General Description

The LTA8181, LTA8182 and LTA8184 (LTA818x) are a family of zero-drift, low power, rail-to-rail output operational amplifiers capable of operating on wide supplies ranging from +4.5 V (±2.25 V) to +48 V (±24 V). The LTA818x op-amps use Linearin's proprietary auto-zeroing techniques to offer outstanding dc precision and ac performance, including low offset voltage (25 µV maximum), near zero-drift over time and temperature, 4 MHz bandwidth, and 0.32 μV_{PP} input voltage noise at 0.1 Hz to 10 Hz. These high-precision, low-quiescent-current op-amps offer high input impedance and rail-to-rail output swing within 10 mV of the rails. The input common-mode range includes the negative rail.

The single version LTA8181 device is available in micro-size MSOP-8L, SOT-23-5L, and SOIC-8L packages. The dual version LTA8182 device is offered in MSOP-8L and SOIC-8L packages. The quad version LTA8184 device is offered in SOIC-14L and TSSOP-14L packages. All versions are specified for operation from –40°C to +125°C.

Features and Benefits

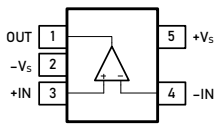
- High DC Precision
  - ±25 µV (maximum) V_{OS} with a Drift of ±50 nV/°C
  - CMRR: 132 dB
  - PSRR: 135 dB
  - A_{VOL}: 136 dB
  - V_n: 0.32 μV_{PP} (0.1 to 10 Hz)
- Wide Supply: ±2.25 V to ±24 V, 4.5 V to 48 V
- Gain Bandwidth: 4 MHz
- Slew Rate: 2.6 V/µs
- Low Quiescent Current: 600 µA per amplifier
- Low Bias Current: ±150 pA
- Rail-to-Rail Output Operation

Applications

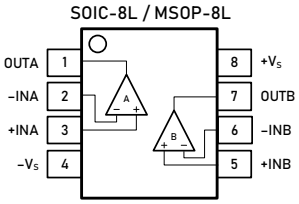
- High-Side and Low-Side Current Sensing
- Transducer Amplifiers
- Precision Active Filters
- Programmable Logic Controllers
- Test and Measurement Equipment
- Multiplexed Data-Acquisition Systems
- Tracking Amplifier in Power Modules
- Power Delivery: UPS, Server, and Merchant Network Power

Pin Configuration (Top View)

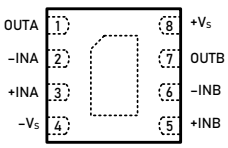
LTA8181
SOT23-5L



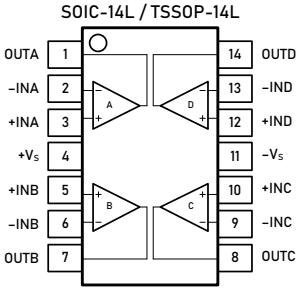
LTA8182
SOIC-8L / MSOP-8L



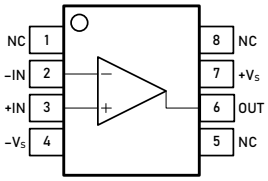
LTA8182
DFN3×3-8L



LTA8184
SOIC-14L / TSSOP-14L



LTA8181
SOIC-8L / MSOP-8L



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Pin Description

Symbol	Description
–IN	Inverting input of the amplifier. The voltage range is from V_{S-} to V_{S+} – 1.5 V.
+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 4.5 V to 4 8V. Split supplies are possible as long as the voltage between V_{S+} and V_{S-} is from 4.5 V to 48 V.
$-V_S$	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 4.5 V to 48 V.
OUT	Amplifier output.
NC	No connection

Ordering Information (1)

Type Number	Package Name	Package Quantity	Eco Class (2)	Marking Code (3)
LTA8181XT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	Z81
LTA8181XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	ZHV81
LTA8181XV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV81
LTA8182XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	ZHV82
LTA8182XV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV82
LTA8182XF8/R6	DFN3x3-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV82
LTA8184XS14/R5	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	ZHV84
LTA8184XT14/R6	TSSOP-14L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV84

(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-}	60 V
Signal Input Terminals: Voltage, Current	$-V_S$ – 0.3 V to $+V_S$ + 0.3 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)	2 000	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.

