

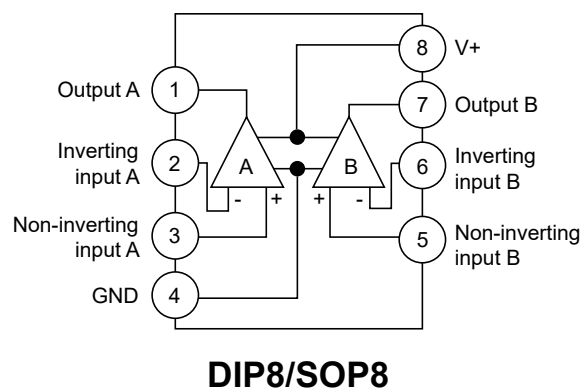
1.Description

The LM2904 consist of two independen hig gain operational amplifiers. It can work with a single power supply or with a dual power supply, and the current consumption of the power supply has nothing to do with the power supply voltage. Applications include variable frequency amplifiers, DC gain sections and all conventional op amp circuits. Available in DIP8 or SOP8 packages.

2.Features

- Can work with single or dual power supply
- Two internally compensated op amps in one package
- logic circuit matching.
- Low power consumption.
- Wide frequency range

3.Pinning Information



4.Limit value(absolute maximum rating, if not otherwise specified, Tamb=25°C)

Parameter		Value	Units
Voltage		26 or ± 13	V
Differential input voltage		± 26	V
Input voltage		-0.3 ~ 26	V
Power consumption	SOP/TSSOP-8 package	530	mW
Output short-circuit current to ground (1 amplifier) (Note 2) ($V^* \leq 15V$, $T_A = 25^\circ C$)		continued	
Working temperature		-40 ~ 125	$^\circ C$
Storage temperature		-65 ~ 150	$^\circ C$



5. Electrical characteristics

For $V_S = (V+) - (V-) = 5V$, $T_A = 25^\circ C$ (unless otherwise noted)

Parameter	Symbol	Conditions ⁽¹⁾	Min	Typ ⁽²⁾	Max	Units
OFFSET VOLTAGE						
Input offset voltage	V_{OS}	$V_S = 5V$ to maximum		3	7	mV
		$V_{CM} = 0V$, $V_O = 1.4V$	$T_A = -40^\circ C$ to $125^\circ C$		10	mV
Input offset voltage drift	dV_{OS}/dT			7		$\mu V/^\circ C$
Input offset voltage vs power supply ($\Delta V_{IO}/\Delta V_S$)	PSRR	$V_S = 5V$ to $30V$	65	100		dB
Channel separation	V_{O1}/V_{O2}	$f = 1kHz$ to $20kHz$		120		dB
INPUT VOLTAGE RANGE						
Common-mode voltage range	V_{CM}	$V_S = 5V$ to maximum	(V-)		(V+)-1.5	V
			$T_A = -40^\circ C$ to $125^\circ C$	(V-)	(V+)-2	V
Common-mode rejection ratio	CMRR	$V_S = 5V$ to maximum; $V_{CM} = 0V$	65	80		dB
INPUT BIAS CURRENT						
Input bias current	I_B	$V_O = 1.4V$		-20	-250	nA
			$T_A = -40^\circ C$ to $125^\circ C$		-500	nA
Input offset current	I_{OS}	$V_O = 1.4V$		2	50	nA
			$T_A = -40^\circ C$ to $125^\circ C$		300	nA
Input offset current drift	dI_{OS}/dT		$T_A = -40^\circ C$ to $125^\circ C$	10		$pA/^\circ C$
NOISE						
Input voltage noise density	e_n	$f = 1kHz$		40		$nV/\sqrt{Hz}$
OPEN-LOOP GAIN						
Open-loop voltage gain	A_{OL}	$V_S = 15V$, $V_O = 1V$ to $11V$, $R_L \geq 2k\Omega$	25	100		V/mV
			$T_A = -40^\circ C$ to $125^\circ C$	15		V/mV



