

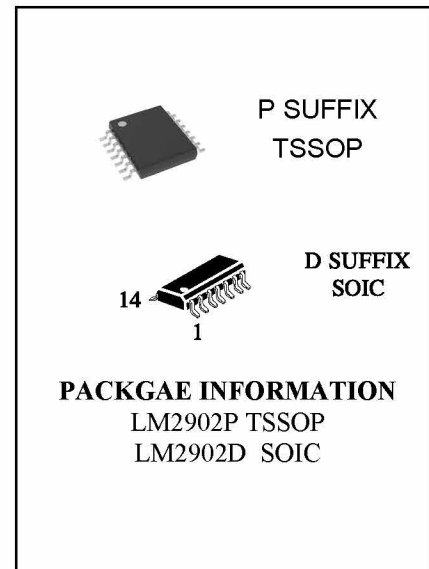
Low Power Quad Operational Amplifier

Description

The LM2902 contains four independent high gain operational amplifiers with internal frequency compensation. The four op-amps operate over a wide voltage range from a single power supply. Also use a split power supply. The device has low power supply current drain, regardless of the power supply voltage. The low power drain also makes the LM2902 a good choice for battery operation.

When your project calls for a traditional op-amp function, now you can streamline your design with a simple single power supply. Use ordinary +5VDC common to practically any digital system or personal computer application, without requiring an extra 15V power supply just to have the interface electronics you need.

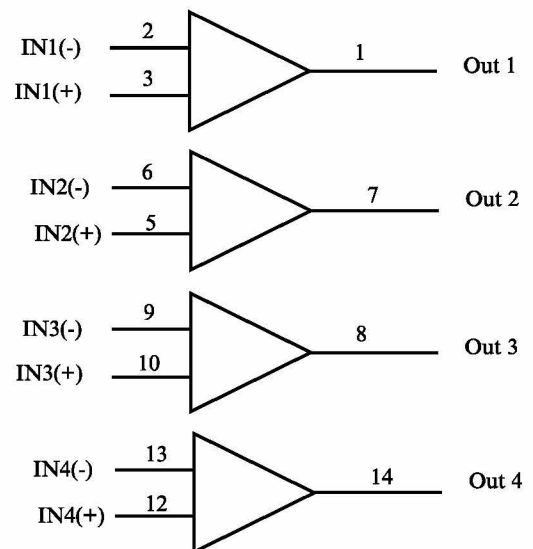
The LM2902 is a versatile, rugged workhorse with a thousand-and-one uses, from amplifying signals from a variety of transducers to dc gain blocks, or any op-amp function. The attached pages offer some recipes that will have your project cooking in no time.



Features

- Internally frequency compensated for unity gain
- Large DC voltage gain: 100dB
- Wide power supply range:
3V ~ 32V (or $\pm 1.5V \sim \pm 16V$)
- Input common-mode voltage range includes ground
- Large output voltage swing: 0V DC to $V_{CC} - 1.5V$ DC
- Power drain suitable for battery operation
- Low input offset voltage and offset current
- Differential input voltage range equal to the power supply voltage
- LM2902 AEC Q100 Qualified
- HBM ESD Level 2kV

Logic Diagram

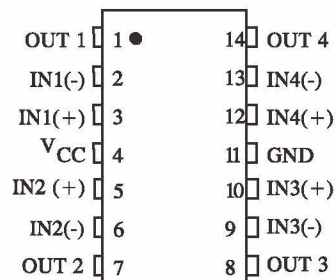


PIN 4 = V_{CC}
 PIN 11 = GND

Ordering information

Part Number	Package	Packing	Temperature(TA)	Package Qty	ESD protection
LM2902DR	SOIC-14	Reel	-40°C ~ 125°C	2500	500V
LM2902PWR	TSSOP-14	Reel	-40°C ~ 125°C	2500	500V
LM2902QPWR	TSSOP-14	Reel	-40°C ~ 125°C	2500	2000V
LM2902KAVQDR	SOIC-14	Reel	-40°C ~ 125°C	2500	2000V
LM2902KAVQPWR	TSSOP-14	Reel	-40°C ~ 125°C	2500	2000V

