TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

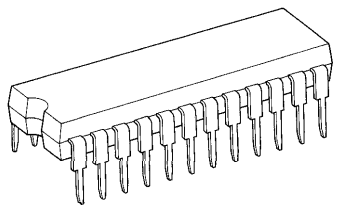
TA2104BN, TA2104BFN

3 V AM / FM 1 CHIP TUNER IC

(for Digital Tuning System)

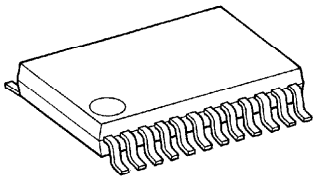
TA2104BN, TA2104BFN are AM / FM 1 chip tuner ICs, which are designed for portable Radios and 3 V Head phone Radios.
This is suitable for Digital Tuning System Applications. FM Local Oscillation Voltage is set up low relativity, for NEW FCC.

TA2104BN



SDIP24-P-300-1.78

TA2104BFN



SSOP24-P-300-0.65A

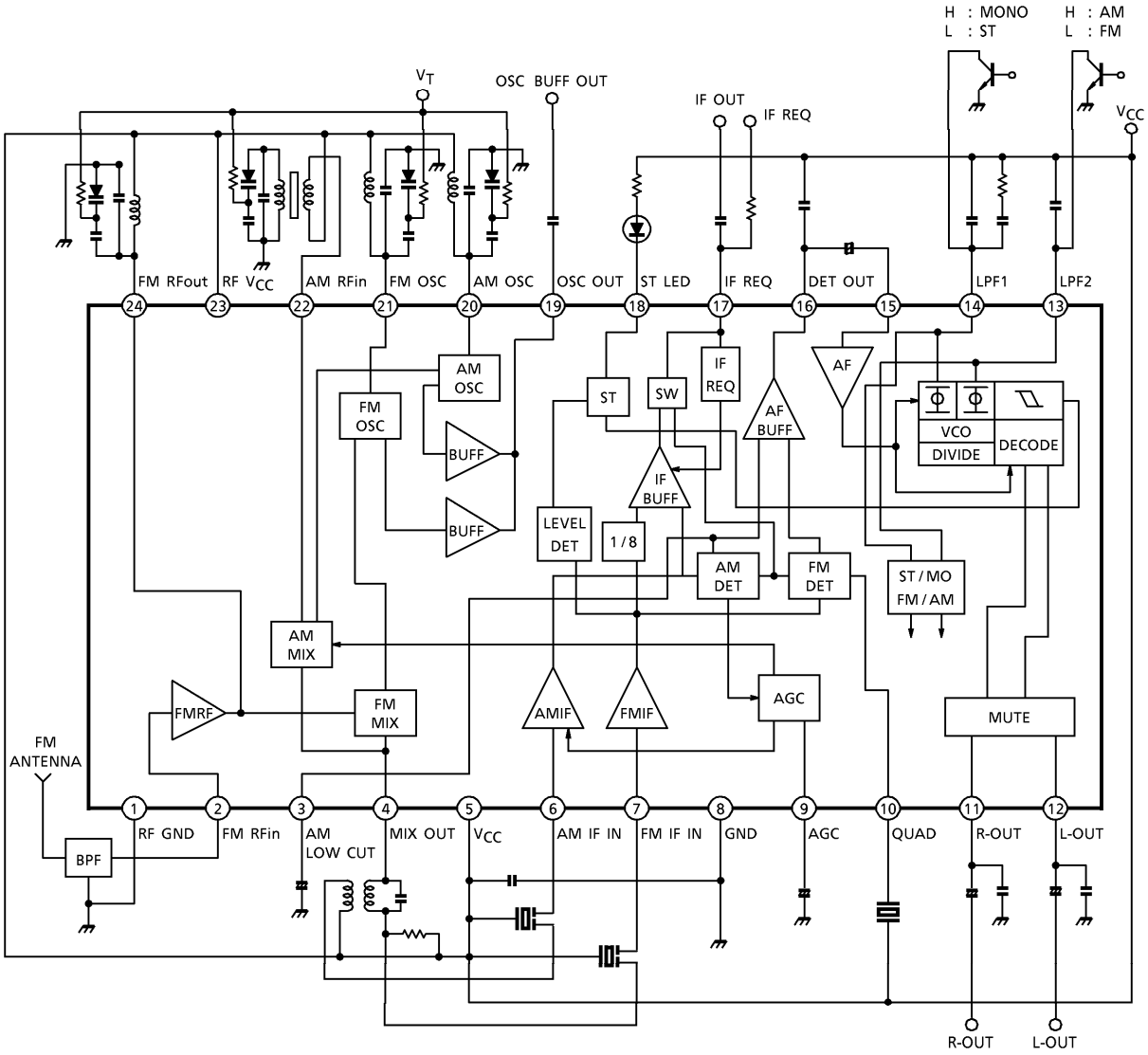
Weight
SDIP24-P-300-1.78 : 1.2 g (Typ.)
SSOP24-P-300-0.65A : 0.14 g (Typ.)

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_{CC} = 3 V, Ta = 25°C)
  Iccq (FM) = 11 mA (Typ.)
  Iccq (AM) = 7 mA (Typ.)
- Operating Supply voltage range : V_{CC} = 1.8~7 V (Ta = 25°C)

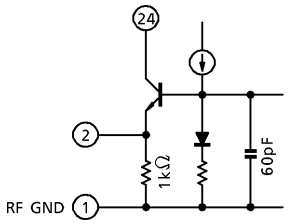
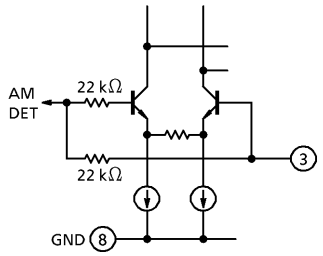
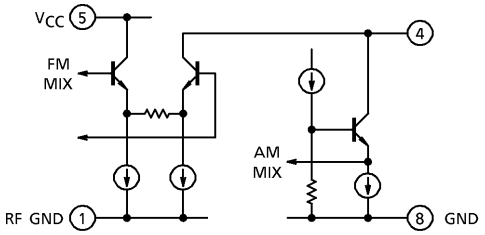
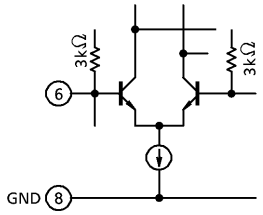
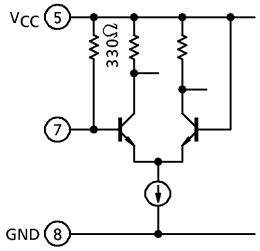
(*) Handle with care to prevent devices from deteriorations by static electricity.

