

## FM/AM Radio

## Description

CXA1611M/N/P is an IC designed for use in FM/AM radios, integrating all necessary functions from the front end detector stage of a radio.

## Features

- Wide application range as it contains functions from the front end to detector stage.
- Operable for wide range of power supply voltages. ( $V_{CC}=2$  to  $9V$ )
- Low current consumption.  
(For FM,  $I_D=6.0mA$ , for AM,  $I_D=4.0mA$ , at  $V_{CC}=6V$ )
- Self-contained LED drive circuit for tuning.
- Self-contained FM band signal output circuit.
- Variable capacitance diode for FM AFC.
- Low distortion factor (0.1% Typ.) for FM detection output.
- AM IF output pin which can be adapted for the AM stereo.
- Needs few peripheral parts. Due to its small size, a high density packaging design is possible.

## Structure

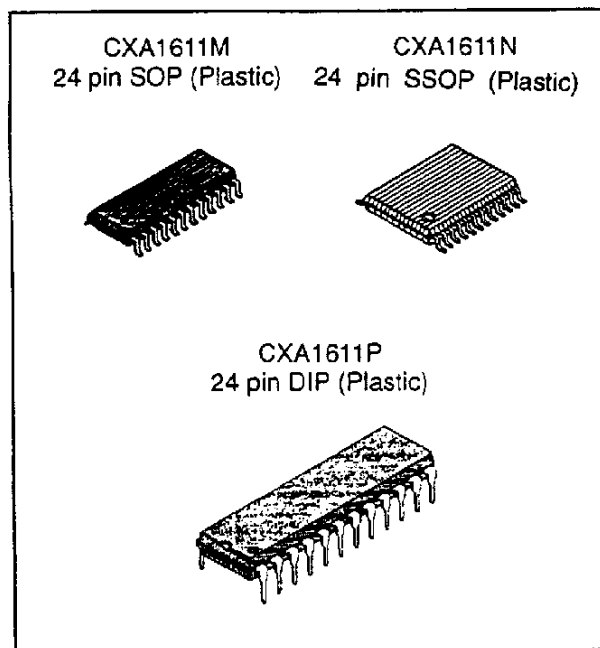
Bipolar silicon monolithic IC

Absolute Maximum Ratings ( $T_a=25^\circ C$ )

• Supply voltage	$V_{CC}$	14	V
• Operating temperature	$T_{opr}$	-20 to +75	$^\circ C$
• Storage temperature	$T_{stg}$	-55 to +150	$^\circ C$
• Allowable power dissipation	$P_D$	800 (DIP)	mW
		500 (SOP)	mW
		250 (SSOP)	mW

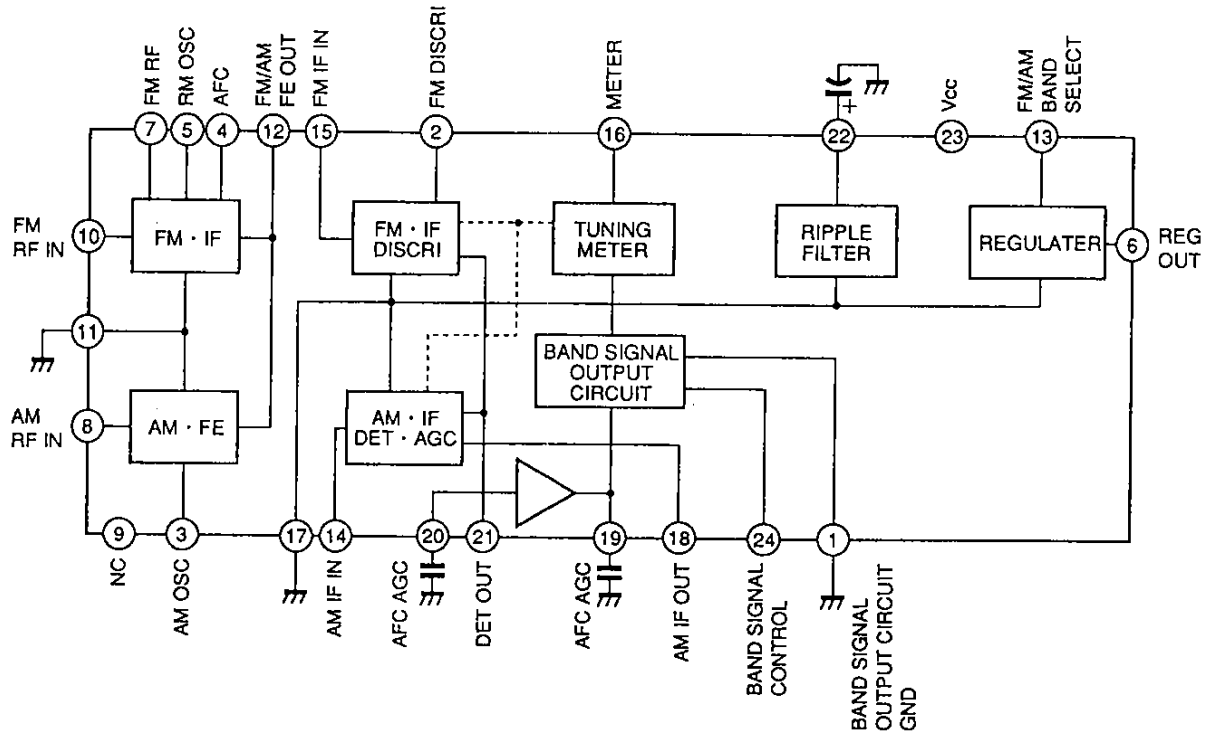
## Recommended Operating Condition

Supply voltage	$V_{CC}$	2 to 9	V
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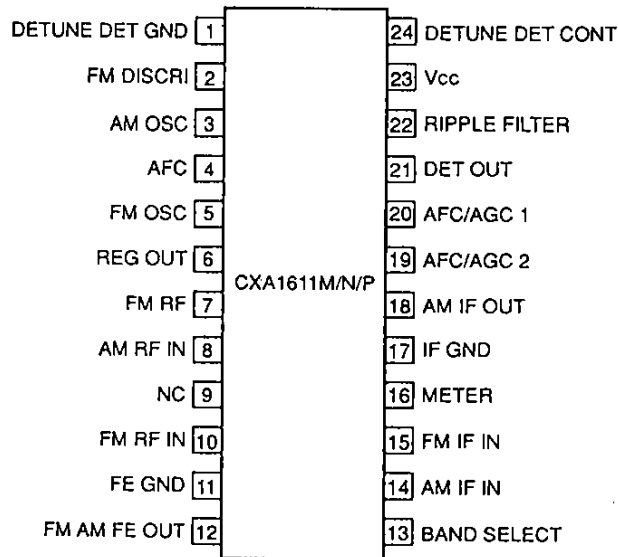


