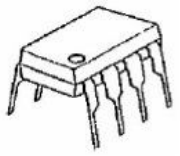
Ground isolation amplifier

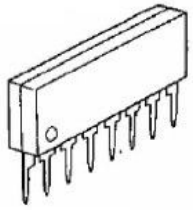
Features

- Large capacitors not required
- High common-mode rejection ratio (57dB typ. At f = 1kHz).
- Low noise (VNO = 3.5mVrms Typ.).
- Low distortion (THD = 0.002% Typ.).
- Two channels.



DIP-8

SOP-8



ZIP-8

Applications

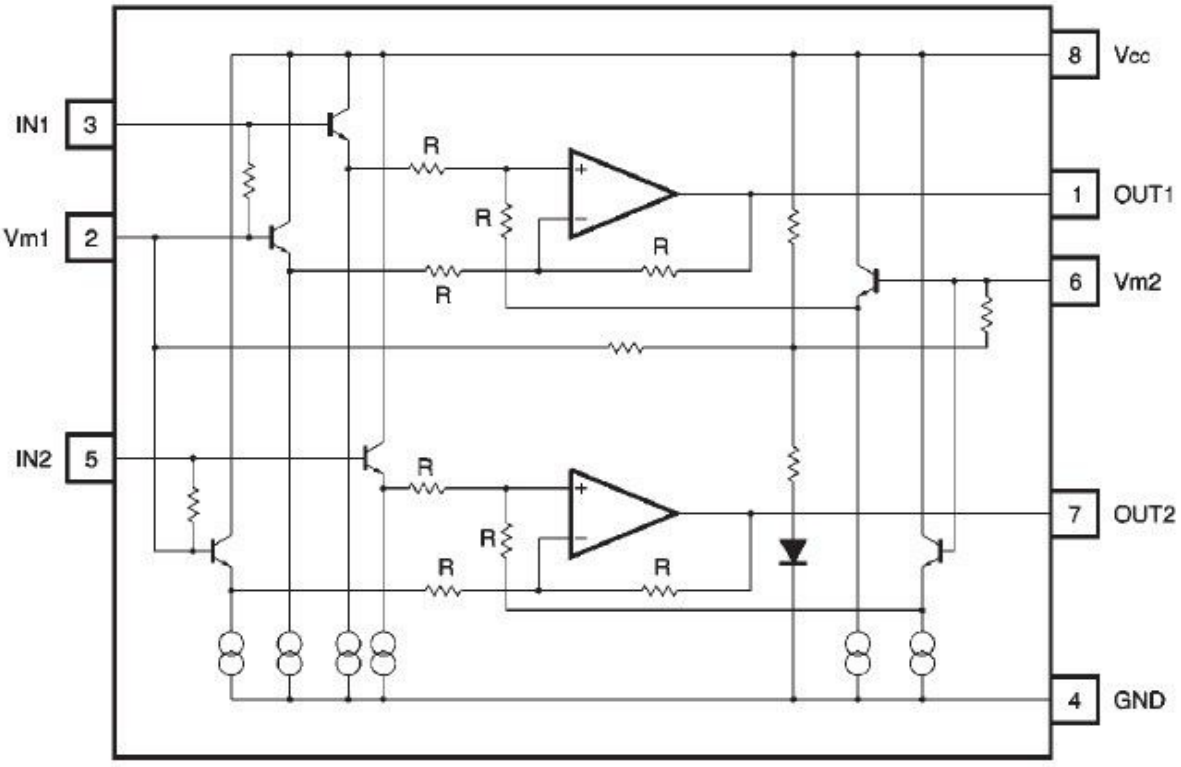
- Car audio systems

GENERAL DESCRIPTION

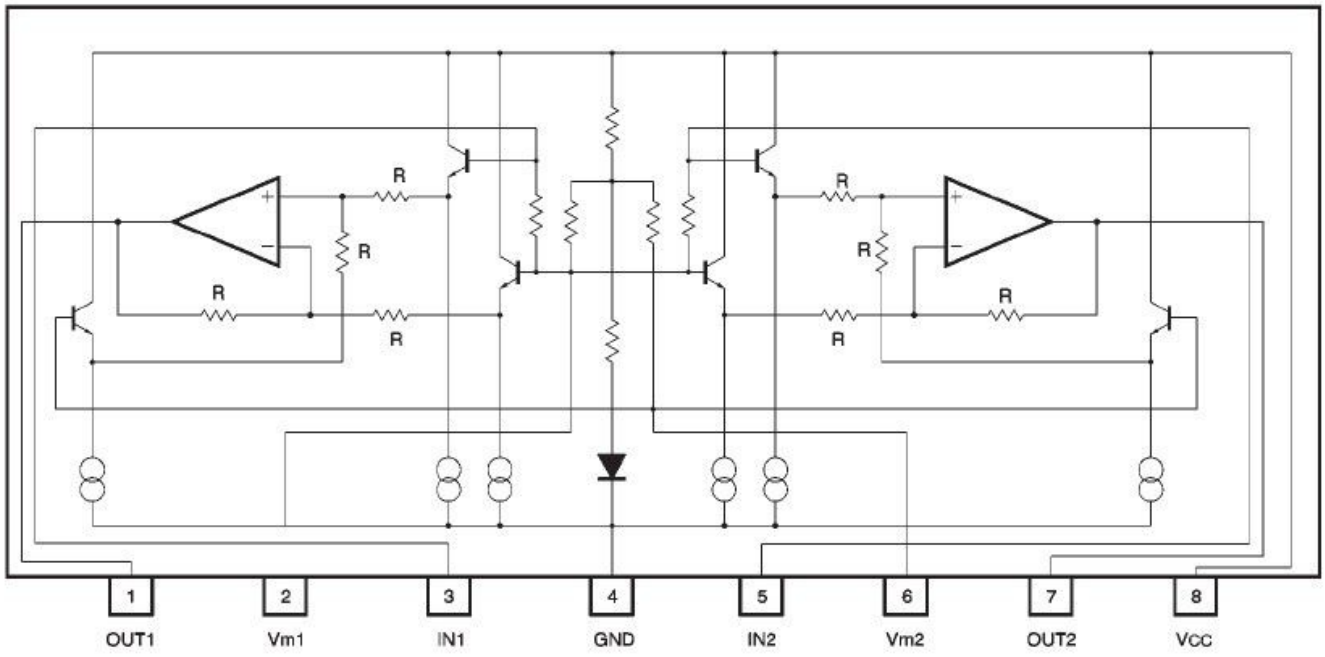
The ZL3121 are ground isolation amplifiers developed for use in car audio applications. These ICs efficiently eliminate problems caused by wiring resistance, and remove noise generated by the electrical devices used in automobiles. The capacitance values of the external capacitors required for the ICs are small to allow compact and reliable set design.

BLOCK DIAGRAM

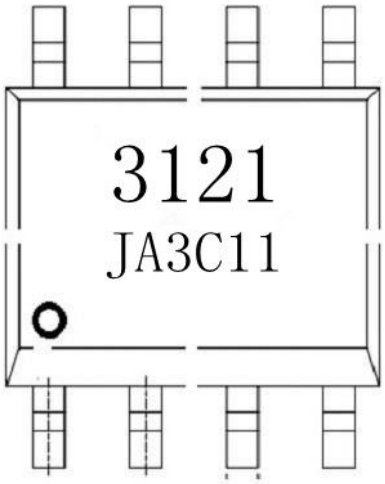
3121



