

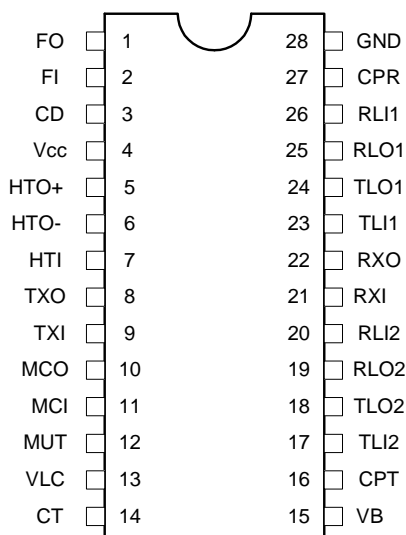
## Voice Switched Speakerphone Circuit BL34118

The BL34118 Voice Switched Speakerphone Circuit incorporates the necessary amplifiers, attenuators, level detectors, and control algorithm to form the heart of a high quality hands-free speakerphone system. Included are a microphone amplifier with adjustable gain and MUTE control, Transmit and Receive attenuators which operate in a complementary manner, level detectors at both input and output of both attenuators, and background noise monitors for both the transmit and receive channels. A Dial Tone Detector prevents the dial tone from being attenuated by the Receive background noise monitor circuit. Also included are two line driver amplifiers, which can be used to form a hybrid network in conjunction with an external coupling transformer. A high-pass filter can be used to filter out 60Hz noise in the receive channel, or for other functions. A chip Disable pin permits powering down the entire circuit to conserve power on long loops where loop current is at a minimum.

The BL34118 may be operated from a power supply, or it can be powered from the telephone line, requiring typically 5.0 mA. The BL34118 can be interfaced directly to Tip and Ring (through a coupling transformer) for stand-alone operation, or it can be used in conjunction with a handset speech network and/or other features of a feature phone.

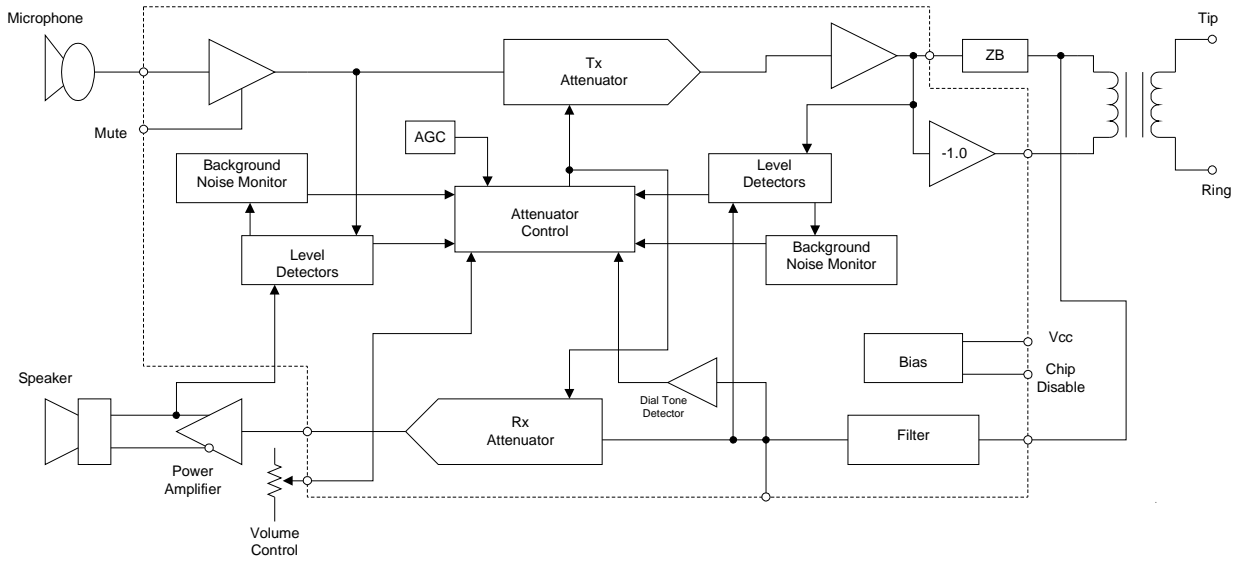
- Improved Attenuator Gain Range: 52 dB Between Transmit and Receive
- Low Voltage Operation for Line-Powered Applications (3.0 – 6.5V)
- 4-Point Signal Sensing for Improved Sensitivity
- Background Noise Monitors for Both Transmit and Receive Paths
- Microphone Amplifier Gain Set by External Resistors – Mute Function Included
- Chip Disable for Active/Standby Operation
- On Board Filter Pinned-Out for User Defined Function
- Dial Tone Detector to Inhibit Receive Idle Mode During Dial Tone Presence
- Standard 28-Pin Plastic DIP Package and SOIC Package Available
- Compatible with BL34119 Speaker Amplifier

