

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

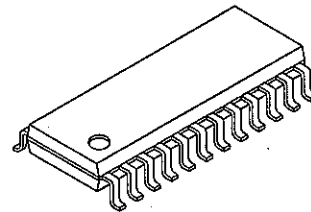
Absolute Maximum Ratings ($T_a=25^\circ C$)

- 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

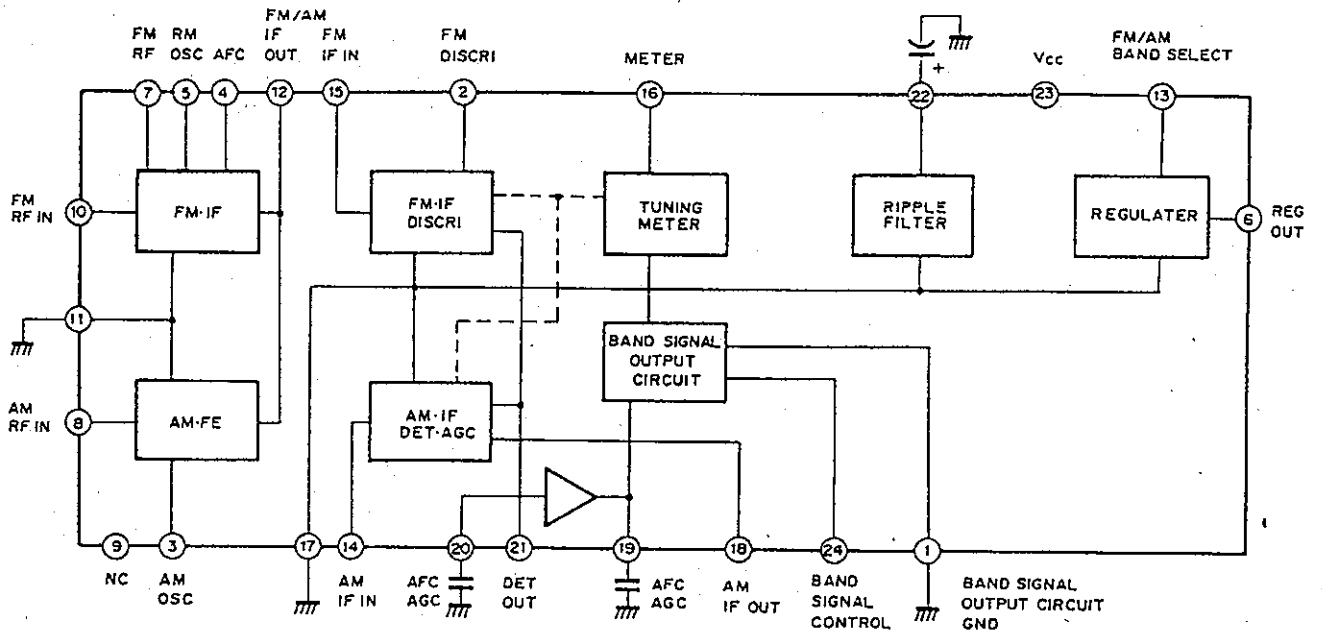
- Supply voltage V_{cc} 2 to 9 V

24 pin SOP (Plastic)

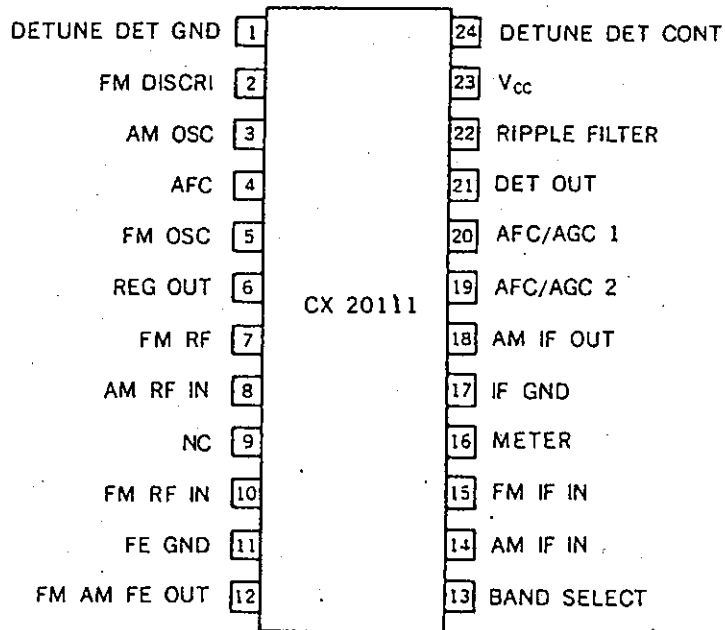


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Block Diagram



Pin Configuration (Top View)



