

FM/AM Radio

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. ($V_{CC}=2$ to $9V$)
- Low current consumption. (For FM, $I_D=6.0$ mA, for AM, $I_D=4.0$ mA, 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

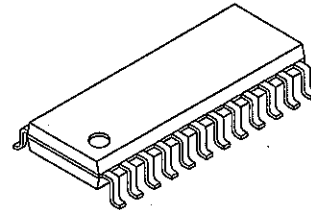
Absolute Maximum Ratings ($T_a=25^\circ C$)

- | | | | |
|-------------------------------|-----------|-------------|------------|
| • Supply voltage | V_{CC} | 10 | V |
| • Operating temperature | T_{opr} | -20 to +75 | $^\circ C$ |
| • Storage temperature | T_{stg} | -55 to +150 | $^\circ C$ |
| • Allowable power dissipation | P_D | 670 | mW |

Recommended Operating Condition

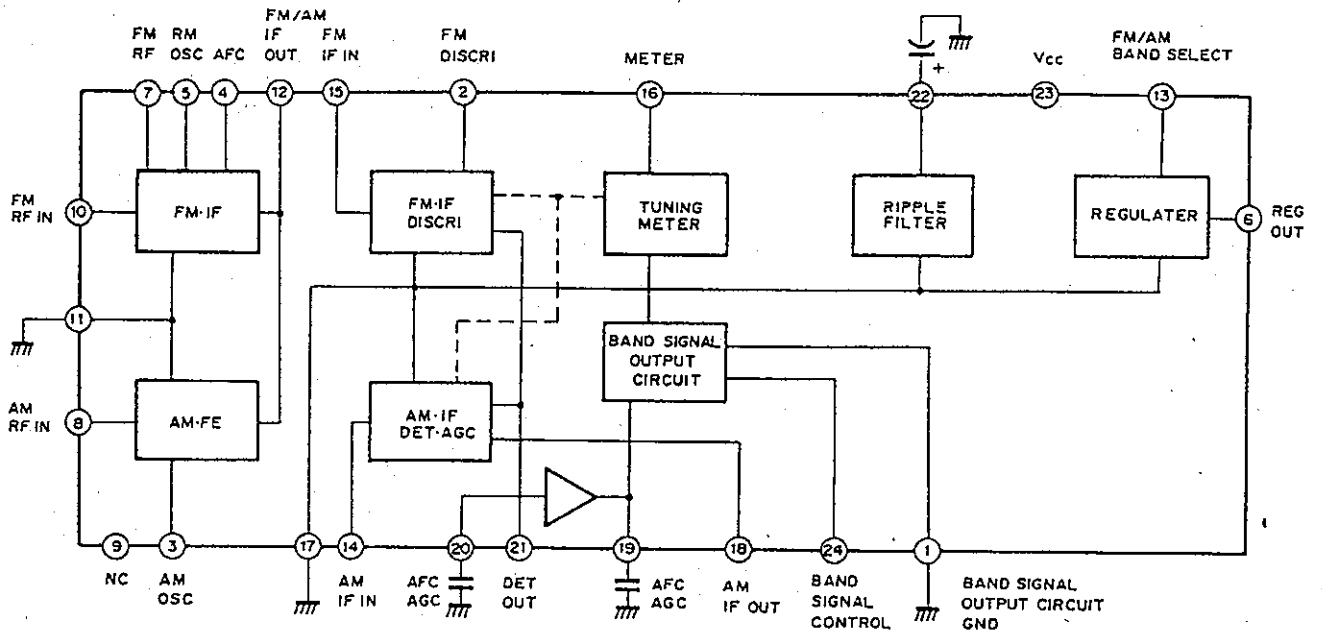
- | | | | |
|------------------|----------|--------|---|
| • Supply voltage | V_{CC} | 2 to 9 | V |
|------------------|----------|--------|---|

24 pin SOP (Plastic)

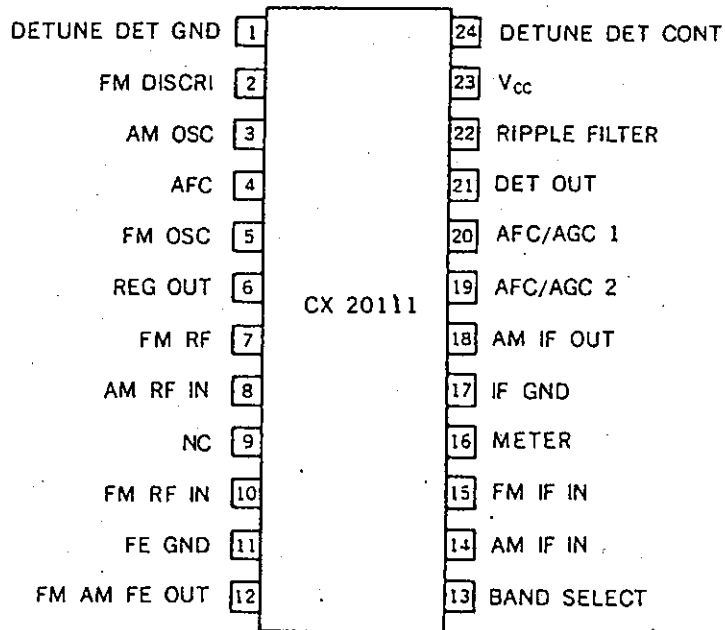


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Block Diagram



Pin Configuration (Top View)