### PIN CONNECTIONS( Top View )



**PIN DESCRIPTION**

Pin	Name	Description
1	FO	Filter output. Output impedance is less than 50 ohms.
2	FI	Filter input. Input impedance is greater than 1.0 Mohm.
3	CD	Chip Disable. A logic low (<0.8V) sets normal operation. A logic high (>2.0V) disables the IC to conserve power. Input impedance is nominally 90 kΩ.
4	VCC	A supply voltage of +2.8 to +6.5 volts is required, at $\approx 5.0$ mA. As Vcc falls from 3.5 to 2.8 volts, an AGC circuit reduces the receive attenuator gain by $\approx 25$ db (when in the receive mode).
5	HTO+	Output of the second hybrid amplifier. The gain is internally set at -1.0 to provide a differential output, in conjunction with HTO-, to the hybrid transformer.
6	HTO-	Output of the first hybrid amplifier. The gain of the amp is set by external resistors.
7	HTI	Input and summing node for the first hybrid amplifier. DC level is $\approx VB$ .
8	TXO	Output of the transmit attenuator. DC level is approximately VB.
9	TXI	Input to the transmit attenuator. Max. signal level is 350 mVrms. Input impedance is $\approx 10$ kΩ.
10	MCO	Output of the microphone amplifier. The gain of the amplifier is set by external resistors.
11	MCI	Input and summing node of the microphone amplifier. DC level is $\approx VB$ .
12	MUT	Mute input. A logic low (<0.8V) sets normal operation. A logic high (>2.0V) mutes the microphone amplifier without affecting the rest of the circuit. Input impedance is nominally 90 kΩ.
13	VLC	Volume control input. When VLC = VB, the receive attenuator is at maximum gain when in the receive mode. When VLC = 0.3VB, the receive gain is down 35 dB. Does not affect the transmit mode.
14	CT	An RC at this pin sets the response time for the circuit to switch modes.
15	VB	An output voltage $\approx Vcc/2$ . This voltage is a system as ground, and biases the volume control. A filter cap is required.
16	CPT	An RC at this pin sets the time constant for the transmit background monitor.
17	TLI2	Input to the transmit level detector on the mike/speaker side.
18	TLO2	Output of the transmit level detector on the mike/speaker side, and input to the transmit background monitor.
19	RLO2	Output of the receive level detector on the mike/speaker side.
20	RLI2	Input to the receive level detector on the mike/speaker side.
21	RXI	Input to the receive attenuator and dial tone detector. Max input level is 350 mVrms. Input impedance is $\approx 10$ kΩ.
22	RXO	Output of the receive attenuator. DC level is approximately VB.
23	TLI1	Input to the transmit level detector on the line side.
24	TLO1	Output of the transmit level detector on the line side.
25	RLO1	Output of the receive level detector on the line side, and input to the receive background monitor.
26	RLI1	Input to the receive level detector on the line side.
27	CPR	An RC at this pin sets the time constant for the receive background monitor.
28	GND	Ground pin for the entire IC.

**BLOCK DIAGRAM**

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Value	Units
Supply Voltage (Pin 4)	-1.0, +7.0	Vdc
Voltage at CD (Pin 3), MUT (Pin 12)	-1.0, Vcc + 1.0	Vdc
Voltage at VLC (Pin 13)	-1.0, Vcc + 0.5	Vdc
Voltage at TXI (Pin 9), RXI (Pin 21), FI (Pin 2)	-0.5, Vcc + 0.5	Vdc
Storage Temperature Range	-65 to +150	°C

**RECOMMENDED OPERATING LIMITS**

Parameter	Min	Typ	Max	Units
Supply Voltage (Pin 4)	3.5	-	6.5	Vdc
CD Input (Pin 3), MUT Input (Pin 12)	0	-	Vcc	Vdc
IVB (Pin 13)	-	-	500	μA
VLC (Pin 13)	0.3xVB	-	VB	Vdc
Attenuator Input Signal Voltage (Pins 9, 21)	0	-	350	mVrms
Microphone Amplifier, Hybrid Amplifier Gain	0	-	40	dB
Load Current @ RXO, TXO (Pins 8, 22)	0	-	± 2.0	mA
@ MCO (Pin 10)	0	-	± 1.0	
@ HTO-, HTO+ (Pins 6, 5)	0	-	± 5.0	
Ambient Operating Temperature Range	-20	-	+60	°C

**ELECTRICAL CHARACTERISTICS** ( $T_A=+25^{\circ}\text{C}$ ,  $V_{CC}=5.0\text{V}$ ,  $C_D \leq 0.8\text{V}$ , unless noted)

Parameter	Symbol	Min	Typ	Max	Units
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**Power Supply**

