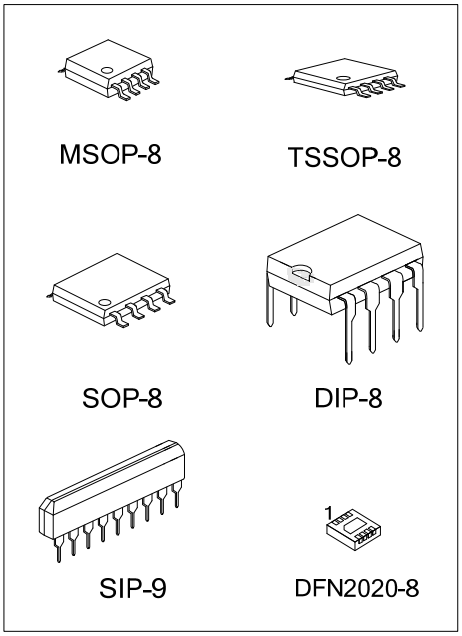
DUAL OPERATIONAL AMPLIFIER



■ DESCRIPTION

The UTC **LM2904** consists of two independent high gain, internally frequency compensated operational amplifier. It can be operated from a single power supply and also split power supplies.

■ FEATURES

*Internally frequency compensated for unity gain.
*Wide power supply range 3V - 32V.
*Input common-mode voltage range include ground.
*Large DC voltage gain.

■ ORDERING INFORMATION

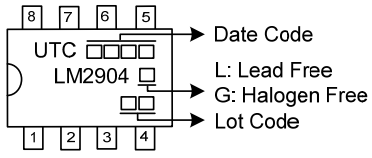
Ordering Number		Package	Packing
Lead Free	Halogen-Free		
LM2904L-D08-T	LM2904G-D08-T	DIP-8	Tube
LM2904L-L09-T	LM2904G-G09-T	SIP-9	Tube
LM2904L-P08-R	LM2904G-P08-R	TSSOP-8	Tape Reel
LM2904L-S08-R	LM2904G-S08-R	SOP-8	Tape Reel
LM2904L-SM1-R	LM2904G-SM1-R	MSOP-8	Tape Reel
LM2904L-K08-2020-R	LM2904G-K08-2020-R	DFN2020-8	Tape Reel

LM2904G-D08-T
(1) Packing Type
(2) Package Type
(3) Green Package

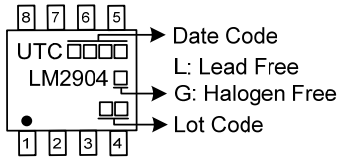
(1) T: Tube, R: Tape Reel
(2) D08: DIP-8, G09: SIP-9, S08: SOP-8, P08: TSSOP-8, SM1: MSOP-8, K08-2020: DFN2020-8
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

