

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TA2149N, TA2149FN

## 3 V AM / FM 1 CHIP TUNER IC

(for Digital Tuning System)

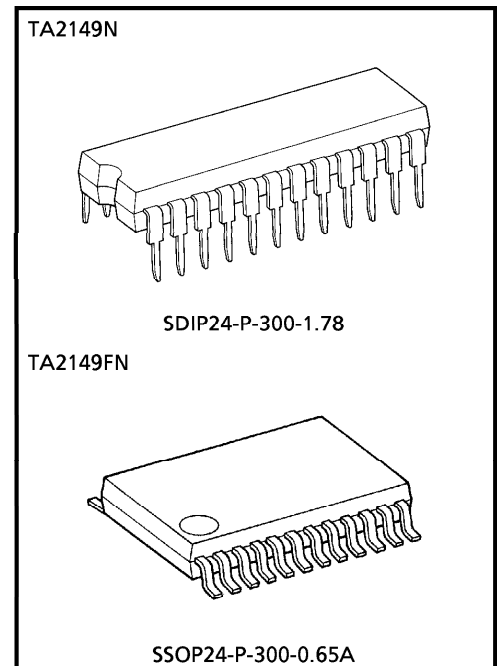
TA2149N, TA2149FN are AM / FM 1 chip tuner ICs, which are designed for portable Radios and 3 V Head phone Radios.

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 1 / 16 Pre-scaler for FM Local OSC Buffer.
- Built-in AM Low cut circuit.
- Low supply current. ( $V_{CC} = 3 V$ ,  $T_a = 25^{\circ}C$ )
  - $I_{ccq}$  (FM) = 13 mA (Typ.)
  - $I_{ccq}$  (AM) = 8.5 mA (Typ.)
- Operating Supply voltage range :  $V_{CC} = 1.8 \sim 7 V$  ( $T_a = 25^{\circ}C$ )