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Electrical Characteristics

V_S = 4.5 V to 48 V, T_A = +25 °C, V_{CM} = V_{OUT} = V_S/2, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted. Boldface limits apply over the specified temperature range, T_A = −40 °C to +125 °C.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
Input offset voltage	V_{OS}			±8	±25	µV
Offset voltage drift	V_{OS} TC	T_A = −40 to +125 °C		±50		µV/°C
Power supply rejection ratio	PSRR	V_S = 4.5 to 48 V, V_{CM} = 0.1 V		135		dB
		T_A = −40 to +125 °C		122		
INPUT BIAS CURRENT						
Input bias current	I_B			150		pA
		T_A = +85 °C		600		
		T_A = +125 °C		3000		
Input offset current	I_{OS}			300		pA
NOISE						
Input voltage noise	V_n	f = 0.1 to 10 Hz		0.32		μV_{P-P}
Input voltage noise density	e_n	f = 1 kHz		15		nV/√Hz
		f = 10 kHz		15		
Input current noise density	I_n	f = 1 kHz		10		fA/√Hz
INPUT VOLTAGE						
Common-mode voltage range	V_{CM}		$-V_S$		$+V_S-1.5$	V
Common-mode rejection ratio	CMRR	$V_{S-} < V_{CM} < V_{S+}-1.5$ V		132		dB
		$V_{S-}+0.5 < V_{CM} < V_{S+}-1.5$ V		143		
		$V_{S-}+0.5 < V_{CM} < V_{S+}-1.5$ V, V_S = ±20 V, T_A = −40 to +125 °C		124		
INPUT IMPEDANCE						
Input capacitance	C_{IN}	Differential		3		pF
		Common mode		4.5		
OPEN-LOOP GAIN						
Open-loop voltage gain	A_{VOL}	$V_{S-}+0.5 < V_O < V_{S+}-0.5$ V		136		dB
		$V_{S-}+0.5 < V_O < V_{S+}-0.5$ V, T_A = −40 to +125 °C		126		
FREQUENCY RESPONSE						
Gain bandwidth product	GBW			4		MHz
Slew rate	SR	G = +1		2.6		V/µs
Total harmonic distortion + noise	THD+N	G = +1, f = 1 kHz, V_O = 3 V_{RMS}		0.0001		%
Settling time	t_S	To 0.1%, V_S = 40 V, G = +1, 5 V step		5		µs
		To 0.01%, V_S = 40 V, G = +1, 5 V step		8		
Overload recovery time	t_{OR}	V_{IN} × Gain > V_S		1.5		µs

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Electrical Characteristics (continued)

V_S = 4.5 V to 48 V, T_A = +25 °C, V_{CM} = V_{OUT} = V_S/2, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted. Boldface limits apply over the specified temperature range, T_A = −40 °C to +125 °C.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OUTPUT						
High output voltage swing	V_{OH}	R_L = 10 kΩ		$+V_S$−100		mV
		R_L = 2 kΩ		$+V_S$−270		
Low output voltage swing	V_{OL}	R_L = 10 kΩ		$-V_S$+60		mV
		R_L = 2 kΩ		$-V_S$+250		
Short-circuit current	I_{SC}			±45		mA
POWER SUPPLY						
Operating supply voltage	V_S	T_A = −40 to +125 °C	4.5		48	V
Quiescent current (per amplifier)	I_Q	V_S = 5 V		600		µA
		V_S = 36 V		690		
THERMAL CHARACTERISTICS						
Operating temperature range	T_A		−40		+125	°C
Package Thermal Resistance	$θ_{JA}$	SOT23-5L		190		°C/W
		MSOP-8L		201		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

