

**FEATURES**

- 100  $\mu$ A typical current drain
- low noise and distortion
- 1.0 to 5 VDC operating range
- DC coupled stages
- Class A output stage
- Schottky diodes for MPO control
- variable transducer current
- 4 k $\Omega$  microphone decoupling resistor

**STANDARD PACKAGING**

- 8 pin PLID<sup>®</sup>
- Chip ( 61 x 55 mils)

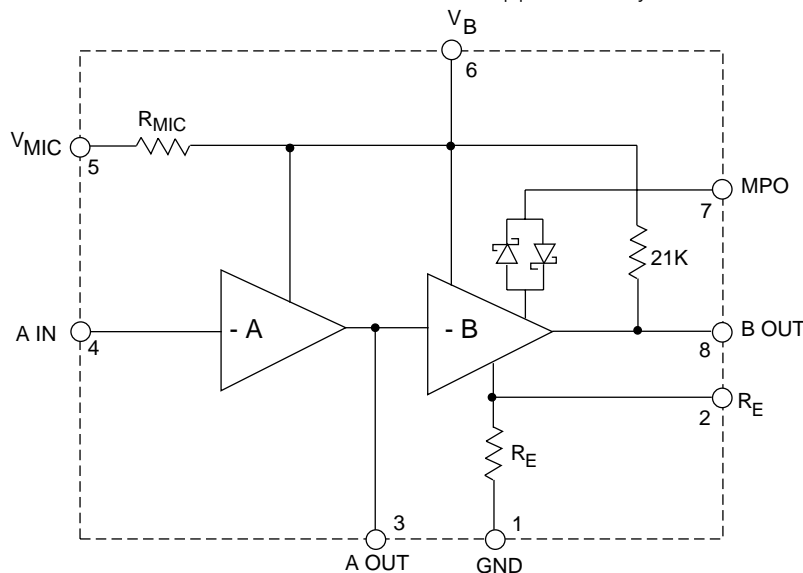
**DESCRIPTION**

The GK509 is a Class A amplifier utilizing Gennum's proprietary low voltage JFET technology. It consists of a single-ended, low noise inverting gain block, a Class A output stage, an on-chip microphone decoupling resistor, and a pair of Schottky diodes for symmetrical peak clipping.

Block A typically has an open loop voltage gain of 56 dB, with the closed loop gain set by the ratio of the feedback resistor to the source impedance. It is recommended that the maximum closed loop gain be 20 dB lower than the open loop gain. All blocks of the device are internally bias compensated, preventing any DC current flow via external feedback resistors. Without this compensation audible scratchiness would be present during changes in volume control settings.

The output stage of the GK509 is a Class A current drive. It has a fixed reference voltage of typically 30 mV at pin 2 of the device. The current that flows in the transducer is the ratio of the 30 mV reference voltage and the on-chip emitter resistor ( $R_E$ ). To increase the bias current in the transducer, simply place an external  $R_E$  resistor from pin 2 to ground, thereby decreasing the equivalent emitter resistance and increasing the current.

The GK509 also contains a pair of Schottky diodes in the feedback configuration of the output stage, which provides approximately 12 dB of MPO control.



All resistors in ohms, all capacitors in farads unless otherwise stated

**BLOCK DIAGRAM**

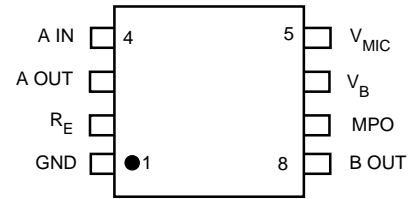
## ABSOLUTE MAXIMUM RATINGS

PARAMETER	VALUE/UNITS
Supply Voltage	5 V DC
Operating Temperature Range	-10°C to 40° C
Storage Temperature Range	-20°C to 70° C

**CAUTION**  
CLASS 1 ESD SENSITIVITY



## PIN CONNECTION



## ELECTRICAL CHARACTERISTICS

$V_p$  - Pin voltage measured with conditions as shown in Test Circuit.

Positive current corresponds to current INTO the pin.

Negative current corresponds with current OUT of the pin.

