

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TA2029FN, TA2029F, TA2029N

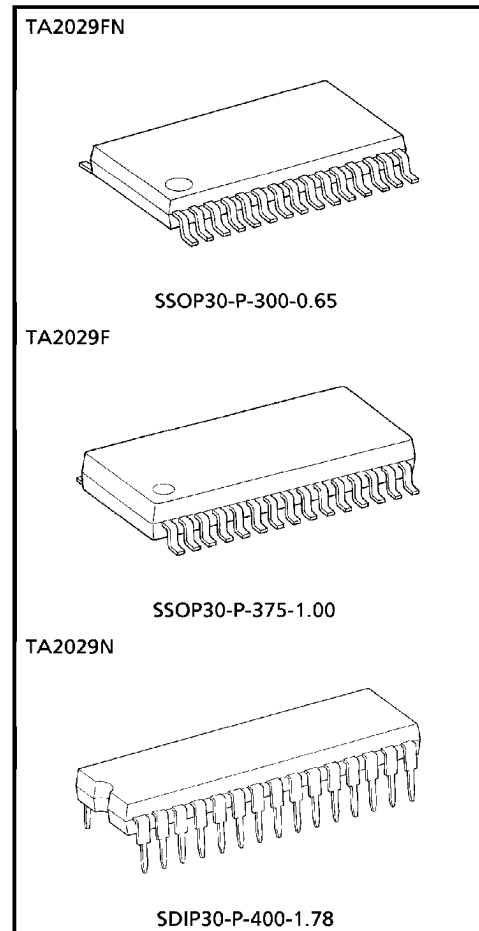
## FM F / E + AM / FM IF + PW IC FOR DIGITAL TUNING SYSTEM

The TA2029FN/F/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. (Pin⑤, Pin⑥)
- 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/F : 3V/8 $\Omega$ )  
 $P_O = 500\text{mW}$  (Typ.), THD = 10% (N : 6V/8 $\Omega$ )
- Operating supply voltage range
  - :  $V_{CC} = 1.8\sim 8\text{V}$  ( $T_a = 25^\circ\text{C}$ )



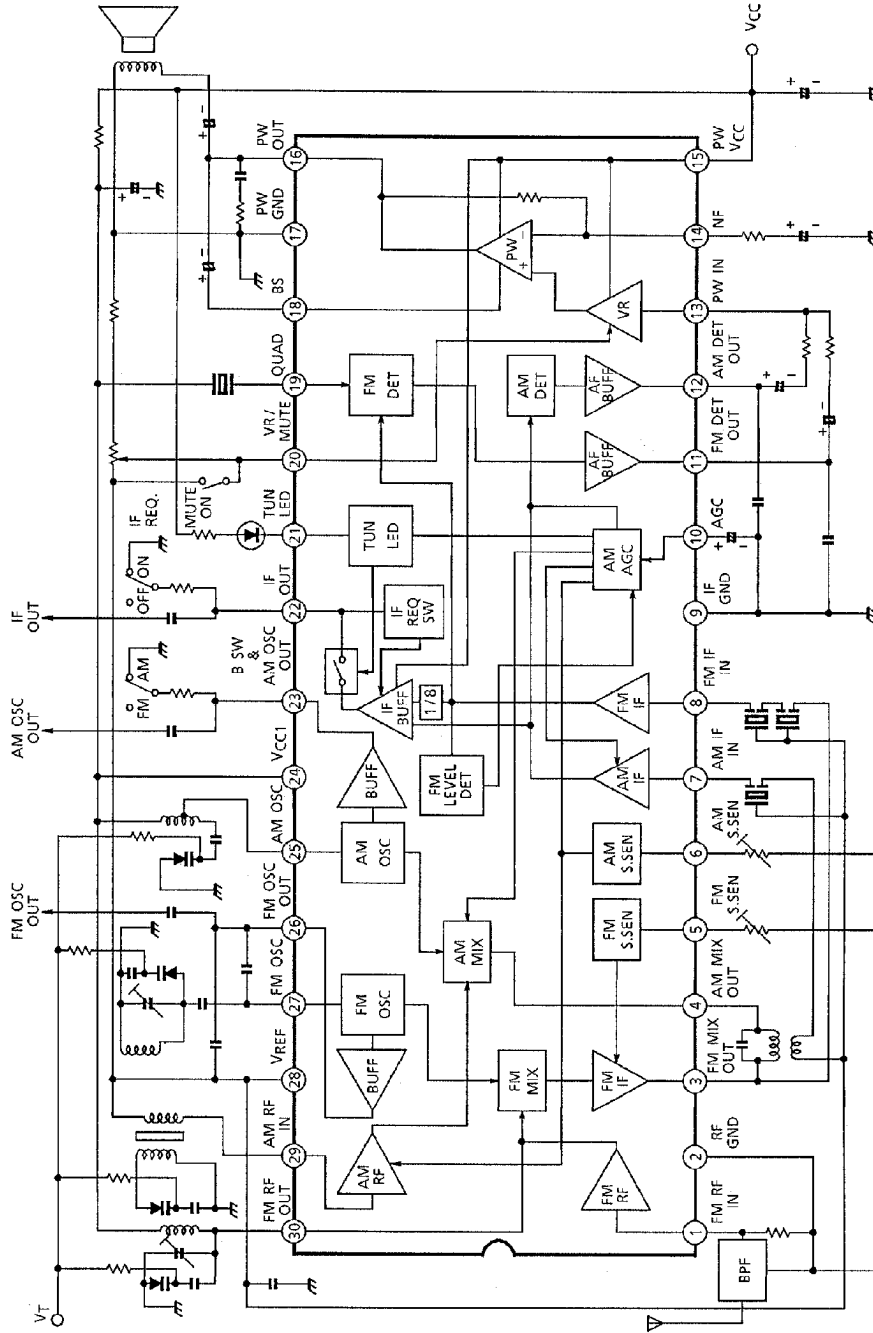
Weight	
SSOP30-P-300-0.65	: 0.17g (Typ.)
SSOP30-P-375-1.00	: 0.7g (Typ.)
SDIP30-P-400-1.78	: 2.2g (Typ.)

