

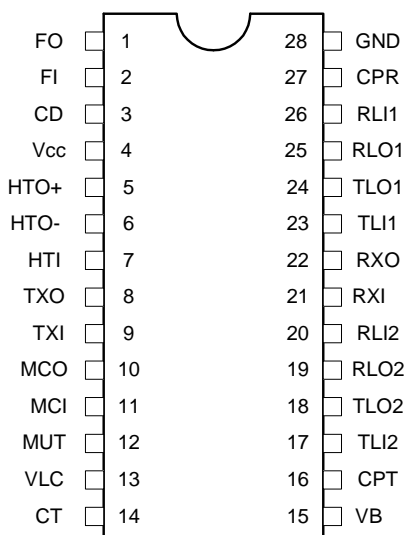
Voice Switched Speakerphone Circuit BL34118

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.

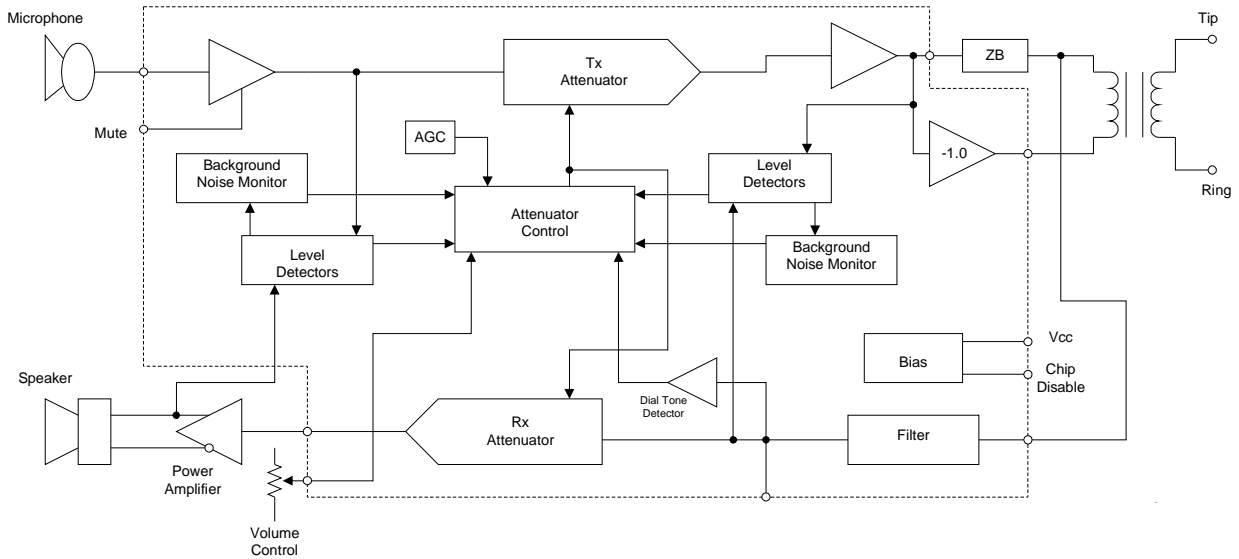
- Improved Attenuator Gain Range: 52 dB Between Transmit and Receive
- Low Voltage Operation for Line-Powered Applications (3.0 – 6.5V)
- 4-Point Signal Sensing for Improved Sensitivity
- Background Noise Monitors for Both Transmit and Receive Paths
- Microphone Amplifier Gain Set by External Resistors – 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 ≈ 5.0 mA. As Vcc falls from 3.5 to 2.8 volts, an AGC circuit reduces the receive attenuator gain by ≈ 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 ≈ 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 ≈ 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 |
|-----------|--------|-----|-----|-----|-------|
|-----------|--------|-----|-----|-----|-------|