Conditions: Frequency = 1 kHz, Temperature = 25°C, Supply Voltage  $V_B = 1.3$  V

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Amplifier Current	$I_{AMP}$		55	100	145	$\mu$ A
Transducer Current	$I_{TRANS}$		170	230	290	$\mu$ A
Maximum Transducer Current	$I_{TRANS (MAX)}$	$V_{P2} = 0$ V	2	-	-	mA
A Input Bias Voltage (pin 4)	$V_{BIAS A}$		500	570	650	mV
A Input Bias Current (pin 4)	$I_{BIAS A}$	$R_{FA} = 1$ M, (Note 1)	-50	0	50	nA
A O/P Voltage Swing-Hi (pin 3)	$V_{OH A}$	$V_{IN} = 0.4$ V DC, $R_{FA} = \infty$ , $I_{P3} = -10$ $\mu$ A (Note 2)	200	580	-	mV
A Output Swing-Lo (pin 3)	$V_{OL A}$	$I_{IN} = +1$ $\mu$ A, $R_{FA} = \infty$ , $I_{P3} = +10$ $\mu$ A (Note 3)	200	280	-	mV
A Open Loop Voltage Gain	$A_{OL}$		46	56	-	dB
B Output Sat. Voltage (pin 8)	$V_{SAT B}$	$R_L = 1$ k $\Omega$ , $V_{P2} = 0$ V	-	100	180	mV
A Output Current Capability	$I_{OUT}$		-	30	-	$\mu$ A
Diode Voltage Drop	$V_D$	(S2 = b), $R_L = \infty$ , (Note 4)	140	265	325	mV
Emitter Bias Voltage (pin 2)	$V_{RE}$		21.5	30	35.5	mV
On-chip Microphone Resistor	$R_{MIC}$		3	4	5	k $\Omega$
On-chip Emitter Resistor	$R_E$		90	125	160	$\Omega$
Input Referred Noise	IRN	NFB 0.2 to 10kHz at 12 dB/Oct	-	1	-	$\mu$ VRMS
Harmonic Distortion	THD	500 mVRMS Output	-	1	-	%

All parameters and switches remain as shown in Test Circuit unless otherwise stated in CONDITIONS column.

- NOTES:**
- $I_{BIAS A} = (V_{P4} - V_{P4[RFA = 1M]}) / 1M$
  - $V_{OH A} = (V_{P3} - V_{P3 [VIN = 0.4VDC, RFA = \infty, IP3 = -10 \mu A]})$
  - $V_{OL A} = (V_{P3} - V_{P3 [IIN = +1 \mu A, RFA = \infty, IP3 = +10 \mu A]})$
  - $V_D = (V_{P8 [Id = +(1.5 \times ITRANS)]} - V_{P8 [Id = +(0.5 \times ITRANS)]}) / 2$