Pin Description

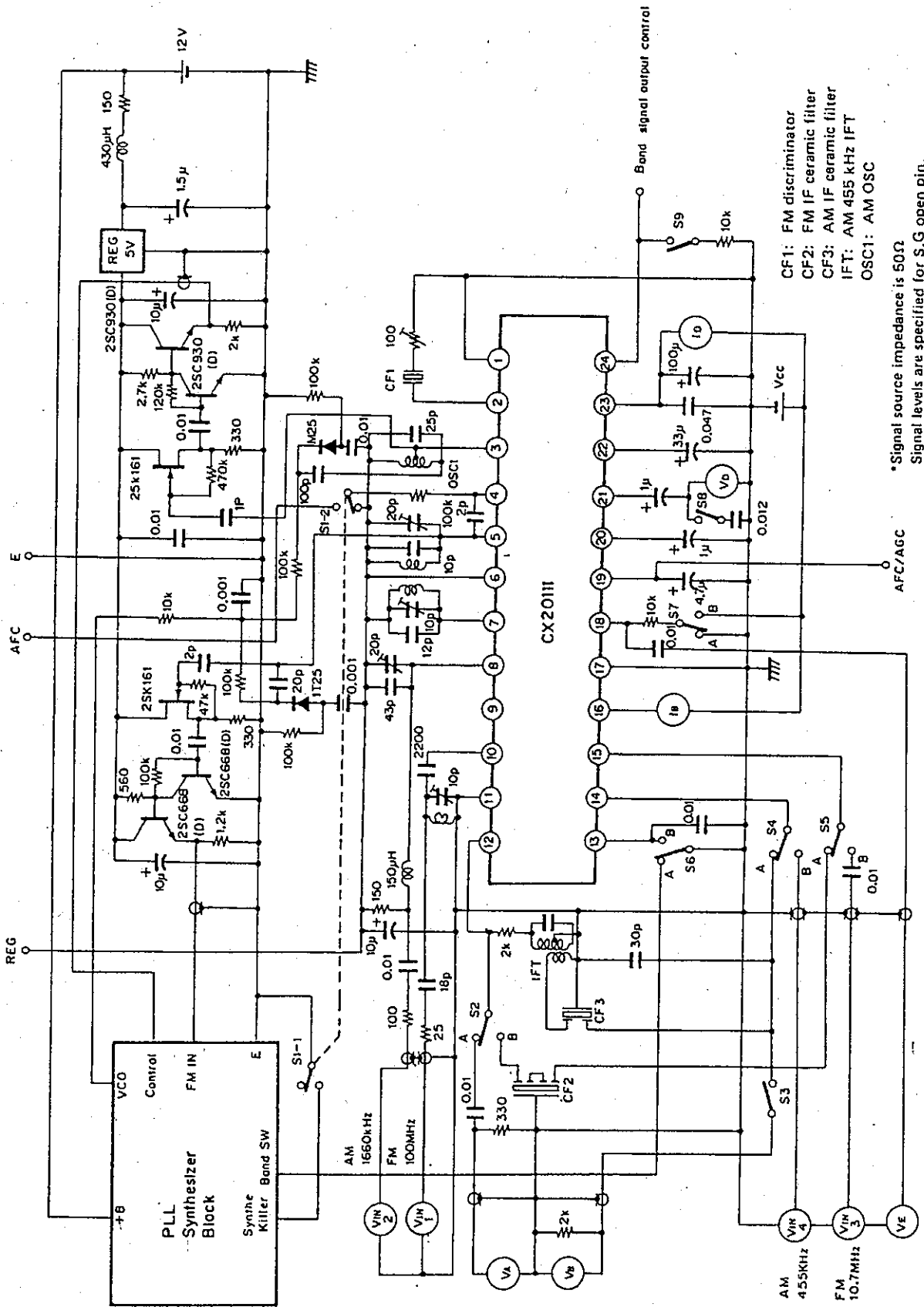
No.	Symbol	Description
1	GND	Ground for band signal output
2	FM DISCRI	Discriminator pin; to be connected to FM discriminator
3	AM OSC	AM local oscillator circuit
4	AFC	AFC input pin
5	FM OSC	FM local oscillator
6	REG OUT	Regulator; 1.25V (typ.)
7	FM RF	FM RF input; connected to RF tank circuit
8	AM 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 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 detector output; impedance; approx. 5k Ω
22	RIPPLE	The ripple filter: the hum suppression level of approx. 34.5 dB can be obtained by connecting a 10 μ F 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				Unit
			S1	S2	S3	S4	S5	S6	S7	S8	S9	V _{M1}	V _{M2}	V _{IN}		V _{M4}	Min.	Typ.	Max.	
1.	Circuit current (1)	ID ₁	OFF	B	OFF	B	A	A	ON	OFF	OFF	OFF	OFF	OFF	ID	Short circuit V _{M1} through V _{M4} when either AM signal of FM signal is not present.	1.8	4.0	6.6	mA
2.	Circuit current (2)	ID ₂	ON	A			B							ID	AM signal of FM signal is not present.	3.6	6.0	8.25	mA	
3.	FM front-end voltage gain(1)	GV ₁	ON	A								ON		V _O	V _{M1} =100MHz 40dBμV CW V _A =10.7MHz CW	33	39	45	dB	
4.	FM detector output level (1)	VD ₁	OFF	B								OFF		V _O	V _{IN} =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 _{O1} and V _{O2} =9V; level difference with same value of V _{O1}	-4.0	-	14.0	dB	
6.	FM IF knee level	VD ₂												V _{IN}	V _{IN} level is -3dB with reference to V _{O1}	-	25	31	dBμ	
7.	FM detector output distortion factor (1)	THD ₁												V _O	V _{IN} =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 _{IN} =10.7MHz 90dBμV CW	-55	0	55	kHz	
9.	FM meter current (1)	IB ₁												IB	V _{IN} =10.7MHz 60 dBμV CW	1.8	3.5	6.05	mA	
10.	FM band signal output band width	F ₂												IB	V _{IN} =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	ON	ON	A		OFF	OFF	OFF	OFF	OFF	V _B	V _{M2} =1660KHz 80dBμV CW V _O =455KH CW	19	24	28	dB	
12.	AM IF voltage gain (3)	GV ₃	OFF	OFF	OFF	OFF						OFF		V _{M4}	Level of V _{M4} at V _O =-34dB	17	23	28	dBμ	
13.	AM IF voltage gain (4)	ΔGV												V _{M4}	V _O =2V; level difference with same condition as GV ₃	-4	0	3	dB	
14.	AM detector output level (3)	VD ₃												V _O	V _{M2} =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 _{M2} =455KHz 85dBμV CW	1.62	3.0	5.5	mA	
16.	AM IF output level	V _I												V _I	V _{M2} =455KHz 85dBμV CW V _I =455KHz CW	72	100	132	mV	
17.	AM detector output distortion factor (2)	THD ₂	ON	ON	ON	A			ON	ON	ON	ON	OFF	V _O	V _{IN} =95dBμV 1660KHz 1KHz 30% MOD, V _O =1KHz sin Wave V _{CC} =7.8V	-	0.6	1.1	%	

