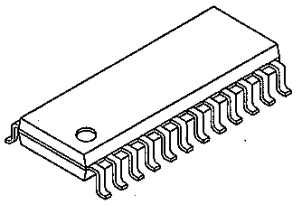
SONY

CX20111

FM/AM Radio

24 pin SOP (Plastic)



Description

CX20111 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 a wide range of power supply voltages. (Vcc=2 to 9V)
- Low current consumption. (For FM, I_D=6.0 mA, for AM, I_D=4.0 mA, at Vcc=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 (Ta=25°C)

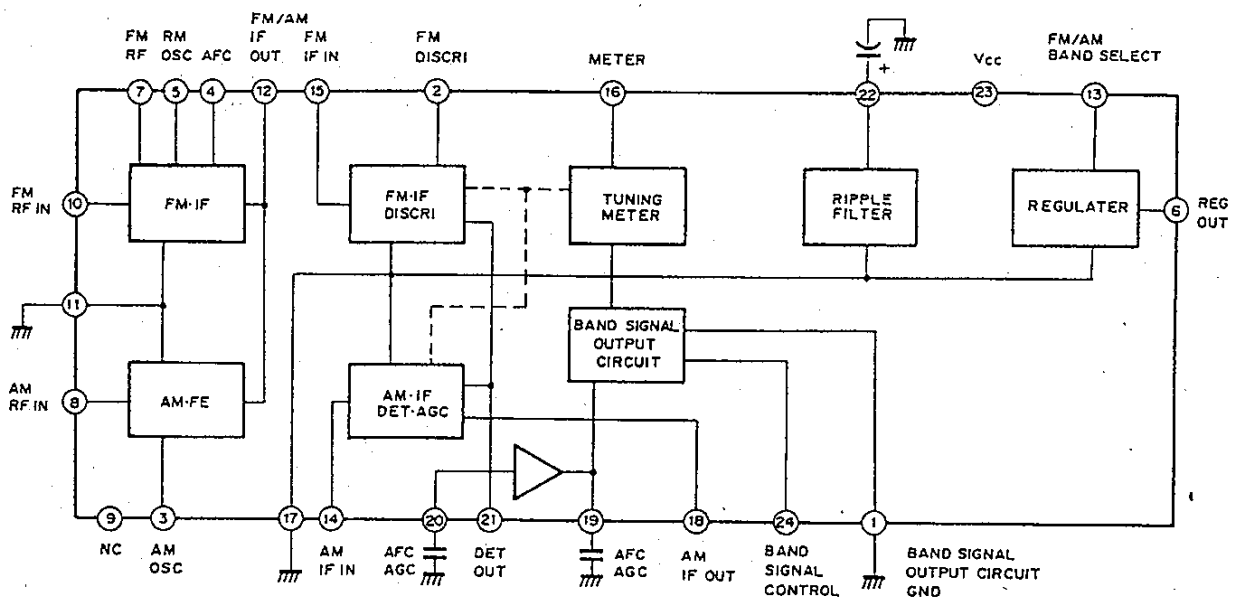
• Supply voltage	Vcc	10	V
• Operating temperature	Topr	−20 to +75	°C
• Storage temperature	Tstg	−55 to +150	°C
• Allowable power dissipation	P_D	670	mW

Recommended Operating Condition

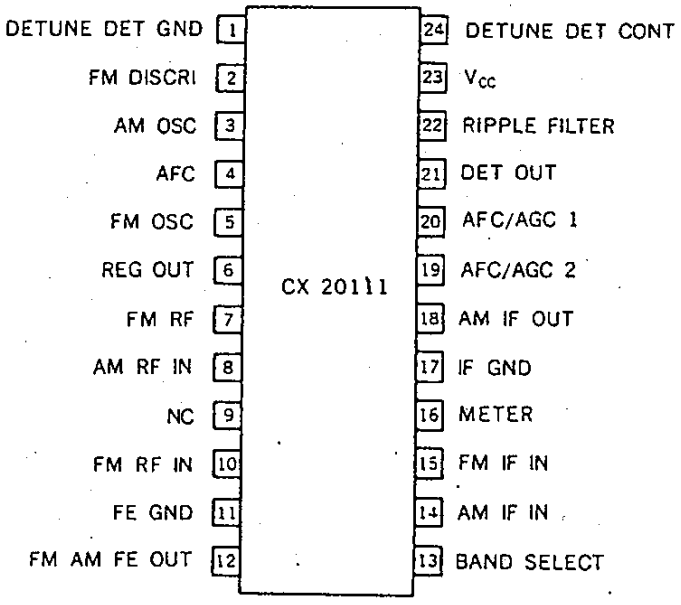
• Supply voltage	Vcc	2 to 9	V

E89121A41

Block Diagram



Pin Configuration (Top View)



