Class A Amplifier with 2 DC Coupled Gain Blocks & Schottky Diodes

GK509 DATA SHEET

FEATURES

- **100 μA 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 kΩ microphone decoupling resistor**

STANDARD PACKAGING

- 8 pin MICROpac
- 8 pin PLID®
- 8 pin SLT
- Chip (61 x 55 mils)

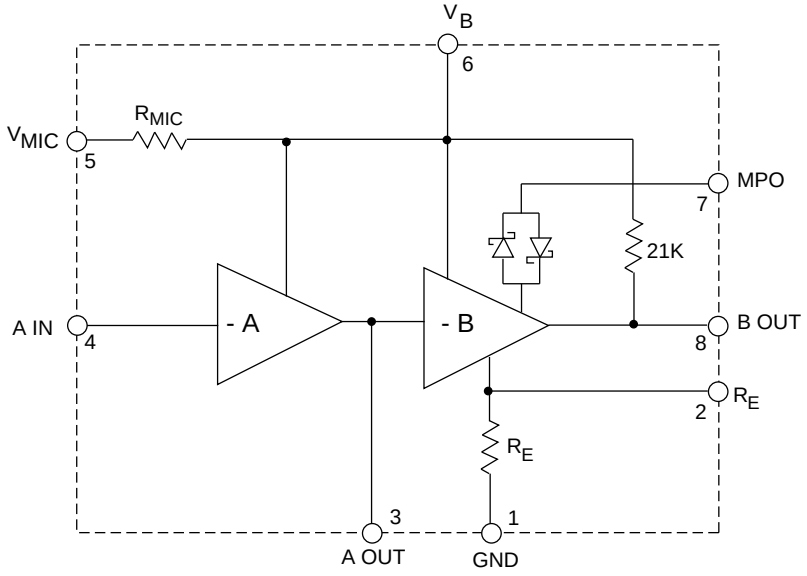
DESCRIPTION

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

Revision Date: February 1996

Document No. 510 - 69 -05

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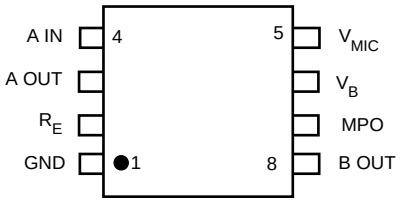
ABSOLUTE MAXIMUM RATINGS

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	µA
Transducer Current	I_{TRANS}		170	230	290	µA
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} = ∞, I_{P3} = -10 µA (Note 2)	200	580	-	mV
A Output Swing-Lo (pin 3)	$V_{OL\ A}$	I_{IN} = +1 µA, R_{FA} = ∞, I_{P3} = +10 µA (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 kΩ, V_{P2} = 0 V	-	100	180	mV
A Output Current Capability	I_{OUT}		-	30	-	µA
Diode Voltage Drop	V_D	(S2 = b), RL = ∞, (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	kΩ
On-chip Emitter Resistor	R_E		90	125	160	Ω
Input Referred Noise	IRN	NFB 0.2 to 10kHz at 12 dB/Oct	-	1	-	µVRMS
Harmonic Distortion	THD	500 mVRMS Output	-	1	-	%

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

NOTES: 1. $I_{BIAS\ A} = (V_{P4} - V_{P4[RFA\ =\ 1M]})/1M$

2. $V_{OH\ A} = (V_{P3} - V_{P3\ [VIN\ =\ 0.4VDC,\ RFA\ =\ \infty,\ IP3\ =\ -10\ \mu A]})$

3. $V_{OL\ A} = (V_{P3} - V_{P3\ [IIN\ =\ +1\mu A,\ RFA\ =\ \infty,\ IP3\ =+10\ \mu A]})$