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

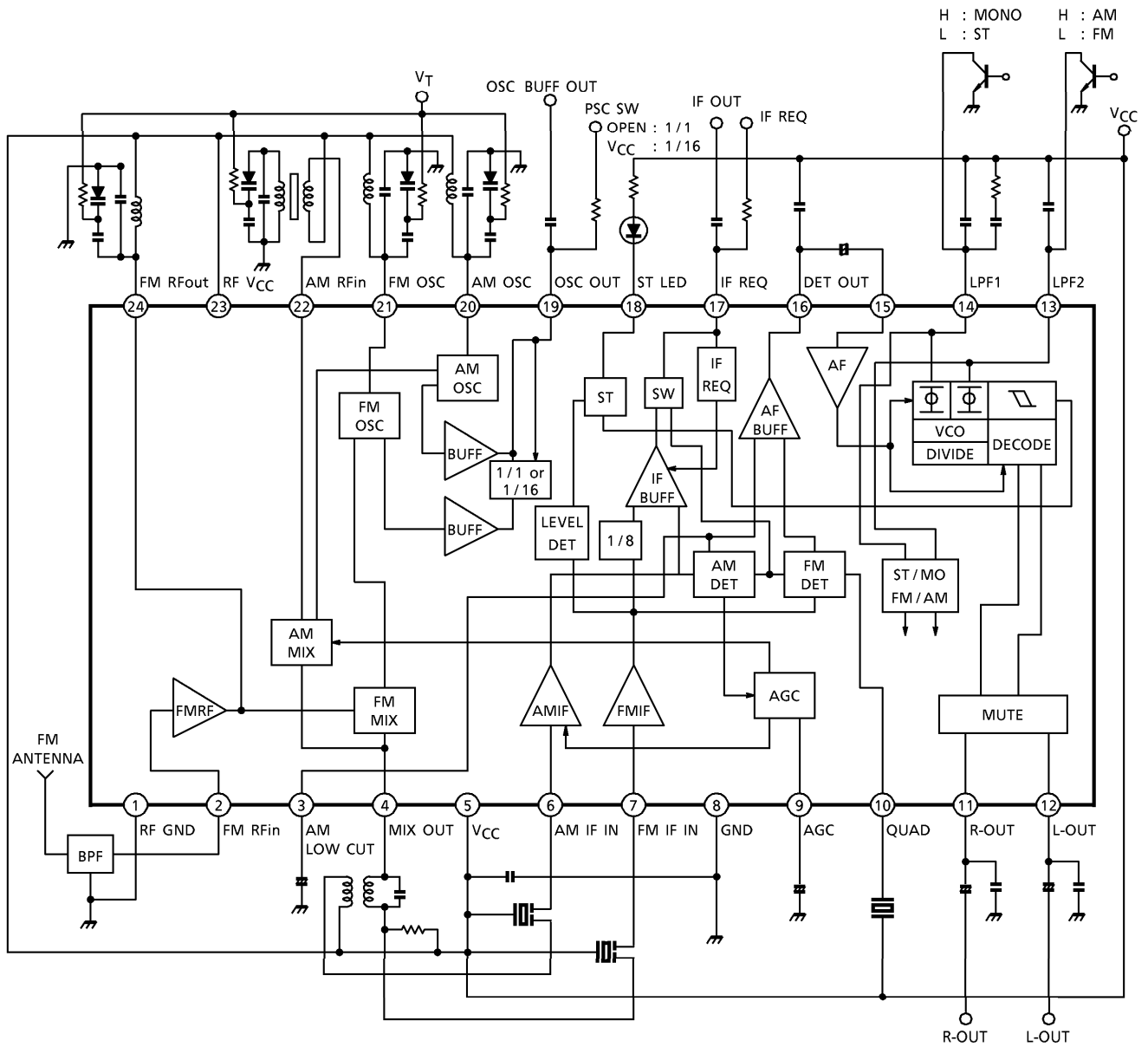


Weight  
 SDIP24-P-300-1.78 : 1.2 g (Typ.)  
 SSOP24-P-300-0.65A : 0.14 g (Typ.)

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BLOCK DIAGRAM



**EXPLANATION OF TERMINALS**

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

PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERMINAL VOLTAGE (Typ.) (V)	
			AM	FM
1	RF GND (GND for FM RF 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	<p>LPF2</p> <ul style="list-style-type: none"> <li>● LPF terminal for phase Detector.</li> <li>● Bias terminal AM / FM SW circuit.</li> </ul> <p>V<sub>13</sub> = GND → AM V<sub>13</sub> = OPEN → FM</p>		0	2.2

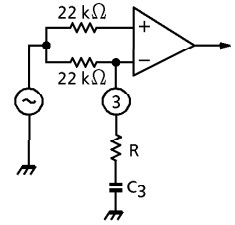
PIN No.	CHARACTERISTIC	INTERNAL CIRCUIT	TERMINAL VOLTAGE (Typ.) (V)	
			AM	FM
14	<p>LPF1</p> <ul style="list-style-type: none"> <li>● LPF terminal for Synchronous Detector.</li> <li>● VCO Stop terminal.</li> </ul> <p>V14 = GND → VCO STOP</p>		0.7	2.4
15	MPX IN		0.7	0.7
16	DET OUT	<p>③ LOW → FM, HIGH → AM ④ LOW → AM, HIGH → FM</p>	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 VCC (VCC for FM RF 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.
- The cut-off frequency f<sub>L</sub> is determined by the internal resistance 22 kΩ (Typ.) and the external capacitor C<sub>3</sub> as following ;

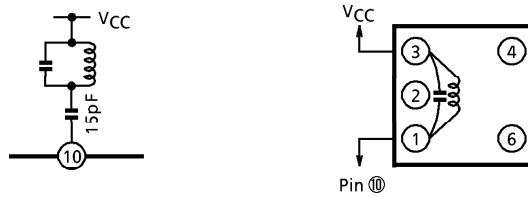


$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^3 \times C_3} \text{ (Hz)}$$

