HA16821P/HA16821MP/HA16821F

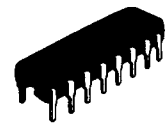
Speech Network IC for Telephone Sets

The HA16821 realizes an excellent branching performance by achieving low current dissipation and low voltage operation as speech network IC. It is possible to send DTMF signal or backtone to line or receiver. Moreover there are three kinds of package.

Features

- Low current dissipation, low voltage operation. (5 mA, 1.8 V)
- Possible of direct interface to light, low impedance receiver.
- Possible of auto gain control cope with line current. (AGC)
- DTMF signal can be send to line and backtone can be send to receiver.
- Built in regulator to bias of small ceramic transmitter.

HA16821P



DP-16

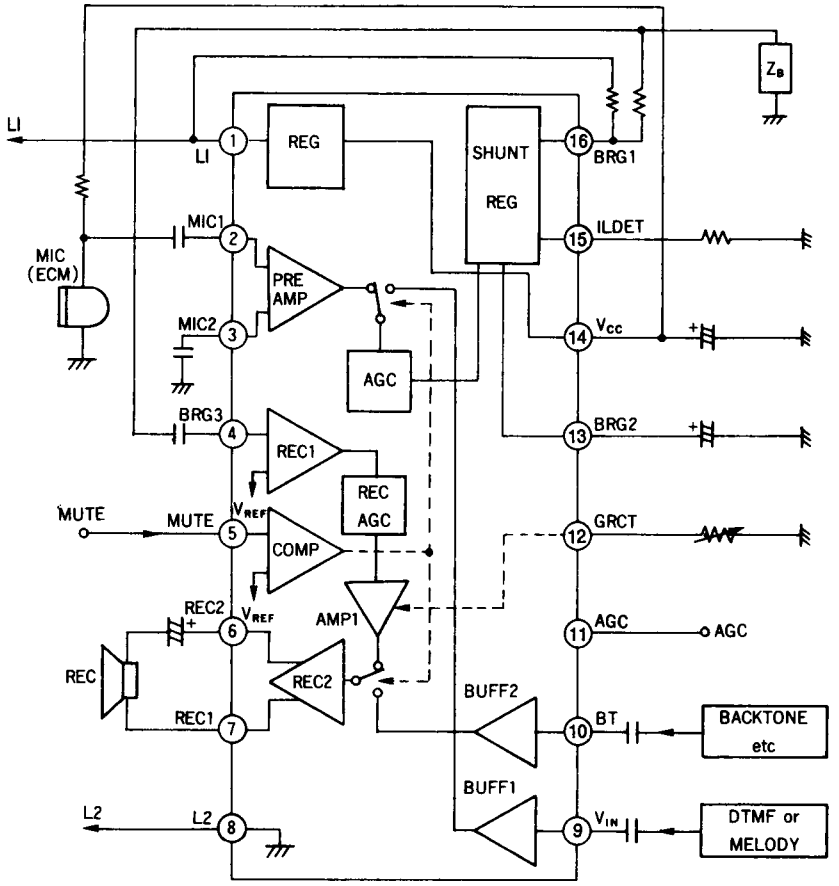
HA16821MP

MP-18

HA16821F

FP-20DN

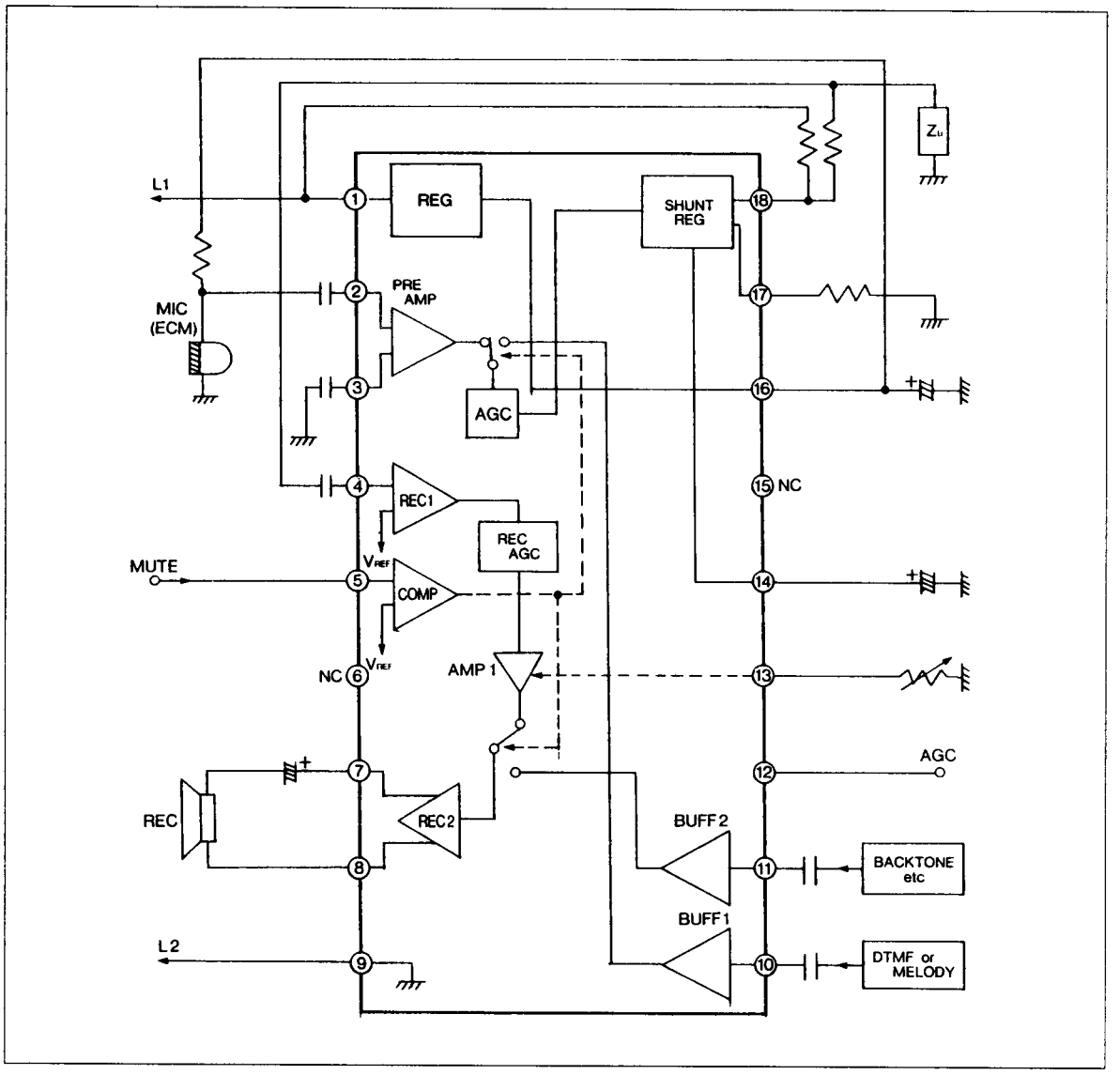
Block Diagram (HA16821P)



Pin Description (HA16821P)

Pin No.	Symbol	Pin Description	
1	LI	Line Input	Connect with plus-output of diode bridge circuit.
2	MIC1	Mike Input	This pin is a signal-input pin from mike. Input impedance is 30 kΩ typ.
3	MIC2	Mike Input	This pin is input of mike pre-amplifier. Input impedance is 30 kΩ typ. To suppress oscillation, connect capacitor.
4	BRG3	Receiver Input	This pin is input of receiver pre-amplifier. Adjust balancing network Z_B to restrain from sidetone.
