

General Description

The LTA8151, LTA8152 and LTA8154 (LTA815x) are a family of zero-drift, micro-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 LTA815x op-amps use Linearin's proprietary auto-zeroing techniques to offer outstanding dc precision and ac performance, including low offset voltage (30 μ V maximum), near zero-drift over time and temperature, 1 MHz bandwidth, and 0.41 μ V_{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 LTA8151 device is available in micro-size MSOP-8L, SOT-23-5L, and SOIC-8L packages. The dual version LTA8152 device is offered in MSOP-8L and SOIC-8L packages. The quad version LTA8154 device is offered in SOIC-14L and TSSOP-14L packages. All versions are specified for operation from -40°C to $+125^{\circ}\text{C}$.

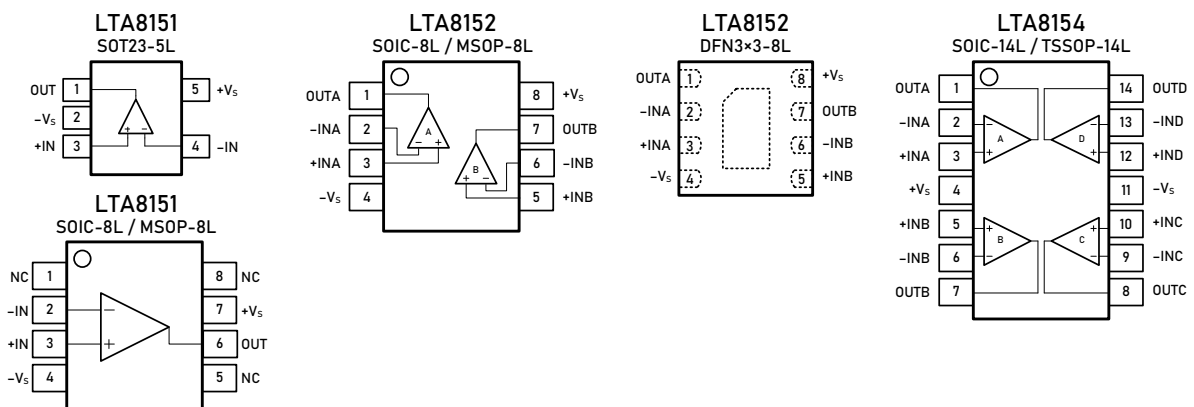
Features and Benefits

- High DC Precision
 - ± 30 μ V (maximum) V_{OS} with a Drift of ± 50 nV/ $^{\circ}\text{C}$
 - CMRR: 130 dB
 - PSRR: 132 dB
 - A_{VOL} : 136 dB
 - V_{n} : 0.41 μ V_{pp} (typical, 0.1 to 10 Hz)
- Wide Supply: ± 2.25 V to ± 24 V, 4.5 V to 48 V
- Gain Bandwidth: 1 MHz
- Slew Rate: 0.56 V/ μ s
- Low Quiescent Current: 142 μ A 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)



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 48 V. 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⁾
LTA8151XT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	Z51
LTA8151XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	ZHV51
LTA8151XV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV51
LTA8152XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	ZHV52
LTA8152XV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV52
LTA8152XF8/R6	DFN3x3-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV52
LTA8154XS14/R5	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	ZHV54
LTA8154XT14/R6	TSSOP-14L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV54

(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 $+150$ °C
Junction Temperature, T_J	150 °C
Lead Temperature Range (Soldering 10 sec)	260 °C

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.

