MSKSEMI 美森科
SEMICONDUCTOR

ESD TVS TSS MOV GDT PLED

LMV721/LMV722

Product specification

GENERAL DESCRIPTION

The LMV721/LMV722 families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth(8MHz), a slew rate of 6.5V/us, and a quiescent current of 510uA/amplifier at 5.0V. The op-amps are unity gain stable and feature an ultra-low input bias current.

The LMV721/LMV722 are designed to provide optimal performance in low-voltage systems. They provide rail-to-rail I/O, and the maximum input offset voltage are 2.5mV for the devices. Their capacitive load capability is also good at low supply voltages. The operating range is from 2.2 V to 5.5 V.

The LMV721/LMV722 families of operational amplifiers are specified at the full temperature range of - 40°C to +125°C under single or dual power supplies of 2.2V to 5.5V.

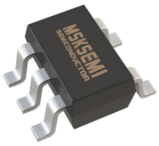
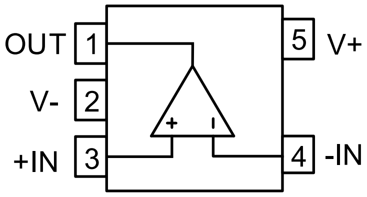
Features

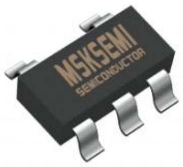
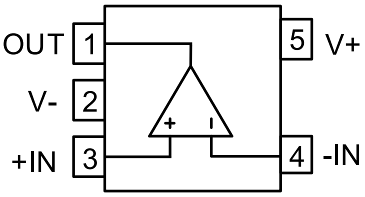
- Input Offset Voltage：2.5mV（MAX
- ）Low Supply Current：510μA（Vs=2.2V）
- Supply Range：2.2V to 5.5V
- Gain Bandwidth：8MHz（V s=5V）
- Slew rate: 6.5V/μs（Vs=5V）
- Rail-to-Rail Input and Output
- Low Cost
- Micro size Packages：
  LMV721IDCKR-MS：SC70-5
  LMV721IDBVR-MS：SOT23-5
  LMV722IDR-MS：SOP-8
  LMV722IDGKR-MS：MSOP-8

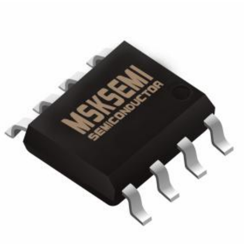
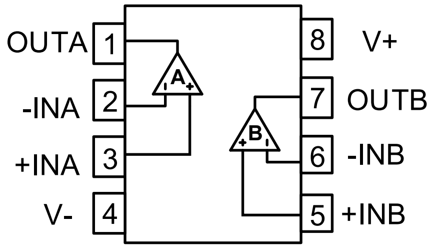
Applications

- Photodiode Amplification
- Active Filter and Buffer
- Battery Powered Electronics
- Sensors
- Cellular and Cordless Phones
- Test Equipment
- Driving A/D Converters

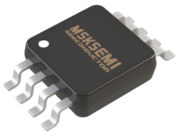
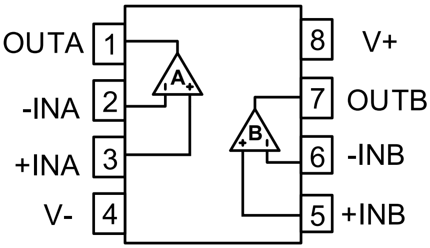
Pin Description AND MARKING

SC70-5	Pin Description	Marking
		

SOT-23-5	Pin Description	Marking
		

<table>
<tr><th>SOP-8</th><th>Pin Description</th><th>Marking</th></tr>
<tr><td></td><td>
</td><td>MSKSEMI
LMV722IDR
MS ***

***Representing internal production codes</td></tr>
</table>

<table>
<tr><th>MSOP-8</th><th>Pin Description</th><th>Marking</th></tr>
<tr><td></td><td>
</td><td>MSKSEMI
LMV722IDGKR
MS ***

***Representing internal production codes</td></tr>
</table>

LMV721IDCKR-MS/LMV721IDBVR-MS

PIN			I/O	DESCRIPTION
NAME	**SC70-5**	**SOT-23-5**		
+IN	3		I	Positive (noninverting) input
-IN	4		I	Negative (inverting) input
OUT	1		O	Output
V+	5		—	Positive (highest) power supply
V-	2		—	Negative (lowest) power supply

LMV722IDR-MS/LMV722IDGKR-MS

PIN			I/O	DESCRIPTION
NAME	**SOP-8**	**MSOP-8**		
+INA	3		I	Noninverting input, channel A
+INB	5		I	Noninverting input, channel B
-INA	2		I	Inverting input, channel A
-INB	6		I	Inverting input, channel B
OUTA	1		O	Output, channel A
OUTB	7		O	Output, channel B
V-	4		—	Negative (lowest) power supply
V+	8		—	Positive (highest) power supply

Package/Order Information

ORDERING NUMBER	Op Temp(℃)	Package	Packing Option
LMV721IDCKR-MS	-55°C~125°C	SC70-5	3000PCS
LMV721IDBVR-MS		SOT23-5	3000PCS
LMV722IDR-MS		SOP-8	2500PCS
LMV722IDGKR-MS		MSOP-8	2500PCS

