

Quad Operational Amplifier

Features

- Large DC voltage gain:100dB
- Bandwidth(unity gain): 1.0MHz
- Input voltage range: -0.3V to 32V
- Low input bias current: 20pA(Typ.)
- Supply voltage range: 3V ~ 32V
- Operating temperature range: 0°C ~ 70°C
- Input offset voltage: 1.0mV(Typ.)
- Large output voltage swing: 0V to $V_{CC}-1.5V$

Applications

- Photodiode amplification
- Sensors
- Active filters
- Driving A/D converters

General Description

The LM324 series of R+O consist of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide voltage range.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 amplifier,DC gain blocks and all the conventional operational amplifier circuits which now can be easily implemented in single power supply systems.

LM 324 series is available in SOP-14 package and TSSOP-14 package.

Reference News

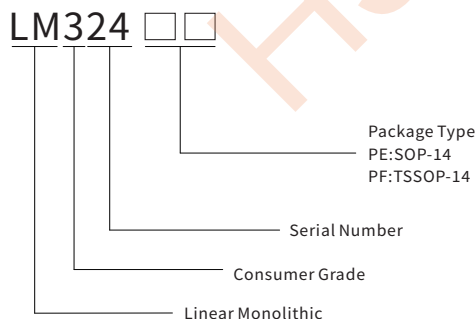
SOP-14 Marking:

LM324PE: R+O+LM324+Date code

TSSOP-14 Marking:

LM324PF: R+O+LM324+Date code

Part Numbering



Ordering Information

Order Number	Package	Package Code	Unit Weight(g)	Reel(pcs)	Box(pcs)	Carton(pcs)	Delivery Mode	MSL
LM324PE	SOP-14	R3	0.134	4000	8000	80000	13"	3
LM324PF	TSSOP-14	R3	0.055	3000	6000	48000	13"	3

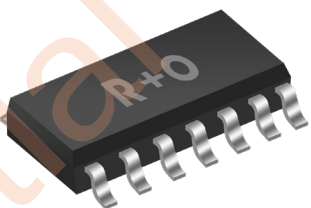
DC Voltage Gain

100dB(Max.)

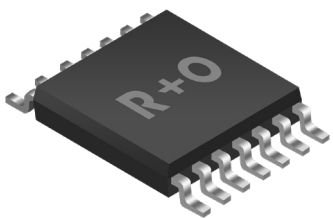
Offset Voltage

1.0mV(Typ.)

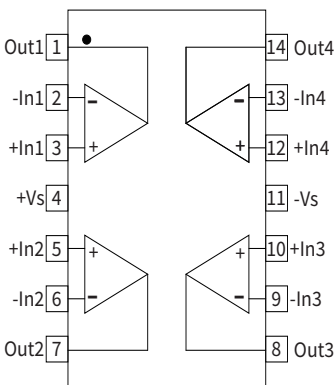
SOP-14



TSSOP-14



Pin Configuration



● Pin Description

Name	Pin	Input/Output	Description
	SOP-14/TSSOP-14		
-IN1	2	I	Inverting input, channel 1
+IN1	3	I	Noninverting input, channel 1
-IN2	6	I	Inverting input, channel 2
+IN2	5	I	Noninverting input, channel 2
-IN3	9	I	Inverting input, channel 3
+IN3	10	I	Noninverting input, channel 3
-IN4	13	I	Inverting input, channel 4
+IN4	12	I	Noninverting input, channel 4
OUT1	1	O	Output, channel 1
OUT2	7	O	Output, channel 2
OUT3	8	O	Output, channel 3
OUT4	14	O	Output, channel 4
V-	11	--	Negative (lowest) power supply
V+	4	--	Positive (highest) power supply