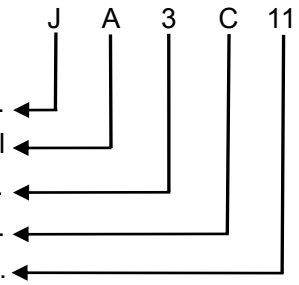
3121N



PRODUCTION INFORMATION



first line: Product model
second line: Date Code
for example:



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	limit	Unit
operating supply voltage	VCC	18	V
Power loss	PD	700	mW
Operating ambient temperature	Topr	-40～+85	℃
Storage temperature range	Tstg	-55～+125	℃

Electrical characteristics

(unless otherwise noted, Ta = 25_C, VCC = 12V, f = 1kHz, Rg = 1.8kW)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
supply voltage	Vpp		4	12	18	V
Quiescent current	IQ	Vin＝0rms	5.6	9.0	14.0	mA
Output noise current	Vno	BPF＝20HZ～20kHz	-	3.5	8.0	uV
Voltage gain	Gv	V0＝-10dbM，Rg＝0	-1.5	-0.04	1.5	D
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
Ripple rejection ratio	RR	f＝100Hz，V＝-10dbm，Rg＝0	72	80	-	dB
Channel separation	CS	Vin＝-10dbm，Rg＝1.8k or ope	-	82	-	dB
Slew rate	SR		-	2.0	-	V/us
Input resistance	Rin		44	55	66	K