- In the case of the AM Low-Cut function is not needed, set up the value of C<sub>3</sub> over 1 μF. In the condition of C<sub>3</sub> ≥ 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

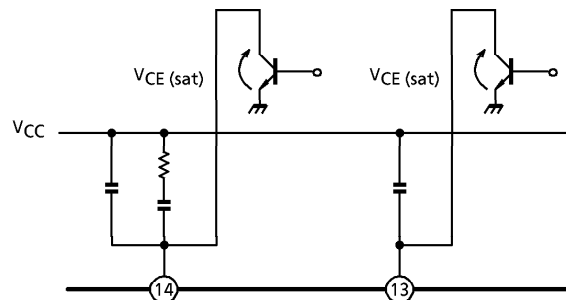
For the FM detection circuit, detection coil is able to use instead of ceramic discriminator. Recommended circuit and recommended coil are as follows. (In this case, please take care that V<sub>in</sub> (lim.) falls a little.)



TEST FREQUENCY	C <sub>o</sub> (pF)	Q <sub>o</sub>	TURNS				WIRE (mm φ)	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.

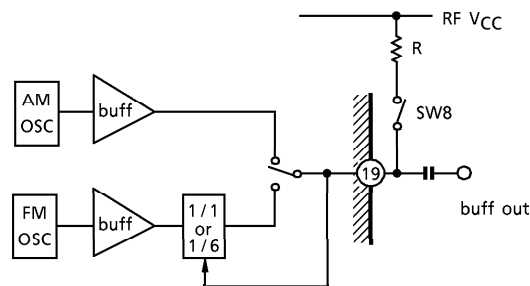
- FM/AM switchover and stereo/forced monaural switchover are done by pin ⑬ and pin ⑭.
- FM/AM switch (pin ⑬)
  - ( V13 : Low (Active Low, V<sub>th</sub> = 0.2 V (Typ.), I<sub>th</sub> 30 μA (Typ.) → AM )
  - ( V13 : OPEN → FM )
- Stereo/forced monaural switch (pin ⑭)
  - ( V14 : Low (Active Low, V<sub>th</sub> = 0.2 V (Typ.), I<sub>th</sub> 30 μA (Typ.) → Forced Monaural )
  - ( V14 : OPEN → Stereo )



4. V<sub>CC</sub> Line

This ICs have two voltage supply terminals, V<sub>CC</sub> (for AM, FM IF, MPX stage) and RF V<sub>CC</sub> (for FM RF stage). Set up the potential difference between V<sub>CC</sub> and RF V<sub>CC</sub> 0.4 V (typ.) or less, otherwise there is the case that this IC doesn't operate normally.

5. How to control the Divider of FM OSC.



Divider of FM OSC ON/OFF switching is controlled by external pull-up resistor of pin ⑱. In case of Divider of FM OSC is used, it is necessary to set up the value of R under 470 Ω (typ.). When R is over 470 Ω, it is feared that Divider is not operating. (At this time, buffer output frequency is equal to FM OSC frequency.) Which ever Divider of FM OSC is used or not, AM OSC buffer frequency and output level is same.

MODE	SW8	OUTPUT FREQUENCY	OUTPUT LEVEL (TYP.)
FM	OPEN	1 / 1 FM OSC	35 mV <sub>rms</sub>
	ON	1 / 16 FM OSC	110 mV <sub>rms</sub>
AM	OPEN	1 / 1 AM OSC	75 mV <sub>rms</sub>
	ON		

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V <sub>CC</sub>	8	V
LED Current		I <sub>LED</sub>	10	mA
LED Voltage		V <sub>LED</sub>	8	V
Power Dissipation	TA2149N	P <sub>D</sub> (Note)	1200	mW
	TA2149FN		500	
Operating Temperature		T <sub>opr</sub>	- 25~75	°C
Storage Temperature		T <sub>stg</sub>	- 55~150	°C

(Note) : Derated above Ta = 25°C in the proportion of 9.6 mW/°C for TA2149N of 4 mW/°C for TA2149FN.



