

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

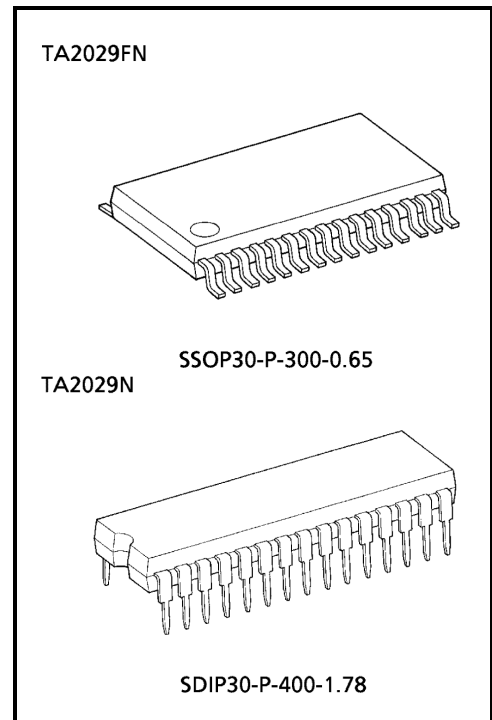
# TA2029FN, TA2029N

FM F / E + AM / FM IF + PW IC  
For Digital Tuning System

The TA2029FN / N are AM / FM single chip radio system ICs which are designed for monaural radio. These ICs have many functions and can be used for digital tuning system.

## Features

- Built-in FM F / E, AM / FM IF, electronic volume and power amplifier.
- Suitable for combination with digital tuning system which has IF counter.
  - AM / FM IF output for IF counter.
    - FM: 1.3375MHz (1 / 8 IF)
    - AM: 450kHz
  - AM / FM oscillation buffer outputs.
  - Auto stop sensitivity at the searching mode is adjustable by external resistances. (pin (5), pin(6) )
- Adjustment-free type FM detector.
- Built-in AF power amplifier, electronic volume and audio muting circuits.
- Detector outputs FM / AM are independent each other.
- $P_o = 100\text{mW}$  (typ.), THD = 10% (FN: 3V / 8Ω)
- $P_o = 500\text{mW}$  (typ.), THD = 10% (N: 6V / 8Ω)
- Operating supply voltage range
  - :  $V_{CC} = 1.8\sim 8\text{V}$  ( $T_a = 25^\circ\text{C}$ )