5	MUTE	MUTE	This IC becomes DTMF/HOLD mode when voltage of this pin is over 1.4 V.
6	REC2	Receiver Output	Connect to dynamic receiver.
7	REC1	Receiver Output	Connect to dynamic receiver.
8	L2	Line (GND)	Connect with minus-output of diode bridge circuit.
9	VIN	DTMF/HOLD Signal Input	The signal entered to this pin is send to line when voltage of this pin is over 1.4 V.
10	BT	Backtone Input	The signal entered to this pin is send to receiver when voltage of this pin is over 1.4 V.
11	AGC	AGC	When this pin is connected with pin ⑬, sending, receiver gain and sending gain of DTMF/HOLD are automatically adjusted to forward line current. And gain is fixed when voltage of this pin is constant.
12	GRCT	Receiver Gain Control	As resistance connected with this pin is smaller, receiver gain is larger.
13	BRG2	Line Voltage Detection	Voltage of this is proportional to line voltage.
14	Vcc	Reference	Connect with ceramic mike via a resistance.
15	ILDET	Line Current Detection	Current proportional to line current through this pin. So, power dissipation of resistance is needed over 1/2 W.
16	BRG1	Shunt Input	This pin is connected to L1 through resistance. Power dissipation of this resistance is needed over 1/2 W.

