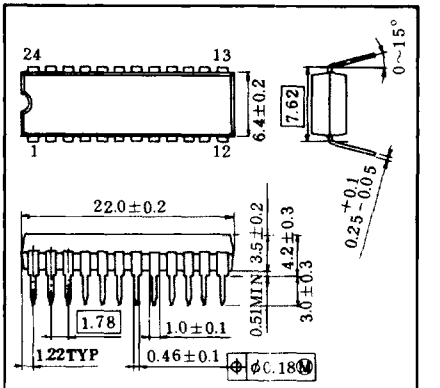
TA31024N, TA31025N, TA31024F, TA31025F

SPEECH NETWORK (For Telephone)

- This is IC for conversion of two-four wires by method of bridge.
- Direct interface with light and compact ceramic transmitter-receiver is possible.
- Switching of balancing network according to the volume of the circuit current is possible.
- Switching between transmitter output and DTMF output is possible.
- Nonlinear circuit of sending system for removing ambient noise is built in.
- Gain control (auto pad) is made automatically according to circuit current.
- Gain control terminal (manual pad) in extension usage is provided.
- Total gain of transmit and receiving, and frequency characteristics are possible to be controlled by means of external components.
- Constant voltage source V_{CC1} (1.8V) for microphone is built in.
- Interface with TA31023P (MULTI-FUNCTION SPEECH CIRCUIT) is possible.
- Wide power supply current range : I_L=15~150mA
- Wide operating temperature range: T_{opr}=-30~85°C
- There is flat package (TA31024F, TA31025F) for surface mount.

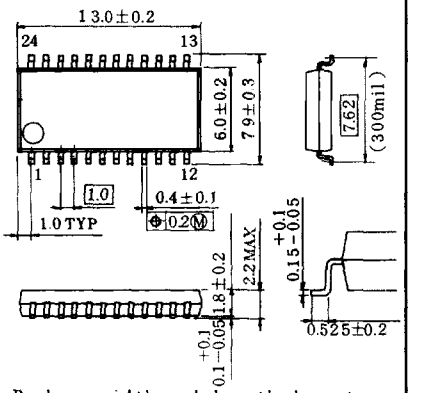
Unit in mm



Package width and length do not include mold protrusion.
Allowable mold protrusion is 0.15mm.

JEDEC	—
TOSHIBA	SDIP24-P-300

Unit in mm



Package width and length do not include mold protrusion.
Allowable mold protrusion is 0.15mm.

JEDEC	—
TOSHIBA	SSOP24-P-300

DIFFERENCE IN TYPES

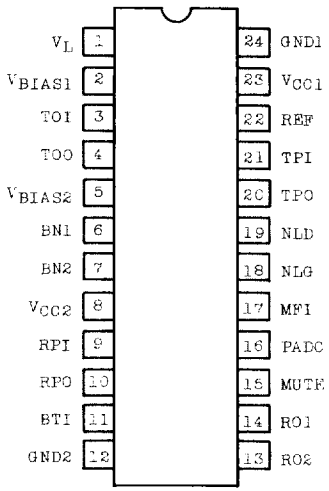
TYPE	OBJECT
TA31024N	For domestic use
TA31025N	For overseas use

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Line Voltage		V_L	15	V
Line Current		I_L	150	mA
Power Dissipation	N Type	P_D	1300	mW
	F Type		450	
Operating Temperature		T_{opr}	-30~85	°C
Storage Temperature		T_{stg}	-55~150	°C

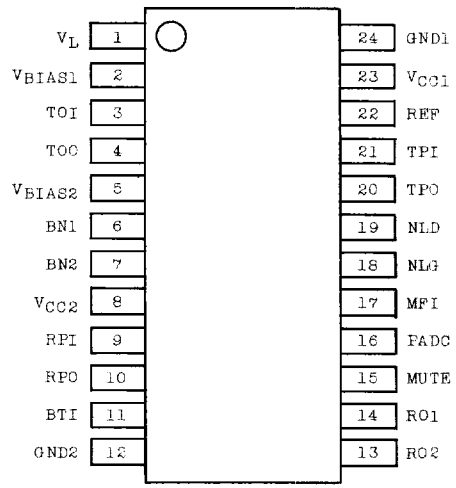
PIN CONNECTION

TA31024N/TA31025N



(TOP VIEW)

TA31024F/TA31025F



(TOP VIEW)

ELECTRICAL CHARACTERISTICS (Ta=25°C)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Line Voltage	TA31024N/F	V_L	1	I_L=20mA		2.2	2.4	3.0	V
				I_L=50mA		3.9	4.2	4.9	
				I_L=80mA		5.7	6.0	6.8	
	TA31025N/F	V_L	1	I_L=20mA		2.6	2.8	4.6	V
				I_L=50mA		4.4	4.6	6.4	
				I_L=80mA		6.1	6.4	8.25	
Transmit Gain		G_T	2	f=1kHz, v_{in}=-60dBV	I_L=30mA	38	40	42	dB
					I_L=80mA	35.5	38	40.5	
Receiving Gain		G_R	4	f=1kHz, v_{in}=-30dBV	I_L=30mA	12.5	14.5	16.5	dB
					I_L=80mA	6.5	8.5	10.5	
MF AMP. Gain		G_{MF}	3	f=1kHz, v_{in}=-60dBV	I_L=30mA	24	26	28	dB
					I_L=80mA	21.5	24	26.5	
Transmit Dynamic Range		DR_T	2	TA31024N/F DIST=10%	I_L=30mA	3.0	-	-	Vp-p
					I_L=80mA	4.0	-	-	
				TA31025N/F DIST=10%	I_L=30mA	3.5	-	-	Vp-p
					I_L=80mA	4.0	-	-	
Receiving Dynamic Range		DR_R	4	I_L=30mA		2.0	-	-	Vp-p
				I_L=80mA		2.0	-	-	
MUTE Input Current		$I_{I(MU)}$	-	I_L=20 ~ 80mA, V_I=GND		-	-	120	μA
PADC Input Current		$I_{I(PA)}$	-	I_L=20 ~ 80mA, V_I=GND		-	-	120	μA
Internal Power Supply Voltage		V_{CC}	6	I_L=20 ~ 80mA		1.5	1.8	2.1	V
Internal Reference Voltage		V_{REF}	7	I_L=20 ~ 80mA		0.5	0.7	0.9	V
Max. Supply Current		I_{CC}	-	I_L=20 ~ 80mA		-	500	-	μA
Nonlinear Loss		G_{NL}	2			-	10	-	dB