Pin Description

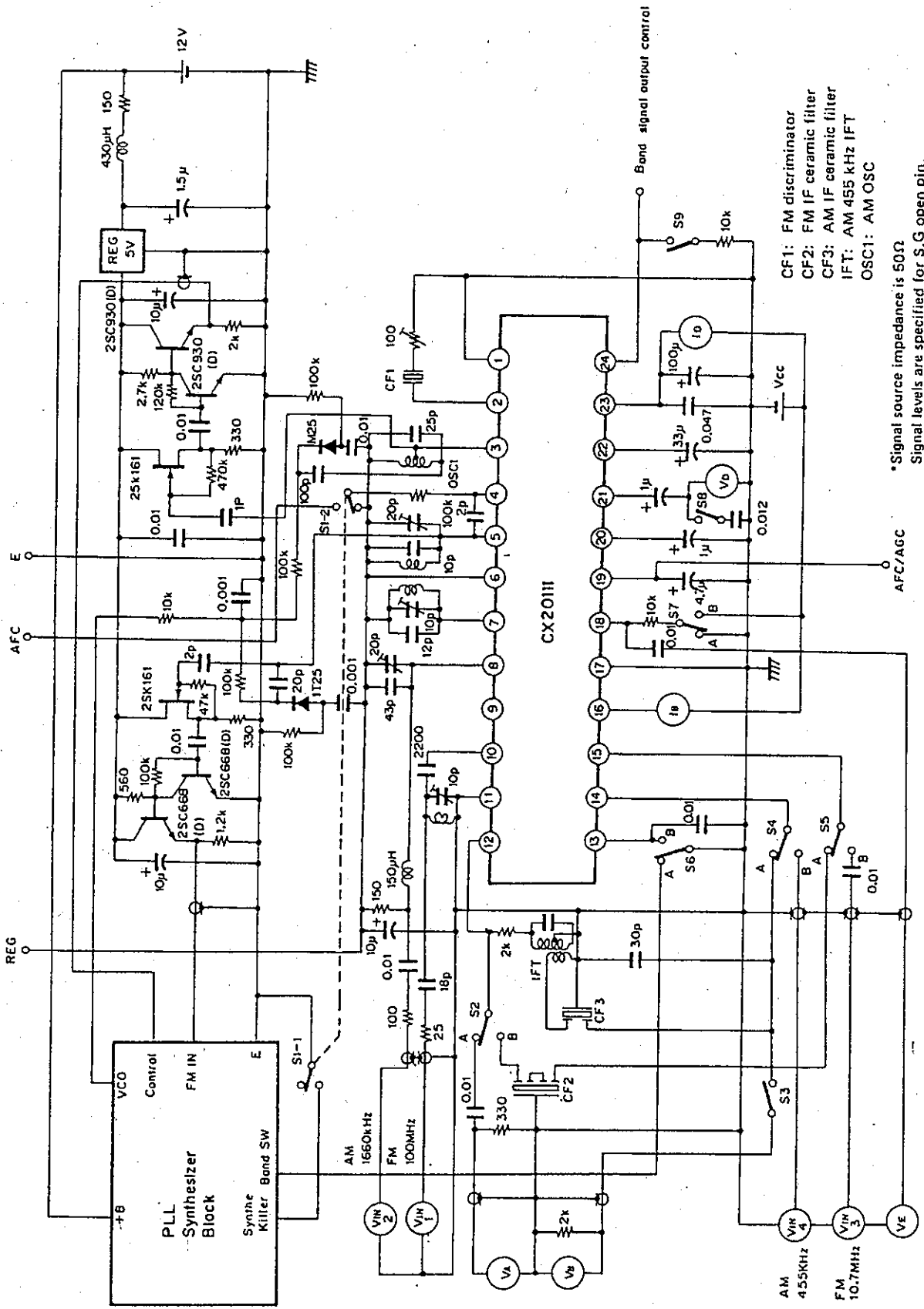
No.	Symbol	Description
1	GND	Ground for band signal output
2	FM DISCRI	Discriminator pin; to be connected to FM discriminator
3	AM OSC	AM local oscillator circuit
4	AFC	AFC input pin
5	FM OSC	FM local oscillator
6	REG OUT	Regulator; 1.25V (typ.)
7	FM RF	FM RF input; connected to RF tank circuit
8	AM 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	Min.	Typ.	Max.	Unit	
			S1	S2	S3	S4	S5	S6	S7	S8	S9	VMI	VIMZ	VIND	VIMH							
1.	Circuit current (1)	ID1	OFF	B	OFF	B	A	A	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ID	Short circuit VMI through VIMH when either AM signal of FM signal is not present.	1.8	4.0	6.6	mA
2.	Circuit current (2)	ID2	OFF	B	OFF	B	B	B	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ID	AM signal of FM signal is not present.	3.6	6.0	8.25	mA
3.	FM front-end voltage gain(1)	GV1	ON	A	OFF	B	A	A	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	V0	VMI=100MHz 40dBµV CW VA=10.7MHz CW	33	39	45	dB
4.	FM detector output level (1)	VD1	OFF	B	OFF	B	A	A	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	V0	VMI=10.7MHz 90dBµV 1KHz 22.5KHz dev V0=1KHz sin Wave	-25.2	-22.5	-19.0	dBs
5.	FM detector output level (2)	ΔVD															V0	VMI and VCC=9V; level difference with same value of VMI	-4.0	-	14.0	dB
6.	FM IF knee level	VD2															VIND	VIND level is -3dB with reference to V0I	-	25	31	dBµ
7.	FM detector output distortion factor (1)	THD1															V0	VMI=10.7MHz 90dBµV 1KHz 75KHz dev V0=1KHz sin Wave	-	0.1	1.1	%
8.	Deviation of FM IF center frequency	F1															-	VIND=10.7MHz 90dBµV CW	-55	0	55	kHz
9.	FM meter current (1)	IB1															Ib	VMI=10.7MHz 60 dBµV CW	1.8	3.5	6.05	mA
10.	FM band signal output band width	F2							ON								Ib	VMI=10.7MHz 235KHz Confirm Ia=0 at 90dBµV	±67.5	±110	±170.5	kHz
11.	AM front end voltage gain (2)	GV2	ON	ON	ON	ON	A	A	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	V8	VMI=1660KHz 80dBµV CW V0=455KH CW	19	24	28	dB
12.	AM IF voltage gain (3)	GV3	OFF	OFF	OFF	OFF	OFF	OFF									VIMH	Level of VIMH at V0=-34dBs	17	23	28	dBµ
13.	AM IF voltage gain (4)	ΔGV															VIMH	VCC=2V; level difference with same condition as GV3	-4	0	3	dB
14.	AM detector output level (3)	VD3															V0	VMI=455KHz 85dBµV 1KHz 30% MOD V0=1KHz sin Wave	-25.5	-22.5	-19.0	dBs
15.	AM meter current (2)	IB2															Ia	VMI=455KHz 85dBµV CW	1.62	3.0	5.5	mA
16.	AM IF output level	V1															V1	VMI=455KHz 85dBµV CW V1=455KHz CW	72	100	132	mV
17.	AM detector output distortion factor (2)	THD2	ON	ON	ON	A	A	A	ON	ON	ON	ON	ON	ON	ON	ON	V0	VMI=95dBµV 1660KHz 1KHz 30% MOD, V0=1KHz sin Wave VCC=7.8V	-	0.6	1.1	%

