**TOSHIBA** TA2104BN/BFN

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# **TA2104BN, TA2104BFN**

## 3 V AM / FM 1 CHIP TUNER IC

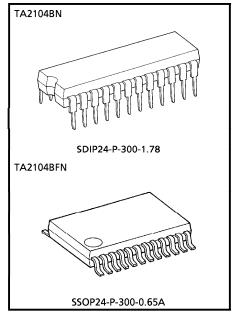
(for Digital Tuning System)

TA2104BN, TA2104BFN are AM/FM 1 chip tuner ICs, which are designed for portable Radios and 3 V Head phone Radios.

This is suitable for Digital Tuning System Applications. FM Local Oscillation Voltage is set up low relativity, for NEW FCC.

#### **FUNCTIONS**

- For NEW FCC.
- Suitable for combination with Digital Tuning System which is included IF Counter.
- One terminal type AM/FM IF count output for IF counter of Digital Tuning System.
  - FM : 1.3375 MHz (1/8 dividing)
  - AM: 450 kHz
- Built-in Mute Circuit for IF count output.
- For adopting ceramic Discriminator, it is not necessary to adjust the FM Quad Detector Circuit.
- Built-in FM MPX VCO circuit.
- Built-in one terminal type AM/FM Local Oscillator Buffer Output for Digital Tuning System Applications.
- Built-in AM Low cut circuit.
- Low supply current. (V<sub>CC</sub> = 3 V, Ta = 25°C) Iccq (FM) = 11 mA (Typ.)Iccq (AM) = 7 mA (Typ.)
- Operating Supply voltage range : V<sub>CC</sub> = 1.8~7 V (Ta = 25°C)



Weight

SDIP24-P-300-1.78 : 1.2 g (Typ.) SSOP24-P-300-0.65A : 0.14 g (Typ.)

(\*) Handle with care to prevent devices from deteriorations by static electricity.

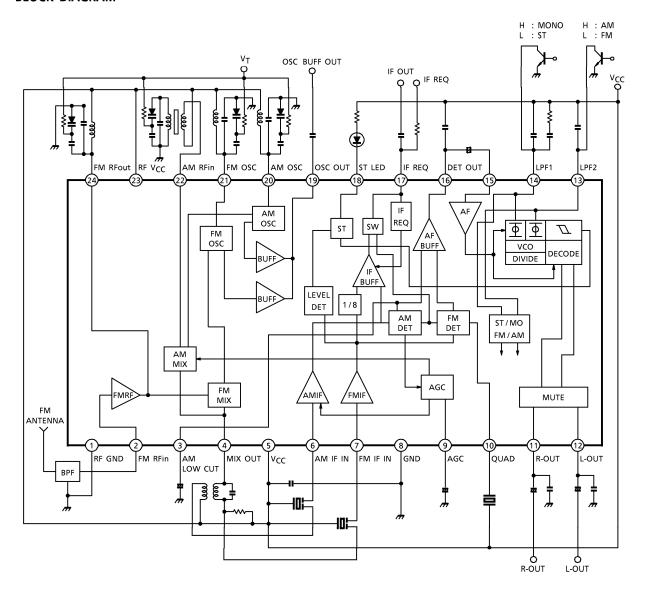
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### **BLOCK DIAGRAM**



# **EXPLANATION OF TERMINALS**

(Terminal Voltage: Typical terminal voltage at no signal with test circuit,  $V_{CC} = 3 \text{ V}$ ,  $Ta = 25^{\circ}\text{C}$ )

PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERM VOLT (Typ.	IINAL FAGE .) (V)
1	RF GND (GND for FM OSC stage)		0 AM	FM 0
2	FM-RFin	2	0	0.8
3	AM LOW CUT	AM 22 kΩ 3 22 kΩ 3 GND (8)	1.0	1
4	MIX OUT	VCC 5 FM MIX AM MIX RF GND 1  8 GND	3.0	3.0
5	V <sub>CC</sub> (V <sub>CC</sub> for AM, FM IF, FM MPX stage)	<del>-</del>	3.0	3.0
6	AM IF IN	GND 8	2.3	2.5
7	FM IF IN	VCC S CONTRACTOR OF THE PART O	3.0	3.0

