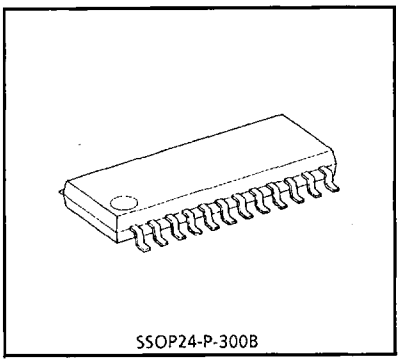
SPEECH NETWORK FOR TELEPHONE

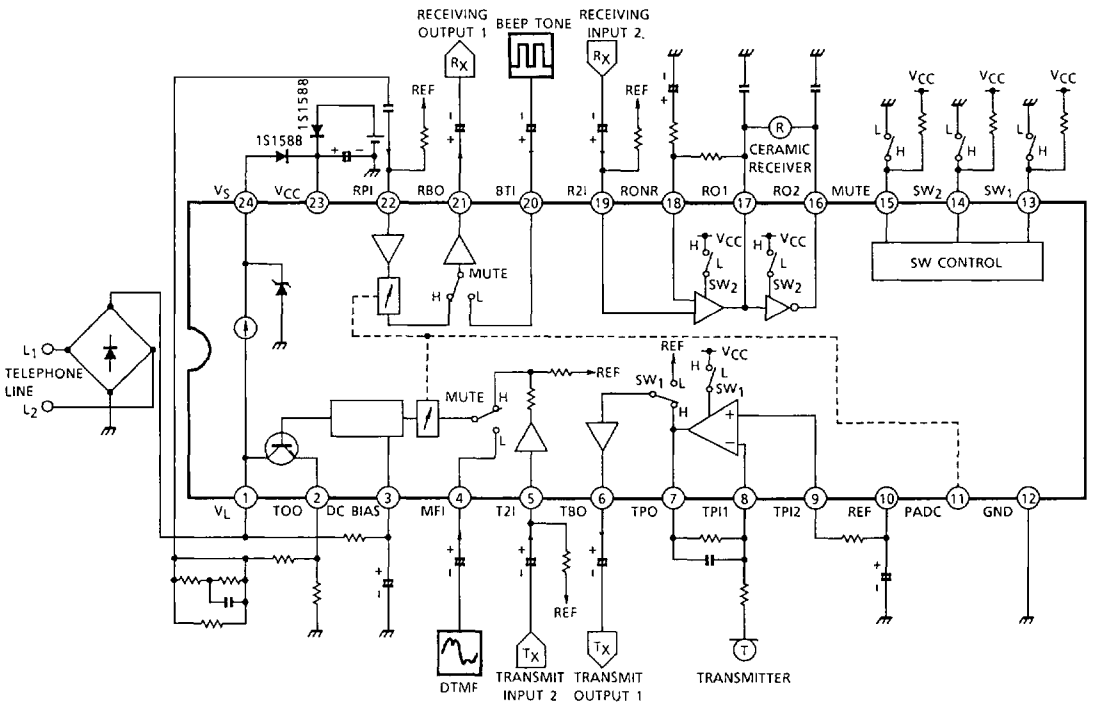
FEATURES

- Possible to use by line power supply, or external power supply.
- Built-in many kinds of signal path, it is convenient three-way calling or extension.
- Gain is automatically controlled according to the line current. (Auto pad function)
- Capable of coping with ceramic and dynamic receivers.
- Small package : MFP 24Pin



Weight : 0.27g (Typ.)

BLOCK DIAGRAM



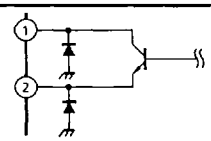
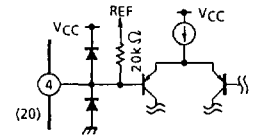
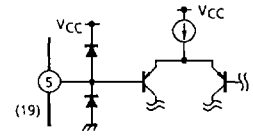
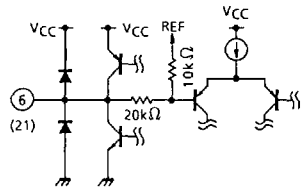
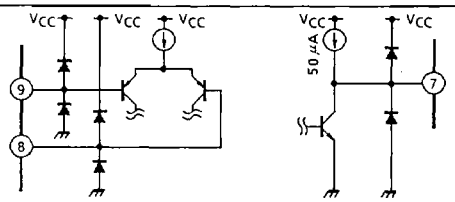
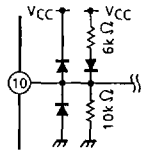
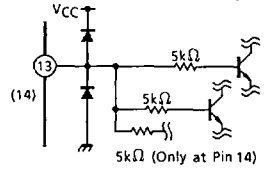
TA31068F-1

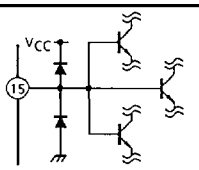
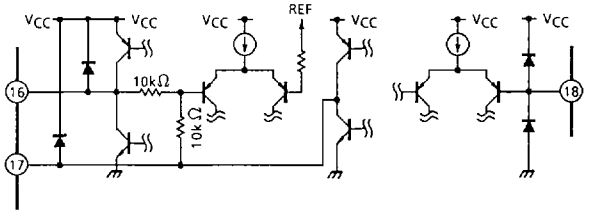
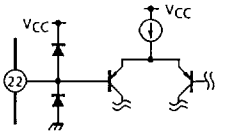
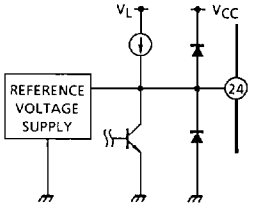
PIN FUNCTION

