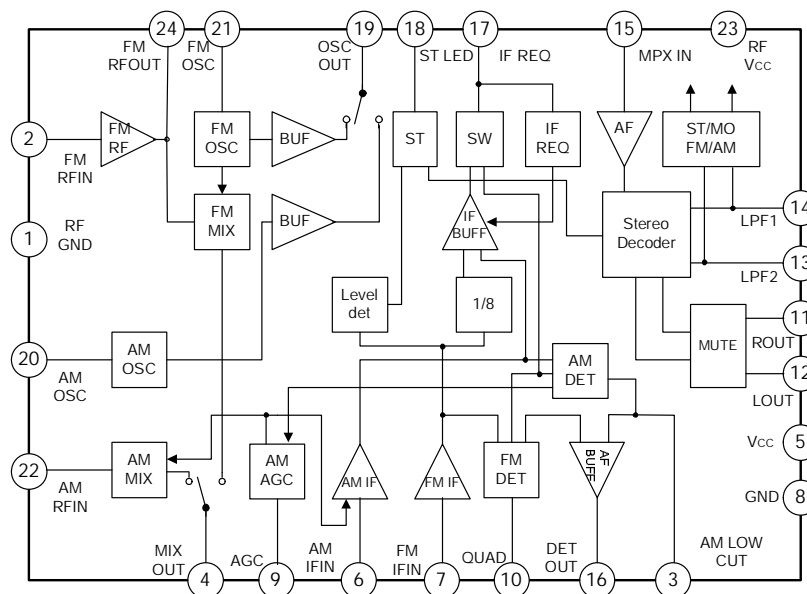
- \* Operating supply voltage range:  $V_{CC}=1.8\sim 10V$  ( $T_{amb}=25^{\circ}C$ )
- \* For NEW FCC
- \* FM/AM and MPX integrated in a single-chip.
- \* Build in FM/AM IF count buffer.
  - FM: 1.3375MHz (1/8 dividing)
  - AM: 450kHz
- \* Build in mute circuit for IF count output according to field 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. ( $V_{CC}=3V$ ,  $T_{amb}=25^{\circ}C$ )
  - $I_{CCq}$  (FM)=11.0mA (Typ.)
  - $I_{CCq}$  (AM)=7.5mA (Typ.)



ORDERING INFORMATION

Part No.	Package
SA2104C	SDIP-24-300-1.778
SA2104CS	SSOP-24-300-0.65

BLOCK DIAGRAM



**MAXIMUM RATINGS (T<sub>amb</sub>=25°C)**

Parameter	Symbol	Rating	Unit
Maximum Supply Voltage	V <sub>CC</sub>	14	V
Indicator Drive Current	I <sub>LED</sub>	10	mA
Indicator Voltage	V <sub>LED</sub>	8	V
Power Dissipation	SA2104C	PD (note)	mW
	SA2104CS		
Operating Temperature	T <sub>opr</sub>	-20~+70	°C
Storage Temperature	T <sub>stg</sub>	-40~+125	°C

Note: Derated above T<sub>amb</sub>=25°C in the proportion of 9.6mW/°C for SA2104C of 4mW/°C for SA2104CS.