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PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERM VOLT (Typ.	TAGE .) (V)
8	GND (GND for AM, FM IF, FM MPX stage)	<u> </u>	AM 0	FM 0
9	AGC	OND (8)	0	0
10	QUAD	VCC S	2.5	2.2
11 12	R-OUT L-OUT	Vcc (\$ 11/12) GND (8)	1.2	1.2
13	LPF2  ■ LPF terminal for phase Detector.  ■ Bias terminal AM / FM SW circuit.  V <sub>13</sub> = GND → AM V <sub>13</sub> = OPEN → FM	(3) AM / FM SW	0	2.2

PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERM VOLT (Typ.	ΓAGE
'**			AM	FM
14	<ul> <li>LPF1</li> <li>LPF terminal for Synchronous Detector.</li> <li>V<sub>CO</sub> Stop terminal.</li> <li>V<sub>14</sub> = GND → V<sub>CO</sub> STOP</li> </ul>	DC AMP	0.7	2.4
15	MPX IN	(I) 555 kΩ (I)	0.7	0.7
16	DET OUT	VCC $\bigcirc$ AM  FM  FM $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bigcirc$	1.0	0.9
17	IF REQ	₹ Vcc	_	_
18	ST LED	19 kHz ———————————————————————————————————	_	_

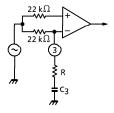
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PIN No.	CHARACTERISTIC	CHARACTERISTIC INTERNAL CIRCUIT							
		V <sub>CC</sub> (5) + (19) (23) RF V <sub>CC</sub>	AM	FM					
19	OSC OUT	VCC S  AM  OSC  OSC  GND 8  T RF GND	2.8	2.7					
20	AM OSC	VCC S  GND 8	3.0	3.0					
21	FM OSC	RF V <sub>CC</sub> (23)  GND (1)	3.0	3.0					
22	AM RFin	VCC (S) AGC  Q2  GND (8)	3.0	3.0					
23	RF V <sub>CC</sub> (V <sub>CC</sub> for FM OSC stage)	_	3.0	3.0					
24	FM RFout	Cf. pin ①	3.0	3.0					

#### **APPLICATION NOTE**

- 1. AM Low-Cut Circuit
  - The AM Low-Cut action is carried out by the bypass of the high frequency component of the positive-feedback signal at the AF AMP stage.
     The external capacitor: C<sub>3</sub> by-pass this component.
  - $\odot$  The cut-off frequency f<sub>L</sub> is determined by the internal resistance 22 k $\Omega$  (Typ.) and the external capacitor C<sub>3</sub> as following ;

$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^3 \times C_3} \text{ (Hz)}$$



- $\odot$  In the case of the AM Low-Cut function is not needed, set up the value of C<sub>3</sub> over 1  $\mu$ F. In the condition of C<sub>3</sub>  $\ge$  1  $\mu$ F, the frequency characteristic has flat response at the low frequency.
- O 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

For the FM detection circuit, detection coil is able to use instead of ceramic discriminator. Recommended circuit and recommended coil are as follows. (In this case, please take care that V<sub>in</sub> (lim.) falls a little.)

 ч	
	<b>→</b> ∨ <sub>CC</sub>
	<b>⊢</b>
	<b>_</b>
	<b>1</b> 5₽.
	Τ_
	(10)



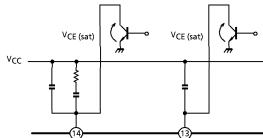
TEST FREQUENCY	C <sub>O</sub> O			TUF	RNS		WIRE	REFERENCE
TEST TREQUENCY	(pF)	$Q_0$	1-2	2-3	1-3	4-6	$(mm\phi)$	KEILKLINGE
10.7 MHz	E 1	45			30		0.08 UEW	TOKO Co., Ltd.
10.7 IVITZ	31	45			30		U.08 UEVV	600BEAS-10018Z

- 3. FM/AM switch and forced monaural switch.
  - FM / AM switchover and stereo / forced monaural switchover are done by pin ® and pin ®.
  - FM / AM switch (pin <sup>(3)</sup>)

( V13 : Low (Active Low, V<sub>th</sub> = 0.2 V (Typ.), I<sub>th</sub> 30 
$$\mu$$
A (Typ.)  $\rightarrow$  AM V13 : OPEN  $\rightarrow$  FM /

Stereo / forced monaural switch (pin (9))