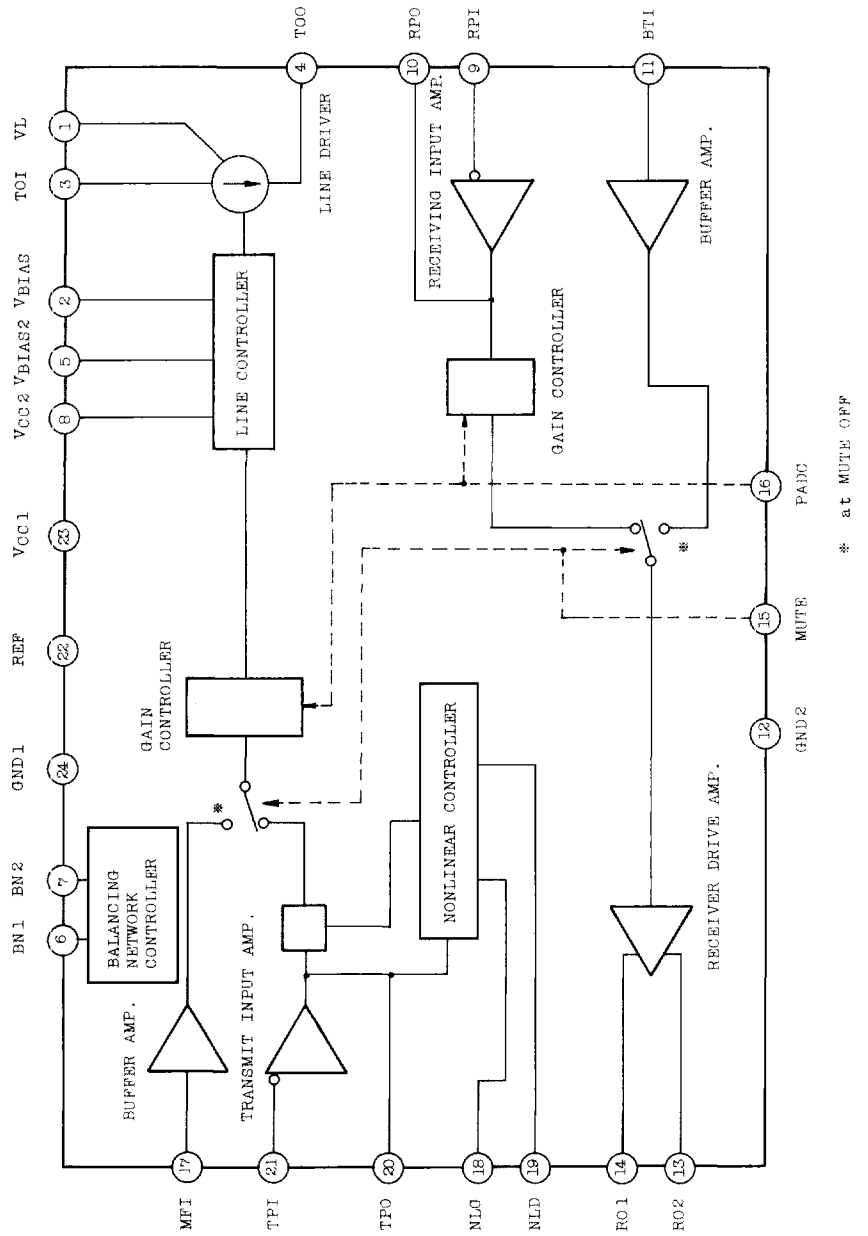
FUNCTION OF EACH TERMINAL

TERMINAL No.	SYMBOL	FUNCTION
1	V_L	Input terminal of line current. This terminal is connected to positive output of diode brideg circuit.
2	V_{BIAS1}	This terminal is connected to V_L terminal through 22μF.
3	TOI	Transmit output terminal. TOI output terminal is connected to V_L terminal through 24Ω.
4	TOO	Transmit output terminal. TOO output terminal is connected to ground terminal through 15Ω.
5	V_{BIAS2}	This terminal is connected to ground terminal through 22μF.
6	BN1	Connection terminal for balancing network. This terminal is connected to balancing network approximated by long distance line. BN1 or BN2 is selected automatically by line current I_L.
7	BN2	Connection terminal for balancing network. This terminal is connected to balancing network approximated by short distance line. BN1 or BN2 is selected automatically by line current I_L.
8	V_{CC2}	To make AC impedance of speech network 600Ω, V_{CC2} terminal is connected to V_L terminal through 910Ω and is connected to ground terminal through 22μF.
9	RPI	Input/output terminal for receiving input amplifier. RPI and RPO are respectively input terminal and output terminal for receiving input amplifier. Adjustment of receiving gain and receiving frequency characteristics can be performed by external components.
10	RPO	
11	BTI	Beep Tone input terminal. This terminal becomes active when MUTE input is "L" (GND). When this terminal is active, input signal to BTI becomes receiving output.
12	GND2	Ground terminal. This terminal is connected to negative output of diode bridge circuit.

