

SLG88104V-EVB

SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board

Description

The SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board is a universal PCB designed to provide electrical circuits for implementing simple user applications based on the OpAmp, including SLG88104V, and GreenPAK™ product series developed by Renesas Electronics.

Features

- Can be used with OpAmp
- Can be used with GreenPAK
- GPIO connector

Specifications

The SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board contains six soldering places for OpAmp and GreenPAK products integration. Every pin is connected to a corresponding soldering pad for additional external components. For each IC there is a dedicated place for a power supply capacitor.

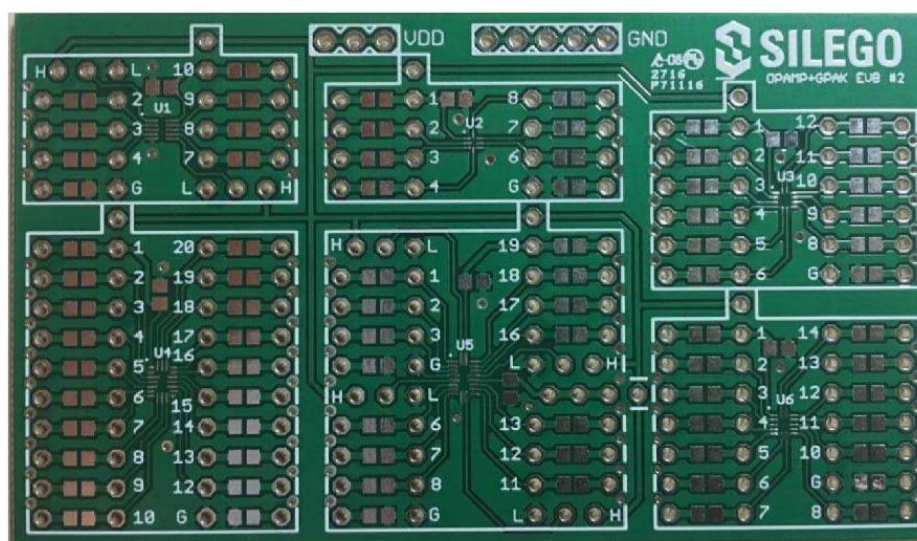


Figure 1. SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board

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1. Functional Description

The SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board (Figure 1) has six soldering pads for 8 (U2), 10 (U1), 12 (U3), 14 (U6) and 20 (U4, U5) pin ICs integrating OpAmp and GreenPAK products.

All pins are accessible through corresponding solder pads, providing convenient access for probing, board modifications, and the integration of external circuitry. This flexible layout simplifies prototyping and allows additional components to be connected without altering the PCB design. Dedicated footprints for power supply bypass capacitors are placed next to each IC, enabling proper local decoupling and supporting stable operation in a wide range of applications.

1.1 Evaluation Board Connections for SLG88104V IC

The PCB layout for U5 (Figure 2) is designed specifically for SLG88104V and provides 20 locations for placing SMD components, which are sufficient to implement typical circuits (inverting, non-inverting, and differential amplifiers) based on an operational amplifier included in the SLG88104V IC (Figure 2, Table 1).

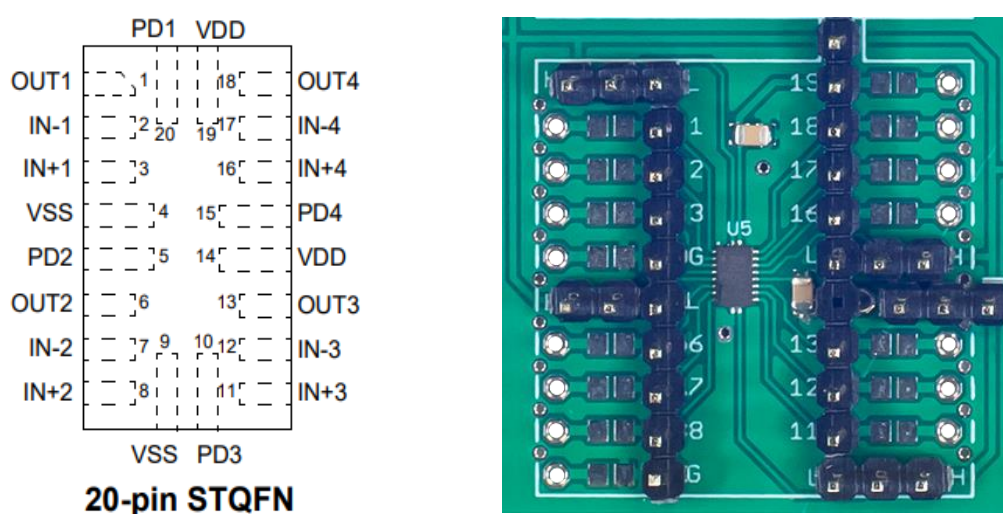


Figure 2. Pin Configuration of the SLG88104V IC and PCB Layout of SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board