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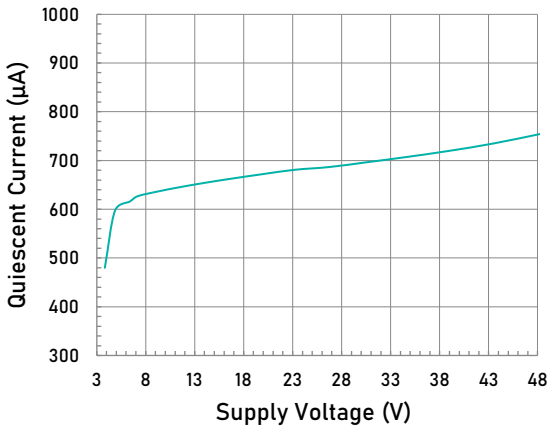
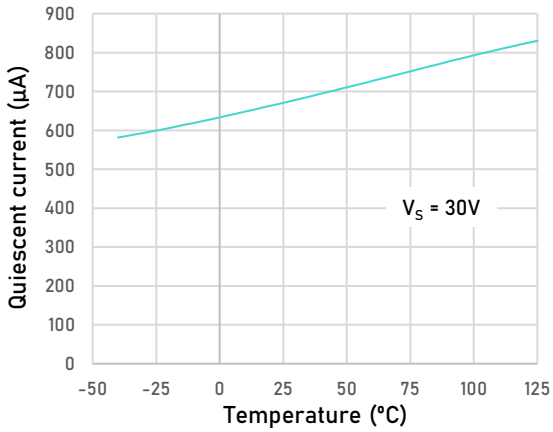
Typical Performance Characteristics

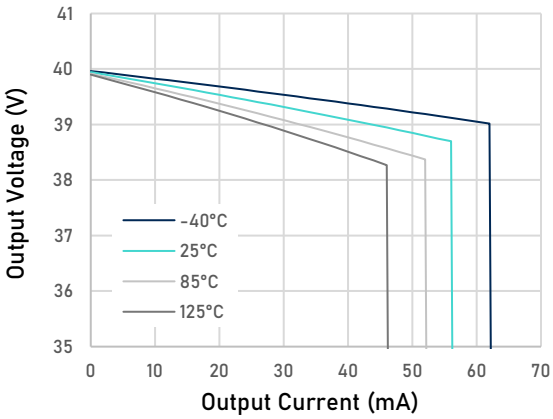
At T_A = +25 °C, V_{CM} = V_S /2, and R_L = 10 kΩ connected to V_S /2, unless otherwise noted.



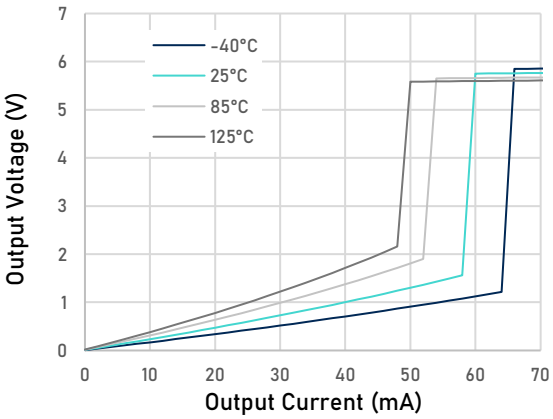
Quiescent Current as a function of Supply Voltage



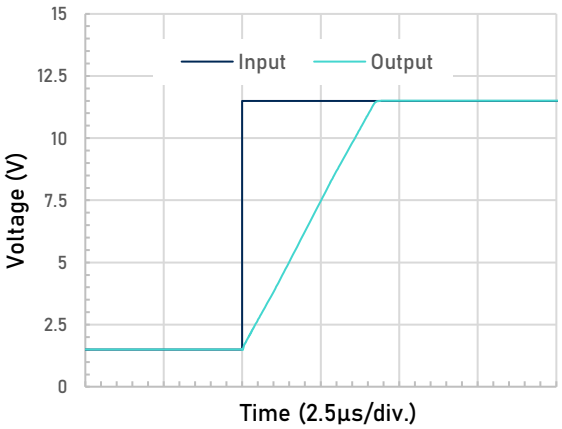
Quiescent Current as a function of Temperature