TYPICAL APPLICATION

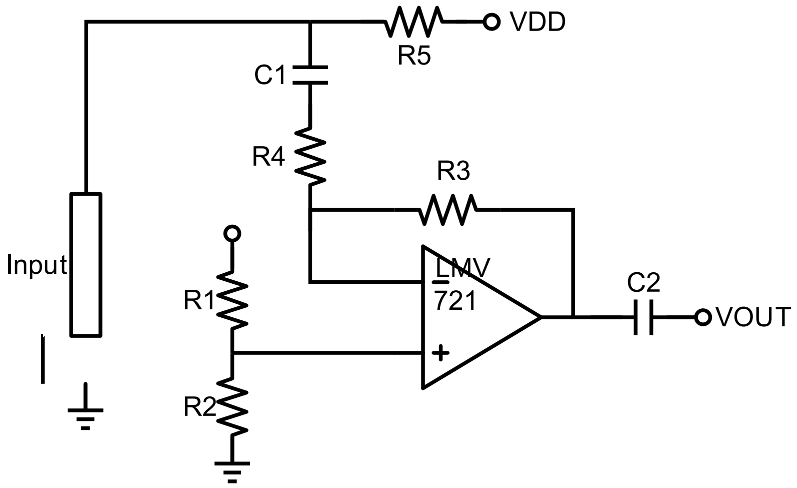


Figure 1. Typical Application

SPECIFICATIONS

Absolute Maximum Ratings(1)

		MIN	MAX	UNIT
Voltage	Supply Voltage		6	V
	Signal Input Terminals Voltage(2)	(V-) - 0.5	(V+) + 0.5	V
	Signal Input Terminals Voltage(3)	(V-) - 0.5	(V+) + 0.5	V
Current	Signal Input Terminals Current(2)	-10	10	mA
	Signal output Terminals Current(3)	-200	200	mA
	Output Short-Circuit(4)	Continuous		
θ_{JA}	Operating Temperature Range	-40	85	°C
	Storage Temperature Range	-65	150	°C
	Junction Temperature	-40	150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Input terminals are diode clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current limited to 10mA or less.

(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±200mA or less.

(4) Short-circuit to ground, one amplifier per package.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM)	±2000	V
		Charged-Device Model (CDM)	±500	V
		Machine Model	100	V

Recommended Operating Conditions

		MIN	MAX	UNIT
Supply voltage， Vs= (V+) - (V-)	Single-supply	2.2	5.5	V
	Dual-supply	±1.1	±2.75	V

ELECTRICAL CHARACTERISTICS(V_S = +5V)

At T_A = 25°C, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
OFFSET VOLTAGE						
V_{OS}	Input Offset Voltage		-2.5	0.8	2.5	mV
dV_{OS}/dT	Input Offset Voltage Average Drift	T_A = -40°C to 85°C		0.6		μV/°C
INPUT CURRENT						
I_B	Input Bias Current			10		pA
		T_A = -40°C to 85°C		4		pA/°C
I_{OS}	Input Offset Current			5		pA
NOISE						
V_N	Input Voltage Noise	f=0.1Hz to 10Hz		4		μV_{PP}
	Input Voltage Noise PSD	f=1kHz		8		nV/√Hz
INPUT VOLTAGE						
V_{CM}	Common-Mode Voltage Range		(V_{S-})-0.1		(V_{S+})+0.1	V
CMRR	Common-Mode Rejection Ratio	ΔV_{IN}=2V		90		dB
FREQUENCY RESPONSE						
GBW	Gain-Bandwidth Product			8		MHz
SR	Slew Rate	G = +1, V_{IN}=2V Step		6		V/μs
Ts	Settling Time	G = +1, V_{IN}=2V Step		0.6		us
OUTPUT						
A_V	Open-Loop Voltage Gain	ΔV_{OUT}=4V	95	105		dB
$V_{OUT-SWING}$	Output Swing from Rail				5	mV
I_{SC}	Output Short-Circuit Current	Sourcing, V_{OUT}=0V $V_{IN(diff)}$=±0.5V		26		mA
		Sinking, V_{OUT}=2.5V $V_{IN(diff)}$=±0.5V		50		mA

C_L(1)	Capacitive Load Drive	G=+1, V_{IN}= 0.2V Step			1000	pF
POWER SUPPLY						
PSRR	Power-Supply Rejection Ratio	V_S=2.5V to 5.5V	90	110		dB
V_S	Operating Voltage Range	I_O=0A	2.2		5.5	V
I_Q	Quiescent Current/Amplifier	I_O=0A		510	600	μA

(1) Capacitive load drive means that above a given maximum value, the output waveform will oscillate under the step response.

ELECTRICAL CHARACTERISTICS(V_S = +2.5V)

At T_A = 25°C, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
OFFSET VOLTAGE						
V_{OS}	Input Offset Voltage			0.18	2.5	mV
dV_{OS}/dT	Input Offset Voltage Average Drift	T_A = -40°C to 85°C		0.4	0.6	μV/°C
INPUT CURRENT						
I_B	Input Bias Current			200	700	pA
		T_A = -40°C to 85°C		4		pA/°C
I_{OS}	Input Offset Current			200		pA
NOISE						
V_N	Input Voltage Noise	f=0.1Hz to 10Hz		15		μV_{PP}
	Input Voltage Noise PSD	f=1kHz		61		nV/√Hz
INPUT VOLTAGE						
V_{CM}	Common-Mode Voltage Range		(VS-)-0.1		(VS+)+0.1	V
CMRR	Common-Mode Rejection Ratio	ΔV_{IN}=1V	80	90		dB
FREQUENCY RESPONSE						
GBW	Gain-Bandwidth Product			6.5		MHz
SR	Slew Rate			5		V/μs
Ts	Settling Time			0.8		us
OUTPUT						
A_V	Open-Loop Voltage Gain	ΔV_{OUT}=2V	105	110		dB
$V_{OUT-SWING}$	Output Swing from Rail				5	mV
I_{SC}	Output Short-Circuit Current	Sourcing, V_{OUT}=0V $V_{IN(diff)}$=±0.5V		11		mA
		Sinking, V_{OUT}=2.2V $V_{IN(diff)}$=±0.5V		-16.6		mA