4. $V_D = (V_{P8\ [Id\ =\ +(1.5\ x\ ITRANS)]} - V_{P8\ [Id\ =\ +(0.5\ x\ ITRANS)]})/2$

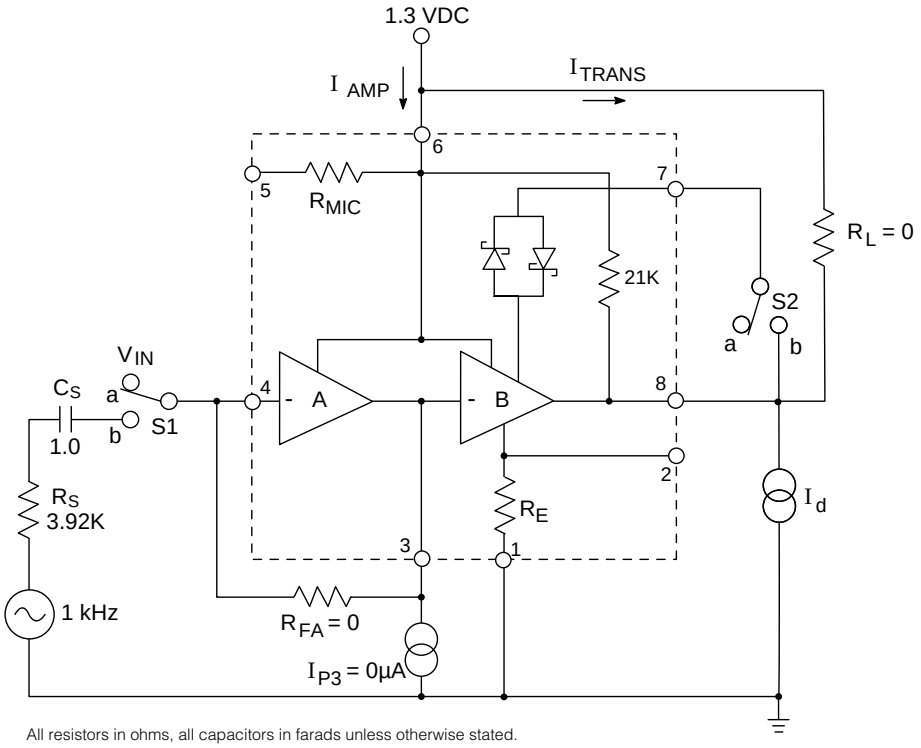