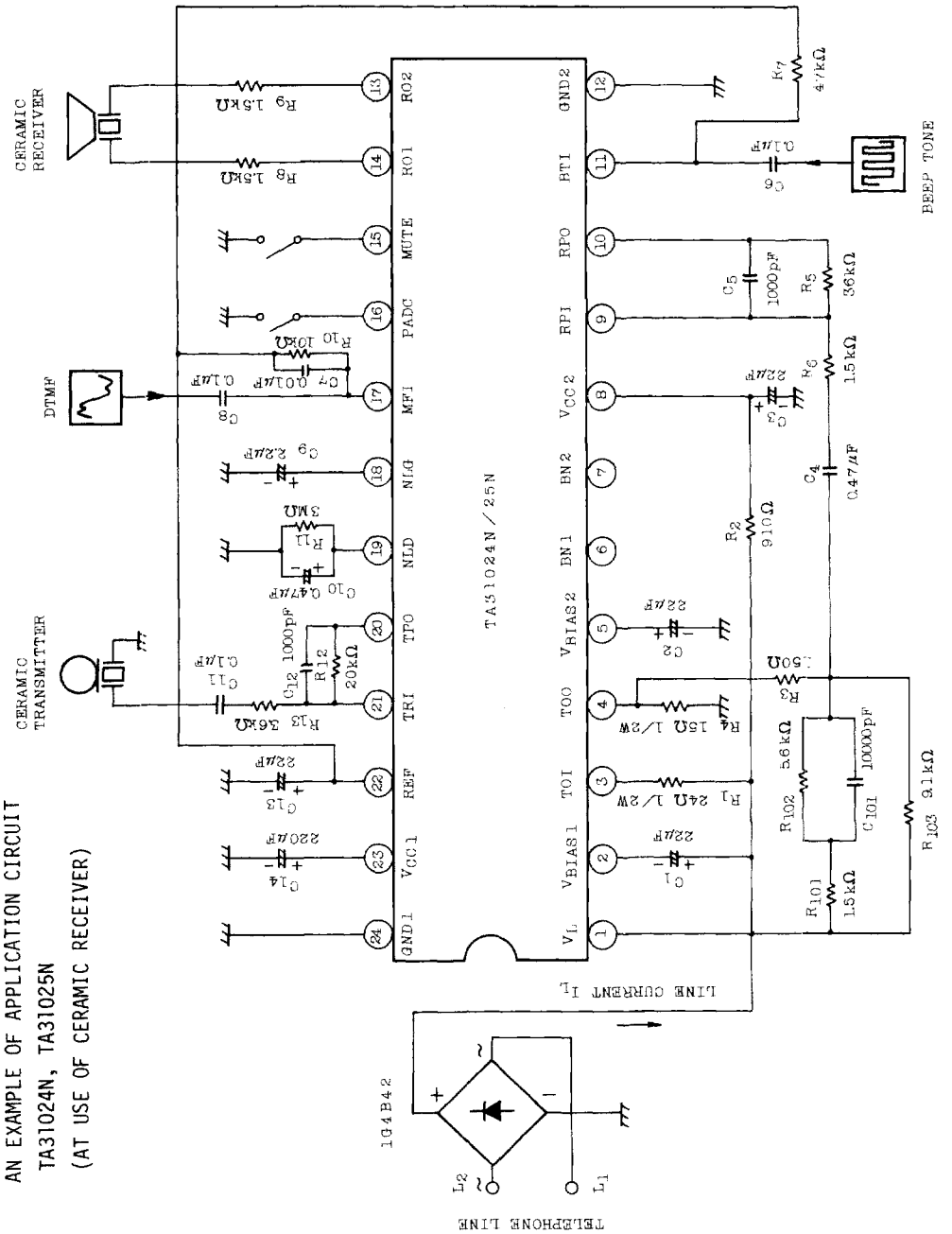
FUNCTION OF EACH TERMINAL

TERMINAL No.	SYMBOL	FUNCTION
13	RO1	Receiving output terminal. RO1 and RO2 are differential outputs. RO1 and RO2 terminals are connected to ceramic receiver.
14	RO2	
15	MUTE	Terminal for switching of talking/DTMF. Open : at talking "L"(GND) : at sending DTMF Transmit output ←MFI input signal Receiving output ←BTI input signal.
16	PADC	PAD control terminal. If "L"(GND) is input to PADC input, a constant volume of loss ($T_X \fallingdotseq -2dB$, $R_X \fallingdotseq -6dB$) is respectively produced in transmitter amplifier and receiver amplifier.
17	MFI	DTMF input terminal. This terminal is connected to TONE output of DTMF generator through coupling capacitor. When MUTE input is "L"(GND), this terminal becomes active.
18	NLG	Reference terminal for detective circuit. This terminal is connected to ground terminal through 2.2μF.
19	NLD	Output terminal for detective circuit. This terminal is connected to ground terminal after smoothed by both resistor and capacitor.
20	TPO	Input/output terminal for transmit input amplifier. TPI and TPO are respectively input terminal and output terminal for transmit input amplifier. Adjustment of transmit gain and transmit frequency characteristics can be performed by external components.
21	TPI	
22	REF	Output terminal for reference voltage. This terminal outputs reference voltage of internal circuit.
23	V_{CC1}	Output terminal for constant voltage power supply. This terminal outputs power supply voltage of internal circuit. V_{CC1} terminal can supply the power supply voltage to microphone.
24	GND1	Ground terminal. This terminal is connected to negative output of diode brideg circuit.