PIN No.	PIN NAME	FUNCTION
1	V_L	[Line current flow-in terminal, line voltage terminal] Connected to positive output of diode bridge circuit. DC potential of this terminal determines line voltage, and if AC signal is not input, the highest DC potential appears.
2	TOO	[Current output terminal of transmit output terminal] Connected to GND terminal (Pin 12) through 33Ω. Since almost all the line currents are flowed out from this terminal, set allowable power of resistance 33Ω to be connected to GND terminal from this terminal considering the maximum current of line current expected to be used.
3	DC BIAS	[DC voltage power supply terminal] DC power supply of internal IC. Connected to GND terminal (Pin 12) through capacitor.
4	MFI	[Input terminal of DTMF or external input signals] Signal, which is input to this terminal, is output at V_L terminal (Pin 1) only when MUTE terminal (Pin 15) "L" state. Since this terminal is biased to almost the same potential as REF terminal (Pin 10) , avoid direct impress of external DC potential by using capacitor at inputting external signal.
5	T2I	[Input terminal of external input signals] Signal, which is input to this terminal, is output at V_L terminal (Pin 1) only when MUTE terminal (Pin 15) "H" state, avoid direct impress of external DC voltage by using capacitor of inputting external signal.
6	TBO	[Output terminal of internal transmit signal] Output terminal to signal only when SW_1 terminal (Pin 13) "H" state Output from signal is without any relation to gain control (PAD) or MUTE since this input does not pass through gain control circuit or MUTE function.
7	TPO	[Output terminal of transmit input amplifier] Makes negative feedback to TPI1 terminal (Pin 8).
8	TPI1	[Inversion input terminal of transmit input amplifier] Receives negative feedback from TPO terminal (Pin 7).
9	TPI2	[Non-inversion input terminal of transmit input amplifier] Apply DC bias to this terminal from REF terminal (Pin 10) through resistance.
10	REF	[Internal reference voltage output terminal] Voltage of this terminal is used as reference voltage of internal pre-amplifier. Never use this terminal as an external power supply.
11	PADC	[Pad control terminal] When this terminal is connected to GND terminal (Pin 12) or V_{CC} terminal (Pin 23) through resistance, operation current of gain control (auto-pad) performed by line current can be controlled.
12	GND	[Ground terminal] Connected to negative output of diode bridge circuit.

PIN No.	PIN NAME	FUNCTION
13	SW_1	[Switch 1 terminal] This terminal is connected to GND terminal (Pin 12) or V_{CC} terminal (Pin 23) through resistance.
14	SW_2	[Switch 2 terminal] This terminal is connected to GND terminal (Pin 12) or V_{CC} terminal (Pin 23) through resistance.
15	MUTE	[MUTE terminal] This terminal is connected to GND terminal (Pin 12) or V_{CC} terminal (Pin 23) through resistance.
16	RO2	[Receiving output terminal, inversion output] Output terminal to receiver. Signal, of which phase is negative of RO1 terminal (Pin 17), is output.
17	RO1	[Receiving output terminal, non-inversion output] Output terminal to receiver. Signal, of which phase is negative of RO2 terminal (Pin 16), is output.
18	RONR	[Output terminal of receiving input amplifier] Makes negative feedback to RO1 terminal (Pin 17).
19	R2I	[Input terminal of external input signals] Apply DC bias to this terminal from REF terminal (Pin 10) through resistance. Signal, which is input to this terminal, is output at RO1·RO2 terminal (Pin 17, Pin 16) when SW_2 terminal (Pin 14) is in "H" state. Avoid direct impressing of external DC voltage through capacitor at inputting external signal.
20	BTI	[Dial confirmation sound (BEEP TONE, DTMF), monitor sound input terminal] Signal, which is input to this terminal, is output to RBO terminal (Pin 21) when MUTE terminal (Pin 15) is in "L" state. Since this terminal is biased to about the same potential as REF terminal (Pin 10), avoid direct impressing of external DC voltage through capacitor at inputting external signal.
21	RBO	[Output terminal of internal Receiving Signal] This terminal is output signal from RPI terminal (Pin 22) when MUTE terminal (Pin 15) is in "H" state, and BTI terminal (Pin 20) when MUTE terminal (Pin 15) is in "L" state.
22	RPI	[Non-inversion input terminal of receiving input amplifier] Apply DC bias to this terminal from REF terminal (Pin 10) through resistance. Signal, which is input to this terminal, is output from BTI terminal (Pin 20) when MUTE terminal (Pin 15) is in "H" state. Avoid direct impressing of external DC voltage through capacitor at inputting external signal.
23	V_{CC}	[Internal power supply voltage terminal] Power supply of internal pre-amplifier. This terminal avoid to add higher voltage than 8V.
24	V_S	[Power supply terminal] Power supply of V_{CC} terminal (Pin 23). This terminal is connected to V_{CC} terminal (Pin 23) through diode. (1S1588) This terminal can supply voltage to external circuit from current V_L (MIN:2mA).

INTERNAL EQUIVALENT CIRCUIT (The values of resistor and current are typical.)