Fig. 1 Test Circuit

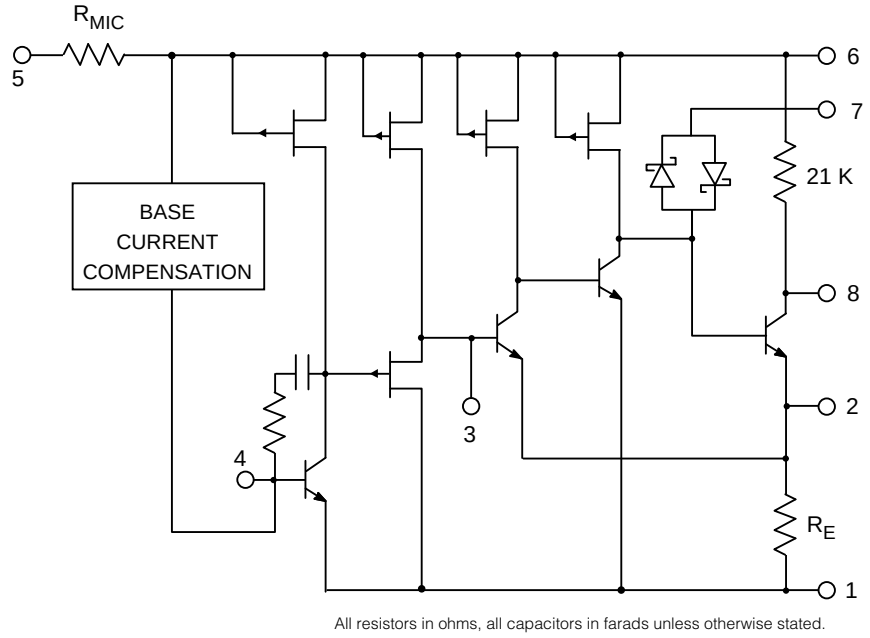
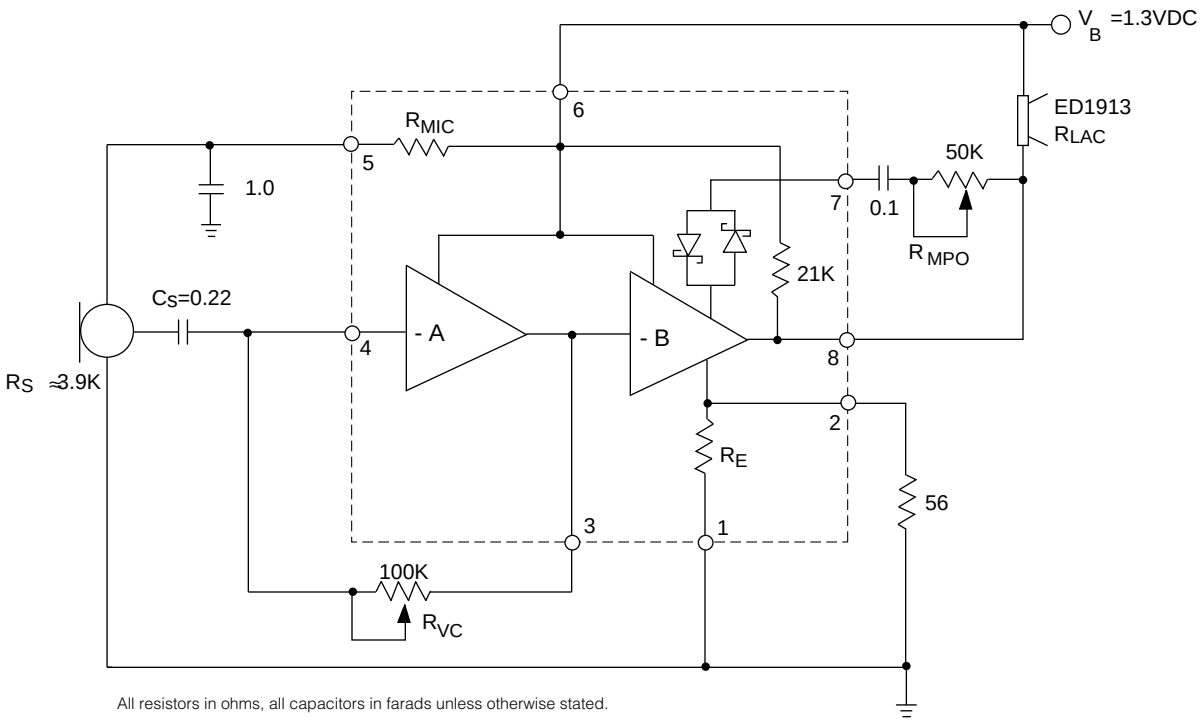