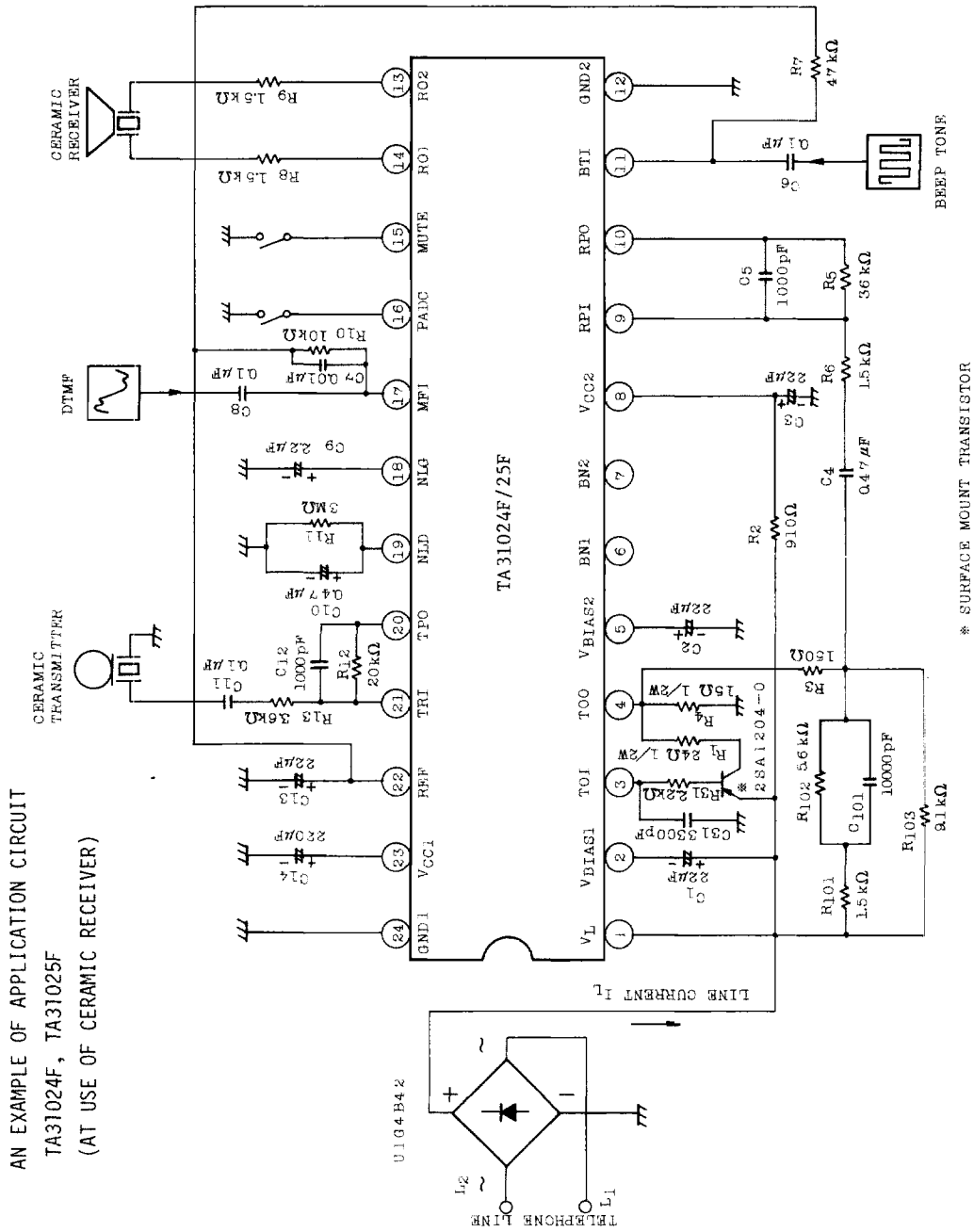
BLOCK DIAGRAM of TA31024N/F, TA31025N/F



AN EXAMPLE OF APPLICATION CIRCUIT
TA31024N, TA31025N
(AT USE OF CERAMIC RECEIVER)

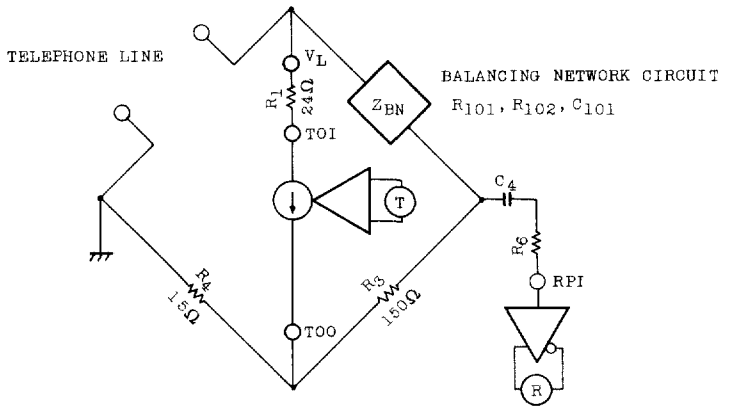


AN EXAMPLE OF APPLICATION CIRCUIT
TA31024F, TA31025F
(AT USE OF CERAMIC RECEIVER)



· CONVERSION OF TWO-FOUR WIRES

The conversion of two-four wires is performed by method of bridge.



The principle drawing is shown below.

· ADJUSTMENT METHOD OF TRANSMIT GAIN

The transmit gain of TA31024N/F and TA31025N/F are determined as follows:

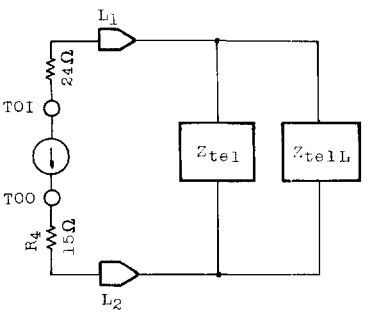
Transmit input AMP. + transmit gain adjustment + line driver = transmit gain.

1. Gain of Line Driver AMP.

   When Z_{telL}, $Z_{tel} \fallingdotseq 600$, the gain of line driver AMP. is calculated as below:

$$\frac{Z_{telL} /\!/ Z_{tel}}{R4} = \frac{300}{15} = 26dB$$

   (Note) Set the value of R4 at 15Ω.



Z_{telL} : Impedance of objective telephone

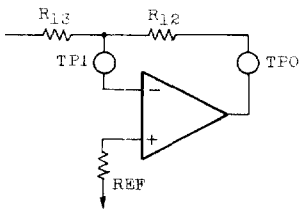
Z_{tel} : Impedance of your telephone

2. Gain of Transmit Gain Adjustment Circuit

The gain (actually an attenuation) is determined by the line current (voltage).

at 20mA (line current) 0dB

at 80mA (line current) -2dB



3. Gain of Transmit Input AMP.

This gain is determined by the external resistance values R_{12} and R_{13}.

Set R_{12} at 100kΩ ~ 20kΩ.

· ADJUSTMENT METHOD OF RECEIVING GAIN

The receiving gain of TA31024N/F and TA31025N/F are determined as follows:

Receiving input AMP. + receiving gain adjustment + receiver drive AMP. = receiving gain.

1. Gain of Receiver Drive AMP.

The gain of the built-in receiver drive AMP. is made to about 20dB by the differential operation.

2. Gain of Receiving Gain Adjustment Circuit

The gain (actually an attenuation) is determined by the line current (voltage).

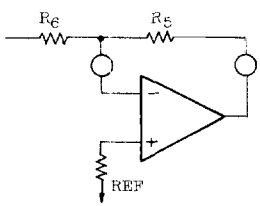
at 20mA (line current) 0dB

at 80mA (line current) -6dB

3. Gain of Receiving Input AMP.

The gain of this AMP. is determined by the external resistance values R5 and R6.

Set R5 at 100kΩ ~ 20kΩ.