**OPERATING CHARACTERISTICS (Unless otherwise specified, T<sub>amb</sub>=25°C, V<sub>CC</sub>=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	ICC(FM)	V <sub>in</sub> =0, FM mode	--	11.0	18	mA
	ICC(AM)	V <sub>in</sub> =0, AM mode	--	7.5	14	
F/E	Input Limiting Voltage	V <sub>in</sub> (lim) V <sub>in</sub> =60 dBμV EMF -3dB limiting	--	10	--	dBμV EMF
	Local OSC BUFFER OUTPUT Voltage	V <sub>osc</sub> (buff) FM f <sub>osc</sub> =108.7MHz	23	35	--	
FM IF	Input Limiting Voltage	V <sub>in</sub> (lim) IF V <sub>in</sub> =80dBμV EMF -3dB limiting	35	38	47	dBμV EMF
	Recovered Output Voltage	V <sub>OD</sub> V <sub>in</sub> =80dBμV EMF	200	270	300	
	Signal To Noise Ratio	S/N V <sub>in</sub> =80dBμV EMF	--	75	--	dB
	Total Harmonic Distortion	THD V <sub>in</sub> =80dBμV EMF	--	0.3	--	%
	AM Rejection Ration	AMR V <sub>in</sub> =80dBμV EMF	--	60	--	dB
	IF Count Output Frequency	f <sub>IF</sub> (FM) V <sub>in</sub> =80dBμV EMFSW7: ON	1.3373	1.3375	1.3377	MHz
	IF Count Output Voltage	V <sub>IF</sub> (FM) V <sub>in</sub> =80dBμV EMF SW7: ON	200	260	--	mV <sub>p-p</sub>
IF Count Output Sensitivity	IF sens (FM) SW7: ON	40	45	50	dBμV EMF	
AM	Gain	GV V <sub>in</sub> =27dBμV EMF	20	38		70
	Recovered Output Voltage	V <sub>OD</sub> V <sub>in</sub> =60dBμV EMF	60	90	120	mV <sub>rms</sub>
	Signal To Noise Ratio	S/N V <sub>in</sub> =60dBμV EMF	--	41	--	dB
	Total Harmonic Distortion	THD V <sub>in</sub> =60dBμV EMF	--	0.7	--	%
	Local OSC Buffer Output Voltage	V <sub>osc</sub> (buff) AM f <sub>osc</sub> =1.45MHz	44	66	--	mV <sub>rms</sub>
	IF Count Output Voltage	V <sub>IF</sub> (AM) V <sub>in</sub> =60dBμV EMF, SW7: ON	200	250	--	mV <sub>p-p</sub>
	IF Count Output Sensitivity	IF sens (AM) SW7: ON	38	43	48	dBμV EMF

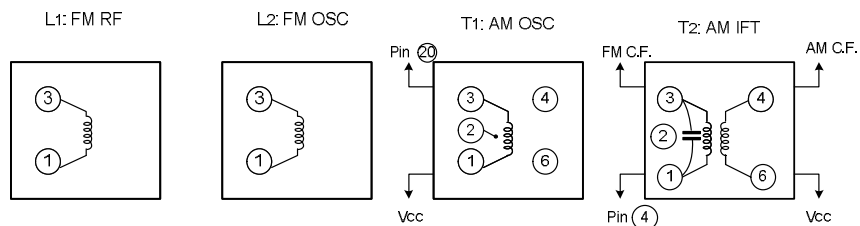
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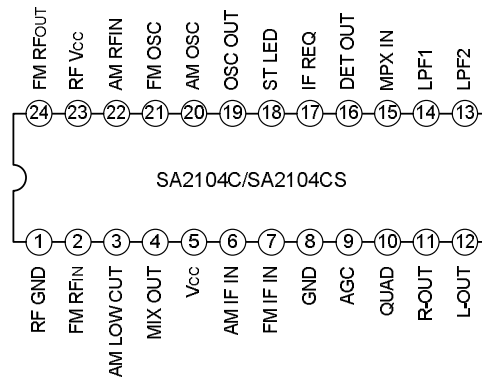
Parameter		Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Pin (17) Output Resistance		R17	FM mode	--	0.75	--	kΩ	
			AM mode	--	15.5	--		
MPX	Input Resistance		RIN	--	55	--	kΩ	
	Output Resistance		ROUT	--	5	--	kΩ	
	Max. Composite Signal Input Voltage		Vin MAX (Stereo)	L+R=90%, P=10%, SW3: LPF ON fm=1kHz, 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**

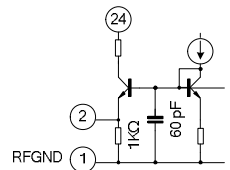
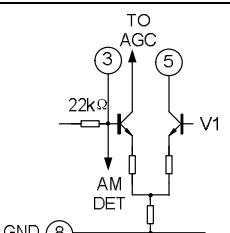
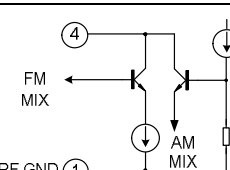
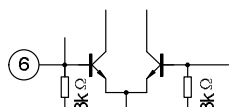
Coil No.	Test Freq.	L (μH)	Co (pF)	Qo	Turns					Wire (mmØ)
					1-2	2-3	1-3	1-4	4-6	
L1 FM RF	100MHz	--	--	79	--	--	--	2 $\frac{1}{2}$	--	0.16UEW
L2 FM OSC	100MHz	--	--	76	--	--	--	2	--	0.16UEW
T1 AM OSC	796kHz	268	--	65	19	95	--	--	--	0.05UEW
T2 AM IFT	455kHz	--	470	60	--	--	109	--	7	0.05UEW