C_L(1)	Capacitive Load Drive	G = +1, V_{IN}=1V Step			100	pF
POWER SUPPLY						
PSRR	Power-Supply Rejection Ratio	V_S=2.5V to 5.5V	90	110		dB
V_S	Operating Voltage Range	I_O=0A	2.2		5.5	V
I_Q	Quiescent Current/Amplifier	I_O=0A		510	600	μA

TYPICAL CHARACTERISTICS

At T_A = 25°C, V_S = +5V, G=+1, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

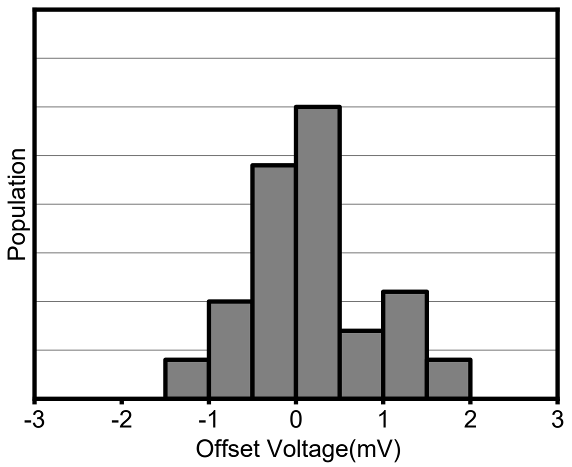


Figure 2. Offset Voltage Production Distribution

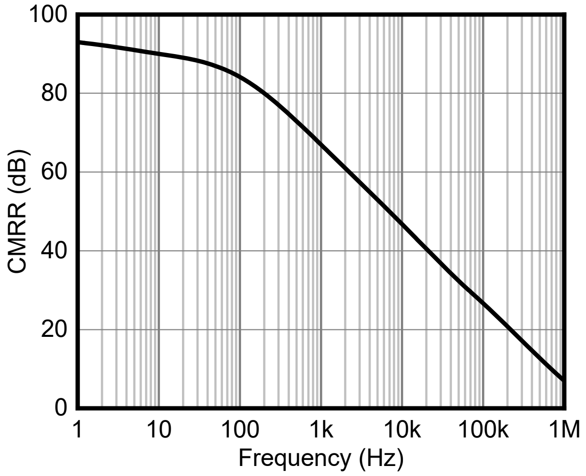


Figure 3. CMRR vs Frequency

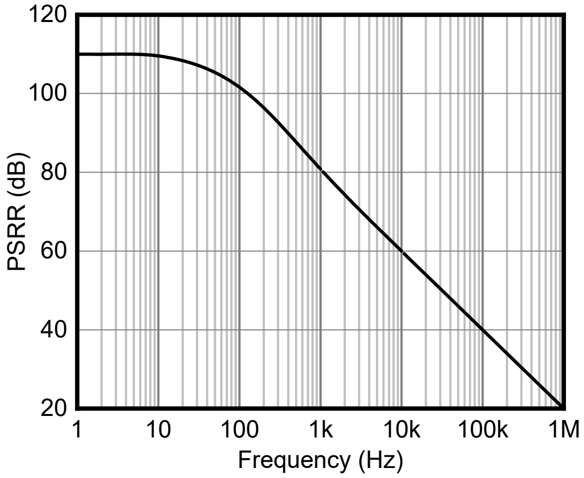


Figure 4. PSRR vs Frequency

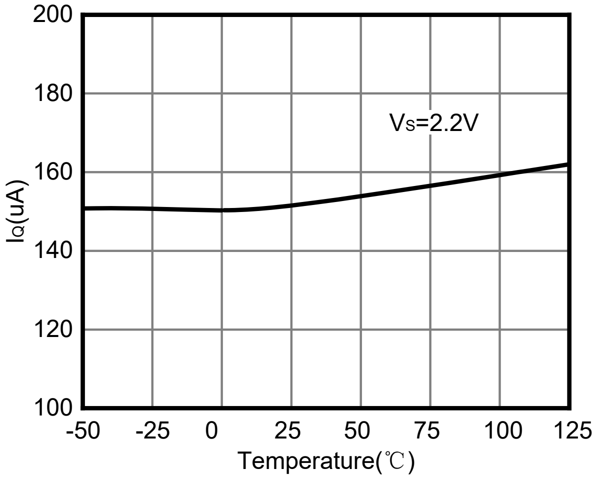


Figure 5. Quiescent Current vs Temperature

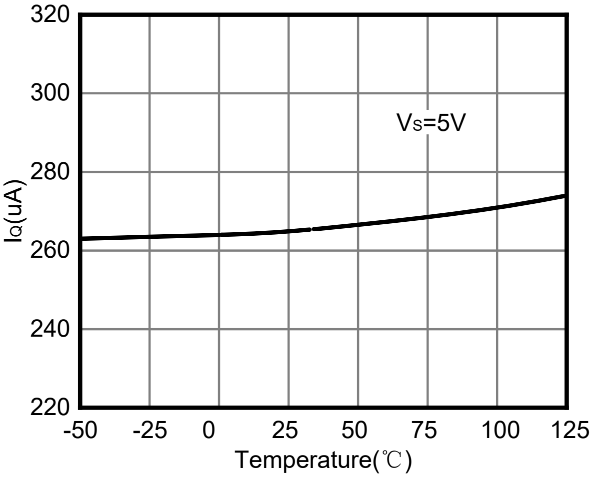