(V14 : Low (Active Low,  $V_{th} = 0.2 \text{ V (Typ.)}$ ,  $I_{th} = 30 \,\mu\text{A} \text{ (Typ.)} \rightarrow \text{Forced Monaural V}$ V14 : OPEN  $\rightarrow \text{Stereo}$ 



# **MAXIMUM RATINGS** (Ta = 25°C)

CHARACTE	RISTIC	SYMBOL	RATING	UNIT
Supply Voltage		Vcc	8	٧
LED Current		ILED	10	mΑ
LED Voltage		VLED	8	V
Power Dissipation	TA2104BN	PD	1200	mW
Power Dissipation	TA2104BFN	(Note)	500	IIIVV
Operating Temper	ature	T <sub>opr</sub>	<b>- 25∼75</b>	°C
Storage Temperat	ure	T <sub>stg</sub>	<b>- 55∼150</b>	°C

(Note) Derated above Ta =  $25^{\circ}$ C in the proportion of  $9.6 \, \text{mW} / ^{\circ}$ C for TA2104BN of  $4 \, \text{mW} / ^{\circ}$ C for TA2104BFN.

## **ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, Ta = 25°C,  $V_{CC}$  = 3 V, F/E : f = 98 MHz,  $f_m$  = 1 kHz FM IF: f = 10.7 MHz,  $\Delta f$  =  $\pm$ 75 kHz,  $f_m$  = 1 kHz AM : f = 1 MHz, MOD = 30%,  $f_m$  = 1 kHz MPX :  $f_m$  = 1 kHz

(	CHARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Suppl	y Current	ICC (FM)	_	V <sub>in</sub> = 0, FM mode V <sub>in</sub> = 0, AM mode	_ 	11 7	14.5 9.5	mA
F/E	Input Limiting Voltage	Vin (lim)	_	$V_{in} = 60 \text{ dB} \mu \text{V EMF},$ $-3 \text{ dB limiting}$	_	12	_	dBμV EMF
F/E	Local OSC Buffer Output Voltage	V <sub>OSC</sub> (buff) FM	_	f <sub>OSC</sub> = 108.7 MHz	23	35	_	mV <sub>rms</sub>
	Input Limiting Voltage	V <sub>in (lim)</sub> IF	_	$V_{in} = 80 \text{ dB}\mu\text{V EMF},$ - 3 dB limiting	37	42	47	dBμV EMF
	Recovered Output Voltage	V <sub>OD</sub>	_	$V_{in} = 80  dB \mu V  EMF$	200	250	300	mV <sub>rms</sub>
	Signal To Noise Ratio	S/N	_	$V_{in} = 80  dB \mu V  EMF$	_	75	_	dB
FM	Total Harmonic Distortion	THD	_	$V_{in} = 80  dB \mu V  EMF$	_	0.3	_	%
IF	AM Rejection Ration	AMR	_	$V_{in} = 80  dB \mu V  EMF$	_	60	_	dB
	IF Count Output Frequency	f <sub>IF</sub> (FM)	_	$V_{in}$ = 80 dB $\mu$ V EMF, SW7 : ON	1.3373	1.3375	1.3377	MHz
	IF Count Output Voltage	V <sub>IF</sub> (FM)	_	$V_{in}$ = 80 dB $\mu$ V EMF, SW7 : ON	200	250	_	mV <sub>p-p</sub>
	IF Count Output Sensitivity	IF sens (FM)	_	SW7 : ON	41	46	51	dBμV EMF
	Gain	GV	_	$V_{in} = 27  dB \mu V  EMF$	20	38	70	mV <sub>rms</sub>
	Recovered Output Voltage	V <sub>OD</sub>	_	V <sub>in</sub> = 60 dBμV EMF	60	85	108	mV <sub>rms</sub>
	Signal To Noise Ratio	S/N	_	V <sub>in</sub> = 60 dBμV EMF	_	41	_	dB
AM	Total Harmonic Distortion	THD	_	V <sub>in</sub> = 60 dBμV EMF	_	0.7	_	%
	Local OSC Buffer Output Voltage	VOSC (buff) AM	_	f <sub>OSC</sub> = 1.45 MHz	44	66	_	mV <sub>rms</sub>
	IF Count Output Voltage	V <sub>IF</sub> (AM)	_	$V_{in}$ = 60 dB $\mu$ V EMF, SW7 : ON	200	250	_	mV <sub>p-p</sub>
	IF Count Output Sensitivity	IF sens (AM)	_	SW7 : ON	38	43	48	dBμV EMF
DIN 6	A Output Posistones	D		FM mode	_	0.75	_	kΩ
FIIN (	① Output Resistance	R <sub>17</sub>		AM mode	_	15.5	_	K77