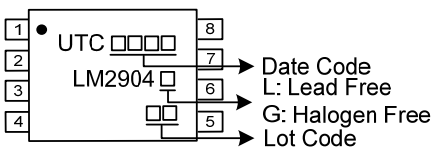
DIP-8



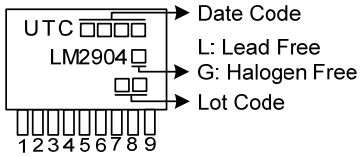
SOP-8/MSOP-8



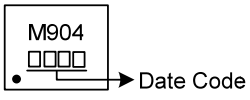
TSSOP-8



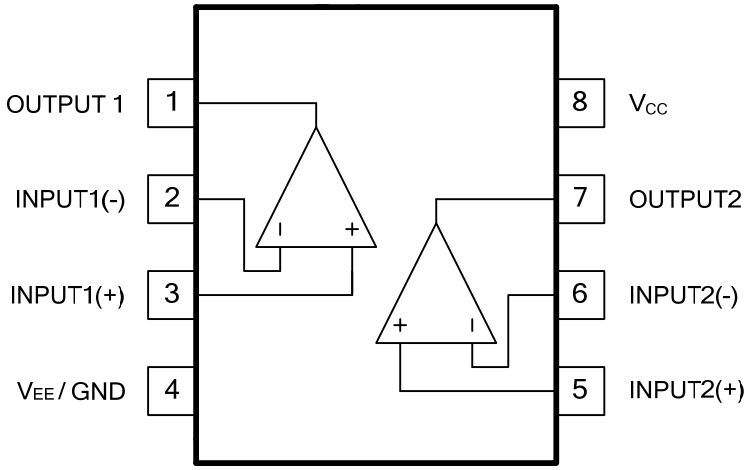
SIP-9



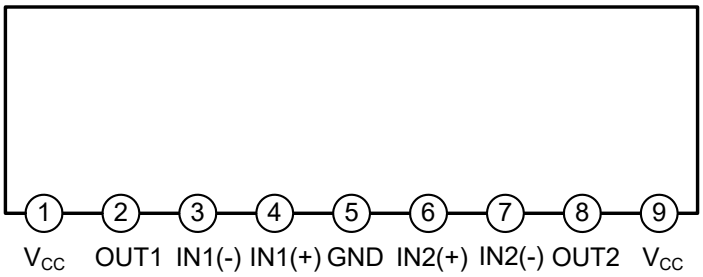
DFN2020-8



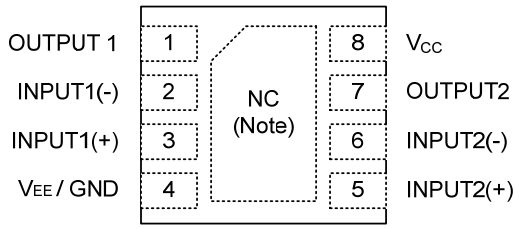
■ PIN DESCRIPTION



SOP-8/DIP-8/MSOP-8/TSSOP-8



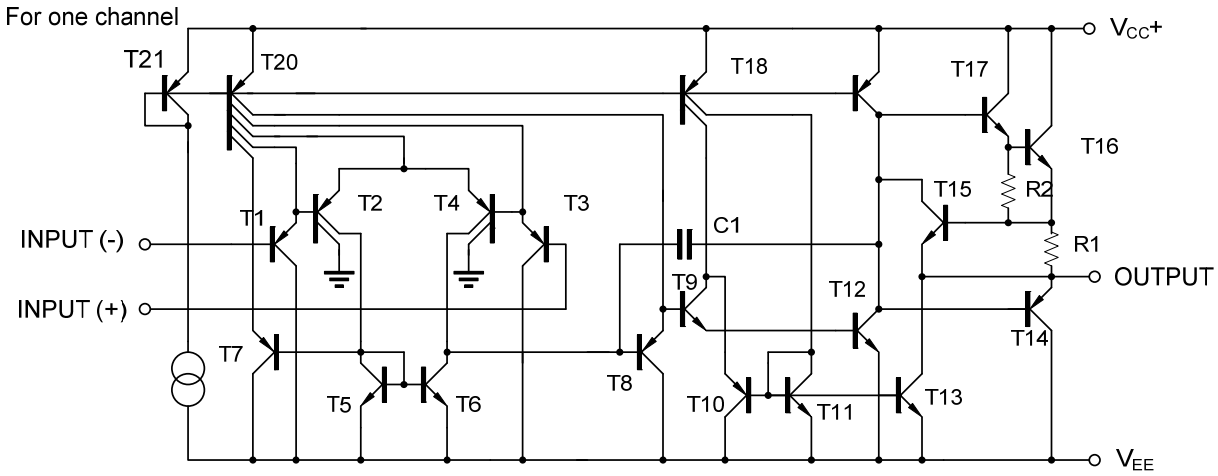
SIP-9



(Top View)
DFN2020-8

Note: No connect.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage		V_{CC}	±16 or 32	V
Differential Input Voltage		$V_{I(DIFF)}$	±32	V
Input Voltage		V_I	-0.3 ~ +32	V
Output Short to Ground			Continuous	
Power Dissipation	SIP-9	P_D	750	mW
	DIP-8		625	mW
	SOP-8		440	mW
	TSSOP-8		360	mW
	MSOP-8		300	mW
	DFN2020-8		830	mW
Junction Temperature		T_J	+150	°C
Operating Temperature (Note 2)		T_{OPR}	-40 ~ +125	°C
Storage Temperature		T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. It is guarantee by design, not 100% be tested.

