LTA6041, LTA6042, LTA6044

140MHz, 90mA Rail-to-Rail Output, Low Power CMOS Amplifiers

General Description

The LTA604x family true single-supply voltage feedback operational amplifiers feature high speed performance with 140 MHz of small signal bandwidth and 107 V/µs slew rate. The products are specified for +3 V, +5 V, and ±5 V supplies, input common mode voltage range extends to 0.2 V below V_{S-} and 1 V from V_{S+}, and output voltage range extends to within 35 mV of either supply rail, allowing wide dynamic range especially desirable in low voltage applications. The LTA604x also offer excellent signal quality of low distortion (−53 dBc with a 2 V_{PP}, 5 MHz output signal) and fast settling time (66ns to 0.1%), which make them ideal as buffers to single-supply ADCs.

Operating on supplies from +2.5 V to +12.6 V and dual supplies up to ±6.3 V, the LTA604x are ideal for a wide range of applications, from battery-operated systems with large bandwidth requirements to high speed systems where component density requires lower power dissipation. The single version LTA6041 device is available in micro-size SOT23-5L and SOIC-8L packages. The dual LTA6042 device is offered in MSOP-8L and SOIC-8L packages. The quad LTA6044 device is offered in SOIC-14L and TSSOP-14L packages.

Features and Benefits

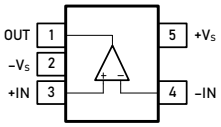
- High Speed and Fast Settling on ±5 V
  - 140 MHz, −3 dB bandwidth (G = +1)
  - 107 V/µs slew rate
  - 66 ns settling time to 0.1%
- Fully specified at +3 V, +5 V, and ±5 V Supplies
- Low Input Bias Current 50 pA
- Input Common Mode Voltage 0.2 V Beyond V_{S-}, 1 V from V_{S+}
- Output Voltage Swing 35 mV from Rails
- Output Short Circuit Current 150 mA
- Linear Output Current ±90 mA
- Operating Temperature Range −40°C to +125°C (except SOT23-5L)

Applications

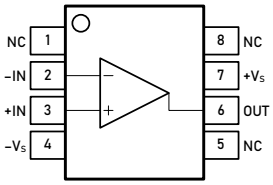
- High speed, battery-operated systems
- High component density systems
- Portable test instruments
- A/D buffers
- Active filters
- High speed, set-and-demand amplifiers

Pin Configuration (Top View)

LTA6041
SOT23-5L



LTA6041
SOIC-8L



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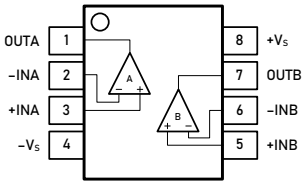
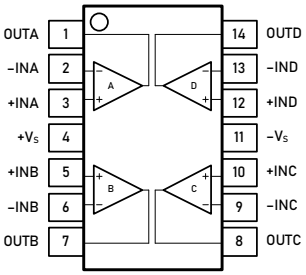
SOIC-8L / MSOP-8L



LTA6044
SOIC-14L / TSSOP-14L



Pin Description

Symbol	Description
–IN	Inverting input of the amplifier. The voltage range is from V_{S-} – 0.2V to V_{S+} – 1V.
+IN	Non-inverting input of the amplifier. This pin has the same voltage range as –IN.
$+V_S$	Positive power supply. The voltage is from 2.5V to 12.6V. Split supplies are possible as long as the voltage between V_{S+} and V_{S-} is from 2.5V to 12.6V.
$-V_S$	Negative power supply. It is normally tied to ground. It can also be tied to a voltage other than ground as long as the voltage between V_{S+} and V_{S-} is from 2.5V to 12.6V.
OUT	Amplifier output.
NC	No connection

Ordering Information (1)

Type Number	Package Name	Package Quantity	Eco Class (2)	Marking Code (3)
LTA6041XT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	W41
LTA6041XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	W6041
LTA6042XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	W6042
LTA6042XV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	W6042
LTA6044XS14/R5	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	W6044
LTA6044XT14/R6	TSSOP-14L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	W6044

(1) Please contact to your Linearin representative for the latest availability information and product content details.

(2) Eco Class - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & Halogen Free).

(3) There may be multiple device markings, a varied marking character of "x" , or additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

Limiting Value – In accordance with the Absolute Maximum Rating System (IEC 60134).