Figure 6. Quiescent Current vs Temperature

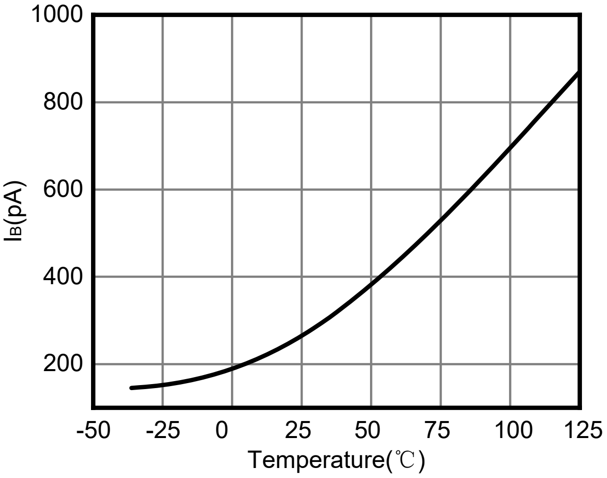


Figure 7. Input Bias Current vs Temperature

TYPICAL CHARACTERISTICS

At T_A = 25°C, V_S = +5V, G=+1, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

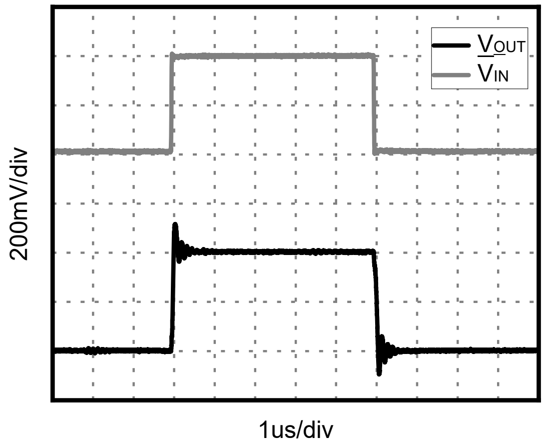


Figure 8. Small-Signal Step Response

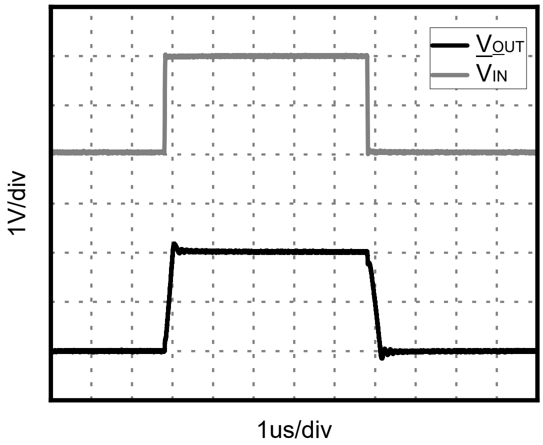


Figure 9. Large-Signal Step Response

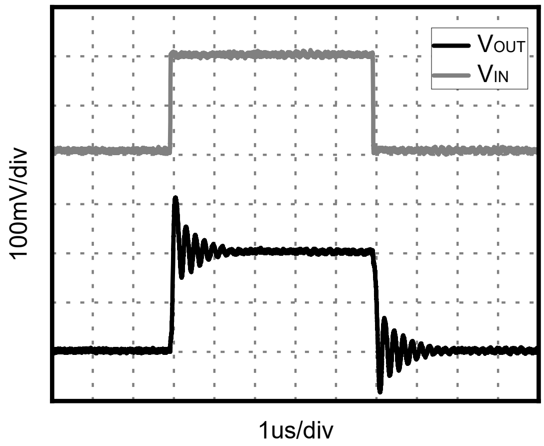


Figure 10. Small-Signal Step Response(V_S=2.2V)

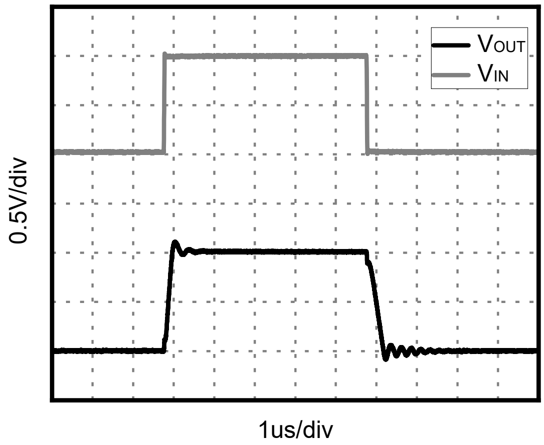


Figure 11. Large-Signal Step Response(V_S=2.2V)

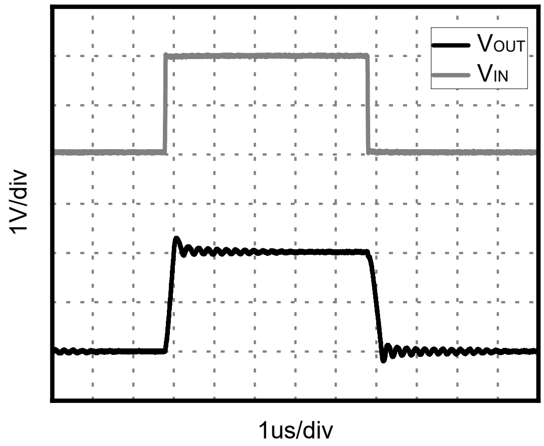


Figure 12. Capacitive Load Drive(C_L=200pF)