Vcc Supply Current ( $V_{CC}=6.5\text{V}$ , $C_D=0.8\text{V}$ )	$I_{CC}$	-	5.5	8.0	mA
( $V_{CC}=6.5\text{V}$ , $C_D=2.0\text{V}$ )		-	600	800	$\mu\text{A}$
CD Input Resistance ( $V_{CC}=V_{CD}=6.5\text{V}$ )	RCD	50	90	-	$\text{k}\Omega$
CD Input Voltage – High	VCDH	2.0	-	$V_{CC}$	Vdc
– Low	VCDL	0	-	0.8	Vdc
VB Output Voltage ( $V_{CC}=3.5\text{V}$ )	VB	-	1.3	-	Vdc
( $V_{CC}=5.0\text{V}$ )		1.8	2.1	2.4	
VB Output Resistance ( $I_{VB}=1.0\text{mA}$ )	ROVB	-	400	-	$\Omega$
VB Power Supply Rejection Ratio ( $C_{VB}=220\mu\text{F}$ , $f=1.0\text{kHz}$ )	PSRR	-	54	-	dB

**ATTENUATORS** ( $T_A=+25^{\circ}\text{C}$ )

Receive Attenuator Gain ( $f=1.0\text{kHz}$ , $V_{LC}=V_B$ )					dB
Rx Mode, $R_{XI}=150\text{mVrms}$ ( $V_{CC}=5.0\text{V}$ )	GRX	+4.0	+6.0	+8.0	
Rx Mode, $R_{XI}=150\text{mVrms}$ ( $V_{CC}=3.5\text{V}$ )	GRX	+4.0	+6.0	+8.0	
Gain Change – $V_{CC}=3.5\text{V}$ versus $V_{CC}=5.0\text{V}$	$\Delta\text{GRX1}$	-0.5	0	+0.5	
AGC Gain Change – $V_{CC}=2.8\text{V}$ versus $V_{CC}=5.0\text{V}$	$\Delta\text{GRX2}$	-	-25	-15	
Idle Mode, $R_{XI}=150\text{mVrms}$	GRXI	-22	-20	-17	
Range (Rx to Tx mode)	$\Delta\text{GRX3}$	49	52	54	
Volume Control Range (Rx Mode, $0.3V_B < V_{LC} < V_B$ )	VCR	27	35	-	dB
RXO DC Voltage (Rx Mode)	VRXO	-	$V_B$	-	Vdc
$\Delta\text{RXO}$ DC Voltage (Rx to Tx Mode)	$\Delta\text{VRXO}$	-	$\pm 10$	$\pm 150$	mV
RXO High Voltage ( $I_{out}=-1.0\text{mA}$ , $R_{XI}=V_B+1.5\text{V}$ )	VRXOH	3.7	-	-	Vdc
RXO Low Voltage ( $I_{out}=-1.0\text{mA}$ , $R_{XI}=V_B-1.0$ , Output measured with respect to $V_B$ )	VRXOL	-	-1.5	-1.0	Vdc
RXI Input Resistance ( $R_{XI} < 350\text{mVrms}$ )	RRXI	7.0	10	14	$\text{k}\Omega$
Transmit Attenuator Gain ( $f=1.0\text{kHz}$ )					dB
Tx Mode, $T_{XI}=150\text{mVrms}$	GTX	+4.0	+6.0	+8.0	
Idle Mode, $T_{XI}=150\text{mVrms}$	GTXI	-22	-20	-17	
Range (Tx to Rx Mode)	$\Delta\text{GTXI}$	49	52	54	
TXO DC Voltage (Tx Mode)	VTXO	-	$V_B$	-	Vdc
$\Delta\text{TXO}$ DC Voltage (Tx to Rx Mode)	$\Delta\text{VTXO}$	-	$\pm 30$	$\pm 150$	mV
TXO High Voltage ( $I_{out}=-1.0\text{mA}$ , $T_{XI}=V_B+1.5\text{V}$ )	VTXOH	3.7	-	-	Vdc
TXO Low Voltage ( $I_{out}=+1.0\text{mA}$ , $T_{XI}=V_B-1.0\text{V}$ , Output measured with respect to $V_B$ )	VTXOL	-	-1.5	-1.0	Vdc
TXI Input Resistance ( $T_{XI} < 350\text{mVrms}$ )	RTXI	7.0	10	14	$\text{k}\Omega$
Gain Tracking ( $\text{GRX} + \text{GTX}$ , @ Tx, Idle, Rx)	GTR	-	$\pm 0.1$	-	dB

**ATTENUATOR CONTROL (TA = +25°C)**

CT Voltage ( Pin 14 – VB)	VCT				mV
Rx Mode (VLC = VB)		-	+240	-	
Idle Mode		-	0	-	
Tx Mode		-	-240	-	
CT Source Current (switching to Rx mode)	ICTR	-85	-60	-40	μA
CT Sink Current (switching to Tx mode)	ICTT	+40	+60	+85	μA
CT Slow Idle Current	ICTS	-	0	-	μA
CT Fast Idle Internal Resistance	RFI	1.5	2.0	3.6	kΩ
VLC Input Current	IVLC	-	-60	-	nA
Dial Tone Detector Threshold	VDT	10	15	20	mV

