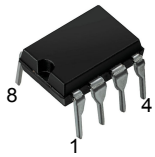
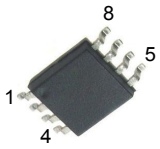
DUAL OPERATIONAL AMPLIFIER

FEATURES

- Wide Power Supply Range
  - Single Supply: 3V ~ 32V
  - Dual Supplies: ±1.5V ~ ±16V
- Lower Input Offset Voltage: 2mV (Typ.)
- Input Common-Mode Voltage Range Include Ground
- Differential Input Voltage Range Equal to the Power Supply Voltage
- Large Output Voltage Swing: 0V ~ (V_{CC} - 1.5V)
- Large DC Voltage Gain: 100dB
- Internal Frequency Compensated for Unity Gain
- Wide Bandwidth (Unity Gain): 1MHz



DIP-8



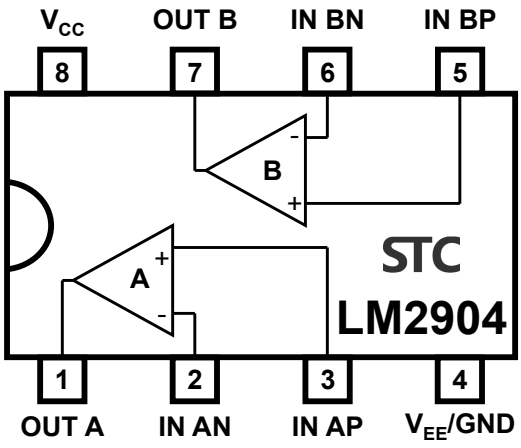
SOP-8

DESCRIPTION

The ***STComponent*** LM2904 consists of two independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, dc gain blocks and all the conventional op amp circuits that now can be more easily implemented in single power supply systems.

INTERNAL SCHEMATIC DIAGRAM



DEVICE SUMMARY

Ordering Code	Package Type	Marking (1)	Shipping
LM2904A	DIP-8	LM2904 STC YM	Tube
LM2904BT	SOP-8		Tube
LM2904BR	SOP-8		Taping reel

Note 1: **Y**: Year code
M: Month code

ABSOLUTE MAXIMUM RATINGS (2)

T_A = 25°C, unless otherwise specified.

PARAMETER	SYMBOL	RATINGS	UNIT
Single Supply Voltage (Referenced to GND = 0V)	V_{CC}	32	V
Dual Supply Voltage	V_{CC}/V_{EE}	+16/-16	V
Differential Input Voltage	V_{ID}	32	V
Input Voltage	V_I	-0.3 ~ +32	V
Power Dissipation DIP-8	P_D	570	mW
SOP-8		280	mW
Operating Ambient Temperature Range	T_{opr}	-40 ~ +125	°C
Storage Temperature Range	T_{stg}	-65 ~ +150	°C
Soldering Temperature & Time	T_{solder}	260°C, 10 sec.	

Note 2: Absolute Maximum Ratings are those values beyond which the device could be permanently damaged. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_{CC} = 5V, All voltage referenced to V_{EE}/GND = 0V unless otherwise noted.