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	CHARACTERISTIC		SYMBOL	TEST CIR- CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
	Input Resis	stance	R <sub>IN</sub>	_	_		_	55	_	kΩ
	Output Re	sistance	ROUT	_	_		_	5	_	kΩ
	Max. Composite Signal Input Voltage		V <sub>in MAX</sub>		L + R = 90%, P = 10 SW3 : LPF ON $f_m = 1 \text{ kHz}$ , THD = 3			700	_	mV <sub>rms</sub>
					$L + R = 180 \mathrm{mV}_{rms}$	$f_m = 100 Hz$	l	45	_	
	Separation		Sep.	_	$P = 20 \text{ mV}_{rms}$	$f_m = 1  \text{kHz}$	35	45	_	dB
					SW3 : LPF ON	$f_m = 10 \text{ kHz}$	_	45	_	
NADY	Total	Monaural	THD (Monaural)	_	V <sub>in</sub> = 200 mV <sub>rms</sub>	_	0.3	_	%	
MPX	Harmonic Distortion	Stereo	THD (Stereo)	-	$L + R = 180 \text{ mV}_{rms}$ , $P = 20 \text{ mV}_{rms}$ , SW3	_	0.3	_	70	
	Voltage G	ain	GV		V <sub>in</sub> = 200 mV <sub>rms</sub>	- 2.7	- 1.2	0.2	dB	
	Channel B	alance	C.B.	_	V <sub>in</sub> = 200 mV <sub>rms</sub>		- 1.5	0	1.5	dB
	Stereo LED	ON	V <sub>L</sub> (ON)	_	Dilat Input (10 kHz)		_	10	14	m\/
	Sensitivity	OFF	V <sub>L</sub> (OFF)	_	Pilot Input (19 kHz)		5	8	_	mV <sub>rms</sub>
	Stereo LED Hysteresis		VH	_	To LED turn off from	To LED turn off from LED turn on		2	_	mV <sub>rms</sub>
	Capture Range		C.R.	_	$P = 15 \text{ mV}_{rms}$		_	±8	_	%
	Signal Noise Ratio S/N		S/N	_	V <sub>in</sub> = 200 mV <sub>rms</sub>		_	80	_	dB
Muti	ng Attenua	tion	MUTE	_	V <sub>in</sub> = 200 mV <sub>rms</sub>		_	80	_	dB

# **COIL DATA**

COIL No.	TEST	L	Со	Qo			TURNS	ı		WIRE	REFERENCE
COIL NO.	FREQ	(μH)	(pF)	Ŷ	1-2	2-3	1-3	1-4	4-6	$(mm\phi)$	REFERENCE
L <sub>1</sub> FM RF	100 MHz			79			$2\frac{1}{2}$			0.16UEW	TOKO Co., Ltd.
Li Livi Ki	100 101112			/ 9			2			0.100244	666SNF-305NK
L <sub>2</sub> FM OSC	100 MHz			76			2			0.16UEW	TOKO Co., Ltd.
L2 FIVI OSC	100 IVITIZ			/6						0.100244	666SNF-306NK
T <sub>1</sub> AM OSC	796 kHz	268		65	19	95				0.05UEW	TOKO Co., Ltd.
I 1 AIVI OSC	/ 90 KHZ	200	_	05	19	93				0.030EVV	5PNR-5146Y
T <sub>2</sub> AM IFT	455 kHz		470	60			109		7	0.05UEW	TOKO Co., Ltd.
12 AIVI IFI	455 KHZ		4/0	80			109		,	U.U3UEVV	5PNR-5147X