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

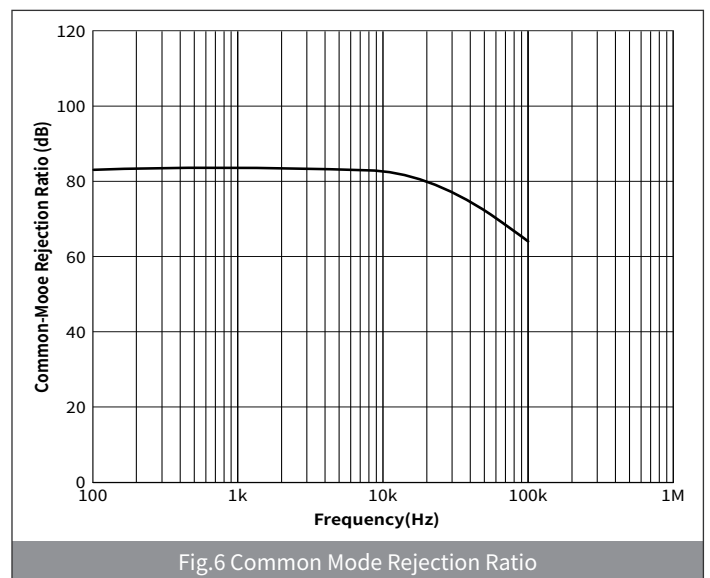
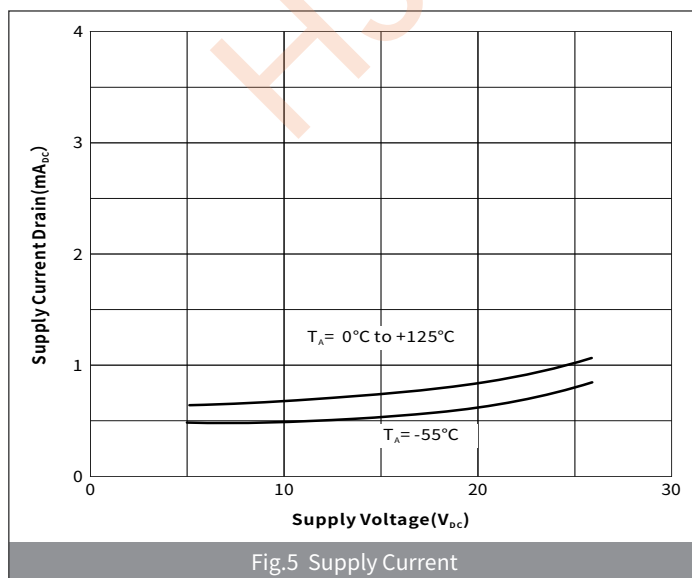
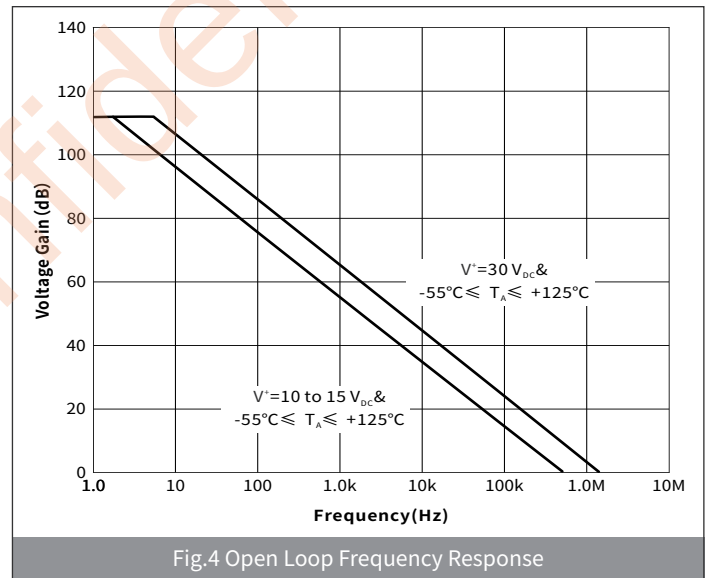
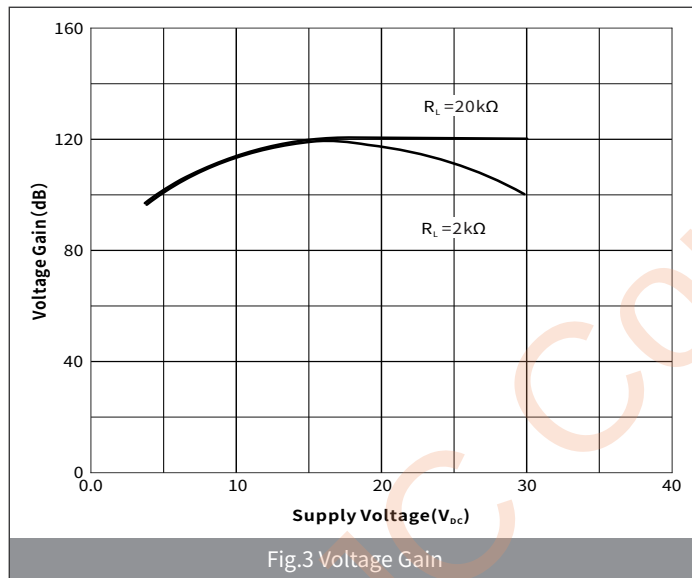
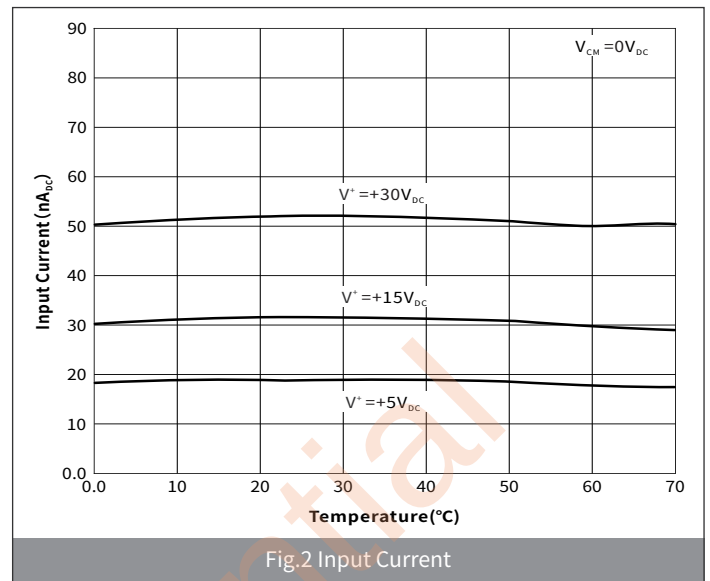
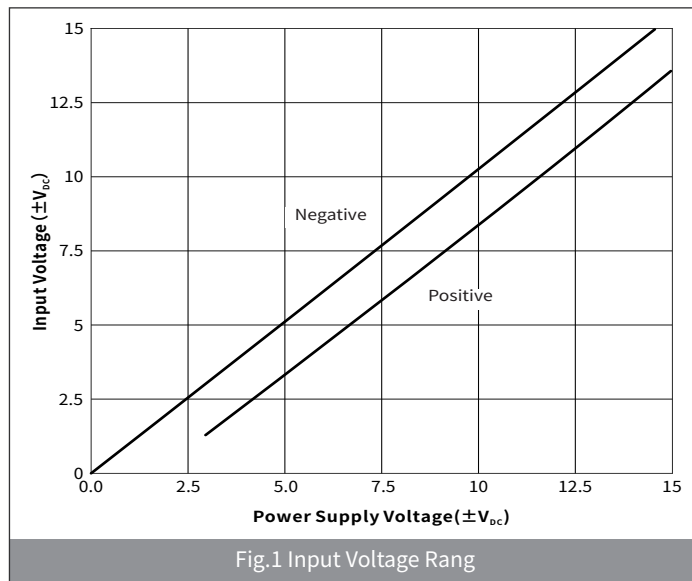
Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	± 16 or 32	V
Differential Input Voltage	V_{ID}	32	V
Input Voltage	V_{IN}	-0.3 to 32	V
Output Short Circuit to GND	--	Continuous	--
Operating Temperature Range	T_{OPR}	0 to 70°C	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	-65 to 150°C	$^{\circ}\text{C}$
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.

