

Low-Power rail-to-rail Operational Amplifier

Features

- Bandwidth: 1.0MHz
- Input Voltage Range: $-0.1V \sim +5.6V (V_S = 5.5V)$
- Low input bias current: 10pA
- Supply Voltage Range: $+2.1V \sim +5.5V$
- Operating temperature range: $-40^{\circ}C \sim +85^{\circ}C$
- Rail to Rail Input and Output
- Input Offset Voltage: $\pm 0.8mV (Typ.)$

Applications

- Active Filters, ASIC Input or Output Amplifier
- Sensor interface
- The mobile communication
- Smoke/Gas/Environment Sensors

General Description

The LMV324 series of R+O are CMOS quad RRIO op-amps with low offset, low power and stable high frequency response. The operating voltage range of these amplifiers is 2.1V to 5.5V, the input common-mode voltage range extends 100mV beyond V_{-} and V_{+} , and the outputs swing rail-to-rail.

They incorporate R+O proprietary design techniques to achieve very good AC performance with 1.0MHz bandwidth, $0.52V/\mu s$ slew rate and low distortion while drawing only $140\mu A (Typ.)$ of quiescent current per amplifier.

The LMV324 is available in SOP-14 and TSSOP-14 package.

Reference News

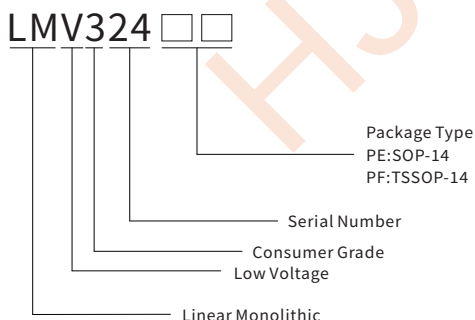
SOP-14 Marking:

LMV324PE: R+O+LMV324+Date code

TSSOP-14 Marking:

LMV324PF: R+O+LMV324+Date code

Part Numbering



Ordering Information

Order Number	Package	Package Code	Unit Weight(g)	Reel(pcs)	Box(pcs)	Carton(pcs)	Delivery Mode	MSL
LMV324PE	SOP-14	R3	0.134	4000	8000	80000	13"	3
LMV324PF	TSSOP-14	R3	0.055	3000	6000	48000	13"	3

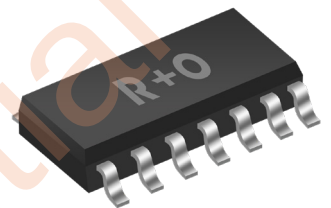
Supply Voltage

$+2.1V \sim +5.5V$

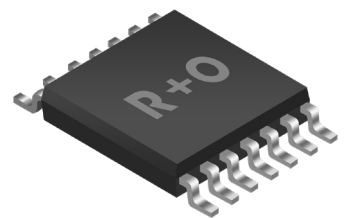
Offset Voltage

$\pm 0.8mV$

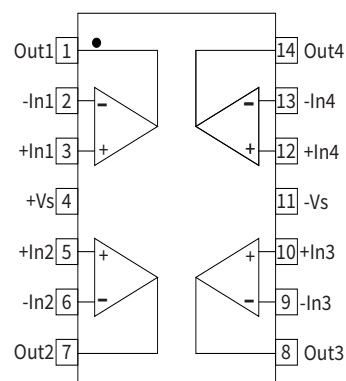
SOP-14



TSSOP-14



Pin Configuration



● **Absolute Maximum Ratings** ($T_a=25^{\circ}\text{C}$ Unless otherwise specified)