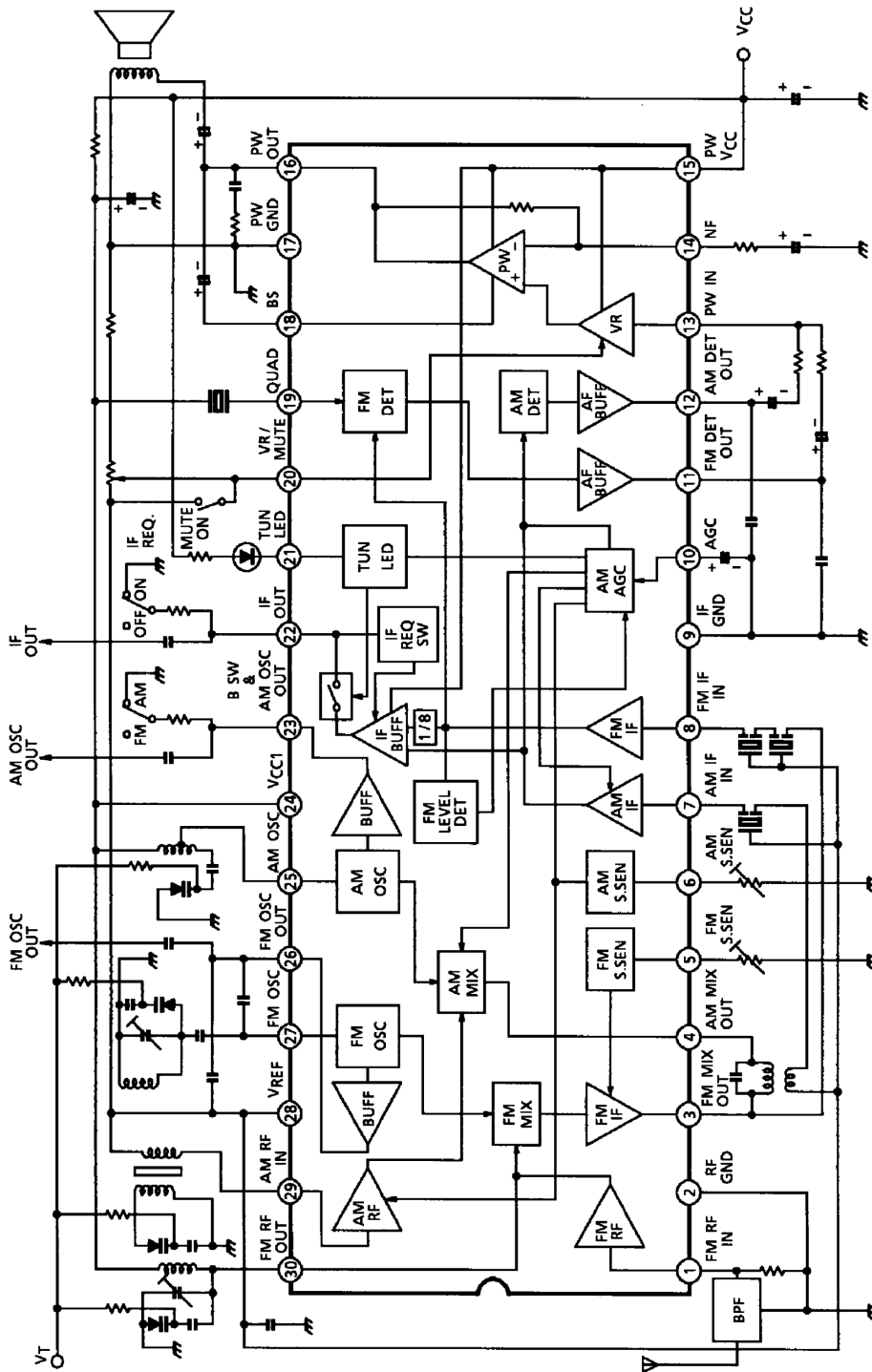


Weight:

SSOP30-P-300-0.65: 0.17g (typ.)

SDIP30-P-400-1.78: 2.2g (typ.)

**BLOCK DIAGRAM**

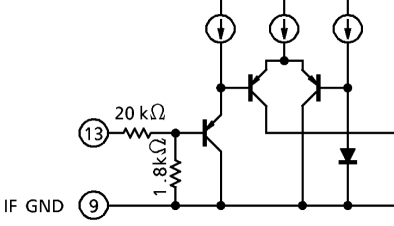
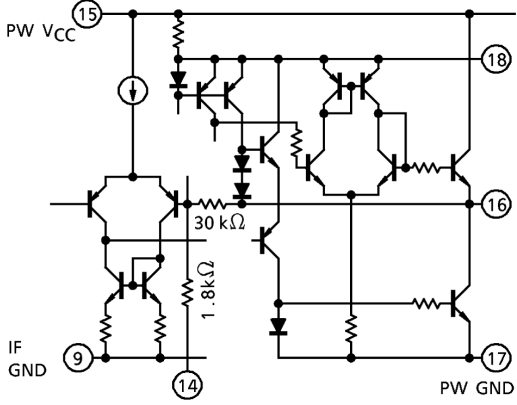
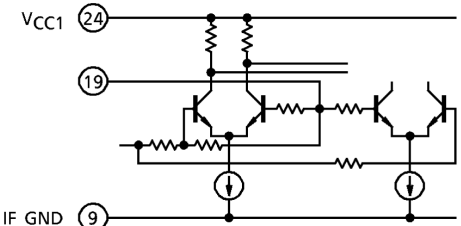
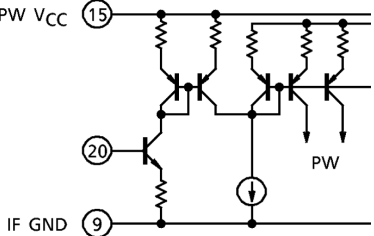
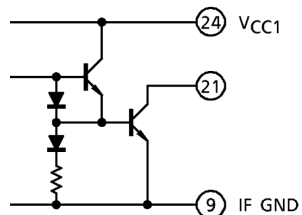