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 | μA |
| 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 | - | Ω |
| 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 $V_{CC}=5.0\text{V}$ | ΔGRX1 | -0.5 | 0 | +0.5 | |
| AGC Gain Change – $V_{CC}=2.8\text{V}$ versus $V_{CC}=5.0\text{V}$ | ΔGRX2 | - | -25 | -15 | |
| Idle Mode, $R_{XI}=150\text{mVrms}$ | GRXI | -22 | -20 | -17 | |
| Range (Rx to Tx mode) | ΔGRX3 | 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) | ΔVRXO | - | ± 10 | ± 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) | ΔGTXI | 49 | 52 | 54 | |
| TXO DC Voltage (Tx Mode) | VTXO | - | V_B | - | Vdc |
| $\Delta\text{TXO DC Voltage}$ (Tx to Rx Mode) | ΔVTXO | - | ± 30 | ± 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 | - | ± 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.

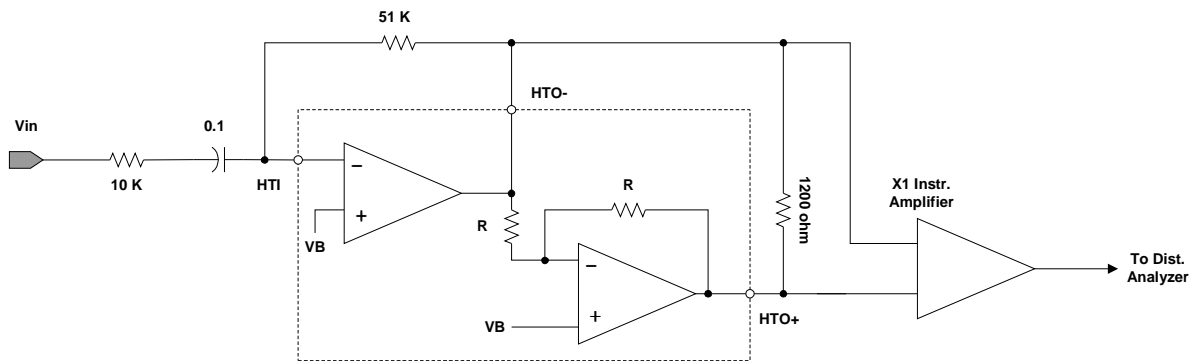


FIGURE 1 – HYBRID AMPLIFIER DISTORTION TEST

FIGURE 2 – ATTENUATOR GAIN versus Vct

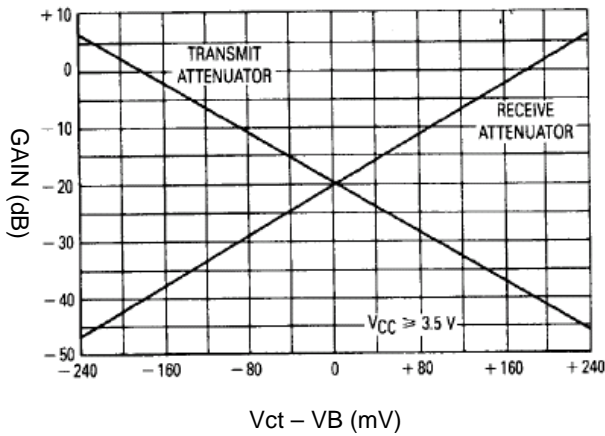


FIGURE 3 – LEVEL DETECTOR DC TRANSFER CHARACTERISTICS

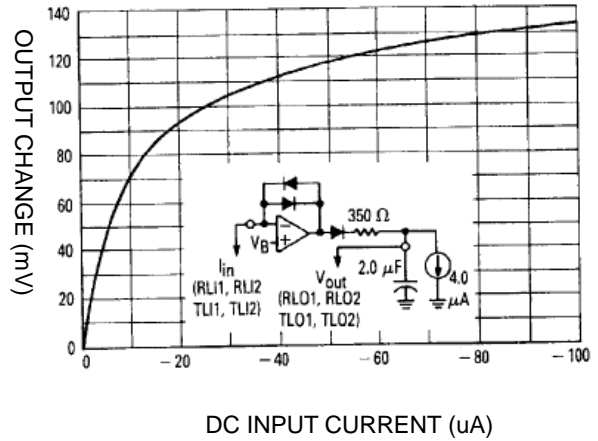