Table 1. Pin Description of the SLG88104V (20L STQFN Package)

Pin #	Pin Name	Pin Description	Pin #	Pin Name	Pin Description
1	OUT1	Analog Output (OpAmp1)	11	IN+3	Non-inverting Input (OpAmp3)
2	IN-1	Inverting Input (OpAmp1)	12	IN-3	Inverting Input (OpAmp3)
3	IN+1	Non-inverting Input (OpAmp1)	13	OUT3	Analog Output (OpAmp3)
4	VSS	Negative Power Supply	14	VDD	Power Supply
5	PD2	Power Down Input (OpAmp2) ¹	15	PD4	Power Down Input (OpAmp4) ¹
6	OUT2	Analog Output (OpAmp2)	16	IN+4	Non-inverting Input (OpAmp4)
7	IN-2	Inverting Input (OpAmp2)	17	IN-4	Inverting Input (OpAmp4)
8	IN+2	Non-inverting Input (OpAmp2)	18	OUT4	Analog Output (OpAmp4)
9	VSS	Negative Power Supply	19	VDD	Power Supply
10	PD3	Power Down Input (OpAmp3) ¹	20	PD1	Power Down Input (OpAmp1) ¹

1. When the PD pin is high, the respective amplifier is powered down.

1.2 Operational Characteristics

The SLG88104V is a quad operational amplifier IC operating in a 1.71 V to 5.50 V power supply range over a wide industrial temperature range from -40 °C to 85 °C. This quad-channel CMOS input operational amplifier has four active low enable pins used to individually power-up/power-down each OpAmp. Its common-mode input voltage range extends from 0 V to V_{DD} , and its output swings rail-to-rail. The important operational characteristics of SLG88104V are displayed in Table 2.

Table 2. Operational Characteristics for the SLG88104V Quad Operational Amplifier

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage		1.71		5.5	V
T_A	Operating Range		-40	--	85	°C
I_Q	Quiescent Current (Per Amplifier)		--	0.38	0.55	μA
		$T_A = -40\text{ °C to }85\text{ °C}$	--	0.4	0.8	μA
		$PDX = V_{DD}$	--	1	--	μA
A_{OL}	DC Open Loop Voltage Gain	$R_L = 1\text{ M}\Omega$; $V_{SS} + 0.1\text{ V} \leq V_{OUT} \leq V_{DD} - 0.1\text{ V}$	100	120	--	dB
		$R_L = 50\text{ k}\Omega$; $V_{SS} + 0.5\text{ V} \leq V_{OUT} \leq V_{DD} - 0.5\text{ V}$	100	120	--	dB
		$R_L = 50\text{ k}\Omega$; $T_A = 85\text{ °C}$; $V_{SS} + 0.1\text{ V} \leq V_{OUT} \leq V_{DD} - 0.1\text{ V}$	80	100	--	dB
V_{OS}	Input Offset Voltage	$V_{CM} = V_{DD}/2$	-1000	±200	1000	μV
		$V_{CM} = V_{DD}/2$; $T_A = -40\text{ °C to }85\text{ °C}$	-1100	±250	1100	μV
		$V_{CM} = V_{SS}$; $T_A = -40\text{ °C to }85\text{ °C}$	-2400	±350	2400	μV
GBW	Gain Bandwidth Product	$G = +1\text{ V/V}$		10		kHz
S_R	Slew Rate	$R_L = 50\text{ k}\Omega$	2.4	5.0		V/ms
t_{OR}	Overload Recovery Time	$T_A = -40\text{ °C to }85\text{ °C}$; $R_L = 50\text{ k}\Omega$		350		μs

Note: $T_A = 25\text{ °C}$, $V_{DD} = 1.71\text{ V to }5.5\text{ V}$, $V_{SS} = \text{GND}$, $V_{CM} = V_{DD}/2$, $V_{OUT} = V_{DD}/2$, $V_L = V_{DD}/2$, $R_L = 1\text{ M}\Omega$ to V_L , unless otherwise stated.