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	13.5 V
Signal Input Terminals: Voltage, Current	$-V_S$ – 0.5 V to $+V_S$ + 0.5 V, ±10 mA
Output Short-Circuit	Continuous
Storage Temperature Range, T_{stg}	–65 to +150 ℃
Junction Temperature, T_J	150 ℃
Lead Temperature Range (Soldering 10 sec)	260 ℃

ESD Rating

Parameter	Item	Value	Unit
Electrostatic Discharge Voltage	Human body model (HBM), per MIL-STD-883J / Method 3015.9 (1)	±4 000	V
	Charged device model (CDM), per ESDA/JEDEC JS-002-2014 (2)	±2 000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible if necessary precautions are taken.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible if necessary precautions are taken.

Electrical Characteristics

V_S = 3 V, T_A = +25 °C, V_{CM} = V_O = V_S /2, and R_L = 2 kΩ to V_S /2, unless otherwise noted.
Boldface limits apply over the specified temperature range, T_A = −40 °C to +125 °C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DYNAMIC PERFORMANCE						
BW_{-3dB}	−3 dB Small Signal Bandwidth	G = +1, V_O = 0.2V_{PP}		120		MHz
		G = +2, −1, V_O = 0.2V_{PP}		43		
$BW_{0.1dB}$	Bandwidth for 0.1 dB Flatness	G = +2, V_O = 0.2V_{PP}, R_L = 150Ω to V_S/2, R_F =402Ω		16		MHz
SR	Slew rate	G = −1, V_O = 2V step		98		V/µs
BW_{FP}	Full Power Response	G = +1, V_O = 1V_{PP}		30		MHz
t_S	Settling time to 0.1%	G = −1, V_O = 2V step		66		ns
NOISE/DISTORTION PERFORMANCE						
THD	Total harmonic distortion	f_C = 5MHz, V_O = 2V_{PP}, G = +2		−36		dBc
e_n	Input voltage noise density	f = 100kHz		27		nV/√Hz
I_n	Input current noise density	f = 10kHz		3		pA/√Hz
DG	Differential Gain Error (NTSC)	G = +2, R_L = 150Ω to V_S/2		0.17		%
		R_L = 1kΩ to V_S/2		0.03		
DP	Differential Phase Error (NTSC)	G = +2, R_L = 150Ω to V_S/2		0.05		deg.
		R_L = 1kΩ to V_S/2		0.03		
DC PERFORMANCE						
V_{OS}	Input offset voltage	LTA6041, LTA6042		±6	±15	mV
		LTA6044			±19	
V_{OS} TC	Offset voltage drift	T_A = −40 to +125 °C		±5		µV/°C
I_B	Input bias current			0.05		nA
		T_A = +125 °C		4		
I_{OS}	Input offset current			70		pA
A_{VOL}	Open-loop voltage gain	R_L = 2kΩ to V_S/2, V_O = 0.5V to 2.5V		96		dB
		R_L = 150Ω to V_S/2, V_O = 0.5V to 2.5V		82		
INPUT CHARACTERISTICS						
R_{IN}	Input Resistance	Common mode		1		GΩ
C_{IN}	Input capacitance	Common mode		2		pF
V_{CM}	Common-mode voltage range	CMRR ≥ 50dB	−0.2		2	V
CMRR	Common-mode rejection ratio	V_{CM} = 0V to 1.5 V		95		dB
OUTPUT						
V_{OH}	High output voltage swing	R_L = 2kΩ to V_S/2		2.99		V
		R_L = 150Ω to V_S/2		2.93		
V_{OL}	Low output voltage swing	R_L = 2kΩ to V_S/2		15		mV
		R_L = 150Ω to V_S/2		65		
I_{OUT}	Output Current	V_{OUT} = 0.5V from either supply		±75		
I_{SC}	Short-circuit current			±110		mA
C_{LOAD}	Capacitive load drive	G = +2		40		pF

Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
POWER SUPPLY						
V_S	Operating supply range		2.5		12.6	V
I_Q	Quiescent current /Amplifier			4.1		mA
PSRR	Power supply rejection ratio	V_S = 3.0 to 3.5 V, V_{CM} = 1.5V		85		dB
V_S = 5 V, T_A = +25 °C, V_{CM} = V_O = V_S /2, and R_L = 2 kΩ to V_S /2, unless otherwise noted. Boldface limits apply over the specified temperature range, T_A = −40 °C to +125 °C.						
DYNAMIC PERFORMANCE						
BW_{-3dB}	−3 dB Small Signal Bandwidth	G = +1, V_O = 0.2V_{PP}		125		MHz
		G = +2, −1, V_O = 0.2V_{PP}		45		
$BW_{0.1dB}$	Bandwidth for 0.1 dB Flatness	G = +2, V_O = 0.2V_{PP}, R_L = 150Ω to V_S/2, R_F =402Ω		14		MHz
SR	Slew rate	G = −1, V_O = 2V step		102		V/µs
BW_{FP}	Full Power Response	G = +1, V_O = 2V_{PP}		18		MHz
t_S	Settling time to 0.1%	G = −1, V_O = 2V step		66		ns
NOISE/DISTORTION PERFORMANCE						
THD	Total harmonic distortion	f_C = 5MHz, V_O = 2V_{PP}, G = +2		−49		dBc
e_n	Input voltage noise density	f = 100kHz		27		nV/√Hz
I_n	Input current noise density	f = 10kHz		3		pA/√Hz
DG	Differential Gain Error (NTSC)	G = +2, R_L = 150Ω to V_S/2		0.16		%
		R_L = 1kΩ to V_S/2		0.05		
DP	Differential Phase Error (NTSC)	G = +2, R_L = 150Ω to V_S/2		0.05		deg.
		R_L = 1kΩ to V_S/2		0.01		
DC PERFORMANCE						
V_{OS}	Input offset voltage	LTA6041, LTA6042		±6	±15	mV
		LTA6044			±19	
V_{OS} TC	Offset voltage drift	T_A = −40 to +125 °C		±5		µV/°C
I_B	Input bias current			0.05		nA
		T_A = +125 °C		4		
I_{OS}	Input offset current			70		pA
A_{VOL}	Open-loop voltage gain	R_L = 2kΩ to V_S/2, V_O = 0.5V to 2.5V		98		dB
		R_L = 150Ω to V_S/2, V_O = 0.5V to 2.5V		82		
INPUT CHARACTERISTICS						
R_{IN}	Input Resistance	Common mode		1		GΩ
C_{IN}	Input capacitance	Common mode		2		pF
V_{CM}	Common-mode voltage range	CMRR ≥ 50dB	−0.2		4	V
CMRR	Common-mode rejection ratio	V_{CM} = 0V to 1.5 V		95		dB
OUTPUT						
V_{OH}	High output voltage swing	R_L = 2kΩ to V_S/2		4.99		V
		R_L = 150Ω to V_S/2		4.91		

Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{OL}	Low output voltage swing	R_L = 2kΩ to V_S/2		20		mV
		R_L = 150Ω to V_S/2		90		
I_{OUT}	Output Current	V_{OUT} = 0.5V from either supply		±80		
I_{SC}	Short-circuit current			±130		mA
C_{LOAD}	Capacitive load drive	G = +2		40		pF
POWER SUPPLY						
V_S	Operating supply range		2.5		12.6	V
I_Q	Quiescent current /Amplifier			4.2		mA
PSRR	Power supply rejection ratio	V_S = 3.0 to 3.5 V, V_{CM} = 1.5V		90		dB

V_S = 10 V, T_A = +25 ℃, V_{CM} = V_O = V_S /2, and R_L = 2 kΩ to V_S /2, unless otherwise noted.
Boldface limits apply over the specified temperature range, T_A = −40 ℃ to +125 ℃.

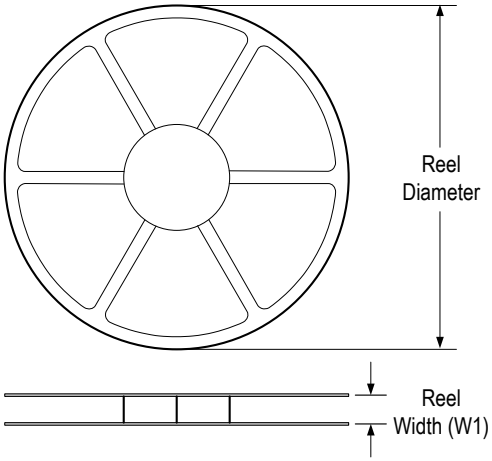
DYNAMIC PERFORMANCE						
BW_{-3dB}	−3 dB Small Signal Bandwidth	G = +1, V_O = 0.2V_{PP}		140		MHz
		G = +2, −1, V_O = 0.2V_{PP}		46		
$BW_{0.1dB}$	Bandwidth for 0.1 dB Flatness	G = +2, V_O = 0.2V_{PP}, R_L = 150Ω to V_S/2, R_F =402Ω		16		MHz
SR	Slew rate	G = −1, V_O = 2V step		107		V/µs
BW_{FP}	Full Power Response	G = +1, V_O = 2V_{PP}		20		MHz
t_S	Settling time to 0.1%	G = −1, V_O = 2V step		66		ns
NOISE/DISTORTION PERFORMANCE						
THD	Total harmonic distortion	f_C = 5MHz, V_O = 2V_{PP}, G = +2		−53		dBc
e_n	Input voltage noise density	f = 100kHz		27		nV/√Hz
I_n	Input current noise density	f = 10kHz		3		pA/√Hz
DG	Differential Gain Error (NTSC)	G = +2, R_L = 150Ω to V_S/2		0.15		%
		R_L = 1kΩ to V_S/2		0.02		
DP	Differential Phase Error (NTSC)	G = +2, R_L = 150Ω to V_S/2		0.05		deg.
		R_L = 1kΩ to V_S/2		0.02		
DC PERFORMANCE						
V_{OS}	Input offset voltage	LTA6041, LTA6042		±6	±15	mV
		LTA6044			±19	
V_{OS} TC	Offset voltage drift	T_A = −40 to +125 ℃		±5		µV/℃
I_B	Input bias current			0.05		nA
		T_A = +125 ℃		4		
I_{OS}	Input offset current			70		pA
A_{VOL}	Open-loop voltage gain	R_L = 2kΩ to V_S/2, V_O = 0.5V to 2.5V		96		dB
		R_L = 150Ω to V_S/2, V_O = 0.5V to 2.5V		82		
INPUT CHARACTERISTICS						
R_{IN}	Input Resistance	Common mode		1		GΩ
C_{IN}	Input capacitance	Common mode		2		pF