Electrical Characteristics Test Circuit



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

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

Standard Circuit Design Data

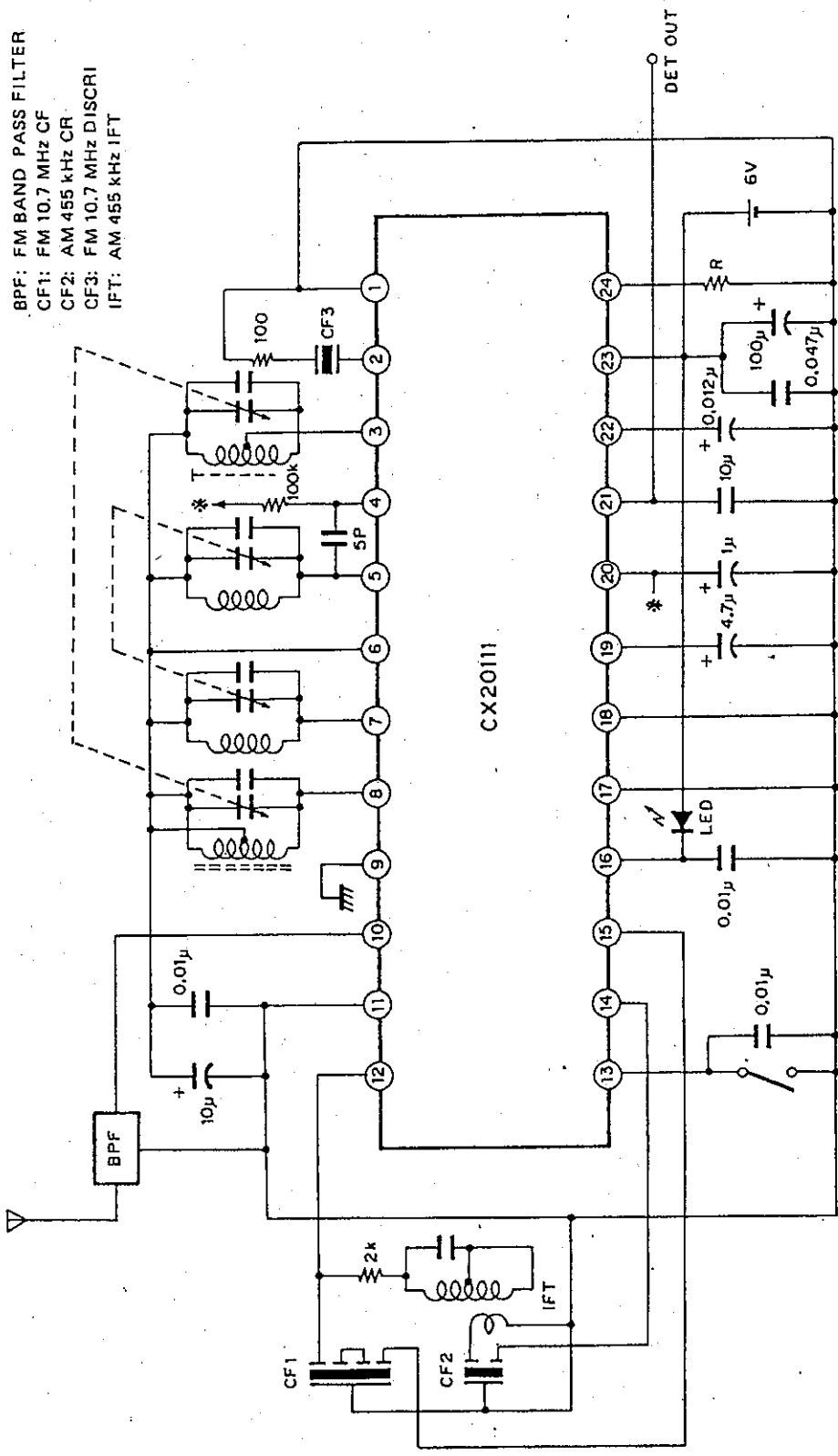
No.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
1	GND	-	-	-	-	-
2	FM DISCRI	2.18	2.70	3.08	3.60	
3	AM OSC	1.25	1.25	1.25	1.25	
4	AFC	1.25	1.15	1.25	1.15	
6	REG OUT	1.25	1.25	1.25	1.25	
5	FM OSC	1.25	1.25	1.25	1.25	
7	FM RF	1.25	1.25	1.25	1.25	
10	FM RF IN	0.3	0	0.3	0	