Fig. 2 Functional Schematic



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

Fig. 3 Typical Hearing Aid Application

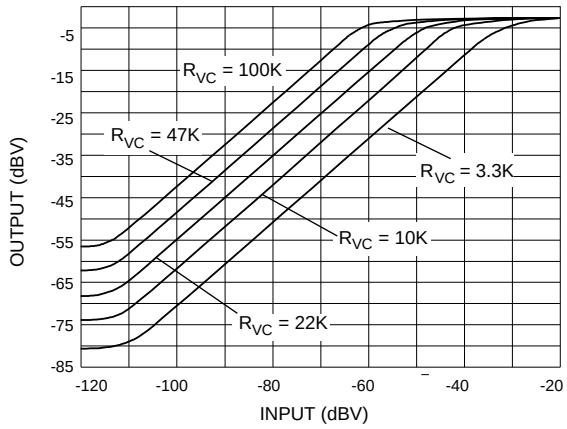


Fig. 4 I/O Curves at Various R_{VC} Settings

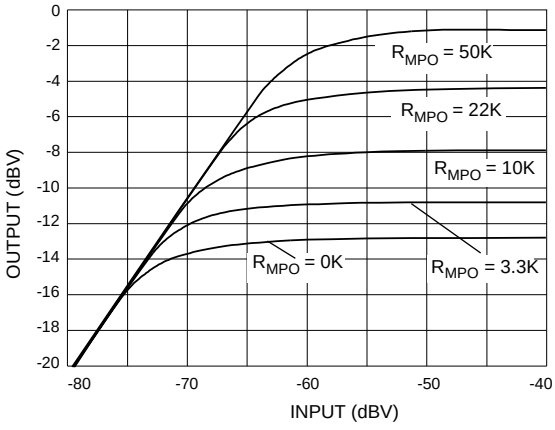


Fig. 5 I/O Curves at Various R_{MPO} Values

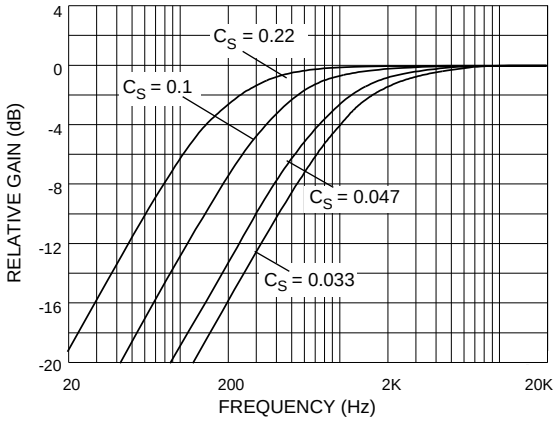


Fig. 6 Closed Loop Frequency Response with Various C_S Values

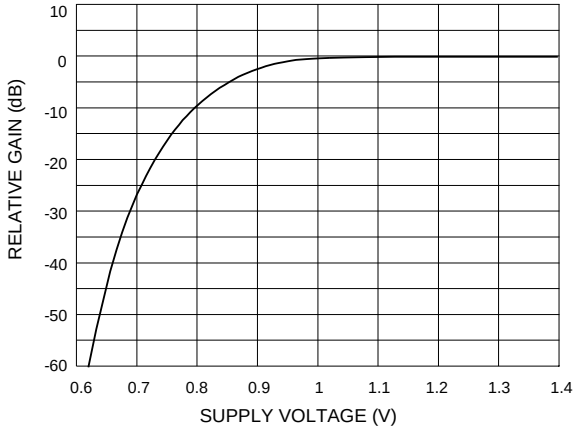


Fig. 7 Gain vs Supply Voltage

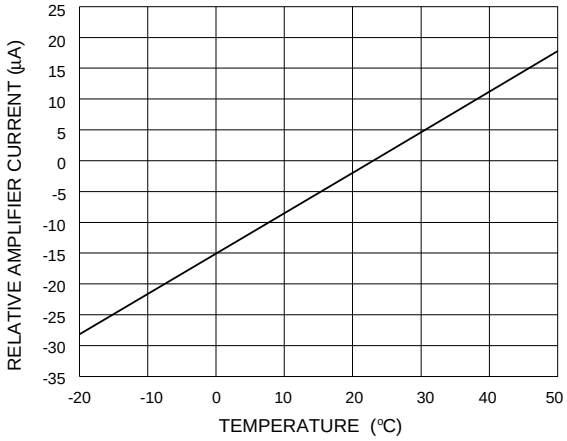


Fig. 8 Amplifier Current vs Temperature

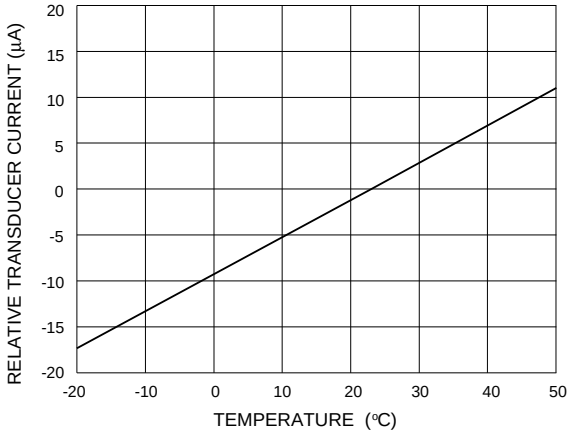


Fig. 9 Transducer Current vs Temperature

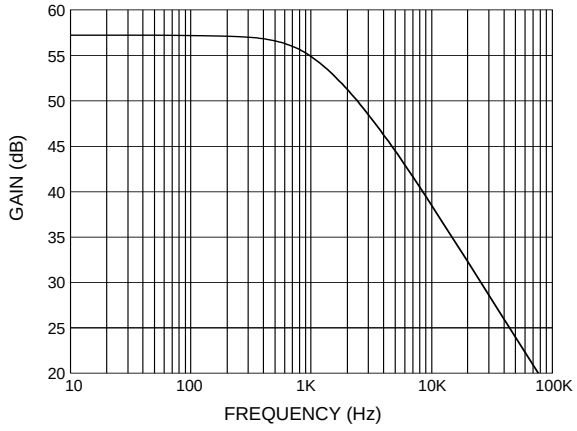


Fig. 10 Preamplifer Open Loop Frequency Response

REVISION NOTES
Au bump removed