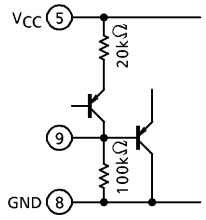
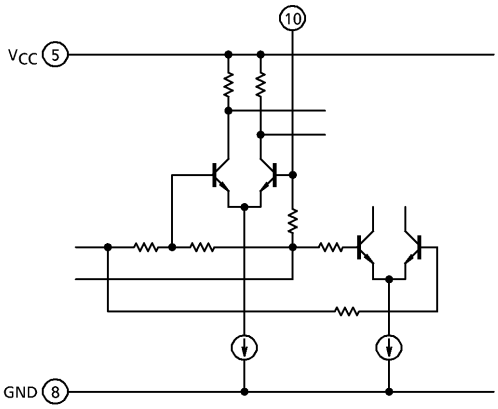
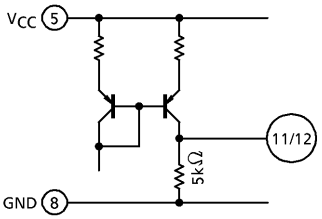
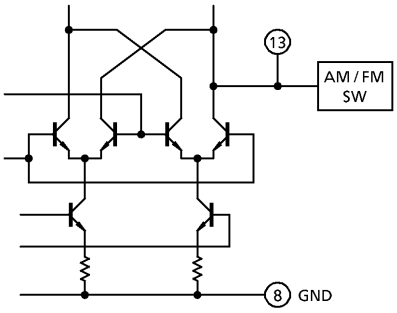
BLOCK DIAGRAM

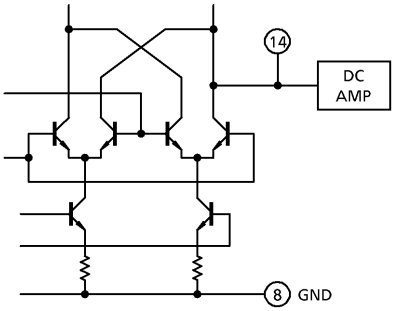
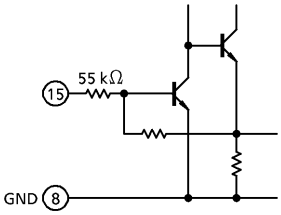
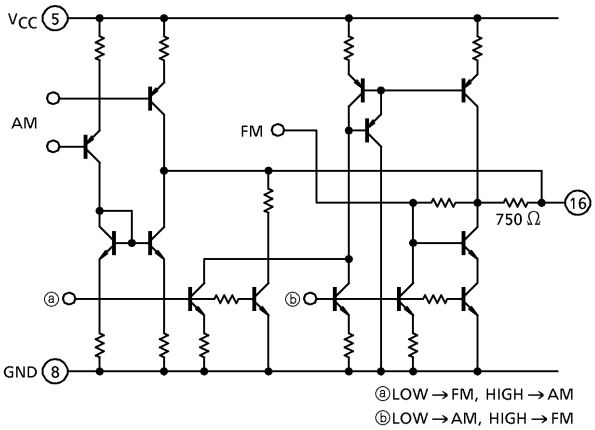
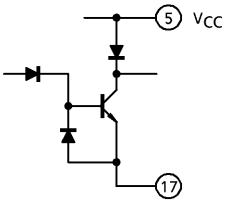
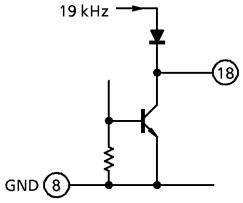


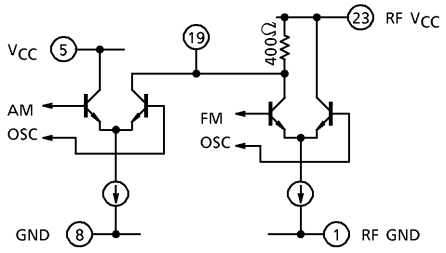
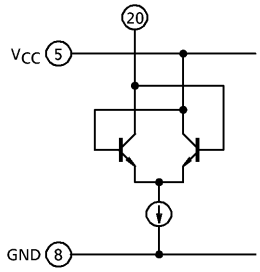
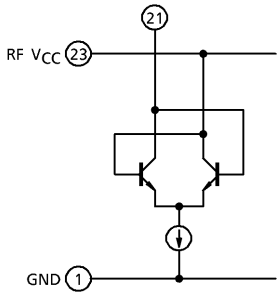
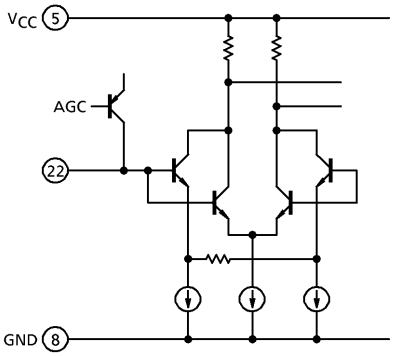
EXPLANATION OF TERMINALS

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

PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERMINAL VOLTAGE (Typ.) (V)	
			AM	FM
1	RF GND (GND for FM OSC stage)	—	0	0
2	FM-RFin		0	0.8
3	AM LOW CUT		1.0	—
4	MIX OUT		3.0	3.0
5	V_{CC} (V_{CC} for AM, FM IF, FM MPX stage)	—	3.0	3.0
6	AM IF IN		2.3	2.5
7	FM IF IN		3.0	3.0