*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					

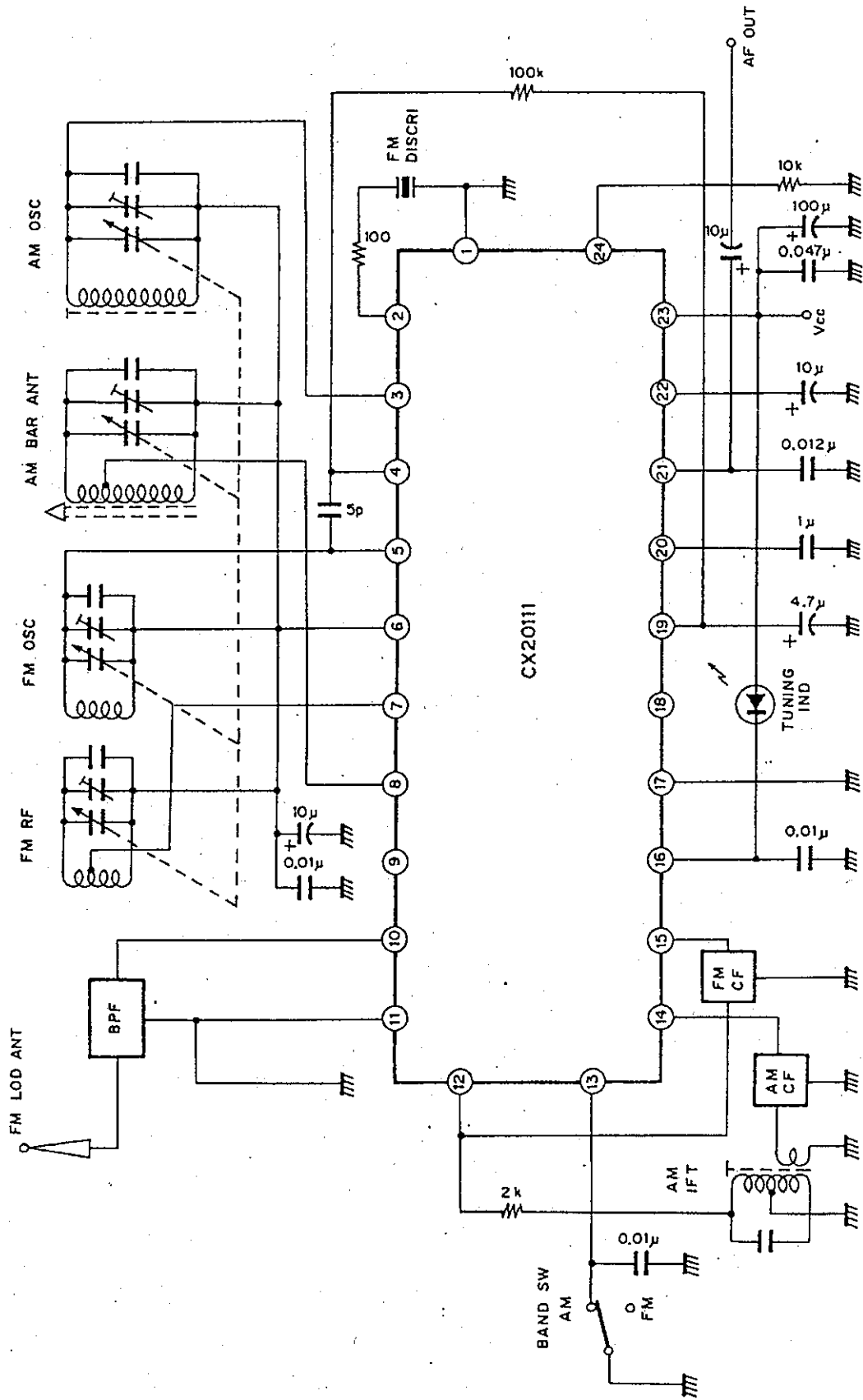
DC Voltage Test Circuit



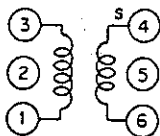
- BPF: FM BAND PASS FILTER
- CF1: FM 10.7 MHz CF
- CF2: AM 455 kHz CR
- CF3: FM 10.7 MHz DISCRI
- IFT: AM 455 kHz IFT

- Note)
- The meter current is cut off under the following conditions: CDA 10.7MC1 (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



Coil Data
AM OSC

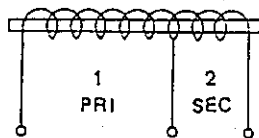


WIRE $\phi 0.06\text{mm}$ 2UEW

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

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

AM Ber ANT

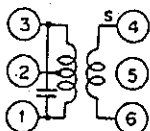


f(kHz)	L(μH)	1	2
796	650	91t	20t

BPF PFWEB SOSHIN (88~108MHz)

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

AM IFT

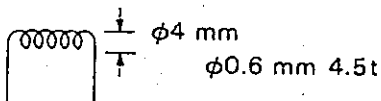


WIRE $\phi 0.07\text{mm}$ UEW

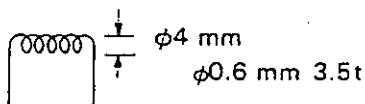
Co(pF)	Qo	t		
		1 to 2	2 to 3	3 to 6
180	90	111	35	7

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

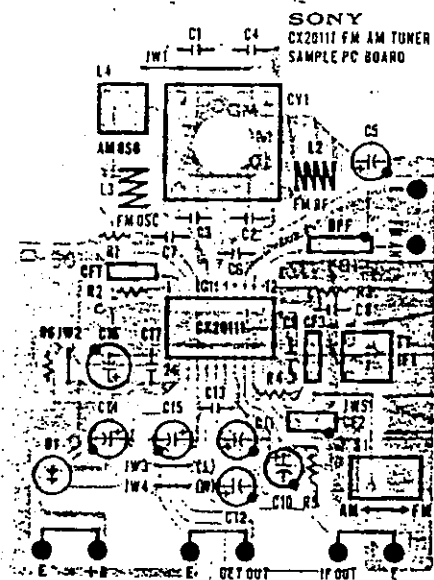
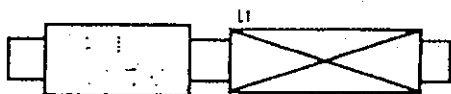
FM RF