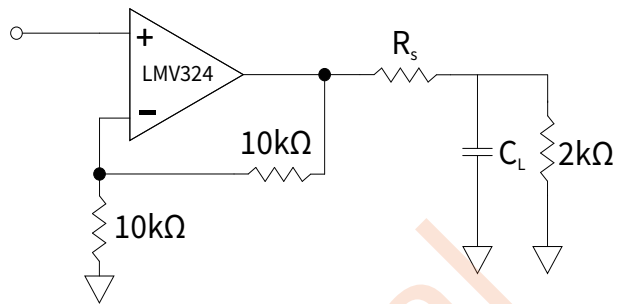
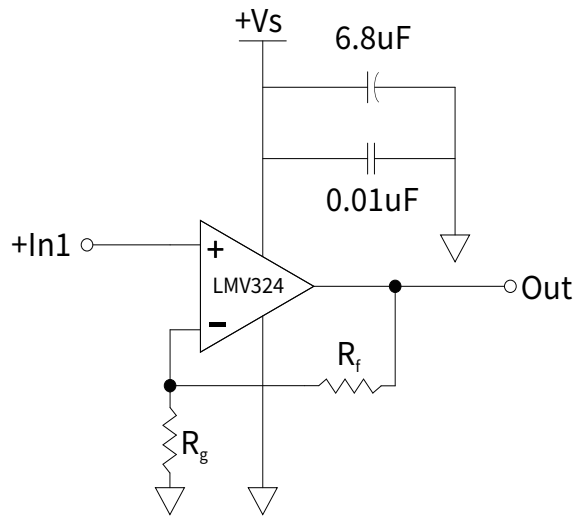
Parameter	Symbol	Value	Unit
Supply Voltage, $(+V_s)-(-V_s)$	V_{CC}	7.5	V
Maximum Junction Temperature	T_J	160	$^{\circ}\text{C}$
Input Voltage	V_{ICR}	$(-V_s)-0.5$ to $(+V_s)+0.5$	V
Operating Temperature Range	T_{OPR}	-45 to 85	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	-65 to 150	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec)	T_L	260	$^{\circ}\text{C}$

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime. Electrostatic discharge can also cause damage to chips, so it is suggested to take some preventive measures for integrated circuits. Failure to follow proper handling and installation can also cause damage. Precision LMV324 and other devices are more vulnerable to damage than ordinary devices in the case of tiny electrostatic, and small parameter changes may make the whole circuit performance substandard.

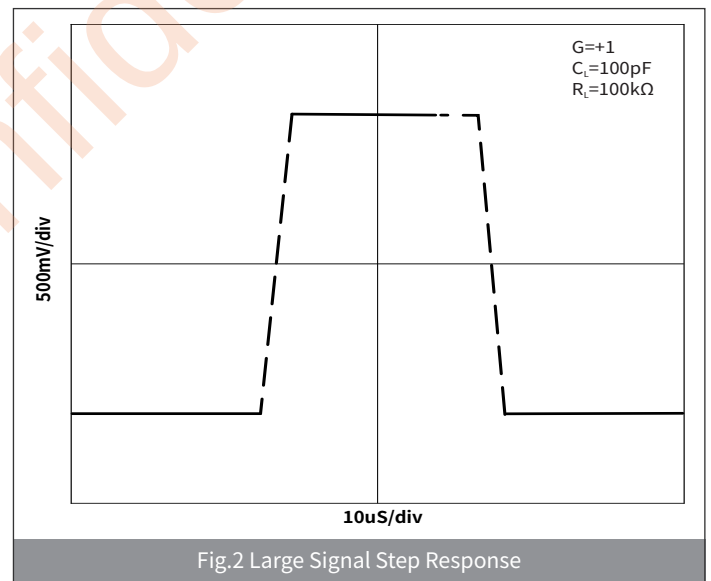
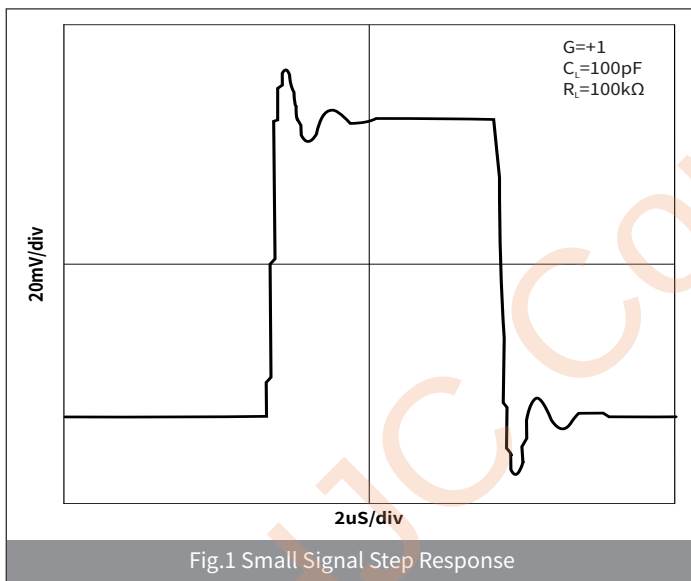
● **Electrical Characteristics** ($V_s=5\text{V}$, $R_L=100\text{k}\Omega$ connected to $V_s/2$, $V_{OUT}=V_s/2$, $T_a=25^{\circ}\text{C}$, unless otherwise specified.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AC Specifications						
Gain-Bandwidth Product	GBW	$C_L=100\text{pF}$	--	1.0	--	MHz
Phase Margin	PM	$R_{LOAD}=100\text{k}\Omega$, $C_{LOAD}=100\text{pF}$	--	52	--	Deg
Gain Margin	GM	$R_{LOAD}=100\text{k}\Omega$, $C_{LOAD}=100\text{pF}$	--	17	--	dB
Slew Rate	SR	$A_V=1$, $V_{OUT}=V_{P-P}$, $C_{LOAD}=100\text{pF}$, $R_{LOAD}=100\text{k}\Omega$	--	0.52	--	$\text{V}/\mu\text{s}$
Input Voltage Noise Density	e_N	$f > 50\text{kHz}$	--	36	--	$\text{nV}/\sqrt{\text{Hz}}$
DC Characteristics						
Input Offset Voltage	V_{OS}	--	--	± 0.8	± 5	mV
Input Bias Current	I_B	--	--	10	--	pA
Input Offset Current	I_{OS}	--	--	10	--	pA
Power Supply Rejection Ratio	PSRR	$V_s=2.5\text{V}$ to 5.5V	60	82	--	dB
Quiescent Current	I_Q	--	--	140	300	μA
Input Characteristics						
Common-mode Input Voltage Range	V_{CMR}	$V_s=5.5\text{V}$	-0.1	--	5.6	V
Common Mode Rejection Ratio	CMRR	$V_s=5.5\text{V}$, $V_O=0.1$ to 4.9V	56	68	--	dB
Output Characteristics						
Output Current	I_O	$R_L=100\text{k}\Omega$	20	23	--	mA
Output Voltage Swing from Rail	V_{OH}	$R_L=100\text{k}\Omega$	--	0.008	--	V