PIN No.	PIN NAME	INTERNAL EQUIVALENT CIRCUIT
1 2	V_L TOO	
4 20	MFI BTI	
5 19	T2I R2I	
6 21	TBO RBO	
7 8 9	TPO TPI1 TPI2	
10	REF	
13 14	SW_1 SW_2	

PIN No.	PIN NAME	INTERNAL EQUIVALENT CIRCUIT
15	MUTE	
16 17 18	RO2 RO1 RONR	
22	RPI	
24	V_S	

DESCRIPTION

1. Operational description

TA31068F can give simple design for inter-call with external power supply or line communication in power failure. Fig.1 shows a relation among each power supply.

(1) At power failure (Telephone Line feed operation)

Supply power source to power terminal (V_{CC}) of internal pre-amplifier system from VS terminal.
VS terminal is stabilize circuit voltage about 3V It is possible to use another power source. (Please put to diode for reverse current prevention)

(2) At extension service (external feed operation)

Supply power source to power terminal (V_{CC}) from external power (ex. AC adaptor).
When external power voltage is about 5V, internal pre-amplifier system operate external power (5V) at circuit communication.

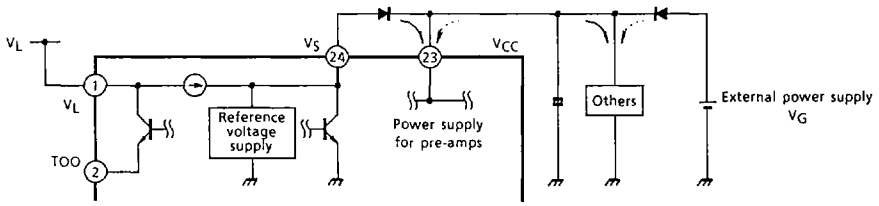


Fig.1

2. Directions of use gain control circuit (PADC terminal)

(1) PADC terminal open state (Auto pad)

Transmit and receiving gains automatically vary according to the line current.
With the increase of line current amount, the gain attenuates by about −4dB at transmit and about −6dB at receiving.

(2) In case PADC terminal is connected to V_{CC} by resistance.

The gain begins to attenuate with the line current amount more than that when PADC terminal is open.

(3) In case PADC terminal is connected to GND by resistance.

The gain begins to attenuate with the line current amount less than that when PADC terminal is open.
But in case voltage value is different from VS terminal voltage, cope with Fig.2 because PAD characteristic vary at external feed and circuit feed.

$R_{111} \gg R_b \; V_G \cdot R_b / (R_a + R_b) \simeq V_G - V_S$

ex) When external power is 5V, $R_{111} = 100k\Omega$.

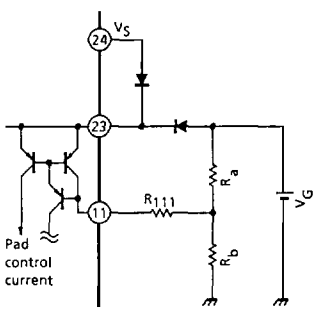


Fig.2

3. Line voltage-increasing method

It is possible to increase line voltage by insert resistance between DC bias terminal and GND terminal.
But power Dissipation grows large therefore the resistance value must be decided under consideration for maximum line current and range of temperature.
Power Dissipation closely resemble next formula.

$P_D \simeq (V_L - R_4 \cdot I_L) \cdot I_L$

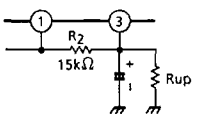


Fig.3

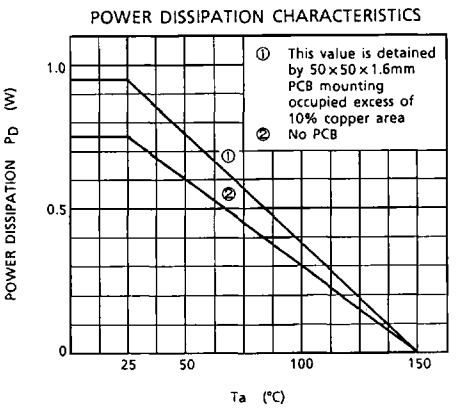


Fig.4

4. Receiver

As the receiver (1) the ceramic type (2) the low-impedance type (dynamic type) are available.

(1) Ceramic type

The receiver of equivalent capacity of about 55nF is assumed, In case of the ceramic type, since the large voltage amplitude is generally required at driving, make the receiver function in BTL mode.

(2) Low-impedance type

The receiver of equivalent resistance of about 150Ω is assumed.
For the connection, refer to the example of Fig.5.

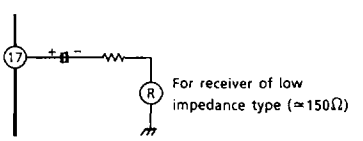
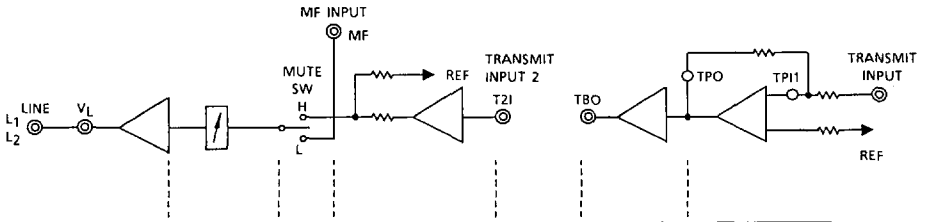