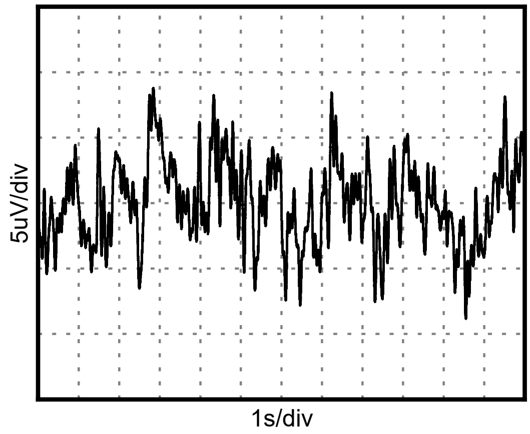


Figure 13. 0.1Hz to 10Hz Noise

TYPICAL CHARACTERISTICS

At T_A = 25°C, V_S = +5V, G=+1, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

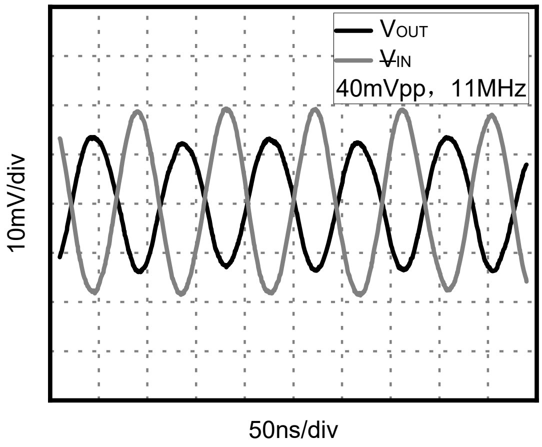


Figure 14. -3dB bandwidth

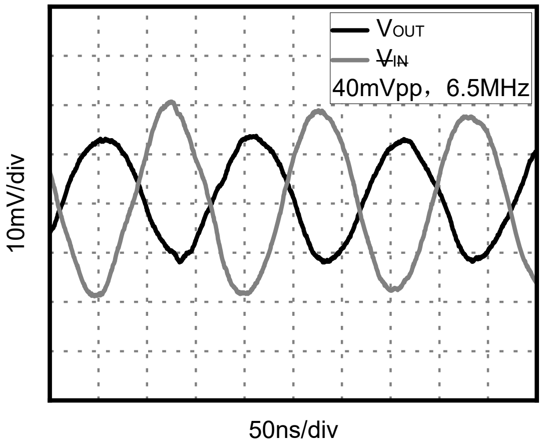


Figure 15. -3dB bandwidth (V_S=2.2V)

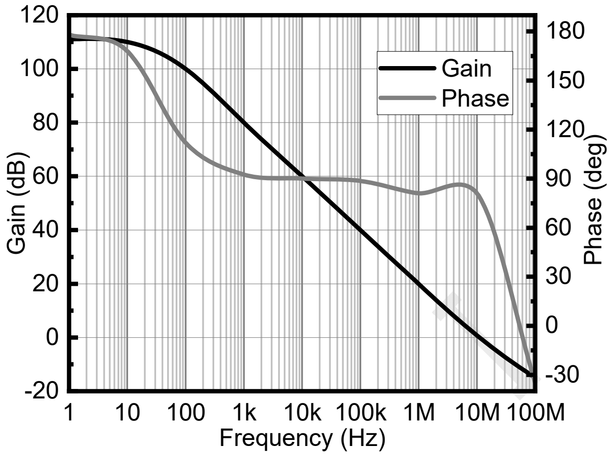


Figure 16. Open-Loop Gain and Phase vs Frequency

Detailed Description

Overview

The LMV721/LMV722 devices are a high-bandwidth, unity-gain stable, rail-to-rail operational amplifier available in single and dual-channel versions that operate in a single-supply voltage range of 2.2V to 5.5V(±1.1V to ±2.75V). A high supply voltage of 6V(absolute maximum) can permanently damage the amplifier. Rail-to-rail input and output wobbles significantly increase the dynamic range, especially in low-supply applications. Good layout practices require that a 0.1uF capacitor be used where it is tightly threaded through the power supply pin.

Phase Reversal Protection

The LMV721/LMV722 devices have internal phase-reversal protection.
Many op amps exhibit phase reversal when the input is driven beyond the linear common-mode range. This condition is most often encountered in noninverting circuits when the input is driven beyond the specified common-mode voltage range,
causing the output to reverse into the opposite rail. The input of the LMV721/LMV722 prevents phase reversal with excessive commonmode voltage. Instead, the appropriate rail
limits the output voltage.

Typical Applications

1 Voltage Follower

As shown in Figure 17, the voltage gain is 1. With this circuit, the output voltage V_{OUT} is configured to be equal to the input voltage V_{IN}. Due to the high input impedance and low output impedance, the circuit can also stabilize the output voltage, the output voltage expression is

$$V_{OUT}=V_{IN} \tag{1}$$

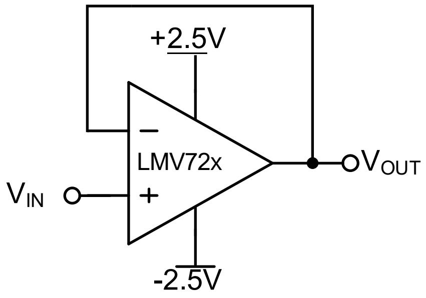


Figure 17. Voltage Follower

2 Inverting Proportional Amplifier

As shown in Figure 18, for a reverse-phase proportional amplifier, the input voltage V_{IN} is amplified by a voltage gain that depends on the ratio of R1 to R2. The output voltage V_{OUT} is inversely with the input voltage V_{IN}. The input impedance of the circuit is equal to R1, and the output voltage expression is