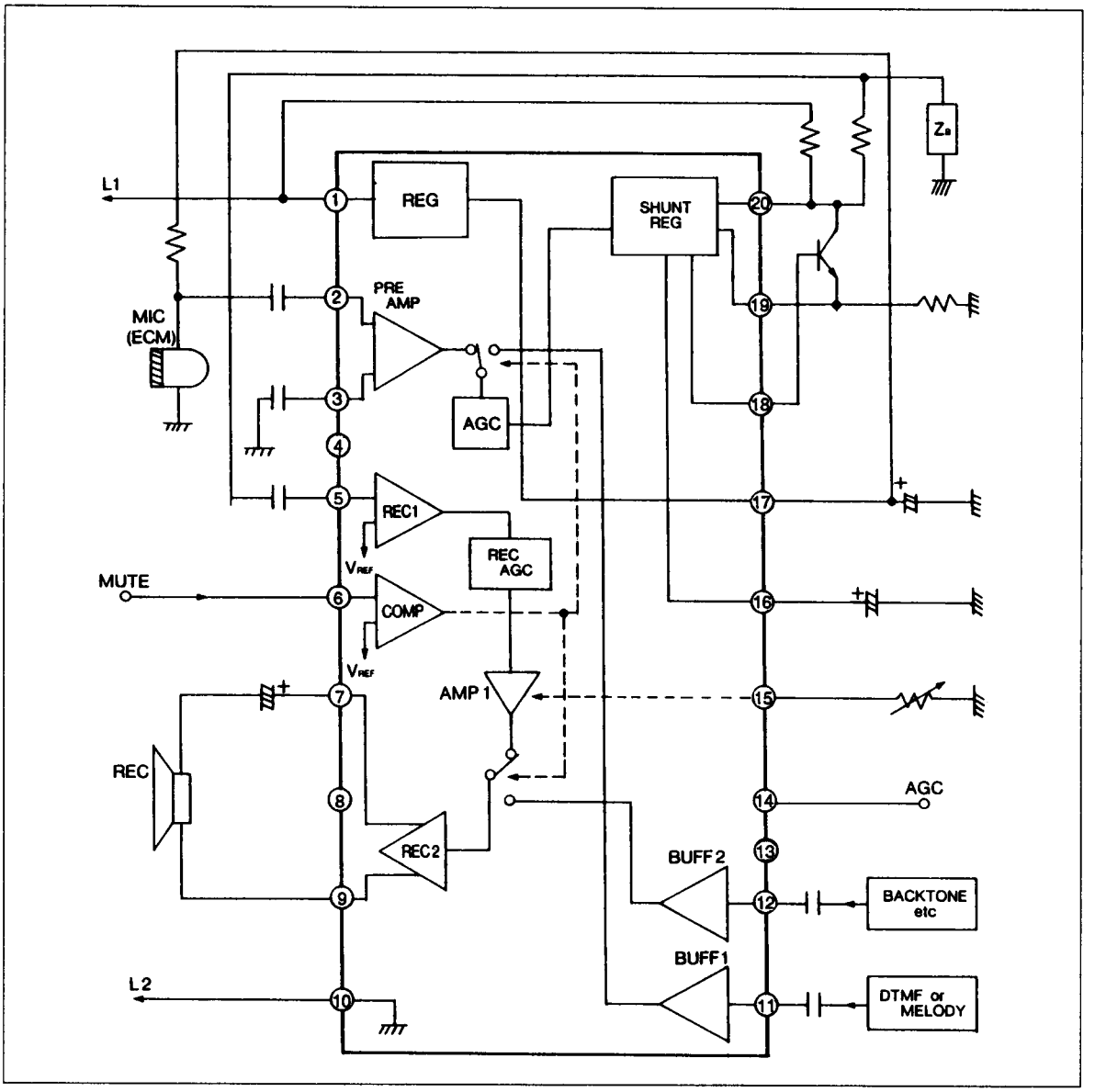
Block Diagram (HA16821MP)



Pin Description (HA16821MP)