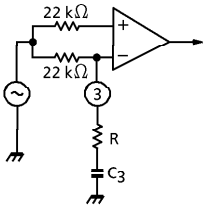
PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERMINAL VOLTAGE (Typ.) (V)	
			AM	FM
8	GND (GND for AM, FM IF, FM MPX stage)	—	0	0
9	AGC		0	0
10	QUAD		2.5	2.2
11 12	R-OUT L-OUT		1.2	1.2
13	LPF2 ● LPF terminal for phase Detector. ● Bias terminal AM / FM SW circuit. V_{13} = GND → AM V_{13} = OPEN → FM		0	2.2

PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERMINAL VOLTAGE (Typ.) (V) AM	FM
14	LPF1 ● LPF terminal for Synchronous Detector. ● V_{CO} Stop terminal. V_{14} = GND → V_{CO} STOP		0.7	2.4
15	MPX IN		0.7	0.7
16	DET OUT		1.0	0.9
17	IF REQ		—	—
18	ST LED		—	—

PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERMINAL VOLTAGE (Typ.) (V)	
			AM	FM
19	OSC OUT		2.8	2.7
20	AM OSC		3.0	3.0
21	FM OSC		3.0	3.0
22	AM RFin		3.0	3.0
23	RF V_{CC} (V_{CC} 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_3 by-pass this component.

○ The cut-off frequency f_L is determined by the internal resistance 22 kΩ (Typ.) and the external capacitor C_3 as following ;

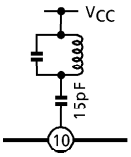
$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^3 \times C_3} \text{ (Hz)}$$

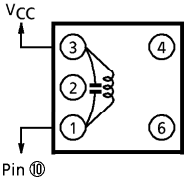
○ In the case of the AM Low-Cut function is not needed, set up the value of C_3 over 1 μF. In the condition of $C_3 \geqq 1$ μF, the frequency characteristic has flat response at the low frequency.

○ 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_{in} (lim.) falls a little.)





TEST FREQUENCY	C_o (pF)	Q_o	TURNS				WIRE (mmϕ)	REFERENCE
			1-2	2-3	1-3	4-6		
10.7 MHz	51	45	—	—	30	—	0.08 UEW	TOKO Co., Ltd. 600BEAS-10018Z

3. FM / AM switch and forced monaural switch.

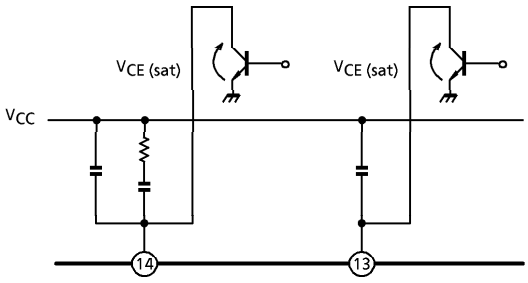
○ FM / AM switchover and stereo / forced monaural switchover are done by pin ⑬ and pin ⑭.

○ FM / AM switch (pin ⑬)

(V13 : Low (Active Low, V_{th} = 0.2 V (Typ.), I_{th} 30 μA (Typ.) → AM
V13 : OPEN → FM)

○ Stereo / forced monaural switch (pin ⑭)

(V14 : Low (Active Low, V_{th} = 0.2 V (Typ.), I_{th} 30 μA (Typ.) → Forced Monaural
V14 : OPEN → Stereo)



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	8	V
LED Current		ILED	10	mA
LED Voltage		VLED	8	V
Power Dissipation	TA2104BN	P_D (Note)	1200	mW
	TA2104BFN		500	
Operating Temperature		T_{opr}	−25~75	°C
Storage Temperature		T_{stg}	−55~150	°C

(Note) Derated above Ta = 25°C in the proportion of 9.6 mW / °C for TA2104BN of 4 mW / °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, Δf = ±75 kHz, f_m = 1 kHz
AM : f = 1 MHz, MOD = 30%, f_m = 1 kHz
MPX : f_m = 1 kHz

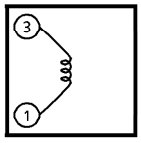
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current		I_{CC} (FM)	—	V_{in} = 0, FM mode	—	11	14.5	mA
		I_{CC} (AM)	—	V_{in} = 0, AM mode	—	7	9.5	
F / E	Input Limiting Voltage	V_{in} (lim)	—	V_{in} = 60 dBμV EMF, −3 dB limiting	—	12	—	dBμV EMF
	Local OSC Buffer Output Voltage	V_{OSC} (buff) FM	—	f_{OSC} = 108.7 MHz	23	35	—	mV_{rms}
FM IF	Input Limiting Voltage	V_{in} (lim) IF	—	V_{in} = 80 dBμV EMF, −3 dB limiting	37	42	47	dBμV EMF
	Recovered Output Voltage	V_{OD}	—	V_{in} = 80 dBμV EMF	200	250	300	mV_{rms}
	Signal To Noise Ratio	S / N	—	V_{in} = 80 dBμV EMF	—	75	—	dB
	Total Harmonic Distortion	THD	—	V_{in} = 80 dBμV EMF	—	0.3	—	%
	AM Rejection Ration	AMR	—	V_{in} = 80 dBμV EMF	—	60	—	dB
	IF Count Output Frequency	f_{IF} (FM)	—	V_{in} = 80 dBμV EMF, SW7 : ON	1.3373	1.3375	1.3377	MHz
	IF Count Output Voltage	V_{IF} (FM)	—	V_{in} = 80 dBμV EMF, SW7 : ON	200	250	—	mV_{p-p}
	IF Count Output Sensitivity	IF sens (FM)	—	SW7 : ON	41	46	51	dBμV EMF
AM	Gain	G_V	—	V_{in} = 27 dBμV EMF	20	38	70	mV_{rms}
	Recovered Output Voltage	V_{OD}	—	V_{in} = 60 dBμV EMF	60	85	108	mV_{rms}
	Signal To Noise Ratio	S / N	—	V_{in} = 60 dBμV EMF	—	41	—	dB
	Total Harmonic Distortion	THD	—	V_{in} = 60 dBμV EMF	—	0.7	—	%
	Local OSC Buffer Output Voltage	V_{OSC} (buff) AM	—	f_{OSC} = 1.45 MHz	44	66	—	mV_{rms}
	IF Count Output Voltage	V_{IF} (AM)	—	V_{in} = 60 dBμV EMF, SW7 : ON	200	250	—	mV_{p-p}
	IF Count Output Sensitivity	IF sens (AM)	—	SW7 : ON	38	43	48	dBμV EMF
PIN ⑰ Output Resistance		R_{17}	—	FM mode	—	0.75	—	kΩ
				AM mode	—	15.5	—	

CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
MPX	Input Resistance		R_{IN}	—	—		—	55	—	kΩ
	Output Resistance		R_{OUT}	—	—		—	5	—	kΩ
	Max. Composite Signal Input Voltage		V_{in} MAX (Stereo)	—	L + R = 90%, P = 10%, SW3 : LPF ON f_m = 1 kHz, THD = 3%		—	700	—	mV_{rms}
	Separation		Sep.	—	L + R = 180 mV_{rms}, P = 20 mV_{rms} SW3 : LPF ON	f_m = 100 Hz	—	45	—	dB
						f_m = 1 kHz	35	45	—	
						f_m = 10 kHz	—	45	—	
	Total Harmonic Distortion	Monaural	THD (Monaural)	—	V_{in} = 200 mV_{rms}		—	0.3	—	%
		Stereo	THD (Stereo)	—	L + R = 180 mV_{rms}, P = 20 mV_{rms}, SW3 : LPF ON		—	0.3	—	
	Voltage Gain		G_V	—	V_{in} = 200 mV_{rms}		− 2.7	− 1.2	0.2	dB
	Channel Balance		C.B.	—	V_{in} = 200 mV_{rms}		− 1.5	0	1.5	dB
	Stereo LED Sensitivity	ON	$V_{L (ON)}$	—	Pilot Input (19 kHz)		—	10	14	mV_{rms}
		OFF	$V_{L (OFF)}$	—			5	8	—	
	Stereo LED Hysteresis		V_H	—	To LED turn off from LED turn on		—	2	—	mV_{rms}
	Capture Range		C.R.	—	P = 15 mV_{rms}		—	±8	—	%
	Signal Noise Ratio		S / N	—	V_{in} = 200 mV_{rms}		—	80	—	dB
Muting Attenuation			MUTE	—	V_{in} = 200 mV_{rms}		—	80	—	dB

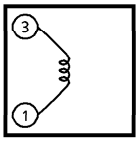
COIL DATA

COIL No.	TEST FREQ	L (μH)	Co (pF)	Qo	TURNS					WIRE (mmϕ)	REFERENCE
					1-2	2-3	1-3	1-4	4-6		
L_1 FM RF	100 MHz			79			$2\frac{1}{2}$			0.16UEW	TOKO Co., Ltd. 666SNF-305NK
L_2 FM OSC	100 MHz			76			2			0.16UEW	TOKO Co., Ltd. 666SNF-306NK
T_1 AM OSC	796 kHz	268	—	65	19	95				0.05UEW	TOKO Co., Ltd. 5PNR-5146Y
T_2 AM IFT	455 kHz	—	470	60			109		7	0.05UEW	TOKO Co., Ltd. 5PNR-5147X