Measurement circuits

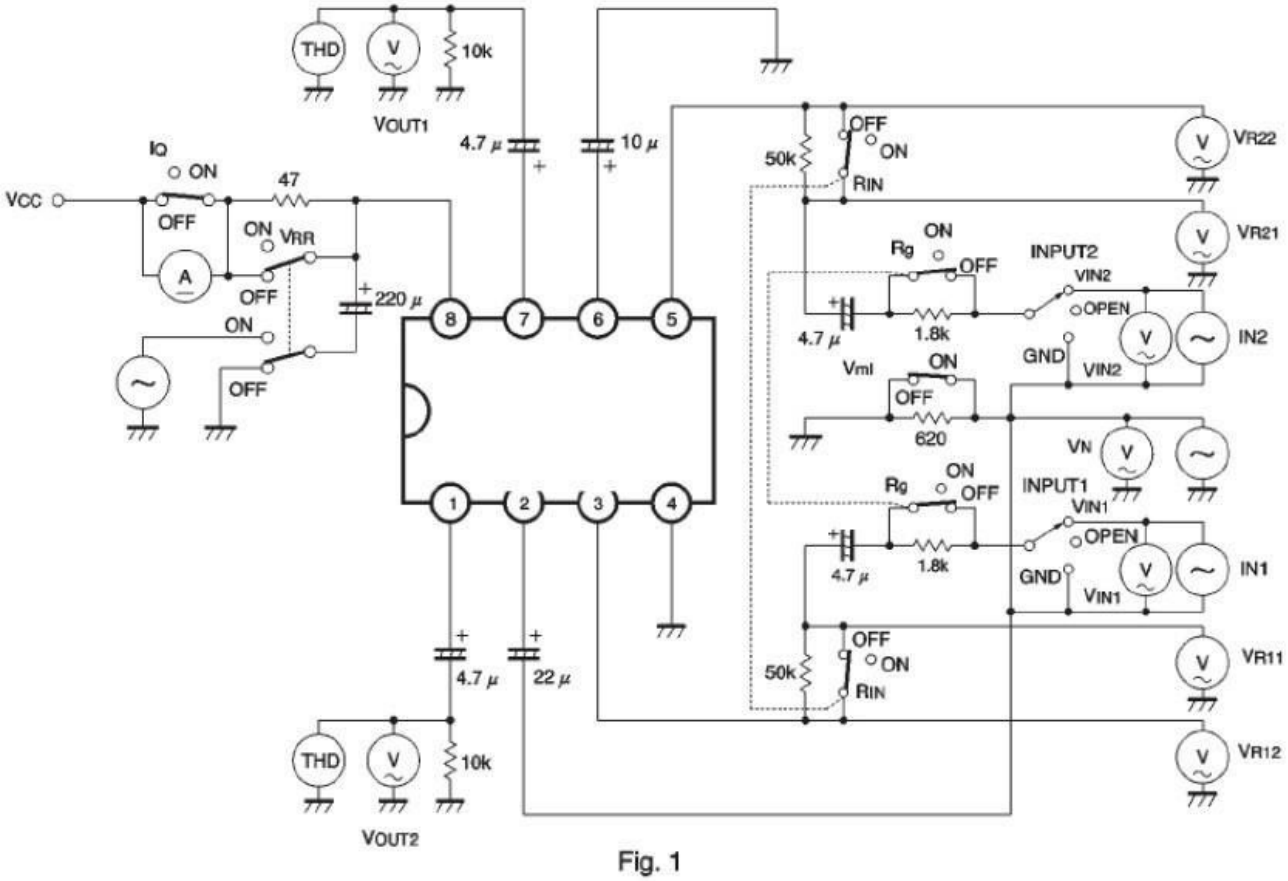


Fig. 1

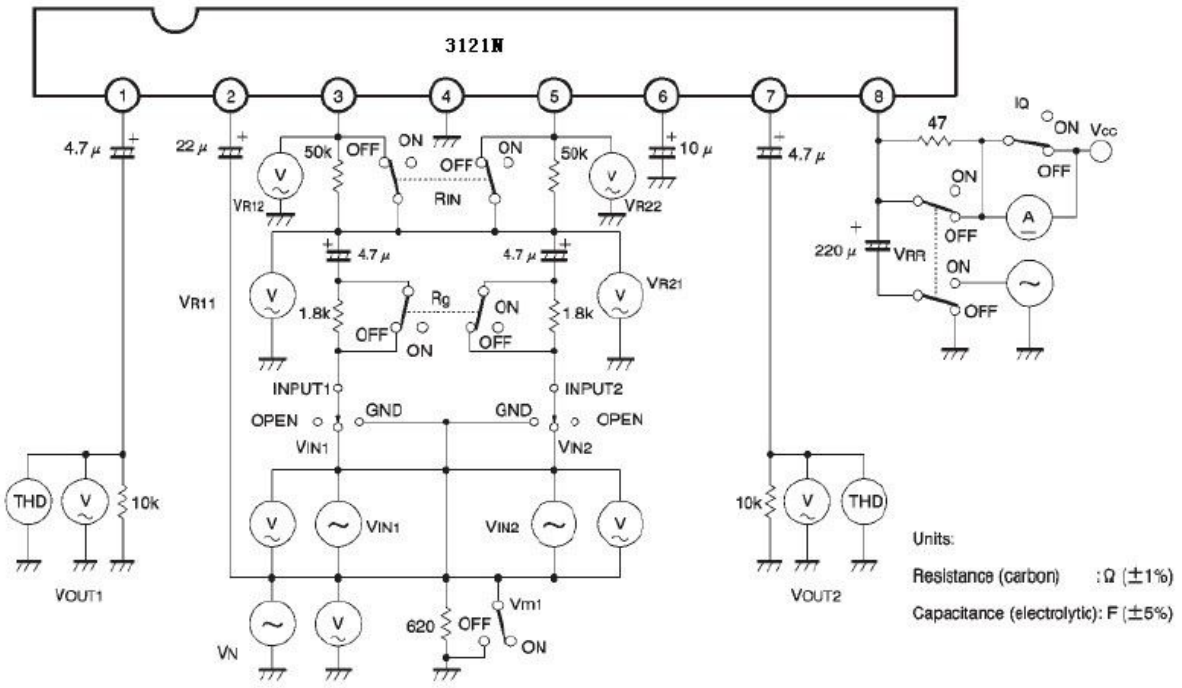


Fig. 2

Circuit operation

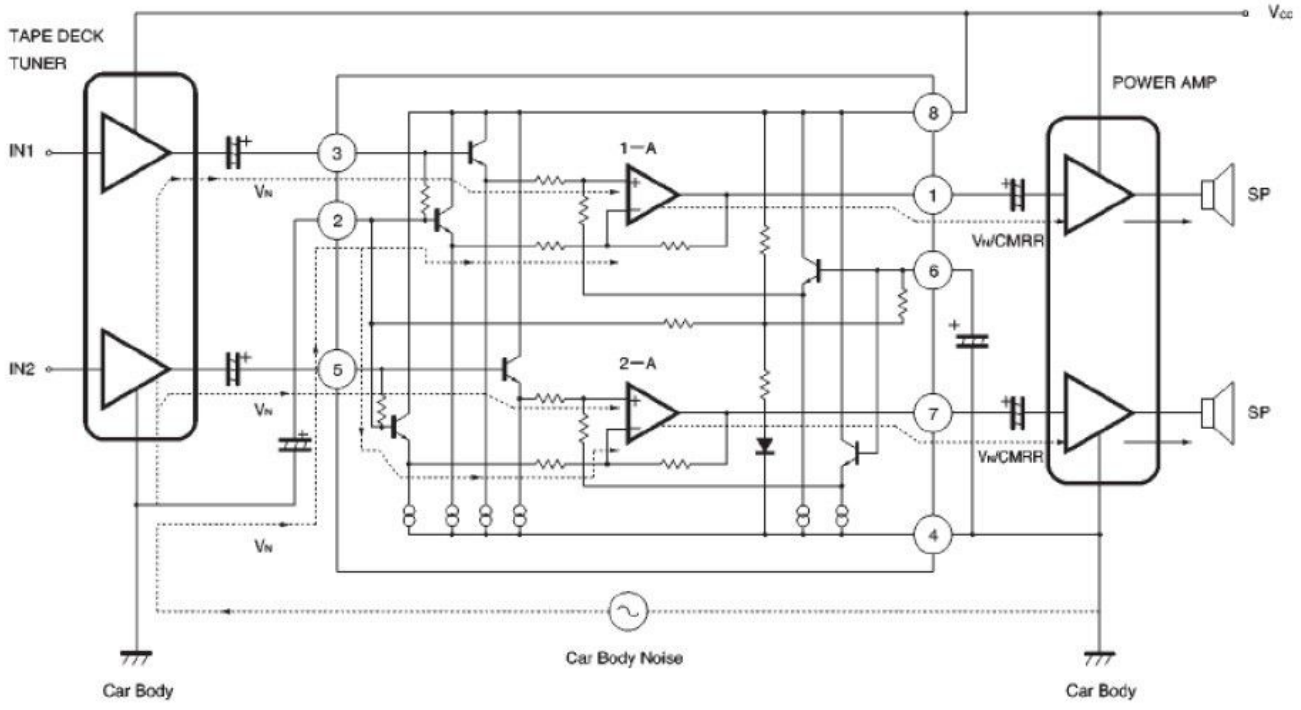


Fig. 3 Flow of noise in car-audio systems

Car-audio systems are earthed to the car body, and for this reason, electrical noise generated by the car electrics can enter the power amplifier input via the chassis, and become audible.
The ZL3121 makes use of the common-mode rejection characteristics of an operational amplifier to eliminate this noise. Without the ZL3121 noise enters the power amplifier input directly, when used, the CMMR of operational amplifiers 1-A and 2-A eliminates the noise.