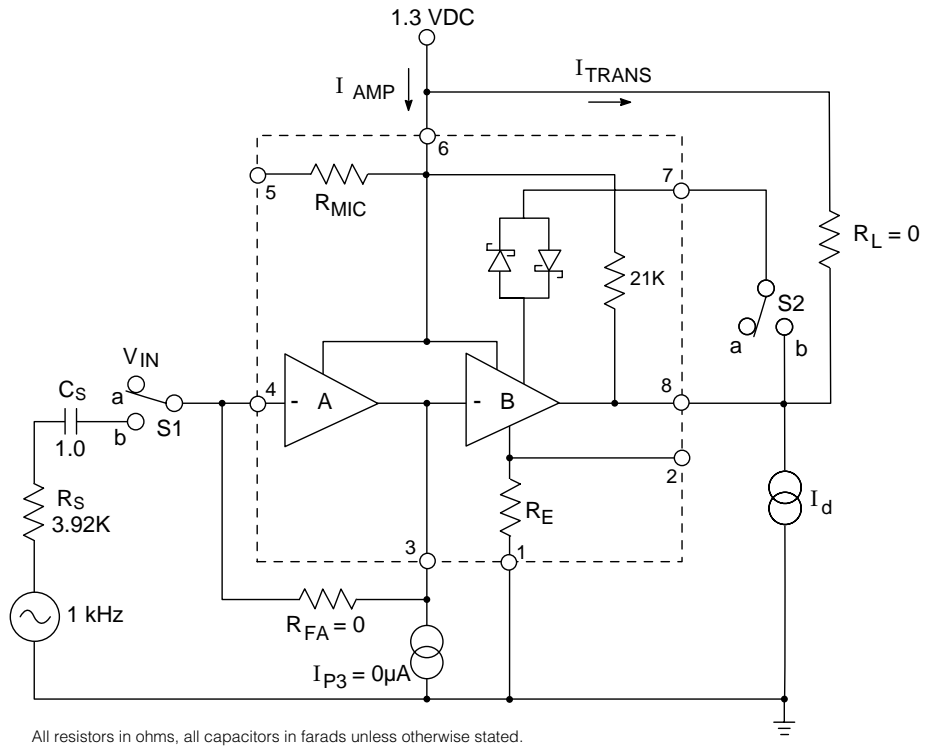


Fig. 1 Test Circuit