**MICROPHONE AMPLIFIER (TA = +25°C, VMUT ≤ 0.8V, AVCL = 31 dB unless otherwise noted)**

Output Offset (VMCO – VB, Feedback R = 180 kΩ)	MCOVOS	-50	0	+50	mVdc
Open Loop Gain (f < 100 Hz)	AVOLM	70	80	-	dB
Gain Bandwidth	GBWM	-	1.0	-	MHz
Output High Voltage (Iout = -1.0mA, Vcc = 5.0V)	VMCOH	3.7	-	-	Vdc
Output Low Voltage (Iout = +1.0mA)	VMCOL	-	-	200	mVdc
Input Bias Current (@ MCI)	IBM	-	-40	-	nA
Muting (ΔGain) (f = 1.0KHz, VMUT = 2.0 V)	GMT	-55	-	-	dB
(300 Hz < f < 10 kHz)		-	-68	-	
MUT Input Resistance ( Vcc = VMUT = 6.5V)	RMUT	50	90	-	kΩ
MUT Input – High	VMUTH	2.0	-	Vcc	Vdc
MUT Input – Low	VMUTL	0	-	0.8	Vdc
Distortion ( 300 Hz < f < 10 kHz)	THDM	-	0.15	-	%

**HYBRID AMPLIFIER (TA = +25°C)**

HTO- Offset (VHTO- - VB, Feedback R = 51 kΩ)	HVOS	-20	0	+20	mVdc
HTO- to HTO+ Offset (Feedback R = 51 kΩ)	HBVOS	-30	0	+30	mVdc
Open Loop Gain ( HTI to HTO-, f < 100 Hz)	AVOLH	60	80	-	dB
Gain Bandwidth	GBWH	-	1.0	-	MHz
Closed Loop Gain ( HTO- to HTO+)	AVCLH	-0.35	0	+0.35	dB
Input Bias Current (@ HTI)	IBH	-	-30	-	nA
HTO- High Voltage ( Iout = -5.0 mA)	VHT-H	3.7	-	-	Vdc
HTO- Low Voltage ( Iout = +5.0 mA)	VHT-L	-	-	250	mVdc
HTO+ High Voltage ( Iout = -5.0 mA)	VHT+H	3.7	-	-	Vdc
HTO+ Low Voltage ( Iout = +5.0 mA)	VTH+L	-	-	450	mVdc
Distortion ( 300 Hz < f < 10 kHz, See Figure 1)	THDH	-	0.3	-	%

**LEVEL DETECTORS AND BACKGROUND NOISE MONITORS (TA = +25°C)**

Transmit-Receive Switching Threshold ( Ratio of Current at RLI1 + RLI2 to 20 uA at TLI1 + TLI2 to switch from Tx to Rx)	ITH	0.8	1.0	1.2	
Source Current at RLO1, RLO2, TLO1, TLO2	ILSO	-	-2.0	-	mA
Sink Current at RLO1, RLO2, TLO1, TLO2	ILSK	-	4.0	-	μA
CPR, CPT Output Resistance ( Iout = 1.5 mA)	RCP	-	35	-	Ω
CPR, CPT Leakage Current	ICPLK	-	-0.2	-	μA

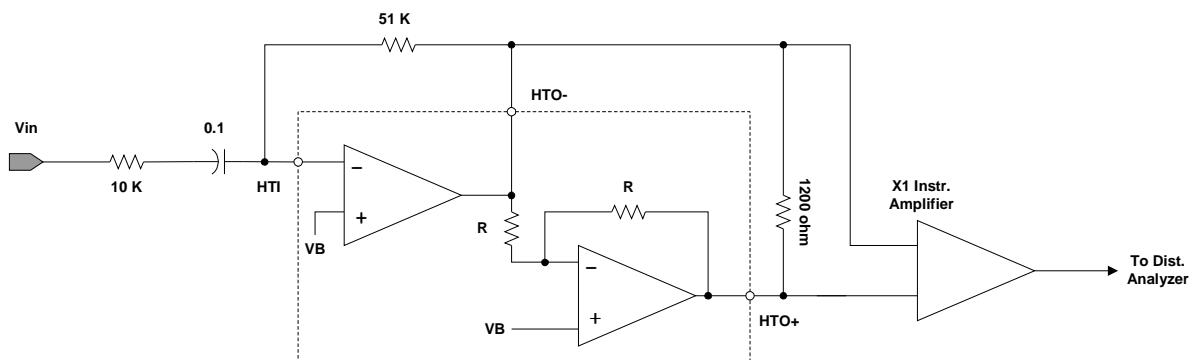
**FILTER (TA = +25°C)**

Voltage Offset at FO (VFO – VB, 220 kΩ from VB to FI)	FOVOS	-200	-90	0	mV
FO Sink Current	IFO	150	260	400	μA
FI Bias Current	IFI	-	-50	-	nA

**SYSTEM DISTORTION (TA = +25°C)**

Rx Mode ( From FI to RXO, FO connected to RXI)	THDR	-	0.5	3.0	%
Tx Mode ( From MCI to HTO-/HTO+, includes Tx attenuator)	THDT	-	0.8	3.0	%

1. All currents into a devices pin are positive, those out of a pin are negative, Algebraic convention rather than magnitude is used to define limits.