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1997-07-07 1/14

BLOCK DIAGRAM



TA2029FN /F/N - 2

**EXPLANATION OF TERMINALS** (Note : Ta = 25°C, VCC = 3V, 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 GND (GND 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 VCC (VCC 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. (MURATA 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	VCC1 (VCC of RF stage)	—	3.0	3.0
25	AM OSC AM OSC Tank circuit is connected.		3.0	3.0
26	FM OSC OUT 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. Pin①	3.0	3.0

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V <sub>CC</sub>	9	V
Power Dissipation	TA2029FN	P <sub>D</sub> (Note)	500	mW
	TA2029F		890	
	TA2029N		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, 7.2mW/°C for TA2029F and 12mW/°C for TA2029N.

**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, Ta = 25°C, VCC = 3V, SW2 : OFF, SW3 : OFF, SW7 : OFF

F / E : f = 83MHz, fm = 1kHz

FM IF : f = 10.7MHz, Δf = ±22.5kHz, fm = 1kHz

AM : f = 1005kHz, MOD = 30%, fm = 1kHz

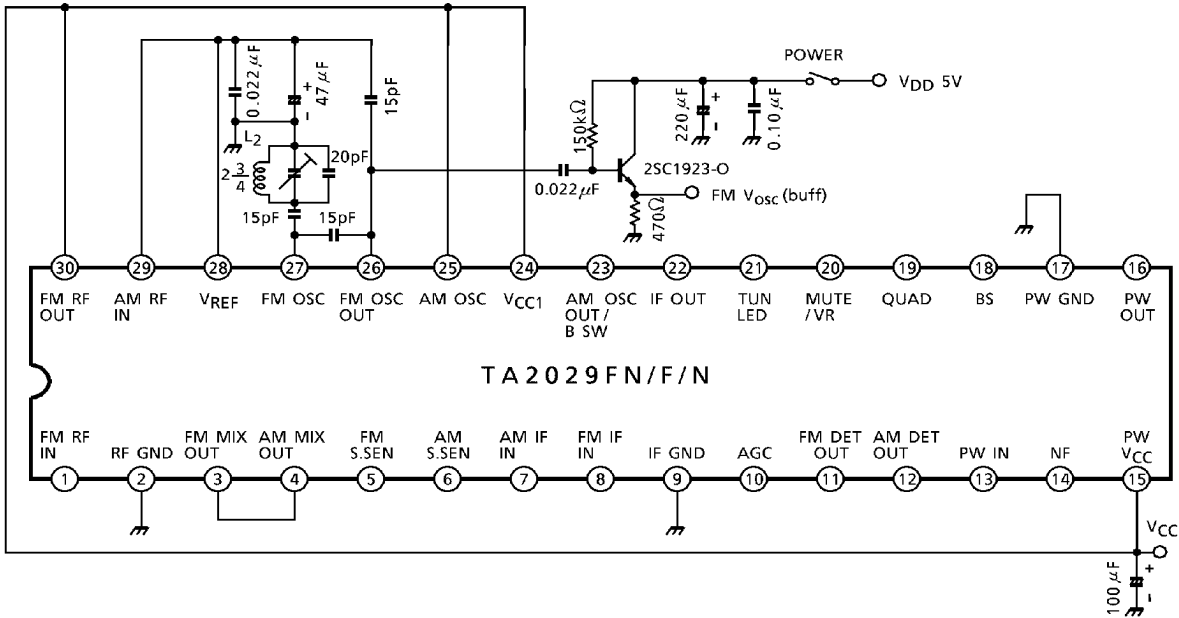
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Supply Current	I <sub>CCQ</sub> (FM)		1	FM Mode V <sub>in</sub> = 0	Power AMP : OFF	—	11.5	16.0	mA
	I <sub>CC</sub> (FM)		1		Power AMP : ON SW <sub>2</sub> : ON, SW <sub>7</sub> : ON	—	18.0	25.0	
	I <sub>CCQ</sub> (AM)		1	AM Mode V <sub>in</sub> = 0	Power AMP : OFF	—	7.5	11.0	
	I <sub>CC</sub> (AM)		1		Power AMP : ON SW <sub>2</sub> : ON, SW <sub>7</sub> : ON	—	17.0	24.0	