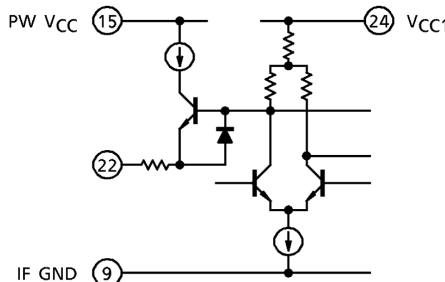
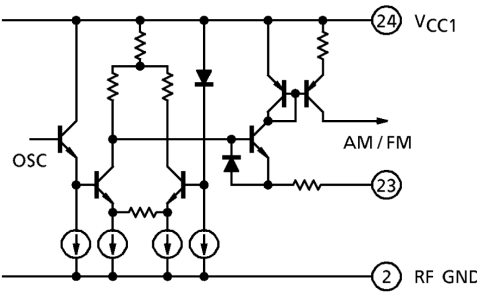
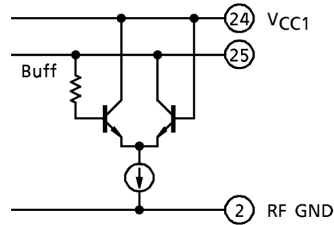
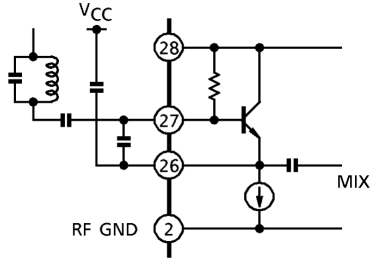
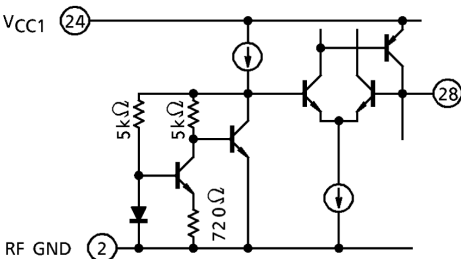
TA2029FN / N - 2

## Explanation Of Terminal (Note: $T_a = 25^\circ\text{C}$ , $V_{CC} = 3\text{V}$ , at no signal)

Pin No.	Characteristic	Internal Circuit	DC Voltage (V) (typ.)	
			AM	FM
1	FM RF in FM RF input terminal		0	0.7
2	RF GND (GND of RF stage)	—	0	0
3	FM mix out Ceramic filter is connected. Recommendation SFE10.7MA5L (murata MFG. Co., LTD)		2.3	1.8
4	AM mix out		2.3	1.8
5	FM S. SEN Adjustable for FM IF output sensitivity by external resistor.		0	0.3
6	AM S. SEN Adjustable for AM IF output sensitivity by external resistor.		0.3	0

Pin No.	Characteristic	Internal Circuit	DC Voltage (V) (typ.)	
			AM	FM
7	AM IF in		1.22	1.2
8	FM IF in		3.0	3.0
9	IF GDN (GDN of AM / FM IF)	—	0	0
10	AGC (AM AGC) Capacitor is connected.		0	0
11	FM DET out FM detector output terminal.		—	1.2
12	AM DET out AM detector output terminal.		0.5	1.2

Pin No.	Characteristic	Internal Circuit	DC Voltage (V) (typ.)	
			AM	FM
13	PW in		0	0
14	NF Capacitor is connected.		0.8	0.8
15	PW V <sub>CC</sub> (V <sub>CC</sub> of PW and buffer amplifier for IF counter)		3.0	3.0
16	PW out		1.6	1.6
17	PW GND (GND of PW)		0	0
18	BS Capacitor is connected.		3.0	3.0
19	QUAD FM QUAD detector ceramic discriminator is connected recommendation CDA10.7MG36. (Murat MFG. Co., LTD)		2.5	2.3
20	MUTE / VR • Variable resistor for electronic volume control is connected. • Mute terminal V <sub>20</sub> : V <sub>ref</sub> → mute on		—	—
21	Tun LED		—	—

Pin No.	Characteristic	Internal Circuit	DC Voltage (V) (typ.)	
			AM	FM
22	IF out IF output terminal pin (22) connects with GND by resistor → come out pin (22): Open → non output		2.5	2.5
23	AM OSC out / band SW AM oscillation buffer output terminal. Bias terminal for AM / FM switch circuit. Pin (23) connects with GND by resistor → AM mode pin (23): Open → FM mode		1.7	2.5
24	V <sub>CC1</sub> (V <sub>CC</sub> of RF stage)	—	3.0	3.0
25	AM OSC AM OSC tank circuit is connected.		3.0	3.0
26	FM OSC Capacitor is connected between pin (26) and pin (27) shown in the right figure.		0.7	0.5
27	FM OSC FM OSC tank circuit is connected shown in the right figure.		1.22	1.15
28	V <sub>ref</sub> regulator voltage output terminal V <sub>ref</sub> = 1.2V (typ.): FM mode 1.22V (typ.): AM mode		1.22	1.2