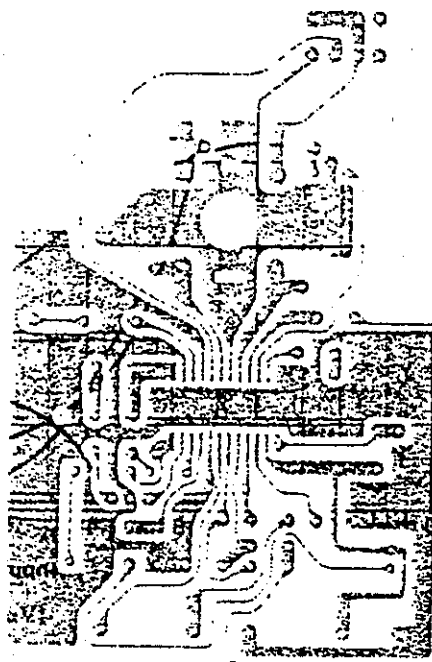
FM OSC



Evaluation Board

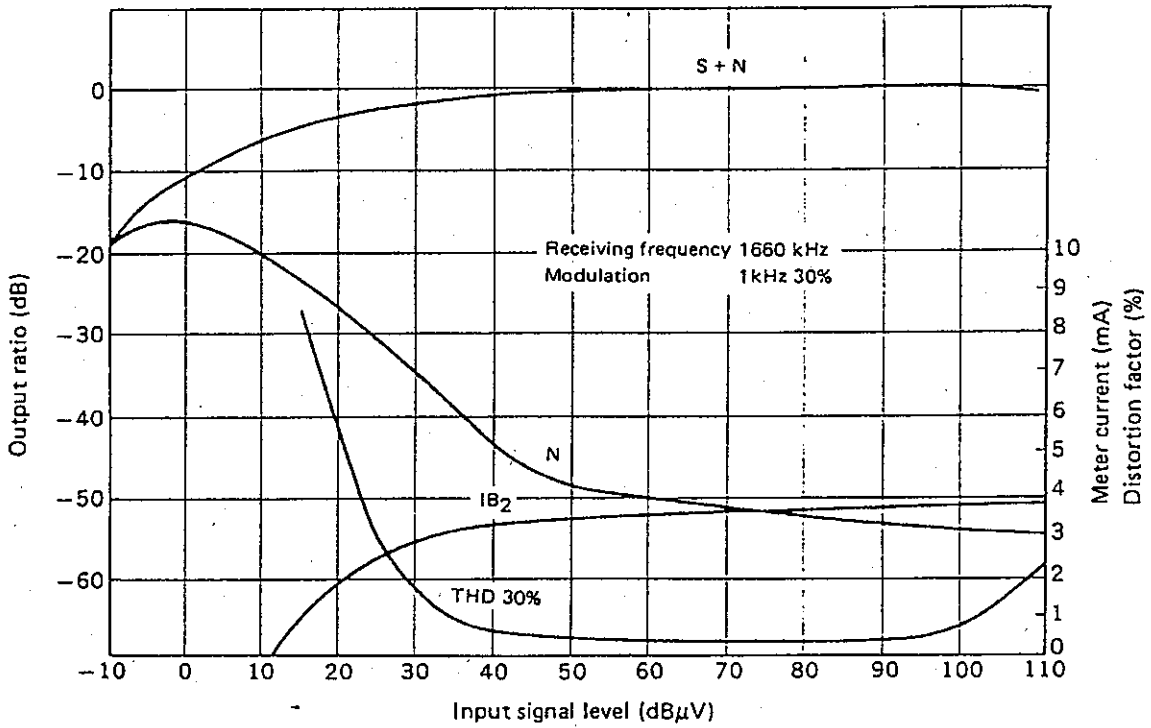


Parts Layout (mounting side)