PIN CONFIGURATION

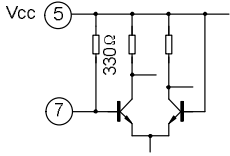
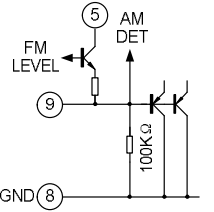
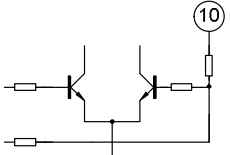
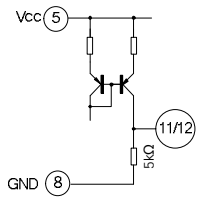
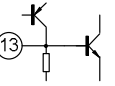
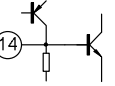


PIN DESCRIPTIONS and Quiescent Voltage

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
6	AMIF IN	AMIF input pin.		2.3	2.5

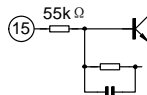
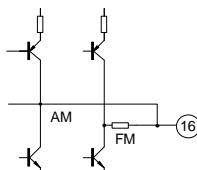
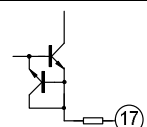
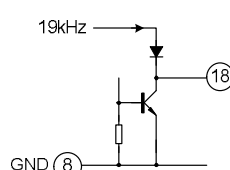
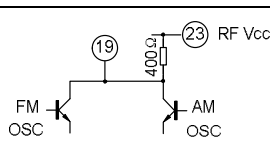
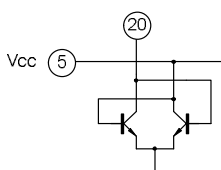
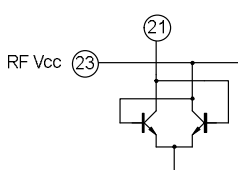
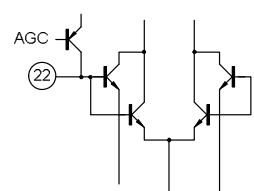
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Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
7	FMIF IN	FMIF input.		3.0	3.0
8	GND	GND for AM, FM IF, FM MPX stage.	--	0	0
9	AGC	Auto gain control pin.		0	0
10	QUAD	FM Quad		2.5	2.2
11 12	R-OUT L-OUT	Right/Left channel 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
14	LPF1	LPF terminal for synchronous detector VCO stop terminal V14=GND→VCO STOP		0.7	2.4

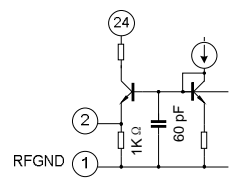
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Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
15	MPX IN	MPX input pin.		0.7	0.7
16	DET OUT	FM/AM detector output pin.		1.0	0.9
17	IF REQ	AM/FM IF output pin.		--	--
18	ST LED	Stereo indicator.		--	--
19	OSC OUT	AM/FM 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
22	AM RF IN	AM RF input pin.		3.0	3.0

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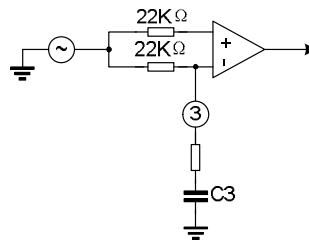
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Pin No.	Symbol	Pin description	Internal circuit	Pin voltage (Typ.) (V)	
				AM	FM
23	RF Vcc	(Vcc for FM OSC stage)	--	3.0	3.0
24	FM RF OUT	FM RF output pin.		3.0	3.0

## 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.

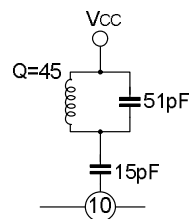
The cut-off frequency  $f_L$  is determined by the internal resistance 22kΩ (Typ.) and the external capacitor C3 as below:

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

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

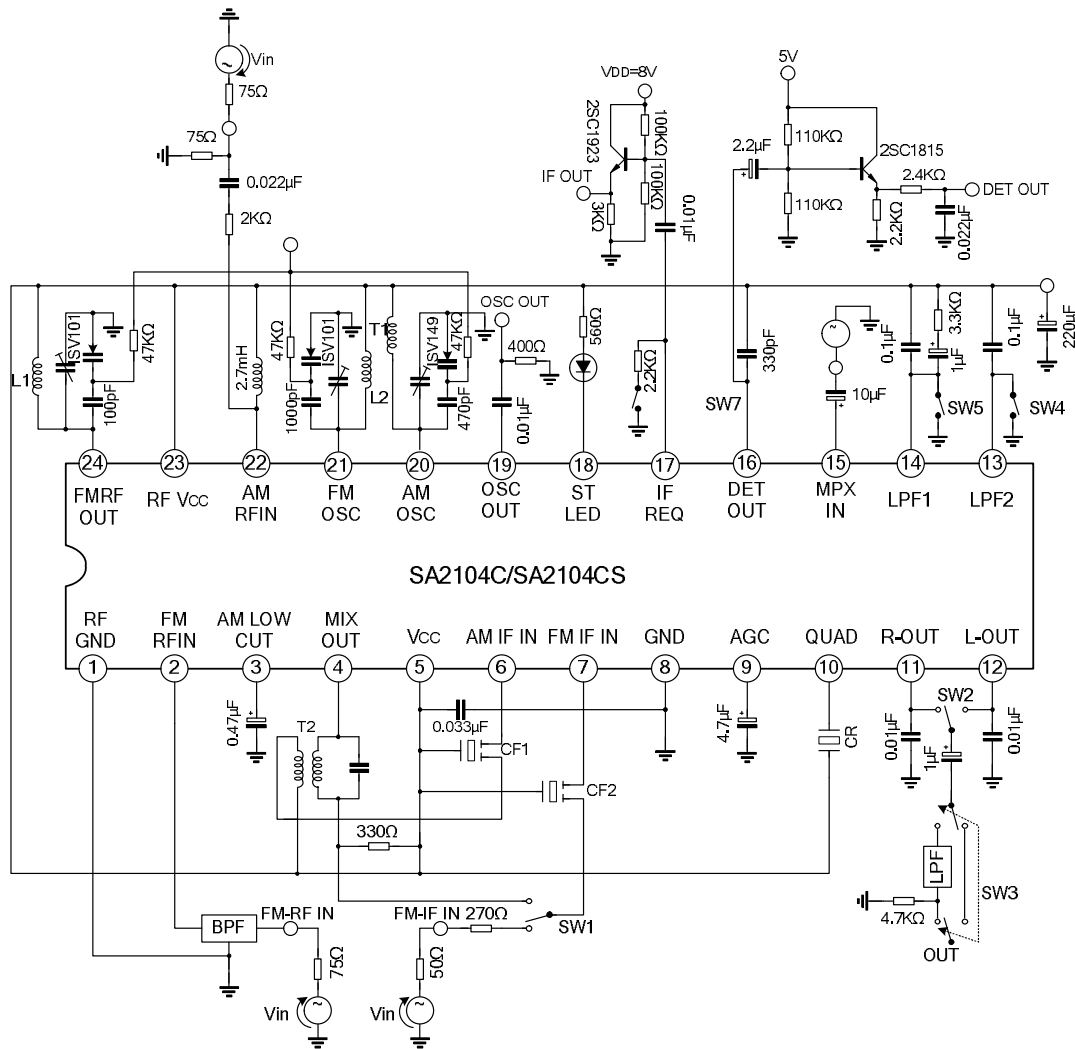
Recommended circuit and recommended coil are as follows. (Test frequency is 10.7M)