Electrical Characteristics

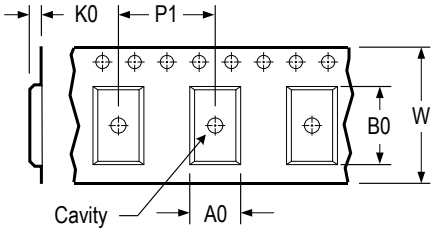
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CM}	Common-mode voltage range	CMRR ≥ 50dB	−0.2		9	V
CMRR	Common-mode rejection ratio	V_{CM} = 0V to 1.5 V		95		dB
OUTPUT						
V_{OH}	High output voltage swing	R_L = 2kΩ to V_S/2		9.97		V
		R_L = 150Ω to V_S/2		9.82		
V_{OL}	Low output voltage swing	R_L = 2kΩ to V_S/2		35		mV
		R_L = 150Ω to V_S/2		170		
I_{OUT}	Output Current	V_{OUT} = 0.5V from either supply		±90		
I_{SC}	Short-circuit current			±150		mA
C_{LOAD}	Capacitive load drive	G = +2		40		pF
POWER SUPPLY						
V_S	Operating supply range		2.5		12.6	V
I_Q	Quiescent current /Amplifier			4.4		mA
PSRR	Power supply rejection ratio	V_S = 3.0 to 3.5 V, V_{CM} = 1.5V		85		dB
THERMAL CHARACTERISTICS						
T_A	Operating temperature range	SOT23-5L	−40		+85	℃
		Other packages	−40		+125	
$θ_{JA}$	Package Thermal Resistance	SOT23-5L		190		℃/W
		MSOP-8L		201		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

Tape and Reel Information

REEL DIMENSIONS

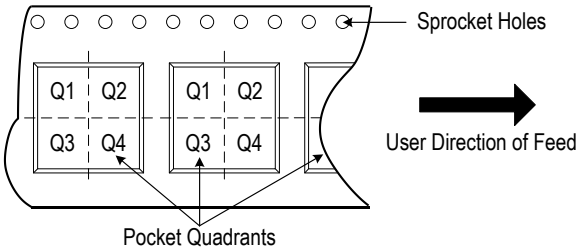


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIETATION IN TAPE

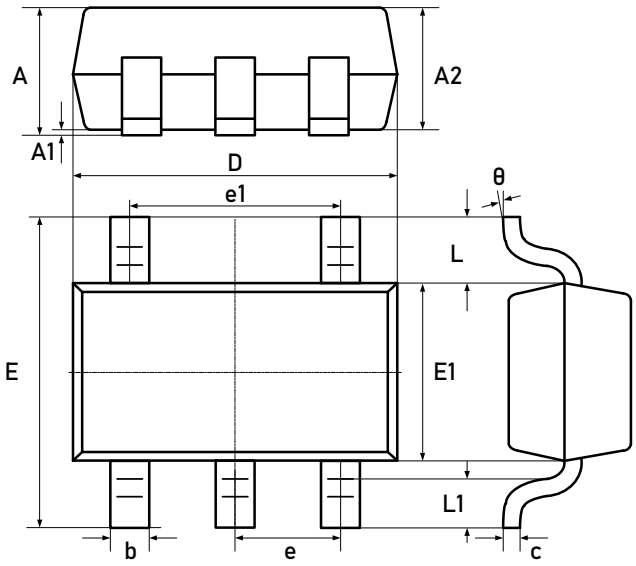


* All dimensions are nominal

Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTA6041XT5/R6	SOT23	5	3 000	178	9.0	3.3	3.2	1.5	4.0	8.0	Q3