Pin Description

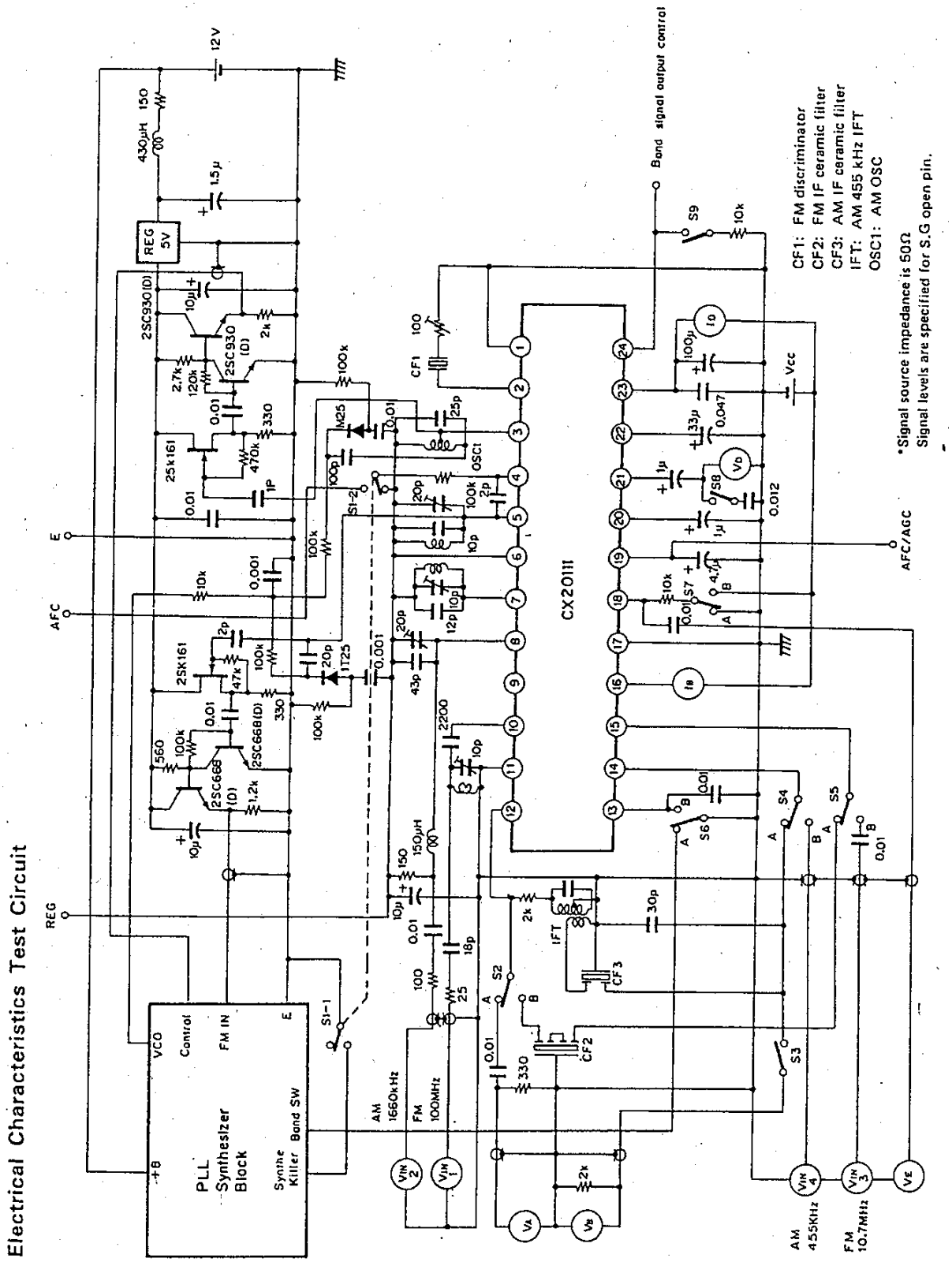
No.	Symbol	Description
1	GND	Ground for band signal output
2	FM DISCRI	Discriminator pin; to be connected to FM discriminator
3	AM OSC	AM local oscillator circuit
4	AFC	AFC input pin
5	FM OSC	FM local oscillator
6	REG OUT	Regulator; 1.25V (typ.)
7	FM RF	FM RF input; connected to RF tank circuit
8	AM 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 filiters
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 detector output; impedence; approx. 5kΩ
22	RIPPLE	The ripple filter: the hum supression level of approx. 34.5 dB can be obtained by connecting a 10 μF capacitor
23	Vcc	IC power supply
24	BAND SIGNAL OUTPUT CONTROL	Band signal output amplitude is adjusted by connecting an outside resistor

Electrical Characteristics

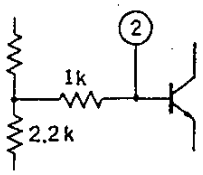
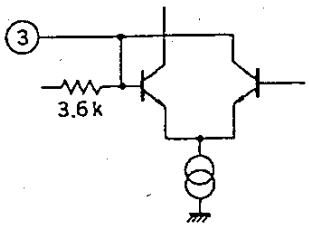
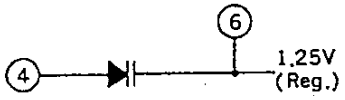
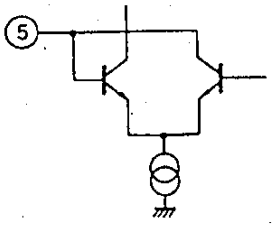
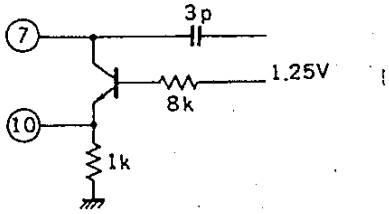
Ta=25°C, See the Electrical Characteristics Test Circuit