FIGURE 4 – LEVEL DETECTOR AC TRANSFER CHARACTERISTICS

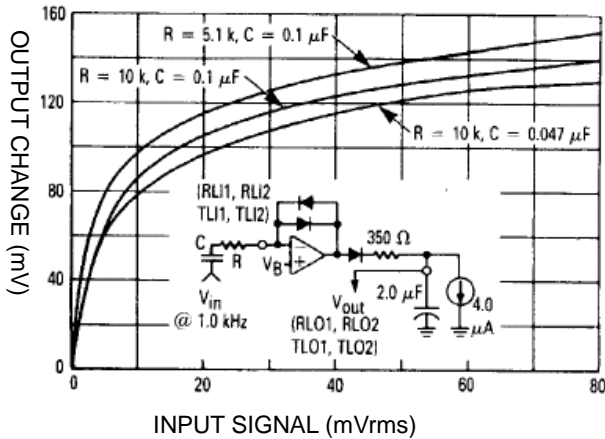


FIGURE 5 – LEVEL DETECTOR AC TRANSFER CHARACTERISTICS versus FREQUENCY

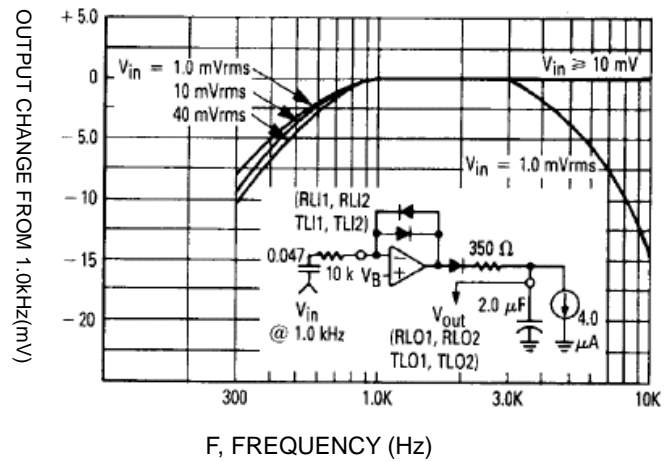


FIGURE 6 – RECEIVE ATTENUATOR versus VOLUME CONTROL

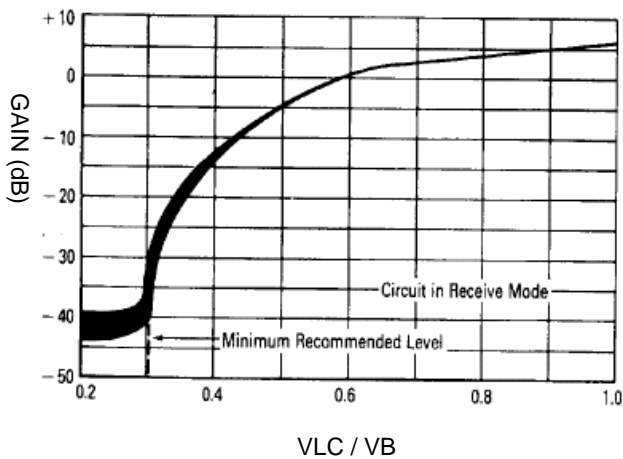


FIGURE 7 – RECEIVE ATTENUATION GAIN versus Vcc

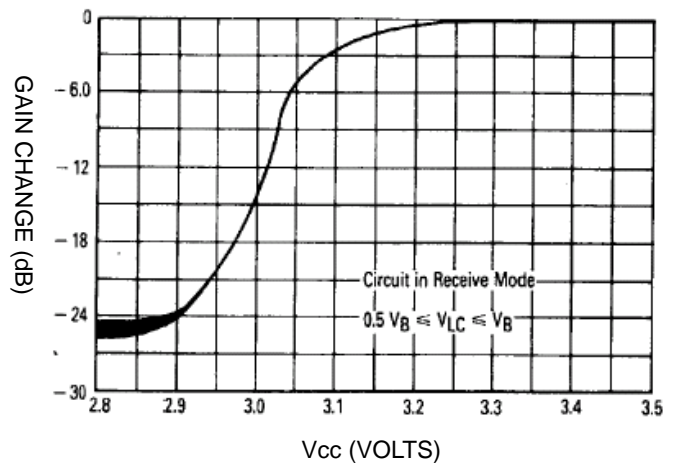


FIGURE 8 – MICROPHONE AMPLIFIER AND 1ST HYBRID AMPLIFIER OPEN LOOP GAIN AND PHASE

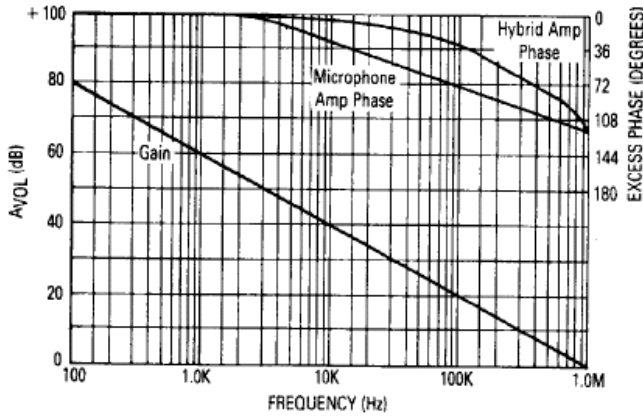