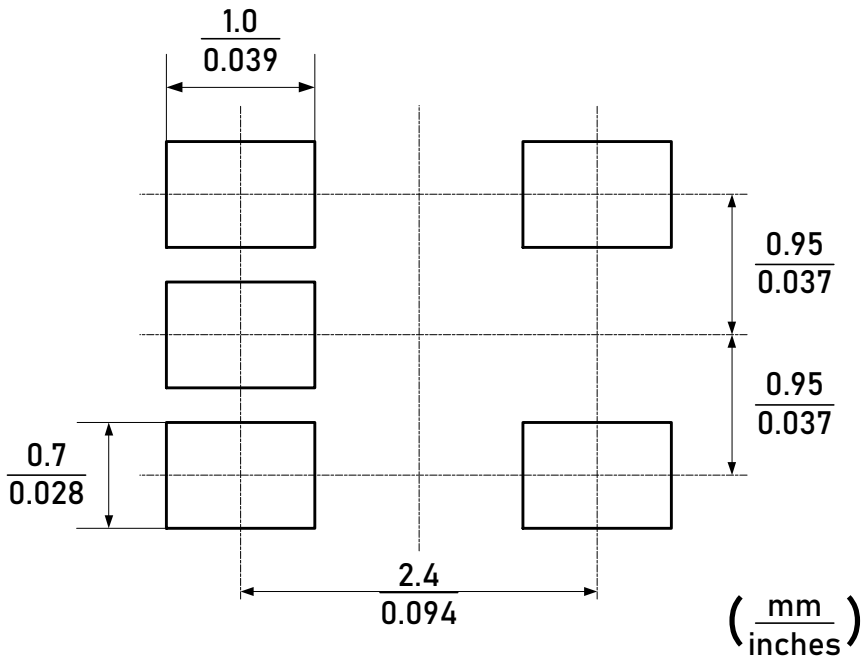
Package Outlines

DIMENSIONS, SOT23-5L



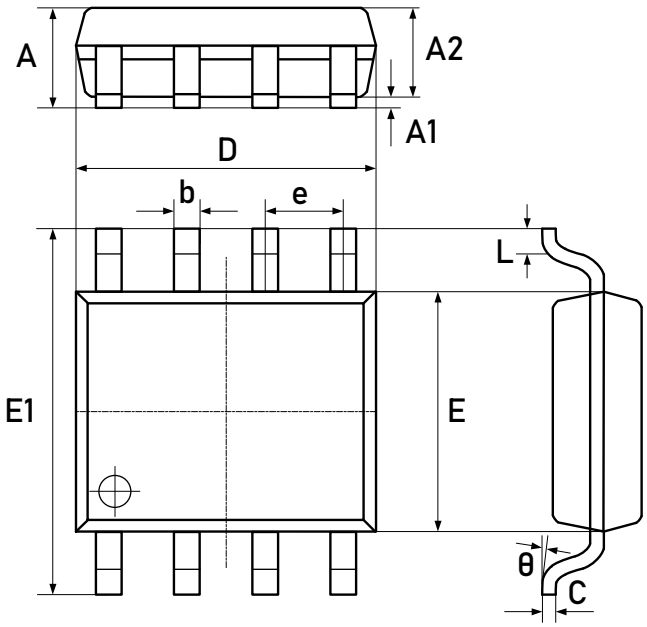
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.60 REF		0.024 REF	
L1	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L