F / E	Input Limiting Voltage	V <sub>in</sub> (lim)	1	-3dB Limiting	—	12	—	dB <sub>μV</sub> EMF	
	Quiescent Sensitivity	Q <sub>S</sub>		S / N = 30dB	—	15	—	dB <sub>μV</sub> EMF	
	Local OSC Stop Voltage	V <sub>stop</sub> (FM)	2	V <sub>in</sub> = 0	—	1.35	—	V	
	Local OSC Buffer Output Voltage	V <sub>osc</sub> (buff)	2	f <sub>osc</sub> = 108MHz	—	130	—	mV <sub>rms</sub>	
FM	Input Limiting Voltage	V <sub>in</sub> (lim) IF	1	-3dB Limiting	39	44	49	dB <sub>μV</sub> EMF	
	Recovered Output Voltage	V <sub>OD</sub>	1	V <sub>in</sub> = 80dB <sub>μV</sub> EMF	55	80	110	mV <sub>rms</sub>	
	Signal To Noise Ratio	S / N	1	V <sub>in</sub> = 80dB <sub>μV</sub> EMF	—	70	—	dB	
	Total Harmonic Distortion	THD	1	V <sub>in</sub> = 80dB <sub>μV</sub> EMF	—	0.4	—	%	
	AM Rejection Ratio	AMR	1	V <sub>in</sub> = 80dB <sub>μV</sub> EMF	—	48	—	dB	
	LED ON Sensitivity	V <sub>L</sub>	1	I <sub>L</sub> = 1mA	40	45	50	dB <sub>μV</sub> EMF	
	IF Count Output Frequency	1 / 8 IF f <sub>1 / 8IF</sub> (FM)	1	SW <sub>2</sub> : ON, V <sub>in</sub> = 80dB <sub>μV</sub> EMF	1.3373	1.3375	1.3377	MHz	
	IF Count Output Voltage	1 / 8 IF V <sub>1 / 8IF</sub> (FM)	1	SW <sub>2</sub> : ON, V <sub>in</sub> = 80dB <sub>μV</sub> EMF	110	200	—	mV <sub>rms</sub>	
	IF Count Output Sensitivity	IF <sub>SENS</sub> (FM)1	1	SW <sub>6</sub> : 10kΩ	—	48	—	dB <sub>μV</sub>	
		IF <sub>SENS</sub> (FM)2	1	SW <sub>6</sub> : 0Ω	—	68	—	EMF	
Pin① Output Resistance	R <sub>11</sub>	1	—	—	1	—	kΩ		