■ ELECTRICAL CHARACTERISTICS (V_{CC}=5.0V, V_{EE}=GND, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$V_{I(OFF)}$	V_{CM}=0V toV_{CC}-1.5V $V_{O(P)}$=1.4V, R_S=0Ω		2.0	5.0	mV
Input Common Mode Voltage	$V_{I(CM)}$	V_{CC}=3V~30V	0		V_{CC}-1.5	V
Differential Input Voltage	$V_{I(DIFF)}$				V_{CC}	V
Input Offset Current	$I_{I(OFF)}$			5	50	nA
Input Bias Current	$I_{I(BIAS)}$			45	250	nA
Output Voltage Swing	V_{OH}	V_{CC}=5V, R_L=2KΩ	V_{CC}-1.6			V
		V_{CC}=30V, R_L=2KΩ	26			V
		V_{CC}=30V, R_L=10KΩ	27	28		V
	V_{OL}	V_{CC}=5V, R_L≧10KΩ		5	20	mV
Large Signal Voltage Gain	G_V	V_{CC}=15V, R_L≧2KΩ $V_{O(P)}$=1V ~ 11V	25	100		V/mV
Power Supply Current	I_{CC}	R_L=∝, V_{CC}=30V		1.2	2.0	mA
		R_L=∝, V_{CC}=5V Full Temperature Range		0.5	1.2	mA
Short Circuit Current to Ground	I_{SC}			40	70	mA
Output Current	I_{SOURCE}	V_I(+)=1V, V_I(-)=0V V_{CC}=15V, $V_{O(P)}$=2V	10	20		mA
	I_{SINK}	V_I(+)=0V, V_I(-)=1V V_{CC}=15V, $V_{O(P)}$=2V	10	20		mA
		V_I(+)=0V, V_I(-)=1V V_{CC}=15V, $V_{O(P)}$=200mV	12	100		μA
Common Mode Rejection Ratio	CMRR		65	100		dB
Power Supply Rejection Ratio	PSRR		65	100		dB
Channel Separation	CS	f=1KHZ ~ 20KHZ		120		dB
Gain Bandwidth Product	GBW			1.1		MHz
Slew Rate	SR			0.6		V/μs