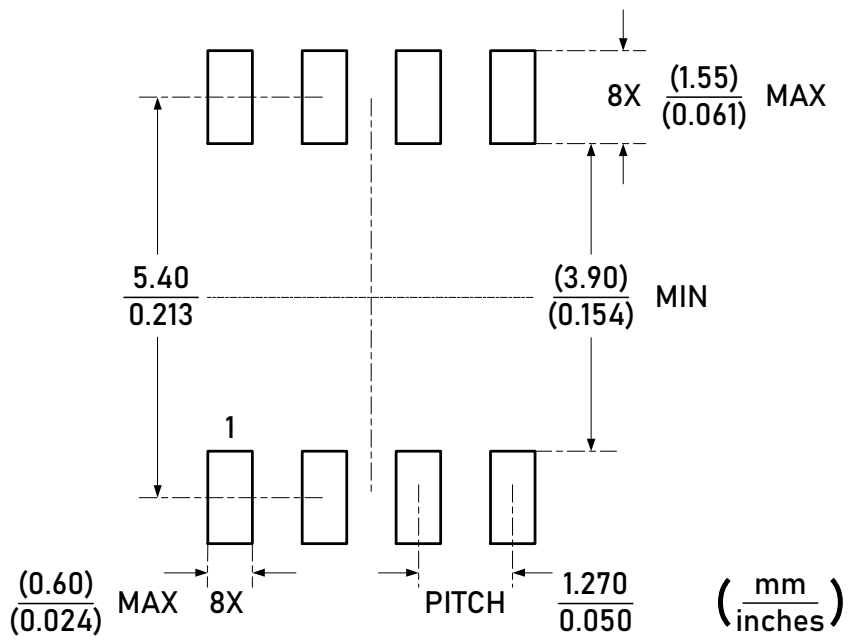
Package Outlines (continued)

DIMENSIONS, SOIC-8L



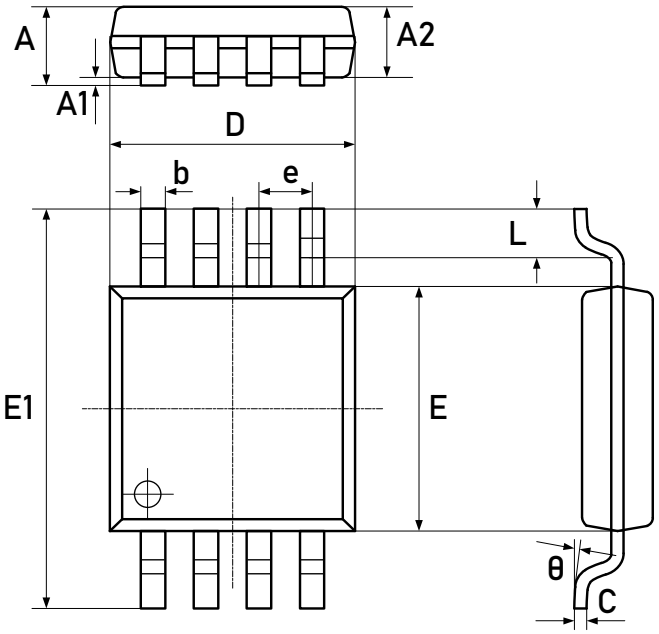
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.370	1.670	0.054	0.066
A1	0.070	0.170	0.003	0.007
A2	1.300	1.500	0.051	0.059
b	0.306	0.506	0.012	0.020
C	0.203 TYP.		0.008 TYP.	
D	4.700	5.100	0.185	0.201
E	3.820	4.020	0.150	0.158
E1	5.800	6.200	0.228	0.244
e	1.270 TYP.		0.050 TYP.	
L	0.450	0.750	0.018	0.030
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L



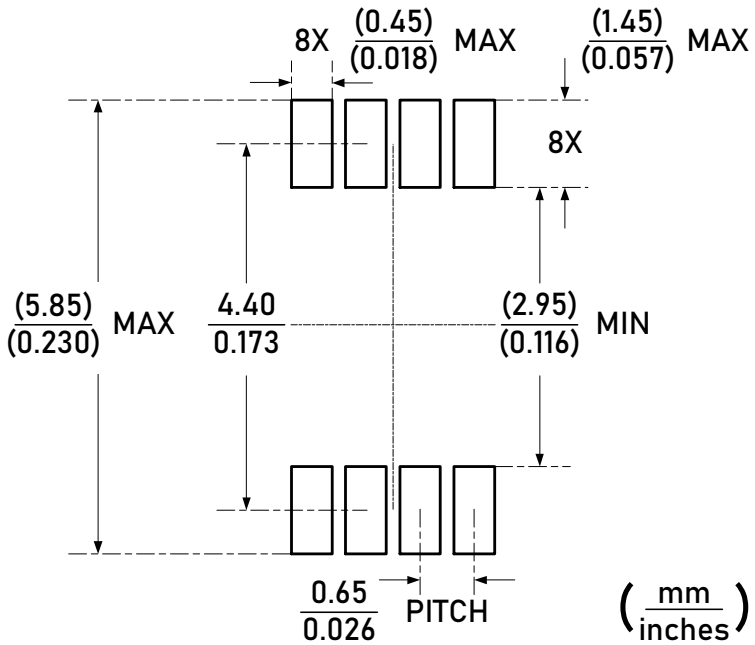
Package Outlines (continued)