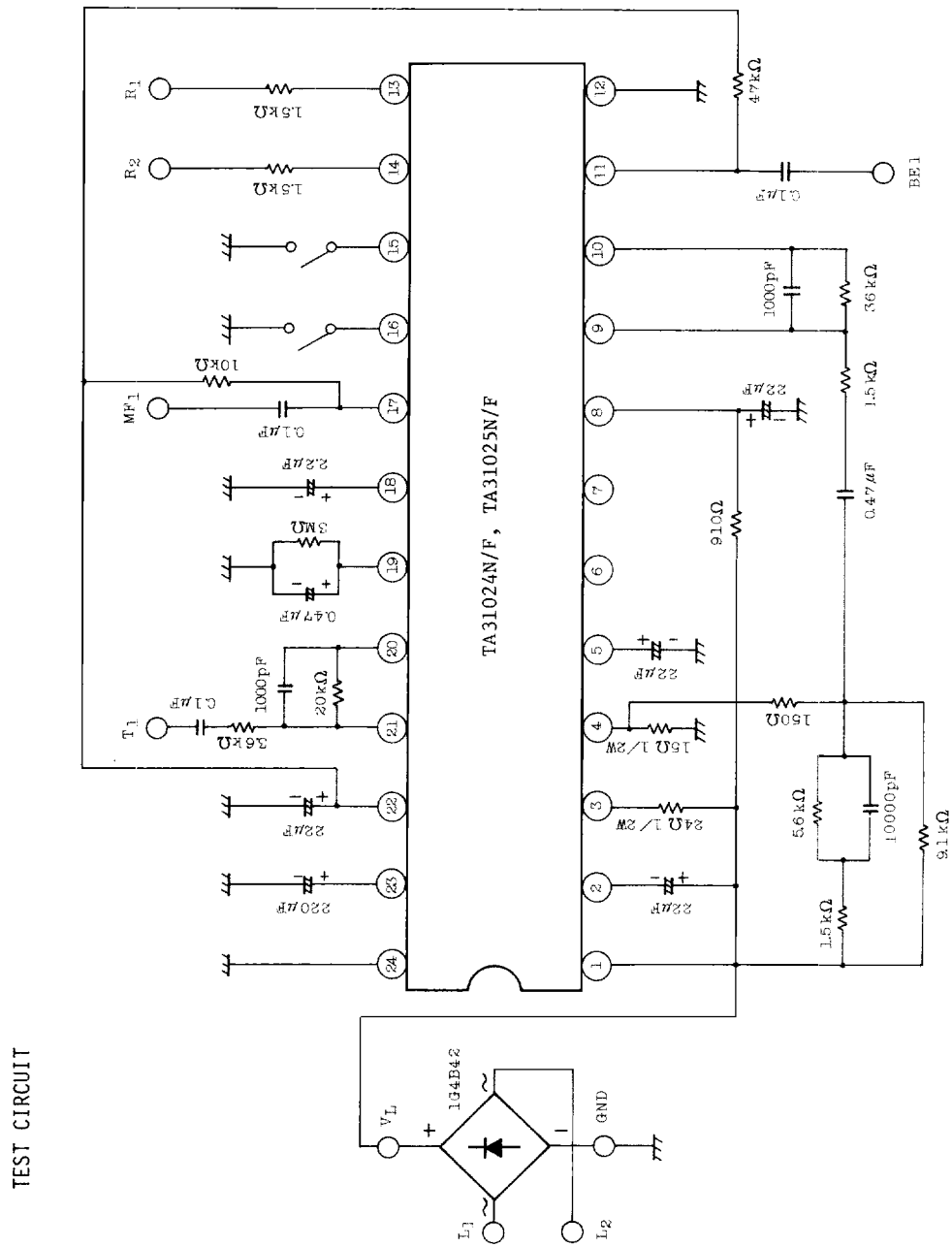


NONLINEAR CIRCUIT OF SENDING SYSTEM

1. When the ceramic transmitter or the electret transmitter is used, TA31024N/F and TA31025N/F can reduce the gain by about 10dB in the low sound pressure level (ambient noise level). As a matter of course, the gain maintains the normally set level in the high sound pressure level (speech voice).
   The switching of this gain can be carried out automatically by the built-in detector and the gain controller.
   It is possible to prevent the ambient noise from leaking to the objective telephone by this circuit.

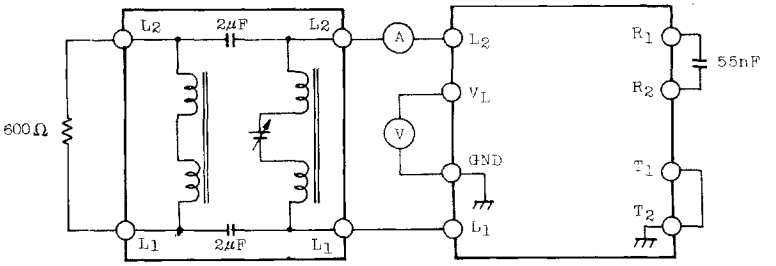
2. Procedure when Nonlinear Circuit is not applied
   Remove R_{11} and C_{10}, and pull up 19 pin to V_{CC1} with 100kΩ.
   Remove C_9, and pull up 18 pin to REF.
   In this case, the gain becomes constant without any relation to the level of the sound pressure (input) inputted to the transmitter (transmit input AMP.).