■ TYPICAL CHARACTERISTICS

Fig.1 Input Voltage Range

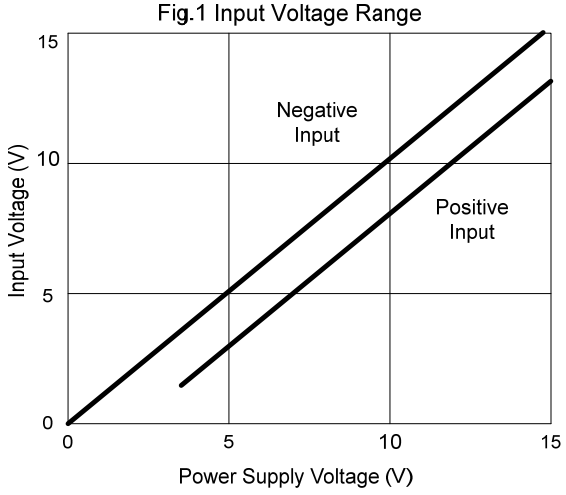


Fig.2 Input Current vs Temperature

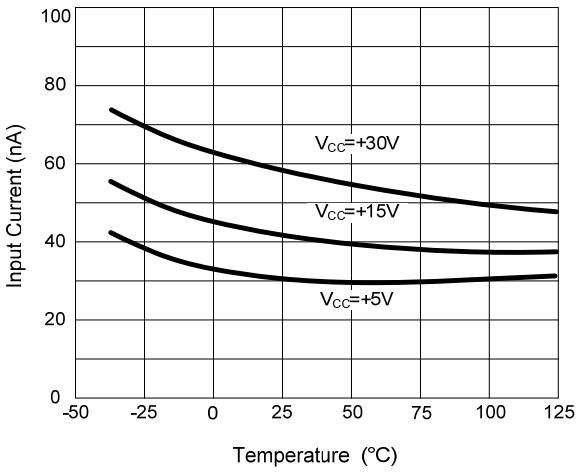


Fig.3 Supply Current vs Supply Voltage

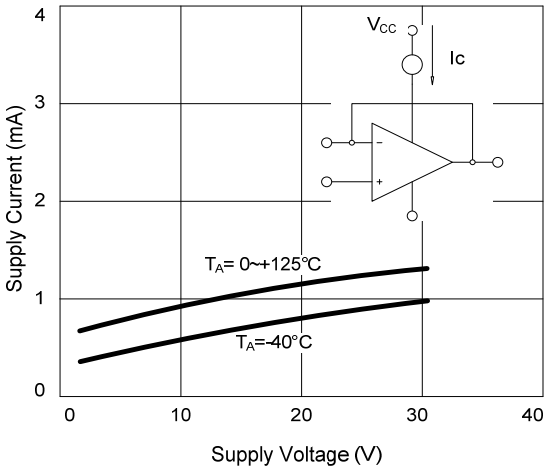


Fig. 4 Voltage Gain vs Supply Voltage

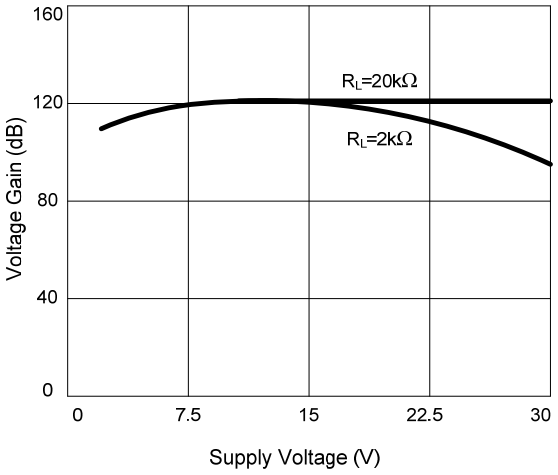


Fig. 5 Open Loop Gain vs Frequency

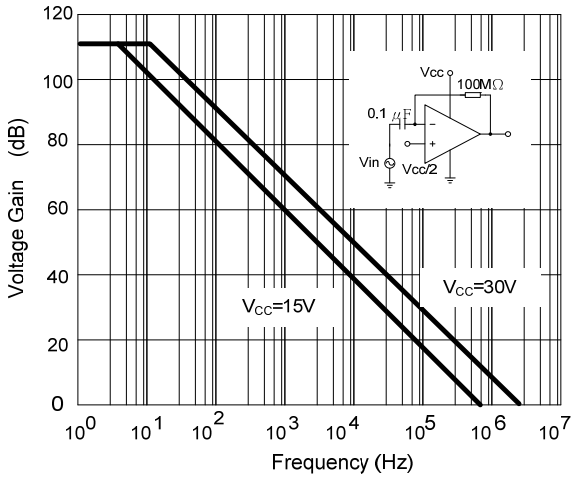
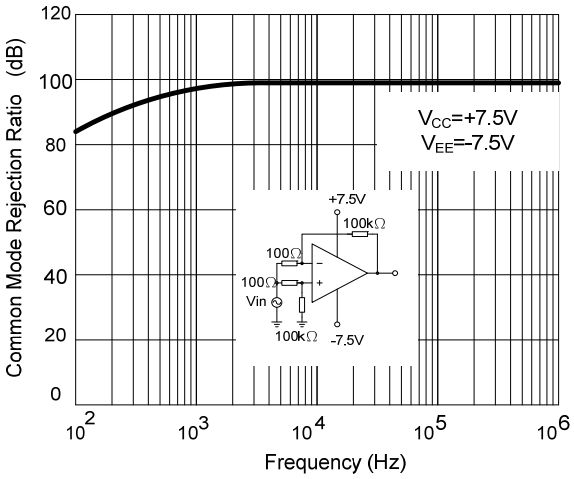


Fig. 6 Common Mode Rejection Ratio vs Frequency



■ TYPICAL CHARACTERISTICS (Cont.)