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Block Diagram



Pin Configuration (Top View)



## Pin Description

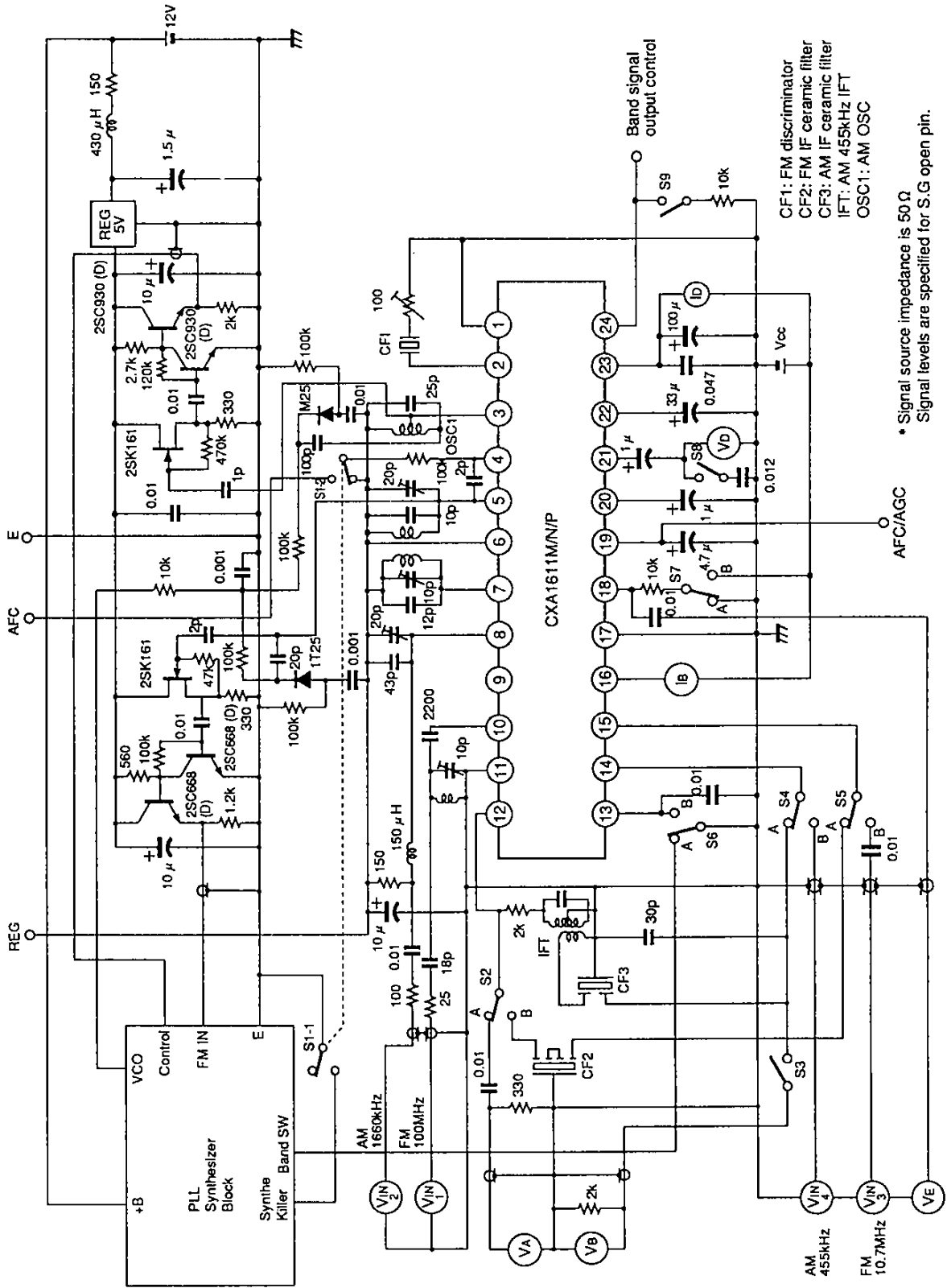
Pin No.	Symbol	Description
1	GND	Ground for band signal output
2	FM DISCRI	Discriminator pin; to be connected to FM discriminator
3	AM OSC	AM local oscillator circuit
4	AFC	AFC input pin
5	FM OSC	FM local oscillator
6	REG OUT	Regulator; 1.25V (typ.)
7	FM RF	FM RF input; connected to RF tank circuit
8	AM RF IN	AM RF input; connected to BAR ANT
9	NC	
10	FM RF IN	FM RF amplifier circuit; FM RF input
11	GND	Ground for front end
12	FM/AM FE OUT	IF output circuit for AM and FM; connected to AM and FM IF filters
13	BAND SELECT	Pin of FM and AM band switch; AM for "GND" and FM for "OPEN"
14	AM IF IN	Input stage of AM IF
15	FM IF IN	The first stage of FM IF amplifier circuit
16	METER	Meter drive circuit
17	IF GND	AM/FM IF stage; ground for detector stage
18	AM IF OUT	AM IF output; emitter output
19	AFC/AGC 2	AFC pin for W band; to adjust the time constant (using a capacitor of external circuit) with AM
20	AFC/AGC 1	AFC pin for J band; to adjust the time constant (using a capacitor in external circuit) with AM
21	DET OUT	Pin of the detector output; impedance; approx. 5k $\Omega$
22	RIPPLE	The ripple filter; the hum suppression level of approx. 34.5dB can be obtained by connecting a 10 $\mu$ F capacitor
23	Vcc	IC power supply
24	BAND SIGNAL OUTPUT CONTROL	Band signal output amplitude is adjusted by connecting an outside resistor