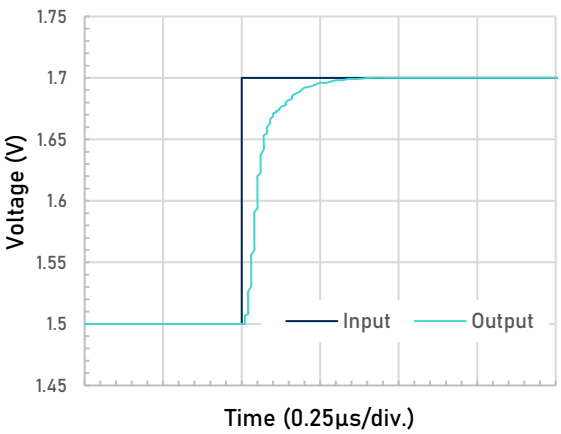
Output Voltage Swing as a function of Output Current (Sourcing, V_S = 40 V)



Output Voltage Swing as a function of Output Current (Sinking, V_S = 40 V)



Large-Signal Step Response(Failing)



Small-Signal Step Response

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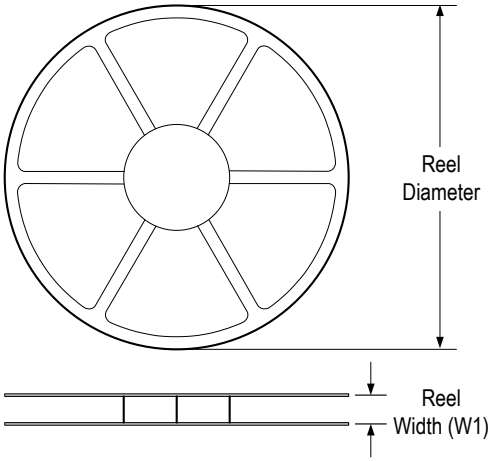
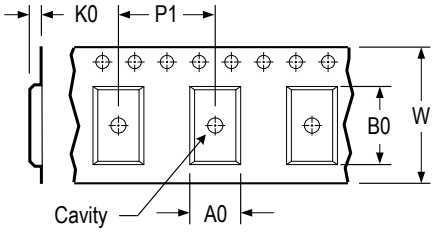
Tape and Reel Information

REEL DIMENSIONS

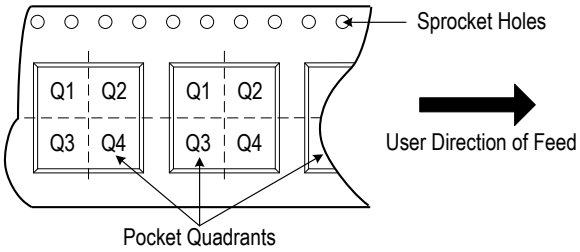


TAPE DIMENSIONS



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
LTA8181XT5/R6	SOT23	5	3 000	178	9.0	3.3	3.2	1.5	4.0	8.0	Q3

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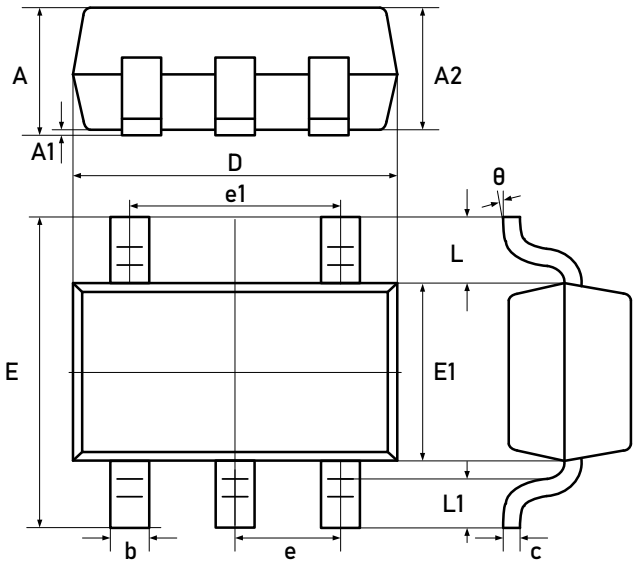
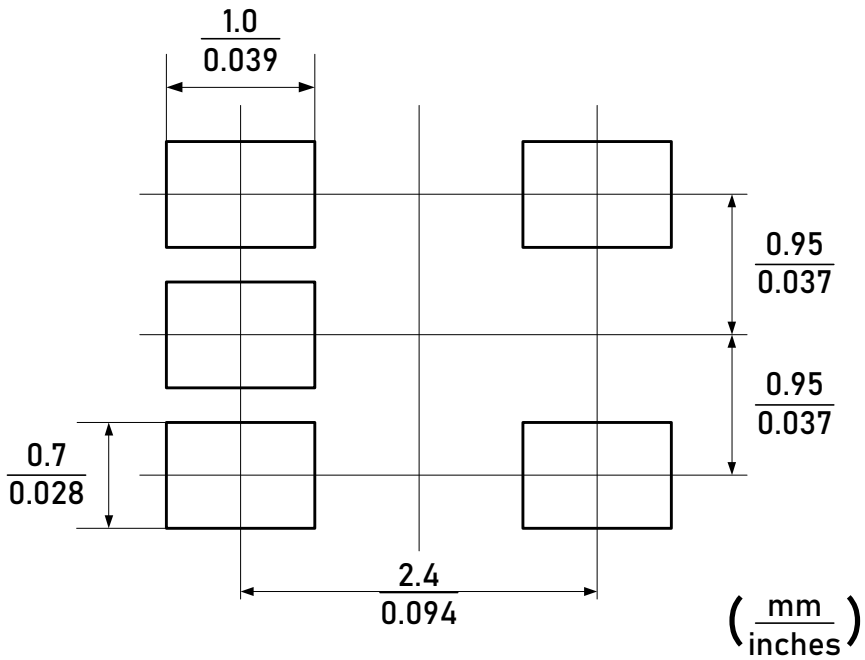
Package Outlines