TEST CIRCUIT

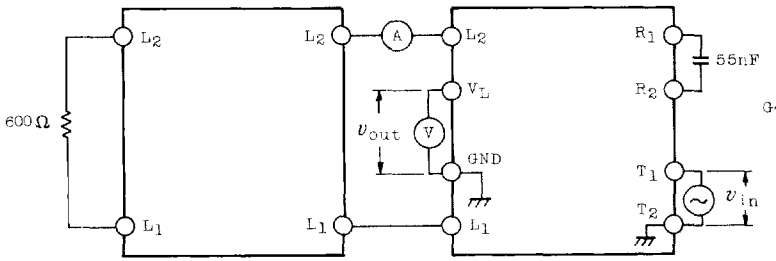


TEST CIRCUIT

(1) V_L

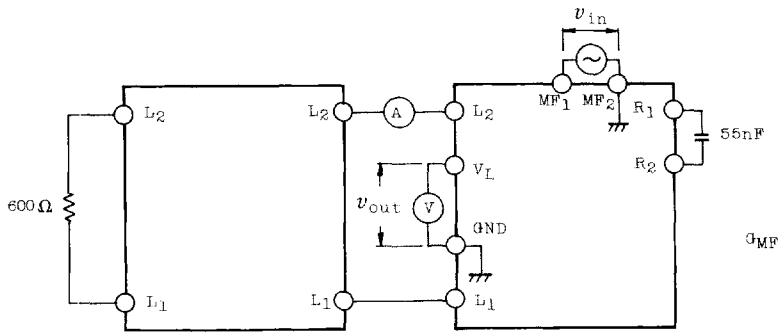


(2) G_T, DR_T, G_{NL}



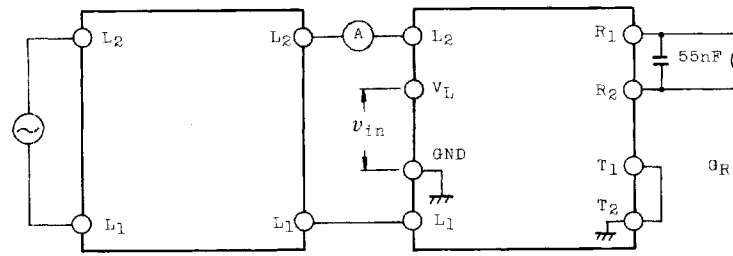
$$G_T = \frac{v_{out}}{v_{in}}$$

(3) G_{MF}



$$G_{MF} = \frac{v_{out}}{v_{in}}$$

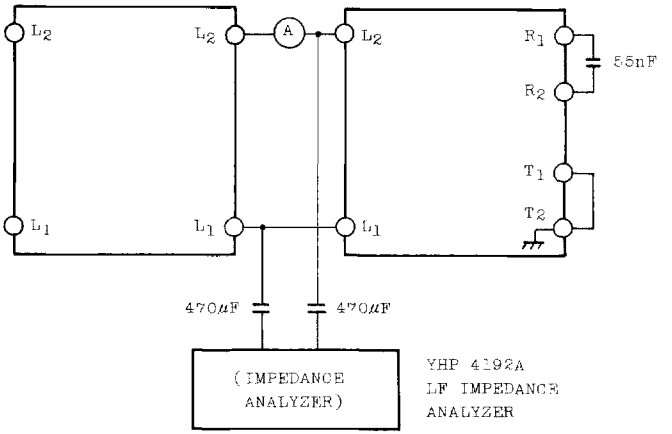
(4) G_R, DR_R



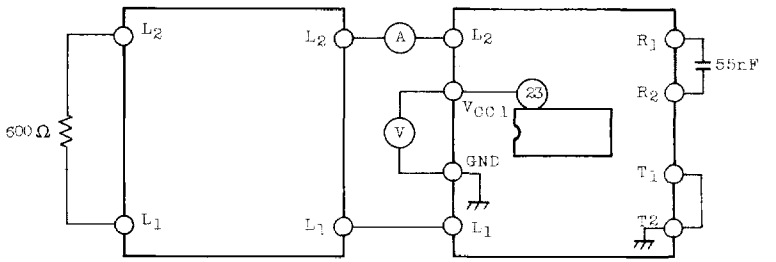
$$G_R = \frac{v_{out}}{v_{in}}$$

TEST CIRCUIT

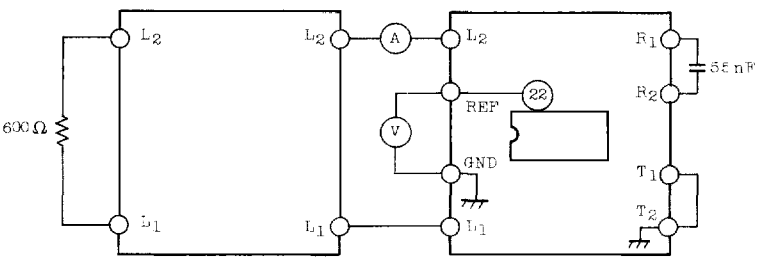
(5) Z_{tel}



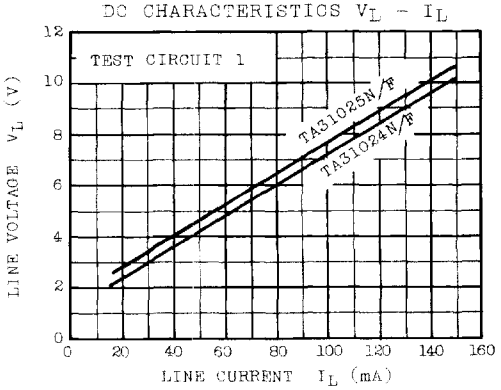
(6) V_{CC}



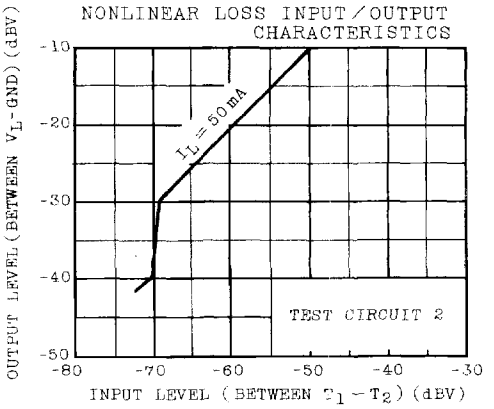
(7) V_{REF}



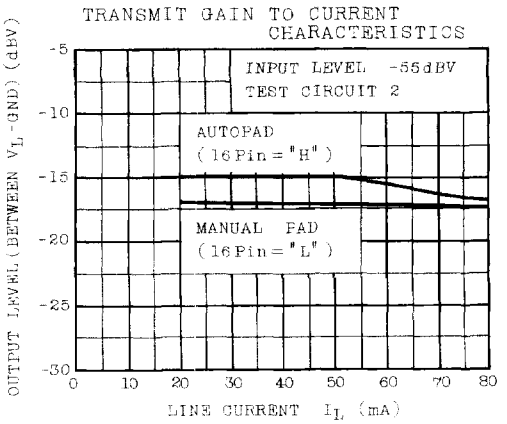
DC CHARACTERISTICS $V_L - I_L$



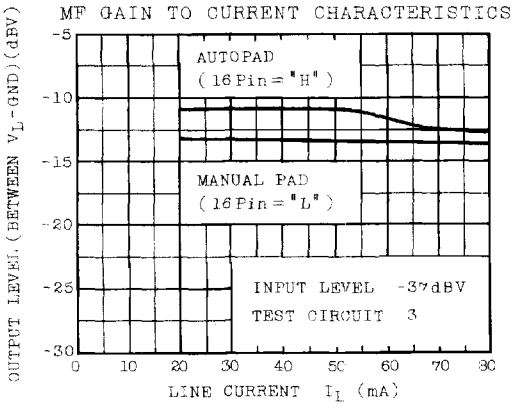
NONLINEAR LOSS INPUT/OUTPUT CHARACTERISTICS