2. Setup and Configuration Examples

For the SLG88104V four-channel operational amplifier, the SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board is convenient for implementing standard configurations, such as inverting and non-inverting amplifier circuits. For these applications, one of the four operational amplifiers of the SLG88104V IC may be utilized along with several external resistors, which should be mounted on the designated pads in the U5 chip-soldering area of the PCB layout. Note that the SLG88104V IC operates from a single supply voltage, which must be considered when performing electrical circuit calculations. As a result, for correct operation, both circuits require DC biasing of the OpAmp input from 0 V.

2.1 Typical Circuit of an Inverting Amplifier with the Evaluation Board

According to the Figure 3, the amplitude of the output signal V_{out} and gain G of inverting amplifier can be calculated using the following formulas:

$$V_{out} = -\frac{R_2}{R_1} V_{in}; G = -\frac{R_2}{R_1}$$

For example (see Figure 3), when $V_{in} = 100 \text{ mV}$, $R_1 = 1 \text{ k}\Omega$, and $R_2 = 10 \text{ k}\Omega$, the gain is $G = -10$. Therefore, $V_{out} \approx 1 \text{ V}$. A negative gain value indicates a phase inversion between the input and output signals.

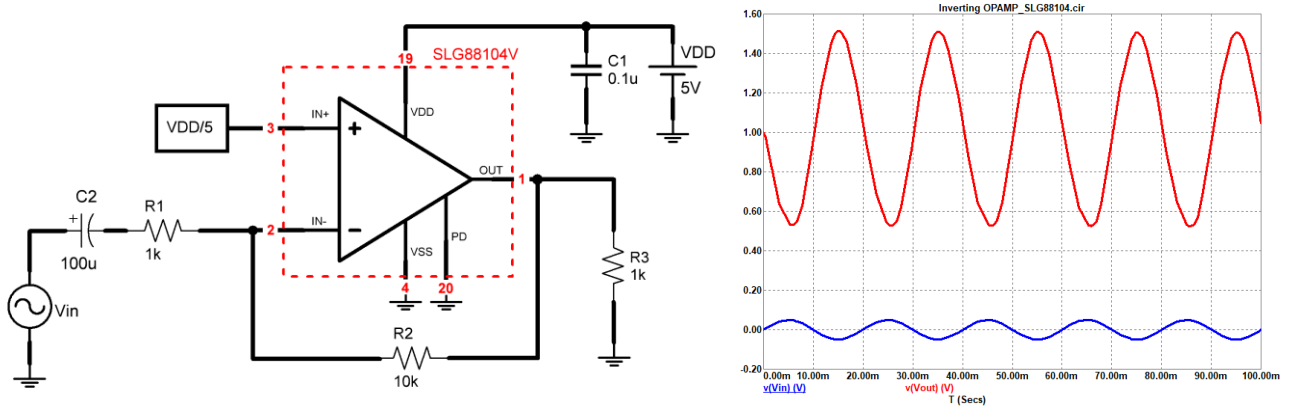


Figure 3. Inverting Amplifier with Single-Supply Voltage: Electrical Circuit and Simulation Results

The electrical circuit shown on Figure 3 and Figure 4 can be easily implemented on the SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board. In case if only one of the four OpAmps of SLG88104V is used, the remaining three unused OpAmps should be configured as a voltage followers by connecting PIN6 to PIN7, PIN12 to PIN13, and PIN17 to PIN18 (see Figure 4). The non-inverting inputs (PIN8, PIN11, and PIN16) should be connected to ground, while the PDx inputs (PIN5, PIN10, and PIN15) should be connected to V_{DD} . To enable OpAmp1, connect the PD1 pin (PIN20) to ground. PIN2 is the inverting input (IN-), PIN3 is the non-inverting input (IN+), and PIN1 is the OpAmp1 output.