Fig.5

GAIN DISTRIBUTION

1. Transmit system gain distribution

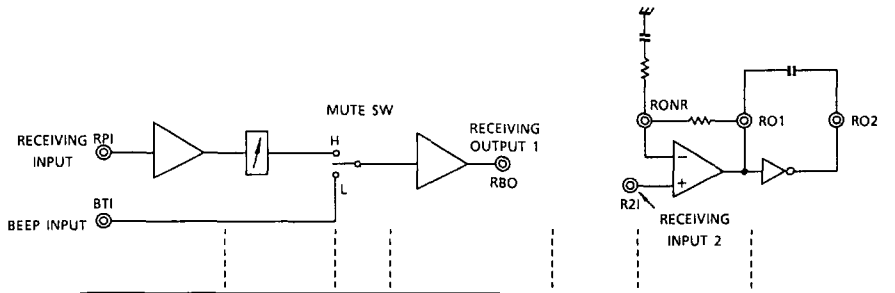


	LINE DRIVER AMP	TRANSMIT PAD	MUTE SW	TRANSMIT AMP 2
I_L = 20mA	36dB*	0dB	0dB	−7dB
I_L = 120mA		−4dB		

TRANSMIT AMP 1	TRANSMIT INPUT PRE-AMP
8dB	(20dB)

* At line 600Ω termination

2. Receiving system gain distribution



	RECEIVING INPUT AMP	RECEIVING PAD	MUTE SW	RECEIVING OUTPUT AMP
IL = 20mA	20dB	0dB	0dB	8dB
IL = 120mA		−6dB		

RECEIVING OUTPUT AMP 2	RECEIVING OUTPUT (INVERSION)
(20dB)	0dB
(26dB) at BTL	

Contents in ( ) can externally be varied.
The gain value is the one roughly determined.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Line Voltage	V_L	20	V
Line Current	I_L	150	mA
Power Dissipation	P_D	750 (*1)	mW
		950 (*2)	
Operating Temperature	T_{opr}	−20~60	°C
Storage Temperature	T_{stg}	−55~150	°C

(*1) No PCB

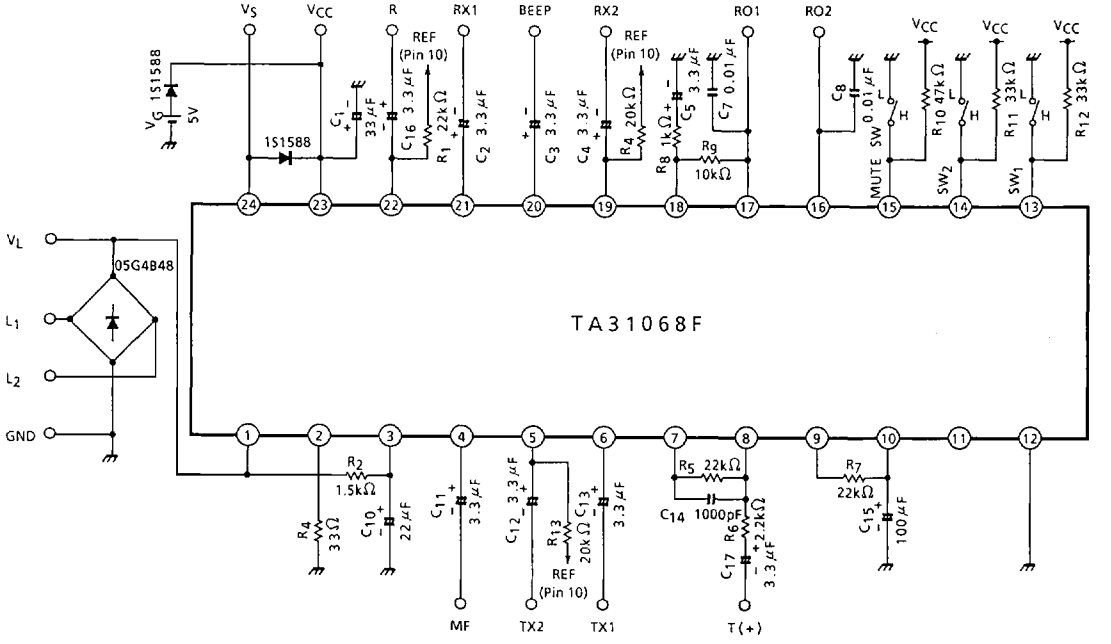
(*2) This value is detained by 50 × 50 × 1.6mm PCB mounting occupied in excess of 10% copper area.