Pin No.	Characteristic	Internal Circuit	DC Voltage (V) (typ.)	
			AM	FM
29	AM RF in AM RF input terminal.		1.22	1.2
30	FM RF out FM RF tank circuit is connected.	Cf. pin (1)	3.0	3.0

### Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	9	V
Power dissipation	P <sub>D</sub> (Note)	500	mW
		1500	
Operating temperature	T <sub>opr</sub>	-25~75	°C
Storage temperature	T <sub>stg</sub>	-55~150	°C

(Note): Derated above 25°C in the proportion of 4.8mW / °C for TA2029FN and 12mW / °C for TA2029N.

## Electrical Characteristics

Unless Otherwise Specified,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3\text{V}$ ,  $\text{SW}_2$ : Off,  $\text{SW}_3$ : Off,  $\text{SW}_7 = \text{Off}$

F / E:  $f = 83\text{MHz}$ ,  $f_m = 1\text{kHz}$

FM IF:  $f = 10.7\text{MHz}$ ,  $\Delta f = \pm 22.5\text{kHz}$ ,  $f_m = 1\text{kHz}$

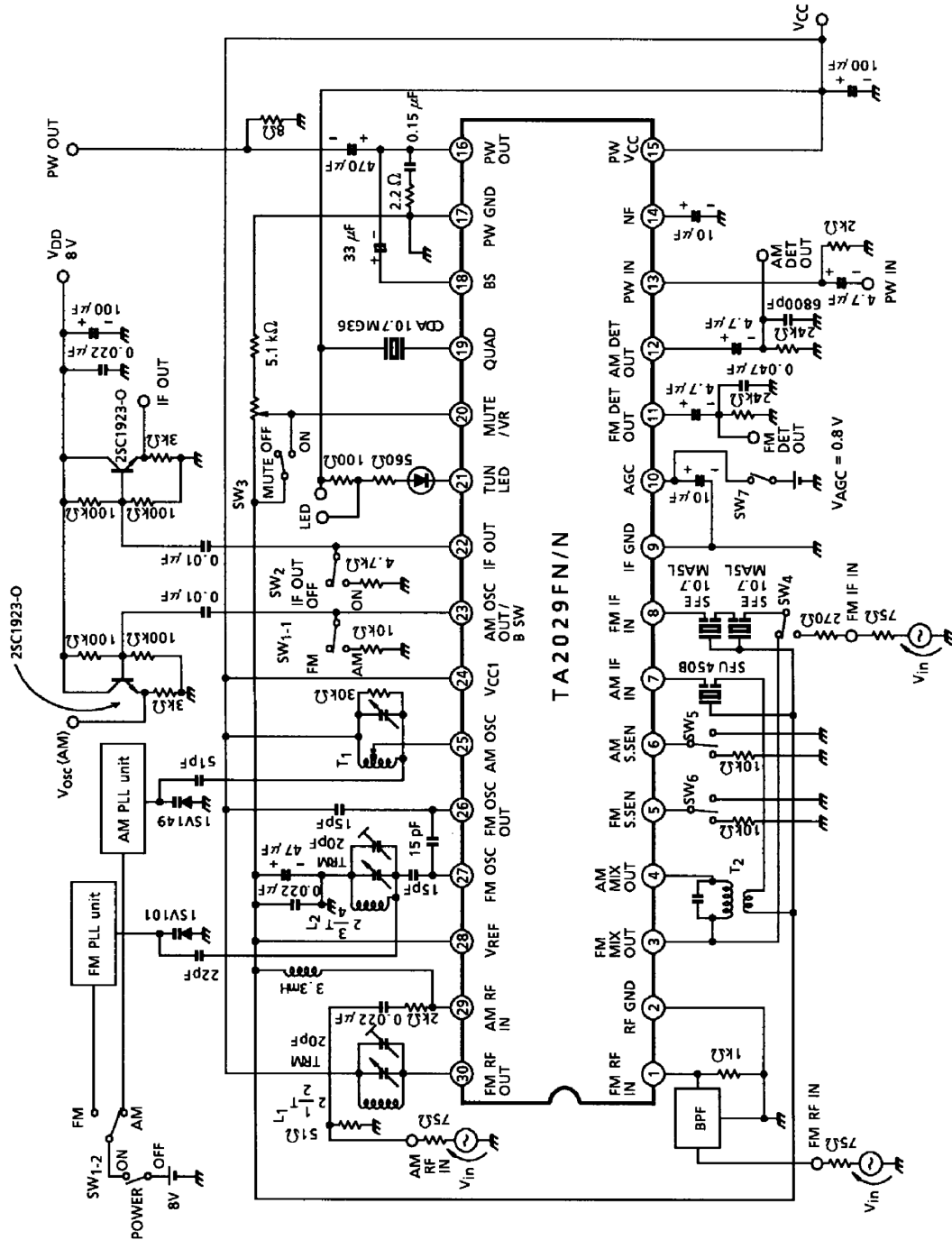
AM:  $f = 1005\text{kHz}$ ,  $\text{MOD} = 30\%$ ,  $f_m = 1\text{kHz}$

Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit	
Supply current	$I_{CCQ}$ (FM)		1	FM mode $V_{in} = 0$	Power amp: Off	—	11.5	16.0	mA
	$I_{CC}$ (FM)		1		Power amp: On $\text{SW}_2$ : On, $\text{SW}_7$ : On	—	18.0	25.0	
	$I_{CCQ}$ (AM)		1	AM mode	Power amp: Off	—	7.5	11.0	
	$I_{CC}$ (AM)		1	$V_{in} = 0$	Power amp: On $\text{SW}_2$ : On, $\text{SW}_7$ : On	—	17.0	24.0	
F / E	Input limiting voltage	$V_{in}(\text{lim})$	1	-3dB limiting		—	12	—	$\text{dB}\mu\text{V}$ EMF
	Quiescent sensitivity	$Q_S$		$S / N = 30\text{dB}$		—	15	—	$\text{dB}\mu\text{V}$ EMF
	Local OSC stop voltage	$V_{\text{stop}}(\text{FM})$	2	$V_{in} = 0$		—	1.35	—	V
	Local OSC buffer output voltage	$V_{\text{osc}}(\text{buff})$	2	$f_{\text{osc}} = 108\text{MHz}$		—	130	—	$\text{mV}_{\text{rms}}$
FM	Input limiting voltage	$V_{in}(\text{lim})$ IF	1	-3dB limiting		39	44	49	$\text{dB}\mu\text{V}$ EMF
	Recovered output voltage	$V_{OD}$	1	$V_{in} = 80\text{dB}\mu\text{V}$ EMF		55	80	110	$\text{mV}_{\text{rms}}$
	Signal to noise ratio	$S / N$	1	$V_{in} = 80\text{dB}\mu\text{V}$ EMF		—	70	—	dB
	Total harmonic distortion	THD	1	$V_{in} = 80\text{dB}\mu\text{V}$ EMF		—	0.4	—	%
	AM rejection ratio	AMR	1	$V_{in} = 80\text{dB}\mu\text{V}$ EMF		—	48	—	dB
	LED on sensitivity	$V_L$	1	$I_L = 1\text{mA}$		40	45	50	$\text{dB}\mu\text{V}$ EMF
	IF count output frequency	$1/8$ IF $f_{1/8}$ IF (FM)	1	$\text{SW}_2$ : On, $V_{in} = 80\text{dB}\mu\text{V}$ EMF		1.3373	1.3375	1.3377	MHz
	IF count output voltage	$1/8$ IF $V_{1/8}$ IF (FM)	1	$\text{SW}_2$ : On, $V_{in} = 80\text{dB}\mu\text{V}$ EMF		110	200	—	$\text{mV}_{\text{rms}}$
	IF count output sensitivity	$IF_{\text{sens}}$ (FM)1	1	$\text{SW}_6$ : 10k $\Omega$		—	48	—	$\text{dB}\mu\text{V}$ EMF
		$IF_{\text{sens}}$ (FM)2	1	$\text{SW}_6$ : 0 $\Omega$		—	68	—	
Pin (11) output resistance	$R_{11}$	1	—		—	1	—	k $\Omega$	