Typical Applications



Typical Performance Characteristics ($V_s=5V, R_L=100k\Omega$ connected to $V_s/2, T_a=25^\circ C$.)



● **Typical Performance Characteristics**($V_s=5V, R_L=100k\Omega$ connected to $V_s/2, T_a=25^\circ C$.)

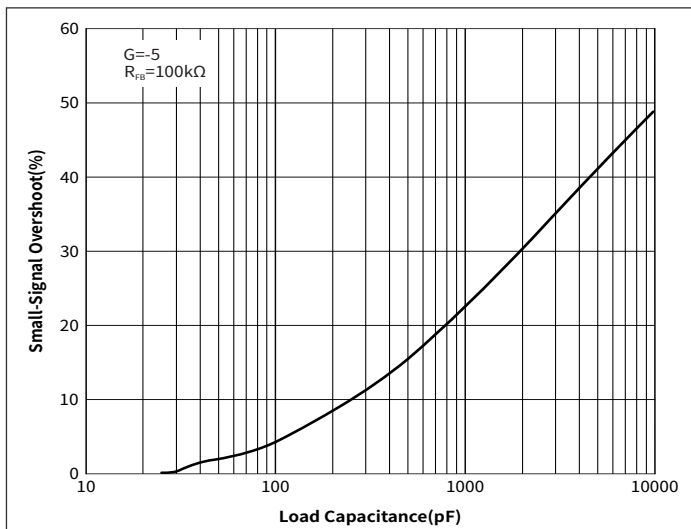


Fig.3 Small-Signal Overshoot vs. Load Capacitance

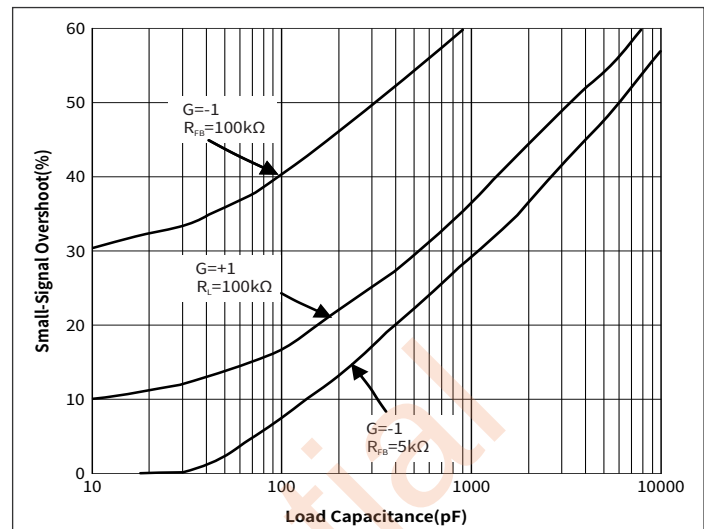


Fig.4 Small-Signal Overshoot vs. Load Capacitance

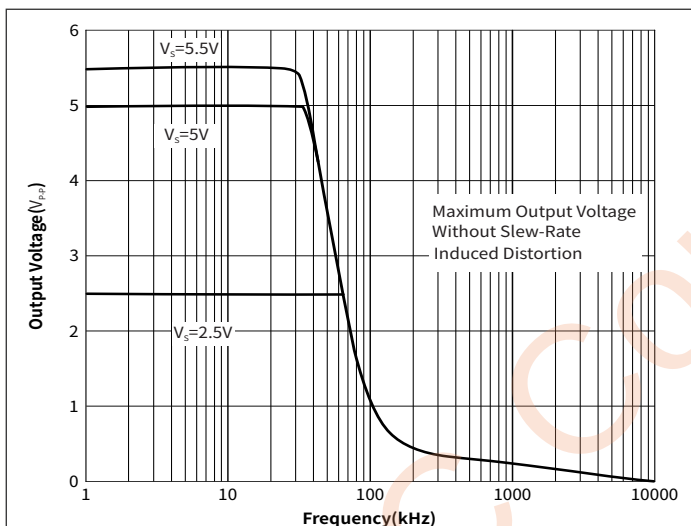