PIN ASSIGNMENT



Pin Functions

PIN			
NAME	SOIC, TSSOP	I/O	DESCRIPTION
IN1-	2	I	Negative input
IN1+	3	I	Positive input
OUT 1	1	O	Output
IN2-	6	I	Negative input
IN2+	5	I	Positive input
OUT2	7	O	Output
IN3-	9	I	Negative input
IN3+	10	I	Positive input
OUT3	8	O	Output
IN4-	13	I	Negative input
IN4+	12	I	Positive input
OUT4	14	O	Output
V _{CC-}	11	—	Negative (lowest) supply or ground (for single-supply operation)
NC	—	—	Do not connect
V _{CC+}	4	—	Positive (highest) supply

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	Power Supply Voltages		
	Single Supply	32	V
	Split Supplies	± 16	
V_{IDR}	Input Differential Voltage Range (1)	± 32	V
V_{ICR}	Input Common Mode Voltage Range	-0.3 to 32	V
I_{SC}	Output Short Circuit Duration	Continuous	
T_J	Junction Temperature Plastic Packages	150	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Plastic Packages	-55 to +125	$^{\circ}\text{C}$
I_{IN}	Input Current, per pin (2)	50	mA
T_L	Lead Temperature, 1mm from Case for 10 Seconds	260	$^{\circ}\text{C}$

* Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Functional operation should be restricted to the Recommended Operating Conditions.

+Derating - Plastic DIP: - 10 mW/ $^{\circ}\text{C}$ from 65 $^{\circ}$ to 125 $^{\circ}\text{C}$

SOIC Package: - 7 mW/ $^{\circ}\text{C}$ from 65 $^{\circ}$ to 125 $^{\circ}\text{C}$

Notes:

1. Split Power Supplies.
2. $V_{IN} < -0.3\text{V}$. This input current will only exist when voltage at any of the input leads is driven negative.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	± 2.5 or 5.0	± 15 or 30	V
T_A	Operating Temperature, All Package Types	LM2902	-40	125
				$^{\circ}\text{C}$

Notes:

1. LM2902KA or LM2902Q uses 32V Supply voltage.

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range $\text{GND} \leq (V_{IN} \text{ or } V_{OUT}) \leq V_{CC}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS ($T_A = -40$ to $+125^\circ\text{C}$)