Parameter	Symbol	Conditions ⁽¹⁾			Min	Typ ⁽²⁾	Max	Units
FREQUENCY RESPONSE								
Gain bandwidth product	GBW					0.7		MHz
Slew rate	SR	G=+1				0.3		V/μs
OUTPUT								
Voltage output swing from rail	V _O	Positive rail	R _L ≥10kΩ		V _S -1.5			V
			V _S =maximum,R _L =2kΩ	T _A =-40°C to 125°C			4	V
			V _S =maximum,R _L ≥10kΩ			2	3	V
		Negative rail, V _S =5 V, R _L ≤10kΩ		T _A =-40°C to 125°C			5	20
Output current	I _O	V _S =15V,V _O =0V,V _{ID} =1V,Source			-20	-30		mA
				T _A =-40°C to 125°C	-10			mA
		V _S =15V,V _O =15V,V _{ID} =-1V,Sink			10	20		mA
				T _A =-40°C to 125°C	5			mA
		V _{ID} =-1V, V _O =200mV				30		μA
Short-circuit current	I _{SC}	V _S =10V, V _O =V _S /2				±40	±60	mA
POWER SUPPLY								
Quiescent current per amplifier	I _Q	V _O =2.5V, I _O =0A		T _A =-40°C to 125°C		350	600	μA
		V _S =maximum,V _O =maximum/2,I _O =0A				500	1000	μA

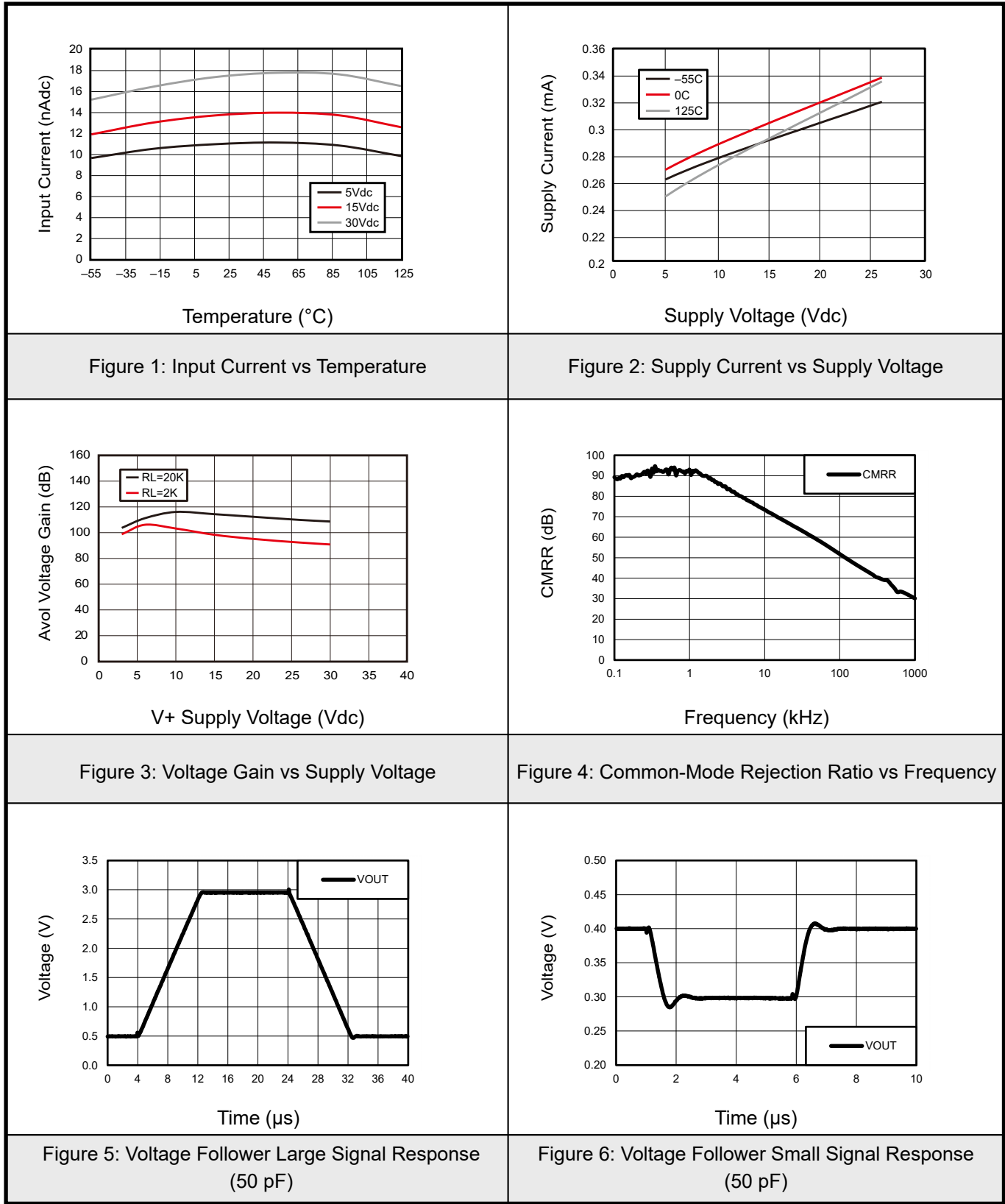
Notes:

(1) All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. Maximum V_S for testing purposes is 26V for LM2904.

(2) All typical values are T_A=25°C.



6.1 Typical Characteristics





6.2 Typical Characterisitics

Figure 7: Maximum Output Swing vs Frequency (V _{CC} =15V)	Figure 8: Output Sourcing Characteristics
Figure 9: Output Sinking Characteristics	Figure 10: Source Current Limiting



7.Parameter Measurement Information

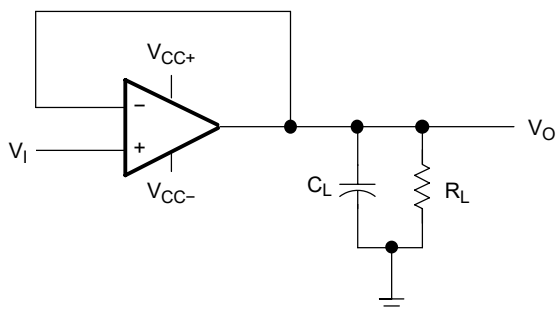


Figure 11: Unity-Gain Amplifier

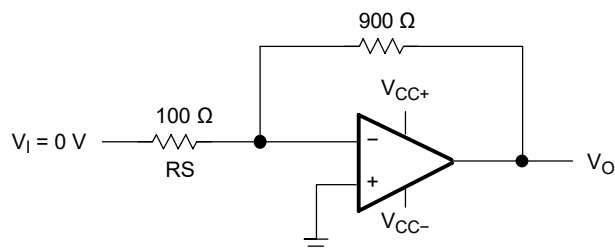