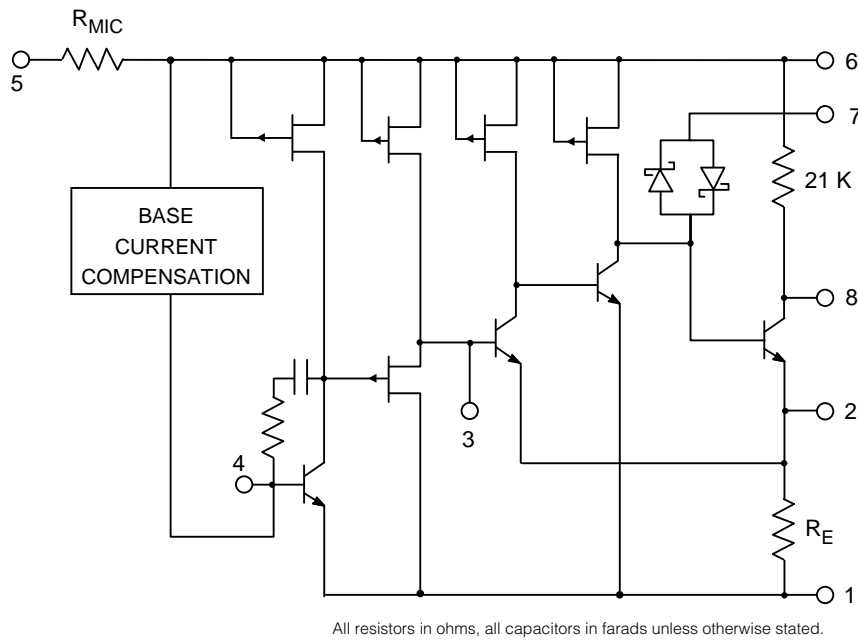
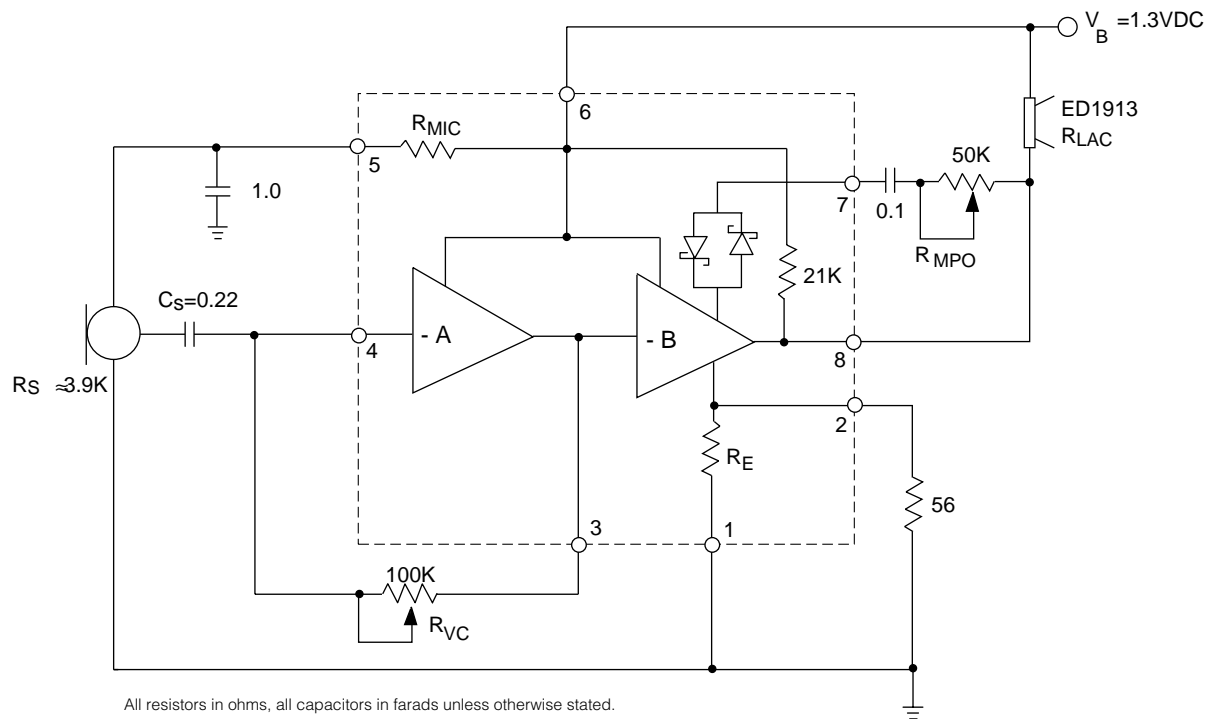