Electrical Characteristics

$V_S = 4.5 \text{ V to } 48 \text{ V}$, $T_A = +25 \text{ }^\circ\text{C}$, $V_{CM} = V_S/2$, $V_O = V_S/2$, and $R_L = 10 \text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40 \text{ }^\circ\text{C to } +125 \text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
Input offset voltage	V_{OS}			± 10	± 30	μV
Offset voltage drift	$V_{OS} \text{ TC}$	$T_A = -40 \text{ to } +125 \text{ }^\circ\text{C}$		± 50		$\text{nV}/^\circ\text{C}$
Power supply rejection ratio	PSRR	$V_S = 4.5 \text{ to } 48 \text{ V}$, $V_{CM} = 0.1 \text{ V}$		132		dB
		$T_A = -40 \text{ to } +125 \text{ }^\circ\text{C}$		120		
INPUT BIAS CURRENT						
Input bias current	I_B			150		pA
		$T_A = -40 \text{ to } +85 \text{ }^\circ\text{C}$		600		
		$T_A = -40 \text{ to } +125 \text{ }^\circ\text{C}$		3000		
Input offset current	I_{OS}			300		pA
NOISE						
Input voltage noise	V_n	$f = 0.1 \text{ to } 10 \text{ Hz}$		0.41		μV_{P-P}
Input voltage noise density	e_n	$f = 10 \text{ Hz}$		22		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 1 \text{ kHz}$		22		
Input current noise density	I_n	$f = 1 \text{ kHz}$		10		$\text{fA}/\sqrt{\text{Hz}}$
INPUT VOLTAGE						
Common-mode voltage range	V_{CM}		$-V_S$		$+V_S-1.5$	V
Common-mode rejection ratio	CMRR	$V_{S-} < V_{CM} < V_{S+}-1.5 \text{ V}$		130		dB
		$V_{S-}+0.5 < V_{CM} < V_{S+}-1.5 \text{ V}$		139		
		$V_{S-}+0.5 < V_{CM} < V_{S+}-1.5 \text{ V}$, $V_S = \pm 20 \text{ V}$, $T_A = -40 \text{ to } +125 \text{ }^\circ\text{C}$		122		
INPUT IMPEDANCE						
Input capacitance	C_{IN}	Differential		3		pF
		Common mode		4.5		
OPEN-LOOP GAIN						
Open-loop voltage gain	A_{VOL}	$V_{S-}+0.5 < V_O < V_{S+}-0.5 \text{ V}$		136		dB
		$V_{S-}+0.5 < V_O < V_{S+}-0.5 \text{ V}$, $T_A = -40 \text{ to } +125 \text{ }^\circ\text{C}$		126		
FREQUENCY RESPONSE						
Gain bandwidth product	GBW			1		MHz
Slew rate	SR	$G = +1$		0.56		$\text{V}/\mu\text{s}$
Total harmonic distortion + noise	THD+N	$G = +1$, $f = 1 \text{ kHz}$, $V_O = 3 V_{RMS}$		0.0002		%
Settling time	t_S	To 0.1%, $V_S = 40 \text{ V}$, $G = +1$, 5 V step		22		μs
		To 0.01%, $V_S = 40 \text{ V}$, $G = +1$, 5 V step		30		
Overload recovery time	t_{OR}	$V_{IN} \times \text{Gain} > V_S$		2		μs

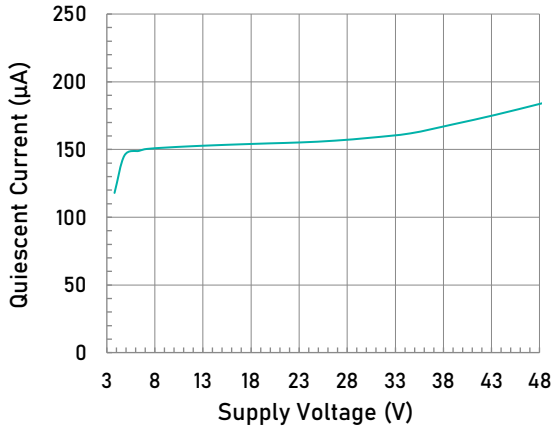
Electrical Characteristics (continued)

$V_S = 4.5 \text{ V to } 48 \text{ V}$, $T_A = +25 \text{ }^\circ\text{C}$, $V_{CM} = V_S/2$, $V_O = V_S/2$, and $R_L = 10 \text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40 \text{ }^\circ\text{C to } +125 \text{ }^\circ\text{C}$.