3. FM/AM switch and forced monaural switch.

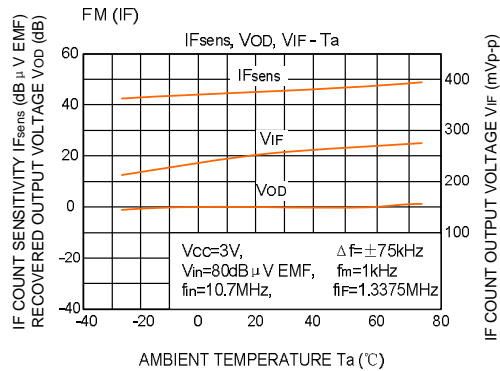
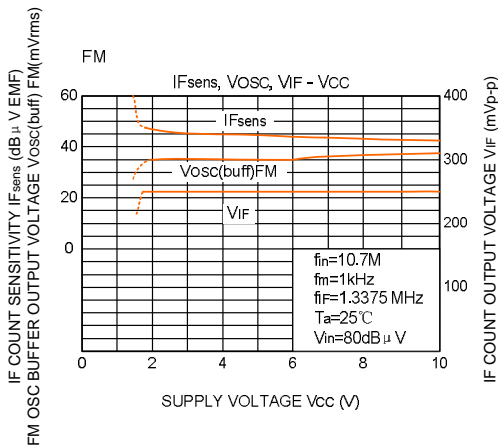
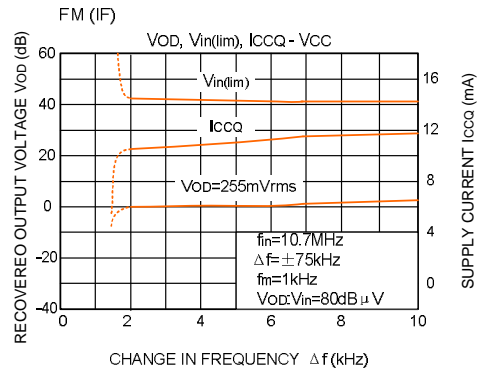
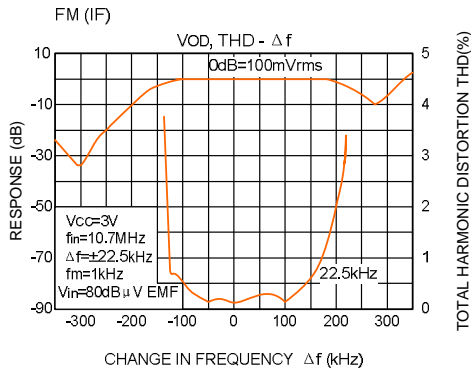
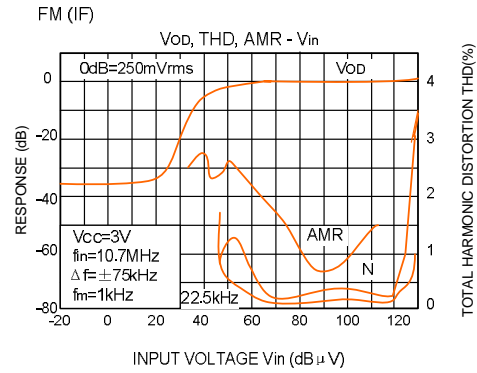
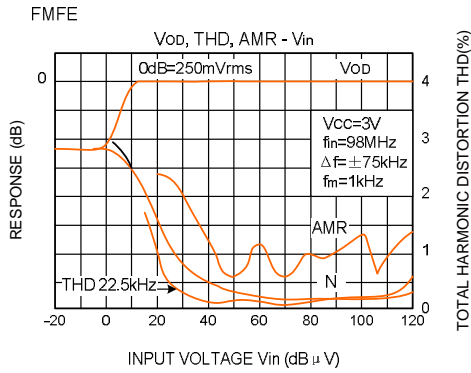
mode	Vpin13	Vpin14
AM	LOW (Vth=0.2V(Typ.), Ith 30μA(Typ.))	/
FM	OPEN	/
STEREO	/	OPEN
FORCED MONAURAL	/	LOW(Vth=0.2V(Typ.), Ith 30μA(Typ.))