FIGURE 10 – SUPPLY CURRENT versus SUPPLY VOLTAGE

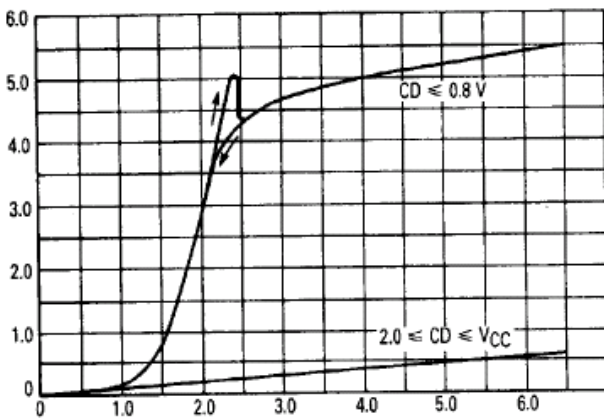


FIGURE 12 – VB POWER SUPPLY REJECTION versus FREQUENCY AND VB CAPACITOR

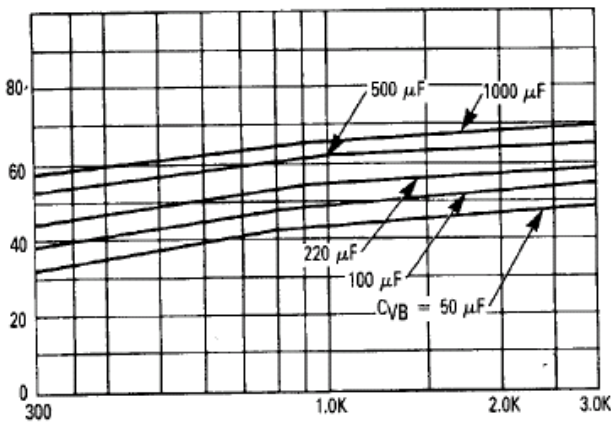


FIGURE 9 – INPUT CHARACTERISTICS @ CD, MUT

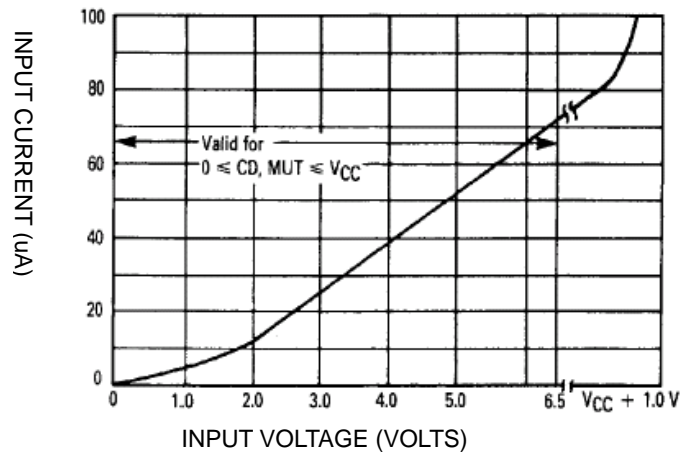


FIGURE 11 – VB OUTPUT CHARACTERISTICS

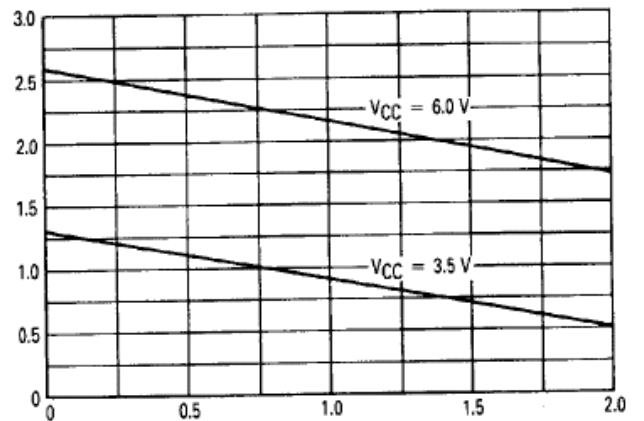


FIGURE 13 – POWER SUPPLY REJECTION OF THE MICROPHONE AND HYBRID AMPLIFIERS

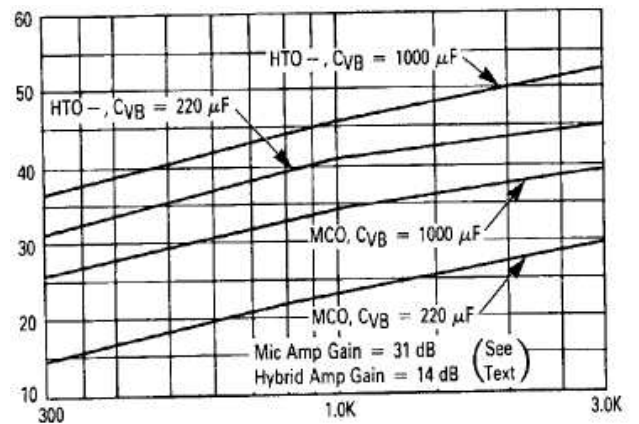
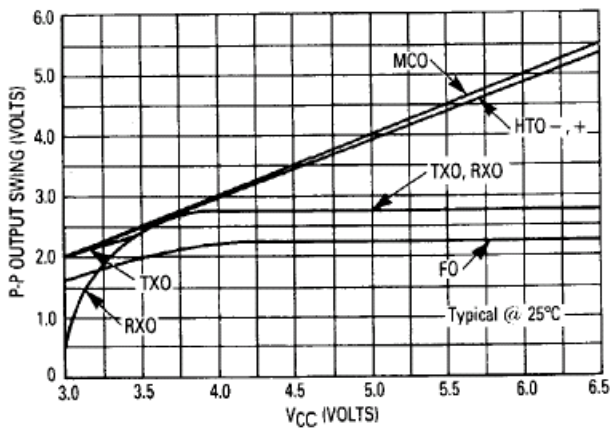