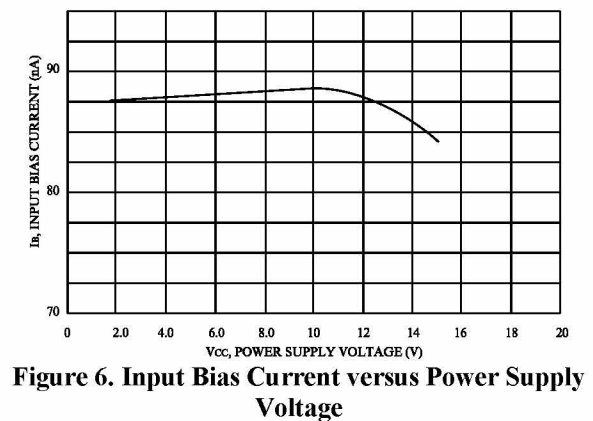
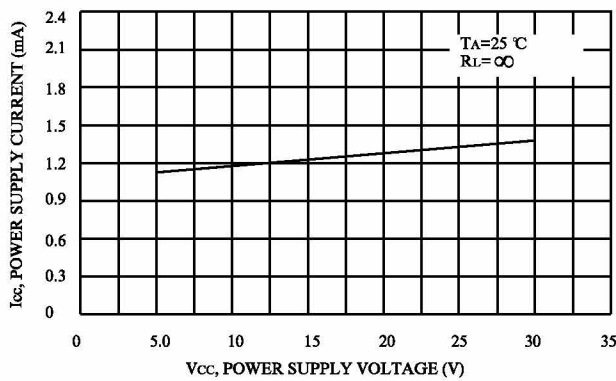
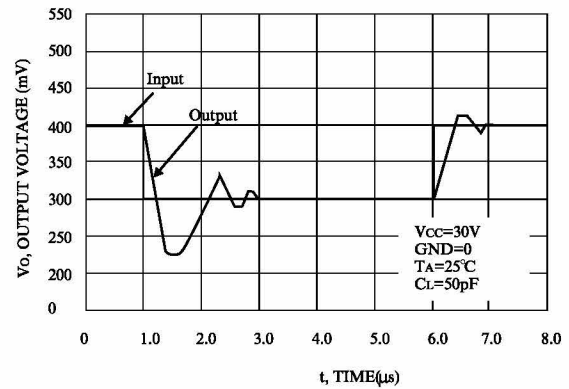
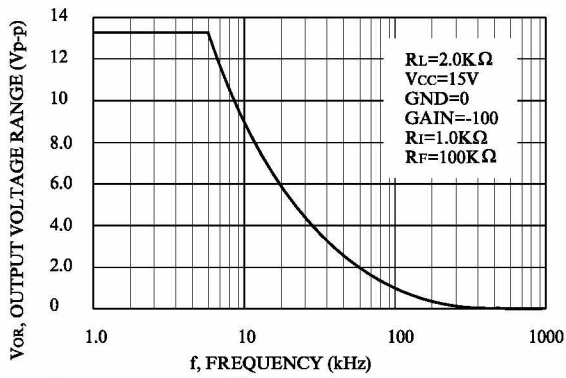
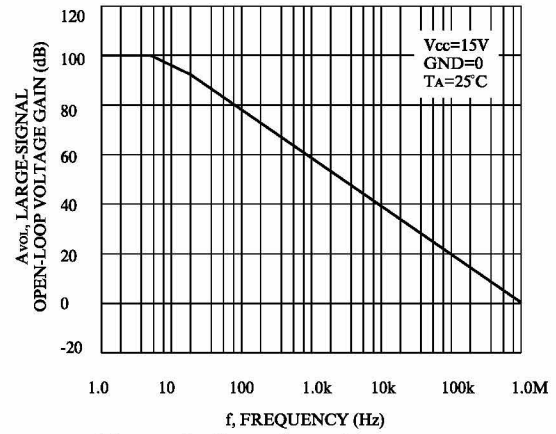
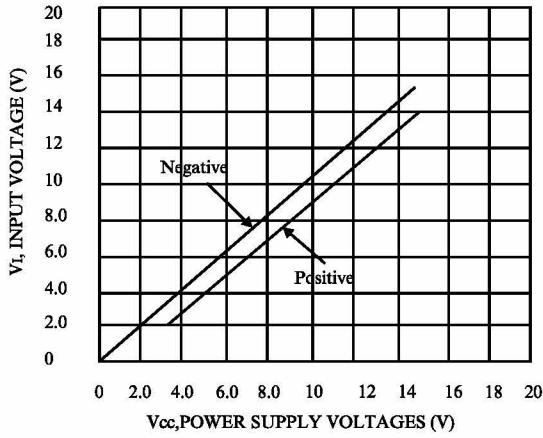
Symbol	Parameter	Test Conditions	Guaranteed Limit			Unit
			Min	Typ	Max	
V_{IO}	Maximum Input Offset Voltage	$V_O=1.4V$, $V_{CC}=5.0-30V$; $R_S=0\Omega$ $V_{ICM}=0V$ to $V_{CC}-1.7V$			9.0 5.0*	mV
$\Delta V_{IO}/\Delta T$	Input Offset Voltage Drift	$R_S=0\Omega$, $V_{CC}=30V$		7.0		$\mu\text{V}/^\circ\text{C}$
I_{IO}	Maximum Input Offset Current	$V_{CC}=5.0V$			150 50*	nA
$\Delta I_{IO}/\Delta T$	Input Offset Current Drift	$R_S=0\Omega$, $V_{CC}=30V$		10		$\text{pA}/^\circ\text{C}$
I_{IB}	Maximum Input Bias Current	$V_{CC}=5.0V$			500 250*	nA
V_{ICR}	Input Common Mode Voltage Range	$V_{CC}=30V$	0		28	V
I_{CC}	Maximum Power Supply Current	$R_L=\infty$, $V_{CC}=30V$, $V_O=0V$ $R_L=\infty$, $V_{CC}=5V$, $V_O=0V$			3 1.2	mA
A_{VOL}	Minimum Large Signal Open-Loop Voltage Gain	$V_{CC}=15V$, $R_L \geq 2K\Omega$	15 25*			V/mV
V_{OH}	Minimum Output High-Level Voltage Swing	$V_{CC}=30V$, $R_L=2K\Omega$ $V_{CC}=30V$, $R_L=10K\Omega$	26 27			V
V_{OL}	Maximum Output Low-Level Voltage Swing	$V_{CC}=5V$, $R_L=10K\Omega$			20	mV
CMR	Common Mode Rejection	$V_{CC}=30V$, $R_S=10K\Omega$	65*			dB
PSR	Power Supply Rejection	$V_{CC}=30V$	65*			dB
CS	Channel Separation	$f=1\text{KHz}$ to 20KHz , $V_{CC}=30V$	-120*			dB
I_{SC}	Maximum Output Short Circuit to GND	$V_{CC}=5.0V$			60*	mA
I_{source}	Minimum Output Source Current	$V_{IN+}=1V$, $V_{IN-}=0V$, $V_{CC}=15V$, $V_O=0V$	10			mA
I_{sink}	Minimum Output Sink Current	$V_{IN+}=0V$, $V_{IN-}=1V$, $V_{CC}=15V$, $V_O=15V$ $V_{IN+}=0V$, $V_{IN-}=1V$, $V_{CC}=15V$, $V_O=15V$	5 10* 12*			mA μA
V_{IDR}	Differential Input Voltage Range	All $V_{IN} \geq \text{GND}$ or V-Supply (if used)			V_{CC}^*	V