No.	Test Item	Symbol	Switch Position									Bias Condition				Test point	Output Waveform and Method of Test	Min.	Typ.	Max.	Unit
			S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	V_{IN1}	V_{IN2}	V_{IN3}	V_{IN4}						
1.	Circuit current (1)	ID_1	OFF	B	OFF	B	B	A	A	ON	OFF	OFF	OFF	OFF	OFF	I_D	Short circuit V_{IN1} through V_{IN4} when either AM signal of FM signal is not present	1.8	4.0	6.6	mA
2.	Circuit current (2)	ID_2	↓	↓	↓	↓	↓	B	↓	↓	↓	↓	↓	↓	↓	I_D	↓	3.6	6.0	8.25	mA
3.	FM front-end voltage gain(1)	GV_1	ON	A	↓	↓	↓	↓	↓	↓	↓	ON	↓	↓	↓	V_O	V_{IN1}=100MHz 40dBμV CW V_A=10.7MHz CW	33	39	45	dB
4.	FM detector output level (1)	VD_1	OFF	B	↓	↓	↓	↓	↓	↓	↓	OFF	↓	ON	ON	V_O	V_{IN3}=10.7MHz 90dBμV 1KHz 22.5KHz dev V_O=1KHz sin Wave	−25.2	−22.5	−19.0	dBs
5.	FM detector output level (2)	ΔVD	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	V_O	V_{D1} and V_{CC}=9V: level difference with same value of V_{D1}	−4.0	–	14.0	dB
6.	FM IF knee level	VD_2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	V_{IN3}	V_{IN3} level is −3dB with reference to V_{D1}	–	25	31	dBμ
7.	FM detector output distortion factor (1)	THD_1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	V_O	V_{IN3}=10.7MHz 90dBμV 1KHz 75KHz dev V_O=1KHz sin Wave	–	0.1	1.1	%
8.	Deviation of FM IF center frequency	F_1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	–	V_{IN3}=10.7MHz 90dBμV CW	−55	0	55	kHz
9.	FM meter current (1)	IB_1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	I_B	V_{IN3}=10.7MHz 60 dBμV CW	1.8	3.5	6.05	mA
10.	FM band signal output band width	F_2	↓	↓	↓	↓	↓	↓	↓	↓	ON	↓	↓	↓	↓	I_B	V_{IN3}=10.7MHz 235KHz Confirm I_B=0 at 90dBμV	±67.5	±110	±170.5	kHz
11.	AM front end voltage gain (2)	GV_2	ON	↓	ON	↓	↓	A	↓	↓	OFF	↓	ON	OFF	OFF	V_B	V_{IN2}=1660KHz 60dBμV CW V_B=455KH CW	19	24	28	dB
12.	AM IF voltage gain (3)	GV_3	OFF	↓	OFF	↓	OFF	↓	↓	↓	↓	↓	OFF	↓	ON	V_{IN4}	Level of V_{IN4} at V_D=−34dBS	17	23	28	dBμ
13.	AM IF voltage gain (4)	ΔGV	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	V_{IN4}	V_{CC}=2V: level difference with same condition as GV_3	−4	0	3	dB
14.	AM detector output level (3)	VD_3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	V_O	V_{IN4}=455KHz 85dBμV 1KHz 30% MOD V_O=1KHz sin Wave	−25.5	−22.5	−19.0	dBs
15.	AM meter current (2)	IB_2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	I_B	V_{IN4}=455KHz 85dBμV CW	1.62	3.0	5.5	mA
16.	AM IF output level	V_L	↓	↓	↓	↓	↓	↓	B	↓	↓	↓	↓	↓	↓	V_L	V_{IN4}=455KHz 85dBμV CW V_L=455KHz CW	72	100	132	mV
17.	AM detector output distortion factor (2)	THD_2	ON	↓	↓	A	↓	↓	A	↓	↓	↓	ON	↓	OFF	V_O	V_{IN2}=95dBμV 1660KHz 1KHz 30% MOD. V_O=1KHz sin Wave Vcc=7.8V	–	0.6	1.1	%

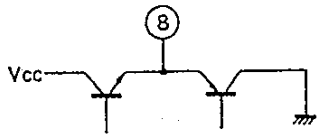
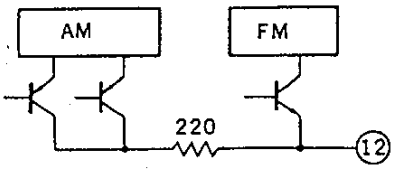
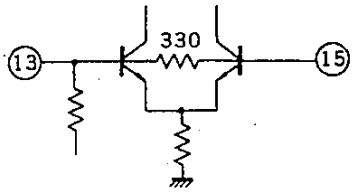
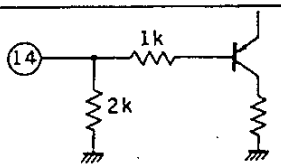
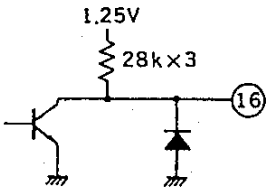
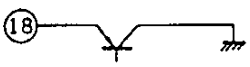
Electrical Characteristics Test Circuit

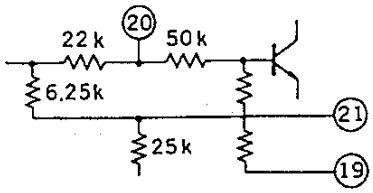
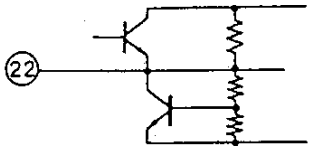
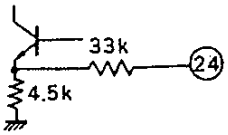