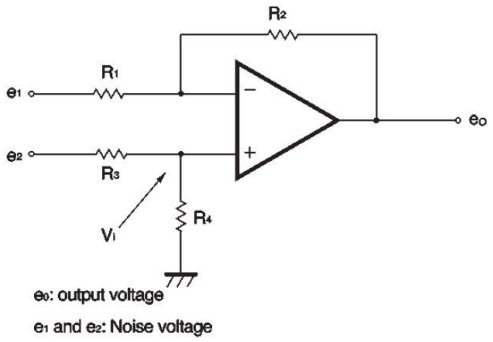


Fig. 4 The principle of noise rejection

To obtain the output voltage (eO)

$$V_i = \frac{R_4}{(R_3+R_4)} \cdot e_2 \qquad ①$$

$$e_O = -\frac{R_2}{R_1} e_1 + \frac{R_1+R_2}{R_1} \cdot V_i \qquad ②$$

From ① and ②

$$e_O = -\frac{R_2}{R_1} e_1 + \frac{R_1+R_2}{R_1} \cdot \frac{R_4}{(R_3+R_4)} \cdot e_2$$

$$= -\frac{R_2}{R_1} \cdot (e_1 - e_2) + \frac{R_1R_4 - R_2R_3}{R_1(R_3+R_4)} \cdot e_2$$

Ideally, if R1R4 = R2R3, and e1 = e2, the noise voltage will become zero. However, due to mismatching between the resistors, difference in the noise voltages (e1 and e2), and tolerances in the operational amplifier, a noise voltage does result.
With the ZL3121, the elimination level of the noise is expressed as: CMMR = 20log (eO/ei) (ei = e1 = e2)
Therefore, CMRR _ 41dB can be guaranteed.

Operation notes

(1) Maintain a ratio of 2: 1 for the values of the capacitors connected to pin 2 (Vm1) and pin 6 (Vm2) to keep the ripple rejection ratio stable. If this ratio is maintained, the ripple rejection ratio will not vary significantly even if the capacitance values are halved.
(2) If the value of the capacitor connected to pin 2 (Vm1) in the example is doubled, the bass-region CMMR will be +6dB, and if it is halved, it will be _6dB (see Fig. 16).