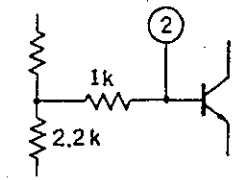
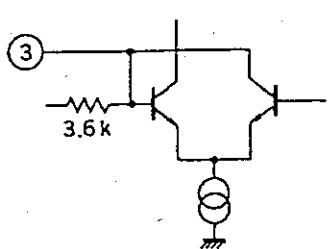
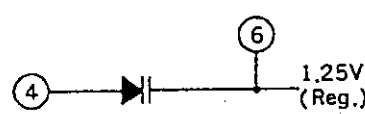
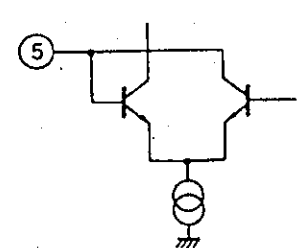
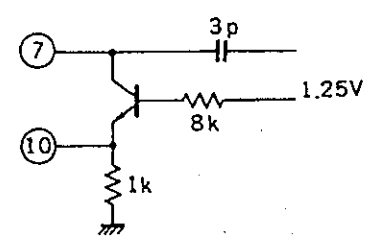
Electrical Characteristics Test Circuit



- 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

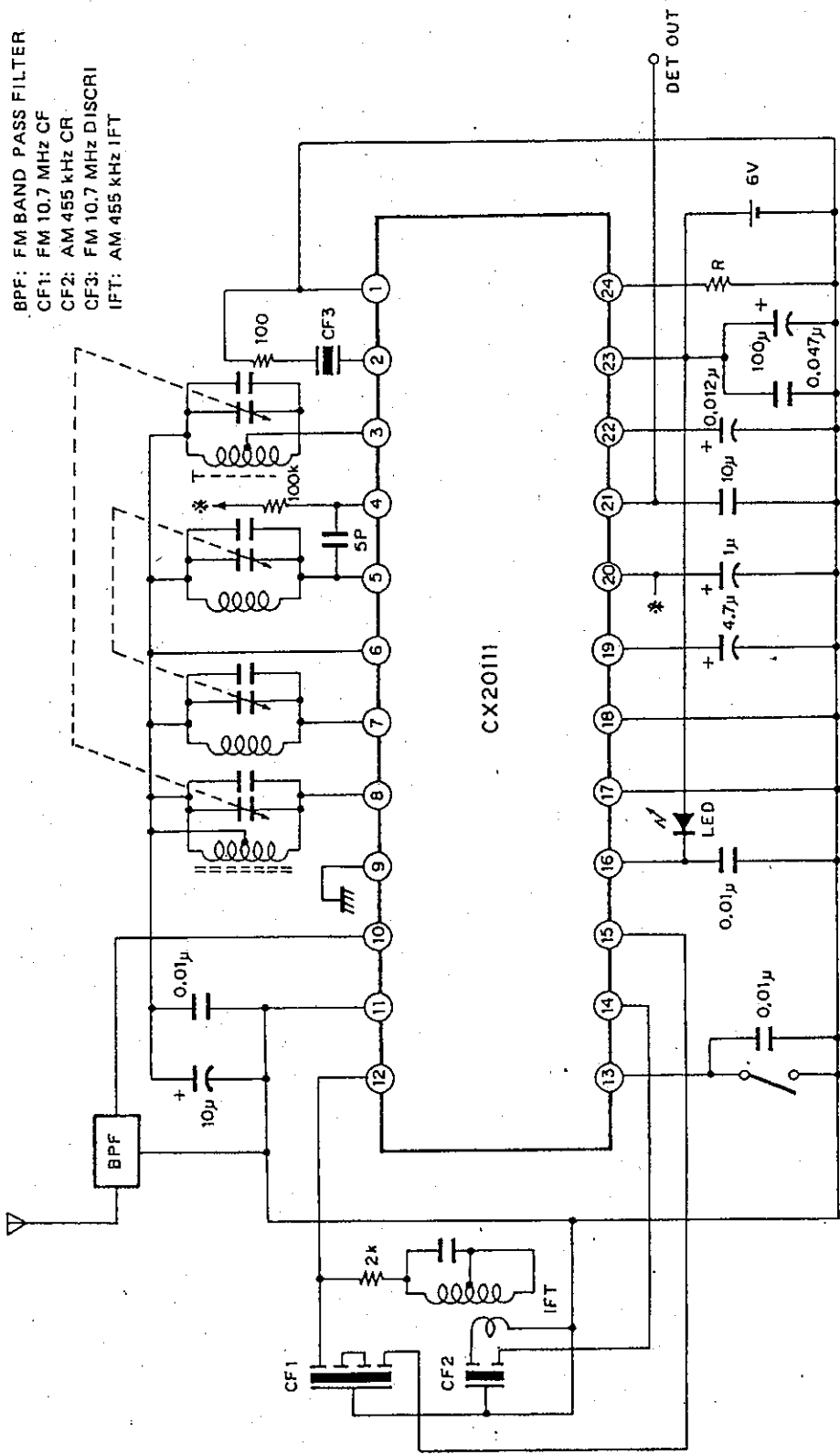
No.	Symbol	Voltage (V)*				Equivalent circuit
		Vcc=3V		Vcc=6V		
		FM	AM	FM	AM	
1	GND	-	-	-	-	-
2	FM DISCRI	2.18	2.70	3.08	3.60	
3	AM OSC	1.25	1.25	1.25	1.25	
4	AFC	1.25	1.15	1.25	1.15	
6	REG OUT	1.25	1.25	1.25	1.25	
5	FM OSC	1.25	1.25	1.25	1.25	
7	FM RF	1.25	1.25	1.25	1.25	
10	FM RF IN	0.3	0	0.3	0	