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



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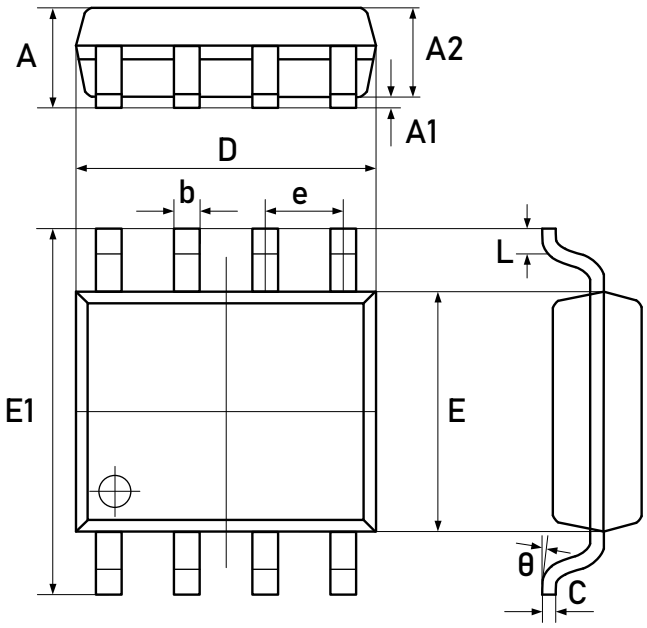
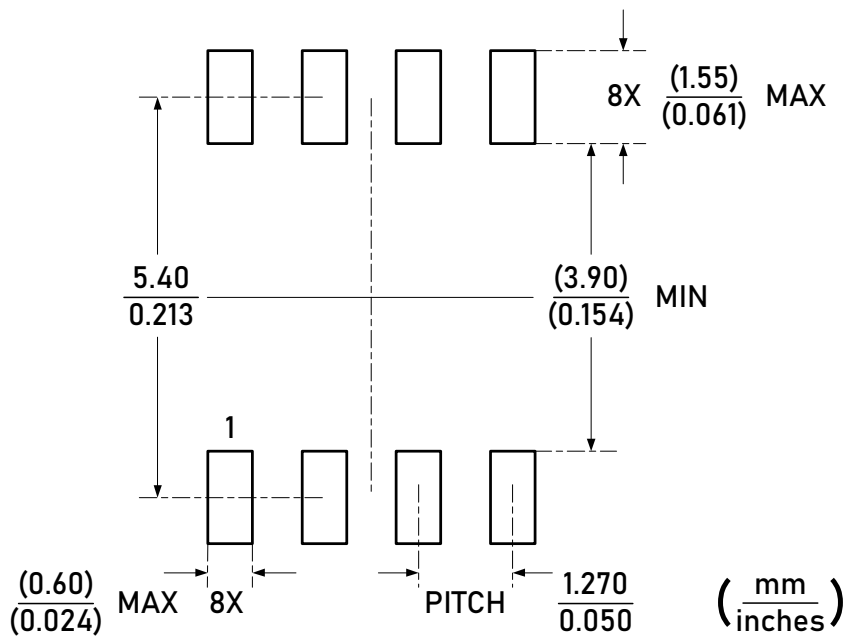
Package Outlines (continued)