PARAMETER		SYMBOL	TEST CONDITIONS (3)		MIN	TYP	MAX	UNIT
Input Offset Voltage		V_{IO}	V_{CM} = 0V ~ (V_{CC} – 1.5V), V_O = 1.4V, R_S = 0Ω			2	7	mV
				*			15	
Input Offset Voltage Drift		$\Delta V_{IO}/\Delta T_A$		*		7		μV/°C
Input Offset Current		I_{IO}				3	50	nA
				*			100	
Input Offset Current Drift		$\Delta I_{IO}/\Delta T_A$		*		10		pA/°C
Input Bias Current (4)		I_{IB}	V_{CM} = 0V			45	250	nA
				*			300	
Input Common-Mode Voltage Range (5)		V_{ICM}	V_{CC} = 30V		0		28.5	V
				*	0		28	
Supply Voltage (Each Amplifier)		I_{CC}	V_{CC} = 30V, R_L = ∞	*		1.5	2.3	mA
			V_{CC} = 5V, R_L = ∞	*		0.5	1.2	
Large Signal Voltage Gain		G_V	V_{CC} = 15V, R_L > 2kΩ, (For V_O = 1V ~ 11V)		50	100		V/mV
				*	25			
Common-Mode Rejection Ratio		CMRR	V_{CM} = 0V ~ (V_{CC} – 1.5V)		70	85		dB
Power Supply Rejection Ratio		PSRR	V_{CC} = 5V ~ 30V		65	100		dB
Amplifier-to-Amplifier Coupling (6)		X_{TALK}	f = 1kHz ~ 20kHz, (Input referred)			-120		dB
Output Current	Source	I_{SOURCE}	V_{INP} = 1V, V_{INN} = 0V, V_{CC} = 15V, V_O = 2V			-40	-20	mA
				*		-20	-10	
	Sink	I_{SINK}	V_{INP} = 0V, V_{INN} = 1V, V_{CC} = 15V, V_O = 2V		10	20		mA
				*	5	8		
			V_{INP} = 0V, V_{INN} = 1V, V_{CC} = 15V, V_O = 0.2V		12	50		μA

T_A = 25°C, V_{CC} = 5V, All voltage referenced to V_{EE}/GND = 0V unless otherwise noted.

PARAMETER	SYMBOL	TEST CONDITIONS (3)		MIN	TYP	MAX	UNIT
Short Circuit To Ground (7)	I_{SC}	V_{CC} = 15V			40	60	mA
Output Voltage Swing	V_{OH}	V_{CC} = 30V, R_L = 2kΩ	∗	26			V
		V_{CC} = 30V, R_L = 10kΩ	∗	27	28		
	V_{OL}	V_{CC} = 5V, R_L = 10kΩ	∗		5	20	mV
Differential Input Voltage	V_{ID}					V_{CC}	V

Note 3: The "∗" denotes specifications which apply over the full operating temperature range, -40°C ≤ T_A ≤ +125°C.

Note 4: 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.

Note 5: The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V (at 25°C). The upper end of the common-mode voltage range is V_{CC} − 1.5V (at 25°C), but either or both inputs can go to +32V without damage, independent of the magnitude of V_{CC}.

Note 6: 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 capacitance increases at higher frequencies.

Note 7: Short circuits from the output to V_{CC} can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 40mA independent of the magnitude of V_{CC}. At values of supply voltage in excess of +15V, continuous short-circuits can exceed the power dissipation ratings and cause eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