Pin No.	Symbol	Pin Description	
1	LI	Line Input	Connect with plus-output of diode bridge circuit.
2	MIC1	Mike Input	This pin is a signal-input pin from mike. Input impedance is 30 kΩ typ.
3	MIC2	Mike Input	This pin is input of mike pre-amplifier. Input impedance is 30 kΩ typ. To suppress oscillation, connect capacitor.
4	BRG3	Receiver Input	This pin is input of receiver pre-amplifier. Adjust balancing network Z_B to restrain from sidetone.
5	MUTE	MUTE	This IC becomes DTMF/HOLD mode when voltage of this pin is over 1.4 V.
6	NC	NC	No connect
7	REC2	Receiver Output	Connect to dynamic receiver.
8	REC1	Receiver Output	Connect to dynamic receiver.
9	L2	Line (GND)	Connect with minus-output of diode bridge circuit.
10	VIN	DTMF/HOLD Signal Input	The signal entered to this pin is send to line when voltage of this pin is over 1.4 V.
11	BT	Backtone Input	The signal entered to this pin is send to receiver when voltage of this pin is over 1.4 V.
12	AGC	AGC	When this pin is connected with pin ⑭, sending, receiver gain and sending gain of DTMF/HOLD are automatically adjusted to forward line current. And gain is fixed when voltage of this pin is constant.
13	GRCT	Receiver Gain Control	As resistance connected with this pin is smaller, receiver gain is larger.
14	BRG2	Line Voltage Detection	Voltage of this is proportional to line voltage.
15	NC	NC	No connect
16	Vcc	Reference	Connect with ceramic mike via a resistance.
17	ILDET	Line Current Detection	Current proportional to line current through this pin. So, power dissipation of resistance is needed over 1/2 W.
18	BRG1	Shunt Input	This pin is connected to L1 through resistance. Power dissipation of this resistance is needed over 1/2 W.

Block Diagram (HA16821F)



Pin Description (HA16821F)

Pin No.	Symbol	Pin Description	
1	LI	Line Input	Connect with plus-output of diode bridge circuit.
2	MIC1	Mike Input	This pin is a signal-input pin from mike. Input impedance is 30 kΩ typ.
3	MIC2	Mike Input	This pin is input of mike pre-amplifier. Input impedance is 30 kΩ typ. To suppress oscillation, connect capacitor.
4	NC	NC	No connect
5	BRG3	Receiver Input	This pin is input of receiver pre-amplifier. Adjust balancing network Z_B to restrain from sidetone.
6	MUTE	MUTE	This IC becomes DTMF/HOLD mode when voltage of this pin is over 1.4 V.
7	REC2	Receiver Output	Connect to dynamic receiver.
8	NC	NC	No connect
9	REC1	Receiver Output	Connect to dynamic receiver.
10	L2	Line (GND)	Connect with minus-output of diode bridge circuit.
11	VIN	DTMF/HOLD Signal Input	The signal entered to this pin is send to line when voltage of this pin is over 1.4 V.
12	BT	Backtone Input	The signal entered to this pin is send to receiver when voltage of this pin is over 1.4 V.
13	NC	NC	No connect
14	AGC	AGC	When this pin is connected with pin ⑯, sending, receiver gain and sending gain of DTMF/HOLD are automatically adjusted to forward line current. And gain is fixed when voltage of this pin is constant.
15	GRCT	Receiver Gain Control	As resistance connected with this pin is smaller, receiver gain is larger.
16	BRG2	Line Voltage Detection	Voltage of this is proportional to line voltage.
17	Vcc	Reference	Connect with ceramic mike via a resistance.
18	SHTRS	Shunt Output	This is connected to base of external transistor. Almost of line current flow through this transistor.
19	ILDET	Line Current Detection	Current proportional to line current through this pin. So, power dissipation of resistance is needed over 1/2 W.
20	BRG1	Shunt Input	This pin is connected to L1 through resistance. Power dissipation of this resistance is needed over 1/2 W.

Function Description

DTMD/HOLD Interface:

The DTMF/HOLD sending mode is activated when pin ⑤ (F: ⑥)becomes 1.4 V or more (threshold is 1.2 V typ.). In this mode, the sending and receiving input amp. are off and the buffer amp. 1, 2 are on and the DTMF/HOLD signal is sent out the line.

The DTMF/HOLD signal is input to pin ⑨ (MP: ⑩/ F: ⑪).

However, since it has a bias of about 1 V, and AC couple (Cex8) is required.