Standard Circuit Design Data

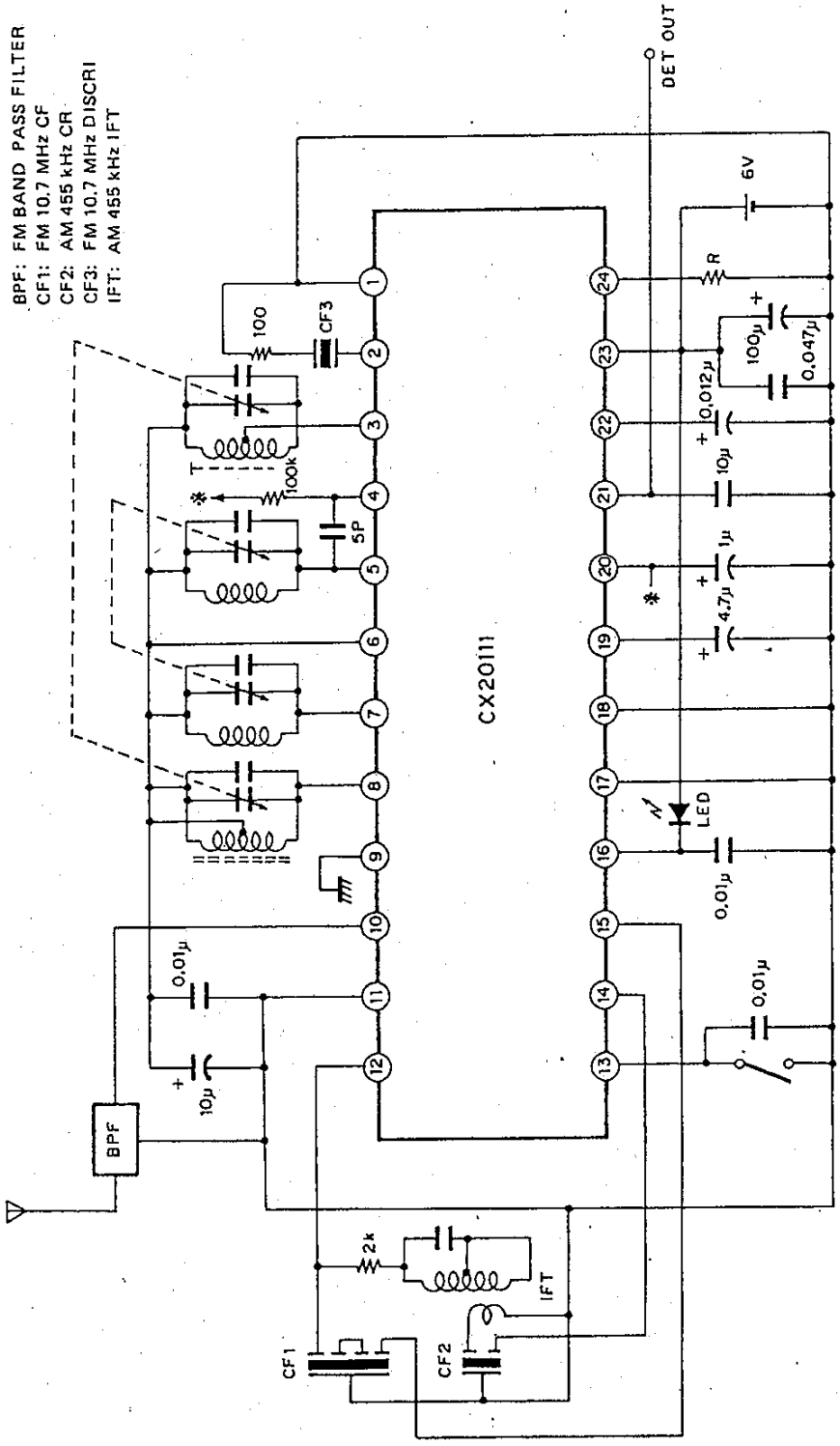
No.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
1	GND	–	–	–	–	–
2	FM DISCRI	2.18	2.70	3.08	3.60	
3	AM OSC	1.25	1.25	1.25	1.25	
4	AFC	1.25	1.15	1.25	1.15	
6	REG OUT	1.25	1.25	1.25	1.25	
5	FM OSC	1.25	1.25	1.25	1.25	
7	FM RF	1.25	1.25	1.25	1.25	
10	FM RF IN	0.3	0	0.3	0	