TYPICAL APPLICATION CIRCUIT

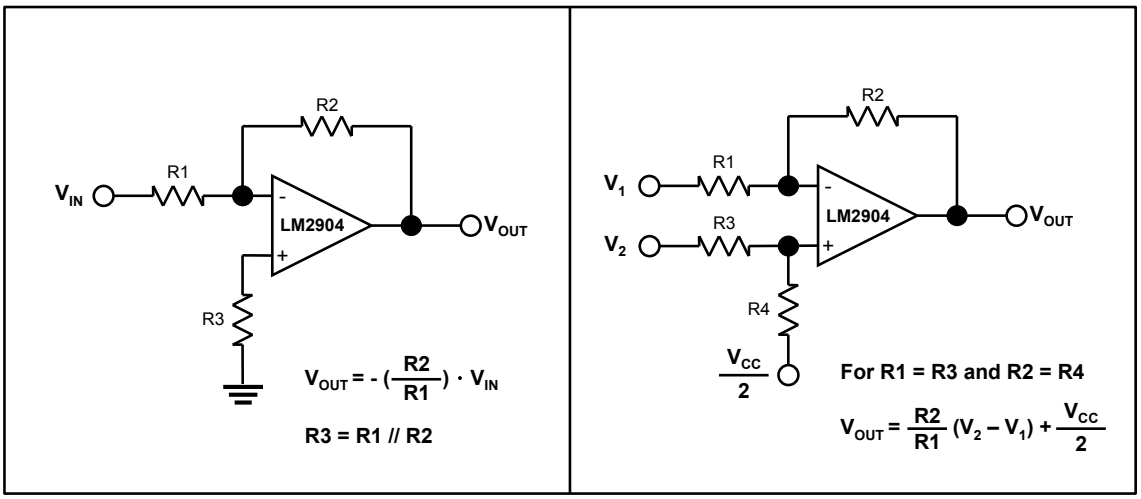


Figure 1: Cancelling the Error Caused Input Bias Current

Figure 2: Difference Amplifier

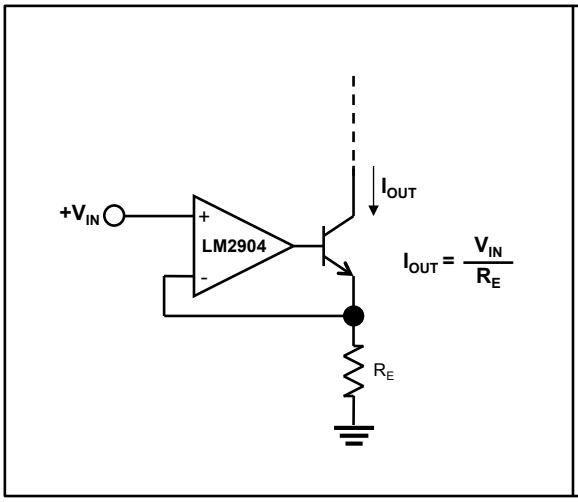


Figure 3: High Compliance Current Sink