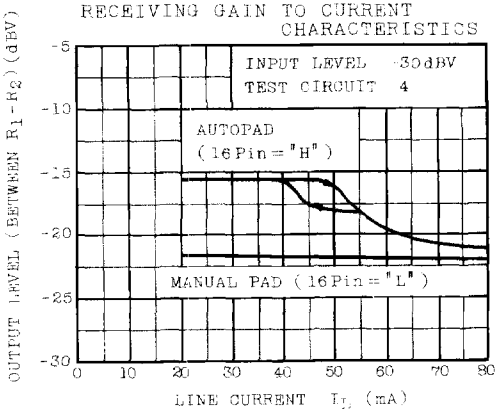
TRANSMIT GAIN TO CURRENT CHARACTERISTICS



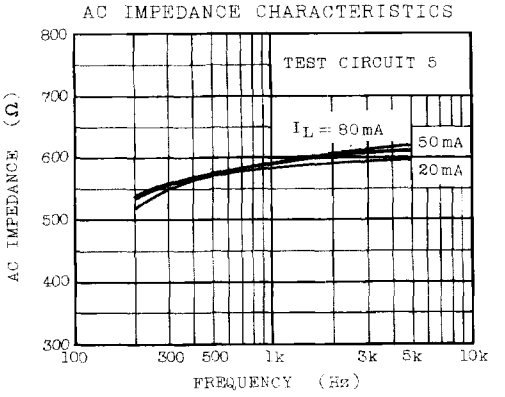
MF GAIN TO CURRENT CHARACTERISTICS



RECEIVING GAIN TO CURRENT CHARACTERISTICS



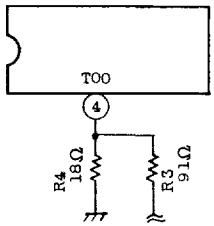
AC IMPEDANCE CHARACTERISTICS



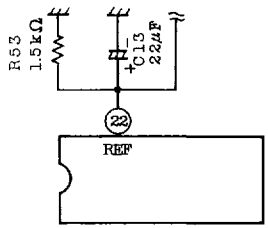
1 LOW IMPEDANCE (ELECTROMAGNETIC TYPE, DYNAMIC TYPE) RECEIVER IS USED

By using TA31024N/F and TA31025N/F, the low impedance receiver can be used with the connections described below.

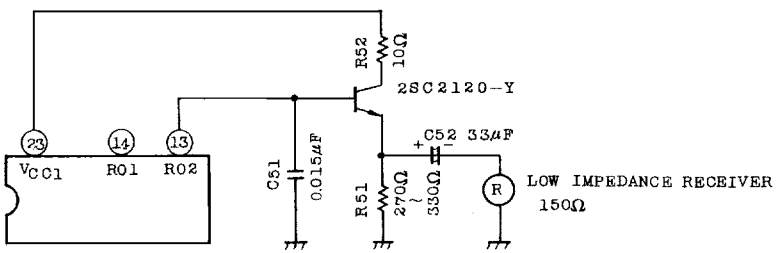
1. Set the resistance R4 between TOO (4-pin) and GND at 18Ω.



2. Add the resistance R53=1.5kΩ between REF (22-pin) and GND, and set the resistance so as to make the REF (22-pin) terminal voltage 0.4 to 0.5V.



3. Receiving output circuit



∘ C51 is the capacitor for frequency compensation.

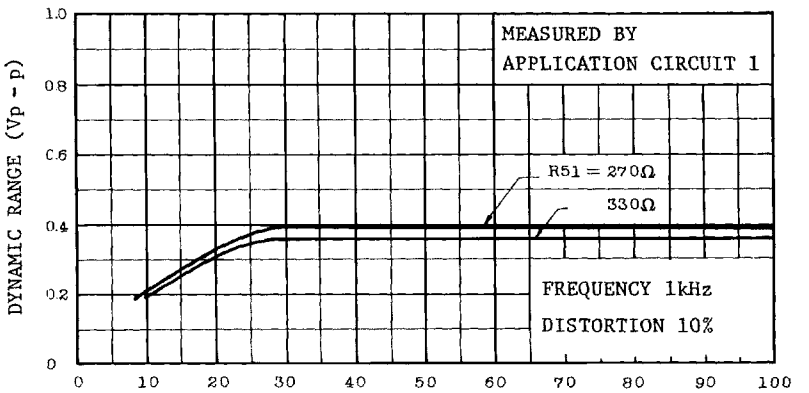
- R52 is the resistance for short-circuit protection.
- Make R01 (14-pin) open.
- Use the receiver having the impedance of about 150Ω.
- Supply the power of the reciever from V_{CC1} (23-pin).

2 DYNAMIC RANGE OF RECEIVING OUTPUT AT USING LOW IMPEDANCE RECEIVER

The maximum amplitude level when the low impedance receiver (150Ω) is used is as shown in the graph below.

RECEIVING OUTPUT DYNAMIC RANGE

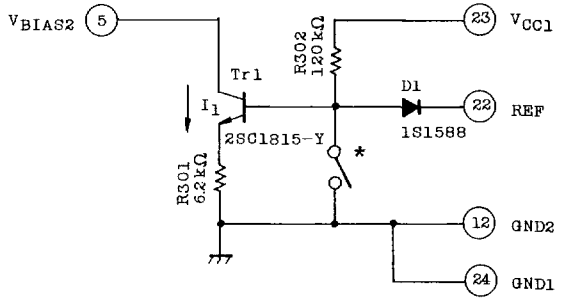
(at the connection with load resistance 150Ω)



3 METHOD FOR RAISING DC RESISTANCE (LINE VOLTAGE)

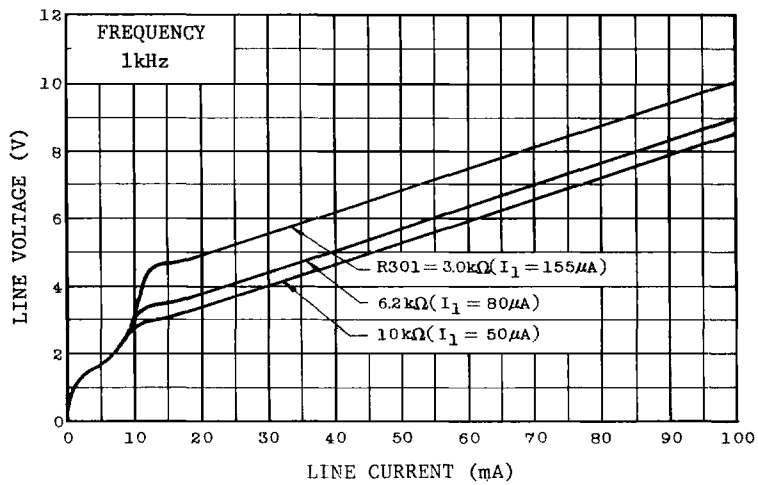
The DC resistance (line voltage) can be raised as shown in the graph below by adding the outside devices as shown in the figure below.