Fig.5 Maximum Output Voltage vs. Frequency

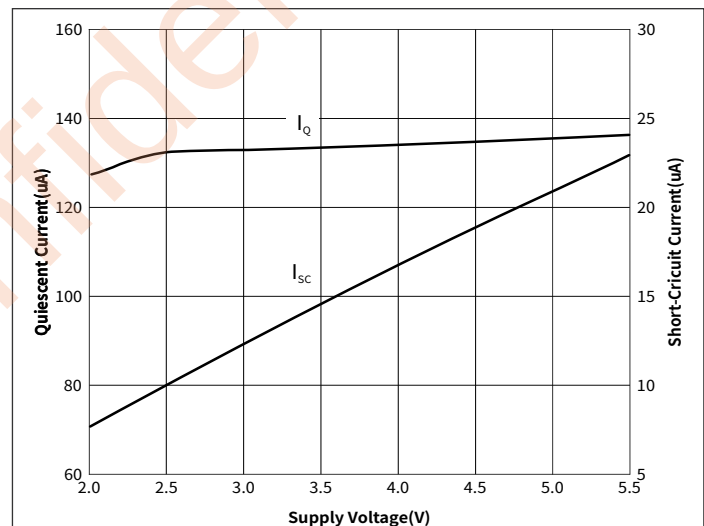


Fig.6 Quiescent and Short-Circuit Current vs. Supply Voltage

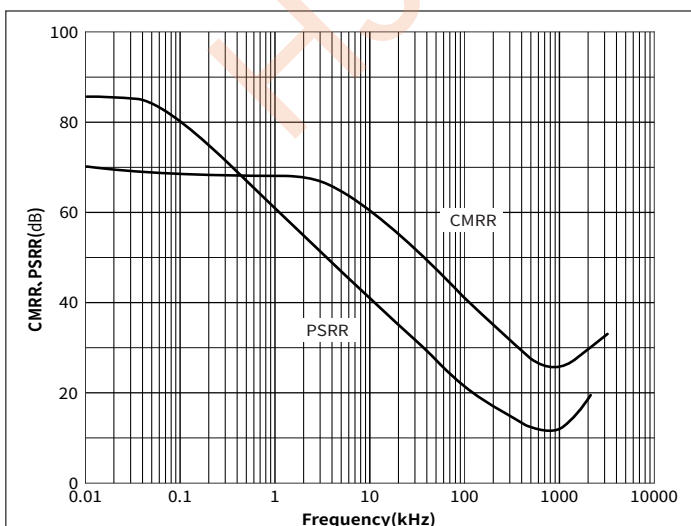


Fig.7 CMRR, PSRR vs. Frequency

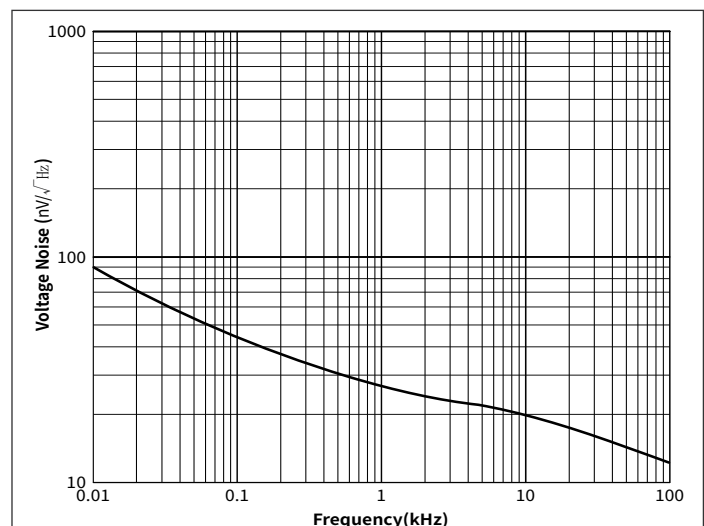


Fig.8 Input Voltage Noise Spectral Density vs. Frequency

● Typical Performance Characteristics ($V_s=5V, R_L=100k\Omega$ connected to $V_s/2, T_a=25^\circ C$.)