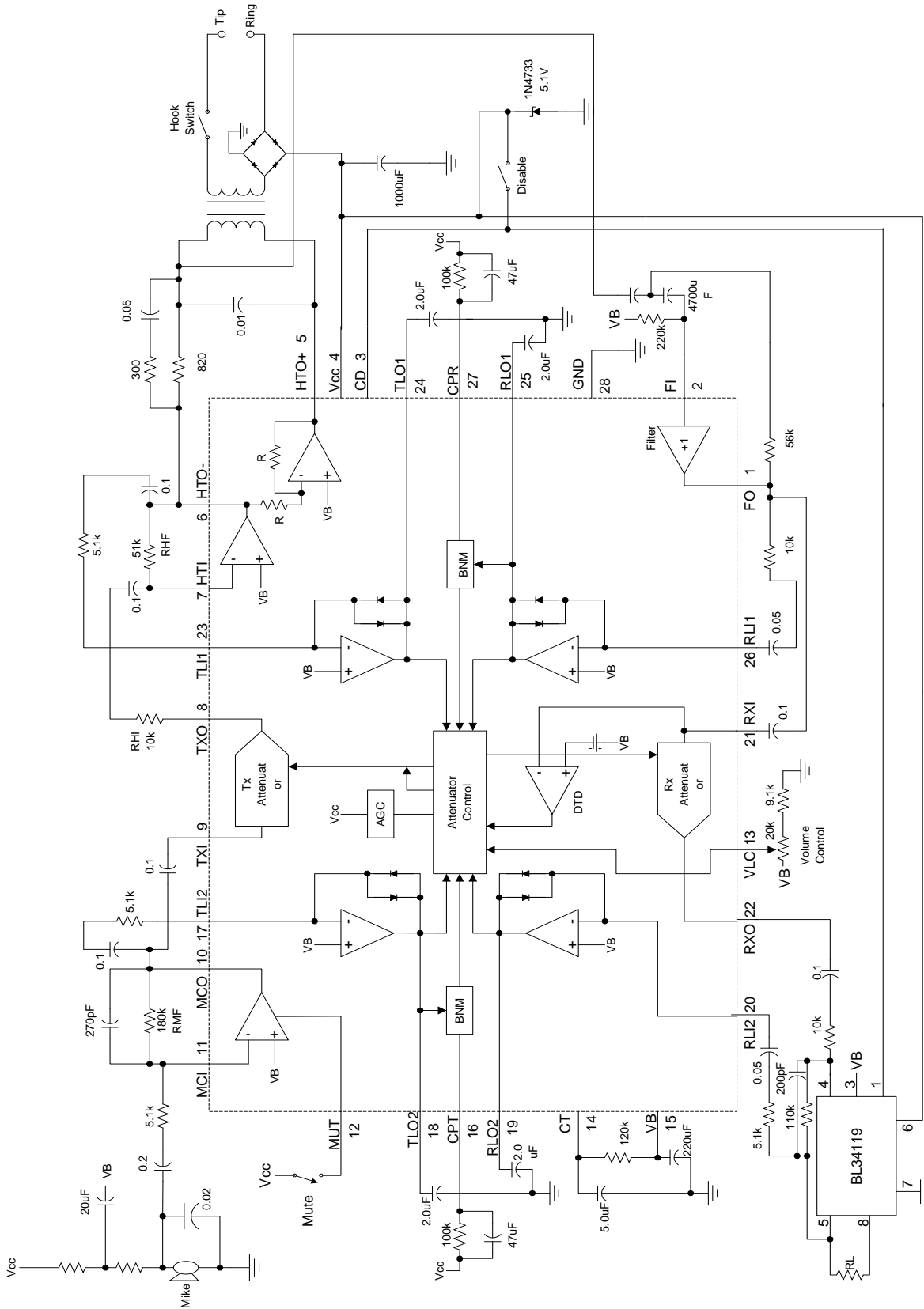


FIGURE 14 – TYPICAL OUTPUT SWING versus V_{CC}

TEMPERATURE CHARACTERISTICS

| Parameter | Typical Value @ 25 °C | Typical Change -20 to +60 °C |
|---|--------------------------|---------------------------------|
| V _{CC} Supply Current (CD = 0.8 V) | 5.0 mA | - 0.3 %/°C |
| V _{CC} Supply Current (CD = 2.0 V) | 400 μA | -0.4 %/°C |
| VB Output Voltage (V _{CC} = 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 |

APPLICATION CIRCUIT



ASSEMBLY PACKAGE DIMENSION

Unit: inches (mm)

SOP 28