*= $@25^\circ\text{C}$

Notes:

- LM2902KA or LM2902Q uses 60mA channel current .

TYPICAL PERFORMANCE CHARACTERISTICS



Typical Application

A typical application for an operational amplifier in an inverting amplifier. This amplifier takes a positive voltage on the input, and makes it a negative voltage of the same magnitude. In the same manner, it also makes negative voltages positive.

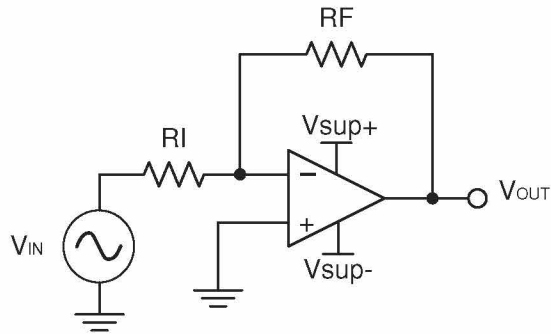
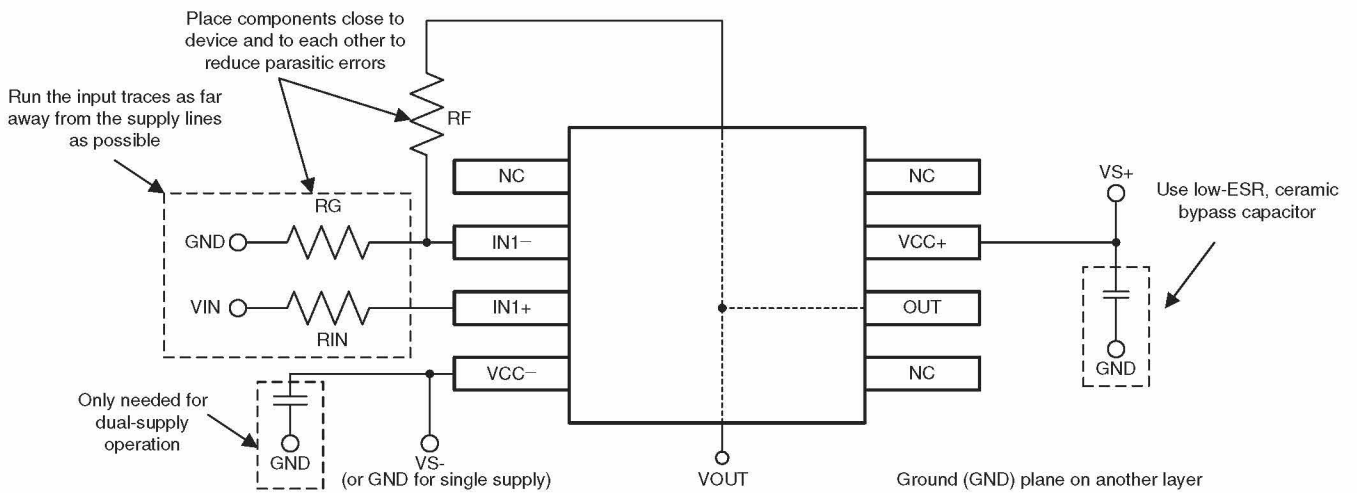


Figure 9-1. Application Schematic

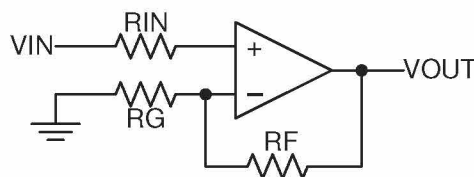
Design Requirements

The supply voltage must be chosen such that it is larger than the input voltage range and output range. For instance, this application will scale a signal of ± 0.5 V to ± 1.8 V. Setting the supply at ± 12 V is sufficient to accommodate this application.

