

# Quad Differential Amp Monolithic IC MM1366

## Outline

This IC is an audio quad differential amp with 4 channels – 2-input and 2-output. A 50kHz LPF is built in, doing away with the need for external capacitors and resistors and simplifying the design process.

## Features

1. CMRR 60dB typ.
2. PSRR1  $f = 100\text{Hz}$  80dB typ.
3. Operating voltage 4 ~ 6V
4. Consumption current 1.5mA typ.
5. Input impedance 47 k $\Omega$  typ.
6. Maximum output voltage (when  $R_L = 10\text{k}\Omega$ , THD = 10%) 1.25V<sub>rms</sub> typ.

## Package

TSOP-20A

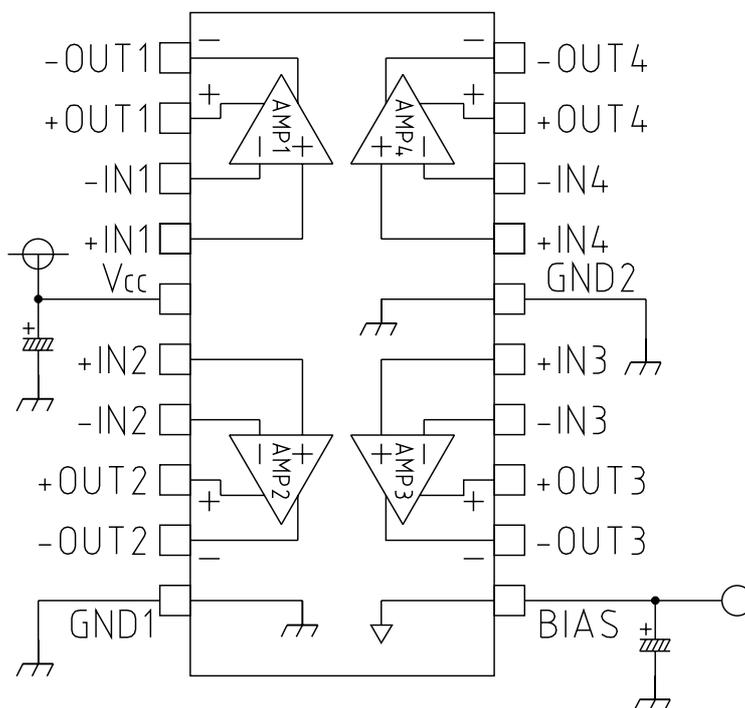
## Applications

- (1) Notebook PC audio

## Pin Description

Pin No.	Pin name	Functions	Pin No.	Pin name	Functions
1	-OUT1	Inverting output of AMP1	11	BIAS	BIAS voltage terminal BIAS voltage= $V_{CC}/2$
2	+OUT1	Non Inverting output AMP1			
3	-IN1	Inverting input to AMP1	12	-OUT3	Inverting output of AMP3
4	+IN1	Non Inverting input to AMP1	13	+OUT3	Non Inverting output of AMP3
5	V <sub>CC</sub>	Supply voltage input pin	14	-IN3	Inverting input to AMP3
6	+IN2	Non Inverting input to AMP2	15	+IN3	Non Inverting output of AMP3
7	-IN2	Inverting input to AMP2	16	GND2	GND for AMP3, AMP4 connected to GND1.
8	+OUT2	Non Inverting output of AMP2			
9	-OUT2	Inverting output of AMP2	17	+IN4	Non Inverting output of AMP4
10	GND1	GND for AMP1, AMP2 connected to GND2.	18	-IN4	Inverting input to AMP4
			19	+OUT4	Non Inverting output of AMP4
			20	-OUT4	Inverting output of AMP4

Pin Assignment



Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Ratings	Units
Storage temperature	T <sub>STG</sub>	-40~+125	°C
Operating temperature	T <sub>OPR</sub>	-20~+75	°C
Supply voltage	V <sub>CCmax.</sub>	10	V
Allowable loss	P <sub>d</sub>	300	mW

