

# Low power dual operational amplifier

# AU2904

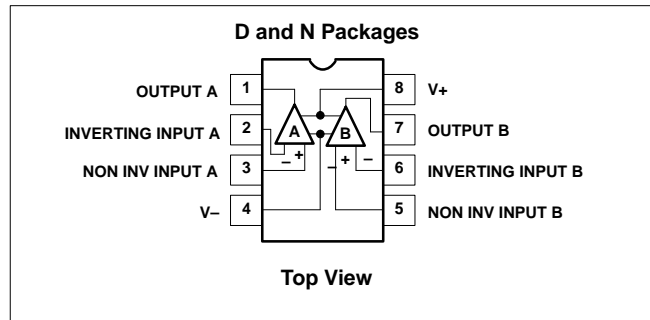
## DESCRIPTION

The AU2904 consists of two independent, high-gain, internally frequency-compensated operational amplifiers designed specifically to operate from a single power supply over a wide range of voltages. Operation from dual power supplies is also possible, and the low power supply current drain is independent of the magnitude of the power supply voltage.

## FEATURES

- Internally frequency-compensated for unity gain
- Large DC voltage gain: 100dB
- Wide bandwidth (unity gain): 1MHz (temperature-compensated)
- Wide power supply range Single supply:  $3V_{DC}$  to  $30V_{DC}$  or dual supplies:  $\pm 1.5V_{DC}$  to  $\pm 15V_{DC}$
- Very low supply current drain ( $400\mu A$ ): essentially independent of supply voltage ( $1mW/op\ amp$  at  $+5V_{DC}$ )
- Low input bias current:  $45nA_{DC}$  (temperature-compensated)
- Low input offset voltage:  $2mV_{DC}$  and offset current:  $5nA_{DC}$
- Differential input voltage range equal to the power supply voltage
- Large output voltage:  $0V_{DC}$  to  $V+ - 1.5V_{DC}$  swing

## PIN CONFIGURATION



## UNIQUE FEATURES

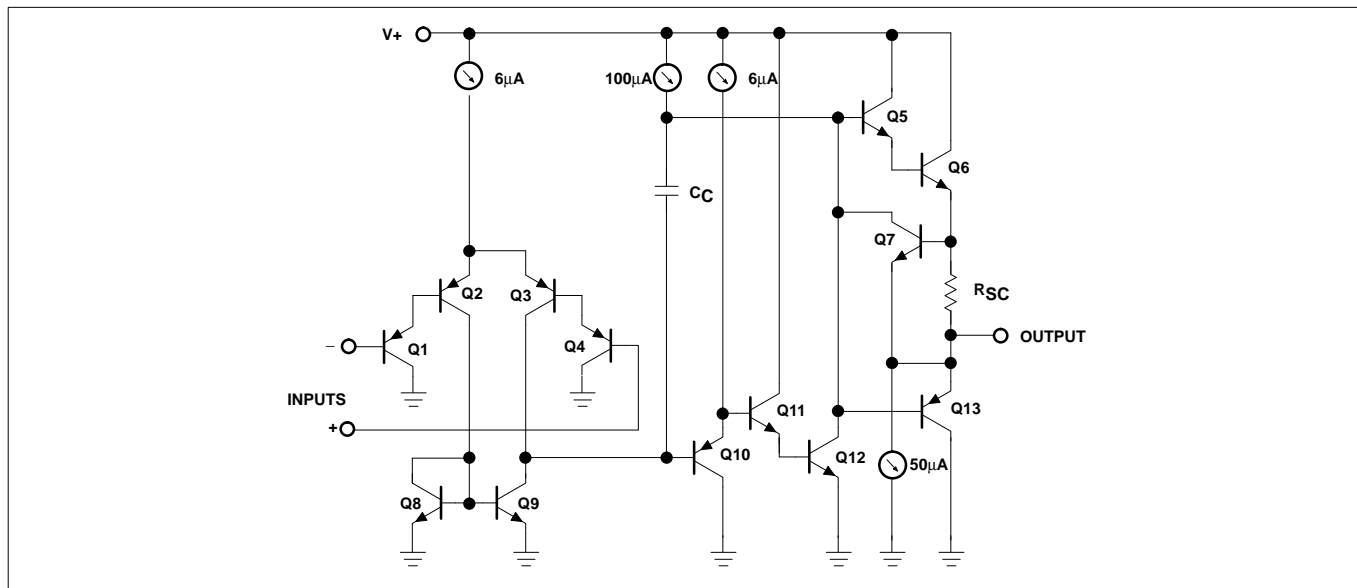
In the linear mode the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage.