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



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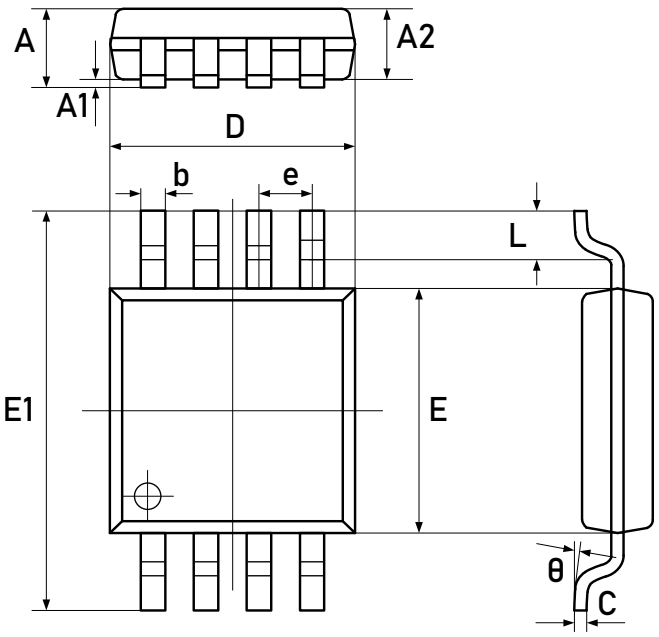
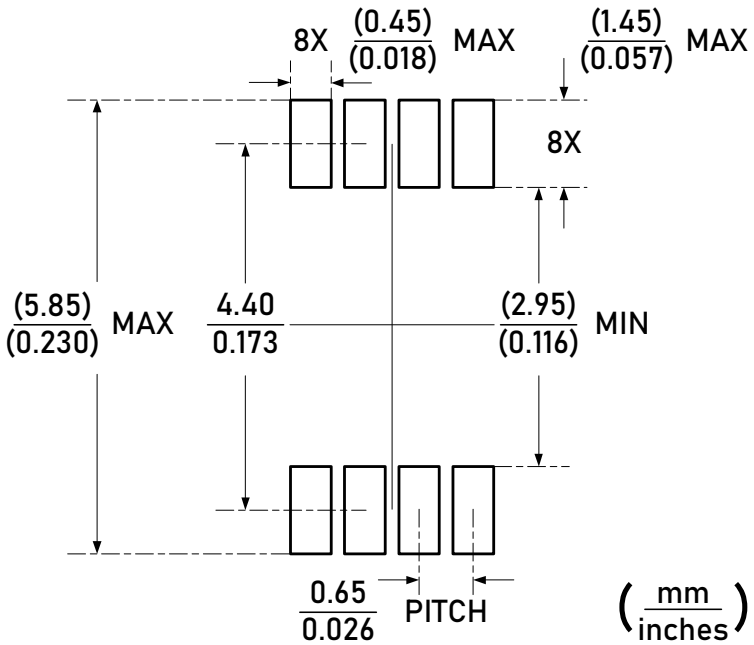
Package Outlines (continued)