**FIGURE 1 – HYBRID AMPLIFIER DISTORTION TEST**

FIGURE 2 – ATTENUATOR GAIN versus Vct

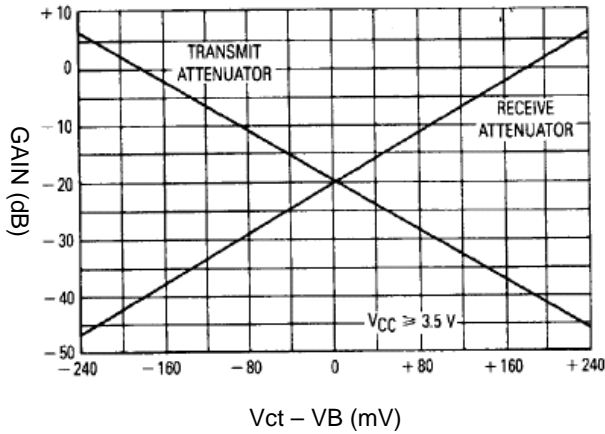


FIGURE 3 – LEVEL DETECTOR DC TRANSFER CHARACTERISTICS

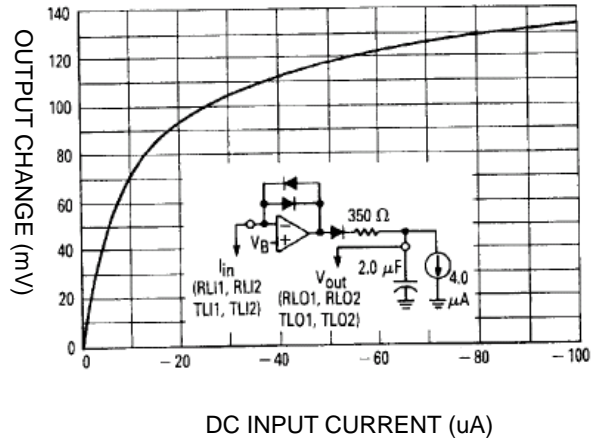


FIGURE 4 – LEVEL DETECTOR AC TRANSFER CHARACTERISTICS

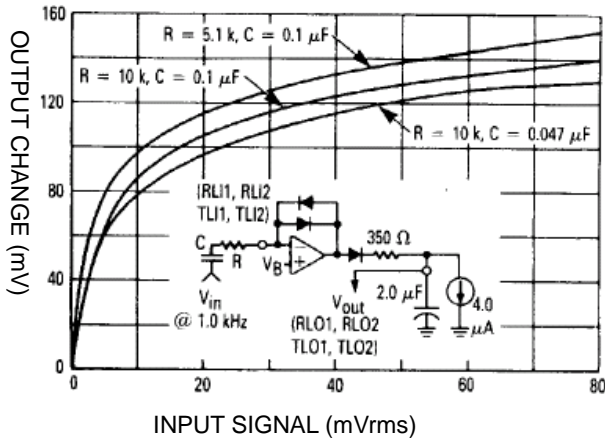


FIGURE 5 – LEVEL DETECTOR AC TRANSFER CHARACTERISTICS versus FREQUENCY

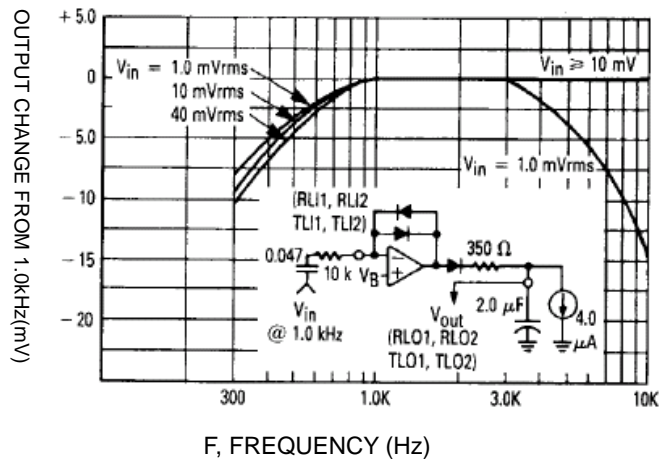


