ADVANCED SENSOR INTEGRATIONS

AS2604 High Performance Operational Amplifier

General description

The AS2604 is ultra low distortion, low noise, and high slew rate and high performance operational amplifier. Based on the leading edge process technology with state-of-the-art circuit design, the AS2604 operational amplifier delivers superior audio signal amplification with outstanding performance. The AS2604 combines extremely low voltage noise density with low THD+N (< 0.00003%) to easily satisfy the most demanding general application especially in audio. To ensure that the most challenging loads are driven without components, the AS2604 has a high slew rate of ±22V/us and an output current capability of 26mA. Further dynamic range is maximized by an output stage that drives 2KΩ loads to within 1V of either power supply voltage and to within 1.4V when driving 600Ω loads.

The AS2604's outstanding CMRR (110dB), PSRR (110dB) and V_{OS} (300μV) give the amplifier excellent DC performance.

The AS2604 has wide supply range of ±2.5V to ±18V. Over supply range, the amplifier's input circuitry maintains excellent common mode and power supply rejection, as well as maintaining its low input bias current. The amplifier is unity gain stable. The operation amplifier achieves outstanding AC performance while driving complex loads with values as high as 100pF.

The AS2604 is available in 8-lead Plastic DIP and SOIC.

Key Specification

• Power supply voltage range	±2.5V to ±18V
• THD + N (A_V= 1, V_{OUT} = 3V_{RMS} f_{IN}= 1KHz R_L= 600Ω, LPF 20KHz)	<0.00003%
• Input Noise Density	5nV/√Hz
• Slew rate	±22V/us
• Gain Bandwidth Product	23MHz
• Open loop gain (R_L = 600Ω)	130dB
• Input Bias current	50nA
• Input Offset Voltage	300μV
• DC gain linearity Error	0.00001%

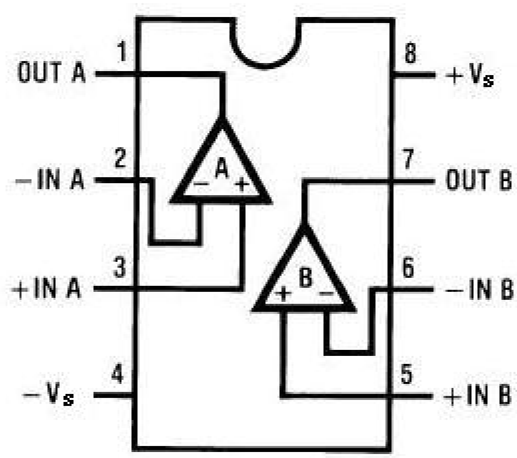
Features

- Easily drives 600Ω loads
- Optimized for superior audio signal fidelity
- Output short circuit protection
- PSRR and CMRR exceeds 110 dB
- DIP and SOIC package

Applications

- Ultra high quality audio amplification
- High fidelity preamplifiers
- High fidelity multimedia
- State-of-the-art phone pre amps
- High fidelity equalization and crossover networks
- High performance line drivers and receiver

Pin Connections

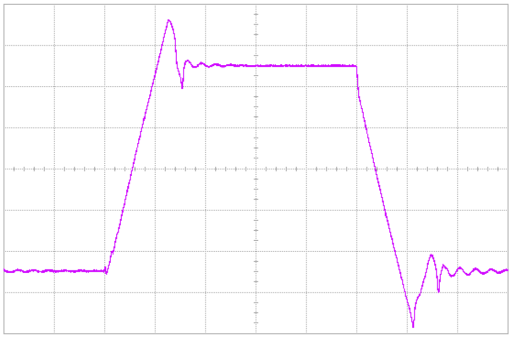


Electrical Characteristics

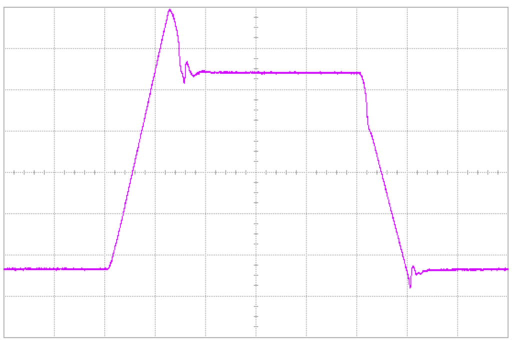
The following specifications apply for $V_S = \pm 15V$, $R_L = 2K\Omega$ and $T_A = 25^oC$ unless otherwise specified.