$$V_{OUT}=-\frac{R2}{R1}V_{IN} \tag{2}$$

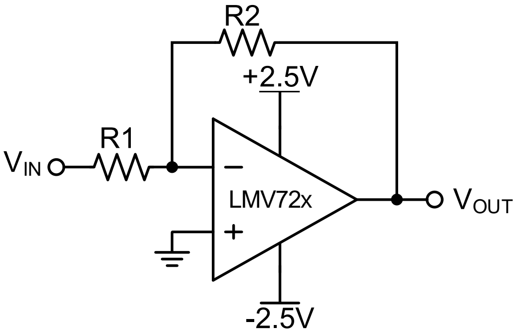


Figure 18. Inverting Proportional Amplifier

3 Noninverting Proportional Amplifier

As shown in Figure 19, for a noninverting amplifier, the input voltage V_{IN} is amplified by a voltage gain that depends on the ratio of R1 to R2. The output voltage V_{OUT} is in phase with the input voltage V_{IN}. In fact, this circuit has a high input impedance because its input side is the same as the input side of the operational amplifier. The output voltage expression is

$$V_{OUT}=(1+\frac{R2}{R1})V_{IN} \quad (3)$$

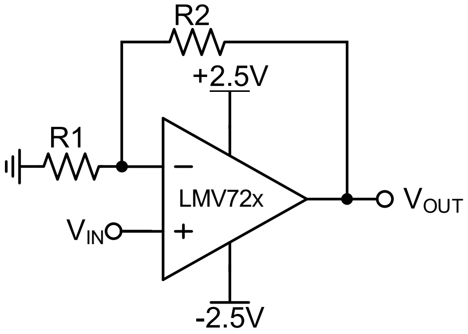


Figure 19. Noninverting Proportional Amplifier

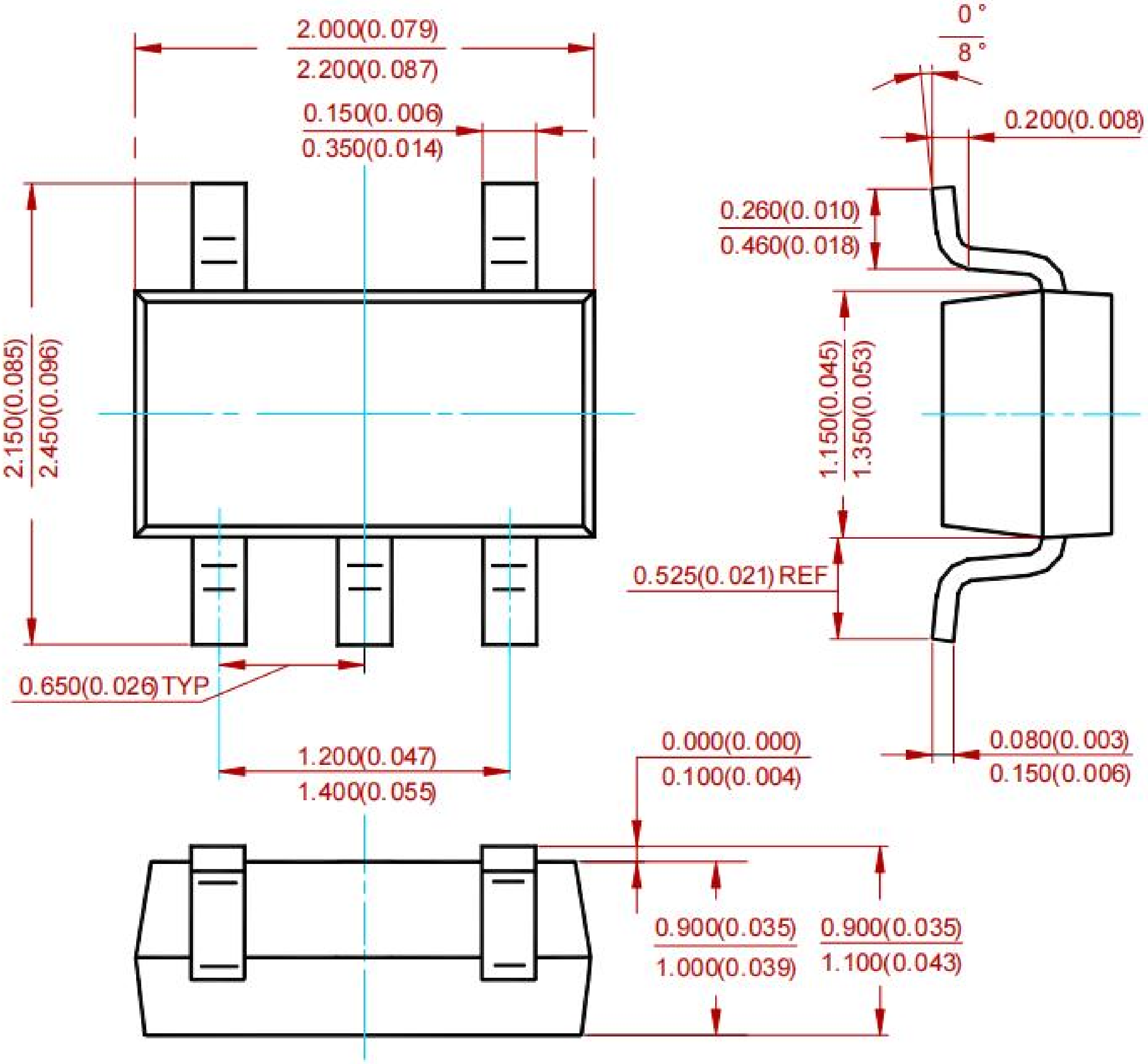
Layout Guidelines

Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins.