*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

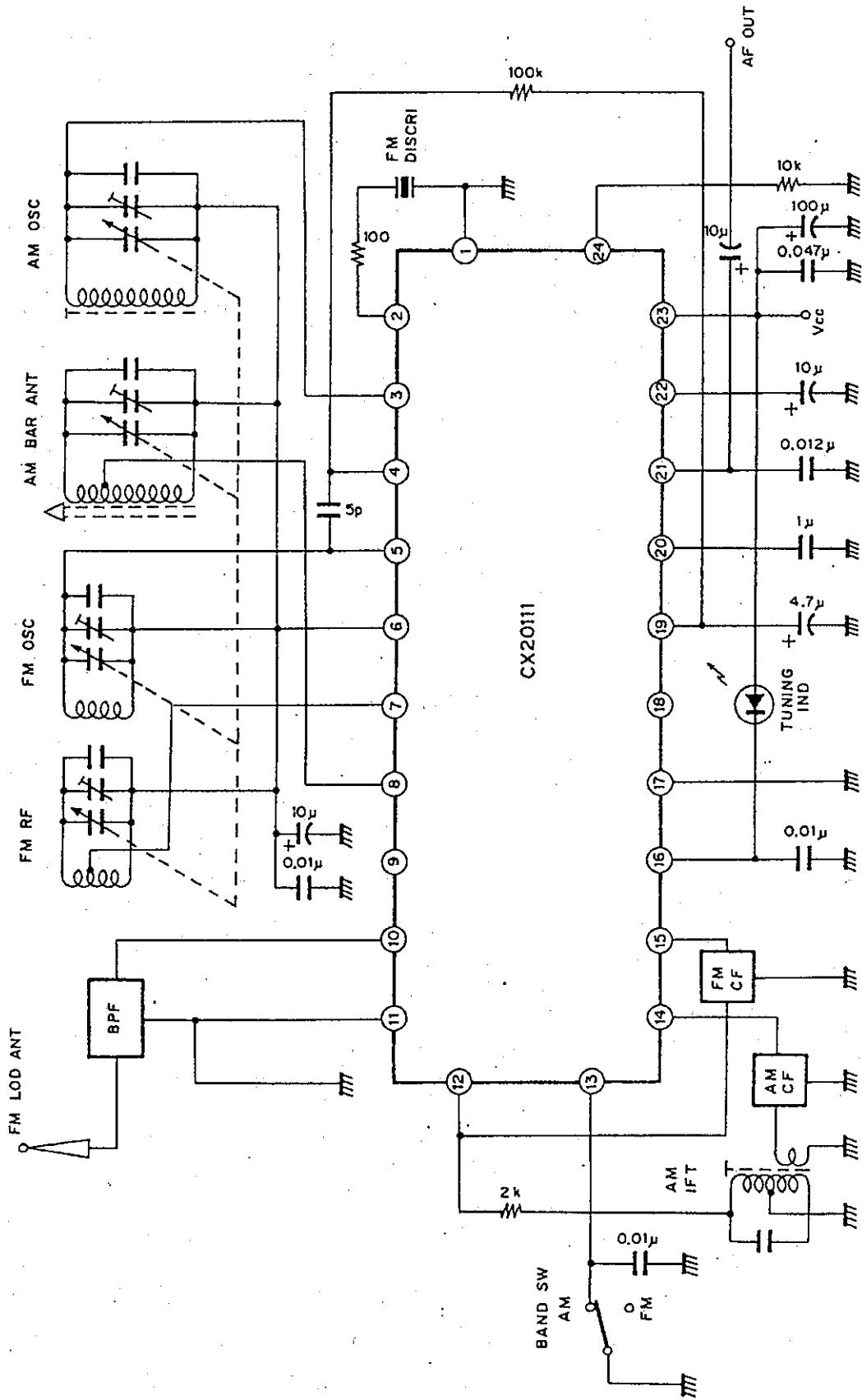


- BPF: FM BAND PASS FILTER
- CF1: FM 10.7 MHz CF
- CF2: AM 455 kHz CR
- CF3: FM 10.7 MHz DISCRI
- IFT: AM 455 kHz IFT

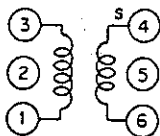
CX20111

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

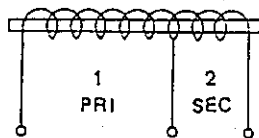


WIRE ϕ 0.06mm 2UEW

f(kHz)	L(μ H)	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.

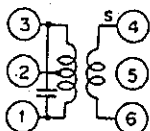
AM Ber ANT



f(kHz)	L(μ H)	1	2
796	650	91t	20t

BPF PFWEB SOSHIN (88~108MHz)

AM IFT



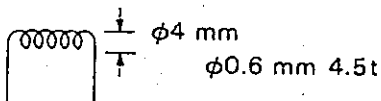
WIRE ϕ 0.07mm UEW

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

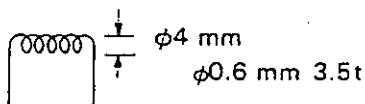
Equivalent to 21K7H5 R12-8558A.
Mitsumi Electric Co., Ltd. or
7MC-7789N TOKO Co., Ltd.

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

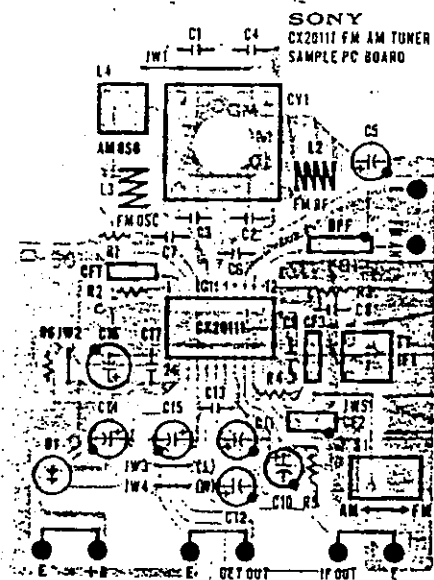
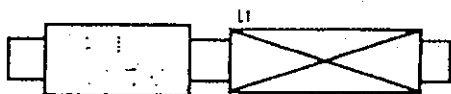
FM RF