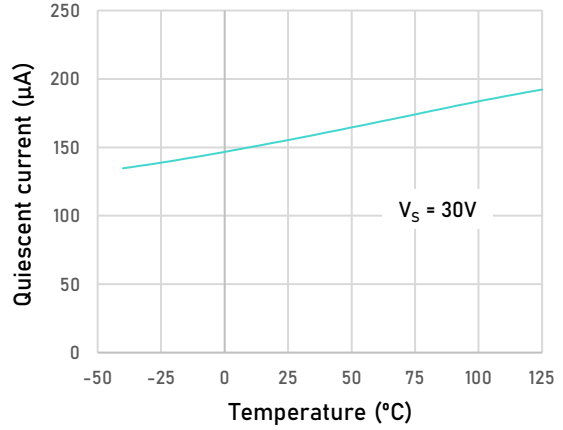
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<i>OUTPUT</i>						
High output voltage swing	V_{OH}	$R_L = 10 \text{ k}\Omega$		$+V_S-100$		mV
		$R_L = 2 \text{ k}\Omega$		$+V_S-270$		
Low output voltage swing	V_{OL}	$R_L = 10 \text{ k}\Omega$		$-V_S+60$		mV
		$R_L = 2 \text{ k}\Omega$		$-V_S+250$		
Short-circuit current	I_{SC}			± 45		mA
<i>POWER SUPPLY</i>						
Operating supply voltage	V_S	$T_A = -40 \text{ to } +125 \text{ }^\circ\text{C}$	4.5		48	V
Quiescent current (per amplifier)	I_Q	$V_S = 5 \text{ V}$		142		μA
		$V_S = 36 \text{ V}$		160		
<i>THERMAL CHARACTERISTICS</i>						
Operating temperature range	T_A		-40		+125	$^\circ\text{C}$
Package Thermal Resistance	θ_{JA}	SOT23-5L		190		$^\circ\text{C/W}$
		MSOP-8L		201		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

Typical Performance Characteristics

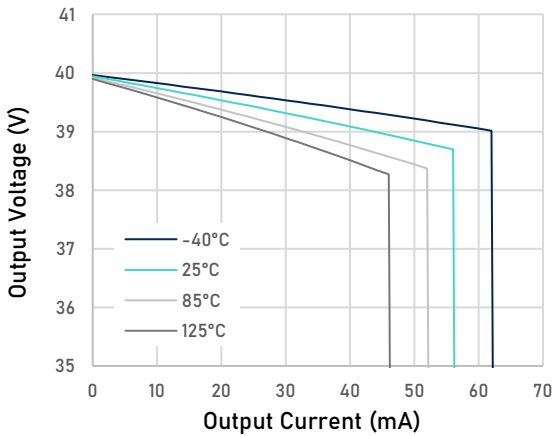
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



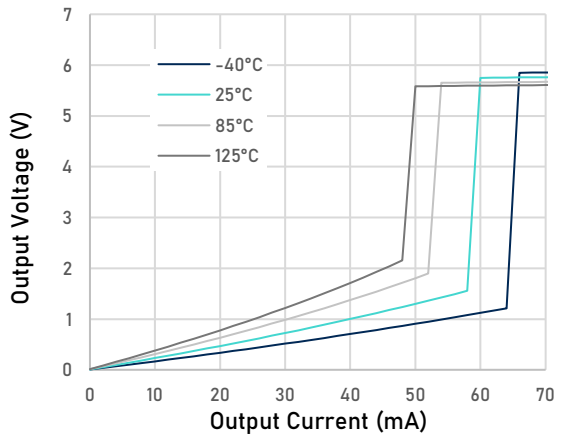
Quiescent Current as a function of Supply Voltage