(Ta=25°C, See the Electrical Characteristics Test Circuit)

Electrical Characteristics

No.	Test Item	Symbol	Switch Position										Bias Condition				Test Point	Output Waveform and Method of Test	Min.	Typ.	Max.	Unit			
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S9	VIN1/VIN2	VIN3/VIN4	OFF	OFF							OFF	OFF	
1	Circuit current (1)	ID1	OFF	B	OFF	B	A	A	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	IB	1.8	4.0	6.6	mA
2	Circuit current (2)	ID2	ON	A	ON	B	B	A	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	IB	3.6	6.0	8.25	mA
3	FM front end voltage gain (1)	GV1	ON	A	ON	A	A	A	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	VD	33	39	45	dB
4	FM detector output level (1)	VD1	OFF	B	OFF	B	B	B	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	VD	-25.2	-22.5	-19.0	dBs
5	FM detector output level (2)	ΔVD																			VD	-4.0	-	+4.0	dB
6	FM IF knee level	VD2																			VIN3	-	25	31	dBμ
7	FM detector output distortion factor (1)	THD1																			VD	-	0.1	1.1	%
8	Deviation of FM IF center frequency	F1																			-	-55	0	55	kHz
9	FM meter current (1)	IB1																			IB	1.8	3.5	6.05	mA
10	FM band signal output band width	F2	ON	A	ON	B	B	A	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	IB	±67.5	±110	±170.5	kHz
11	AM front end voltage gain (2)	GV2	ON	A	ON	A	A	A	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	VB	19	24	28	dB
12	AM IF voltage gain (3)	GV3	OFF	B	OFF	B	B	B	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	VIN4	17	23	28	dBμ
13	AM IF voltage gain (4)	ΔGV																			VIN4	-4	0	3	dB
14	AM detector output level (3)	VD3																			VD	-25.5	-22.5	-19.0	dBs
15	AM meter current (2)	IB2																			IB	1.62	3.0	5.5	mA
16	AM IF output level	VE	ON	A	ON	B	B	A	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	VE	72	100	132	mV
17	AM detector output distortion factor (2)	THD2	ON	A	ON	A	A	A	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	VD	-	0.6	1.1	%

Electrical Characteristics Test Circuit



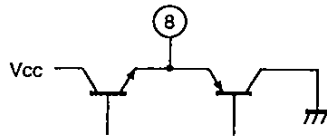
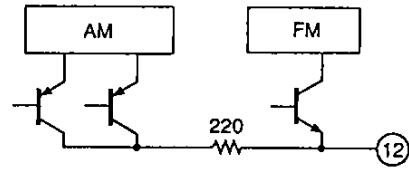
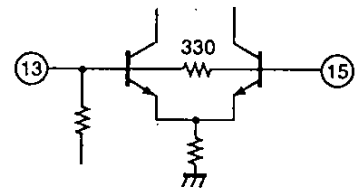
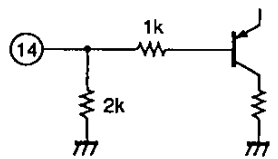
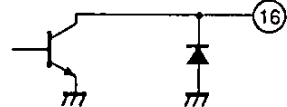
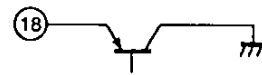
CF1: FM discriminator  
 CF2: FM IF ceramic filter  
 CF3: AM IF ceramic filter  
 IFT: AM 455kHz IFT  
 OSC1: AM OSC

• Signal source impedance is 50 Ω  
 Signal levels are specified for S.G open pin.

Standard Circuit Design Data

NO.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
1	GND	—	—	—	—	—
2	FM DISCRI	2.18	2.70	3.08	3.60	
3	AM OSC	1.25	1.25	1.25	1.25	
4	AFC	1.25	1.15	1.25	1.15	
6	REG OUT	1.25	1.25	1.25	1.25	
5	FM OSC	1.25	1.25	1.25	1.25	
7	FM RF	1.25	1.25	1.25	1.25	
10	FM RF IN	0.3	0	0.3	0	

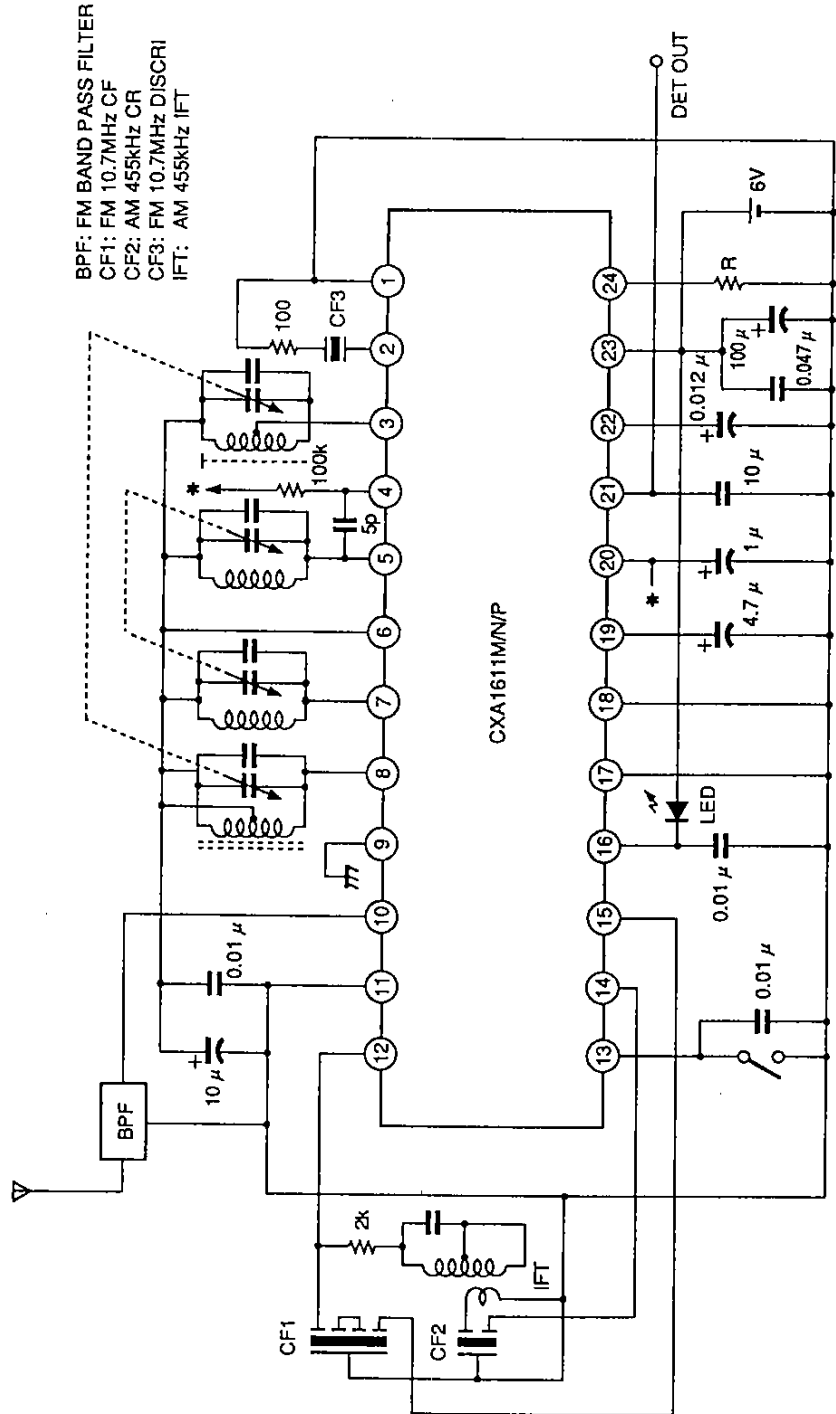
\* See the DC Voltage Test Circuit.  
Values are typical values.