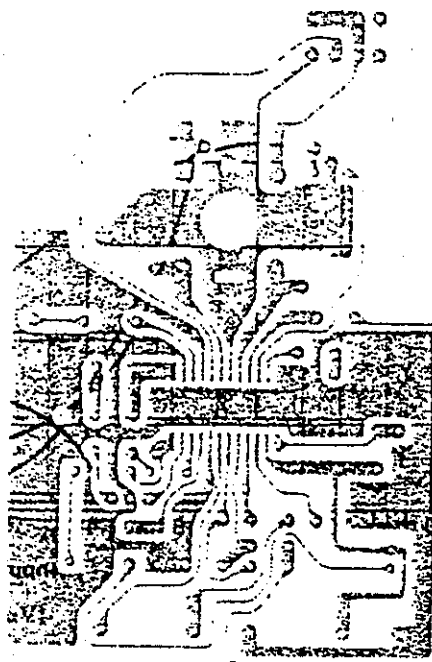
FM OSC



Evaluation Board

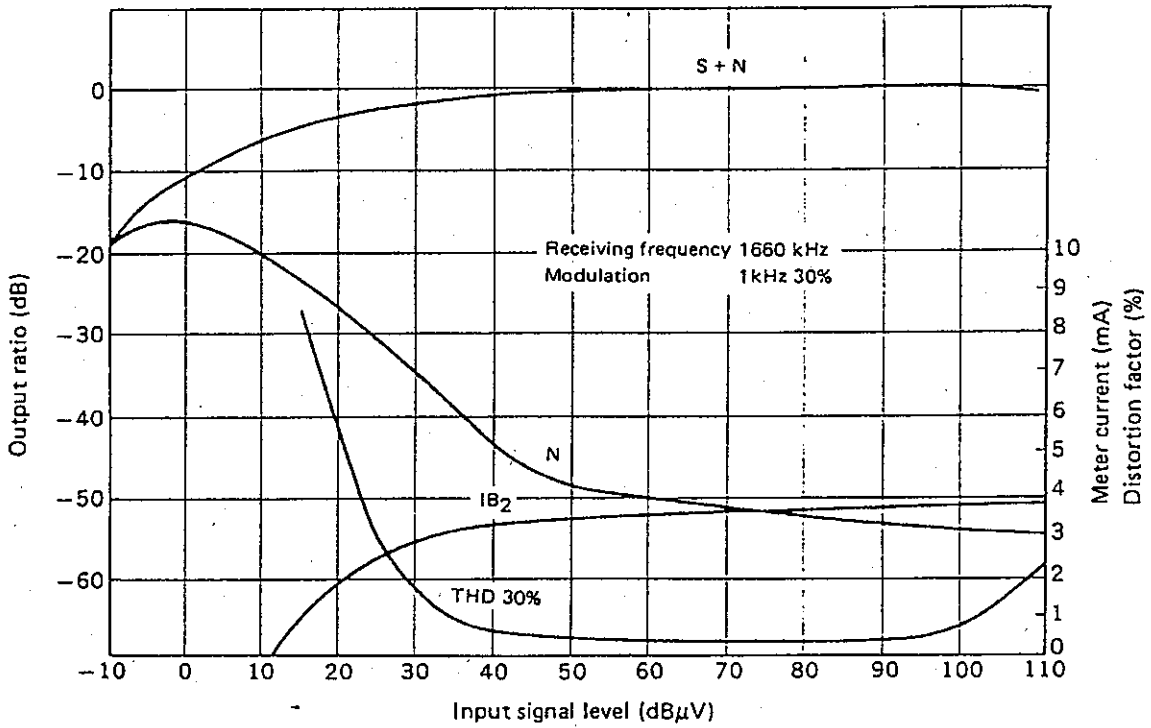


Parts Layout (mounting side)