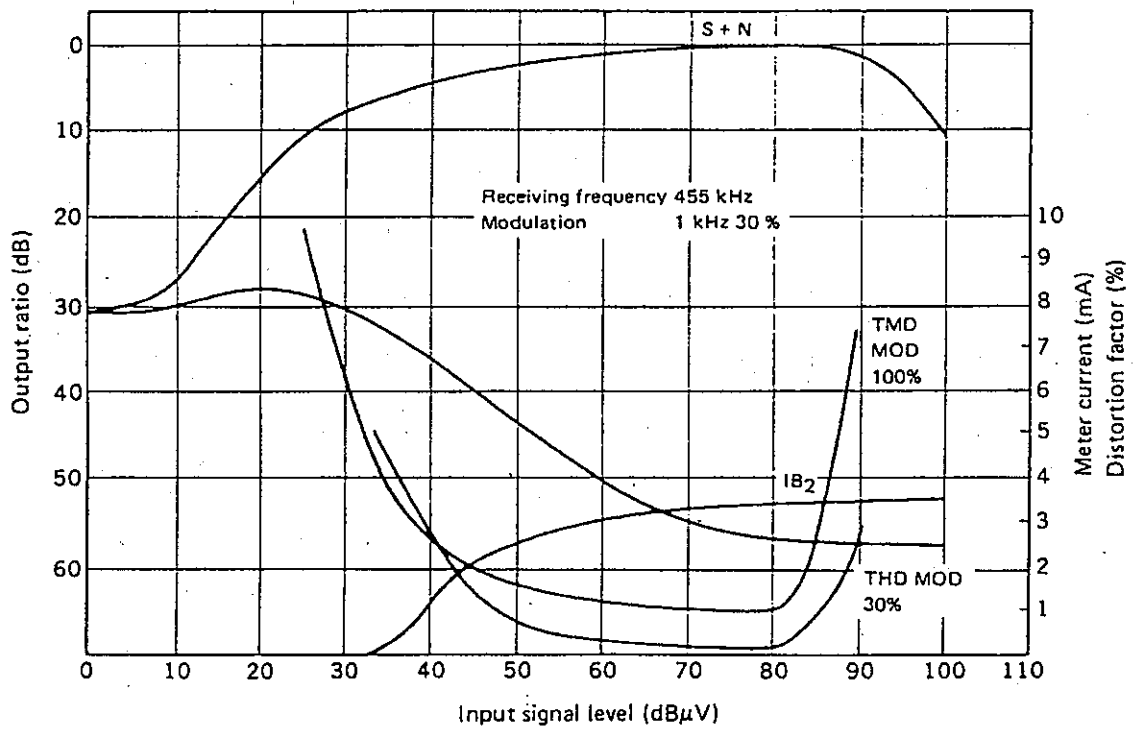


Pattern

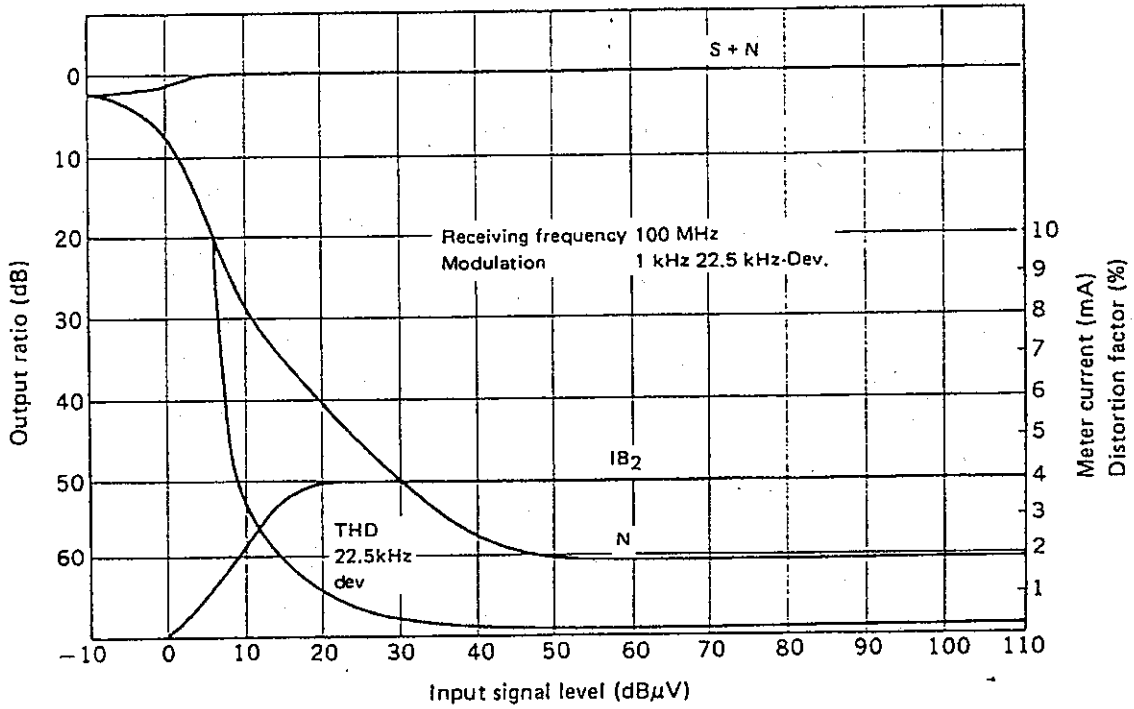
AM I/O Characteristic



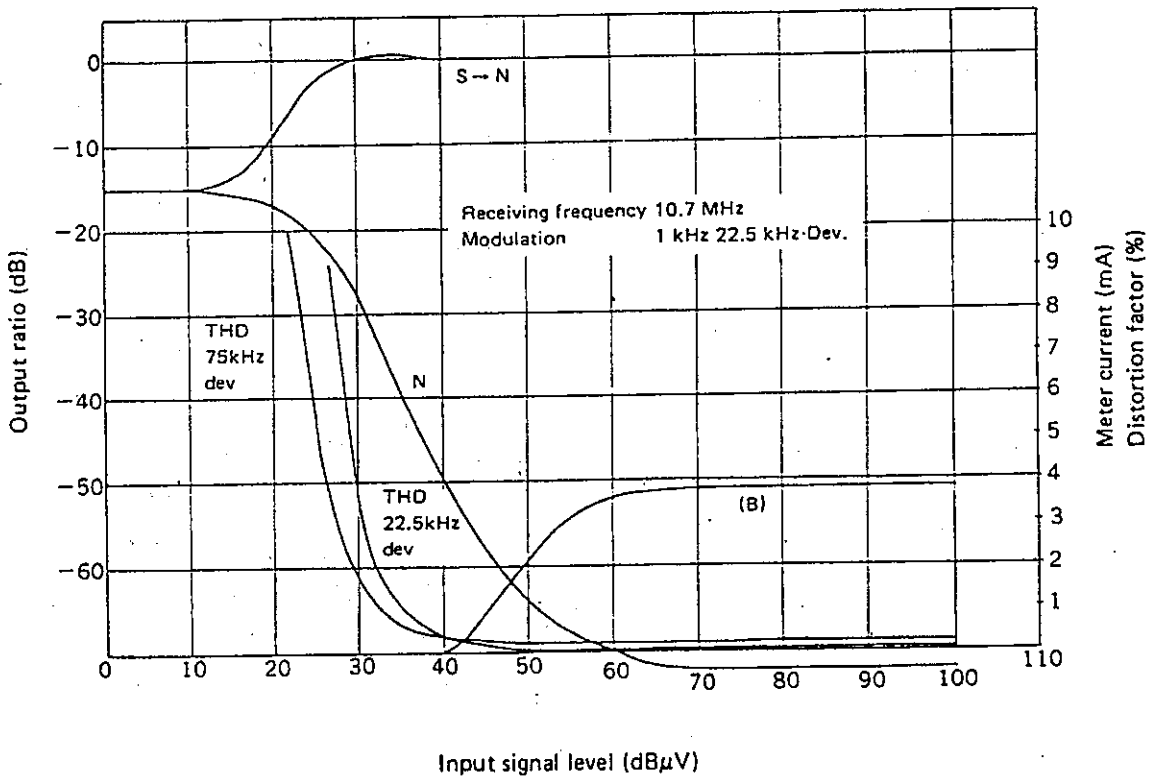
AM I/O Characteristic



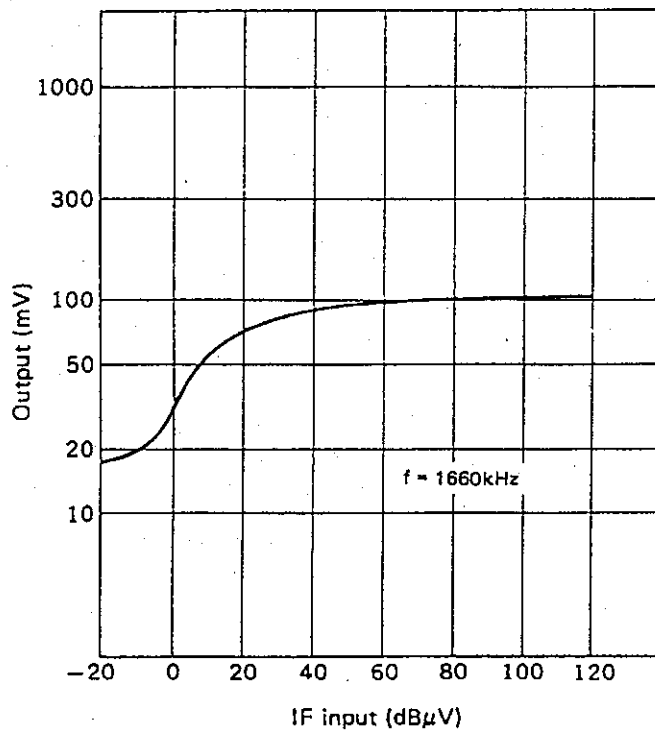