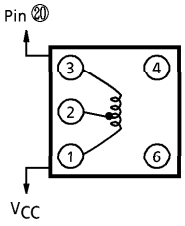
L_1 : FM RF



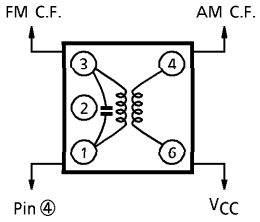
L_2 : FM OSC



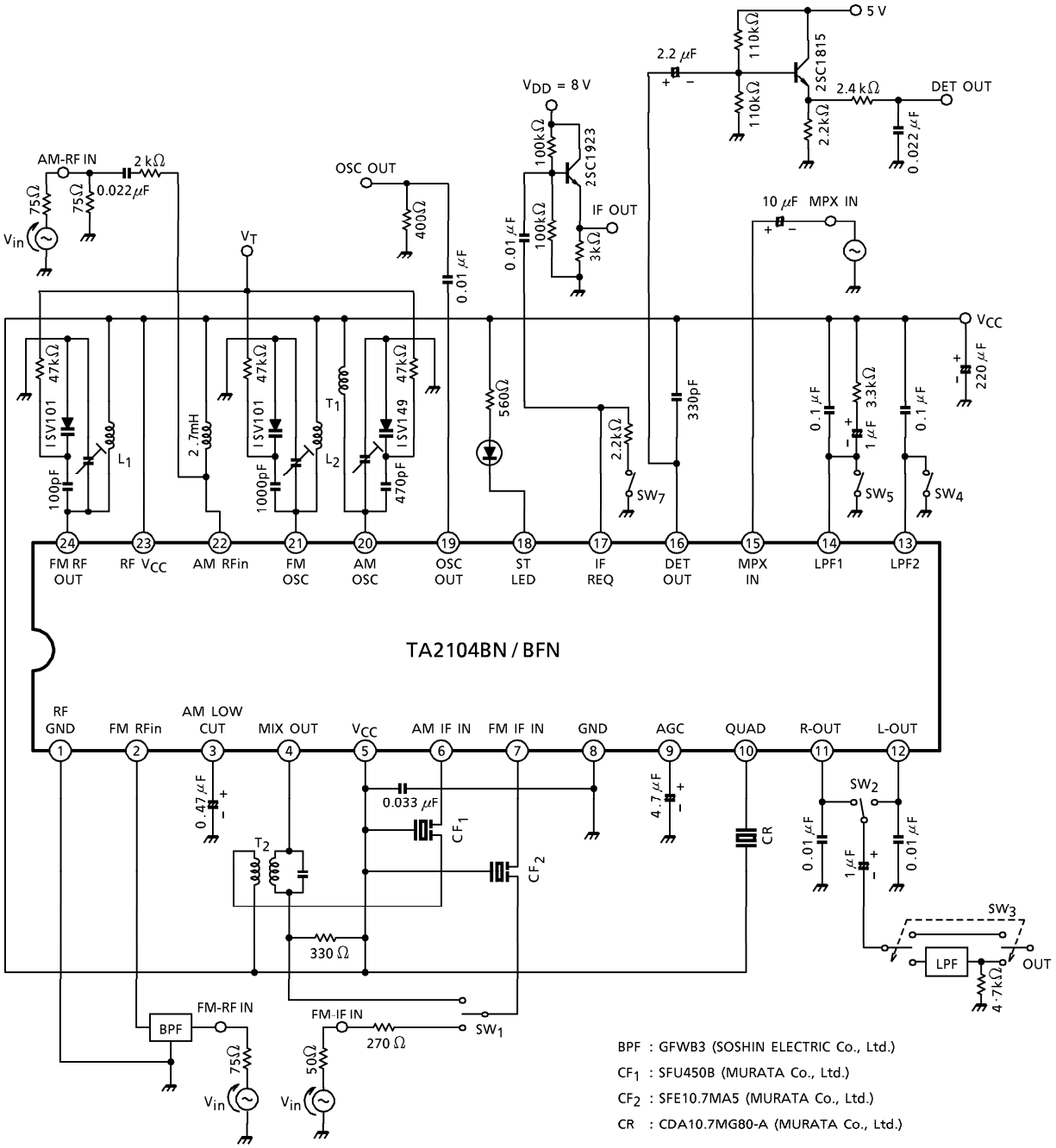
T_1 : AM OSC



T_2 : AM IFT

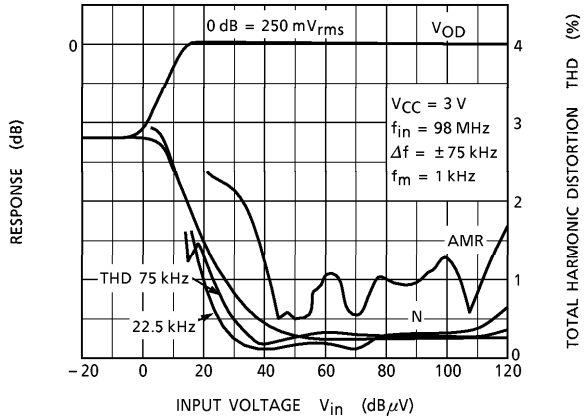


TEST CIRCUIT

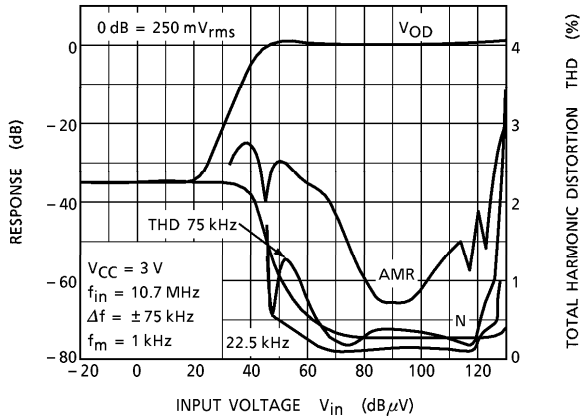


BPF : GFWB3 (SOSHIN ELECTRIC Co., Ltd.)
CF_1 : SFU450B (MURATA Co., Ltd.)
CF_2 : SFE10.7MA5 (MURATA Co., Ltd.)
CR : CDA10.7MG80-A (MURATA Co., Ltd.)

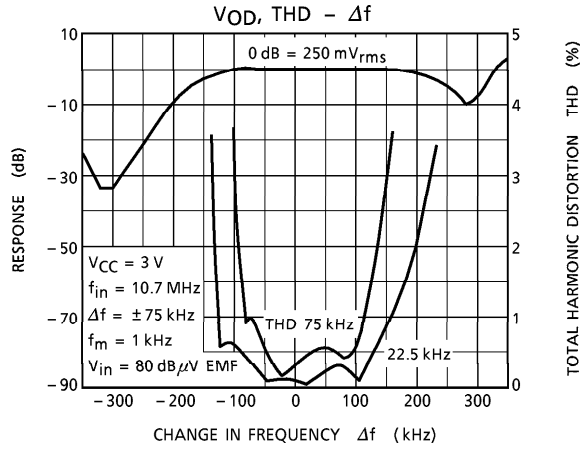
FMFE



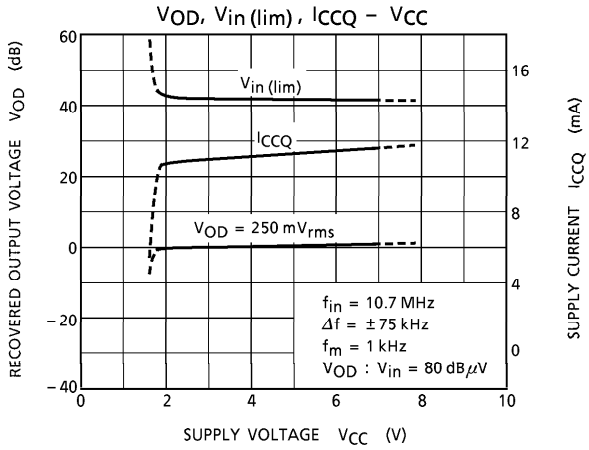
FM (IF)