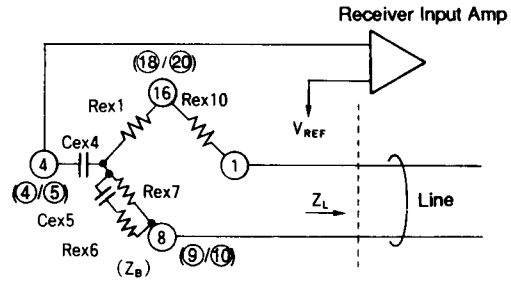
Input level of from 50 to 70mVrms is appropriate since the sending gain is a little over 20 dB. When DTMF/HOLD signal is input to pin ⑩ (⑪/⑫), backtone is generated from receiver.

Sidetone Suppression Circuit:

Sidetone suppression circuit is constructed with bridge-type resistance. To suppress sidetone Z_B is adjusted by the following equation in response to line impedance Z_L.

$$\frac{Rex1}{Rex10} = \frac{Z_B}{Z_L}$$

Receive gain is increased by increasing resistance while maintaining a Rex1/Rex10 ratio. For example, when Rex1/rRex10 = 330Ω/30Ω, receiver gain is increased by about 6 dB over that when Rex1/Rex10 = 110Ω/10Ω.

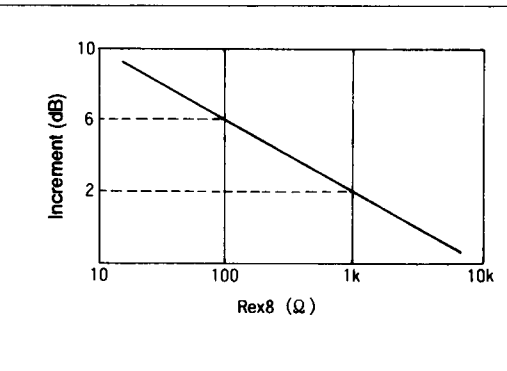


Number inside ( ) is a number for MP/F.

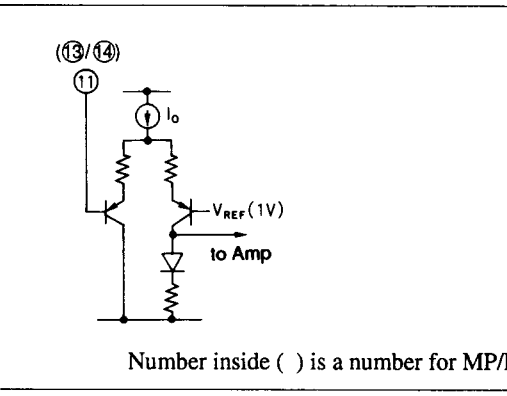
Receiving Gain Variable:

Receiving gain is increased by lowing Rex8.

For example, when Rex8 = 100Ω, receiving gain is increased by about 6 dB over that when pin ⑫ (⑬/⑮) is open. In some modes receiving gain adjust-function is automatically set to off.



Mode	Speech	Dialing (DTMF Sending)
Receiver Amp.	On	Off



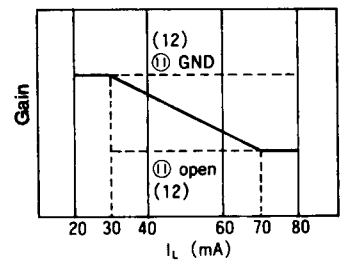
Number inside ( ) is a number for MP/F.

AGC Characteristics (line Compensation):

By connecting pin ⑪ (⑫/⑭) and ⑬ (⑭/⑯) sending and receiving gain, DTMF and melody sending gain are automatically adjust to coincide with line current.

The gain fixed mode is set by disconnecting pin ⑬ (⑭/⑯) and applying a constant voltage to pin ⑪ (⑫/⑭).

High gain fixed when 0V ≤ V ⑪ (⑫/⑭) ≤ 0.3 V, low gain fixed when V ⑪ (⑫/⑭) = V① or open. Gain changes when I_L is from 30 mA to 70 mA.



Number inside ( ) is a number for MP/F.

Line current Detection:

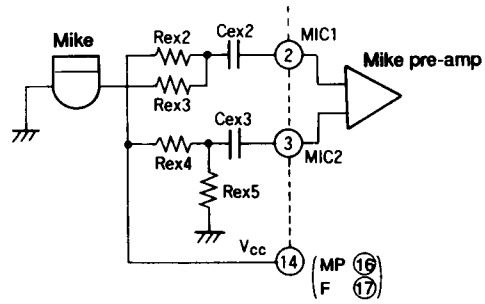
Line current is detected by Rex9 of pin ⑮ (⑰/⑲).