((When ceramic receiver is used))



* At open, active.

The graph below shows the changed current I_1 flowing to Tr1 and the raised DC resistance (line voltage) made by the variation of the resistance R301.



((Low impedance receiver is used))

When the low impedance receiver is used, since the electric potential of REF terminal (22-pin) is reduced down about to 0.4V, the DC resistance (line voltage) can be raised similarly to the case, in which the ceramic receiver is used, by means of changing R301 and adjusting the current I_1 flowing to Tr1.

4 BTI TERMINAL (11-pin) IS NOT USED.

When BTI terminal (11-pin) is not used, remove C6 and R7, and pull up BTI terminal (11-pin) to REF.

5 DTMF TERMINAL (17pin) IS NOT USED.

When DTMF terminal (17-pin) is not used, remove C7, C8, and R10, and pull up DTMF terminal (17-pin) to REF.

6 MUTE TERMINAL (15-pin), PADC TERMINAL (16-pin)

- MUTE terminal (15-pin) and PADC terminal (16-pin) become active when connected to GND.

- For controlling these terminals, use the terminals having the capacity of receiving 100μA or over for the low output level current (IOL) and 0.1V or less for the low output level voltage (VOL).

7 V_{CC1} TERMINAL (23-pin)

- V_{CC1} terminal (23-pin) can be used as the constant voltage source for driving the microphone or the low impedance (electromagnetic type, dynamic type) receiver.

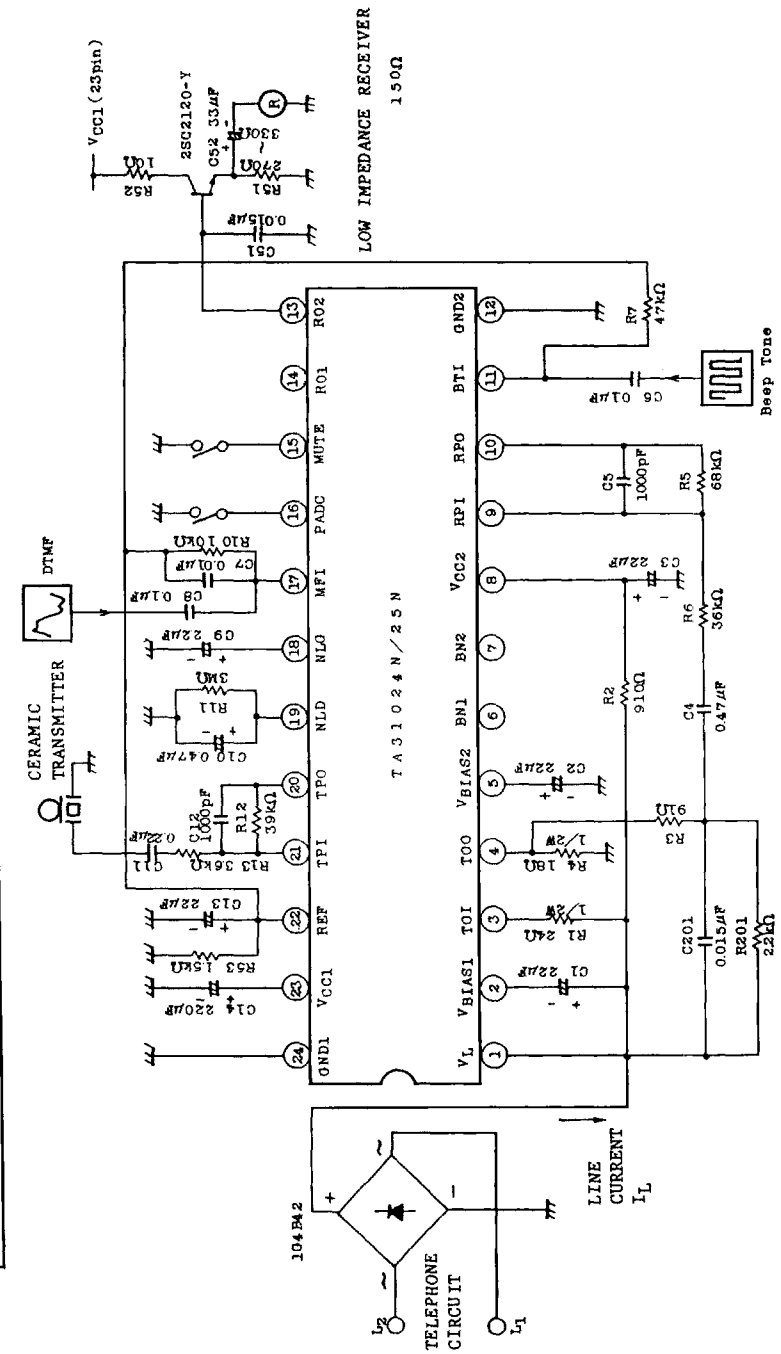
8 TRANSMITTER ABLE TO USE WITH TA31024N/F OR TA31025N/F

By using TA31025N/F or TA31025N/F, various transmitter can be used.

Example
Ceramic type transmitter
Electromagnetic type transmitter
Dynamic type transmitter
Condencer microphone

APPLICATION CIRCUIT 1 ((TA31024N/25N IS USED)).

LOW IMPEDANCE (ELECTROMAGNETIC TYPE, DYNAMIC TYPE)
RECEIVER IS USED



APPLICATION CIRCUIT 2 ((TA31024F/25F(FLAT PACKAGE) IS USED)).

LOW IMPEDANCE (ELECTROMAGNETIC TYPE, DYNAMIC TYPE)

RECEIVER IS USED