The unity gain crossover frequency and the input bias current are temperature-compensated.

## ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
8-Pin Plastic Dual In-Line Package (DIP)	-40 to +125°C	AU2904N	0404B
8-Pin Plastic Small Outline (SO) Package	-40 to +125°C	AU2904D	0174C

## EQUIVALENT SCHEMATIC



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## ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
V <sub>S</sub>	Supply voltage V <sub>+</sub>	32 or ±16	V <sub>DC</sub>
	Differential input voltage	32	V <sub>DC</sub>
V <sub>IN</sub>	Input voltage	-0.3 to +32	V <sub>DC</sub>
P <sub>DMAX</sub>	Maximum power dissipation, T <sub>A</sub> =25°C(still-air) <sup>1</sup> N package D package	1160 780	mW mW
	Output short-circuit to GND <sup>5</sup> V <sub>+</sub> <15V <sub>DC</sub> and T <sub>A</sub> =25°C	Continuous	
T <sub>A</sub>	Operating ambient temperature range AU2904	-40 to +125	°C
T <sub>STG</sub>	Storage temperature range	-65 to +150	°C
T <sub>SOLD</sub>	Lead soldering temperature (10sec max)	300	°C

## NOTES:

- Derate above 25°C at the following rates:  
N package at 9.3mW/°C  
D package at 6.2mW/°C

## DC ELECTRICAL CHARACTERISTICS

T<sub>A</sub>=25°C V<sub>+</sub> =+5V, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	AU2904			UNIT
			Min	Typ	Max	
V <sub>OS</sub>	Offset voltage <sup>1</sup>	R <sub>S</sub> =0Ω		±2	±7	mV
		R <sub>S</sub> =0Ω, over temp.			±9	
V <sub>OS</sub>	Drift	R <sub>S</sub> =0Ω, over temp.		7		μV/°C
I <sub>OS</sub>	Offset current	I <sub>IN</sub> (+)-I <sub>IN</sub> (-)		±5	±50	nA
		Over temp.			±150	nA
I <sub>OS</sub>	Drift	Over temp.		10		pA/°C
I <sub>BIAS</sub>	Input current <sup>2</sup>	I <sub>IN</sub> (+) or I <sub>IN</sub> (-)		45	250	nA
		Over temp., I <sub>IN</sub> (+) or I <sub>IN</sub> (-)		40	500	
I <sub>BIAS</sub>	Drift	Over temp.		50		pA/°C
V <sub>CM</sub>	Common-mode voltage range <sup>3</sup>	V <sub>+</sub> =30V	0		V <sub>+</sub> -1.5	V
		Over temp., V <sub>+</sub> =30V	0		V <sub>+</sub> -2.0	V
CMRR	Common-mode rejection ratio	V <sub>+</sub> =30V	65	70		dB
V <sub>OH</sub>	Output voltage swing	R <sub>L</sub> ≥2kΩ, V <sub>+</sub> =30V, over temp.	26			V
		R <sub>L</sub> ≥10kΩ, V <sub>+</sub> =30V, over temp.	27	26		
V <sub>OL</sub>	Output voltage swing	R <sub>L</sub> ≥10kΩ, Over temp.		5	20	mV
I <sub>CC</sub>	Supply current	R <sub>L</sub> =∞, V <sub>+</sub> =30V		0.5	1.0	mA mA
		R <sub>L</sub> =∞ on all amplifiers, Over temp., V <sub>+</sub> =30V		0.6	1.2	
A <sub>VOL</sub>	Large-signal voltage gain	R <sub>L</sub> ≥2kΩ, V <sub>OUT</sub> ±10V, V <sub>+</sub> =15V	25	100		V/mV
		Over temp.	15			
PSRR	Supply voltage rejection ratio	R <sub>S</sub> =0Ω	65	100		dB
	Amplifier-to-amplifier coupling <sup>4</sup>	f=1kHz to 20kHz (input referred)		-120		dB
I <sub>OUT</sub>	Output current source	V <sub>IN+</sub> =+1V <sub>DC</sub> , V <sub>IN-</sub> =0V <sub>DC</sub> , V <sub>+</sub> =15V <sub>DC</sub>	20	40		mA
		Over temp.	10	20		