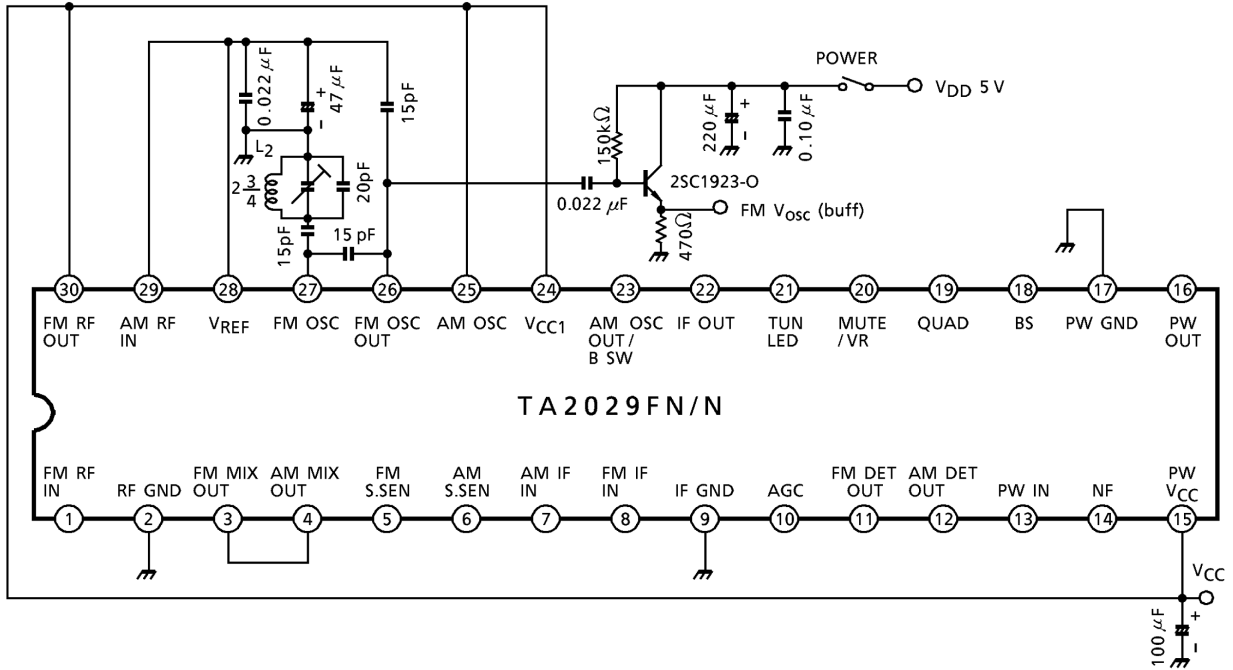
Characteristic		Symbol	Test Cir-cuit	Test Condition	Min.	Typ.	Max.	Unit
AM	Gain	$G_V$	1	$V_{in} = 26\text{dB}\mu\text{V EMF}$	20	45	80	$\text{mV}_{\text{rms}}$
	Recovered output voltage	$V_{OD}$	1	$V_{in} = 60\text{dB}\mu\text{V EMF}$	50	75	100	$\text{mV}_{\text{rms}}$
	Signal to noise ratio	S / N	1	$V_{in} = 60\text{dB}\mu\text{V EMF}$	—	42	—	dB
	Total harmonic distortion	THD	1	$V_{in} = 60\text{dB}\mu\text{V EMF}$	—	1.0	—	%
	LED on sensitivity	$V_L$	1	$I_L = 1\text{mA}$	24	29	34	$\text{dB}\mu\text{V EMF}$
	Local OSC buff. Output voltage	$V_{osc} (AM)$	1	$f_{osc} = 1455\text{kHz}$	80	140	—	$\text{mV}_{\text{rms}}$
	IF count output voltage	$V_{IF} (AM)$	1	SW <sub>2</sub> : On, $V_{in} = 60\text{dB}\mu\text{V EMF}$	110	200	—	$\text{mV}_{\text{rms}}$
	IF count output sensitivity	IFSENS (AM) 1	1	SW <sub>5</sub> : 10k $\Omega$	—	29	—	$\text{dB}\mu\text{V EMF}$
		IFSENS (AM) 2		SW <sub>5</sub> : 0 $\Omega$	—	45	—	
Pin (12) output resistance	$R_{12}$	1	—	—	5	—	k $\Omega$	
PW	Voltage gain	$G_V$	1	$f = 1\text{kHz}, R_L = 8\Omega,$ $V_o = 0.775V_{\text{rms}}, SW_7: \text{On}$	27	30	33	dB
	Output power	$P_{o1}$	1	$f = 1\text{kHz}, R_L = 8\Omega,$ THD = 10%, SW <sub>7</sub> : On	70	100	—	mW
		$P_{o2}$	1	$V_{CC} = 6\text{V}, f = 1\text{kHz},$ $R_L = 8\Omega, \text{THD} = 10\%,$ SW <sub>7</sub> : On	350	500	—	
	Total harmonic distortion	THD	1	$f = 1\text{kHz}, R_L = 8\Omega,$ $P_o = 50\text{mW}, SW_7: \text{On}$	—	0.6	1.5	%
	Output noise voltage	$V_{no}$	1	$R_g = 10\text{k}\Omega, R_L = 8\Omega,$ SW <sub>7</sub> : On BPF = 30Hz~20kHz	—	0.45	—	$\text{mV}_{\text{rms}}$
	Muting attenuation	ATT	1	$V_o = 0.775V_{\text{rms}}$ SW <sub>3</sub> : Off → on, SW <sub>7</sub> : On	65	77	—	dB