CHARACTERISTIC		SYMBOL	TEST CIRCUIT	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	SW2 : ON, $V_{in} = 60\text{dB}\mu\text{V}$ EMF	110	200	—	$\text{mV}_{\text{rms}}$
	IF Count Output Sensitivity	IFSENS(AM)1	1	SW5 : $10\text{k}\Omega$	—	29	—	$\text{dB}\mu\text{V}$
		IFSENS(AM)2		SW5 : $0\Omega$	—	45	—	EMF
Pin <sup>®</sup> Output Resistance	$R_{12}$	1	—	—	5	—	$\text{k}\Omega$	
PW	Voltage Gain	$G_V$	1	$f = 1\text{kHz}$ , $R_L = 8\Omega$ , $V_O = 0.775V_{\text{rms}}$ , SW7 : ON	27	30	33	dB
	Output Power	$P_{o1}$	1	$f = 1\text{kHz}$ , $R_L = 8\Omega$ , THD = 10%, SW7 : ON	70	100	—	mW
		$P_{o2}$	1	$V_{CC} = 6\text{V}$ , $f = 1\text{kHz}$ , $R_L = 8\Omega$ , THD = 10%, SW7 : ON	350	500	—	
	Total Harmonic Distortion	THD	1	$f = 1\text{kHz}$ , $R_L = 8\Omega$ , $P_O = 50\text{mW}$ , SW7 : ON	—	0.6	1.5	%
	Output Noise Voltage	$V_{no}$	1	$R_g = 10\text{k}\Omega$ , $R_L = 8\Omega$ , SW7 : ON BPF = 30Hz~20kHz	—	0.45	—	$\text{mV}_{\text{rms}}$
Muting Attenuation	ATT	1	$V_O = 0.775V_{\text{rms}}$ SW3 : OFF→ON, SW7 : ON	65	77	—	dB	



TEST CIRCUIT 2

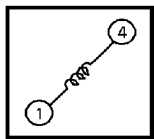


COIL DATA

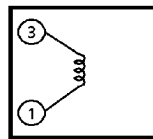
COIL No.	TEST FREQUENCY	L (μH)	C <sub>0</sub> (pF)	Q <sub>0</sub>	TURNS					WIRE (mm φ)	REF.
					1-2	2-3	1-3	1-4	4-6		
L <sub>1</sub> FM RF	100MHz	—	—	100	—	—	2 $\frac{1}{2}$	—	—	0.5UEW	Ⓢ 53T-037-202
L <sub>2</sub> FM OSC	100MHz	—	—	100	—	—	2 $\frac{3}{4}$	—	—	0.5UEW	Ⓢ 0258-244
T <sub>1</sub> AM OSC	796kHz	288	—	115	13	73	—	—	—	0.08UEW	Ⓢ 4147-1356-038
T <sub>2</sub> AM IFT	455kHz	—	180	120	—	—	180	—	15	0.08UEW	Ⓢ 2150-2162-165