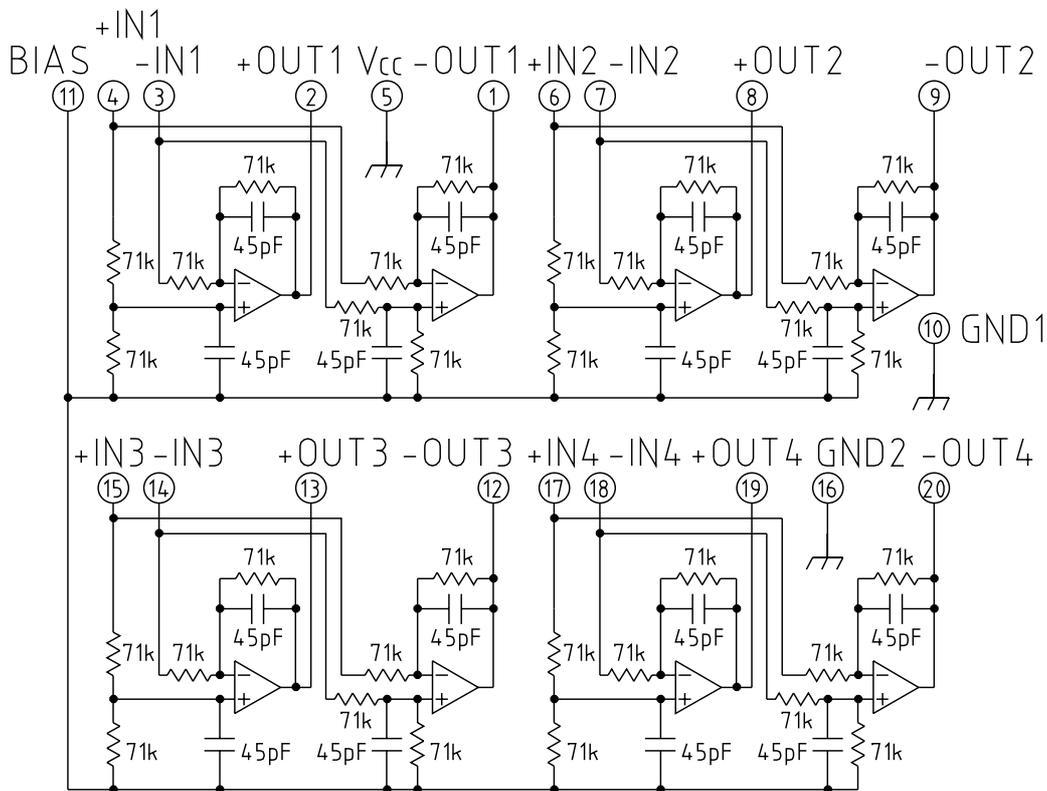
Recommended Operating Conditions

Item	Symbol	Ratings	Units
Operating temperature	T <sub>OPR</sub>	-20~+75	°C
Operating voltage 1	V <sub>OP</sub>	4.0~6.0	V
Operating voltage 2	V <sub>OPBIAS</sub>	V <sub>OP</sub> /2	V

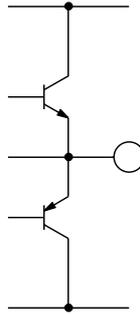
**Electrical Characteristics** (Except where otherwise indicated,  $T_a=25^{\circ}\text{C}$ ,  $V_{CC}=5\text{V}$ ,  $f=1\text{kHz}$ ,  $V_{BIAS}=2.5\text{V}$ )

Item	Signal	Measurement conditions	Min.	Typ.	Max.	Unit
Full circuit current consumption	$I_{CC}$	When non signal input, non load Input voltage=0, $R_L=\infty$	0.9	1.5	2.4	mA
Input impedance	$Z_{IN}$		37.5	47.0	57.5	k $\Omega$
Input voltage (DC)	$V_i$		1.0		$V_{CC}-1.0$	V
Voltage gain 1	$A_{V1}$	$R_L=10\text{k}\Omega$ , $f_{IN}=20\text{Hz}\sim 10\text{kHz}$	-1.0	0	+1.0	dB
Voltage gain 2 (50kHz)	$A_{V2}$	$R_L=10\text{k}\Omega$ , $f_{IN}=50\text{kHz}$	-6.0	-3.0	+1.0	dB
Voltage gain 3 (200kHz)	$A_{V3}$	$R_L=10\text{k}\Omega$ , $f_{IN}=200\text{kHz}$	-16.0	-12.0	-8.0	dB
Differential BIAS voltage input / output	$\Delta V_B$		-12		12	mV
Output voltage	$V_{OR}$		1.0		$V_{CC}-1.0$	V
Maximum output voltage	$V_{max.}$	$R_L=10\text{k}\Omega$ , When THD=10% $V_{BIAS}=2.5\text{V}$	1.00	1.25		$V_{rms}$
Total Harmonic Distortion	THD	$R_L=10\text{k}\Omega$ , Input 1.0V <sub>P-P</sub>		0.03	0.10	%
Output impedance	$Z_o$			5.0	15.0	$\Omega$
Common mode ripple rejection ratio	CMRR	$R_L=10\text{k}\Omega$ , Input 1.0V <sub>P-P</sub>	50	60		dB
Power supply ripple rejection ratio 1	PSRR1	$f=100\text{Hz}$ , $R_L=10\text{k}\Omega$ , $V_{CC}=1.0\text{V}_{P-P}$	70	80		dB
Power supply ripple rejection ratio 2	PSRR2	$f=20\text{kHz}$ , $R_L=10\text{k}\Omega$ , $V_{CC}=1.0\text{V}_{P-P}$	46	52		dB
Output noise voltage	$V_{ON}$	Range 10Hz~110kHz BW=10Hz~110kHz		30	90	$\mu\text{V}_{rms}$