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



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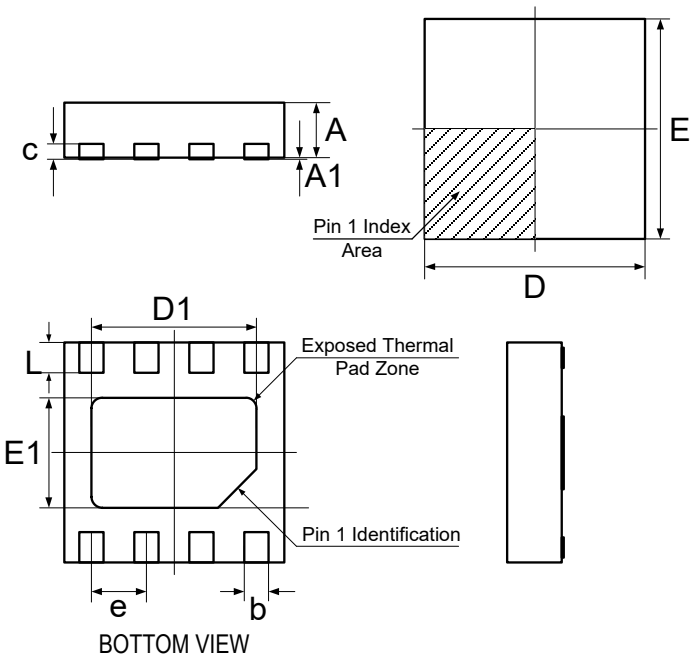
Package Outlines (continued)

DIMENSIONS, DFN3x3-8L



Symbol	Millimeters		
	Min.	Nom.	Max.
A	0.70	0.75	0.80
A1	-	0.02	0.05
b	0.255	0.28	0.305
c	0.19	0.21	0.23
D	2.90	3.00	3.10
D1	2.25	2.30	2.35
E	2.90	3.00	3.10
E1	1.45	1.50	1.55
e	0.625	0.65	0.675
L	0.25	0.30	0.35

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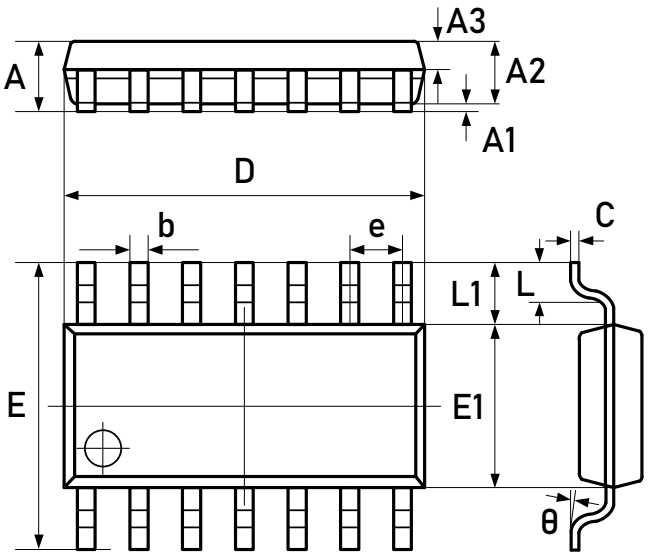
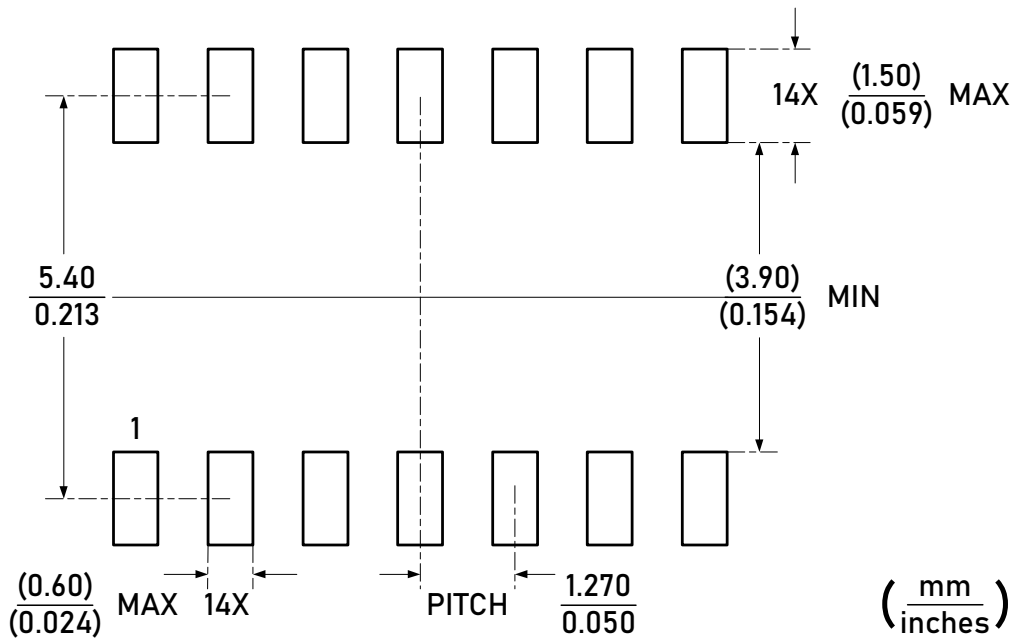
Package Outlines (continued)