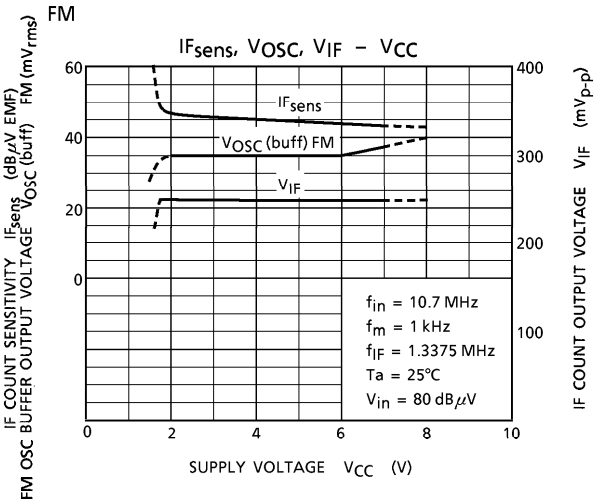
FM (IF)



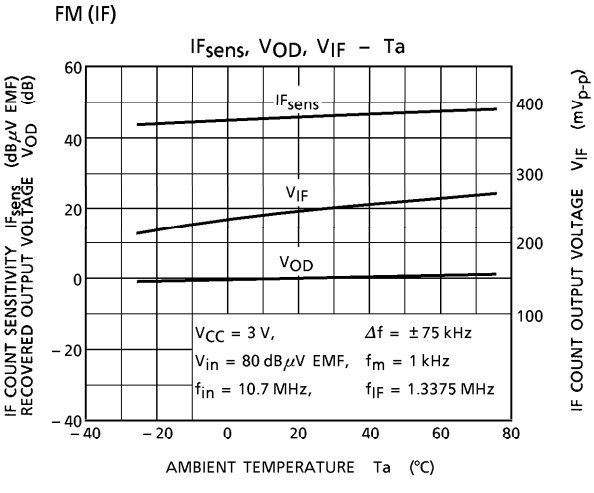
FM (IF)



FM

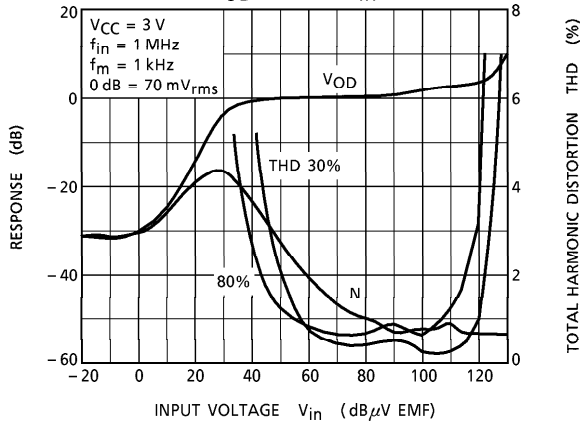


FM (IF)