FIGURE 6 – RECEIVE ATTENUATOR versus VOLUME CONTROL

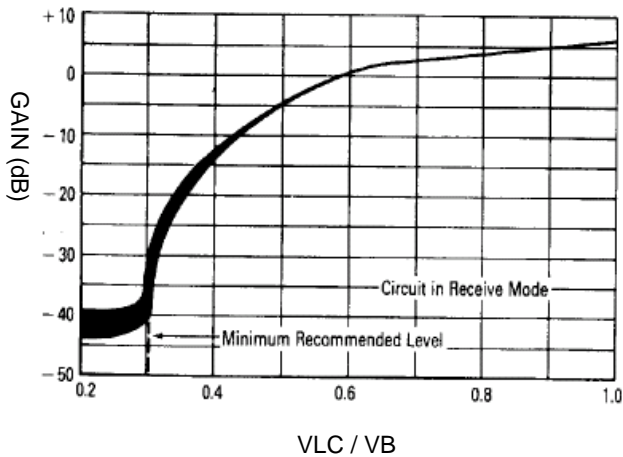
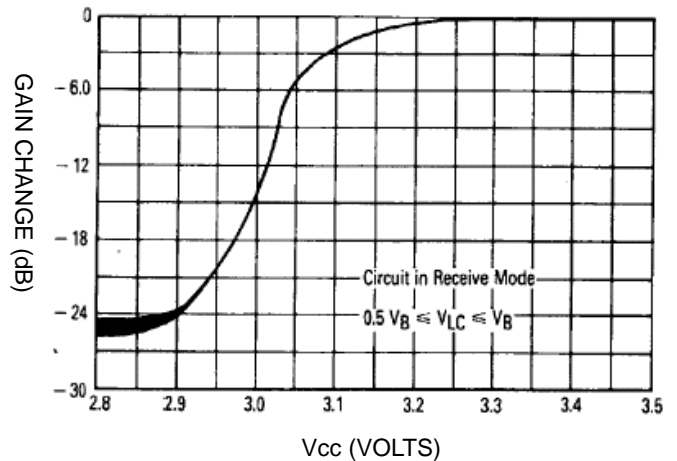
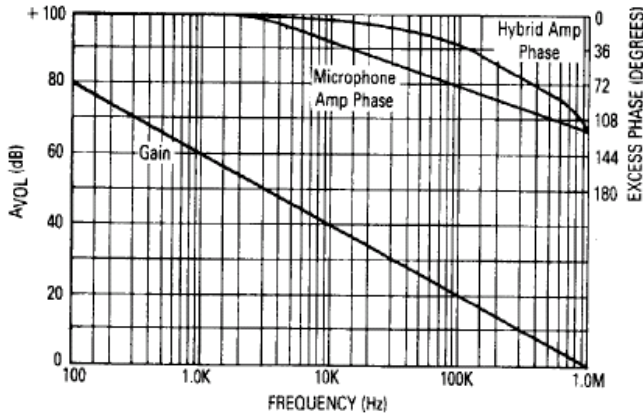


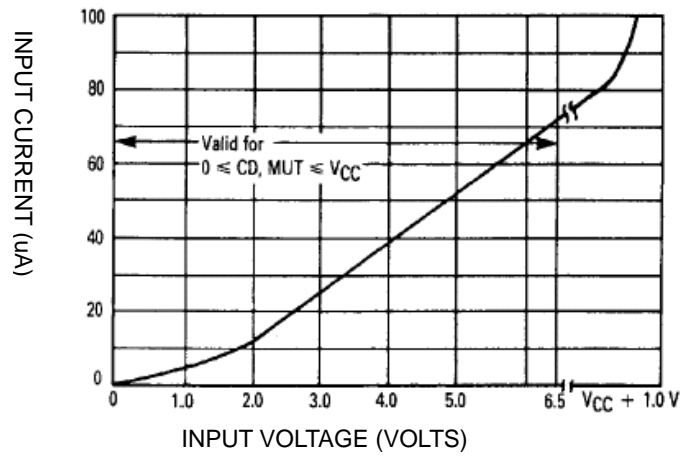
FIGURE 7 – RECEIVE ATTENUATION GAIN versus Vcc



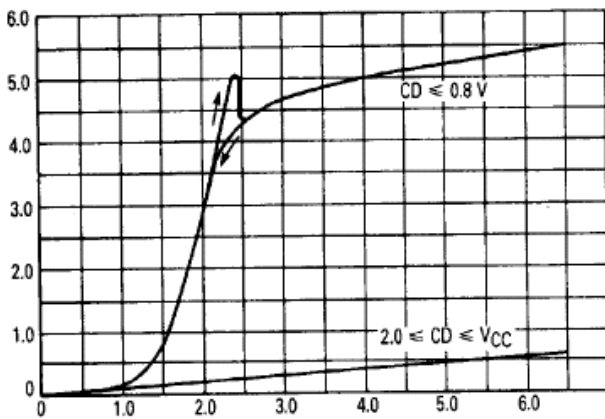
**FIGURE 8 – MICROPHONE AMPLIFIER AND 1<sup>ST</sup> HYBRID AMPLIFIER OPEN LOOP GAIN AND PHASE**