TEST CIRCUIT 1



TA2029FN/N

**TEST CIRCUIT 2**

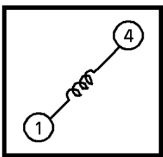


**Coil Data**

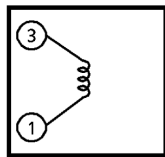
Coil No.	Test Frequency	L (µH)	C <sub>o</sub> (pF)	Q <sub>o</sub>	Turns					Wire (mmφ)	Ref.
					1-2	2-3	1-3	1-4	4-6		
L <sub>1</sub> FM RF	100MHz	—	—	100	—	—	—	2 <sup>1</sup> / <sub>2</sub>	—	0.5 UEW	(S) 53T-037-202
L <sub>2</sub> FM OSC	100MHz	—	—	100	—	—	2 <sup>3</sup> / <sub>4</sub>	—	—	0.5 UEW	(S) 0258-244
T <sub>1</sub> AM OSC	796kHz	288	—	115	13	73	—	—	—	0.08 UEW	(S) 4147-1356-038
T <sub>2</sub> AM IFT	455kHz	—	180	120	—	—	180	—	15	0.08 UEW	(S) 2150-2162-165

(S) Sumida electric co., LTD

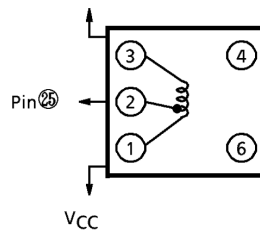
L<sub>1</sub> : FM RF



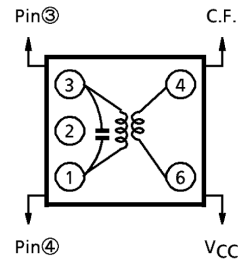
L<sub>2</sub> : FM OSC



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

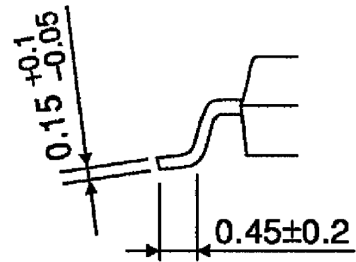
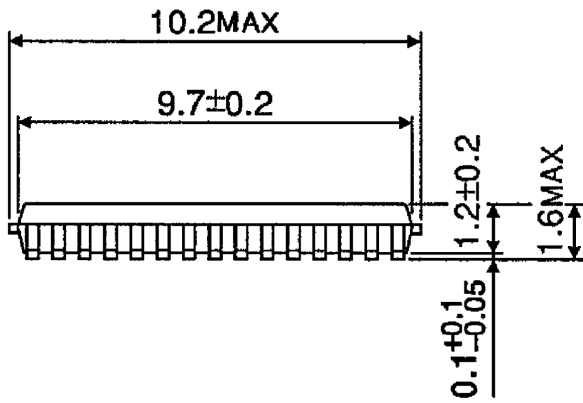
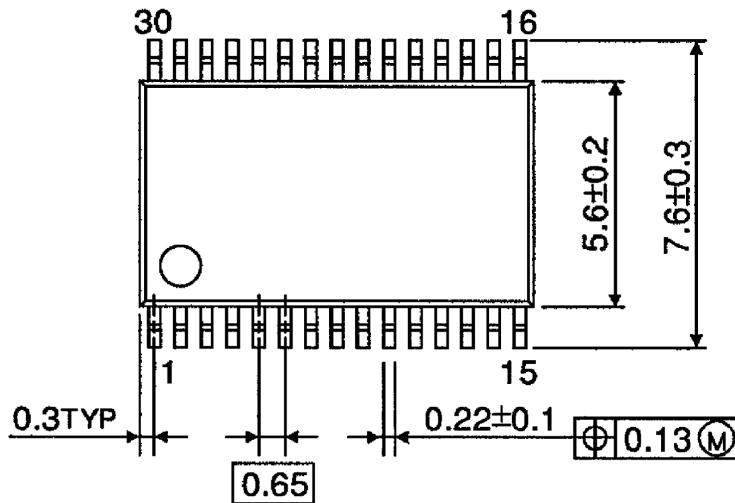