These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

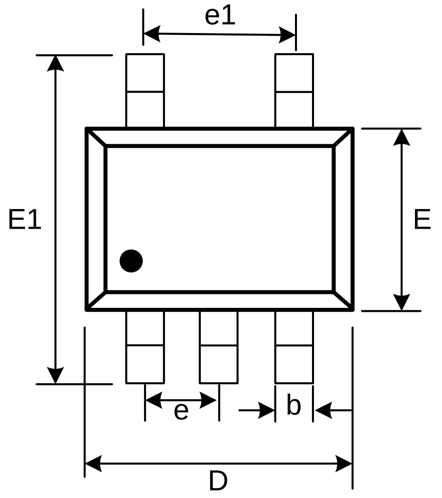
Package Outline Dimensions (All dimensions in mm(inch).)

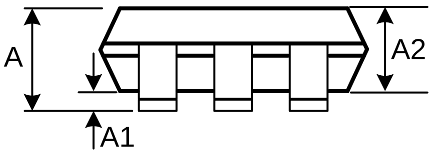
SC-70-5

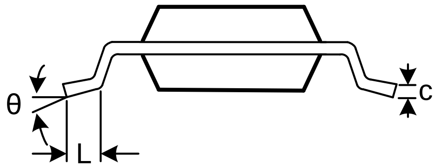


Package Description

SOT23-5



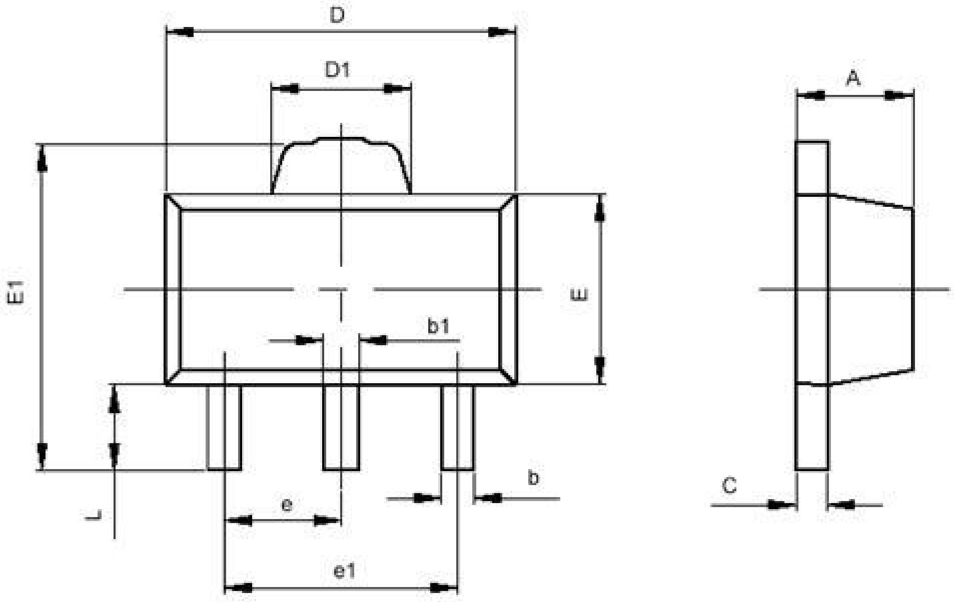




(Unit: mm)

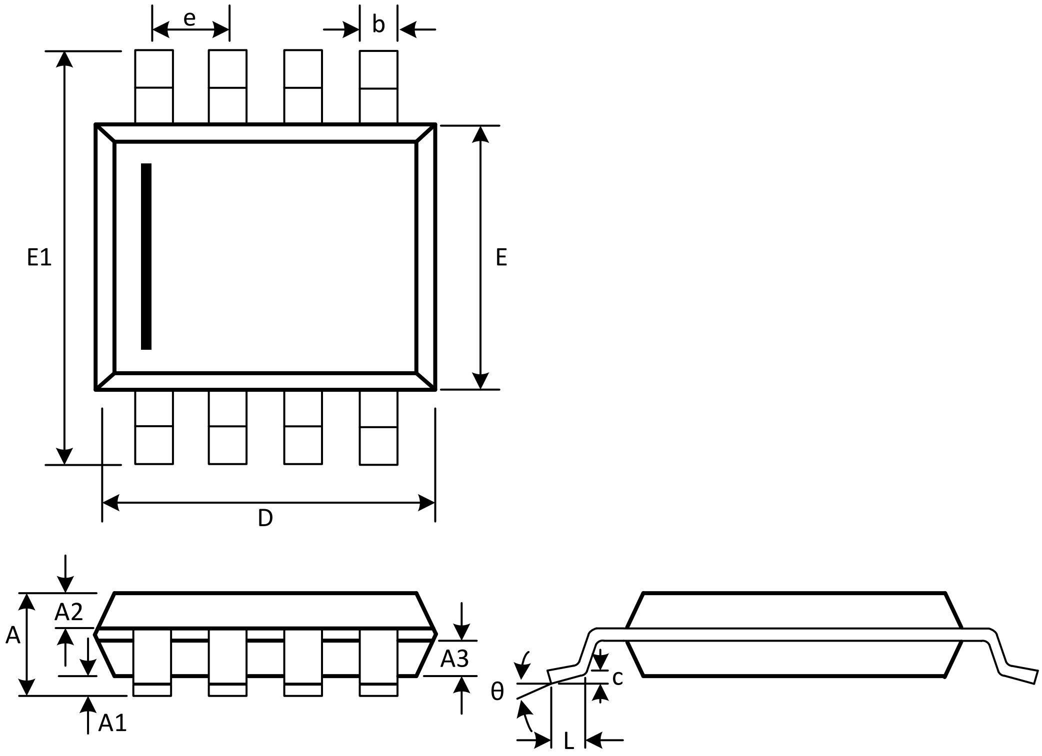
Symbol	Min	Max
A	1.05	1.25
A1	0	0.1
A2	1.05	1.15
b	0.3	0.5
c	0.1	0.2
D	2.82	3.02
e	0.95(BSC)	
e1	1.9(BSC)	
E	1.5	1.7
E1	2.65	2.95
L	0.3	0.6
θ	0°	8°

