

## Ground Isolation Amplifier

### PRODUCT DESCRIPTION

The MS3121 is a ground isolation amplifier, which is used in car audio system. It can solve the problem of wiring resistance in car audio system, and noise problem caused by the electrical devices in automobile. In addition, the required external capacitance is small, which is convenient for system integration. It is noted that the chip ground needs to be the same electric potential as the ground of power amplifier.



**SOP8**

### FEATURES

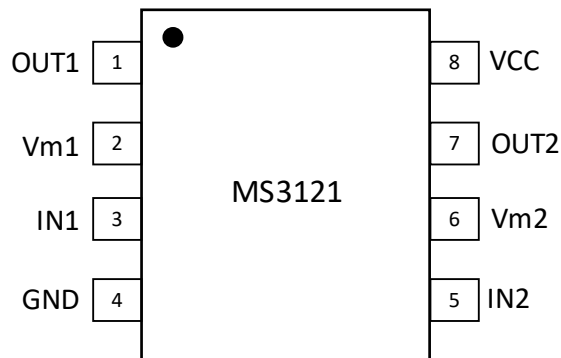
- No Need for Large Capacitance
- Low Harmonic Distortion (THD=0.002%)
- High Common-mode Rejection Ratio (57dB@1kHz)
- Two Channels
- Low Noise
- SOP8 Package