Application example

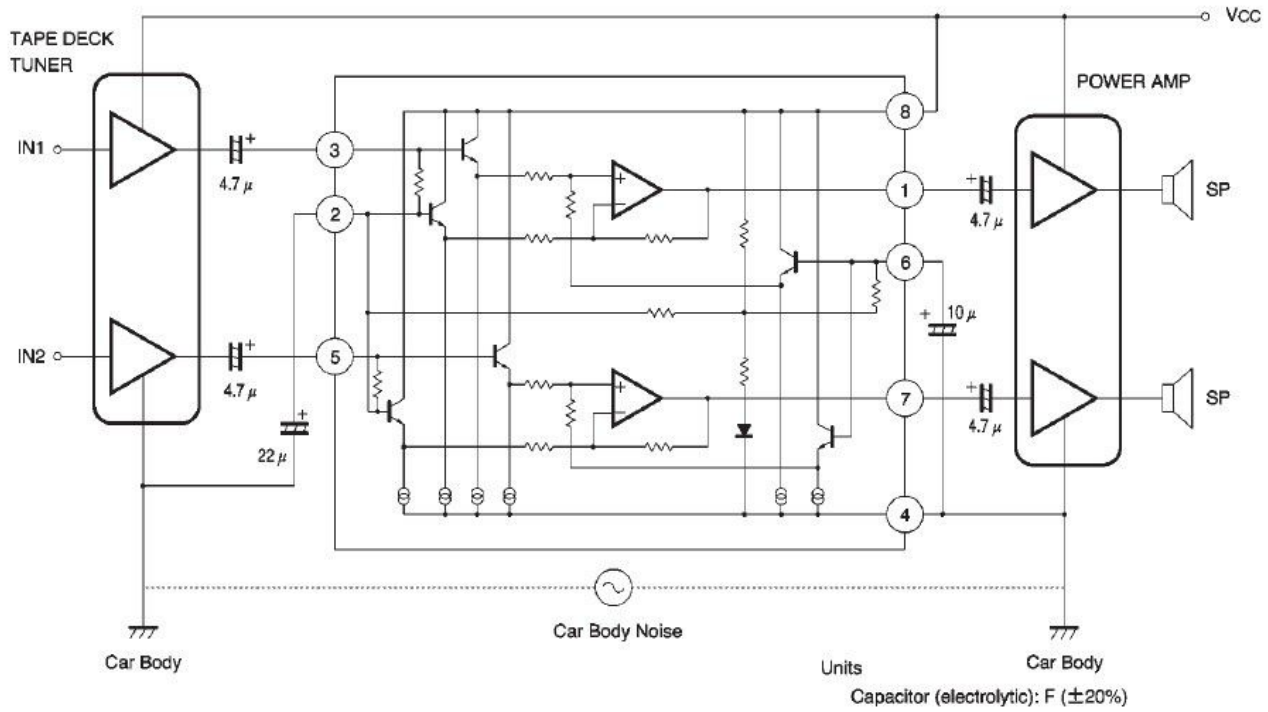


Fig. 5

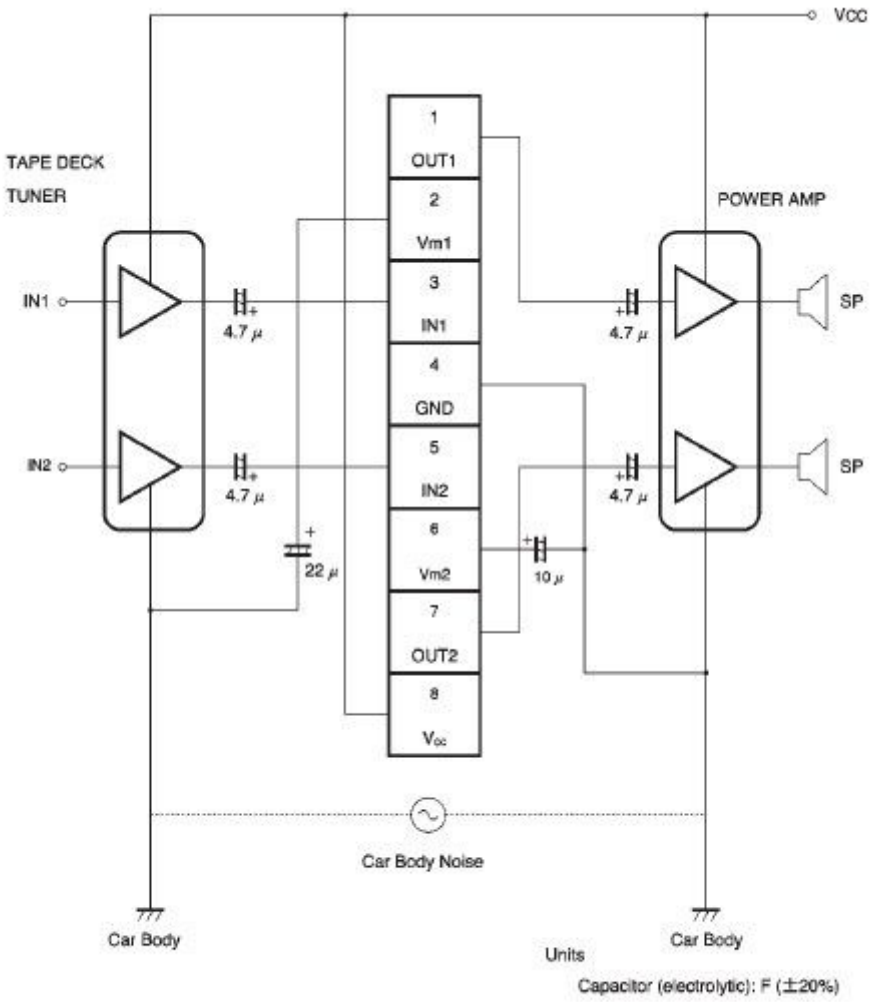
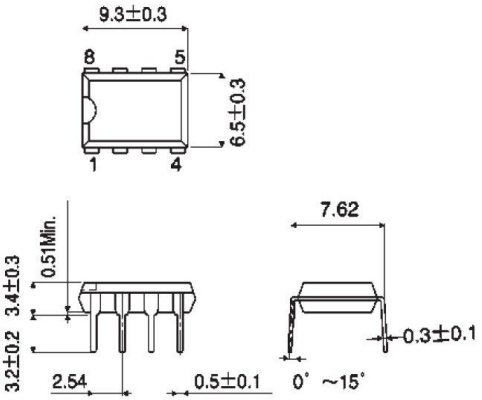
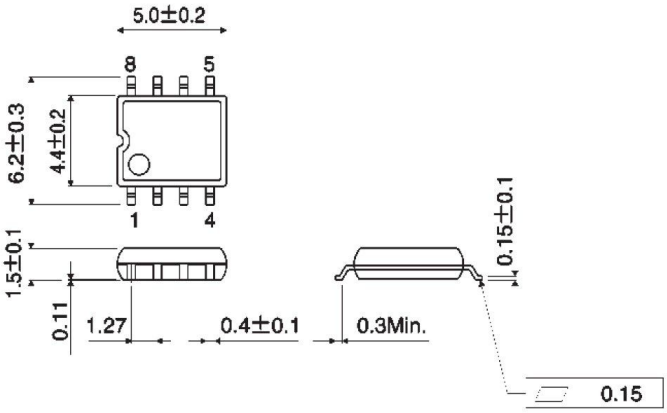

VCC
TAPE DECK
TUNER
IN1
IN2
4.7 μ
4.7 μ
22 μ
1
OUT1
2
Vm1
3
IN1
4
GND
5
IN2
6
Vm2
7
OUT2
8
Vcc
10 μ
POWER AMP
4.7 μ
4.7 μ
SP
SP
Car Body Noise
Car Body
Car Body
Units
Capacitor (electrolytic): F (±20%)

Fig. 6

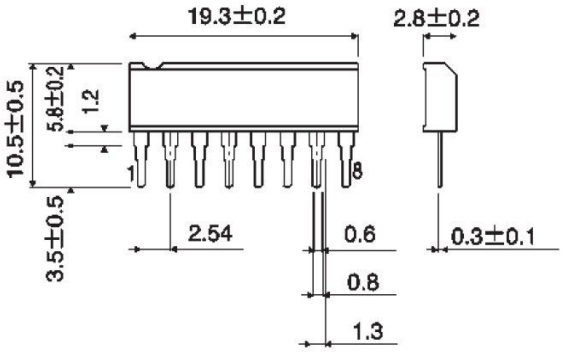
External dimensions (Units: mm)



ZL3121 F (DIP-8)



ZL3121 (SOP-8)



ZL3121N(SIP-8)