DIMENSIONS, MSOP-8L



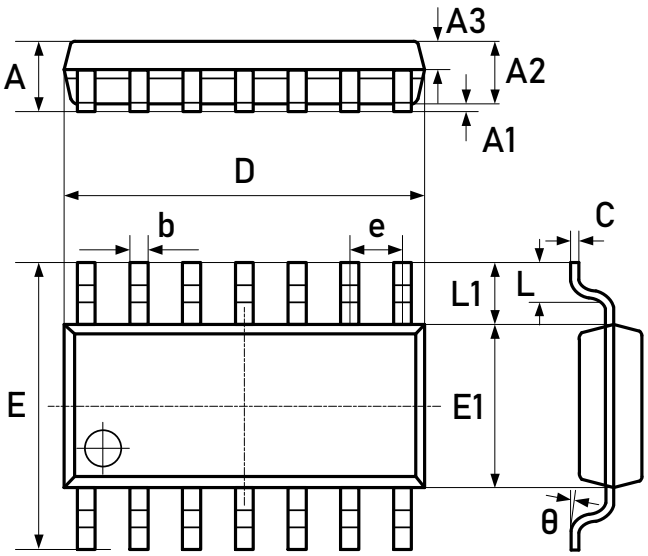
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.100	0.031	0.043
A1	0.050	0.150	0.002	0.006
A2	0.750	0.950	0.030	0.037
b	0.290	0.380	0.011	0.015
C	0.150	0.200	0.006	0.008
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
e	0.650 TYP.		0.026 TYP.	
L	0.400	0.700	0.016	0.028
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



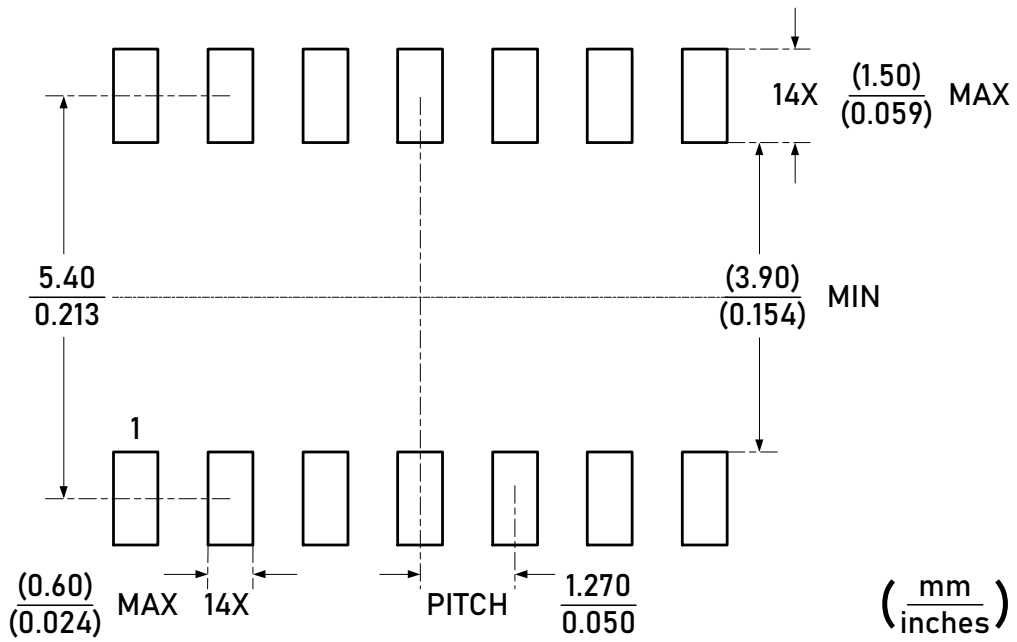
Package Outlines (continued)