**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, Ta = 25°C, VCC = 3 V, F/E : f = 98 MHz, fm = 1 kHz  
 FM IF : f = 10.7 MHz, Δf = ±75 kHz, fm = 1 kHz  
 AM : f = 1 MHz, MOD = 30%, fm = 1 kHz  
 MPX : fm = 1 kHz

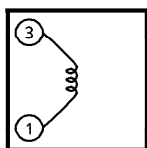
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current		I <sub>CC</sub> (FM)	—	V <sub>in</sub> = 0, FM mode	—	13	16.5	mA
		I <sub>CC</sub> (AM)	—	V <sub>in</sub> = 0, AM mode	—	8.5	11.0	
F/E	Input Limiting Voltage	V <sub>in</sub> (lim)	—	V <sub>in</sub> = 60 dB $\mu$ V EMF, -3 dB limiting	—	10	—	dB $\mu$ V EMF
	Local OSC Buffer Output Voltage 1	V <sub>OSC</sub> (buff) FM <sub>1</sub>	—	f <sub>OSC</sub> = 108.7 MHz	23	35	—	mV <sub>rms</sub>
	Local OSC Buffer Output Voltage 2	V <sub>OSC</sub> (buff) FM <sub>2</sub>	—	f <sub>OSC</sub> = 6.79375 MHz SW8 : ON	75	110	—	mV <sub>rms</sub>
FM IF	Input Limiting Voltage	V <sub>in</sub> (lim) IF	—	V <sub>in</sub> = 80 dB $\mu$ V EMF, -3 dB limiting	35	40	45	dB $\mu$ V EMF
	Recovered Output Voltage	V <sub>OD</sub>	—	V <sub>in</sub> = 80 dB $\mu$ V EMF	200	250	300	mV <sub>rms</sub>
	Signal To Noise Ratio	S/N	—	V <sub>in</sub> = 80 dB $\mu$ V EMF	—	75	—	dB
	Total Harmonic Distortion	THD	—	V <sub>in</sub> = 80 dB $\mu$ V EMF	—	0.3	—	%
	AM Rejection Ration	AMR	—	V <sub>in</sub> = 80 dB $\mu$ V EMF	—	60	—	dB
	IF Count Output Frequency	f <sub>IF</sub> (FM)	—	V <sub>in</sub> = 80 dB $\mu$ V EMF, SW7 : ON	1.3373	1.3375	1.3377	MHz
	IF Count Output Voltage	V <sub>IF</sub> (FM)	—	V <sub>in</sub> = 80 dB $\mu$ V EMF, SW7 : ON	200	260	—	mV <sub>p-p</sub>
	IF Count Output Sensitivity	IF sens (FM)	—	SW7 : ON	47	52	57	dB $\mu$ V EMF
AM	Gain	G <sub>V</sub>	—	V <sub>in</sub> = 27 dB $\mu$ V EMF	20	38	70	mV <sub>rms</sub>
	Recovered Output Voltage	V <sub>OD</sub>	—	V <sub>in</sub> = 60 dB $\mu$ V EMF	60	85	108	mV <sub>rms</sub>
	Signal To Noise Ratio	S/N	—	V <sub>in</sub> = 60 dB $\mu$ V EMF	—	41	—	dB
	Total Harmonic Distortion	THD	—	V <sub>in</sub> = 60 dB $\mu$ V EMF	—	0.7	—	%
	Local OSC Buffer Output Voltage	V <sub>OSC</sub> (buff) AM	—	f <sub>OSC</sub> = 1.45 MHz	55	75	—	mV <sub>rms</sub>
	IF Count Output Voltage	V <sub>IF</sub> (AM)	—	V <sub>in</sub> = 60 dB $\mu$ V EMF, SW7 : ON	200	250	—	mV <sub>p-p</sub>
	IF Count Output Sensitivity	IF sens (AM)	—	SW7 : ON	34	39	44	dB $\mu$ V EMF
PIN ⑰ Output Resistance	R <sub>17</sub>	—	FM mode	—	0.75	—	k $\Omega$	
			AM mode	—	15.5	—		