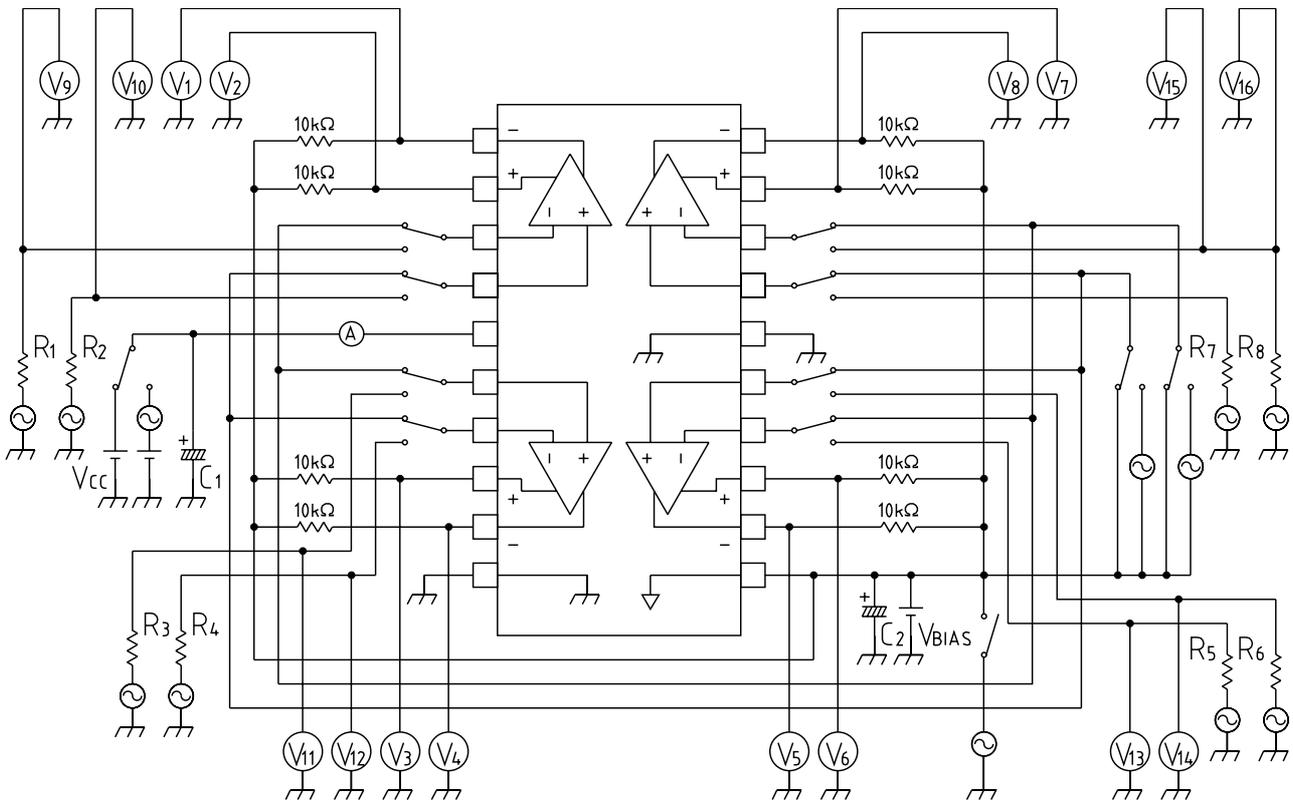
**Block Diagram**



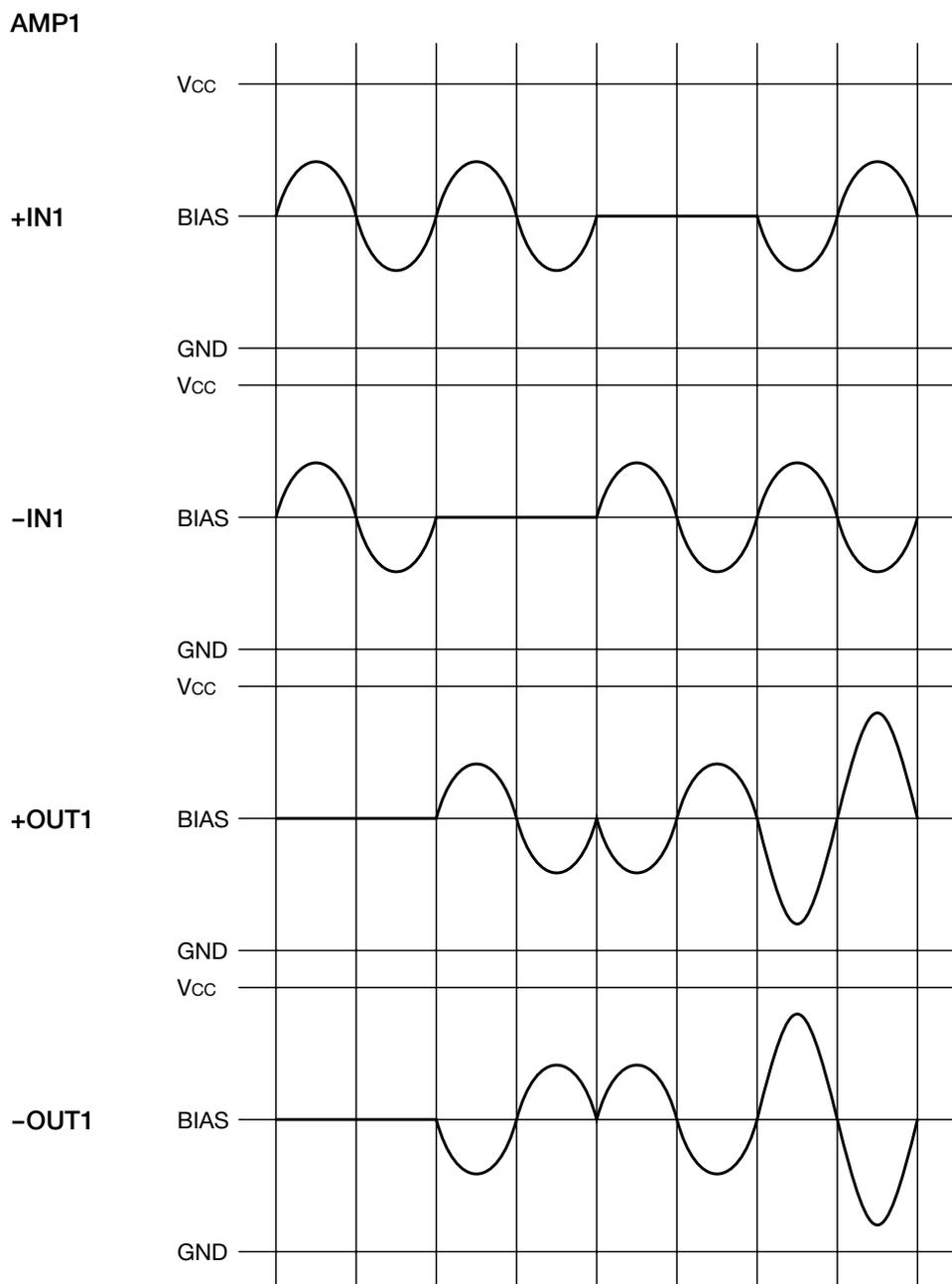
Output circuit



Measuring Circuit



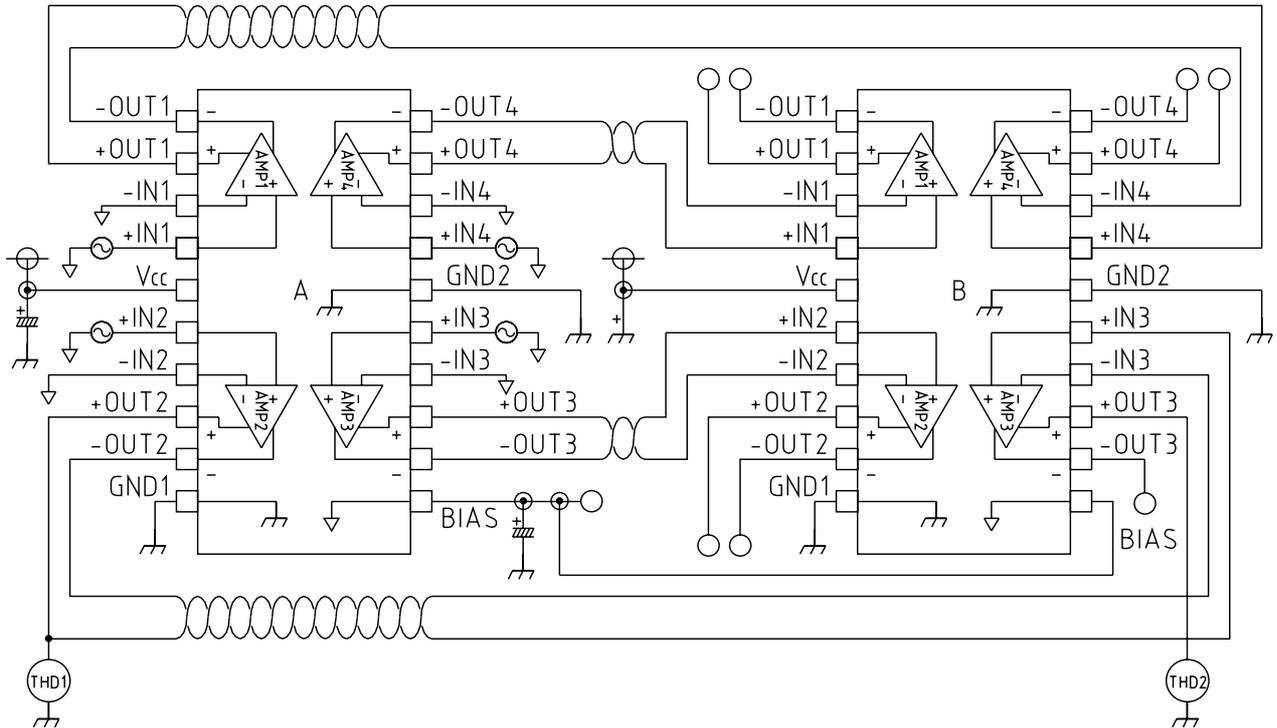
Time Waveforms



\*1 : AMP2, AMP3, AMP4 are same as AMP1.

\*2 : BIAS voltage= $V_{cc}/2$

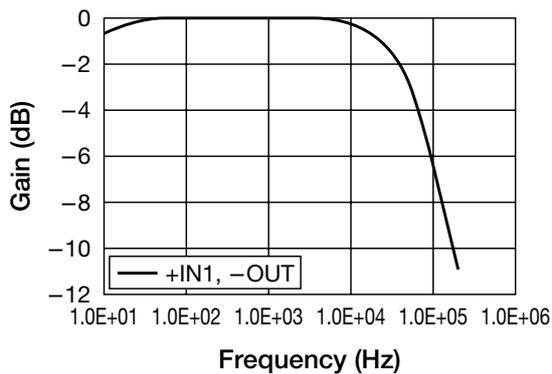