Fig. 2 Functional Schematic



$$\text{Gain of Stage A} = 20 \log \frac{R_{VC}}{R_S} \quad \text{Gain of Stage B} = 20 \log \frac{R_{LAC} // 21K}{56 // R_E}$$

Fig. 3 Typical Hearing Aid Application

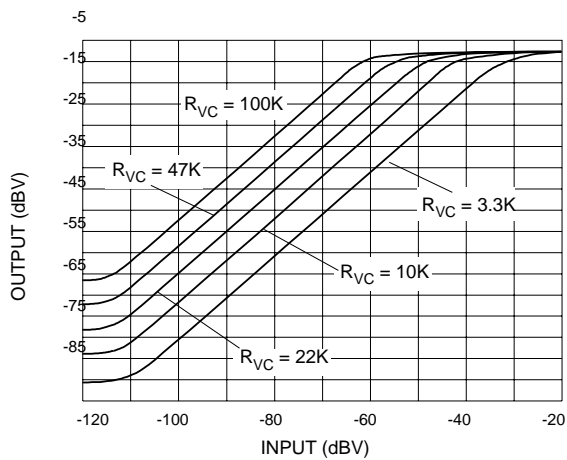


Fig. 4 I/O Curves at Various  $R_{VC}$  Settings

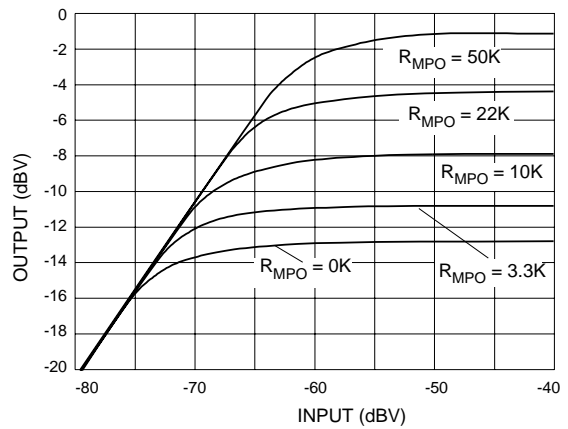


Fig. 5 I/O Curves at Various  $R_{MPO}$  Values

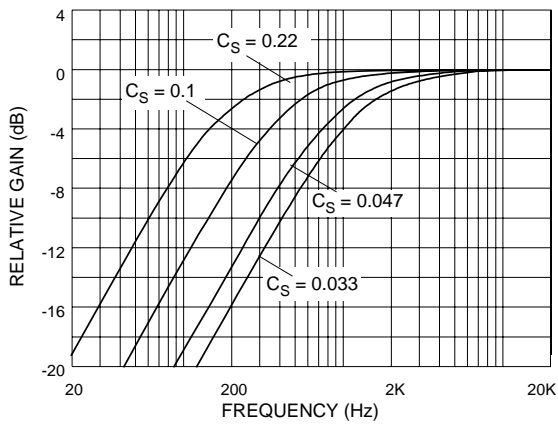


Fig. 6 Closed Loop Frequency Response with Various  $C_S$  Values

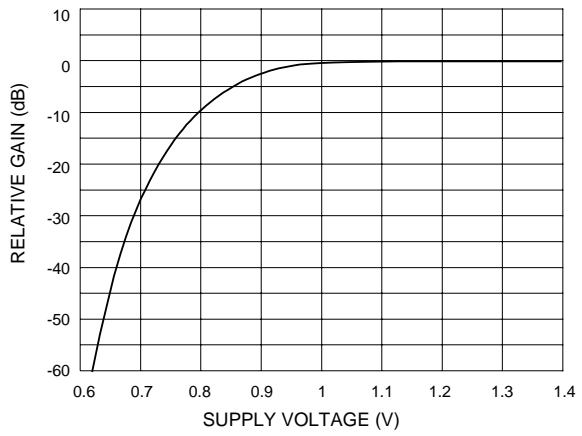


Fig. 7 Gain vs Supply Voltage

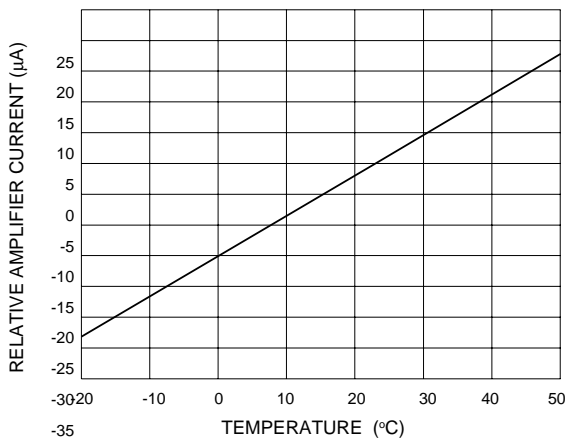


Fig. 8 Amplifier Current vs Temperature

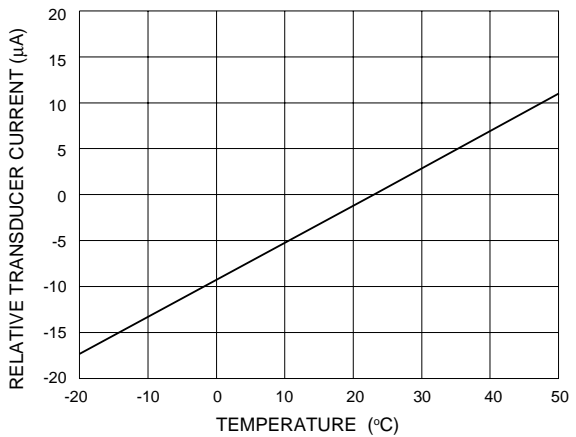


Fig. 9 Transducer Current vs Temperature

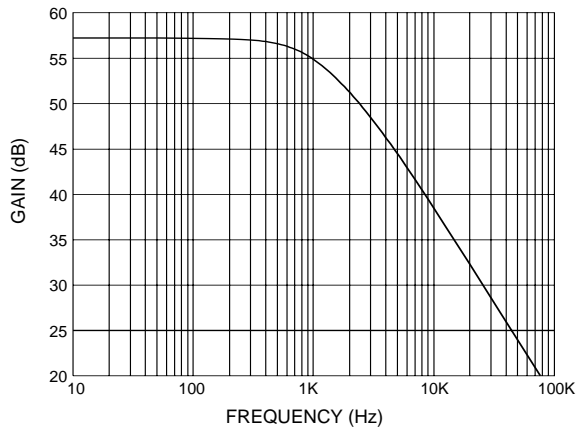


Fig. 10 Preampifier Open Loop Frequency Response

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**DOCUMENT IDENTIFICATION: DATA SHEET**

The product is in production. Gennum reserves the right to make changes at any time to improve reliability, function or design, in order to provide the best product possible.

**REVISION NOTES:**

Changes to standard packaging information.