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta = 25°C, f_{IN} = 1kHz, SW_1 : H, SW_2 : H, MUTE SW : H)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Line Voltage	V_L	1	I_L = 20mA	—	3.1	3.6	4.1	V
			I_L = 120mA		6.0	7.9	10.0	
VS Terminal Voltage	V_S	1	I_L = 20mA	I_{CO} = 2mA	2.5	—	—	V
			I_L = 120mA		2.8	—	—	
Transmit Gain 1 (T(+) IN-TX1 OUT)	G_{T1}	2	I_L = 20mA	V_{IN} = −55dBV	26	28	30	dB
			I_L = 120mA		26	28	30	
Transmit Gain 2 (TX2 IN-V_L OUT)	G_{T2}	3	I_L = 20mA	V_{IN} = −55dBV	26	29	32	dB
			I_L = 120mA	SW_1, SW_2 : L	23	26	29	
MF Gain	G_{MF}	4	I_L = 20mA	V_{IN} = −55dBV	34	36	38	dB
			I_L = 120mA	ALL SW : L	30	32	34	
Receiving Gain 1 (R IN-RX1 OUT)	G_{R1}	5	I_L = 20mA	V_{IN} = −55dBV	26.5	29	31.5	dB
			I_L = 120mA	SW_1, SW_2 : L	20.5	23	25.5	
Receiving Gain 2 (RX2 IN-RO2 OUT)	G_{R2}	6	I_L = 20mA	V_{IN} = −55dBV	18	20	22	dB
			I_L = 120mA	SW_1, MUTE SW : L	18	20	22	
BEEP Gain	G_{BP}	7	I_L = 20mA	V_{IN} = −50dBV	6	8	10	dB
			I_L = 120mA	ALL SW : L	6	8	10	
SW_1 Terminal Input Voltage	$V_{IH(S1)}$	—	I_L = 20~120mA		V_{CC} − 0.2	—	V_{CC}	V
	$V_{IL(S1)}$	—			0	—	0.2	
SW_2 Terminal Input Voltage	$V_{IH(S2)}$	—	I_L = 20~120mA		V_{CC} − 0.2	—	V_{CC}	V
	$V_{IL(S2)}$	—			0	—	0.2	

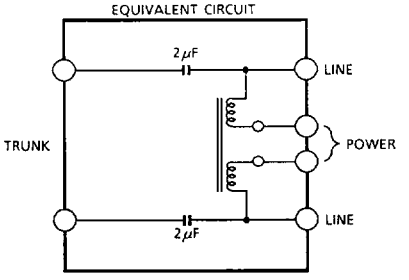
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
MUTE Terminal Input Voltage	V_{IH} (MU)	—	I_L = 20~120mA		V_{CC} − 0.2	—	V_{CC}	V
	V_{IL} (MU)	—			0	—	0.2	
Transmit Dynamic Range1 (TPI1 IN-TB0 OUT)	DR_{T1}	2	I_L = 20mA	THD = 4%,	—	1.8	—	V_{p-p}
			I_L = 120mA		—	1.8	—	
Transmit Dynamic Range2 (T2I IN-V_L OUT)	DR_{T2}	3	I_L = 20mA	THD = 4%, SW_1, SW_2 : L	—	4.3	—	V_{p-p}
			I_L = 120mA		—	6.1	—	
Receiving Dynamic Range1 (RPI IN-RB0 OUT)	DR_{R1}	5	I_L = 20mA	THD = 10%, SW_1, SW_2 : L	—	1.8	—	V_{p-p}
			I_L = 120mA		—	1.8	—	
Receiving Dynamic Range2 (R2I IN-RO2 OUT)	DR_{R2}	6	I_L = 20mA	THD = 10%, SW_1, MUTE SW : L	—	1.9	—	V_{p-p}
			I_L = 120mA		—	2.1	—	

TEST CIRCUIT

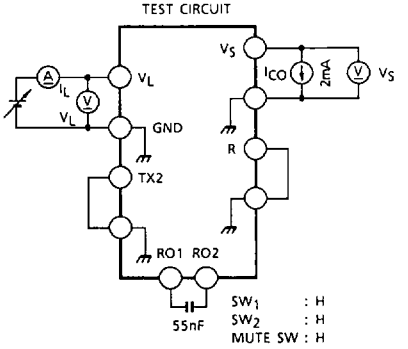


TEST CIRCUIT

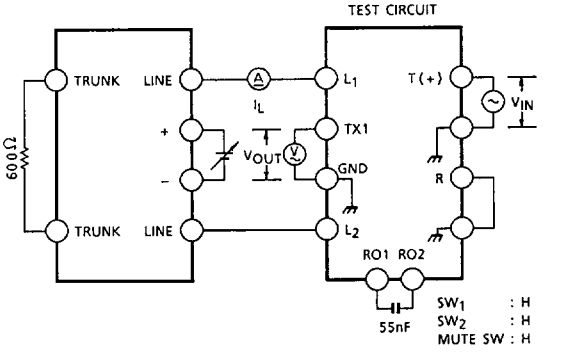
TELEPHONE LINE SIMULATION EQUIVALENT CIRCUIT



(1) V_L, V_S

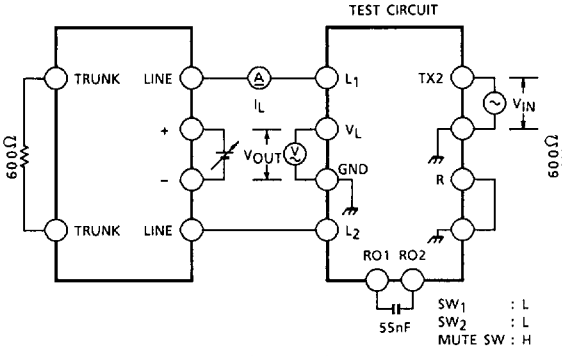


(2) G_{T1}, DR_{T1}



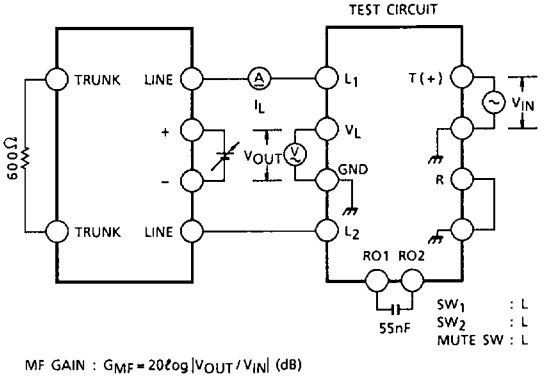
TRANSMIT GAIN 1 : $G_{T1} = 20\log |V_{OUT} / V_{IN}|$ (dB)
TRANSMIT DYNAMIC RANGE 1 : $D_{RT1} = V_{OUT}$ (V_{p-p}) (at V_{OUT} : DIST = 4%)