TEST CIRCUIT

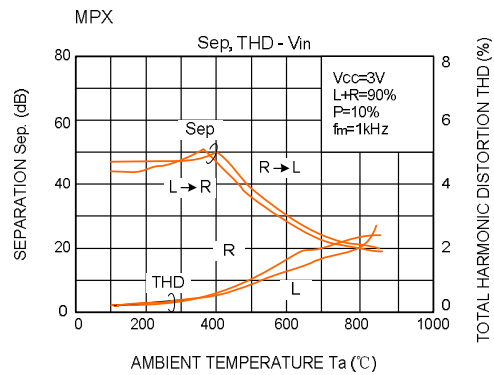
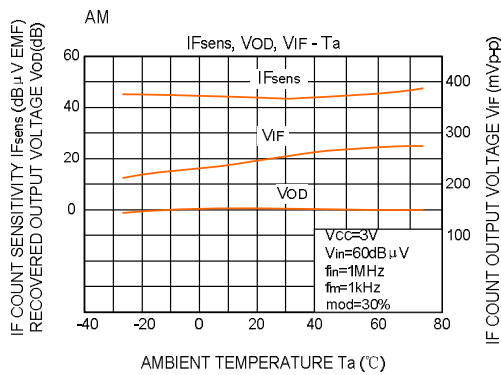
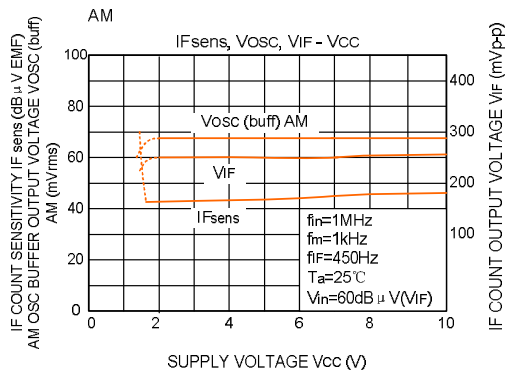
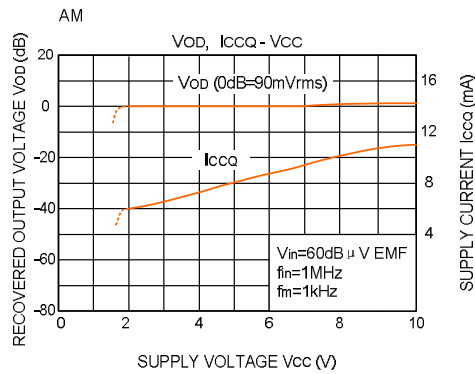
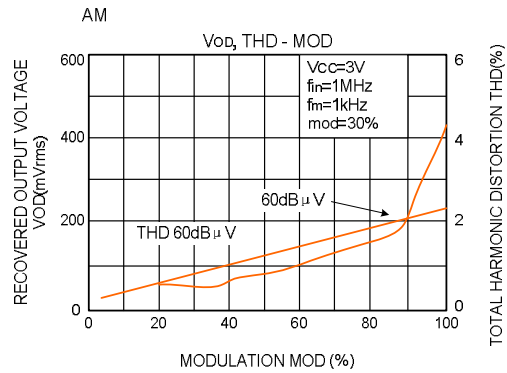
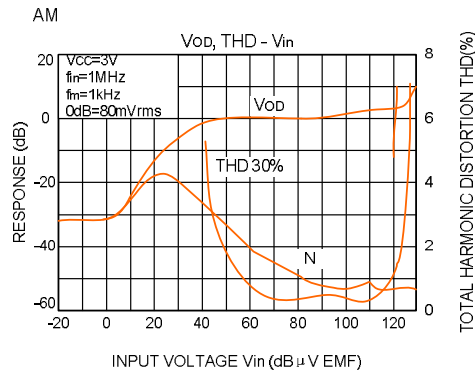




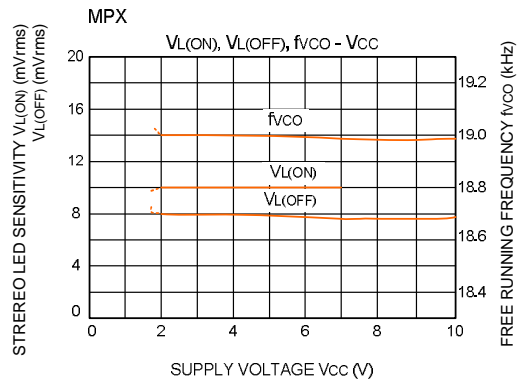
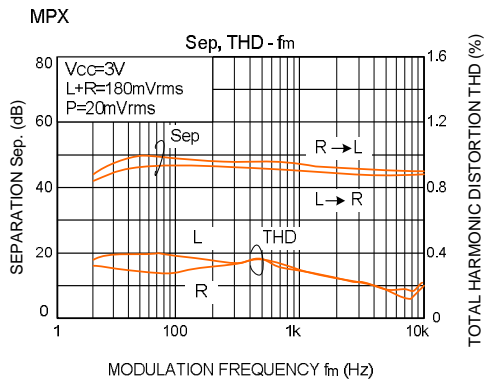
ELECTRICAL CHARACTERISTICS CURVES