The voltage of pin ⑬ (⑭/⑯) is V ⑬ (⑭/⑯) = V ⑮ (⑰/⑲) +0.3 V.

The line matching impedance is proportional to the Rex9. $Z_{IN} \propto$ Rex9.

Mike Bias:

Mike bias is provided for capacitor mike. Pin ⑭ (MP: ⑯, F: ⑰) Vcc is used for mike bias source. This Vcc is 1.8 V typ. and the Rex2, 3, 4, 5 of which is determined by the type of mike used. This signal from the mike is input to mike pre-amplifier through Cex2.



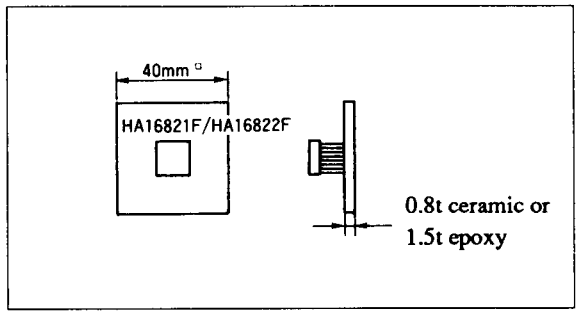
Number inside ( ) is a number for MP/F.

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings			Unit	Notes
		HA16821P	HA16821MP	HA16821F		
Supply Voltage	V_L	15	15	15	V	1
Supply Current	I_L	120	120	120	mA	
Operating Temperature Range	Topr	–20 to +70	–20 to +70	–20 to +70	°C	
Storage Temperature Range	Tstg	–55 to +125	–55 to +125	–55 to +125	°C	
Power Dissipation	P_T	720	720	390	mW	2

Note 1) 3ms Pulse duration (Keep the duration to be more than 3 sec.)

Note 2) Value at Ta ≤ 70°C, when Ta is more than 70°C, 7.14 mW/°C derating shall be performed. (Condition: glass epoxy with 30% metallization density)

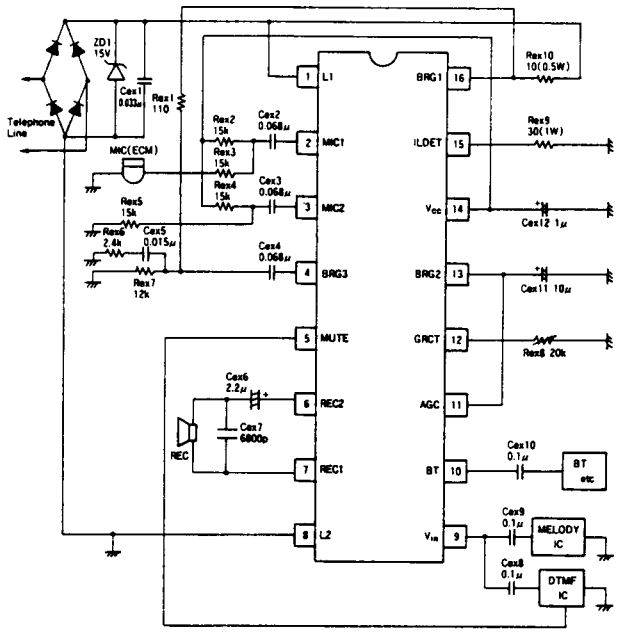


Electrical Characteristics (Ta = 25°C)

Item		Symbol	Test Conditions I_L mA		Min	Typ	Max	Unit
Line Voltage	Speaking	V_L	20		2.5	2.85	3.3	V
			80		5.6	6.8	8.0	V
	Dialing		20		3.6	4.0	4.4	V
			80		6.8	8.0	9.2	V
Reference	Voltage	V_{DD}	20		1.6	1.8	2.0	V
	Current	I_{DD}	20	V_{DD} = 1.6 V	0.15	0.3		mA
Mute Current	Stand-by	I_M	20	V = 0.9 V	–5	0	5	μA
	Mute		20	V = 1.5 V		1	10	μA
Mute	Stand-by	V_{TH}	20				0.9	V
threshold	Mute		20		1.4			V
V_{IN} Input Impedance		Z_{VIN}	20		20k	30k		Ω
BT Input Impedance		Z_{BT}	20		20k	30k		Ω
MIC Input Impedance		Z_{MIC}	20		20k	30k		Ω
Line Matching Impedance		Z_{IN}	20	f = 1 kHz	480	600	720	Ω
			80		480	600	720	Ω
Sending Gain		G_T	30	f = 1 kHz	38	41	44	dB
			80		32	35	38	dB
Receiving Gain		G_R	30	f = 1 kHz	–7	–4	–1	dB
			80		–12	–9	–6	dB
DTMF/HOLD Sending Gain		G_{MF}	30	f = 1 kHz	21	24	27	dB
			80		18	21	24	dB
BT Sending Gain		G_{BT}	30	f = 1 kHz	–15	–11.5	–8	dB
			80		–15	–11.5	–8	dB
Sending Dynamic Range*		DR_T	30	f = 1 kHz	2.4			Vp-p
			80		3.5			Vp-p
Receiving Dynamic Range*		DR_R	30	f = 1 kHz	0.6			Vp-p
			80		0.7			Vp-p
DTMF/HOLD Dynamic		DR_{MF}	30	f = 1 kHz	2.5			Vp-p
Range*			80		3			Vp-p