NO.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
8	AM RF IN	1.25	1.25	1.25	1.25	
9	NC	—	—	—	—	—
11	GND	—	—	—	—	—
12	FM/AM FE OUT	0.57	0.2	0.8	0.2	
13	BAND SELECT	1.25	0	1.25	0	
15	FM IF IN	1.25	0	1.25	0	
14	AM IF IN	0	0	0	0	
16	METER	1.6	1.6	4.5	4.5	
17	IF GND					
18	AM IF OUT					

NO.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
19	AFC/AGC 2	1.15	1.47	1.15	1.47	
20	AFC/AGC 1	1.47	1.15	1.47	1.15	
21	DET OUT	1.0	1.0	1.0	1.0	
22	RIPPLE	2.7	2.7	4.0	4.0	
23	Vcc	3.0	3.0	6.0	6.0	
24	BAND SIGNAL OUTPUT CONTROL					

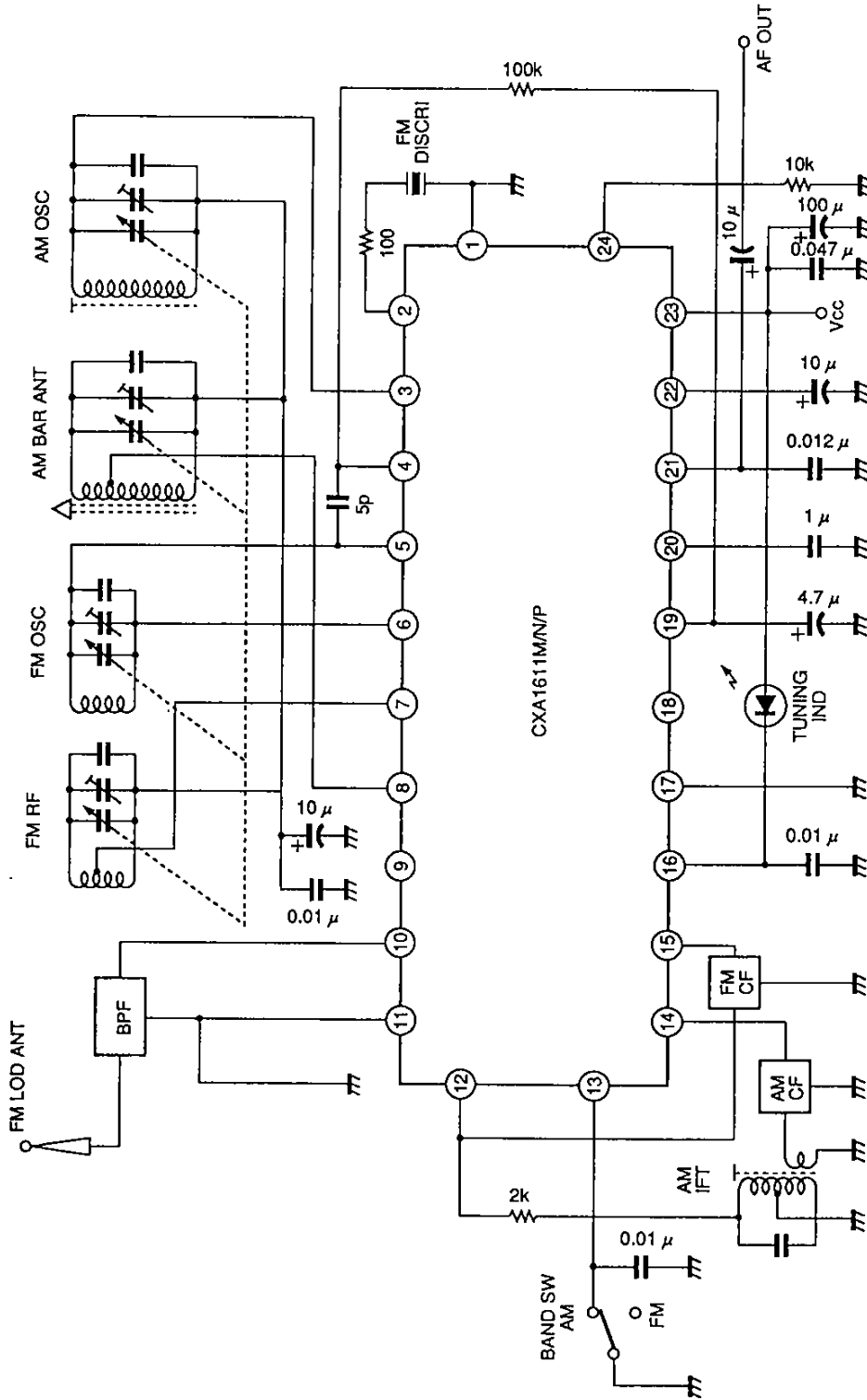


DC Voltage Test Circuit