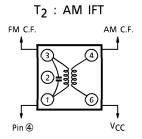
L<sub>1</sub>: FM RF



 $L_2:FM\ OSC$ 

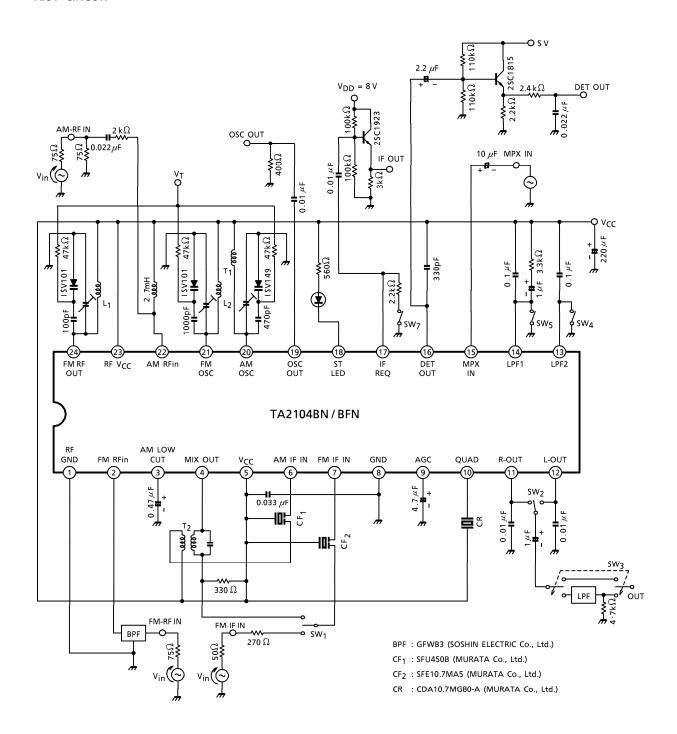


T<sub>1</sub>: AM OSC

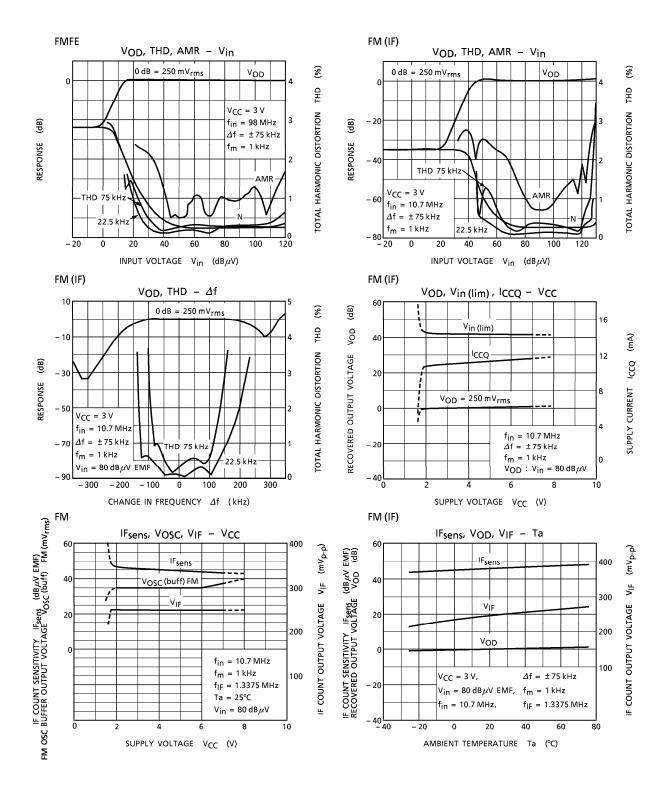


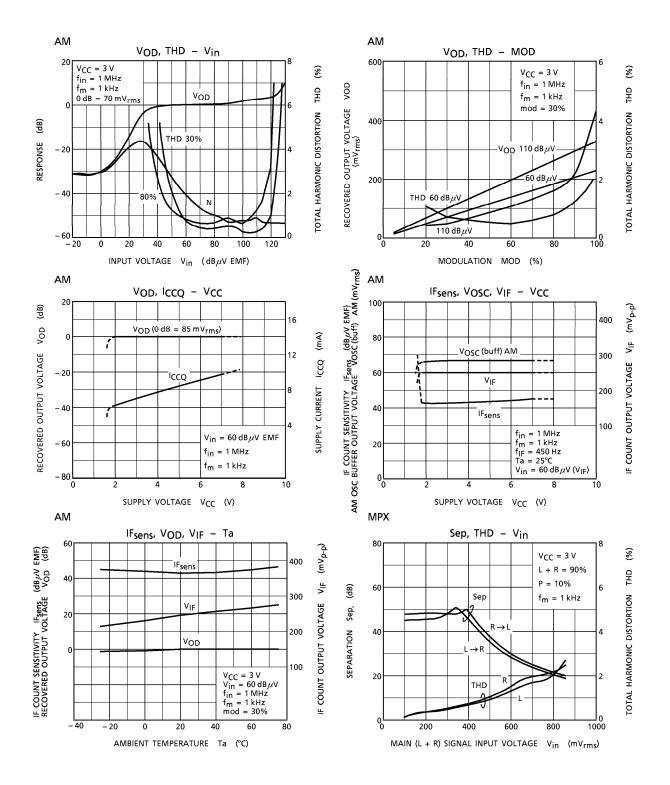
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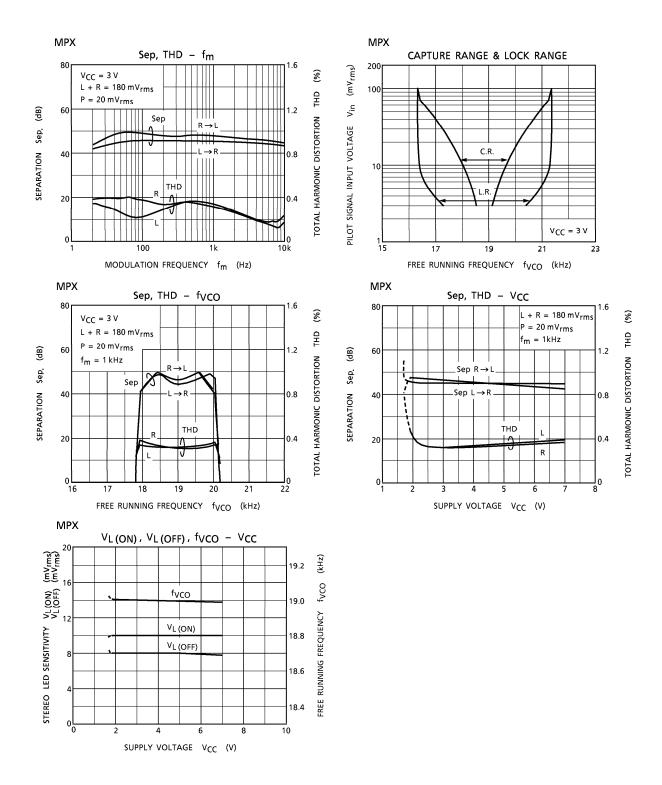