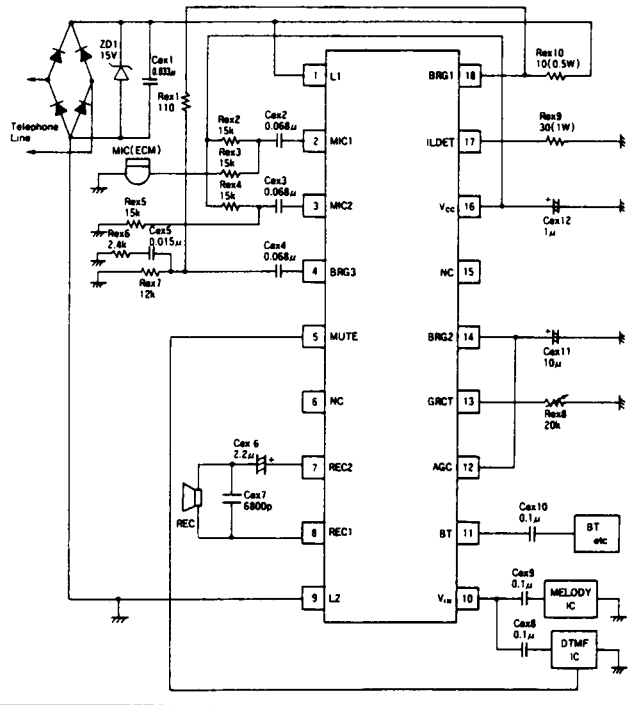
* Distortion ratio : 5%

Pin Arrangement and Application Circuit (HA16821P)



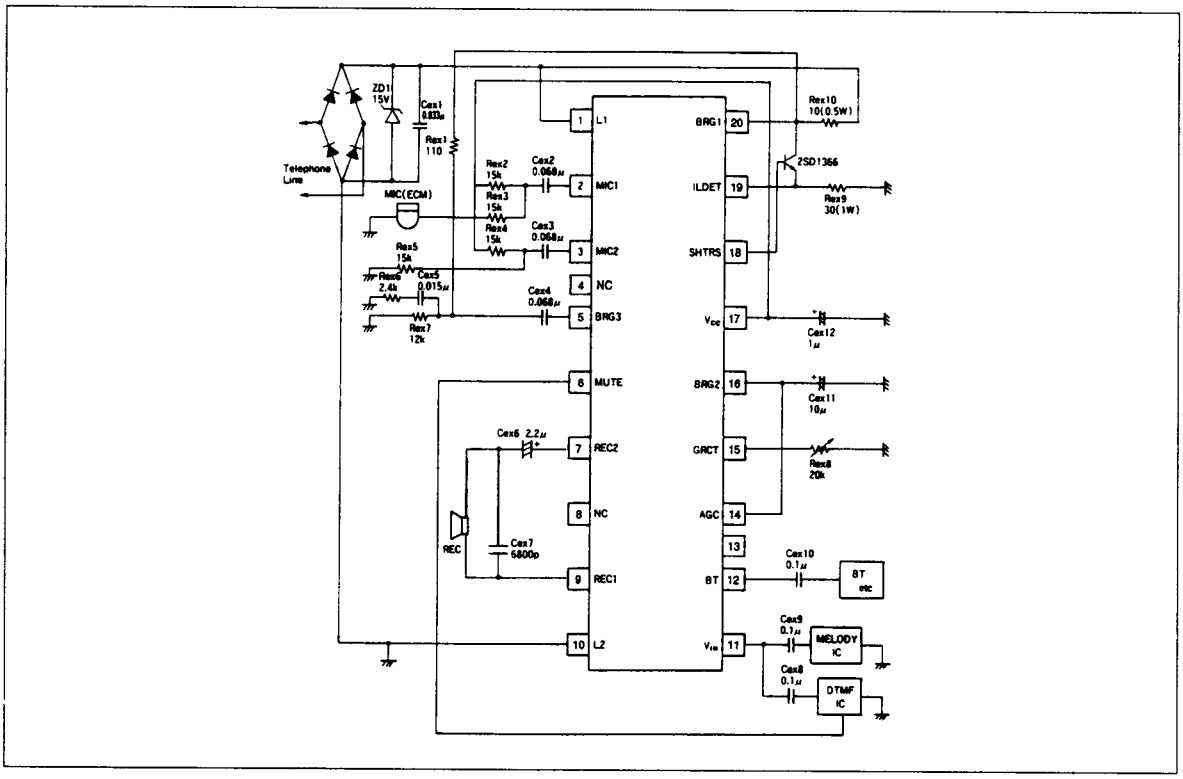
Note 1) Externalized components are example.
Unit: R; Ω, C; F