### APPLICATIONS

- Car Audio System

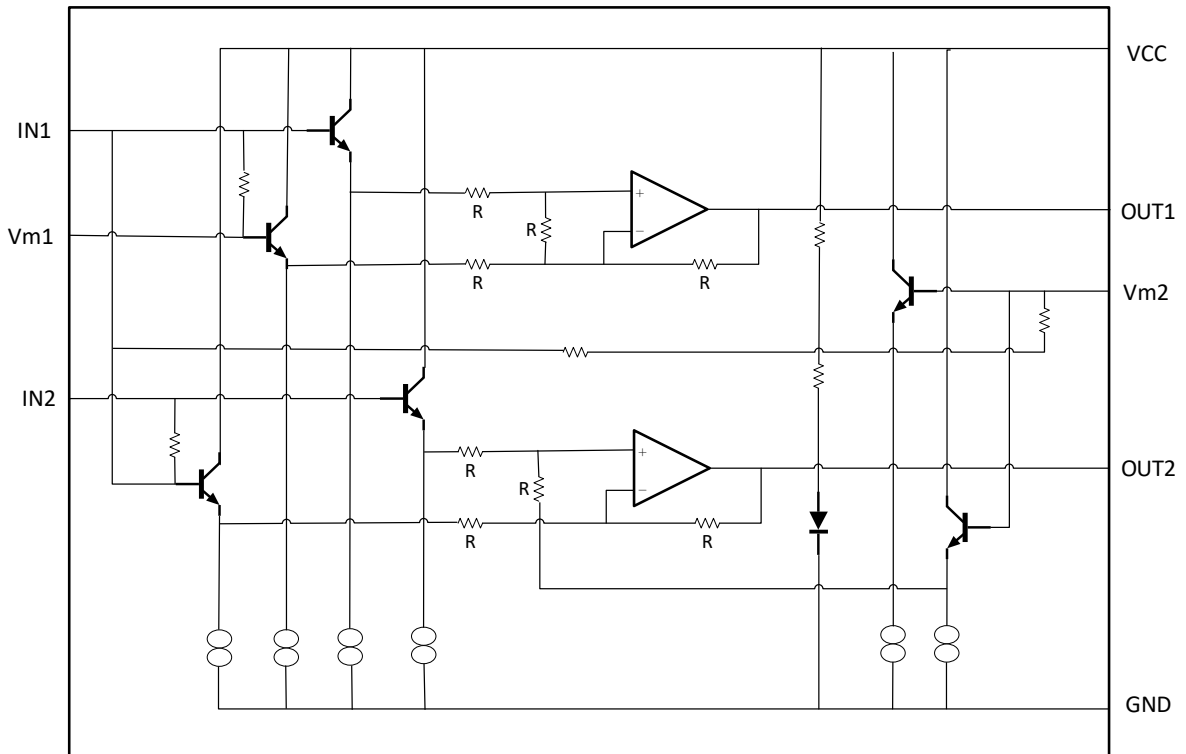
### PRODUCT SPECIFICATION

Part Number	Package	Marking
MS3121	SOP8	MS3121

**PIN CONFIGURATION**

**PIN DESCRIPTION**

Pin	Name	Type	Description
1	OUT1	O	Output 1
2	Vm1	I	Reference Voltage 1, Externally Connect to Filtering Capacitor
3	IN1	I	Input 1
4	GND	-	Ground. It is suggested that the chip ground should be connected with the ground of power amplifier
5	IN2	I	Input 2
6	Vm2	I	Reference Voltage 2, Externally Connect to Filtering Capacitor
7	OUT2	O	Output 2
8	VCC	-	Power Supply

BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS**

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

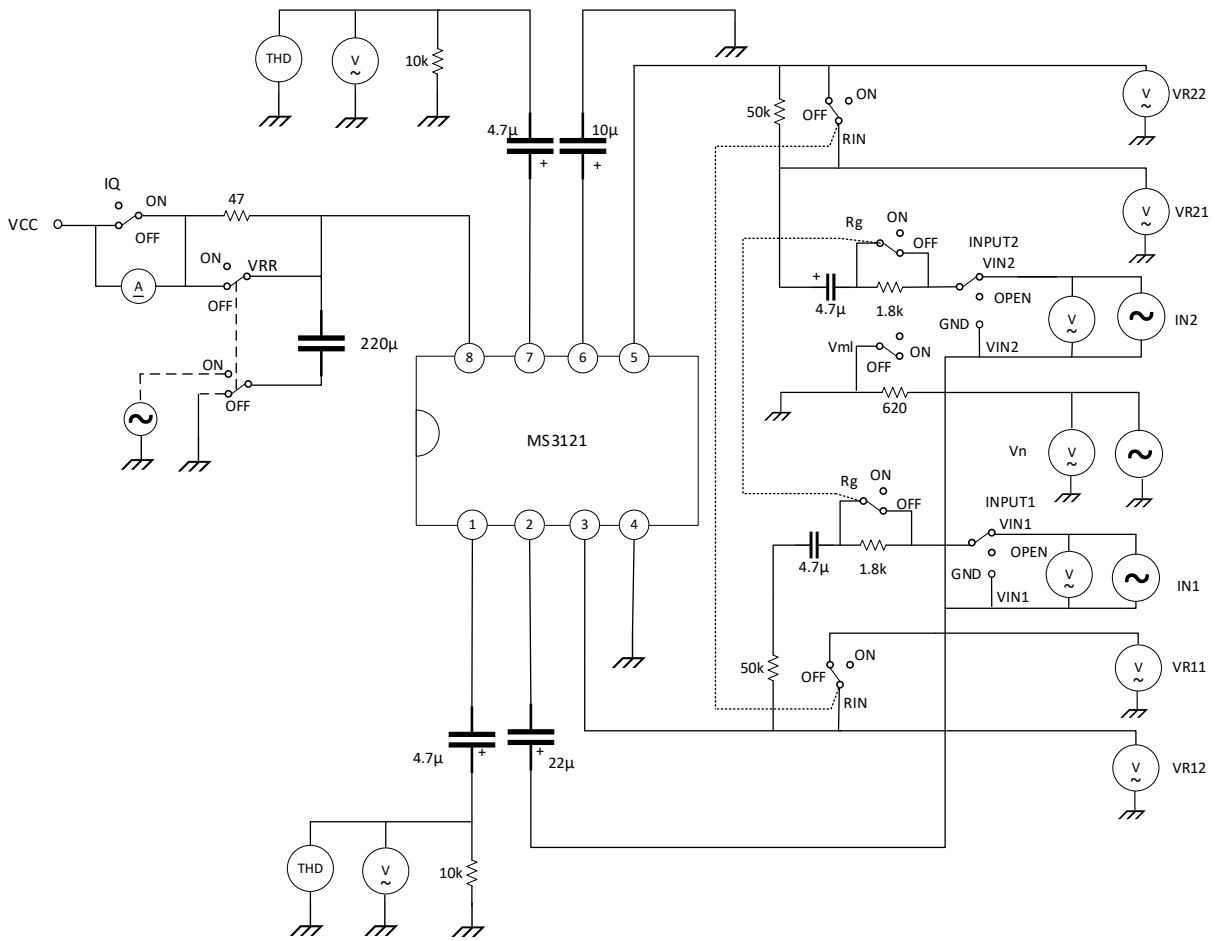
Parameter	Symbol	Ratings	Unit
Power Supply	VCC	18	V
Power Dissipation	PD	700	mW
Operating Temperature	Topr	- 40 ~ +100	°C
Storage Temperature	Tstg	-55 ~ +125	°C