### **TEST CIRCUIT**



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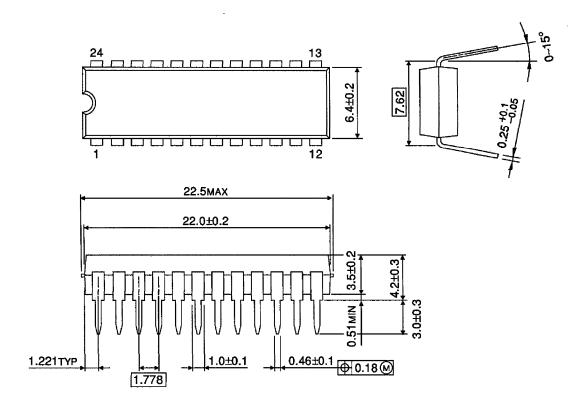




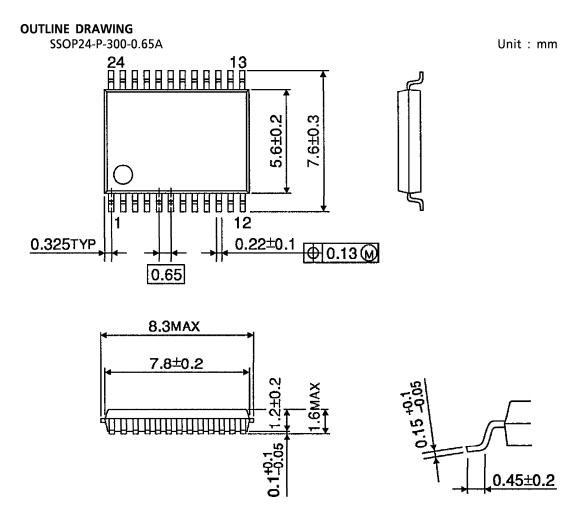


## OUTLINE DRAWING SDIP24-P-300-1.78

Unit: mm



Weight: 1.2 g (Typ.)



Weight: 0.14 g (Typ.)