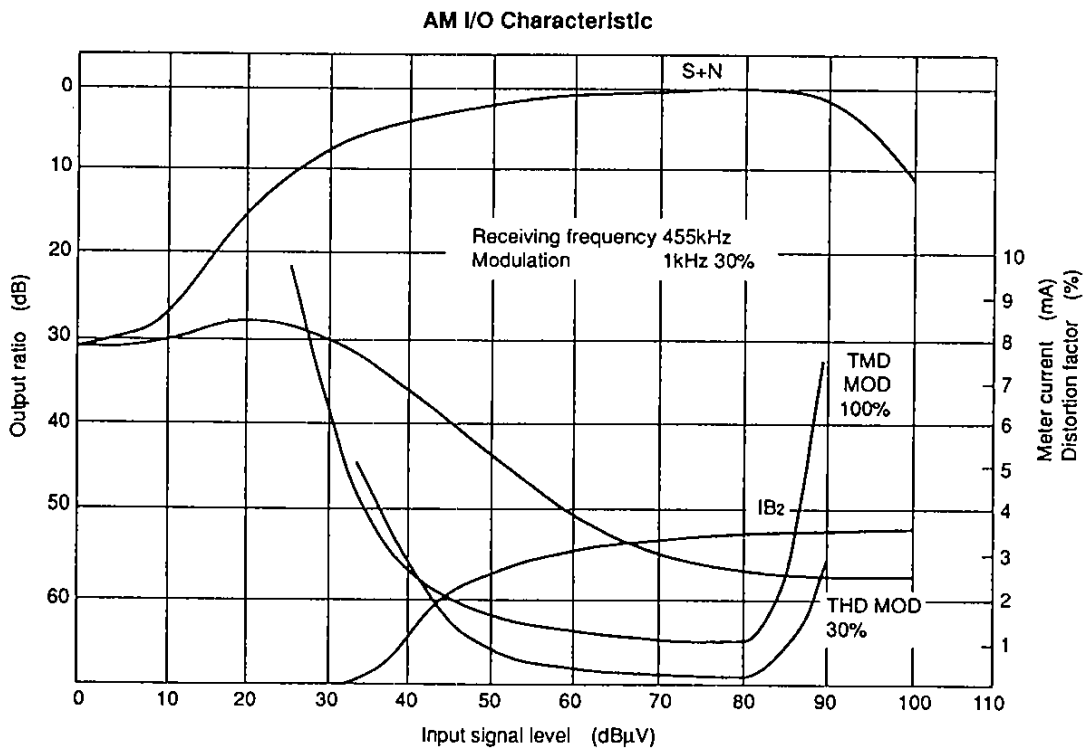
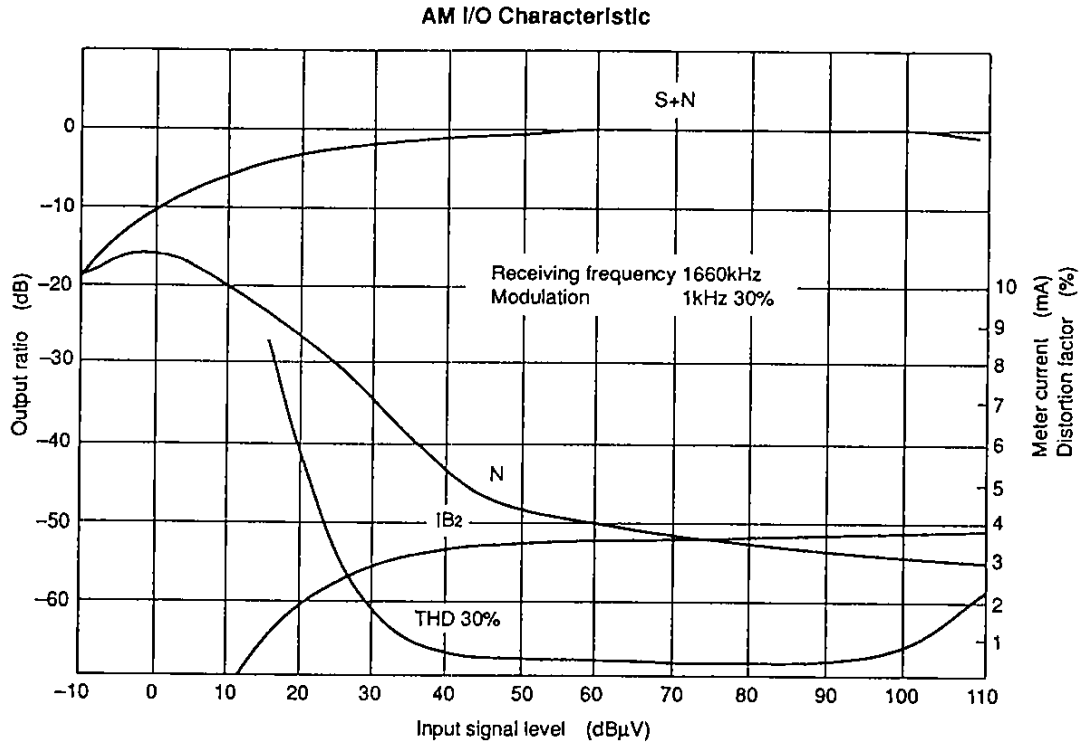
Note) · The meter current is cut off under the following conditions: CDA 10.7MG1 (Murata Seisakusho co.) is used as CF1, and the input frequency is either 10.7MHz ± 100kHz or more when R is 10kΩ, or 10.7MHz ± 150kHz or more when R is 100kΩ.  
 · The band signal output function cuts off the meter current when the signal is out of tuning by a specified frequency from the FM IF center frequency.  
 · The band signal output function is cut off when the voltage on pin 24 is the same as the regulator voltage or Vcc.