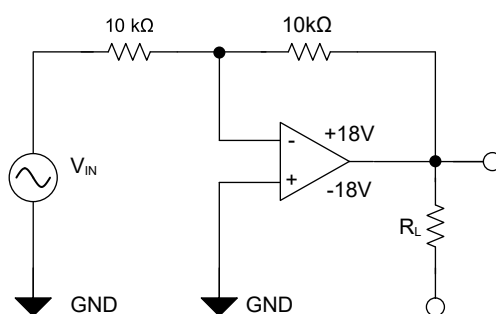
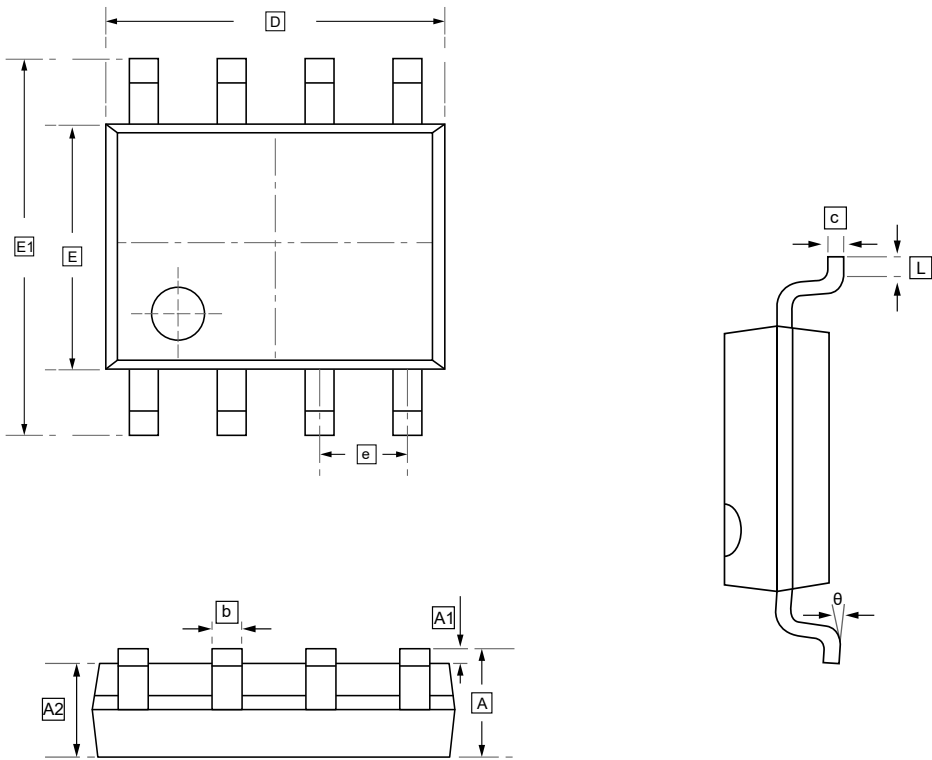


Figure 12: Noise-Test Circuit

Figure 13: Test Circuit, $G=-1$, for THD+N and Small-Signal Step Response



8.SOP-8 Package Outline Dimensions

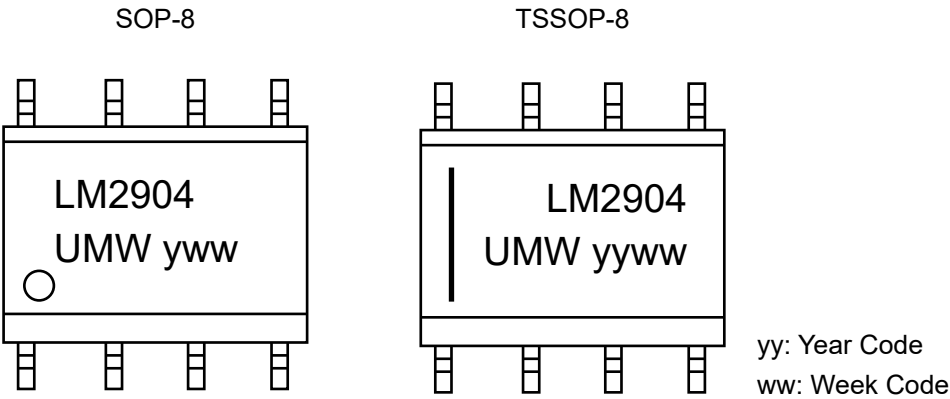


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°



9.Ordering Information



Order Code	Marking	Package	Base QTY	Delivery Mode
UMW LM2904DR	LM2904	SOP-8	2500	Tape and reel
UMW LM2904PWR	LM2904	TSSOP-8	4000	Tape and reel



10.Disclaimer

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