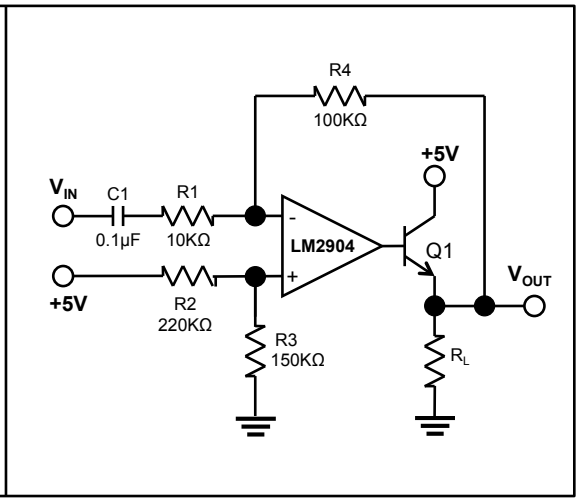


Figure 4: Power Amplifier

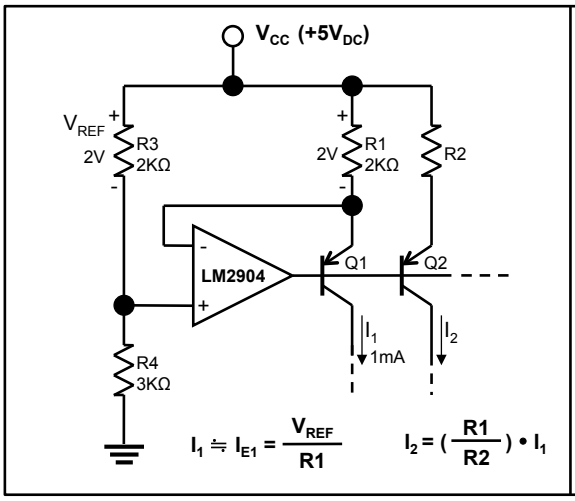


Figure 5: Fixed Current Source

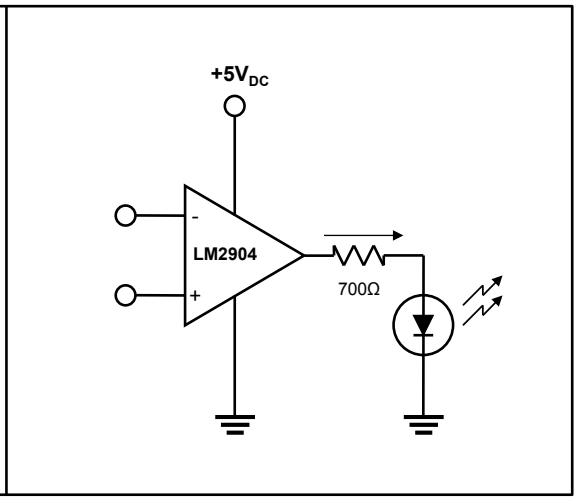
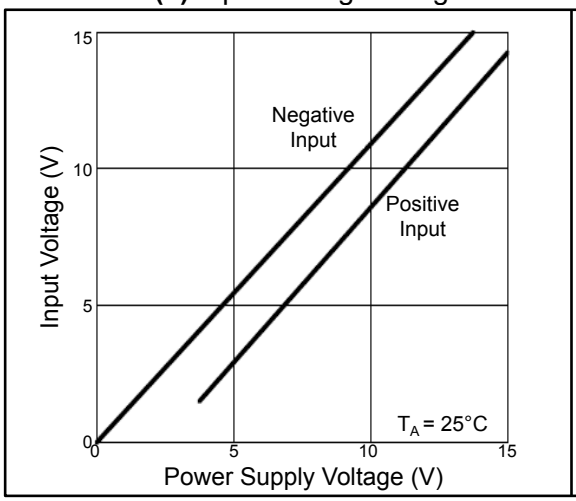