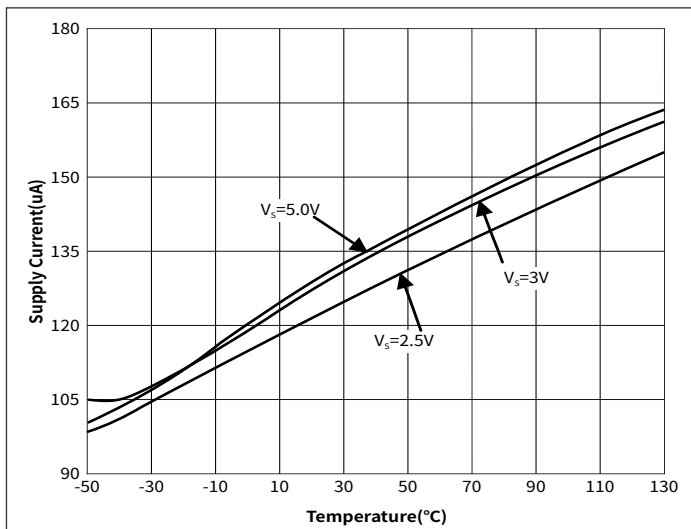


Fig.9 Supply Current vs. Temperature

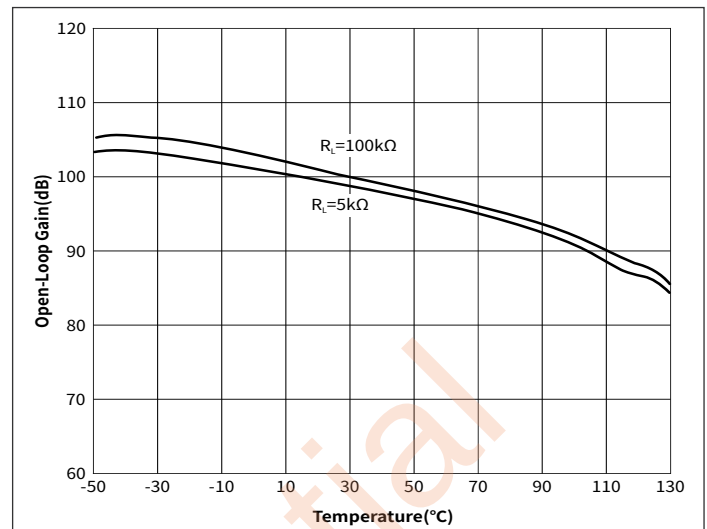


Fig.10 Open-Loop Gain vs. Temperature

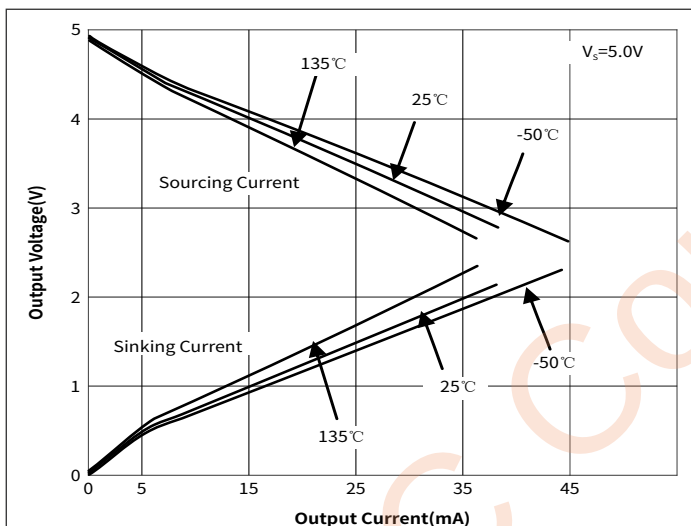


Fig.11 Output Voltage vs. Output Current

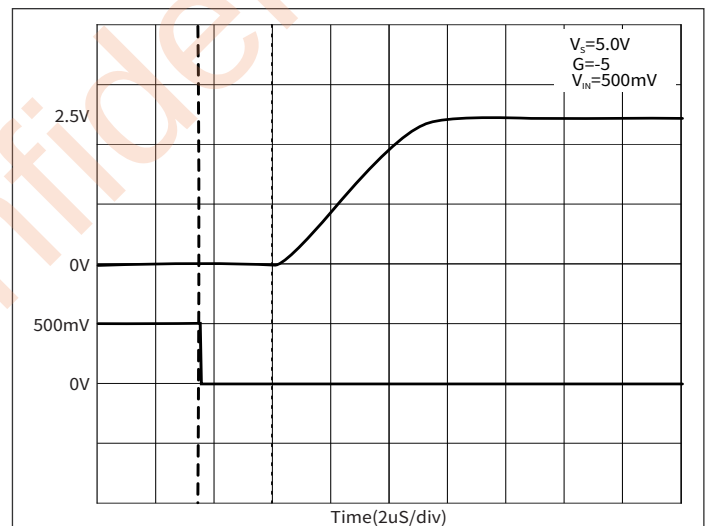


Fig.12 Overload Recovery Time

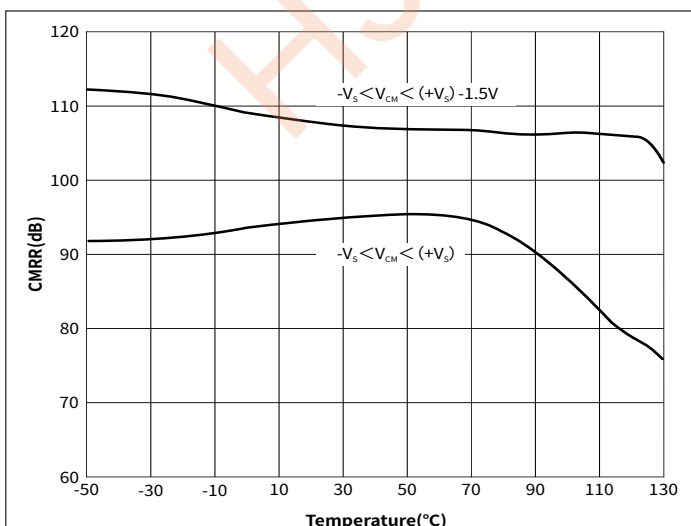


Fig.13 CMRR vs. Frequency

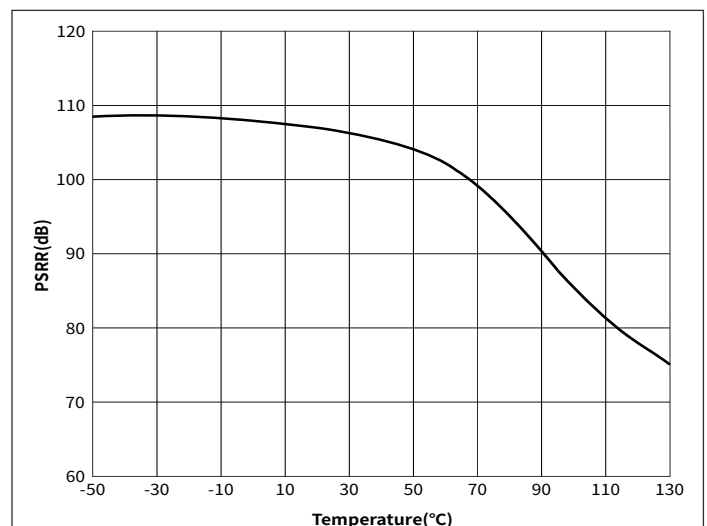
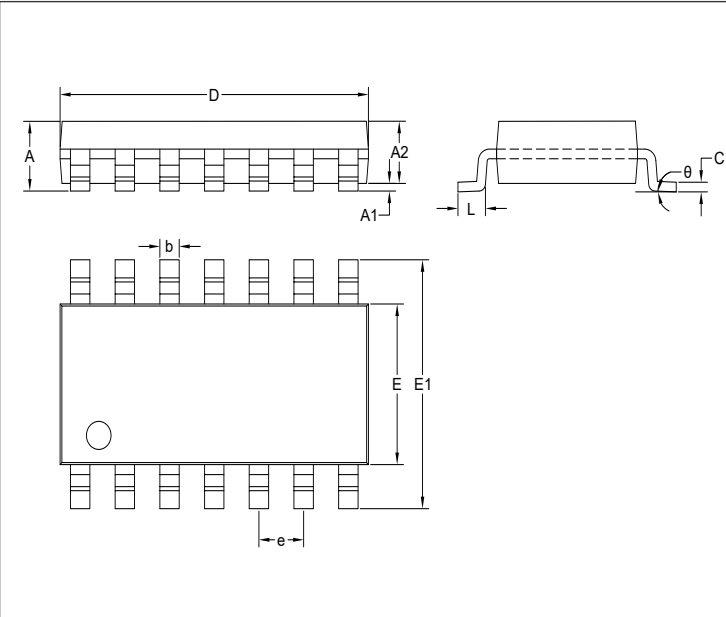


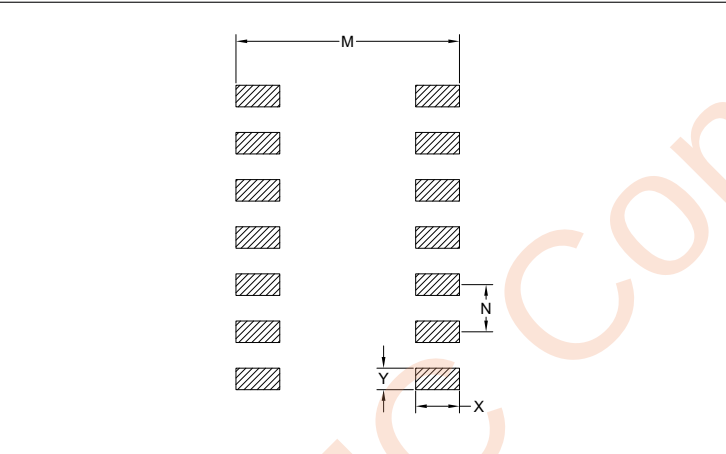
Fig.14 PSRR vs. Frequency

● Package Outline Dimensions (SOP-14)



Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.35	1.55	0.053	0.061
b	0.33	0.51	0.013	0.020
c	0.17	0.25	0.007	0.010
D	8.36	8.76	0.329	0.345
E	3.80	4.00	0.150	0.157
E1	5.80	6.20	0.228	0.244
e	1.27BSC		0.050BSC	
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

● Suggested Pad Layout



Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
X	-	1.18	-	0.046
Y	-	0.58	-	0.023
N	-	1.27	-	0.050
M	-	6.5	-	0.256

LMV324 Series

Operational Amplifier

Package Outline Dimensions (TSSOP-14)

Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	-	1.20	-	0.047
A1	0.05	0.15	0.002	0.006
A2	0.90	1.05	0.035	0.041
b	0.20	0.28	0.008	0.011
c	0.13	0.17	0.005	0.007
D	4.90	5.10	0.193	0.201
E	4.30	4.50	0.169	0.177
E1	6.20	6.60	0.244	0.260
e	0.65BSC		0.026BSC	
L	0.45	0.75	0.018	0.030
θ	0°	8°	0°	8°

Suggested Pad Layout

Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
X	-	1.26	-	0.050
Y	-	0.36	-	0.014
N	-	0.65	-	0.026
M	-	7.06	-	0.278