Fig. 7 Voltage Follower Pulse Response

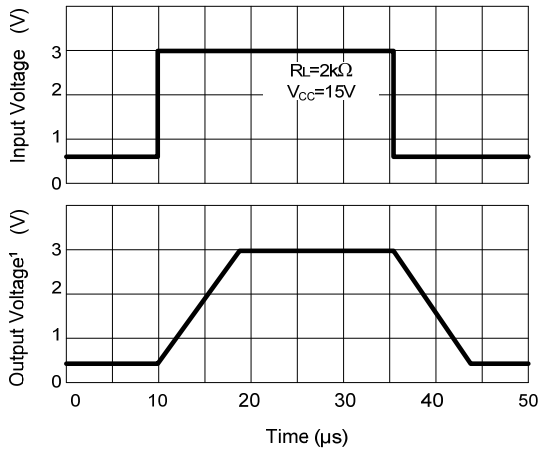


Fig. 8 Voltage Follower Response (Small Signal)

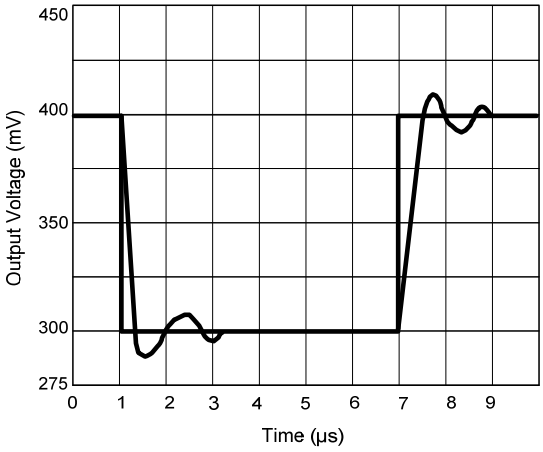


Fig. 9 Gain vs. Large Signal Frequency

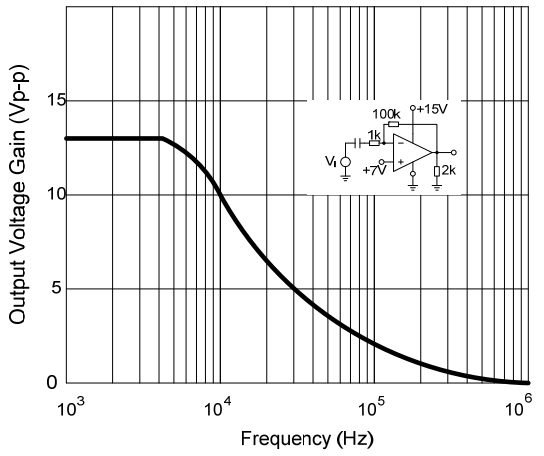


Fig. 10 Output Source Current vs Output Voltage

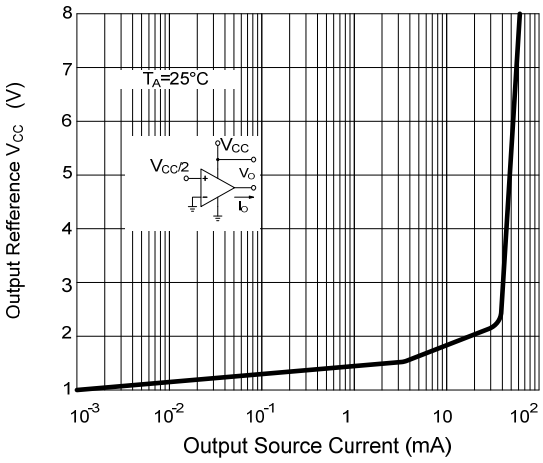


Fig. 11 Output Sink Current vs Output Voltage

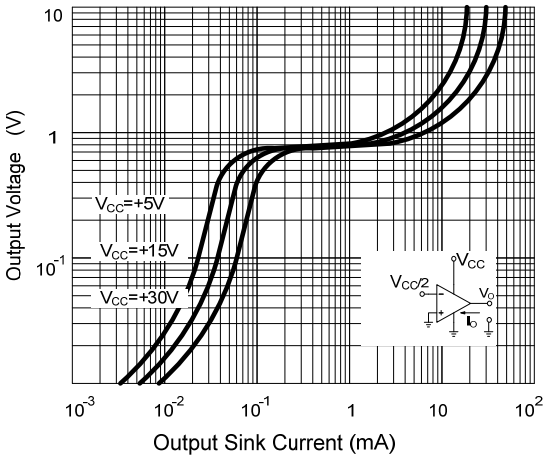


Fig.12 Current Limiting vs Temperature