(3) G_{T2}, DR_{T2}



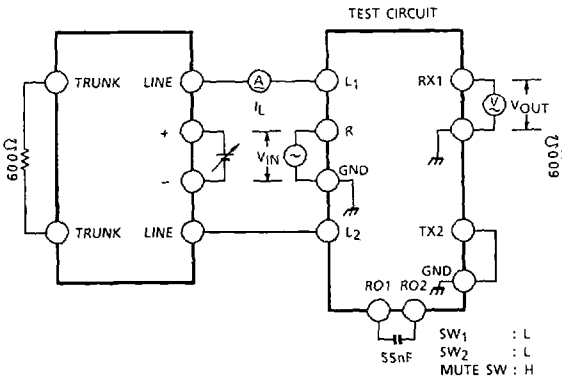
TRANSMIT GAIN 2 : $G_{T2} = 20\log |V_{OUT} / V_{IN}|$ (dB)
TRANSMIT DYNAMIC RANGE 2 : $D_{RT2} = V_{OUT}$ (V_{p-p}) (at V_{OUT} : DIST = 4%)

(4) G_{MF}



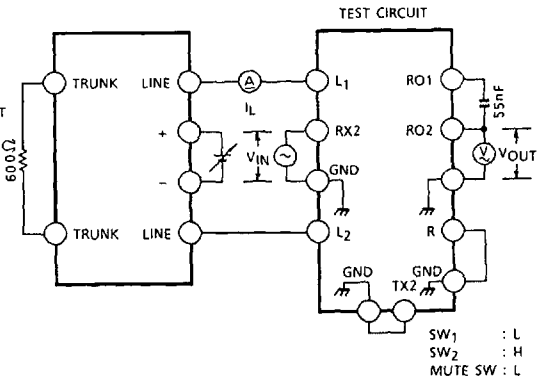
MF GAIN : $G_{MF} = 20\log |V_{OUT} / V_{IN}|$ (dB)

(5) G_{R1}, DR_{R1}



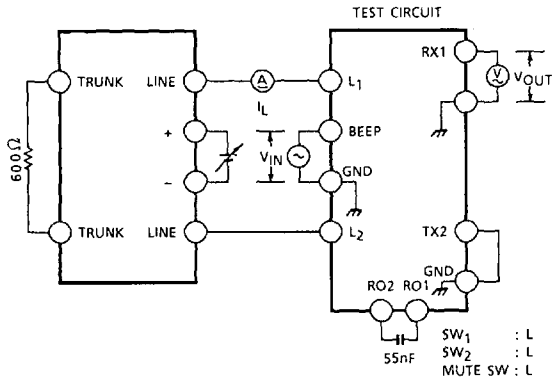
RECEIVING GAIN 1 : $G_{R1} = 20\log|V_{OUT}/V_{IN}|$ (dB)
RECEIVING DYNAMIC RANGE 1 : $D_{RR1} = V_{OUT}$ (V_{p-p}) (at V_{OUT} : DIST = 10%)

(6) G_{R2}, DR_{R2}



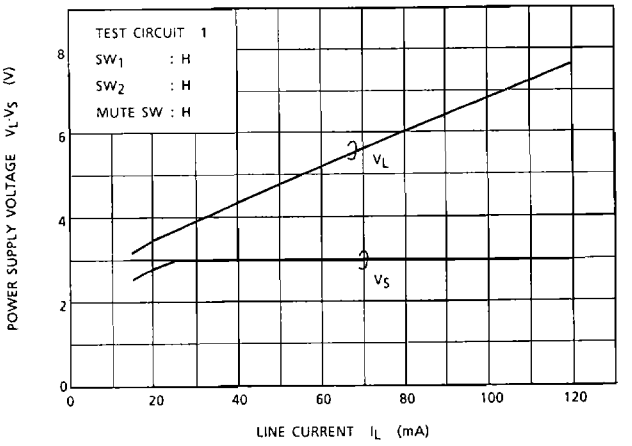
RECEIVING GAIN 2 : $G_{R2} = 20\log|V_{OUT}/V_{IN}|$ (dB)
RECEIVING DYNAMIC RANGE 2 : $D_{RR2} = V_{OUT}$ (V_{p-p}) (at V_{OUT} : DIST = 10%)

(7) G_{BP}

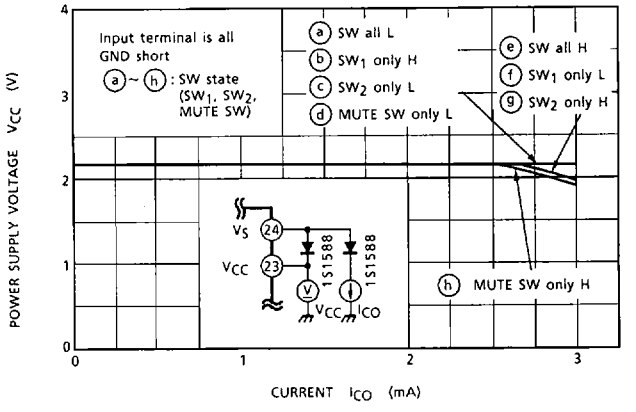


BEEP GAIN : $G_{BP} = 20\log|V_{OUT}/V_{IN}|$ (dB)