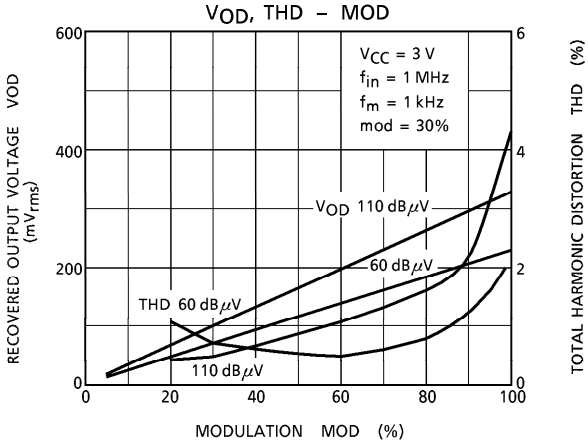
AM

V_{OD}, THD – V_{in}



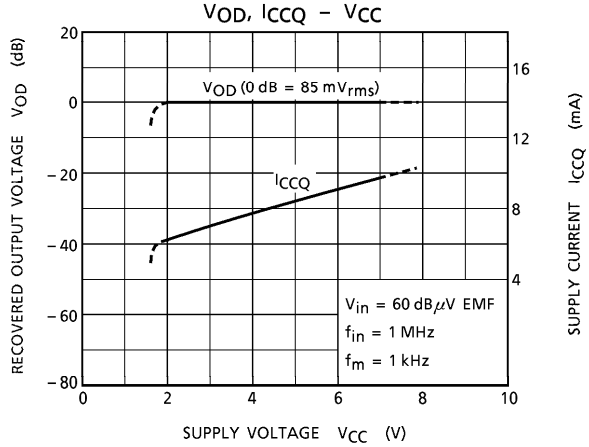
AM

V_{OD}, THD – MOD



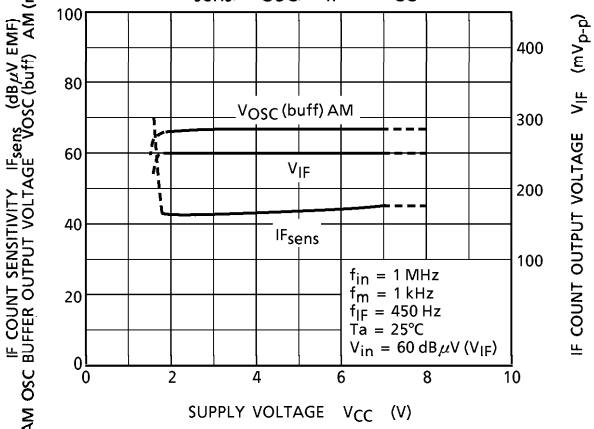
AM

V_{OD}, I_{CCQ} – V_{CC}



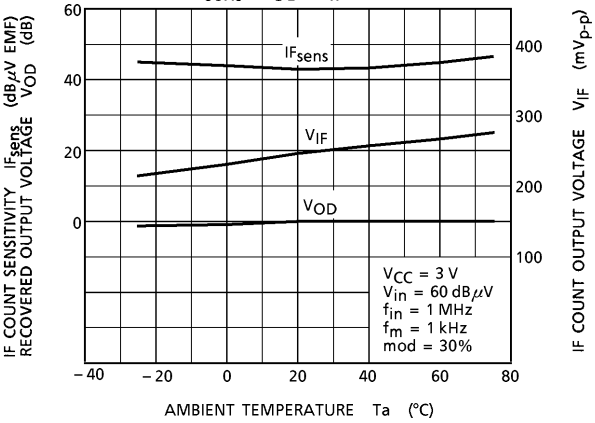
AM

IF_{sens}, V_{OSC}, V_{IF} – V_{CC}



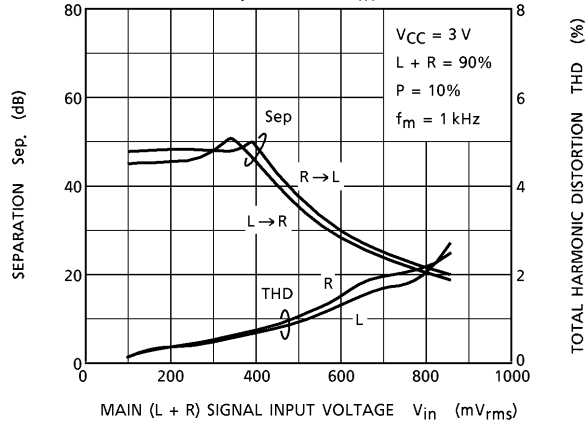
AM

IF_{sens}, V_{OD}, V_{IF} – Ta



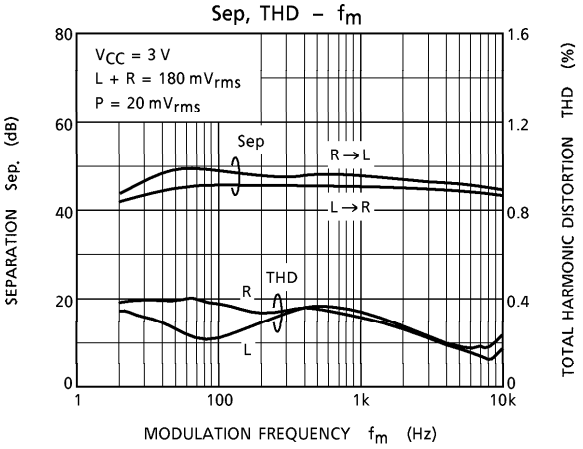
MPX

Sep, THD – V_{in}



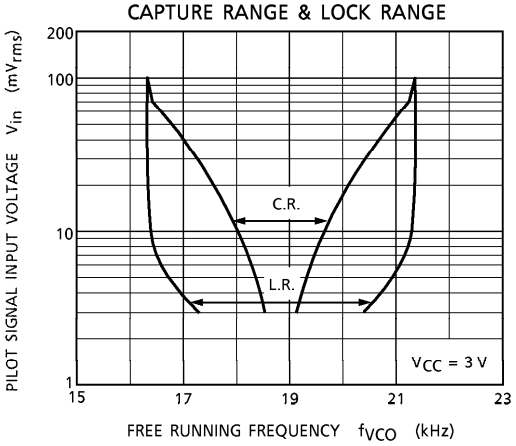
MPX

Sep, THD – f_m