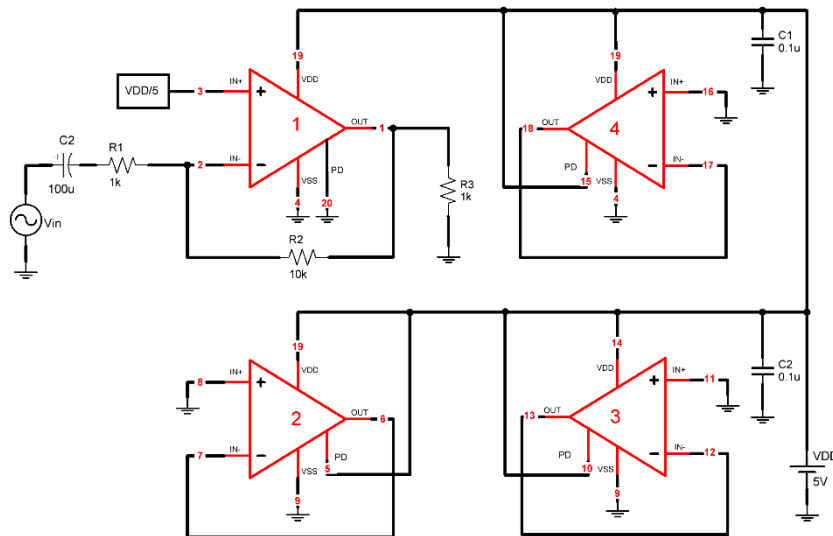


Figure 4. Electrical Circuit of an Inverting Amplifier Implemented Using OpAmp1 of the SLG88104V.

2.2 Typical Circuit of a Non-Inverting Amplifier with the Evaluation Board

A non-inverting amplifier can be implemented by applying an input signal to the non-inverting input (IN+) and negative feedback to the inverting one (IN-) (see Figure 5). The electrical circuit for the selected OpAmp1 of SLG88104V IC, which implements a non-inverting amplifier configuration, is shown on Figure 5. The remaining three unused OpAmps (OpAmp2, OpAmp3 and OpAmp4) should also be configured as a voltage followers (see Figure 4).

The output voltage V_{out} of the circuit on the OpAmp due to the negative feedback tries to reduce the voltage difference at the inputs of the OpAmp to zero (or value of DC bias voltage). Then the voltage at the inverting

input V_{IN-} will be equal to the input voltage $V_{in} = V_{IN-} = V_{IN+}$. The voltage at the inverting input $V_{in} = V_{IN-}$ is formed by the resistive divider, which consists of resistors R_1 and R_2 , and follows the equation:

$$V_{in} = V_{out} \cdot \frac{R_1}{R_1 + R_2}$$

The amplitude of the output signal V_{out} and a voltage gain K of the non-inverting amplifier can be calculated with the following formulas:

$$V_{out} = V_{in} \frac{R_1 + R_2}{R_1}; K = \frac{V_{out}}{V_{in}} = 1 + \frac{R_2}{R_1}$$

When $V_{in} = 100$ mV, $R_1 = 1$ k Ω , and $R_2 = 10$ k Ω , the voltage gain K is equal to 11. Thus, $V_{out} \approx 1.1$ V. Taking into account the single-supply voltage for the four operational amplifiers in the SLG88104V IC, $V_{bias} = 100$ mV for the input signal must be applied to ensure correct operating conditions (Figure 5).

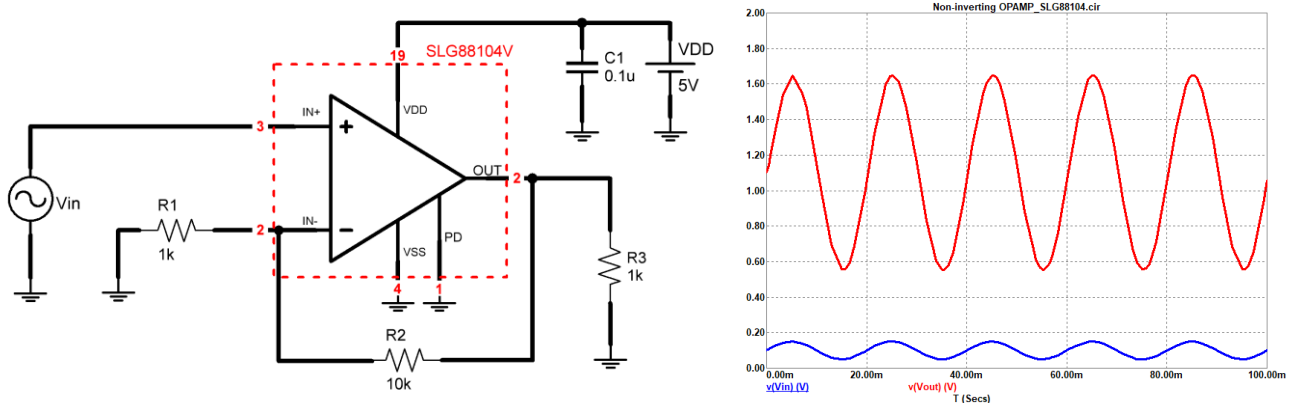


Figure 5. Non-Inverting Amplifier with Single-Supply Voltage: Electrical Circuit and Simulation Results