SOT-89-3



符号	最小值（mm）	最大值（mm）
A	1.400	1.600
b	0.320	0.520
b1	0.360	0.560
c	0.350	0.440
D	4.400	4.600
D1	1.400	1.800
E	2.300	2.600
E1	3.940	4.250
e	1.500TYP	
e1	2.900	3.100
L	0.900	1.100

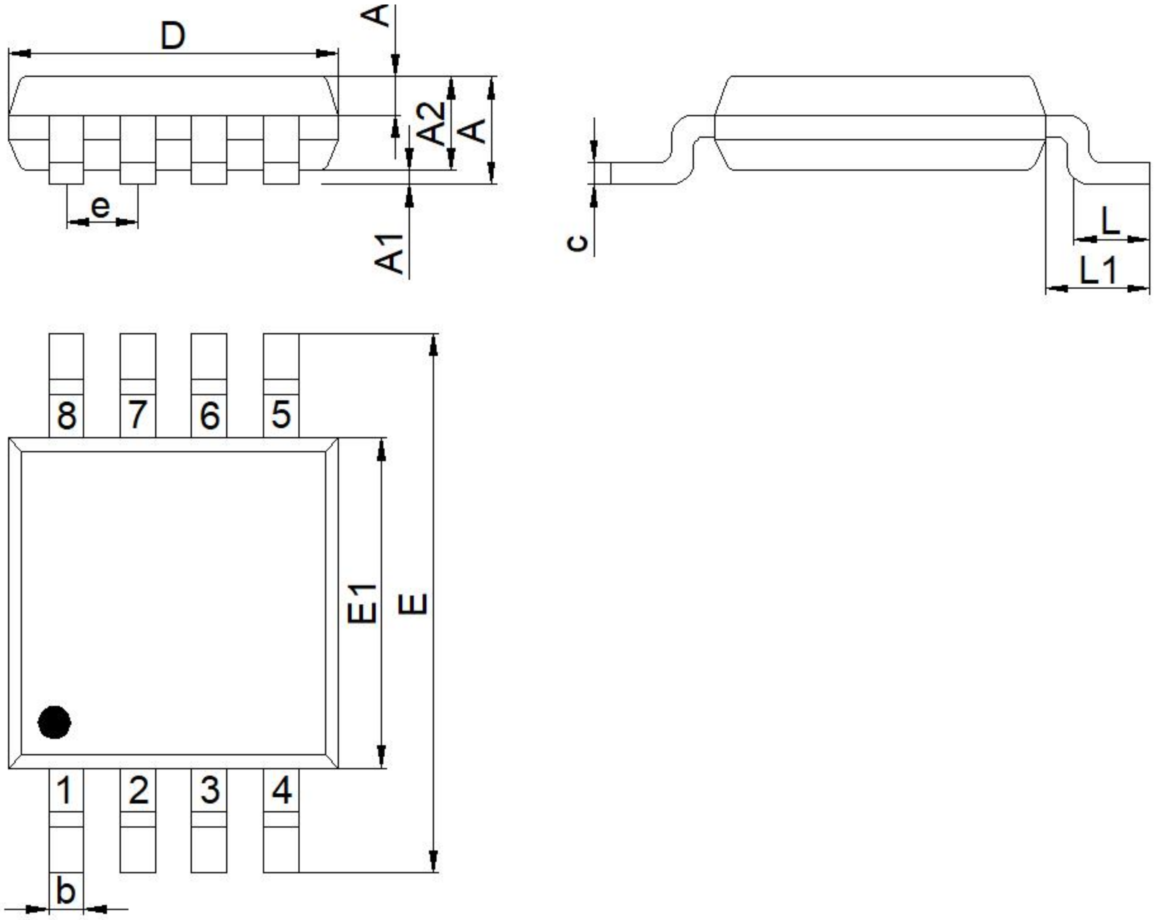
SOP-8



(Unit: mm)

Symbol	Min	Max
A	1.300	1.600
A1	0.050	0.200
A2	0.550	0.650
A3	0.550	0.650
b	0.356	0.456
c	0.203	0.233
D	4.800	5.000
e	1.270(BSC)	
E	3.800	4.000
E1	5.800	6.200
L	0.400	0.800
θ	0°	8°

MSOP8 封装外形尺寸



MSOP8 外形图

单位：mm

项目	尺寸			项目	尺寸		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	---	---	1.10	D	2.90	3.00	3.10
A1	0.05	---	0.15	E	4.70	4.90	5.10
A2	0.75	0.85	0.95	E1	2.90	3.00	3.10
A3	0.30	0.35	0.40	e	---	0.65	---
b	0.28	---	0.38	L	0.40	---	0.70
c	0.15	---	0.19	L1	---	0.95	---

Attention

- Any and all MSKSEMI Semiconductor products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your MSKSEMI Semiconductor representative nearest you before using any MSKSEMI Semiconductor products described or contained herein in such applications.
- MSKSEMI Semiconductor assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specificationsof any andall MSKSEMI Semiconductor products described orcontained herein.
- Specifications of any and all MSKSEMI Semiconductor products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer'sproducts orequipment.
- MSKSEMI Semiconductor. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with someprobability. It is possiblethat these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits anderror prevention circuitsfor safedesign, redundant design, and structural design.
- In the event that any or all MSKSEMI Semiconductor products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from theauthorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of MSKSEMI Semiconductor.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. MSKSEMI Semiconductor believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringementsof intellectual property rights or other rightsof third parties.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. Whendesigning equipment, referto the "Delivery Specification" for the MSKSEMI Semiconductor productthat you intend to use.