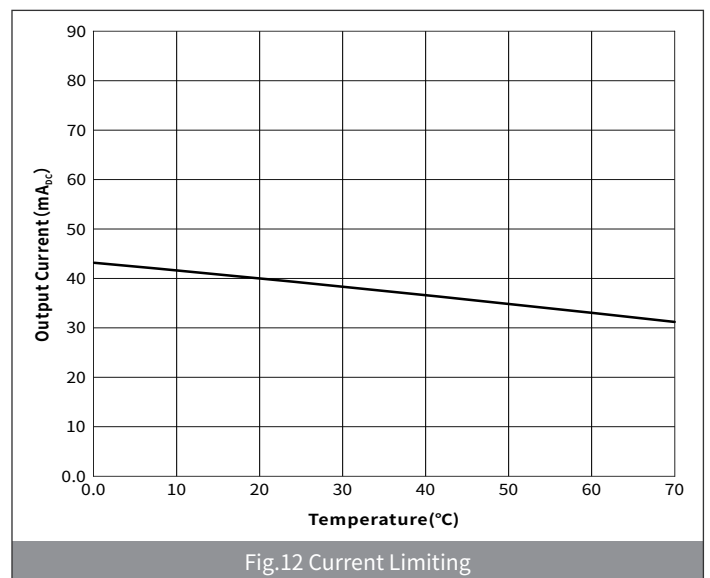
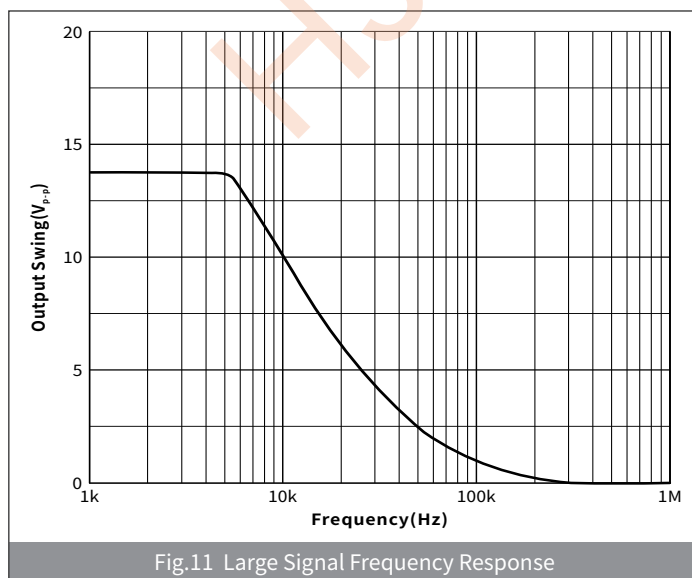
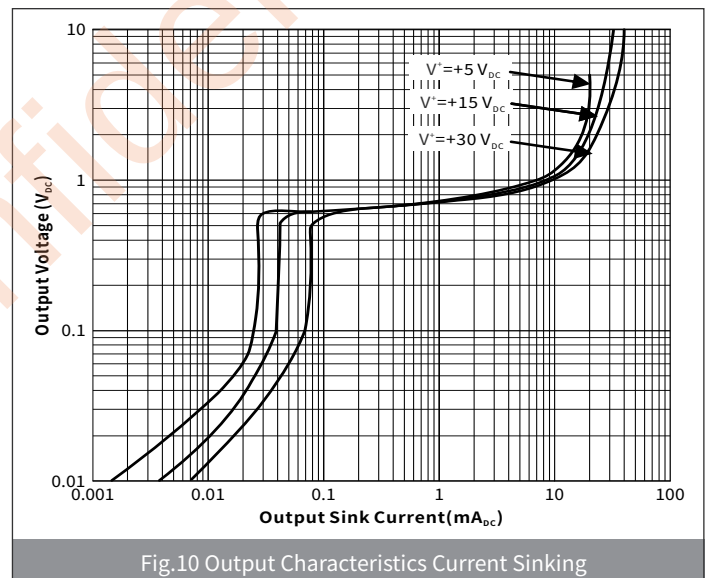
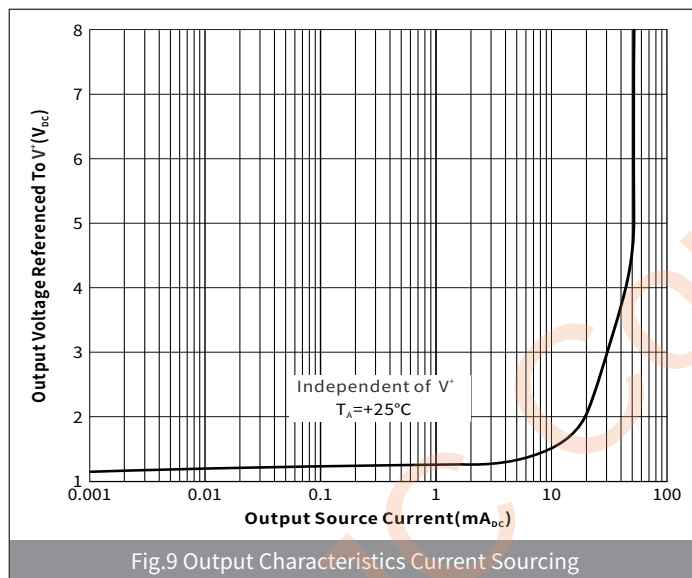
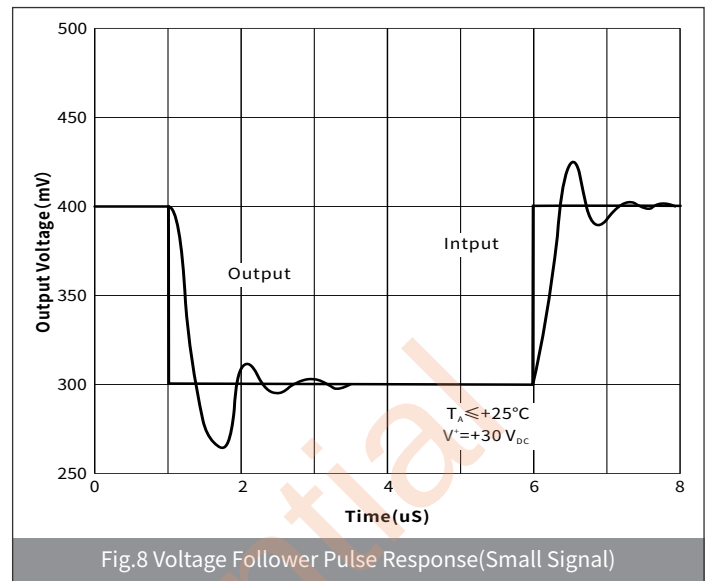
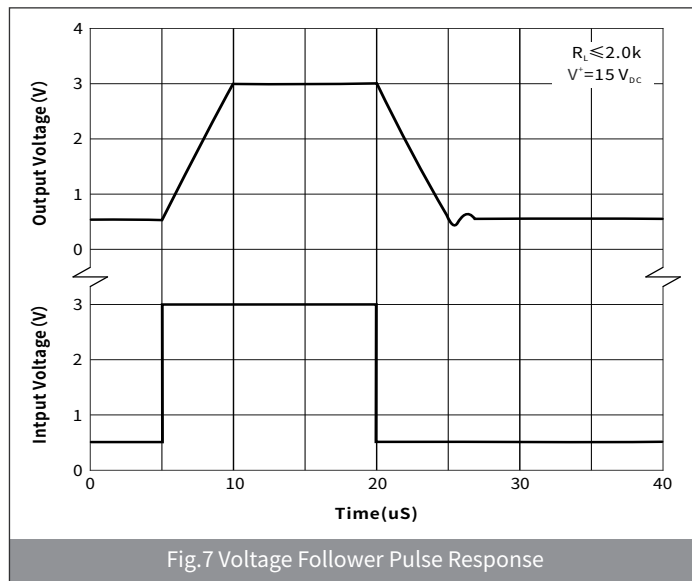
● **Electrical Characteristics** (Unless otherwise specified: $V_{CC}=5V, T_A=25^{\circ}C$.)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AC Specifications						
Gain-Bandwidth Product	GBW	--	--	1.0	--	MHz
DC Characteristics						
Input Offset Voltage	V_{OS}	$T_A=0^{\circ}C$	--	--	5	mV
		$T_A=25^{\circ}C$	--	1	3	
		$T_A=70^{\circ}C$	--	--	5	
Input Bias Current	I_B	$I_{IN(+)} \text{ or } I_{IN(-)}, V_{CM}=0V, T_A=25^{\circ}C$	--	20	250	nA
		$I_{IN(+)} \text{ or } I_{IN(-)}, V_{CM}=0V, T_A=0 \text{ to } 70^{\circ}C$	--	--	500	