Pin Arrangement and Application Circuit (HA16821MP)



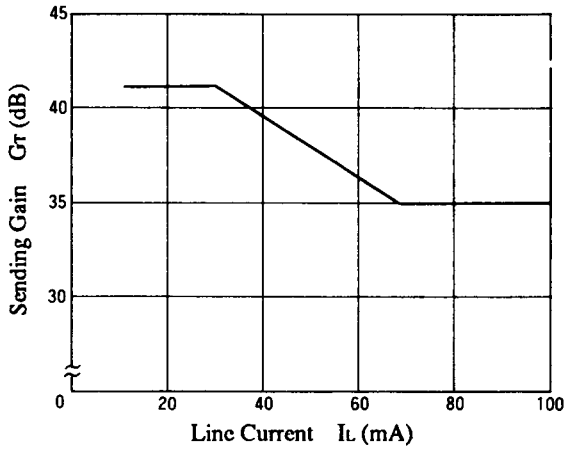
Note 1) Externalized components are example.
Unit : R; Ω, C; F

Pin Arrangement and Application Circuit (HA16821F)

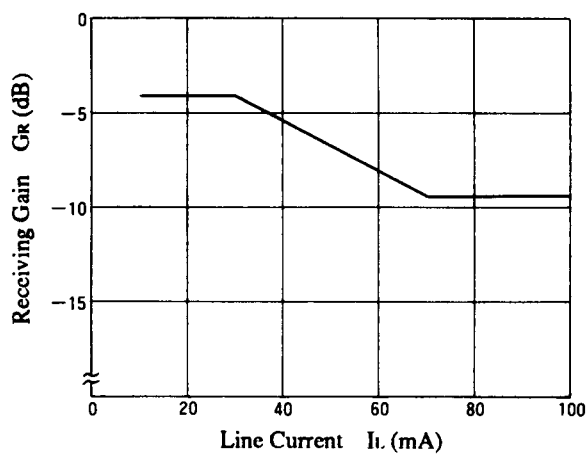


Note 1) Externalized components are example.
Unit: R; Ω, C; F

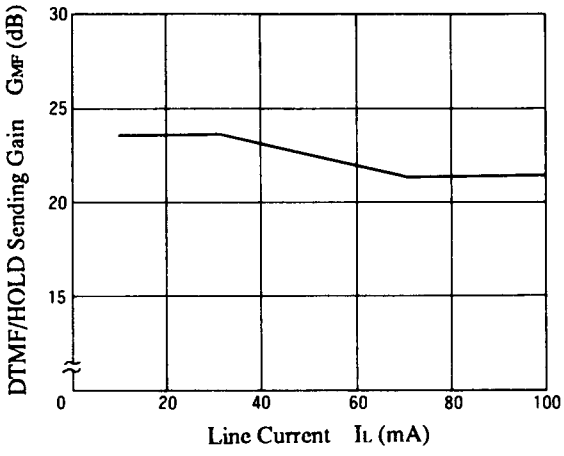
Sending Gain vs. Line Current



Receiving Gain vs. Line Current



DTMF/HOLD Sending Gain vs. Line Current



Line Voltage vs. Line Current