ELECTRICAL CHARACTERISTICS CURVES (Continued)

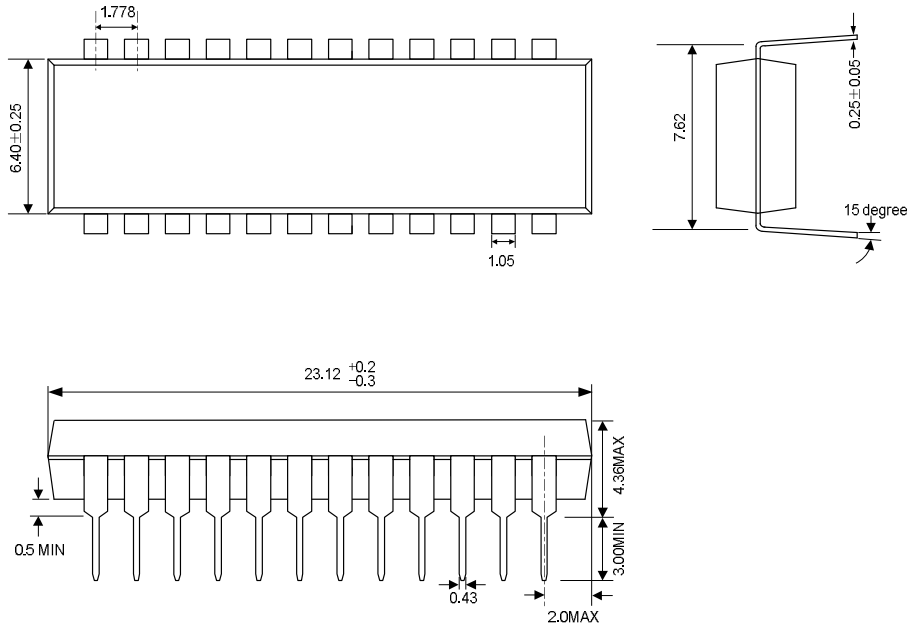


ELECTRICAL CHARACTERISTICS CURVES (Continued)

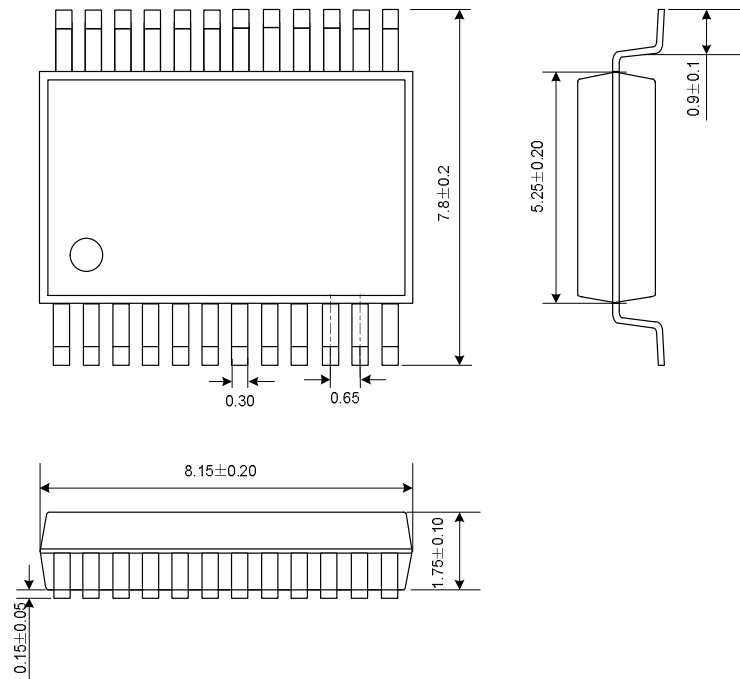


PACKAGE OUTLINE

SDIP-24-300-1.778 UNIT: mm



SSOP-24-300-0.65 UNIT: mm



ATTACH

## Revision History

Data	REV	Description	Page
2005.09.20	1.0	Original	
2005.10.26	1.1	Rename	