T<sub>2</sub> : AM IFT



**PACKAGE DIMENSIONS**  
SSOP30-P-300-0.65

Unit : mm

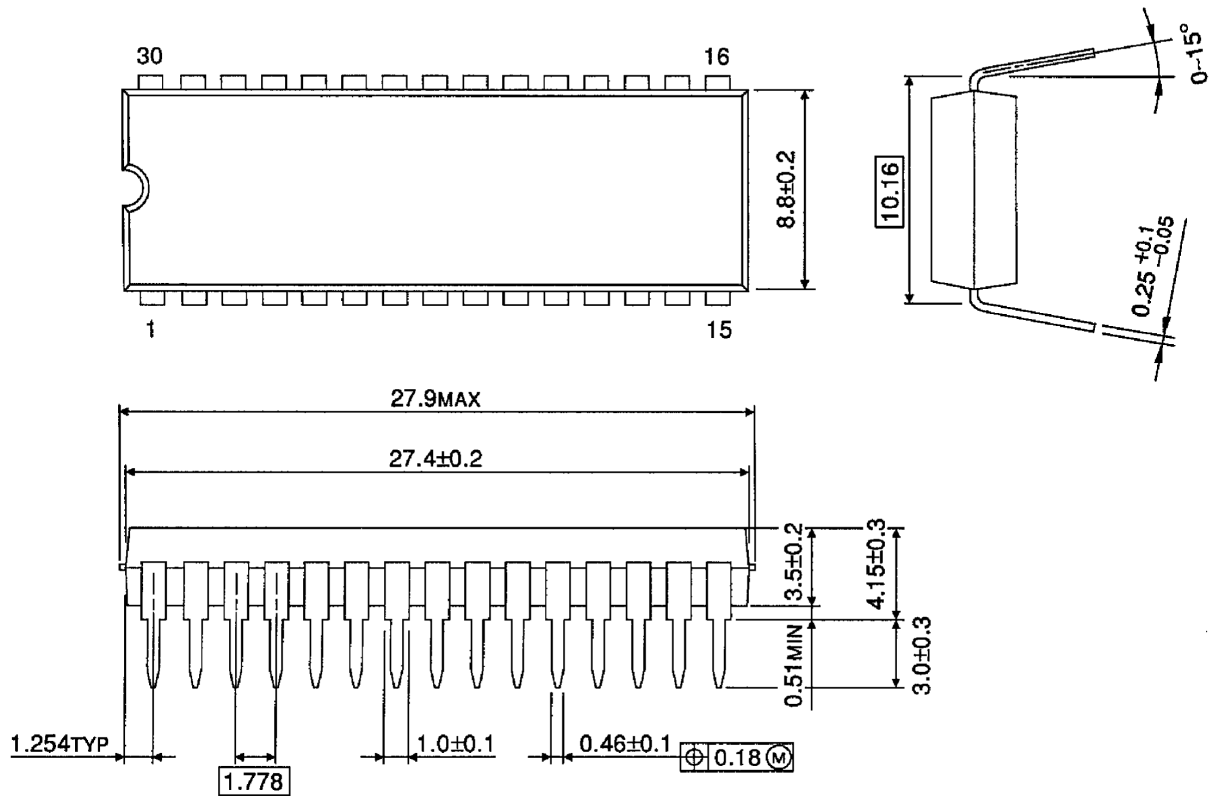


Weight: 0.17g (typ.)

## PACKAGE DIMENSIONS

SDIP30-P-400-1.78

Unit : mm



Weight: 2.2g (typ.)

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000707EBA

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