FM I/O Characteristic



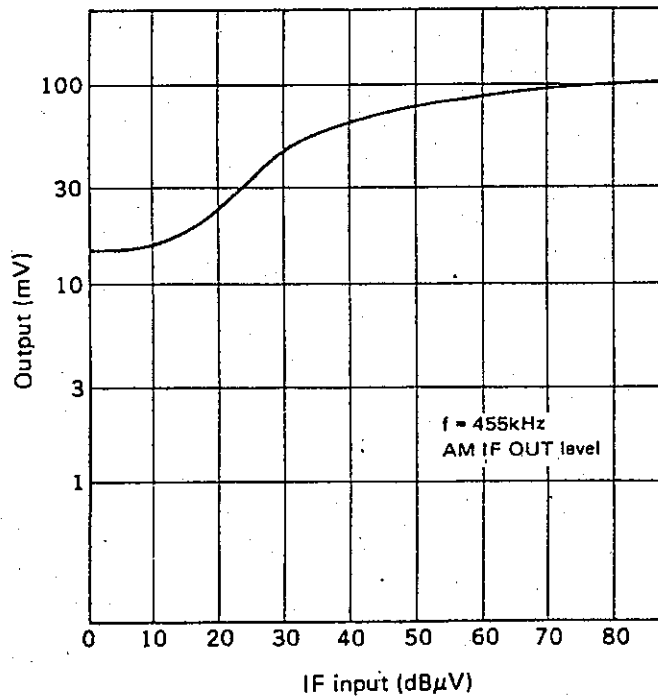
FM I/O Characteristic



AM IF pin output vs. Input (Overall)



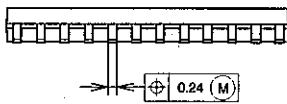
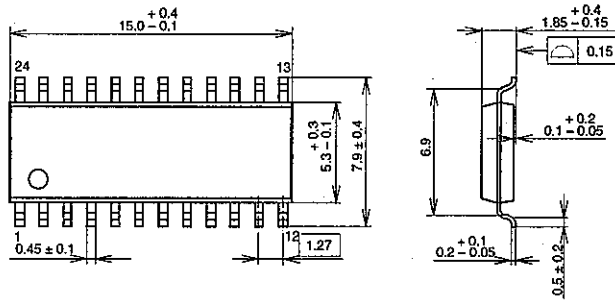
AM IF pin output vs. Input



Package Outline

Unit: mm

24PIN SOP (PLASTIC)

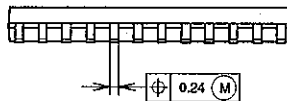
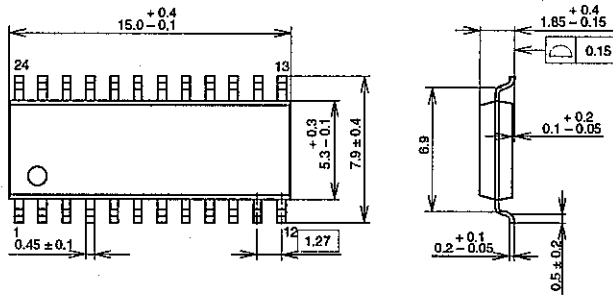


PACKAGE STRUCTURE

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	5-18 μ m