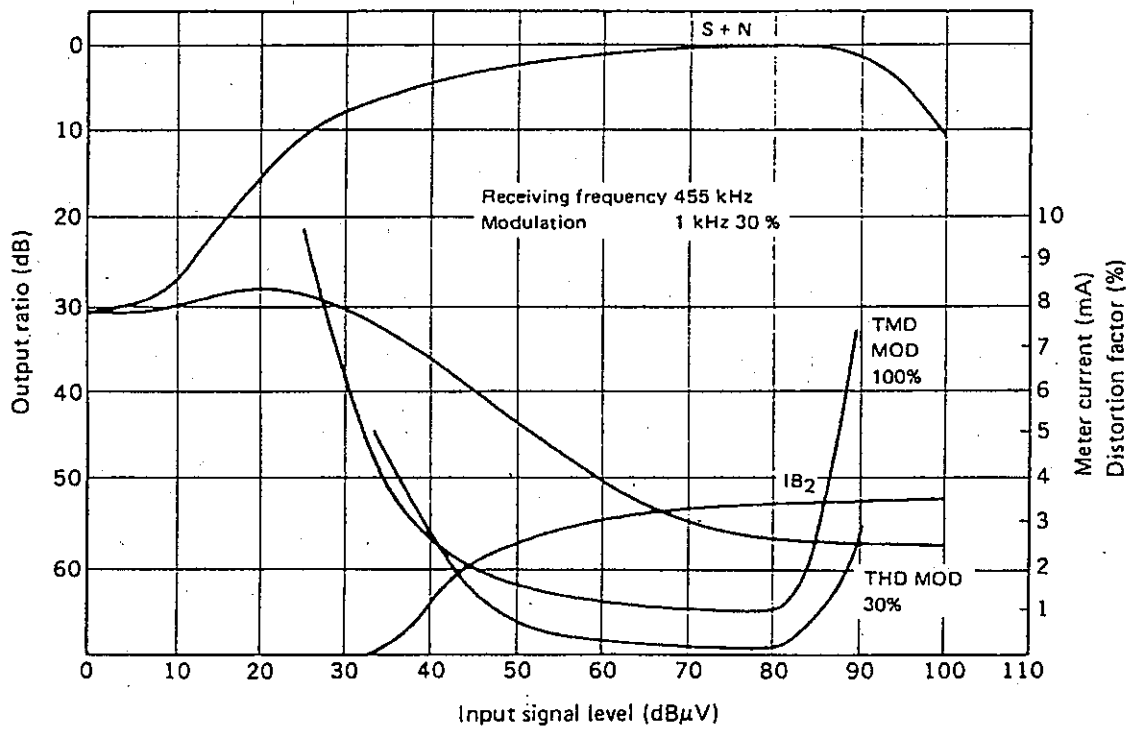


Pattern

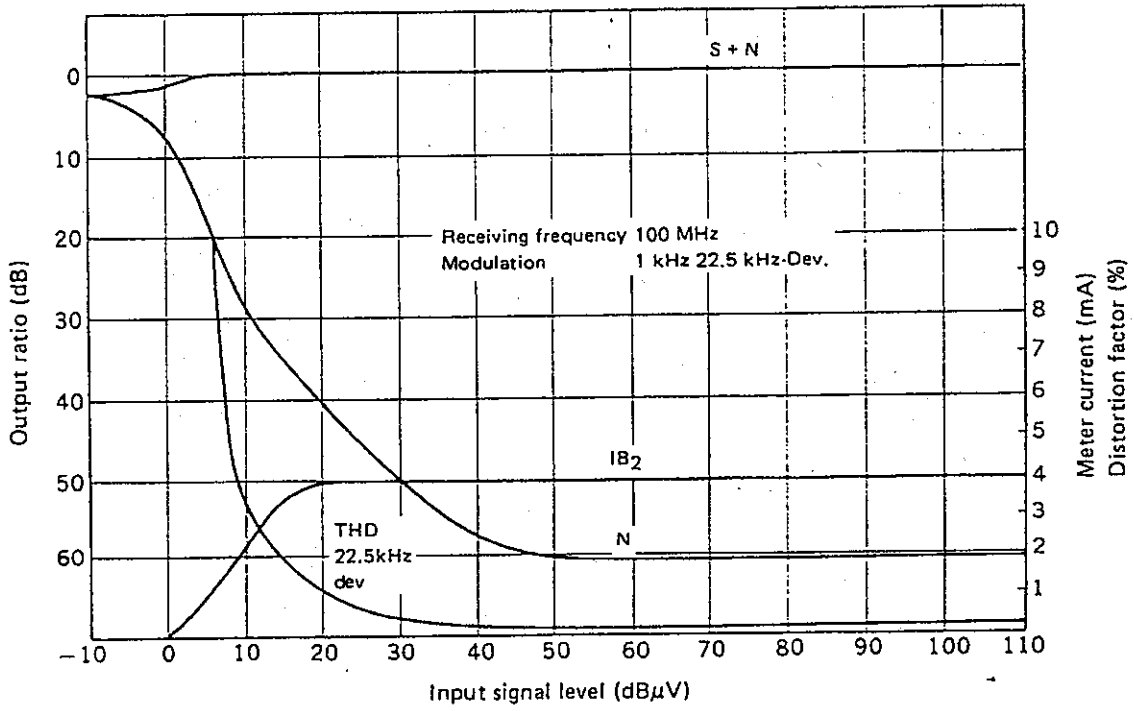
AM I/O Characteristic



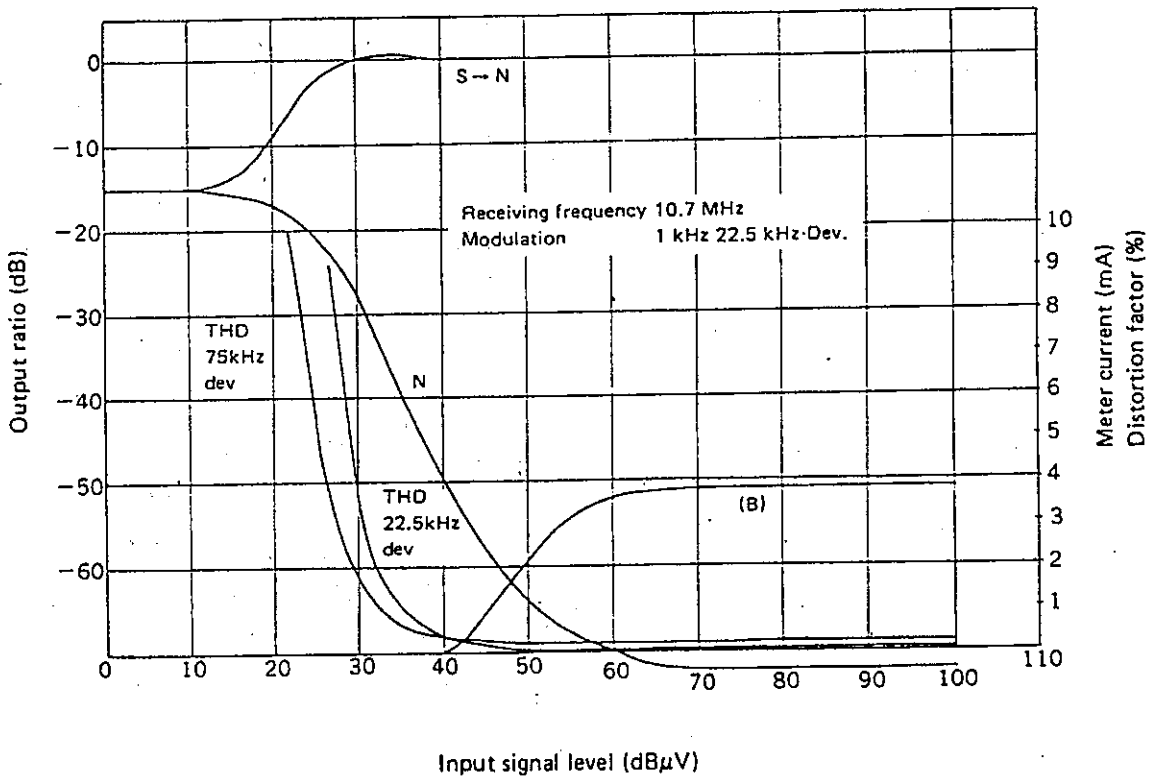
AM I/O Characteristic



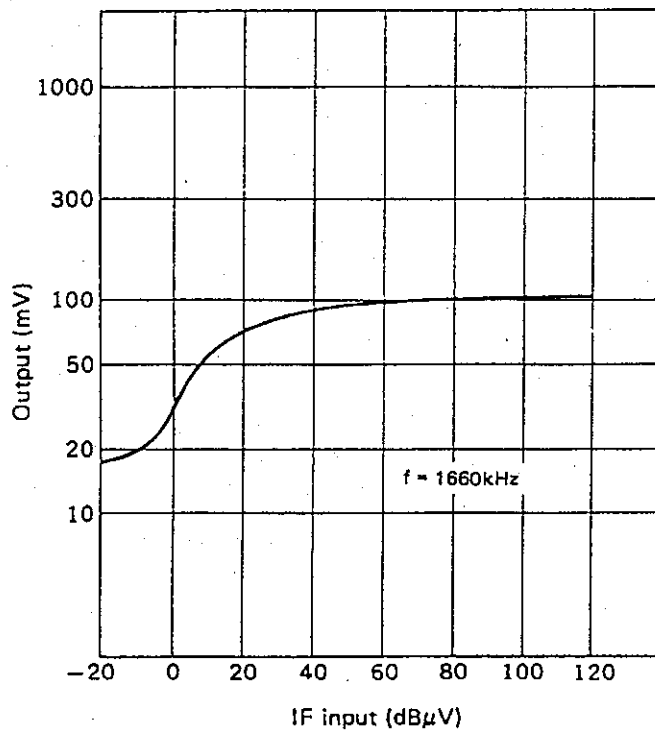