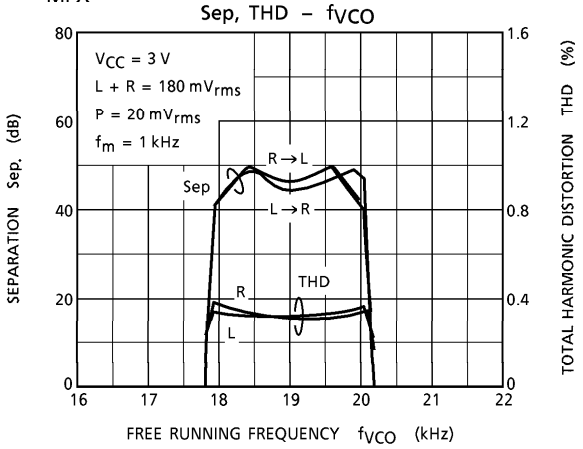
MPX

CAPTURE RANGE & LOCK RANGE



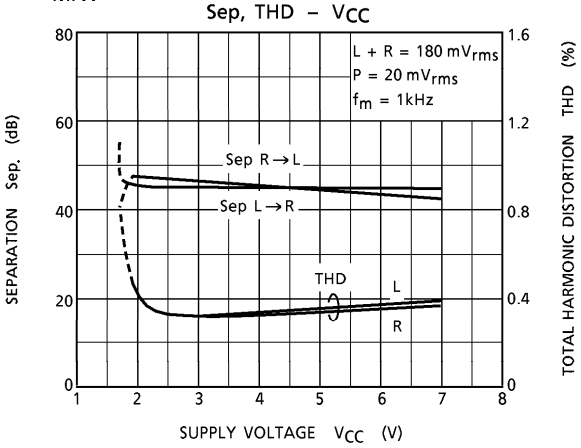
MPX

Sep, THD – f_{VCO}



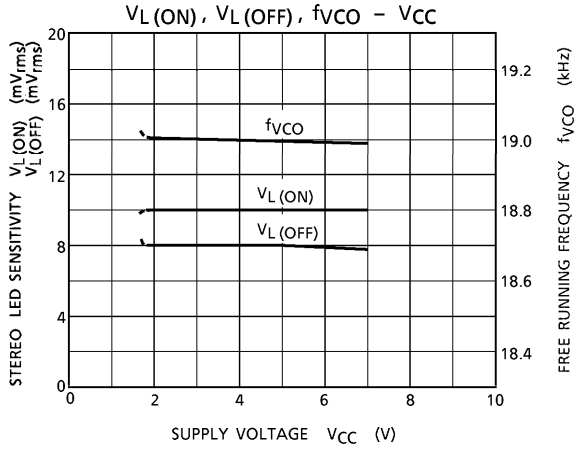
MPX

Sep, THD – V_{CC}



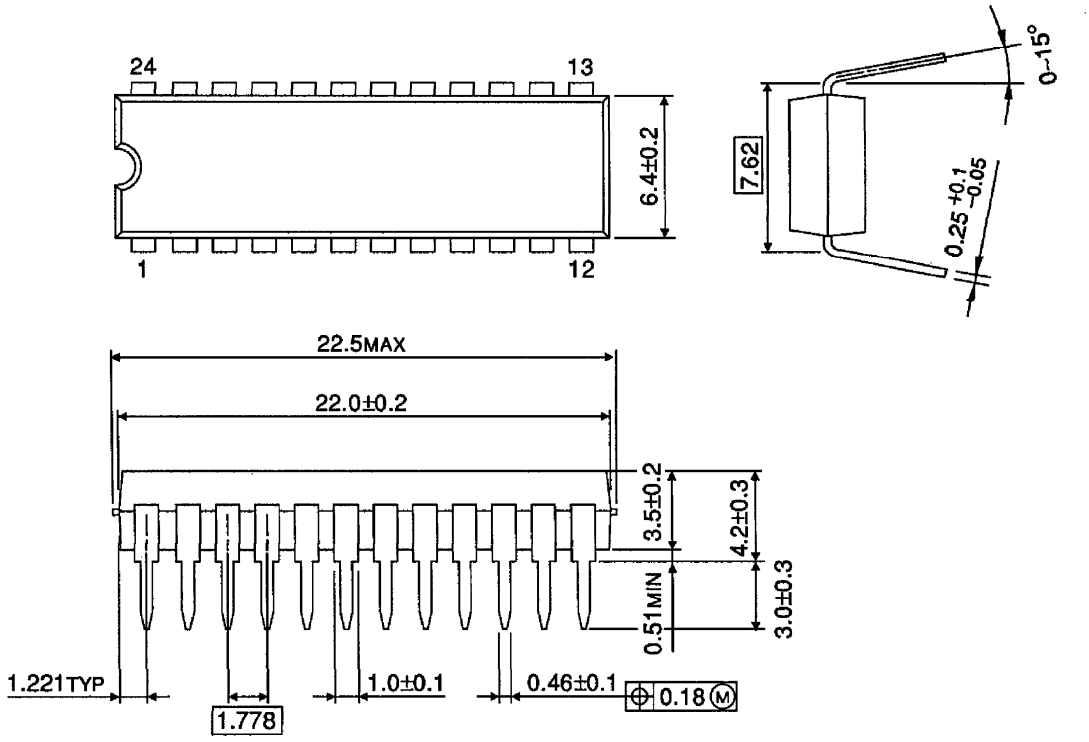
MPX

$V_{L\,(ON)}$, $V_{L\,(OFF)}$, f_{VCO} – V_{CC}



OUTLINE DRAWING

SDIP24-P-300-1.78 Unit : mm

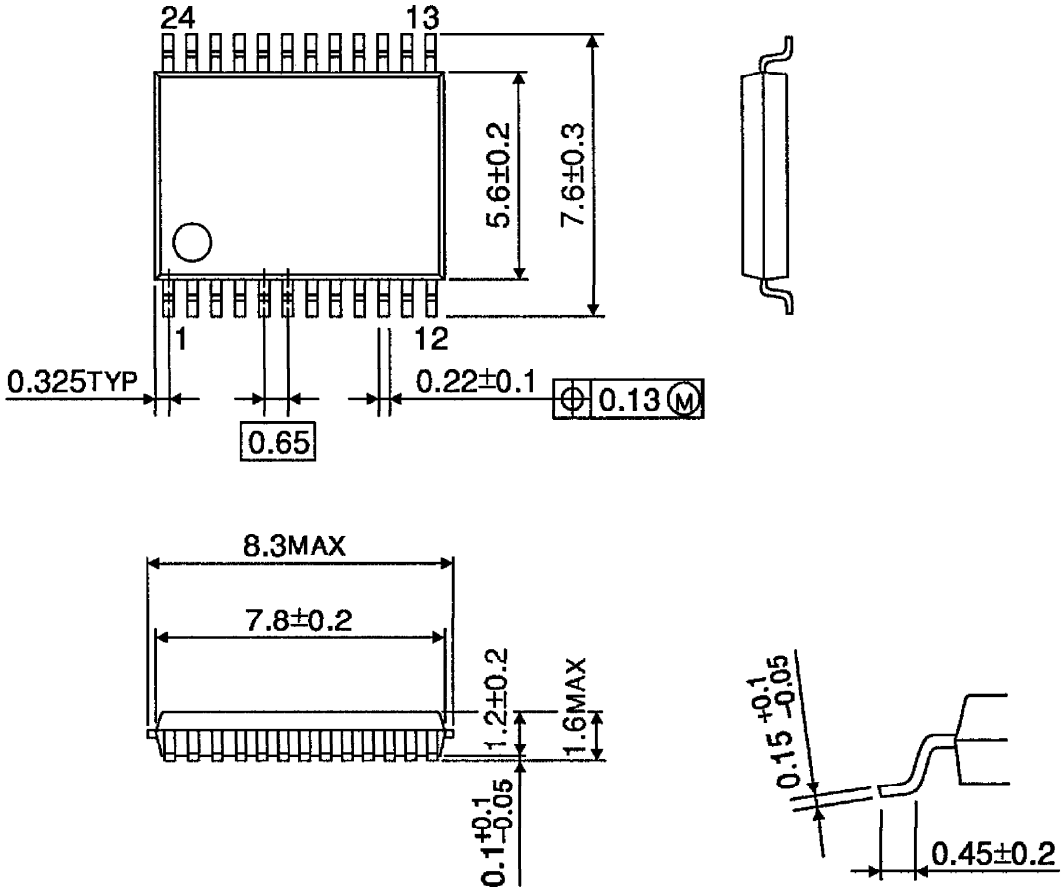


Weight : 1.2 g (Typ.)

OUTLINE DRAWING

SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14 g (Typ.)