Symbol	Parameter	Conditions	Typical	Limit	units
THD +N	Total Harmonic Distortion + Noise	Av=1 $V_{OUT} = 3V_{RMS}$ LPF 20KHz R_L=1KΩ R_L=600Ω	 0.00003 0.00003	 0.0003 0.0003	 %
IMD	Intermodulation Distortion	Av=1, $V_{OUT} = 3V_{RMS}$ Two-tone, 60KHz & 7KHz 4:1	0.00005	0.0002	%
GBWP	Gain Bandwidth Product		23	20	MHz
SR	Slew Rate	Av = -5	22	18	V/µs
FPBW	Full Power Bandwidth	$V_{OUT} = 20V_{pp}$, R_L=1KΩ	300		KHz
T_s	Setting time	A_V=-1, 5V step C_L=30pF	650	1000	ns
e_n	Equivalent input noise voltage Equivalent input noise density	f_{BW}=20Hz to 20KHz f=1KHz	0.7 5	2.2 15	μV_{RMS} nV/√Hz
i_n	Current noise density	f=1KHz	10		pA/√Hz
V_{OS}	Offset voltage		0.3	5	mV
PSRR	Power supply rejection Ratio	$\Delta V_S = 20V$	110	100	dB
$ISO_{CH\text{-}CH}$	Channel to Channel Isolation	f_{IN} = 1KHz	130		dB
I_B	Input Bias Current	$V_{CM} = 0V$	50	200	nA
I_{OS}	Input offset current	$V_{CM} = 0V$	20	50	nA
V_{INCM}	Common mode input voltage range	Vs=±15V	+14 -14	+13.5 -13.5	V(min)
CMRR	Common mode rejection ratio	$-10V < V_{CM} < 10V$	110	100	dB
A_{VOL}	Open loop voltage Gain	$-10V < V_{OUT} < 10V$, R_L= 600Ω	130	110	dB
V_{OUTMAX}	Maximum output voltage swing	R_L=600Ω, Vs=±15V	±13.8	±13.5	V
I_{OUT}	Output current	R_L=600Ω, Vs=±18V	±28	±24	mA
$I_{OUT\text{-}CC}$	Instantaneous Short Circuit current		+40 -45		mA
R_{OUT}	Output impedance	f_{IN} = 10KHz Close-loop Open-loop	 0.03 15		 Ohm
I_S	Total quiescent current	I_{out} = 0mA, Vs=±15V	17.5	19	mA
T_A	Temperature range		0 to 85		^oC

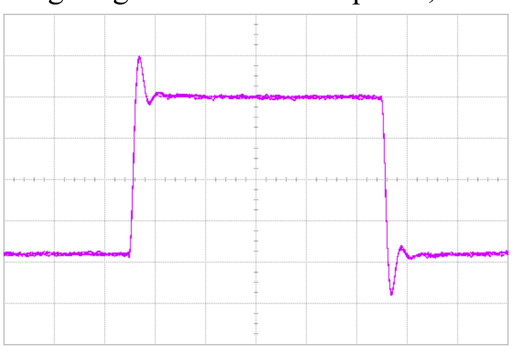
Typical Performance Characteristics



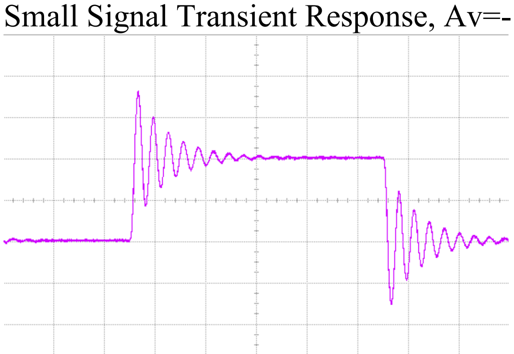
Large Signal Transient Response, Av=+1, 10V step, R_{load} = 600Ω, C_{load} = 30pF