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



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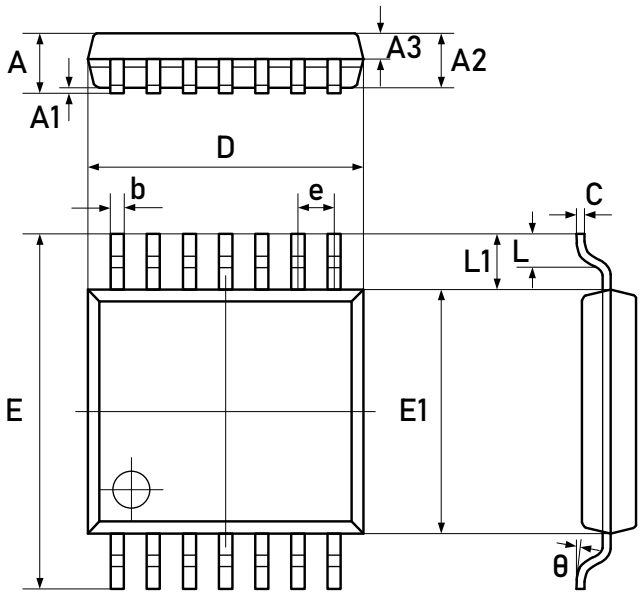
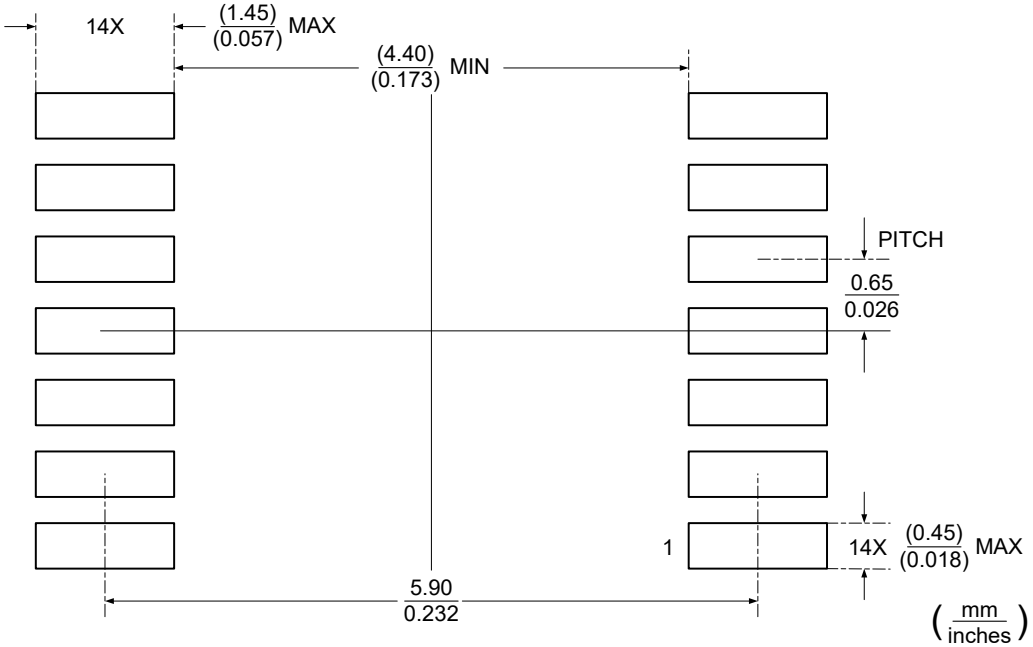
Package Outlines (continued)

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



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