*Note) 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					

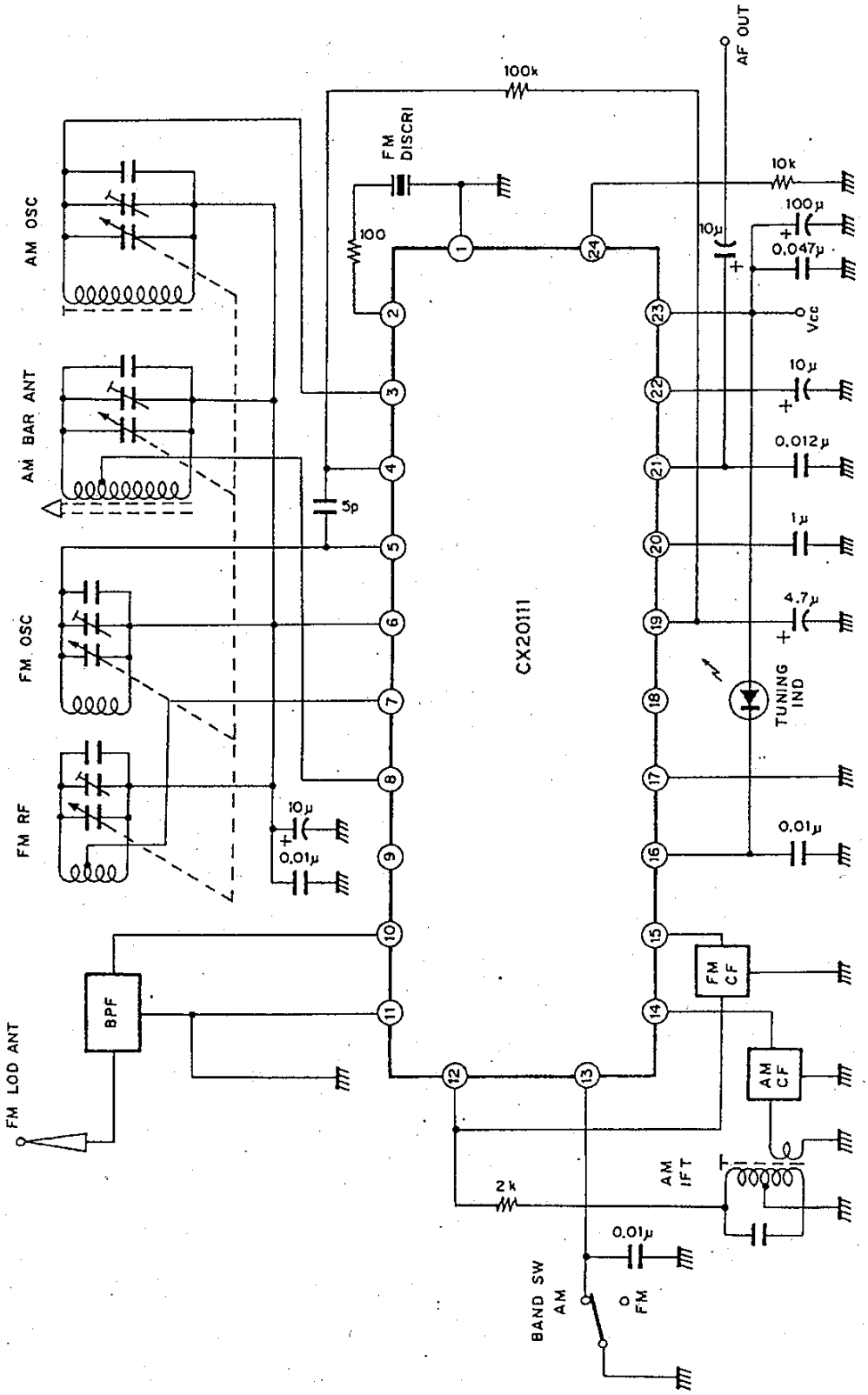
No.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
19	AFC/AGC 2	1.15	1.47	1.15	1.47	
20	AFC/AGC 1	1.47	1.15	1.47	1.15	
21	DET OUT	1.0	1.0	1.0	1.0	
22	RIPPLE	2.7	2.7	4.0	4.0	
23	Vcc	3.0	3.0	6.0	6.0	
24	BAND SIGNAL OUTPUT CONTROL					

DC Voltage Test Circuit



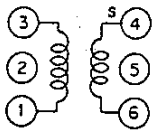
Note)
- The meter current is cut off under the following conditions: CDA 10.7MG1 (Murata Seisakusho co.) is used as CF1, and the input frequency is either 10.7MHz ± 100kHz or more when R is 10kΩ, or 10.7MHz ± 150kHz or more when R is 100kΩ.
- The band signal output function cuts off the meter current 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 V_{CC}.

Application Circuit



Coil Data

AM OSC

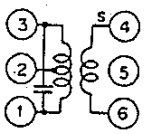


WIRE ϕ0.06mm 2UEW

f(kHz)	L(μH) 1 to 3	Qo 1 to 3	t	
			1 to 3	4 to 6
796	270	125	107	29

Equivalent to L-5K7H5 R12-1684X.
Mitsumi Electric Co., Lts. or
7TRS-8441 TOKO Co., Ltd.

AM IFT

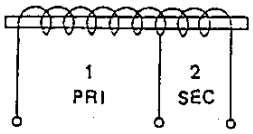


WIRE ϕ0.07mm UEW

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

Equivalent to 21K7H5 R12-8558A.
Mitsumi Electric Co., Ltd. or
7MC-7789N TOKO Co., Ltd.

AM Ber ANT

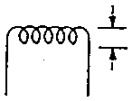


f(kHz)	L(μH)	1	2
796	650	91t	20t

BPF PFWE8 SOSHIN (88~108MHz)

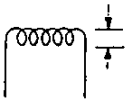
VC PVC2LXT-16L MITSUMI
CF1 CDA10.7MG1
CF2 SFU-455B
CF3 SFE10.7MA5
} MURATA —or CF1 BFCFL-455 TOKO