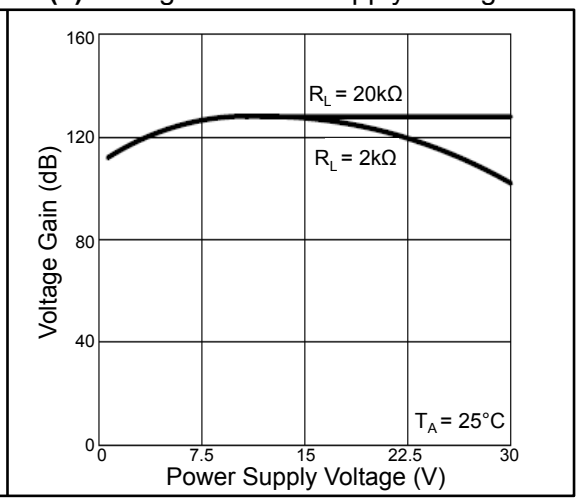
Figure 6: LED Driver

ELECTRICAL CHARACTERISTICS CURVES

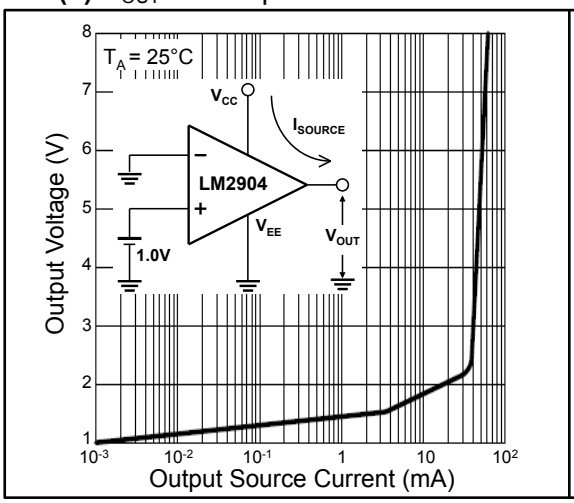
(1) Input Voltage Range



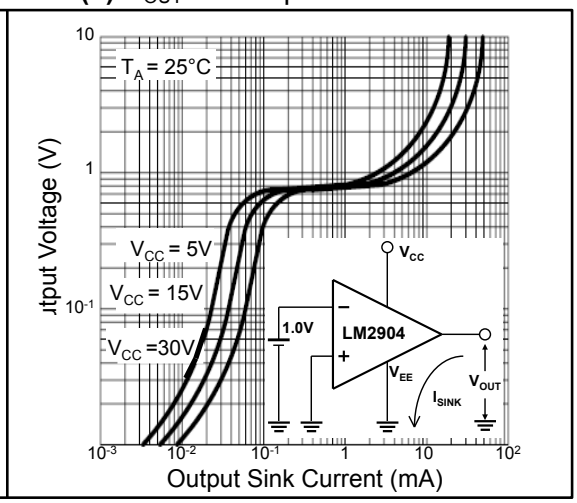
(2) Voltage Gain vs. Supply Voltage



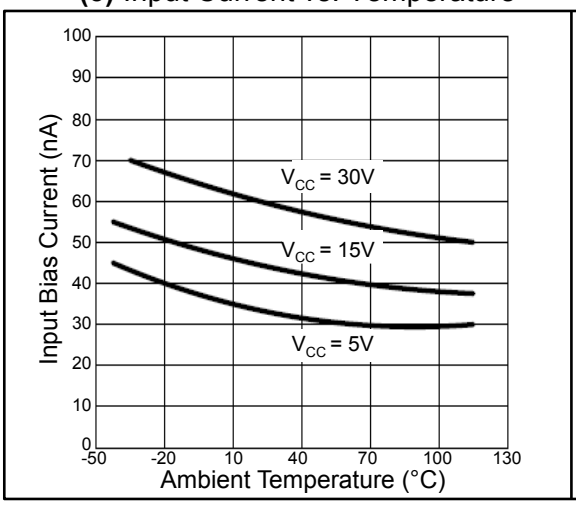
(3) V_{OUT} vs. Output Source Current



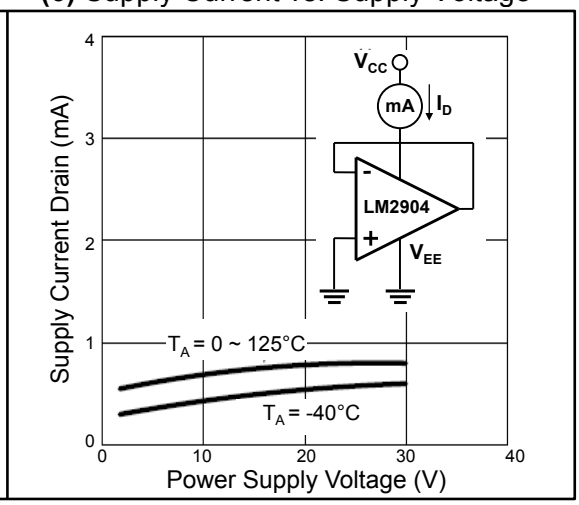
(4) V_{OUT} vs. Output Sink Current



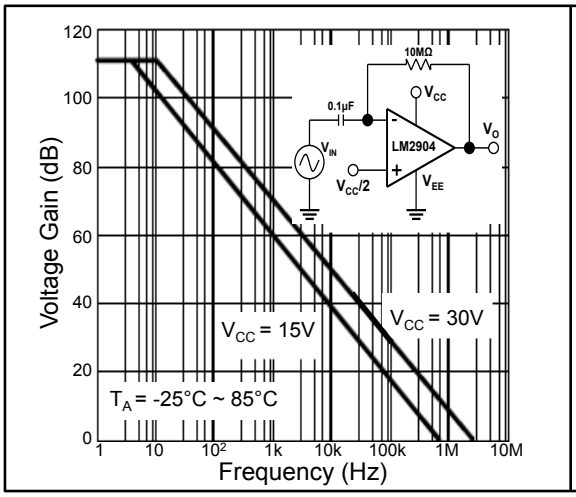