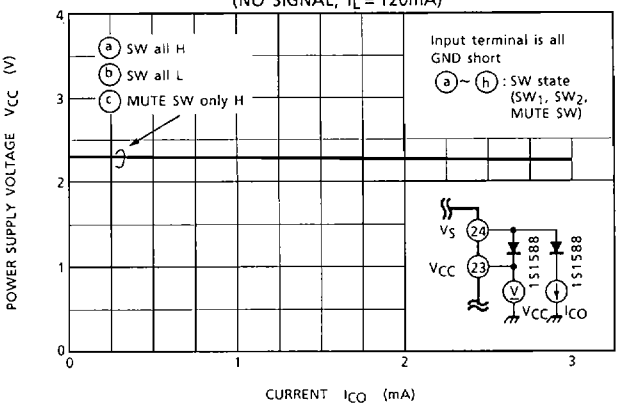
DC CHARACTERISTICS



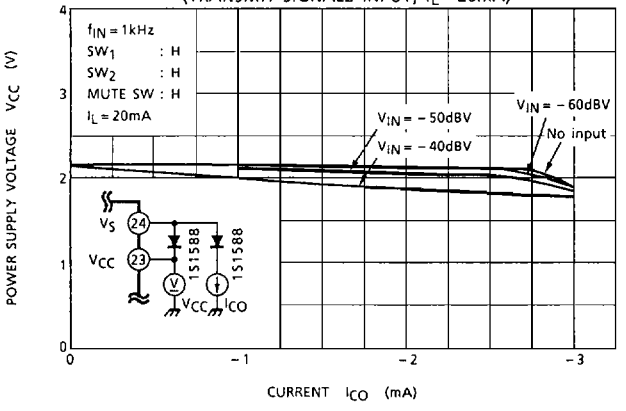
VCC SUPPLY CURRENT CHARACTERISTICS (1)
(NO SIGNAL, I_L = 20mA)



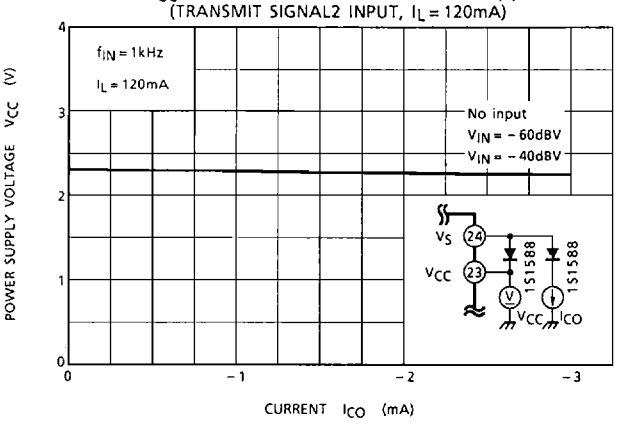
V_{CC} SUPPLY CURRENT CHARACTERISTICS (2)
(NO SIGNAL, I_L = 120mA)



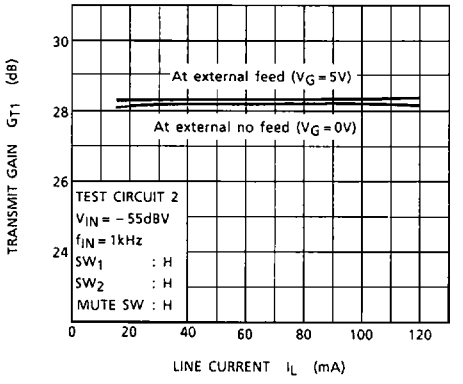
V_{CC} SUPPLY CURRENT CHARACTERISTICS (3)
(TRANSMIT SIGNAL2 INPUT, I_L = 20mA)



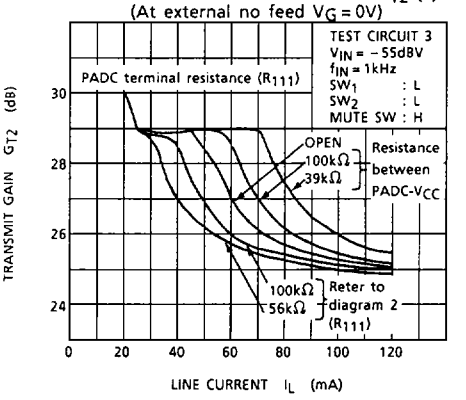
V_{CC} SUPPLY CURRENT CHARACTERISTICS (4)
(TRANSMIT SIGNAL2 INPUT, I_L = 120mA)