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

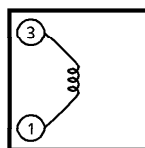
**COIL DATA**

COIL No.	TEST FREQ	L (μH)	Co (pF)	Q <sub>o</sub>	TURNS					WIRE (mm φ)	REFERENCE
					1-2	2-3	1-3	1-4	4-6		
L <sub>1</sub> FM RF	100 MHz			79			2 $\frac{1}{2}$			0.16UEW	TOKO Co., Ltd. 666SNF-305NK
L <sub>2</sub> FM OSC	100 MHz			76			2			0.16UEW	TOKO Co., Ltd. 666SNF-306NK
T <sub>1</sub> AM OSC	796 kHz	268	—	65	19	95				0.05UEW	TOKO Co., Ltd. 5PNR-5146Y
T <sub>2</sub> AM IFT	455 kHz	—	470	60			109		7	0.05UEW	TOKO Co., Ltd. 5PLG-5147X

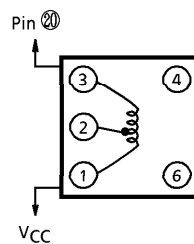
L<sub>1</sub> : FM RF



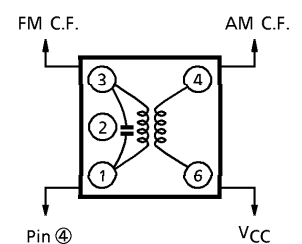
L<sub>2</sub> : FM OSC



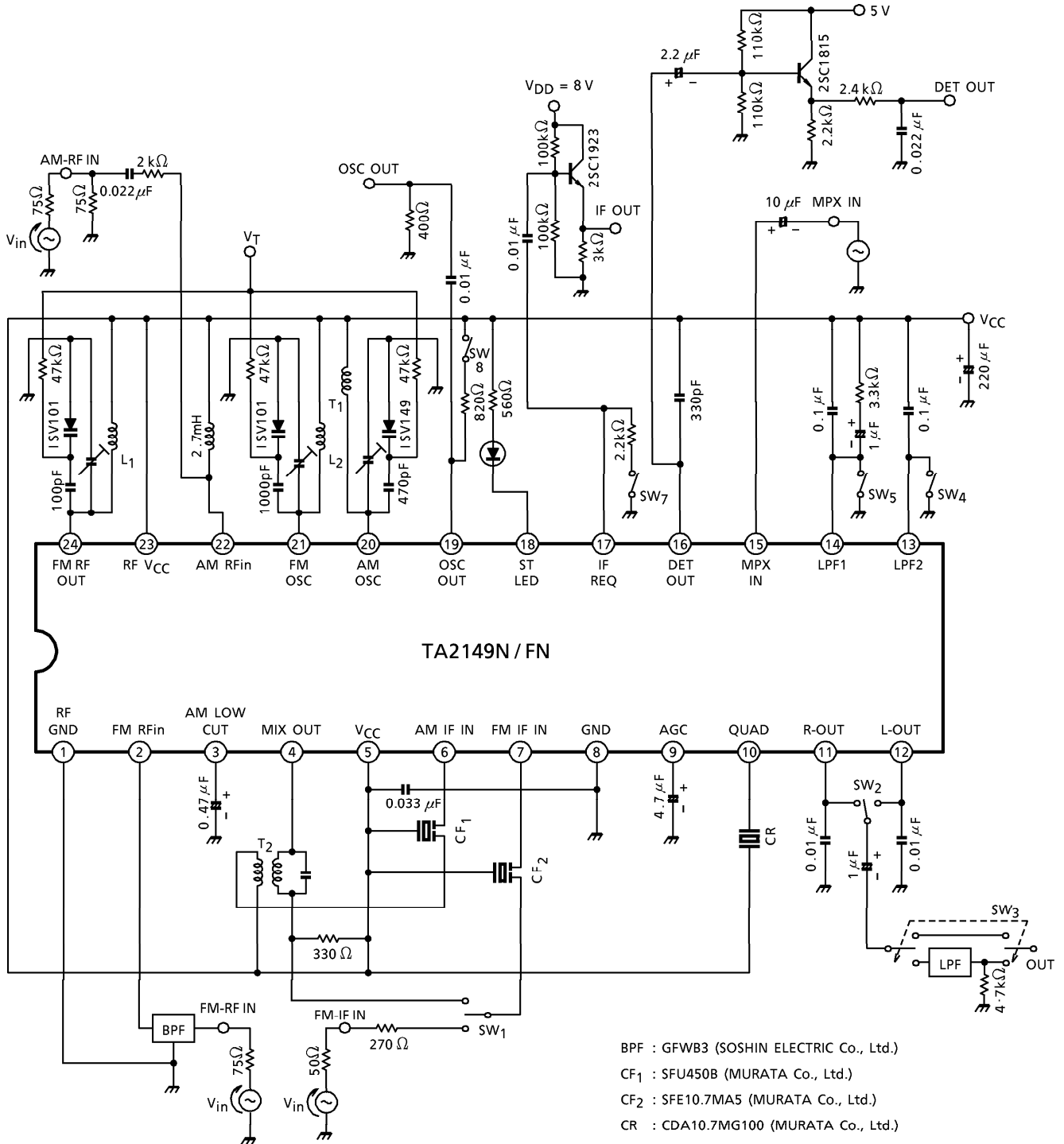
T<sub>1</sub> : AM OSC