Application Circuit



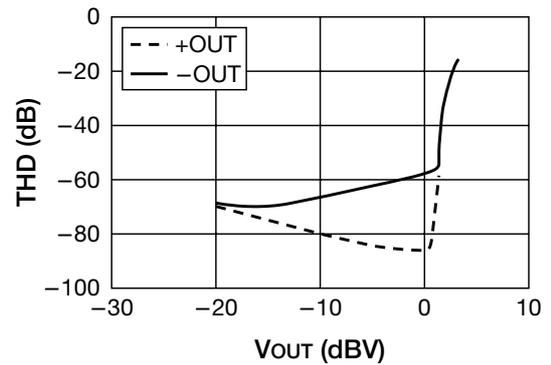
- Note 1 : This is 0dB defferential amp that have plus and minus pin at input and output.  
(The condition of measuring gain is single input and output.)
- Note 2 : The gain is 6dB at typical application circuit.
- Note 3 : When connect A amplifier 2 and B Amplifier 3, improve for distortion rate from THD1=-70dB to THD2=-75dB. (when +OUT3 output-10dB voltage)

Characteristics

Gain vs Frequency



THD vs Vout



Note: The distortion rate for +IN, -OUT can be improved by -15dB as compared to +IN, -OUT.  
( $V_{OUT} = -10\text{dBV}$ )