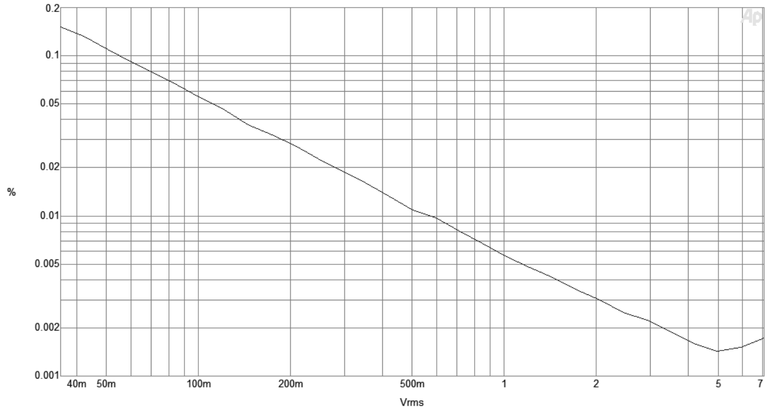
Large Signal Transient Response, Av=-1, 10V step, R_{load} = 2kΩ, C_{load} = 30pF



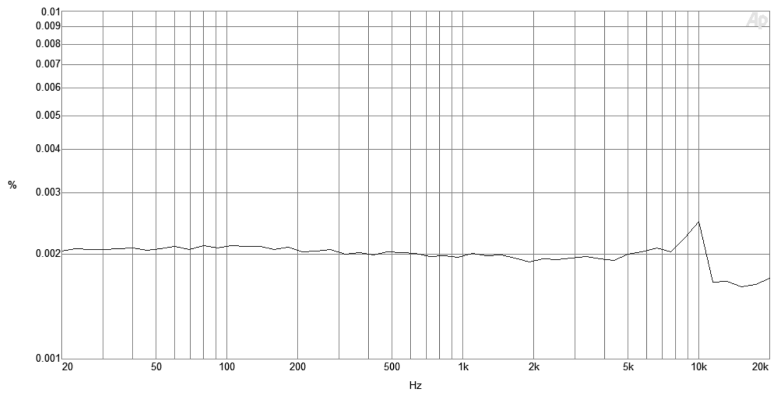
Small Signal Transient Response, Av=-1, 0.2V step, R_{load} = 2kΩ, C_{load} = 30pF



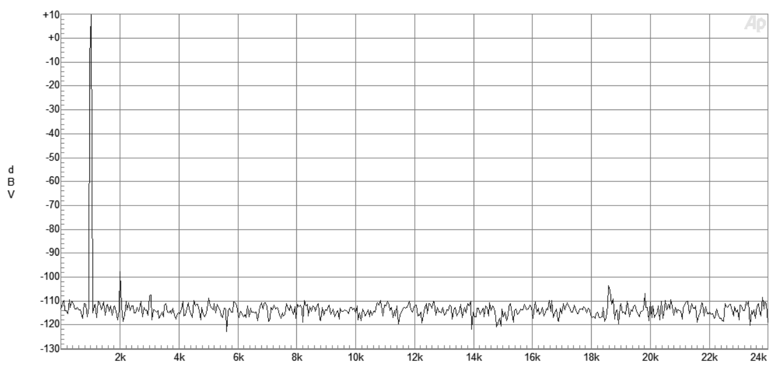
Small Signal Transient Response, Av=+1, 0.2V step R_{load} = 600Ω, C_{load} = 30pF



THD (value should be divided by 100) vs Vout, Freq=1KHz, R_{load} = 600Ω



THD (value should be divided by 100) vs Frequency, Vout=3V_{RMS}, R_{load} = 600Ω



FFT, Vout=3V_{RMS}, Freq=1KHz, R_{load} = 600Ω, Vs=±15V

DISTORTION MESUREMENTS

The distortion produced by the AS2604 is bellow measurement limit of virtually all commercially available equipment. A Special test circuit, however, can be used to extend the measurement capabilities. Op amp distortion can be considered an internal error source which can be referred to the input. Figure below shows a circuit which causes the op amp distortion to be 101 times greater than normally produced by the op amp. The addition of 10Ω to the otherwise standard non-inverting amplifier configuration alters the feedback factor or noise gain of the circuit. The closed-loop gain is unchanged, but the feedback available for error correction is reduced by a factor of 101. This extends the measurement limit, including the effects of the signal-source purity, by a factor of 101. Note that the input signal and load applied to the am amp are the same as with conventional feedback without 10 Ω.

Validity of this technique can be verified by duplicating measurements at high gain and/or high frequency where the distortion is within the measurement capability of the test equipment. Measurements for this data sheet were made with the Audio Precision ATS2 which greatly simplifies such repetitive measurements. The measurement technique can, however, be performed with manual distortion measurement instruments.