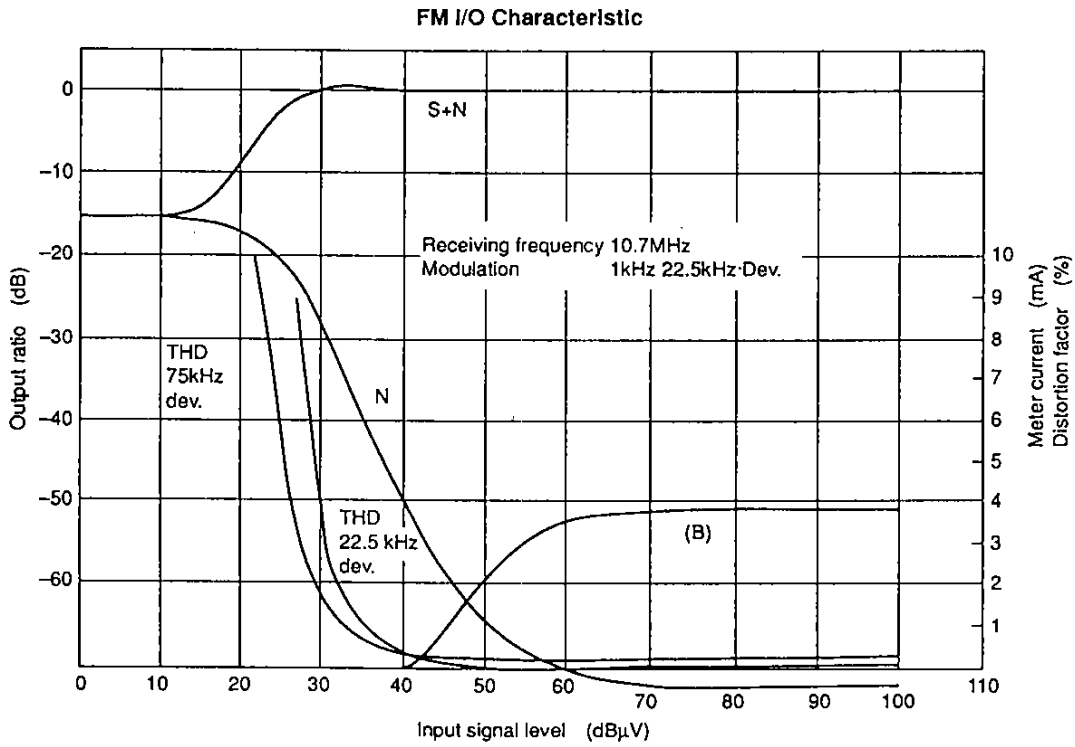
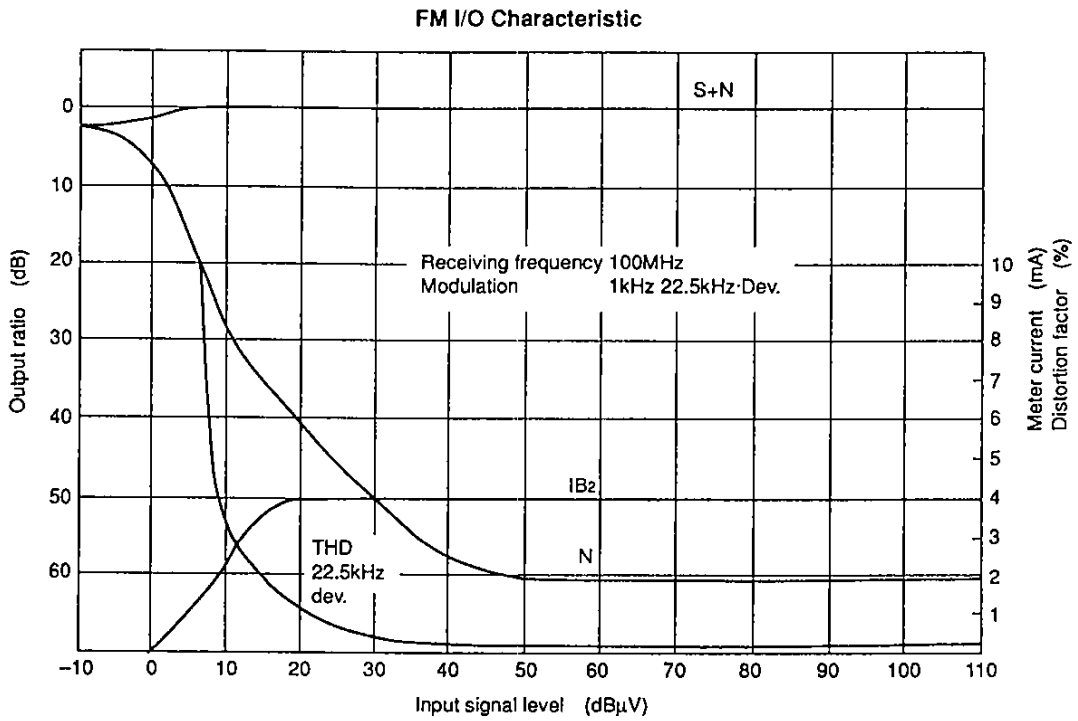
Application Circuit



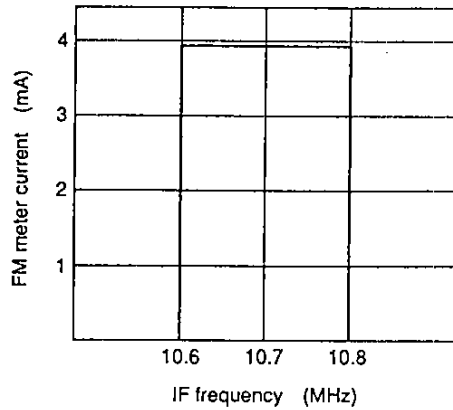
Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