Layout Examples



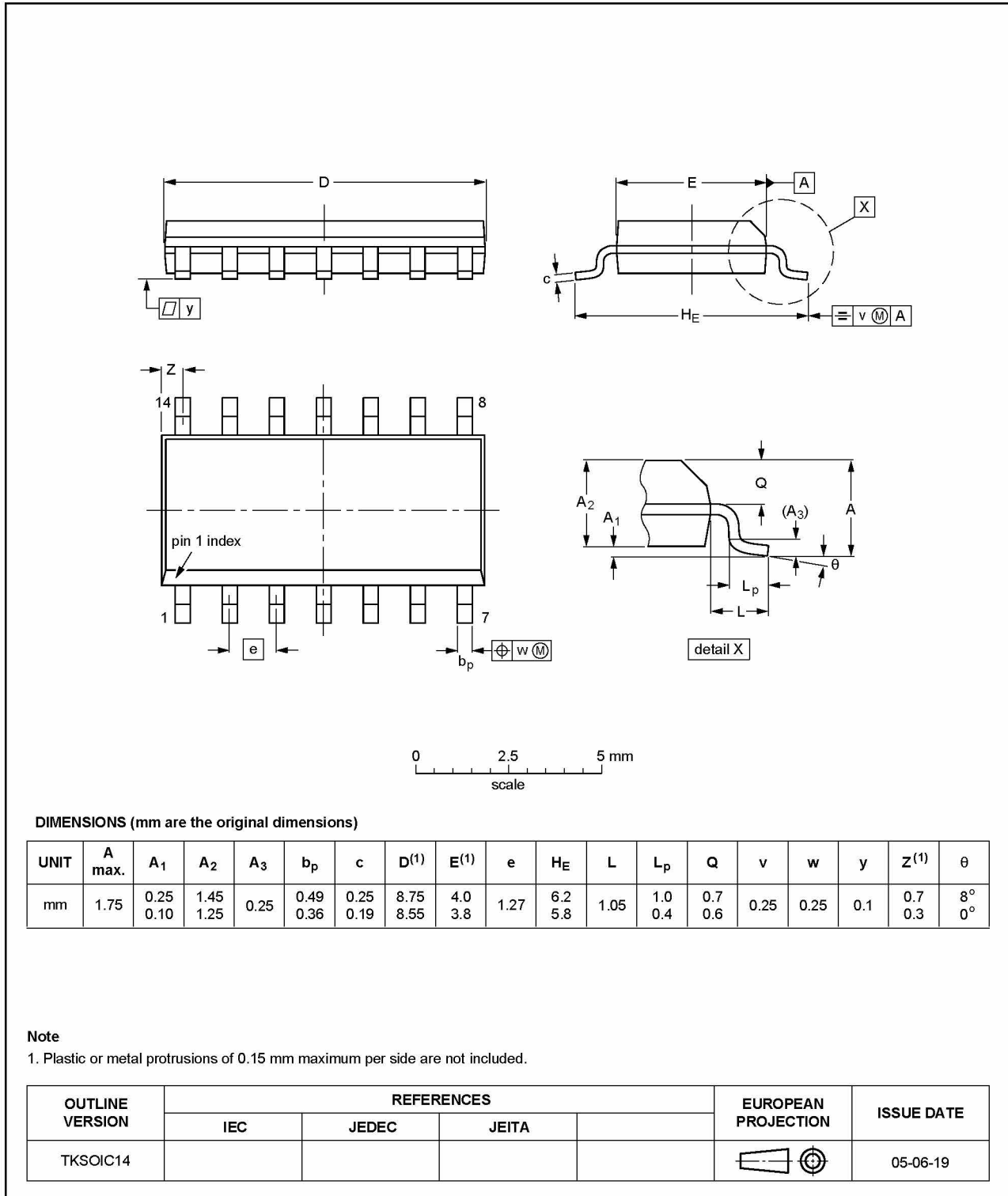
Operational Amplifier Board Layout for Noninverting Configuration



Operational Amplifier Schematic for Noninverting Configuration

Package diagram

SOIC14: plastic small outline package; 14 leads; body width 3.9 mm



TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm