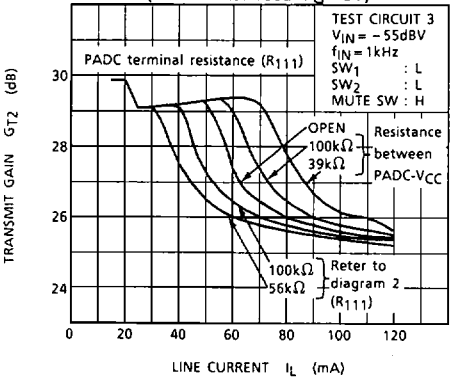
TRANSMIT GAIN CHARACTERISTICS G_{T1}



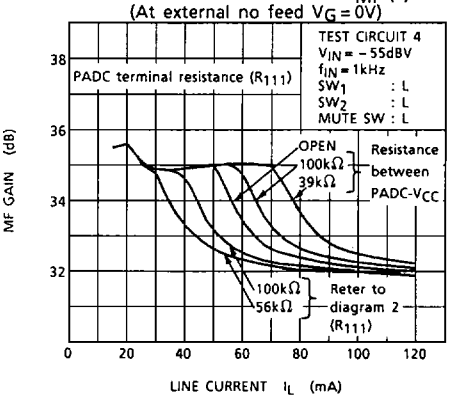
TRANSMIT GAIN CHARACTERISTICS G_{T2} (a)
(At external no feed V_G = 0V)



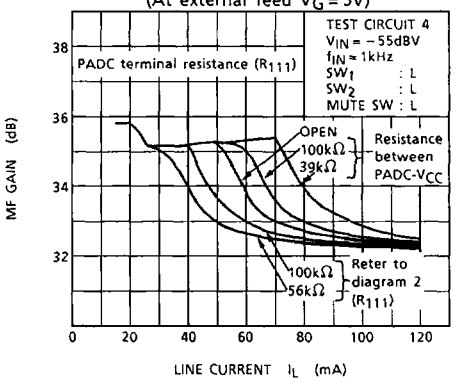
TRANSMIT GAIN CHARACTERISTICS G_{T2} (b)
(At external feed V_G = 5V)



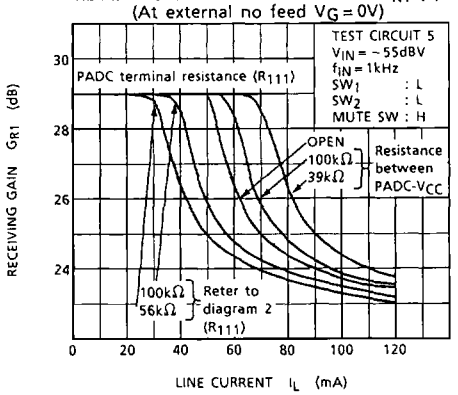
MF GAIN CHARACTERISTICS G_{MF} (a)
(At external no feed V_G = 0V)



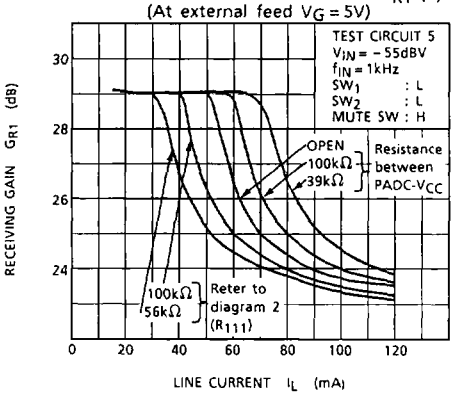
MF GAIN CHARACTERISTICS G_{MF} (b)
(At external feed $V_G = 5V$)



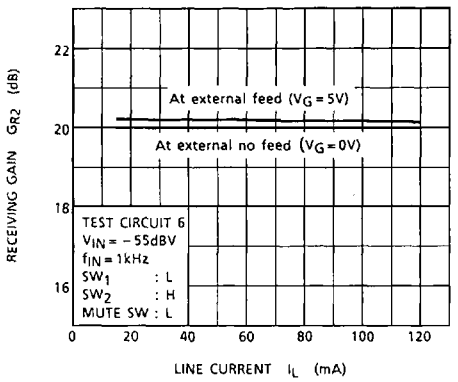
RECEIVING GAIN CHARACTERISTICS G_{R1} (a)
(At external no feed $V_G = 0V$)



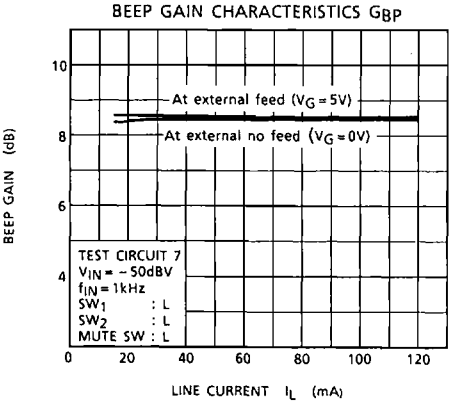
RECEIVING GAIN CHARACTERISTICS G_{R1} (b)
(At external feed $V_G = 5V$)



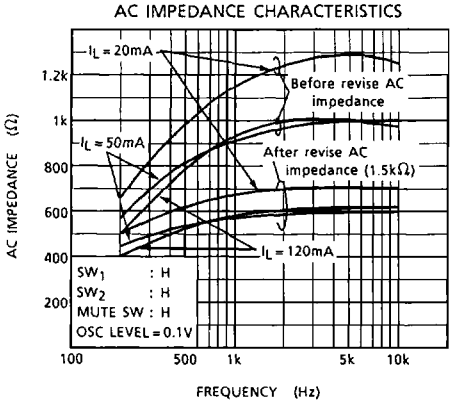
RECEIVING GAIN CHARACTERISTICS G_{R2}



BEEP GAIN CHARACTERISTICS G_{BP}



AC IMPEDANCE CHARACTERISTICS



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EXAMPLE OF APPLICATION CIRCUIT