Input Offset Current	I_{OS}	$I_{IN(+)} \text{ or } I_{IN(-)}, V_{CM}=0V, T_A=25^{\circ}C$	--	5	50	nA
		$I_{IN(+)} \text{ or } I_{IN(-)}, V_{CM}=0V, T_A=0 \text{ to } 70^{\circ}C$	--	--	150	
Power Supply Rejection Ratio	PSRR	$V_{CC}=5.0V \text{ to } 30V$	65	100	--	dB
Input Characteristics						
Common-mode Input Voltage Range	V_{CMR}	$V_{CC}=30V, T_A=25^{\circ}C$	0	--	$V_{CC}-1.5$	V
		$V_{CC}=30V, T_A=0 \text{ to } 70^{\circ}C$	--	--	$V_{CC}-1.8$	
Common Mode Rejection Ratio	CMRR	DC, $V_{CM}=0V \text{ to } V_{CC}-1.5V$	65	85	--	dB
Output Characteristics						
Supply Current	I_{CC}	$V_{CC}=5V, R_L=\infty$	--	0.7	1.2	mA
		$V_{CC}=30V, R_L=\infty$	--	1.5	3.0	mA
Large signal voltage gain	A_{VOL}	$V_{CC}=15V, R_L \geq 2k\Omega, T_A=25^{\circ}C$	25	100	--	dB
		$V_{CC}=15V, R_L \geq 2k\Omega, T_A=0 \text{ to } 70^{\circ}C$	15	--	--	
Output Source Current	I_{O+}	$V_{IN}^{+}=1V, V_{IN}^{-}=0V, V_{CC}=15V, V_O=2V$	20	40	--	mA
Output Sink Current	I_{O-}	$V_{IN}^{+}=0V, V_{IN}^{-}=1V, V_{CC}=15V, V_O=2V$	8	20	--	mA
		$V_{IN}^{+}=0V, V_{IN}^{-}=1V, V_{CC}=15V, V_O=200mV$	12	50	--	μA
Output Short Circuit to Ground	I_{SC}	$V_{CC}=15V$	--	40	60	mA
Output voltage swing	V_{OH}	$V_{CC}=30V, R_L=2k\Omega$	26	--	--	V
		$V_{CC}=30V, R_L=10k\Omega$	27	28	--	V
	V_{OL}	$V_{CC}=5V, R_L=10k\Omega$	--	5	20	mV

● **Typical Performance Characteristics**(Unless otherwise specified: $T_A = 25^\circ\text{C}$.)



● **Typical Performance Characteristics**(Unless otherwise specified: $T_A=25^{\circ}\text{C}$.)



● 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

LM324 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