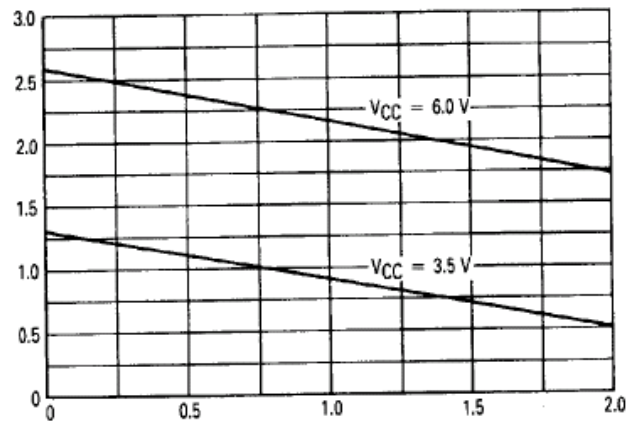
**FIGURE 9 – INPUT CHARACTERISTICS @ CD, MUT**



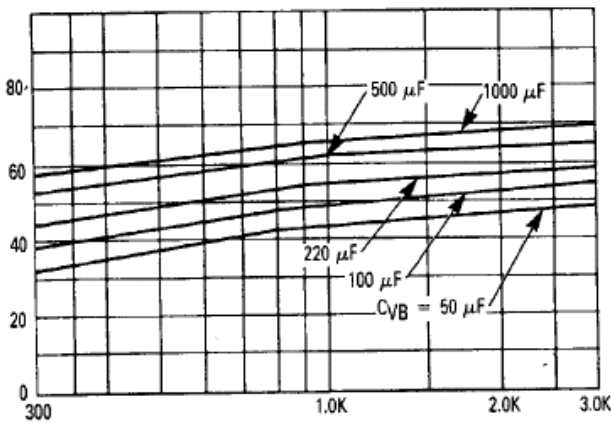
**FIGURE 10 – SUPPLY CURRENT versus SUPPLY VOLTAGE**



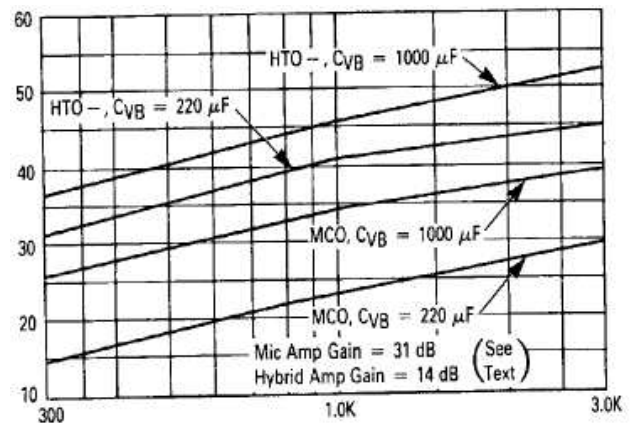
**FIGURE 11 – VB OUTPUT CHARACTERISTICS**



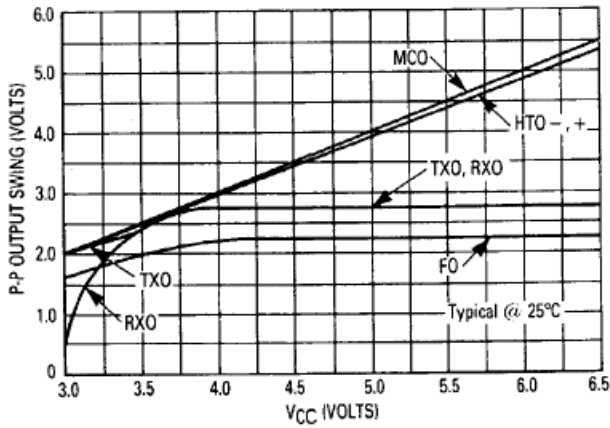
**FIGURE 12 – VB POWER SUPPLY REJECTION versus FREQUENCY AND VB CAPACITOR**



