

Operational Amplifiers Series

Input/Output Full Swing Low Power Operational Amplifiers



LMR981G, LMR982FVM, LMR931G, LMR932F, LMR934F

● **General Description**

Input/Output Full Swing Low Voltage single, dual and quad Op-Amp integrates into a single chip. Especially, these series are operable with low voltage and low supply current. Shutdown function are applied to LMR981 and LMR982.

● **Features**

- Low operating supply voltage
- Input/Output Full Swing
- High large signal voltage gain
- Low input bias current
- Low supply current
- Low input offset voltage

● **Applications**

- Portable equipment
- Low voltage application
- Active filter
- Supply-Current Monitoring
- Battery Monitoring

● **Key Specifications**

- Low Operating Supply Voltage (single supply): +1.8V to +5.0V
- High voltage gain (RL=600Ω): 101dB(Typ.)
- Wide Temperature Range: -40°C to +85°C
- Turn on time from shutdown: 19μs (Typ.)
- Low Input Offset Voltage:
 - LMR981(Single) 4mV(Max.)
 - LMR931(Single) 4mV(Max.)
 - LMR982(Dual) 5.5mV(Max.)
 - LMR932(Dual) 5.5mV(Max.)
 - LMR934(Quad) 5.5mV(Max.)
- Low Input Bias Current: 10nA (Typ.)

● **Package**

	W(Typ.)	xD(Typ.)	xH(Max.)
SSOP5	2.90mm	x 2.80mm	x 1.25mm
SSOP6	2.90mm	x 2.80mm	x 1.25mm
MSOP10	2.90mm	x 4.00mm	x 0.90mm
SOP8	5.00mm	x 6.20mm	x 1.71mm
SOP14	8.70mm	x 6.20mm	x 1.71mm

● **Simplified Schematic**

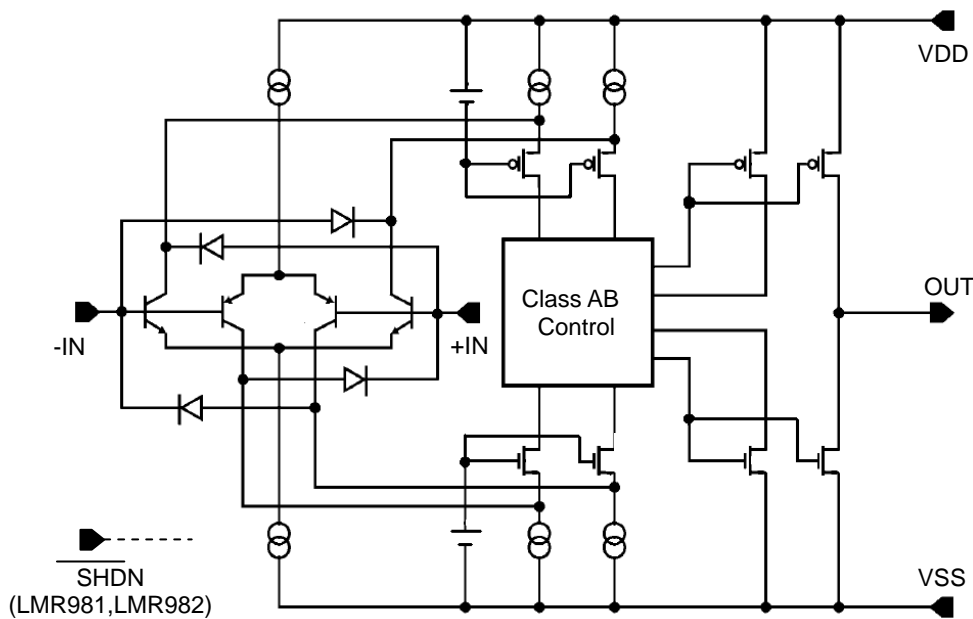
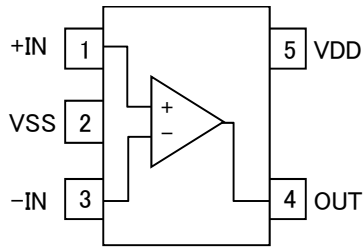


Figure 1. Simplified Schematic (1 channel only)

○Product structure : Silicon monolithic integrated circuit ○This product is not designed protection against radioactive rays.

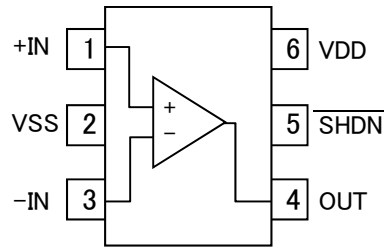
● Pin Configuration

LMR931G : SSOP5



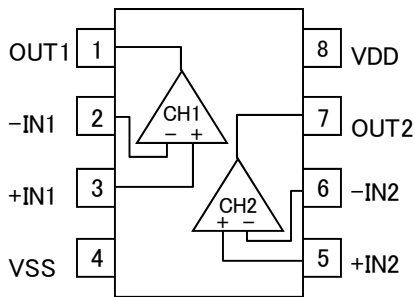
Pin No.	Symbol
1	+IN
2	VSS
3	-IN
4	OUT
5	VDD

LMR981G : SSOP6



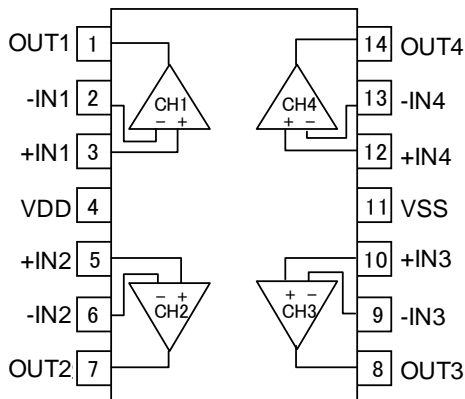
Pin No.	Symbol
1	+IN
2	VSS
3	-IN
4	OUT
5	SHDN
6	VDD