(5) Input Current vs. Temperature



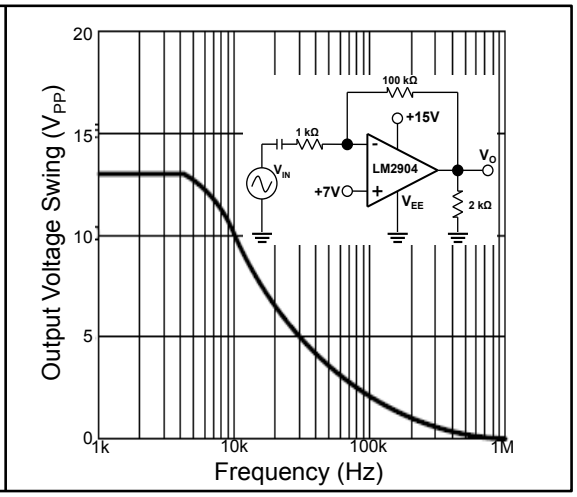
(6) Supply Current vs. Supply Voltage



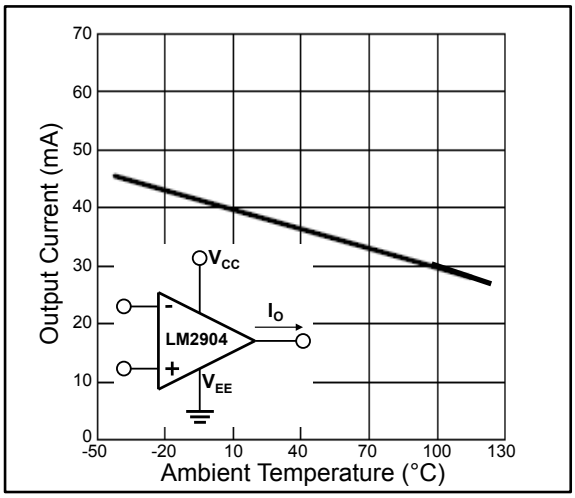
(7) Open Loop Frequency Response



(8) Large Signal Frequency Response



(9) Current Limiting vs. Temperature



PACKAGE DIMENSION

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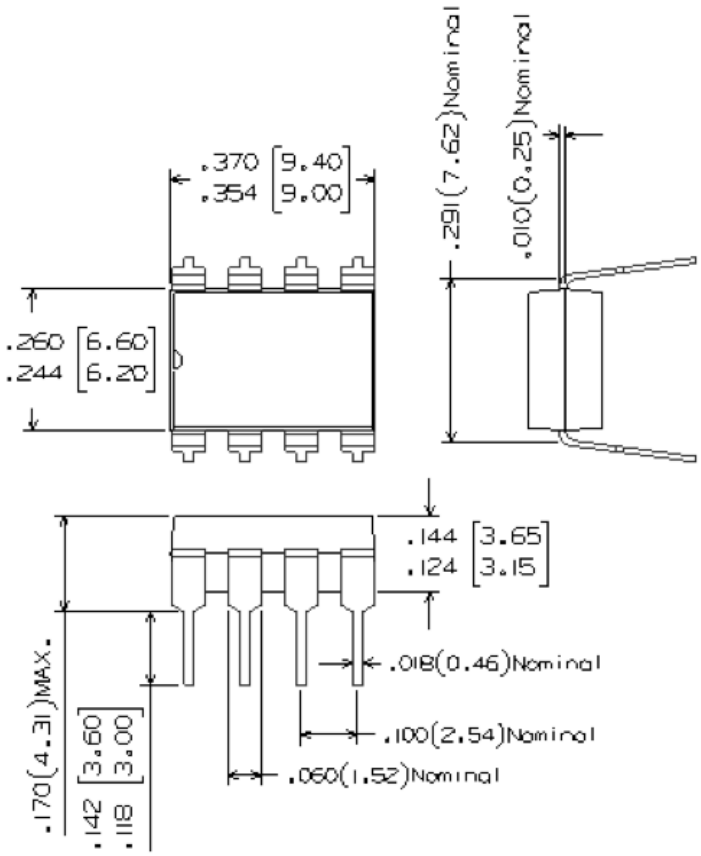
Unit: Inches [Millimeters]



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