Ⓢ SUMIDA ELECTRIC Co., LTD

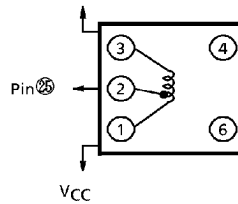
L<sub>1</sub> : FM RF



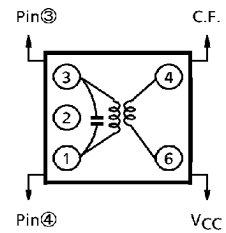
L<sub>2</sub> : FM OSC



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

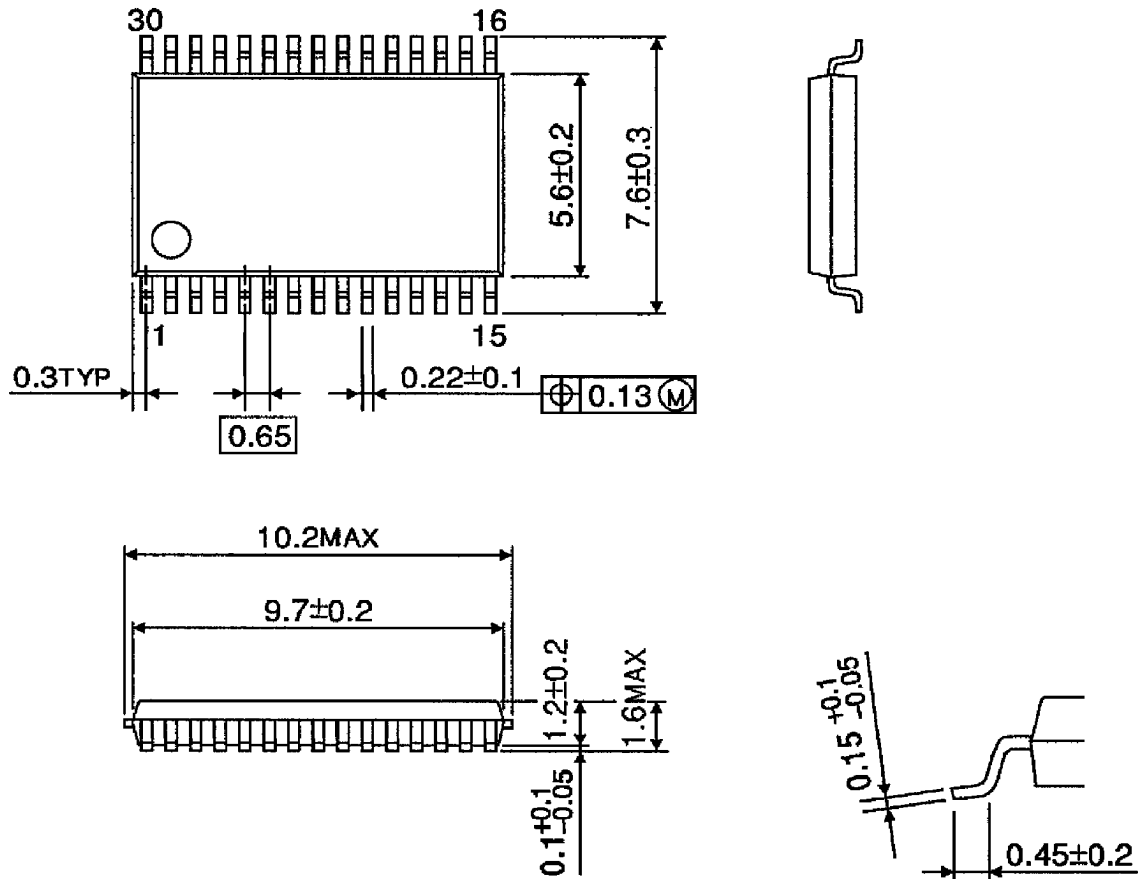


T<sub>2</sub> : AM IFT



OUTLINE DRAWING  
SSOP30-P-300-0.65

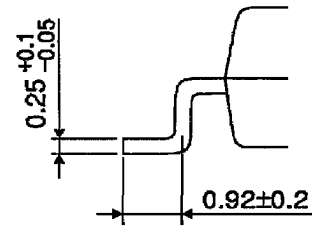
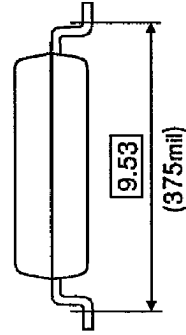
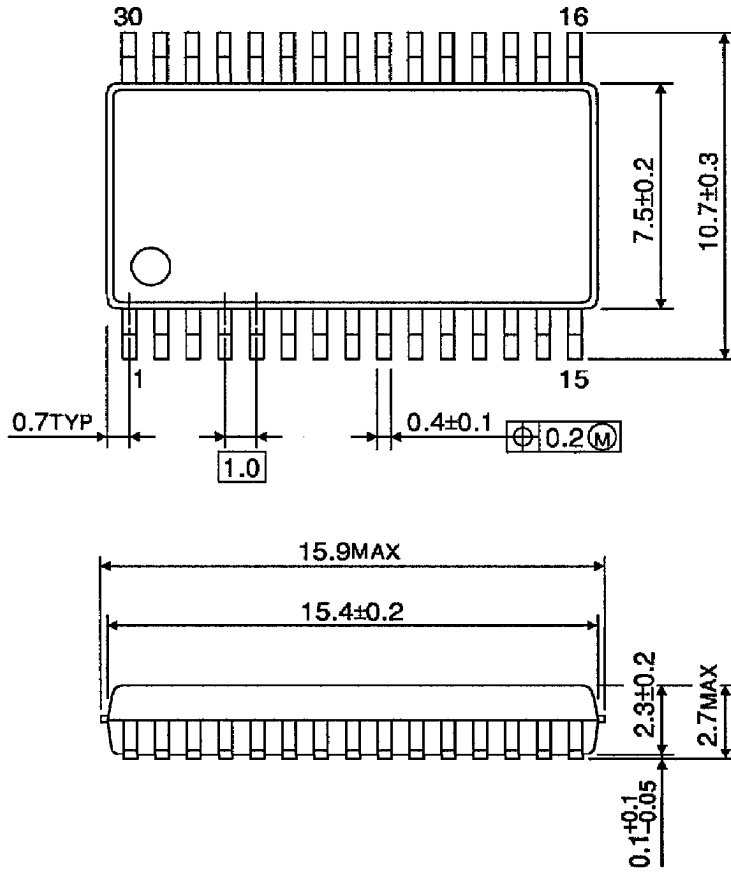
Unit : mm