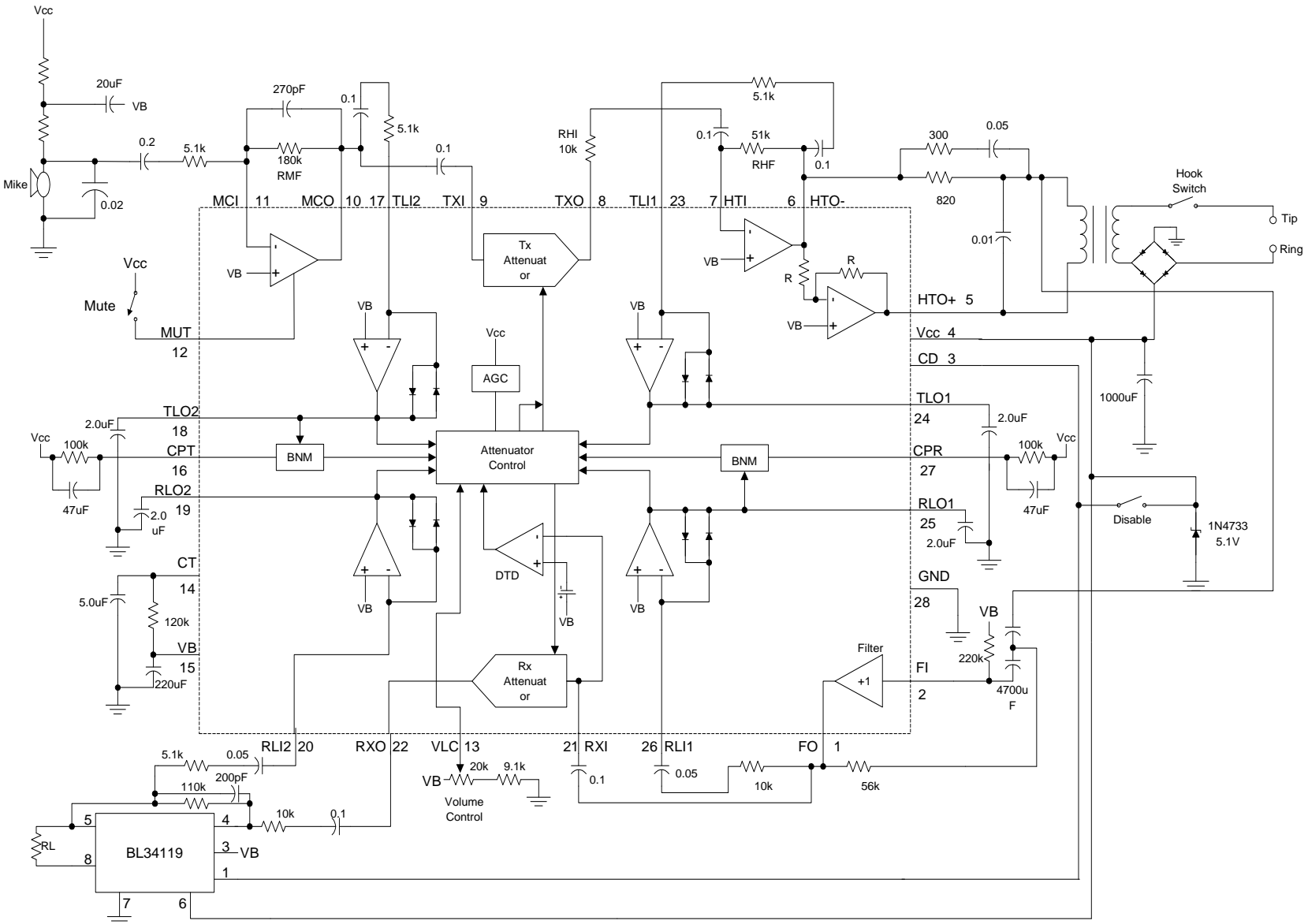
**FIGURE 13 – POWER SUPPLY REJECTION OF THE MICROPHONE AND HYBRID AMPLIFIERS**





**FIGURE 14 – TYPICAL OUTPUT SWING versus Vcc**

**TEMPERATURE CHARACTERISTICS**

Parameter	Typical Value @ 25 °C	Typical Change -20 to +60 °C
Vcc Supply Current (CD = 0.8 V)	5.0 mA	- 0.3 %/°C
Vcc Supply Current (CD = 2.0 V)	400 μA	-0.4 %/°C
VB Output Voltage (Vcc = 5.0 V)	2.1 V	+0.8 %/°C
Attenuator gain (Max Gain )	+6.0 dB	0.0008 dB/°C
Attenuator Gain (Max Attenuation)	-46 dB	0.004 dB/°C
Attenuator Input Resistance (@ TXI, RXI)	10 kΩ	+ 0.6 %/°C
Dial Tone Detector Threshold	15 mV	+20 μV/°C
CT Source, Sink Current	± 60 μA	-0.15 %/°C
Microphone, Hybrid Amplifier Offset	0 mV	± 4.0 μV/°C
Transmit-Receive Switching Threshold	1.0	± 0.02 %/°C
Sink Current at RLO1, RLO2, TLO1, TLO2	4.0 μA	-10 nA/°C
Closed Loop Gain (HTO- to HTO+)	0 dB	0.001 %/°C



ASSEMBLY PACKAGE DIMENSION

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Unit: inches (mm)

SOP 28