FM RF



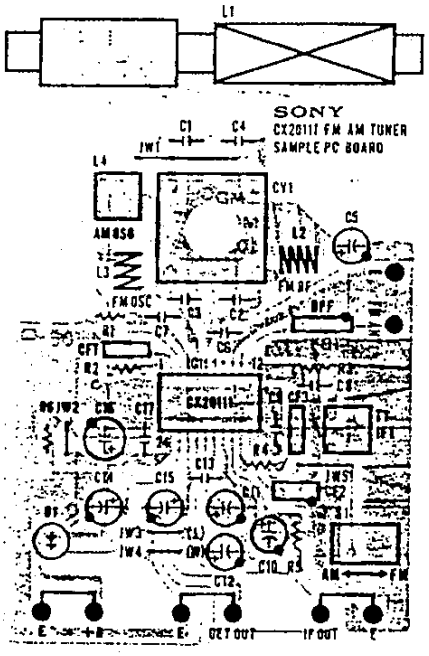
ϕ4 mm
ϕ0.6 mm 4.5t

FM OSC

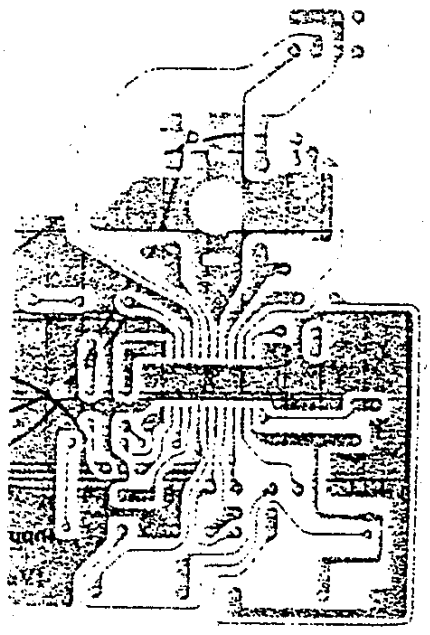


ϕ4 mm
ϕ0.6 mm 3.5t

Evaluation Board

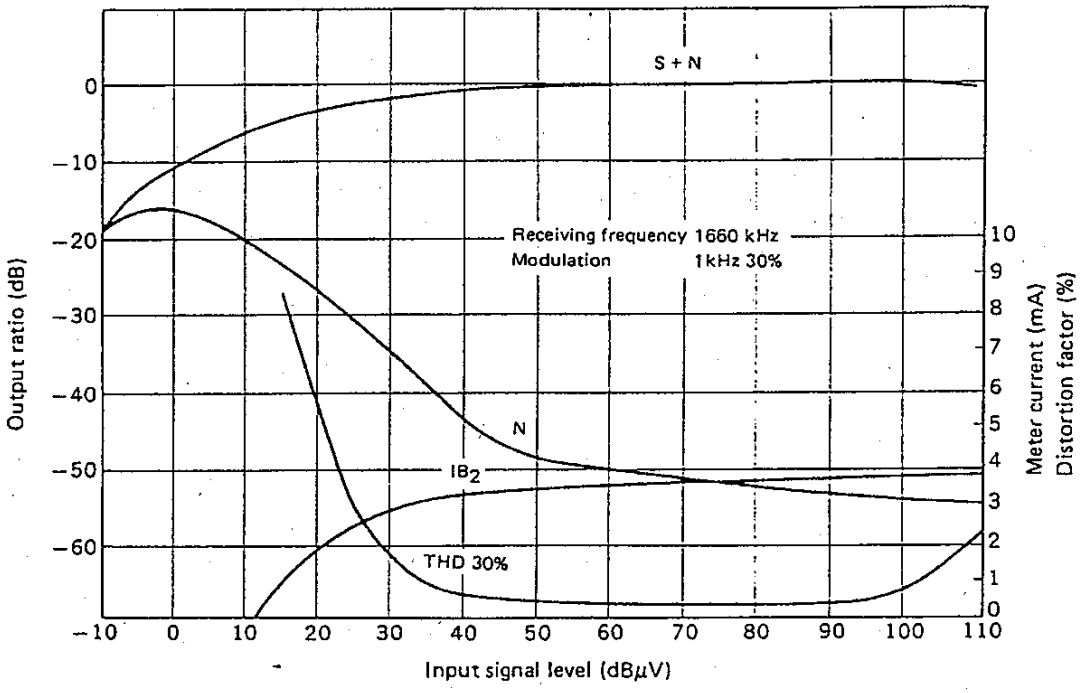


Parts Layout (mounting side)