Weight : 0.17g (Typ.)

OUTLINE DRAWING  
SSOP30-P-375-1.00

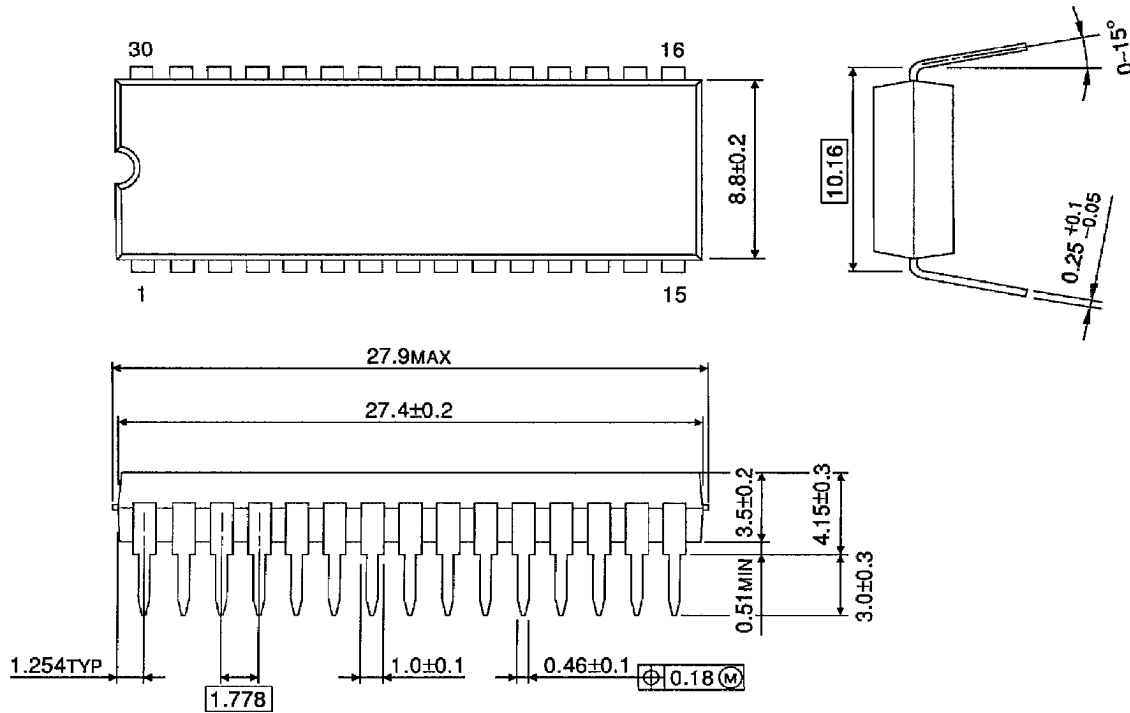
Unit : mm



Weight : 0.7g (Typ.)

**OUTLINE DRAWING**  
SDIP30-P-400-1.78

Unit : mm



Weight : 2.2g (Typ.)