**ELECTRICAL CHARACTERISTICS**

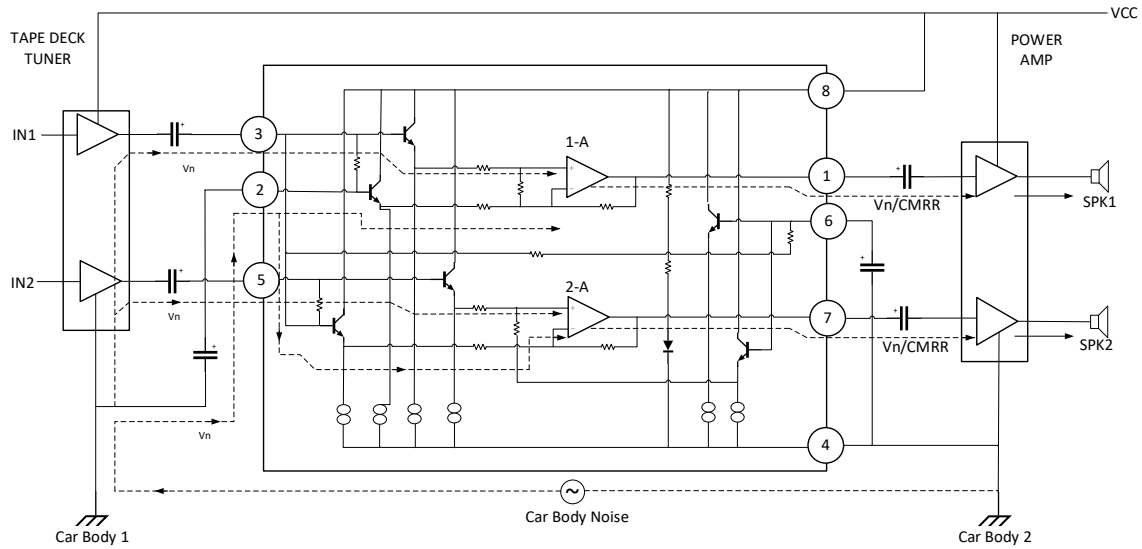
 Unless otherwise noted,  $T_a = 25$ ,  $V_{CC} = 12V$ ,  $f = 1kHz$ ,  $R_g = 1.8k\Omega$ .

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply	Vpp		4	12	18	V
Quiescent Current	IQ	Vin=0rms	5.6	9.0	14.0	mA
Output Noise	Vno	BPF=20Hz~20kHz	-	3.5	8.0	$\mu V$
Voltage Gain	Gv	V0=-10dBm, Rg=0	-1.5	-0.04	1.5	dB
Maximum Output Voltage	Vom	THD=0.1%, VCC=8V	1.8	2.0	-	V
Total Harmonic Distortion	THD	V0=0.7Vrms	-	0.002	0.02	%
Common-mode Rejection Ratio	CMRR		41	57	-	dB
Common-mode Voltage	Vcm	VCC=8V, CMRR=40dB	2.5	3.75	-	V
Power Supply Rejection Ratio	PSRR	f=100Hz, V=-10dBm, Rg=0	72	80	-	dB
Channel Isolation	CS	Vin=-10dBm, Rg=1.8k $\Omega$ or open	-	82	-	dB
Slew Ratio	SR		-	2.0	-	V/ $\mu s$
Input Resistance	Rin		44	55	66	k $\Omega$