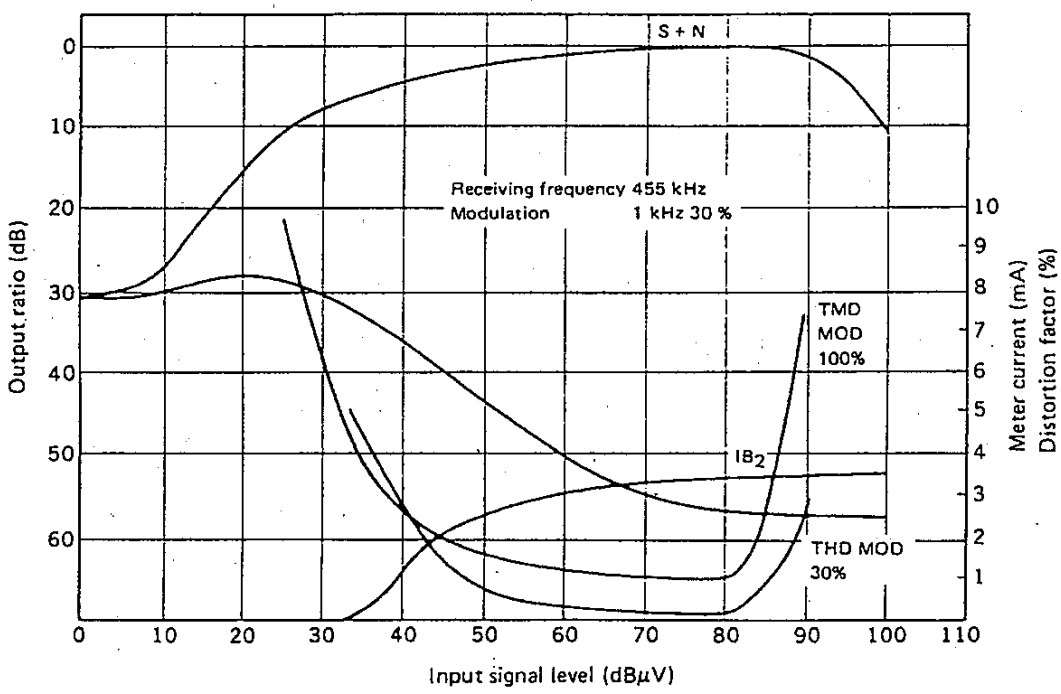


Pattern

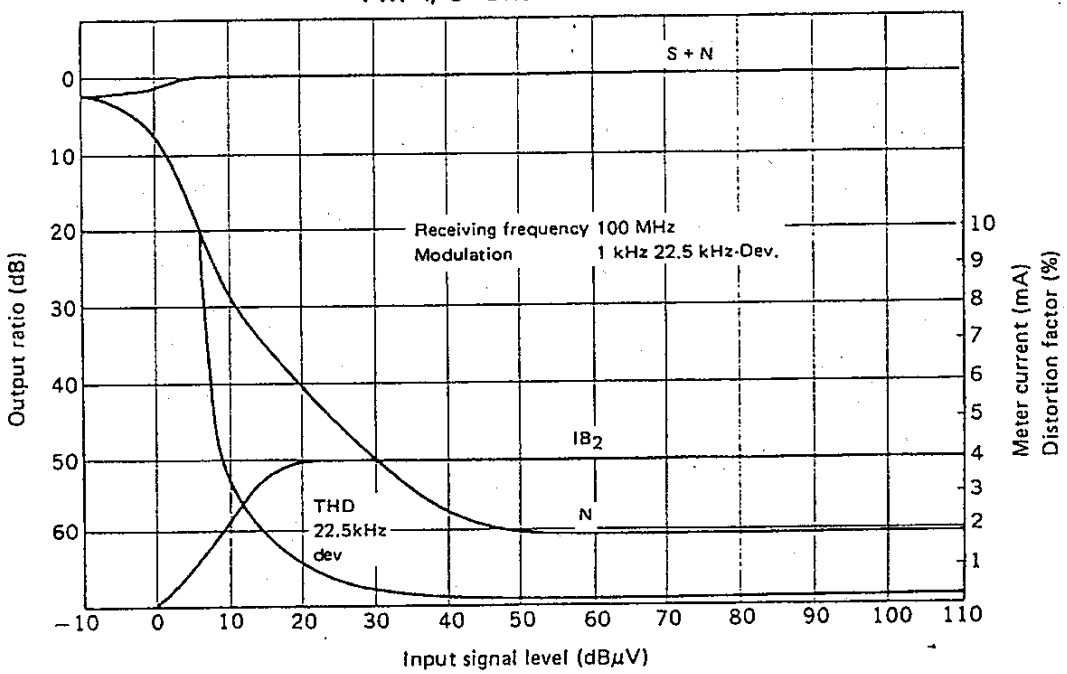
AM I/O Characteristic



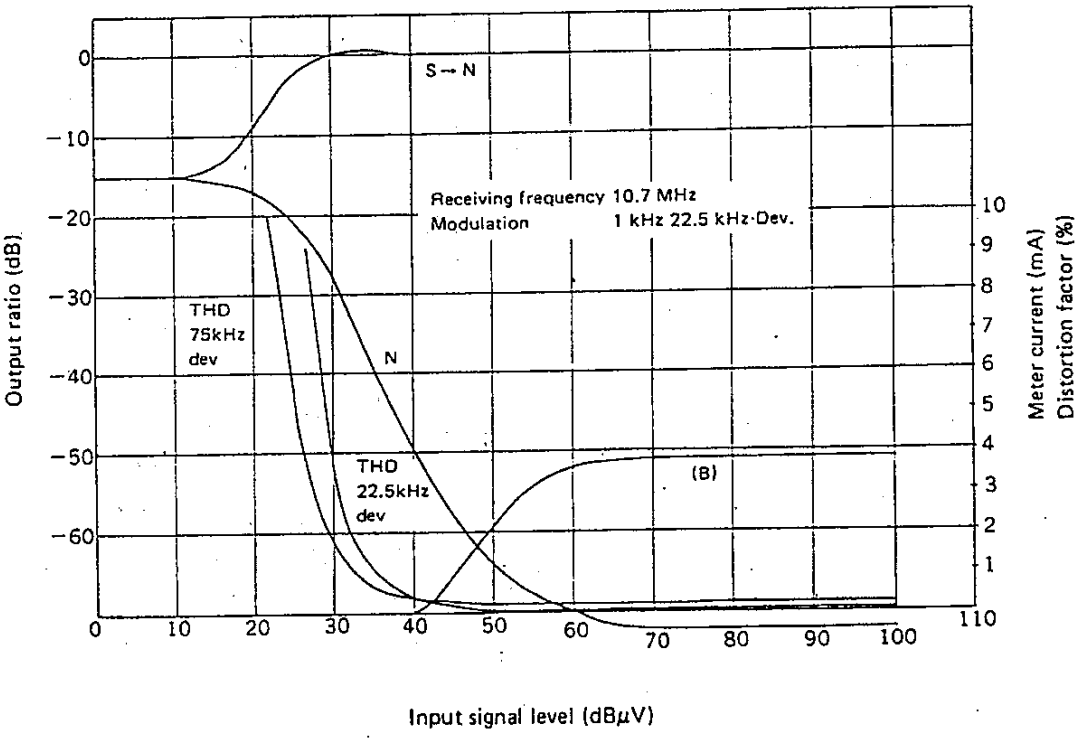
AM I/O Characteristic



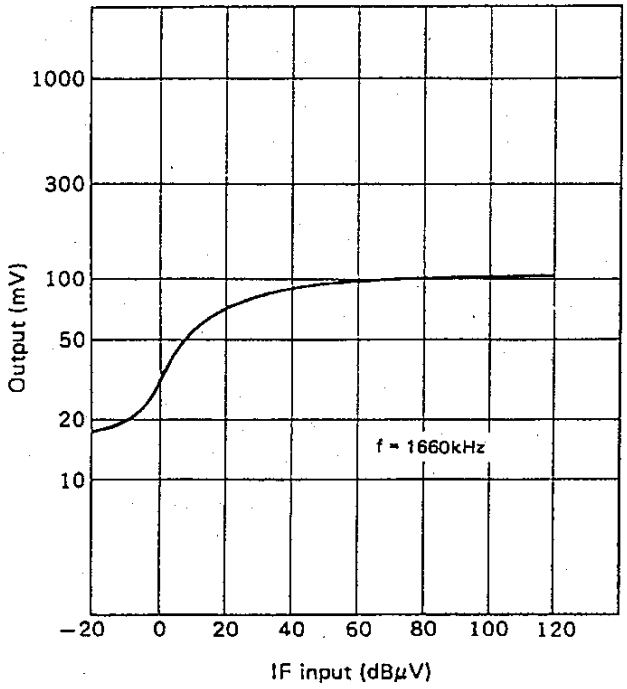
FM I/O Characteristic



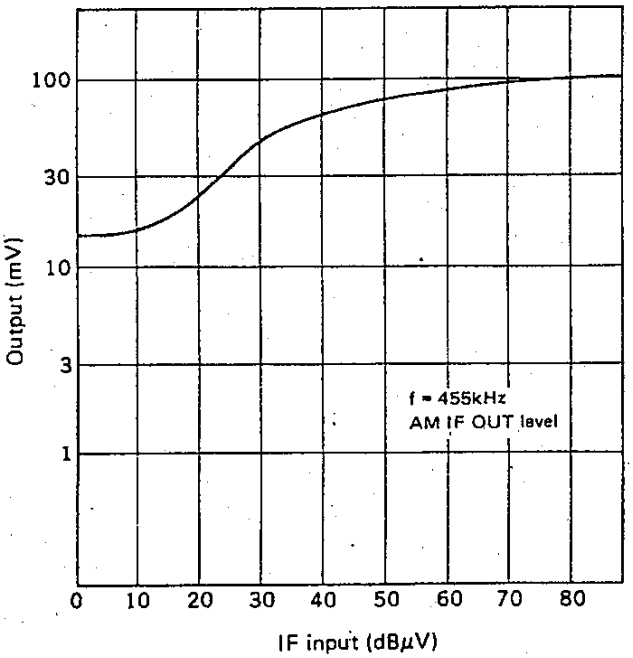
FM I/O Characteristic



AM IF pin output vs. Input (Overall)

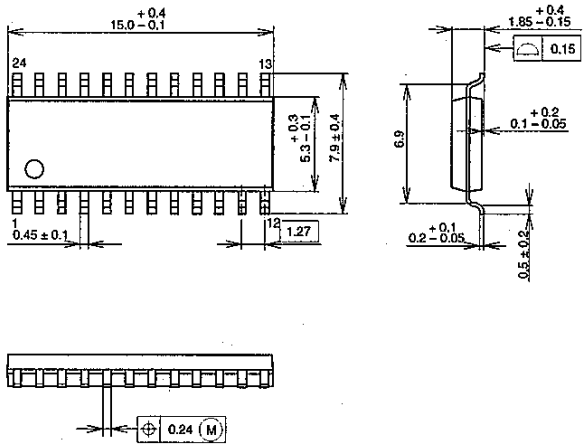