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## DC ELECTRICAL CHARACTERISTICS (continued)

SYMBOL	PARAMETER	TEST CONDITIONS	AU2904			UNIT
			Min	Typ	Max	
$I_{OUT}$	Output current Sink	$V_{IN-}=+1V_{DC}$ , $V_{IN+}=0V_{DC}$ , $V+=15V_{DC}$	10	20		mA
		$V_{IN-}=+1V_{DC}$ , $V_{IN+}=0V_{DC}$ , $V+=15V_{DC}$ , over temp.	5	8		mA
		$V_{IN+}=0V$ , $V_{IN-}=+1V_{DC}$ , $V_O=200mV$	12	50		$\mu A$
$I_{SC}$	Short circuit current <sup>5</sup>			40	60	mA
	Differential input voltage <sup>3</sup>				V+	V
GBW	Unity gain bandwidth	$T_A=25^{\circ}C$		1		MHz
SR	Slew rate	$T_A=25^{\circ}C$		0.3		V/ $\mu s$
$V_{NOISE}$	Input noise voltage	$T_A=25^{\circ}C$ f=1kHz		40		nV/ $\sqrt{Hz}$

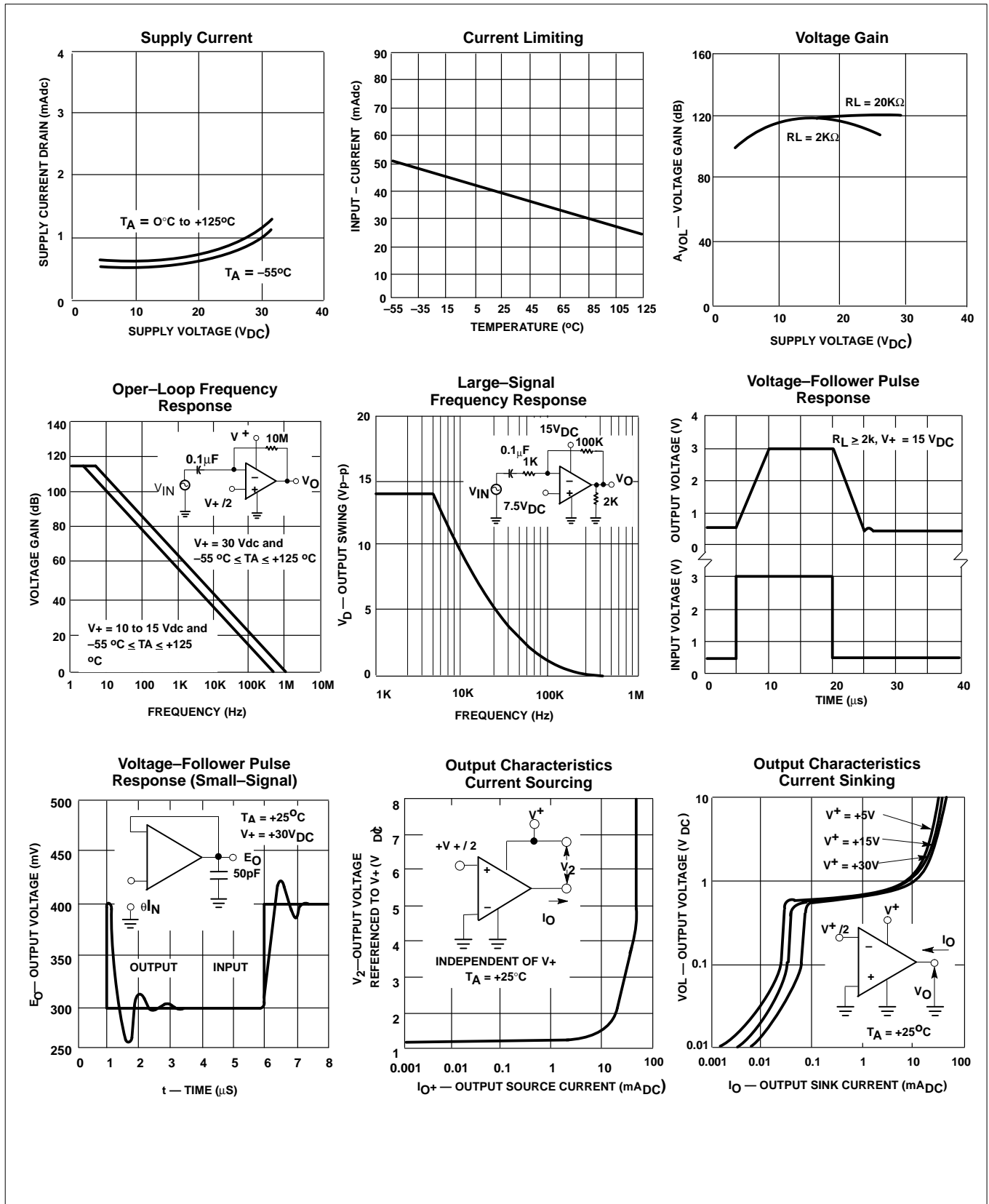
## NOTES:

- $V_O \approx 1.4V$ ,  $R_S=0\Omega$  with  $V_{CC}$  from 5V to 30V and over full input common-mode range ( $0V_{DC+}$  to  $V_{CC}-1.5V$ ).
- The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the input lines.
- The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is  $V+1.5$ , but either or both inputs can go to +32V without damage.
- Due to proximity of external components, insure that coupling is not originating via stray capacitance between these external parts. This typically can be detected as this type of coupling increases at higher frequencies.
- Short-circuits from the output to  $V+$  can cause excessive heating and eventual destruction. The maximum output current is approximately 40mA independent of the magnitude of  $V+$ . At values of supply voltage in excess of  $+15V_{DC}$ , continuous short-circuits can exceed the power dissipation ratings and cause eventual destruction.

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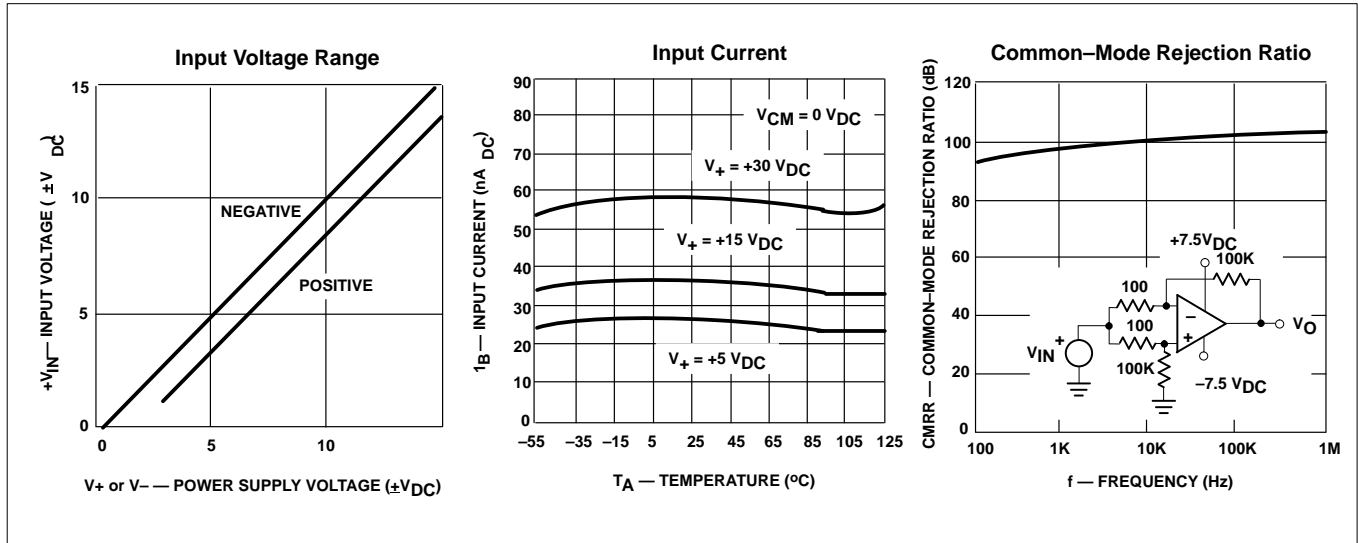
### TYPICAL PERFORMANCE CHARACTERISTICS



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### TYPICAL PERFORMANCE CHARACTERISTICS (Continued)



### TYPICAL APPLICATIONS