DIMENSIONS, SOIC-14L



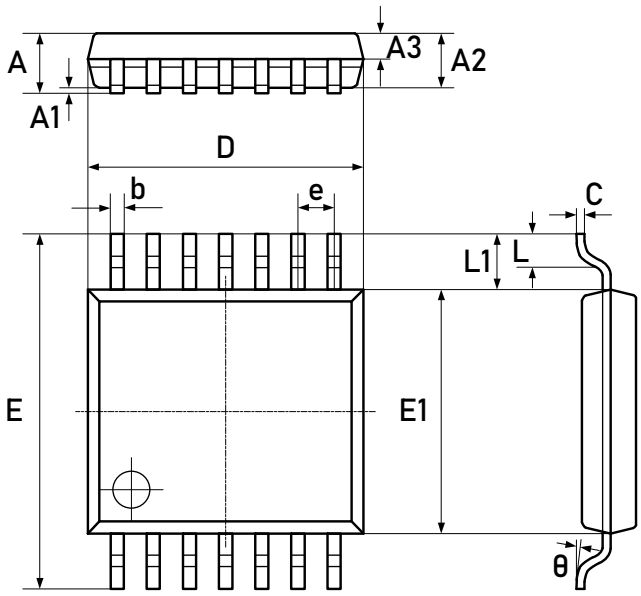
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.850	0.057	0.073
A1	0.100	0.300	0.004	0.012
A2	1.350	1.550	0.053	0.061
A3	0.550	0.750	0.022	0.030
b	0.406 TYP.		0.016 TYP.	
C	0.203 TYP.		0.008 TYP.	
D	8.630	8.830	0.340	0.348
E	5.840	6.240	0.230	0.246
E1	3.850	4.050	0.152	0.159
e	1.270 TYP.		0.050 TYP.	
L1	1.040 REF.		0.041 REF.	
L	0.350	0.750	0.014	0.030
θ	2°	8°	2°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



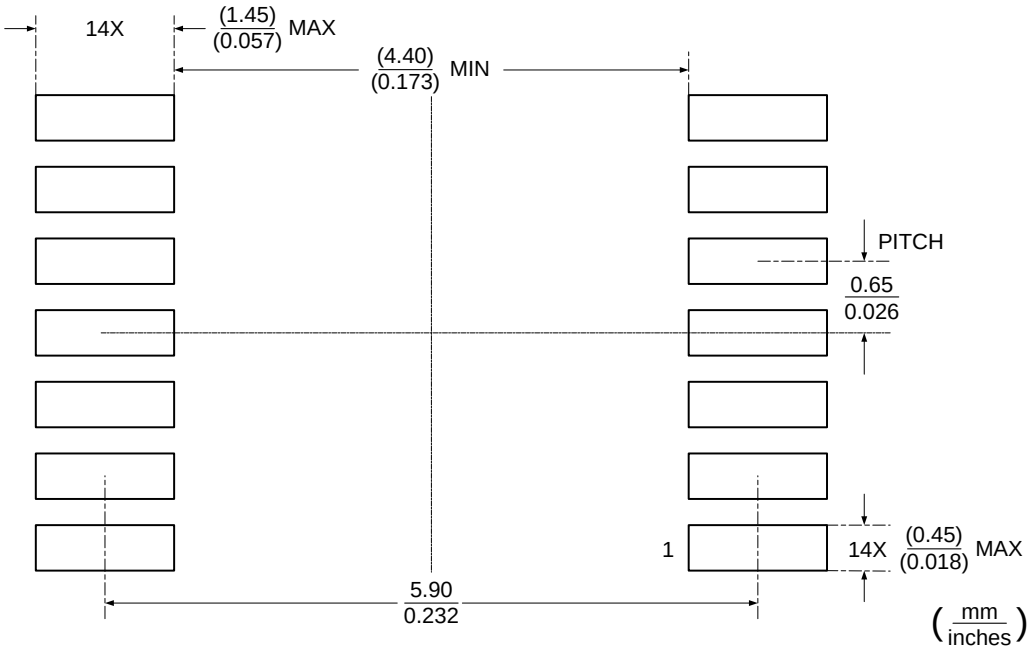
Package Outlines (continued)

DIMENSIONS, TSSOP-14L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.200	-	0.047
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.035	0.041
A3	0.390	0.490	0.015	0.019
b	0.200	0.290	0.008	0.011
C	0.130	0.180	0.005	0.007
D	4.860	5.060	0.191	0.199
E	6.200	6.600	0.244	0.260
E1	4.300	4.500	0.169	0.177
e	0.650 TYP.		0.026 TYP.	
L1	1.000 REF.		0.039 REF.	
L	0.450	0.750	0.018	0.030
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



Important Notice

Linearin is a global fabless semiconductor company specializing in advanced high-performance high-quality analog/mixed-signal IC products and sensor solutions. The company is devoted to the innovation of high performance, analog-intensive sensor front-end products and modular sensor solutions, applied in multi-market of medical & wearable devices, smart home, sensing of IoT, intelligent industrial & smart factory (industrie 4.0), and automotives. Linearin's product families include widely-used standard catalog products, solution-based application specific standard products (ASSPs) and sensor modules that help customers achieve faster time-to-market products. Go to http://www.linearin.com for a complete list of Linearin product families.

For additional product information, or full datasheet, please contact with the Linearin's Sales Department or Representatives.

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