T<sub>2</sub> : AM IFT

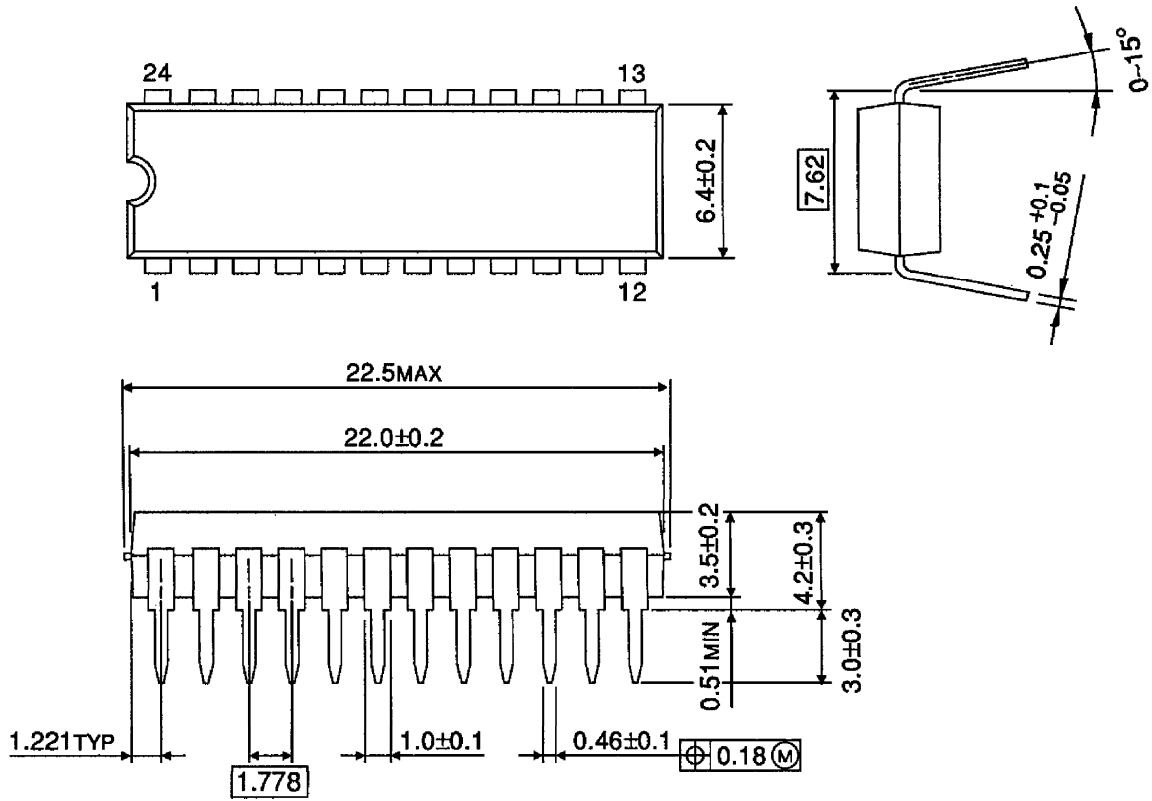


TEST CIRCUIT



**PACKAGE DIMENSIONS**  
SDIP24-P-300-1.78

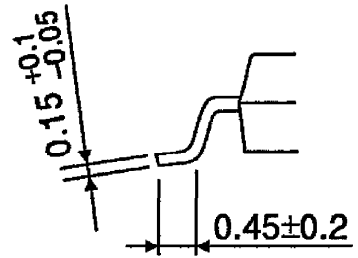
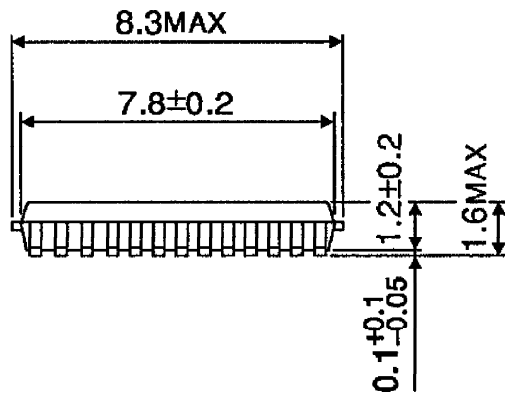
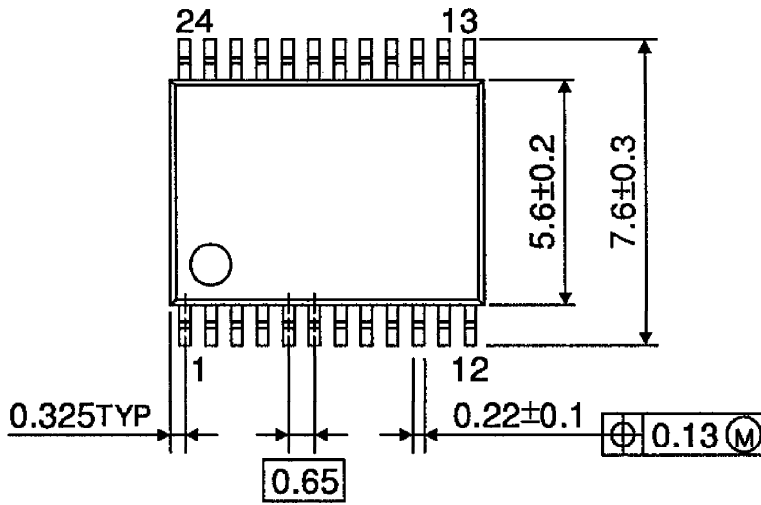
Unit : mm



Weight : 1.2 g (Typ.)

**PACKAGE DIMENSIONS**  
SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14 g (Typ.)