3. Schematic Diagrams and Board View

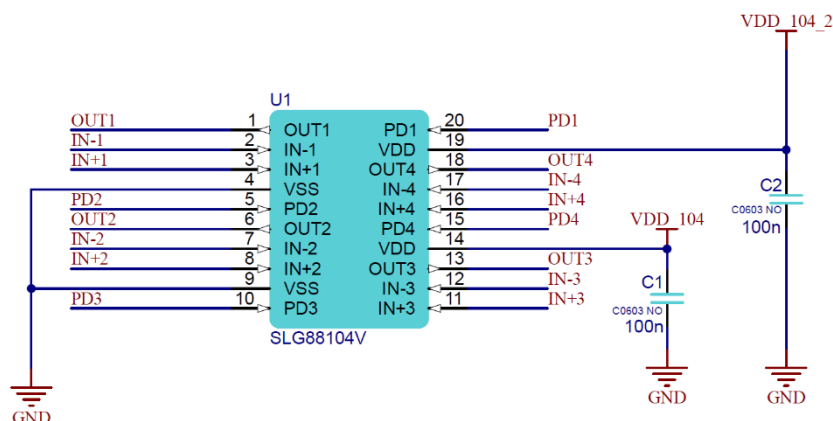


Figure 6. SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board Schematic

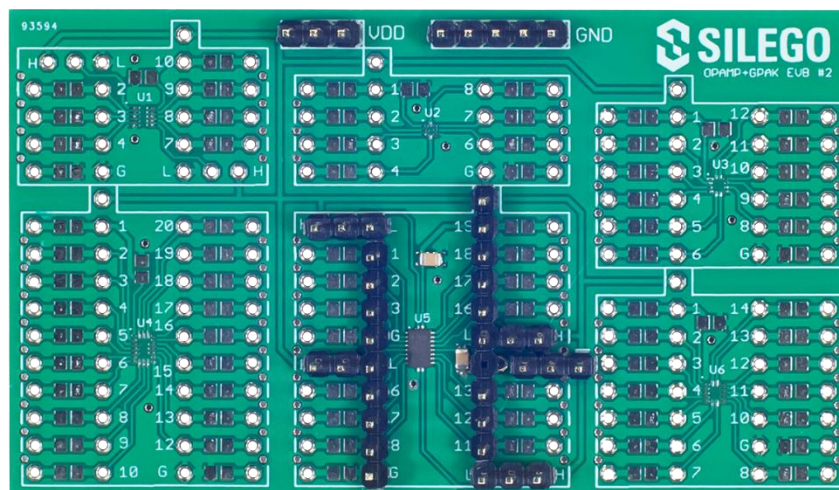


Figure 7. SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board Top View

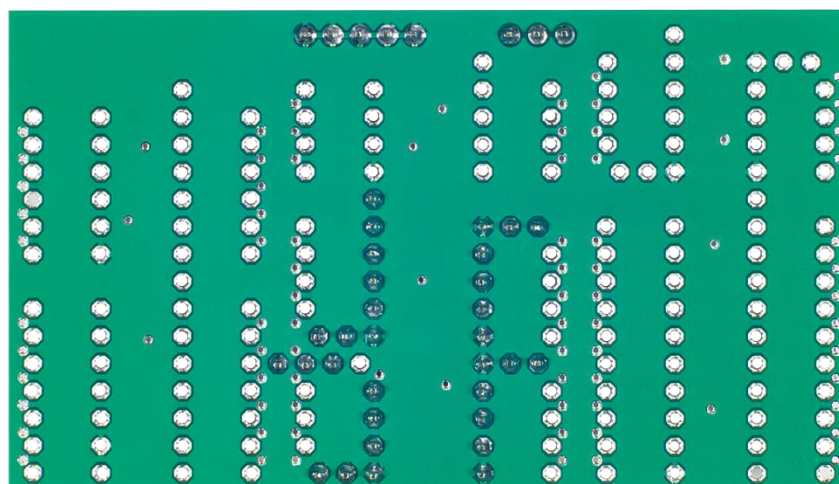


Figure 8. SLG88104V Quad-Channel Micropower Operational Amplifier Evaluation Board Bottom View

4. Revision History

Revision	Date	Description
1.00	Sep 30, 2026	Initial release.