Example of Representative Characteristics

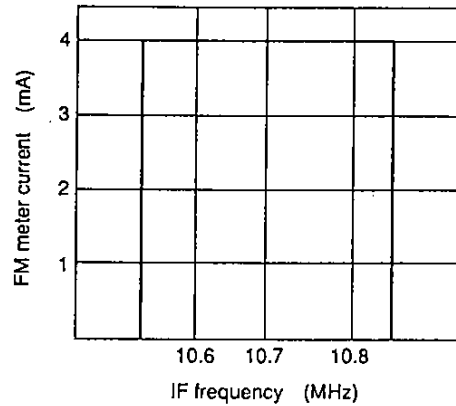




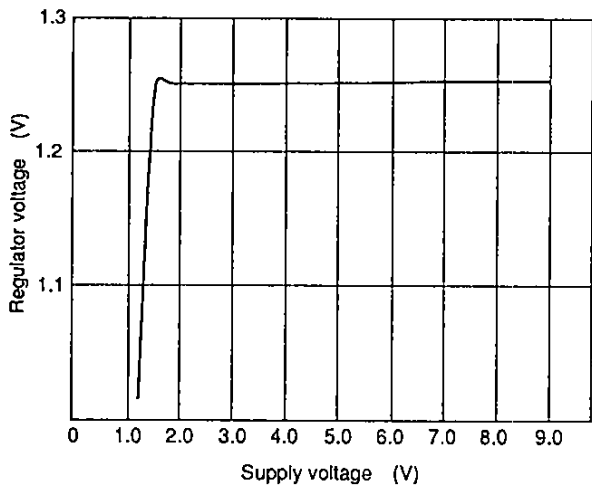
FM Band signal output characteristic  
(Narrow band)



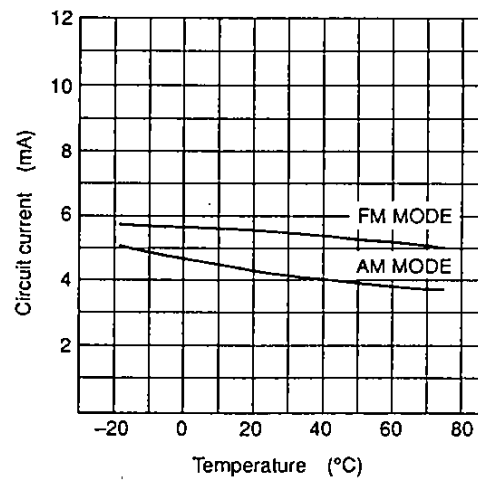
FM Band signal output characteristic  
(Normal)



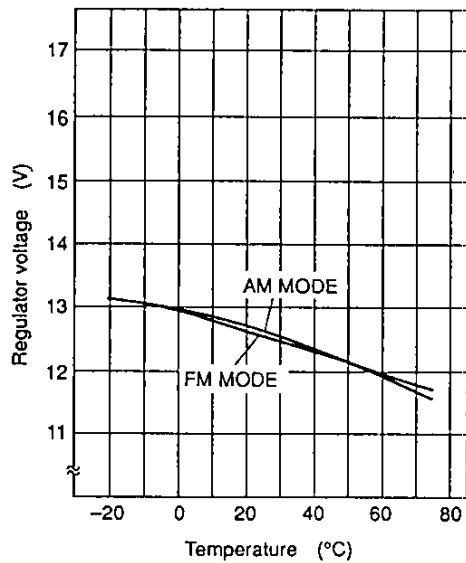
Regulator output vs. Supply voltage characteristics



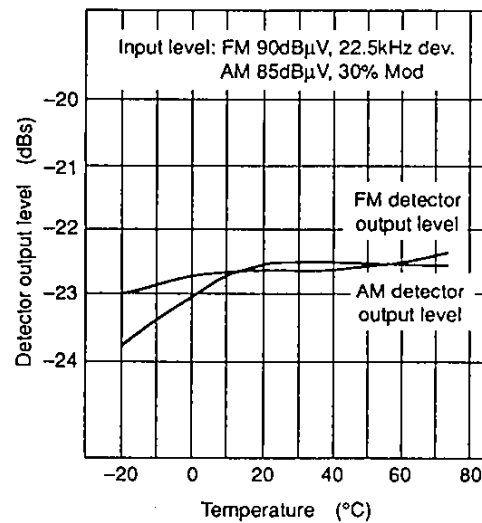
Temperature characteristics of circuit current



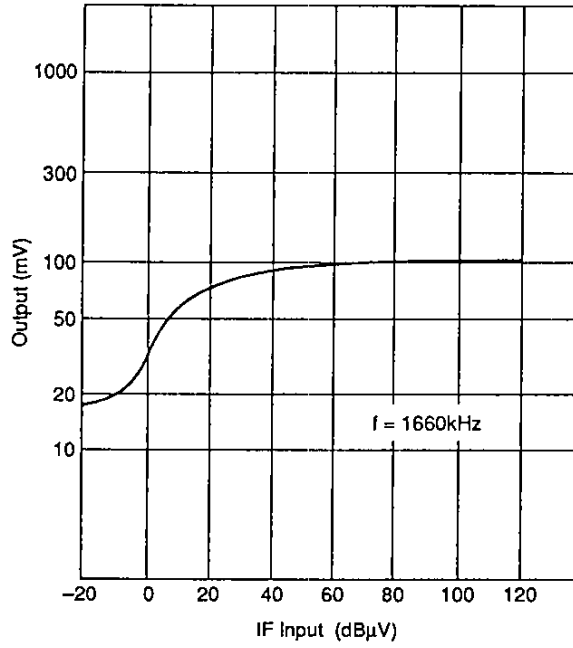
Temperature characteristics of regulator



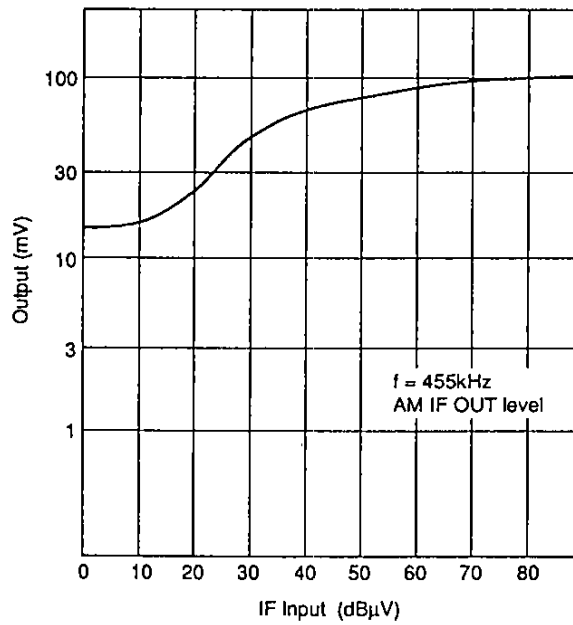
Temperature characteristics of detector output