FM I/O Characteristic



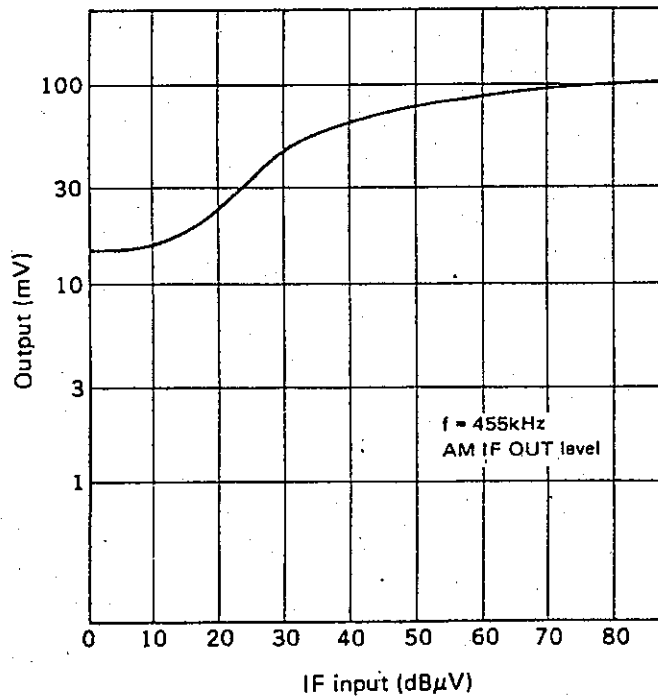
FM I/O Characteristic



AM IF pin output vs. Input (Overall)



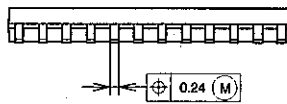
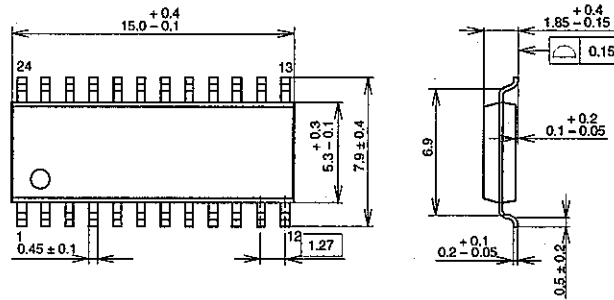
AM IF pin output vs. Input



Package Outline

Unit: mm

24PIN SOP (PLASTIC)

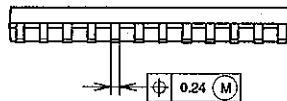
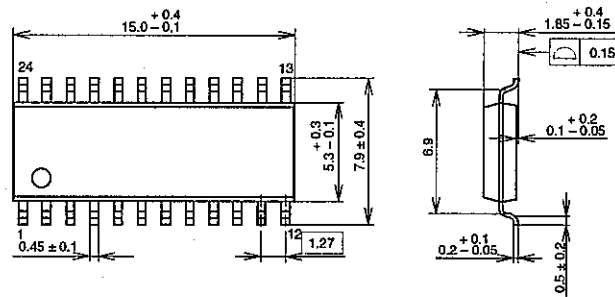


PACKAGE STRUCTURE

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