Test Circuit Diagram

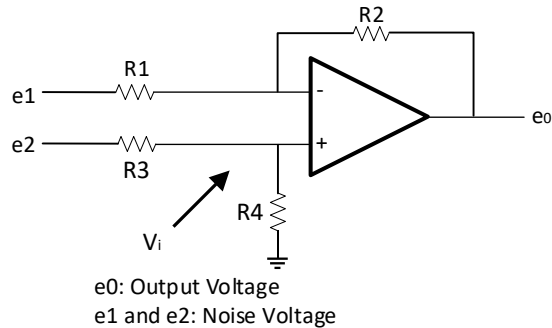


**OPERATION PRINCIPLE**



The ground of car-audio system is connected to car body. Due to this reason, electrical noise of car electrics enters into audio amplifier by the chassis, thus affecting audio quality.

The MS3121 can effectively eliminate noise according to the high common-mode rejection ratio(CMRR) characteristic. If the MS3121 is not used, noise would directly enter into audio amplifier. However, when the MS3121 is used, the CMRR characteristic of the 1-A and 2-A can remove the noise.



The Principles of Noise Rejection

The formula for output voltage of amplifier is as follows:

$$\begin{aligned}
 V_i &= \frac{R_4}{(R_3 + R_4)} \times e_2 \\
 e_0 &= -\frac{R_2}{R_1} e_1 + \frac{R_1 + R_2}{R_1} \times V_i \\
 e_0 &= -\frac{R_2}{R_1} e_1 + \frac{R_1 + R_2}{R_1} \times \frac{R_4}{(R_3 + R_4)} \times e_2 \\
 &= -\frac{R_2}{R_1} \times (e_1 - e_2) + \frac{R_1 R_4 - R_2 R_3}{R_1 (R_3 + R_4)} \times e_2
 \end{aligned}$$

In theory, if  $R1R4 = R2R3$ , and  $e1 = e2$ , the output noise voltage would become zero. In fact, output noise cannot be eliminated completely due to the circuit's asymmetry and the difference in the input noise voltages ( $e1$  and  $e2$ ). When the MS3121 is used, the rejection ratio can reach above 41dB.

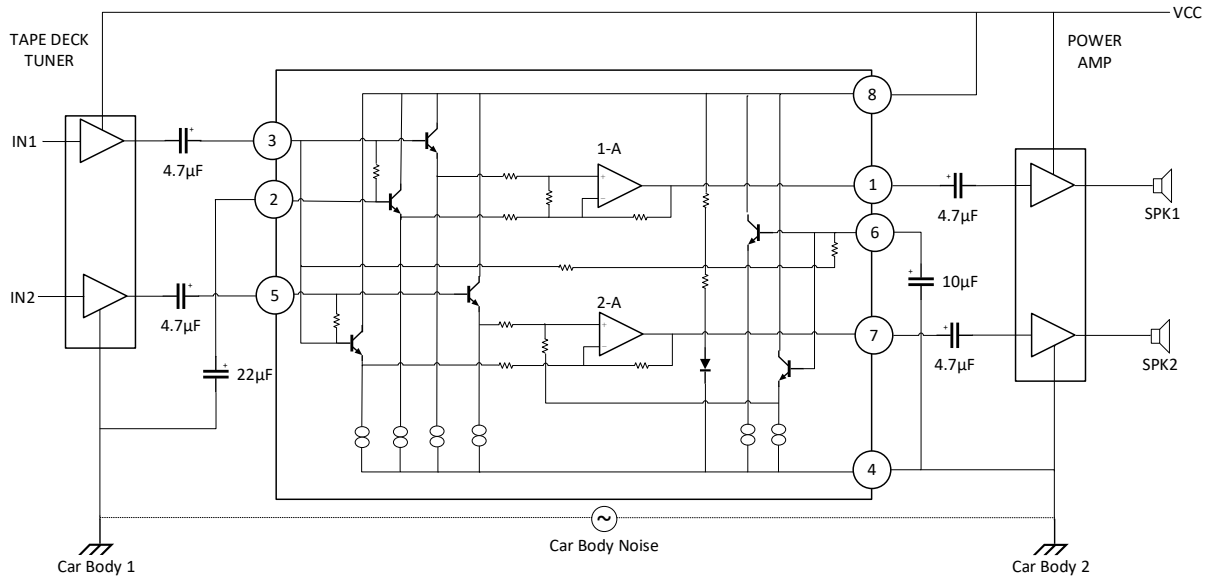
Note:

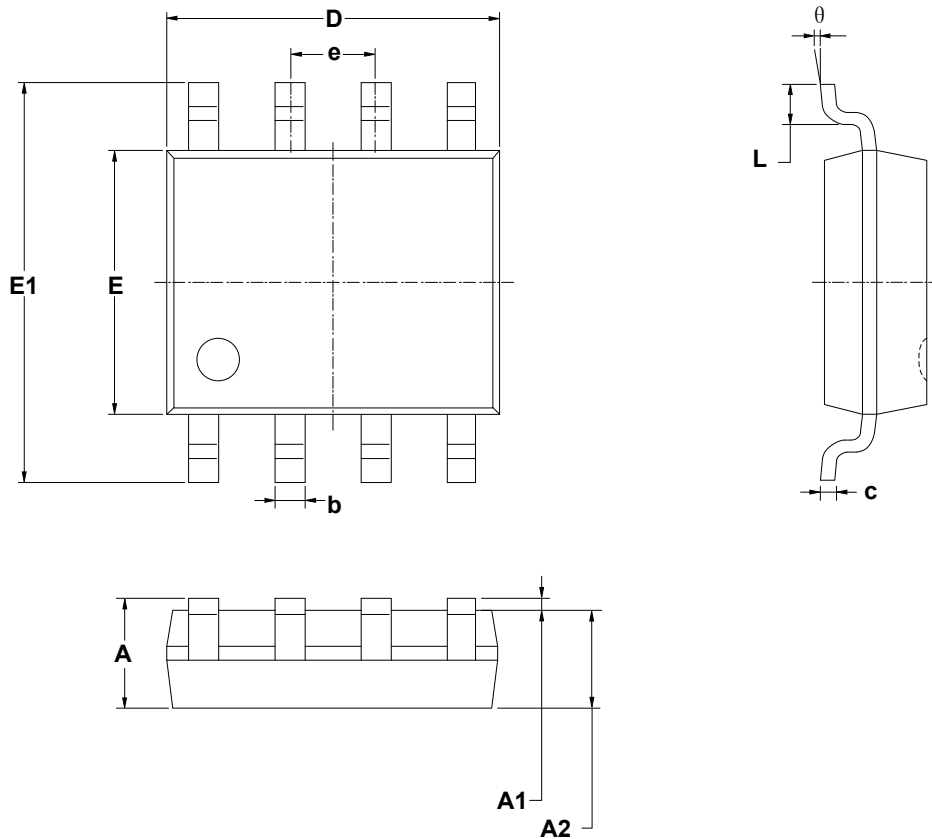
1. External capacitance setting is 2 for Pin2 ( $V_{m1}$ ) and Pin6 ( $V_{m2}$ ) : Seeing value 1 to prevent capacitance change from affecting the rejection of power supply.

(2) If external capacitor of Pin2 ( $V_{m1}$ ) is doubled, the bass-region CMRR would increase 6dB. If capacitance is halved, CMRR would decrease 6dB.



TYPICAL APPLICATION DIAGRAM



**PACKAGE OUTLINE DIMENSIONS**
**SOP8**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

**MARKING and PACKAGING SPECIFICATIONS**

**1. Marking Drawing Description**



Product Name : MS3121

Product Code : XXXXXX

**2. Marking Drawing Demand**

Laser printing, contents in the middle, font type Arial.

**3. Packaging Specifications**

Device	Package	Piece/Reel	Reel/Box	Piece /Box	Box/Carton	Piece/Carton
MS3121	SOP8	2500	1	2500	8	20000

**STATEMENT**

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- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.



### MOS CIRCUIT OPERATION PRECAUTIONS

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.



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