LMR932F : SOP8



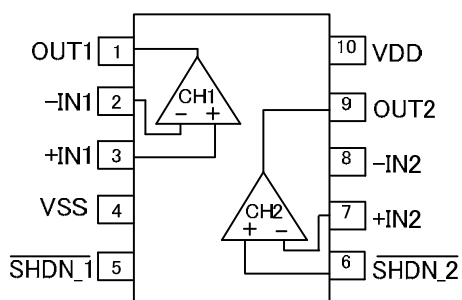
Pin No.	Symbol
1	OUT1
2	-IN1
3	+IN1
4	VSS
5	+IN2
6	-IN2
7	OUT2
8	VDD

LMR934F : SOP14



Pin No.	Symbol
1	OUT1
2	-IN1
3	+IN1
4	VDD
5	+IN2
6	-IN2
7	OUT2
8	OUT3
9	-IN3
10	+IN3
11	VSS
12	+IN4
13	-IN4
14	OUT4

LMR982FVM : MSOP10



Pin No.	Symbol
1	OUT1
2	-IN1
3	+IN1
4	VSS
5	SHDN_1
6	SHDN_2
7	+IN2
8	-IN2
9	OUT2
10	VDD

Package				
LMR931G	LMR981G	LMR982FVM	LMR932F	LMR934F
SSOP5	SSOP6	MSOP10	SOP8	SOP14

●Shutdown(LMR981G , LMR982FVM)

Pin	Input condition	Shutdown function
$\overline{\text{SHDN}}$	VSS	ON
	VDD	OFF

Note: Please refer to Electrical Characteristics regarding the turn on and off voltage.

●Ordering Information

L M R 9 x x x x x	-	x x
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Part Number LMR931G LMR981G LMR932F LMR982FVM LMR934F	Package G:SSOP5 G:SSOP6 F:SOP8 FVM:MSOP10 F:SOP14	Packaging and forming specification TR: Embossed tape and reel (SSOP5, SSOP6,MSOP10) E2: Embossed tape and reel (SOP8, SOP14)
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●Line-up

Topr	Package		Operable Part Number
-40°C to +85°C	SSOP5	Reel of 3000	LMR931G-TR
	SSOP6	Reel of 3000	LMR981G-TR
	MSOP10	Reel of 3000	LMR982FVM-TR
	SOP8	Reel of 2500	LMR932F-E2
	SOP14	Reel of 2500	LMR934F-E2

●Absolute Maximum Ratings(Ta=25°C)

Parameter	Symbol	Ratings					Unit		
		LMR981G	LMR931G	LMR932F	LMR934F	LMR982FVM			
Supply Voltage	VDD-VSS	+7					V		
Power dissipation	Pd	SSOP5	-	675 ^{*1,5}	-	-	-	mW	
		SSOP6	675 ^{*1,5}	-	-	-	-		
		SOP8	-	-	690 ^{*2,5}	-	-		-
		MSOP10	-	-	-	-	587 ^{*4,5}		-
		SOP14	-	-	-	562 ^{*3,5}	-		-
Differential Input Voltage ^{*6}	Vid	VDD to VSS					V		
Input Common-mode Voltage Range	Vicm	(VSS - 0.3) to (VDD + 0.3)					V		
Operable with low voltage	Vopr	+1.8 to +5.0					V		
Operating Temperature	Topr	- 40 to +85					°C		
Storage Temperature	Tstg	- 55 to +150					°C		
Maximum Junction Temperature	Tjmax	+150					°C		

Note: Absolute maximum rating item indicates the condition which must not be exceeded.
Application of voltage in excess of absolute maximum rating or use out absolute maximum rated temperature environment may cause deterioration of characteristics.

- *1 To use at temperature above Ta=25°C reduce 5.4mW/°C.
- *2 To use at temperature above Ta=25°C reduce 5.52mW/°C.
- *3 To use at temperature above Ta=25°C reduce 4.5mW/°C.
- *4 To use at temperature above Ta=25°C reduce 4.7mW/°C.
- *5 Mounted on a FR4 glass epoxy PCB(70mmx70mmx1.6mm).
- *6 The voltage difference between inverting input and non-inverting input is the differential input voltage. Then input terminal voltage is set to more than VSS.

Notice

●General Precaution

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 - [a] Installation of protection circuits or other protective devices to improve system safety
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 - [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
 - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
 - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
 - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
 - [f] Sealing or coating our Products with resin or other coating materials
 - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
 - [h] Use of the Products in places subject to dew condensation
- 4) The Products are not subject to radiation-proof design.
- 5) Please verify and confirm characteristics of the final or mounted products in using the Products.
- 6) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 7) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
- 8) Confirm that operation temperature is within the specified range described in the product specification.
- 9) ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

● **Precaution for Mounting / Circuit board design**

- 1) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- 2) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

● **Precautions Regarding Application Examples and External Circuits**

- 1) If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
- 2) You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

● **Precaution for Electrostatic**

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

● **Precaution for Storage / Transportation**

- 1) Product performance and soldered connections may deteriorate if the Products are stored in the places where:
 - [a] the Products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [b] the temperature or humidity exceeds those recommended by ROHM
 - [c] the Products are exposed to direct sunshine or condensation
 - [d] the Products are exposed to high Electrostatic
- 2) Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
- 3) Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
- 4) Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

● **Precaution for Product Label**

QR code printed on ROHM Products label is for ROHM's internal use only.

● **Precaution for Disposition**

When disposing Products please dispose them properly using an authorized industry waste company.

● **Precaution for Foreign Exchange and Foreign Trade act**

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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