AM IF pin output vs. Input (Overall)



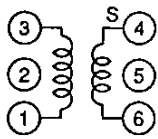
AM IF pin output vs. Input



Coil data

AM OSC

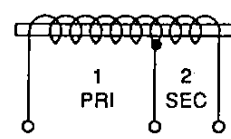
WIRE  $\phi$  0.06mm 2UEW



f (kHz)	L ( $\mu$ H)	Qo	t	
			1 to 3	4 to 6
796	270	125	107	29

Equivalent to L-5K7 H5 R12-1684X.  
Mitsumi Electric Co., Ltd. or  
7TRS-8441 TOKO Co., Ltd.

AM Bar ANT



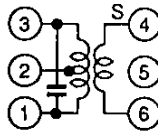
f (kHz)	L ( $\mu$ H)	1	2
796	650	91t	20t

BPF PFWE8 SOSHIN (88 to 108MHz)

VC PVC2LXT-16L MITUMI }  
CF1 CDA10.7MG1 } or  
CF2 SFU-455B } MURATA } CF1 BFCFL-455  
CF3 SFE10.7MA5 } TOKO

AM IFT

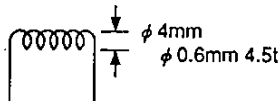
WIRE  $\phi$  0.07mm UEW



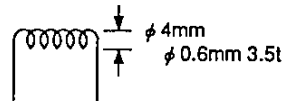
Co (pF)	Qo	t		
		1 to 2	2 to 3	4 to 6
180	90	111	35	7

Equivalent to 21K7 H5 R12-8558A.  
Mitsumi Electric Co., Ltd. or  
7MC-7789N TOKO Co., Ltd.

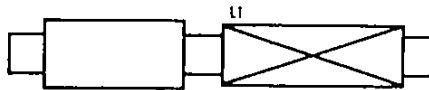
FM RF



FM OSC



Evaluation Board



Parts Layout (mounting side)

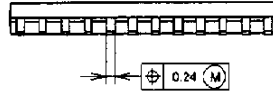
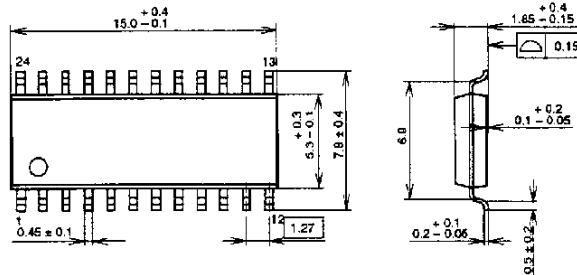


Pattern

Package Outline Unit : mm

CXA1611M

24PIN SOP (PLASTIC)



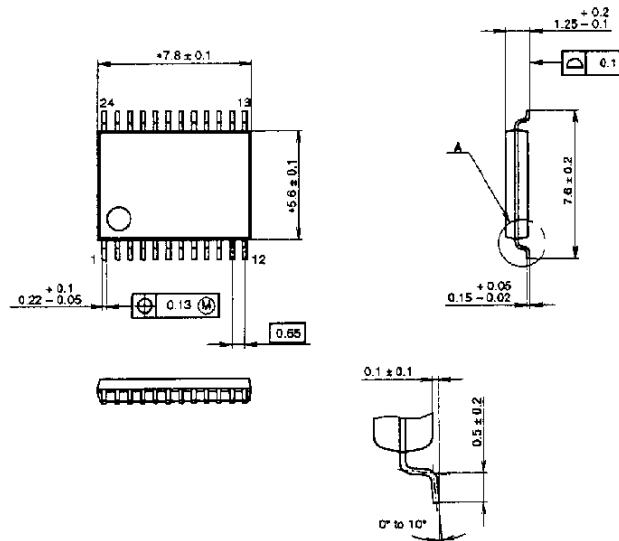
PACKAGE STRUCTURE

SONY CODE	SOP-24P-L01
EIAJ CODE	SOP024-P-0300
JEDEC CODE	

MOLDING COMPOUND	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.3g

CXA1611N

24PIN SSOP(PLASTIC)



NOTE: Dimensions "A" does not include mold protrusion.

DETAIL A

PACKAGE STRUCTURE

SONY CODE	SSOP-24P-L01
EIAJ CODE	SSOP024-P-0058
JEDEC CODE	

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER/PALLADIUM PLATING
LEAD MATERIAL	42/COPPER ALLOY
PACKAGE MASS	0.1g

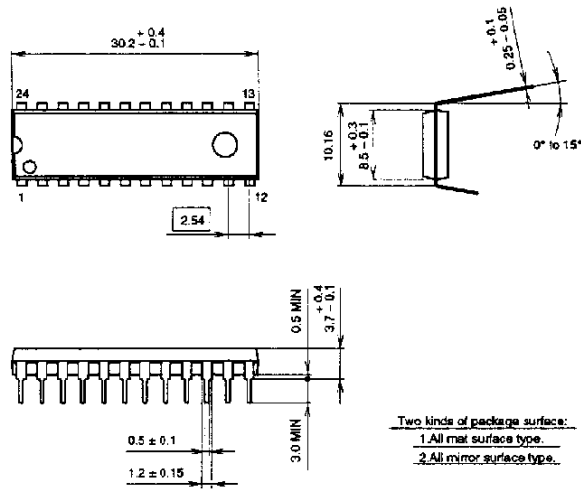
NOTE : PALLADIUM PLATING

This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).



CXA1611P

24PIN DIP(PLASTIC)



PACKAGE STRUCTURE

SONY CODE	DIP-24P-01
EIAJ CODE	DIP024-P-0400
JEDEC CODE	—

PACKAGE MATERIAL	EPOXY RESIN
LEAD TREATMENT	SOLDER PLATING
LEAD MATERIAL	42% COPPER ALLOY
PACKAGE MASS	2.6g