AM IF pin output vs. Input



Package Outline Unit: mm

24PIN SOP (PLASTIC)

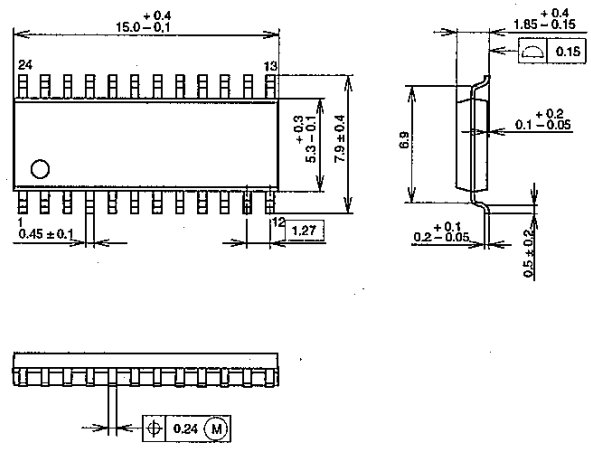


PACKAGE STRUCTURE

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

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

LEAD PLATING SPECIFICATIONS

ITEM	SPEC.
LEAD MATERIAL	COPPER ALLOY
SOLDER COMPOSITION	Sn-Bi Bi:1-4wt%
PLATING THICKNESS	5-18μm