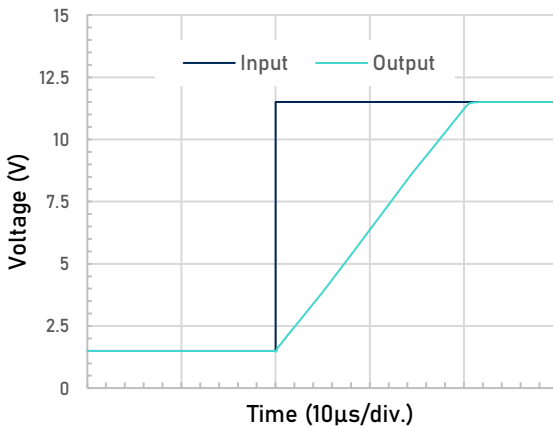
Quiescent Current as a function of Temperature



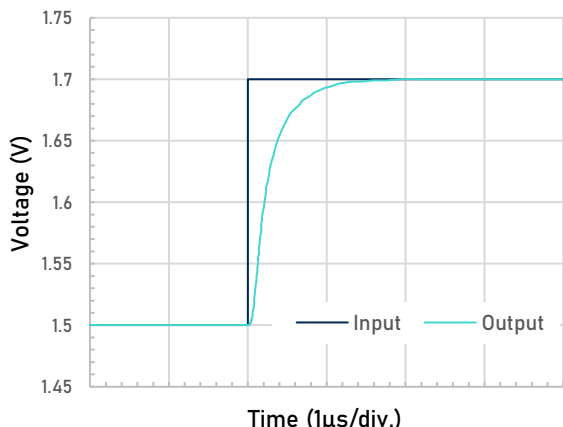
Output Voltage Swing as a function of Output Current (Sourcing, $V_S = 40\text{ V}$)



Output Voltage Swing as a function of Output Current (Sinking, $V_S = 40\text{ V}$)



Large-Signal Step Response (Failing)

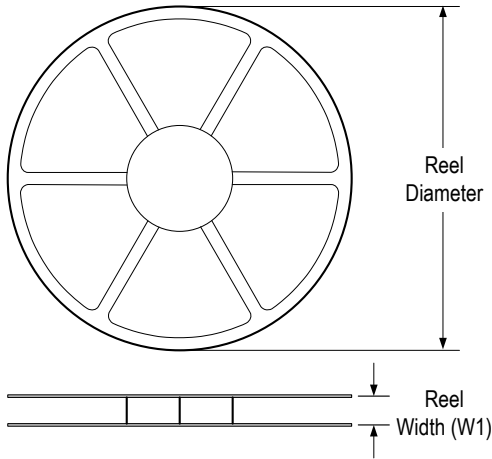


Small-Signal Step Response

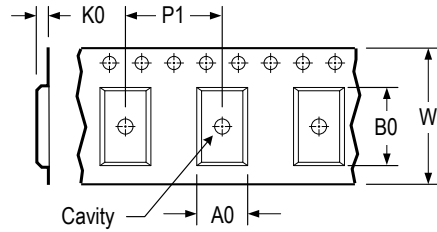
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Tape and Reel Information

REEL DIMENSIONS

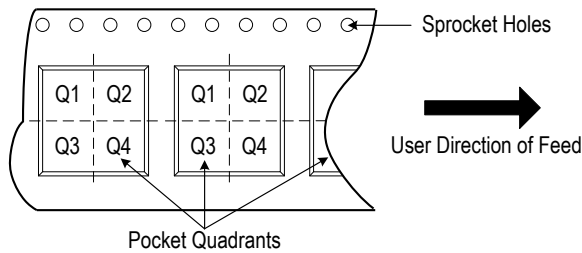


TAPE DIMENSIONS



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 ORIENTATION IN TAPE

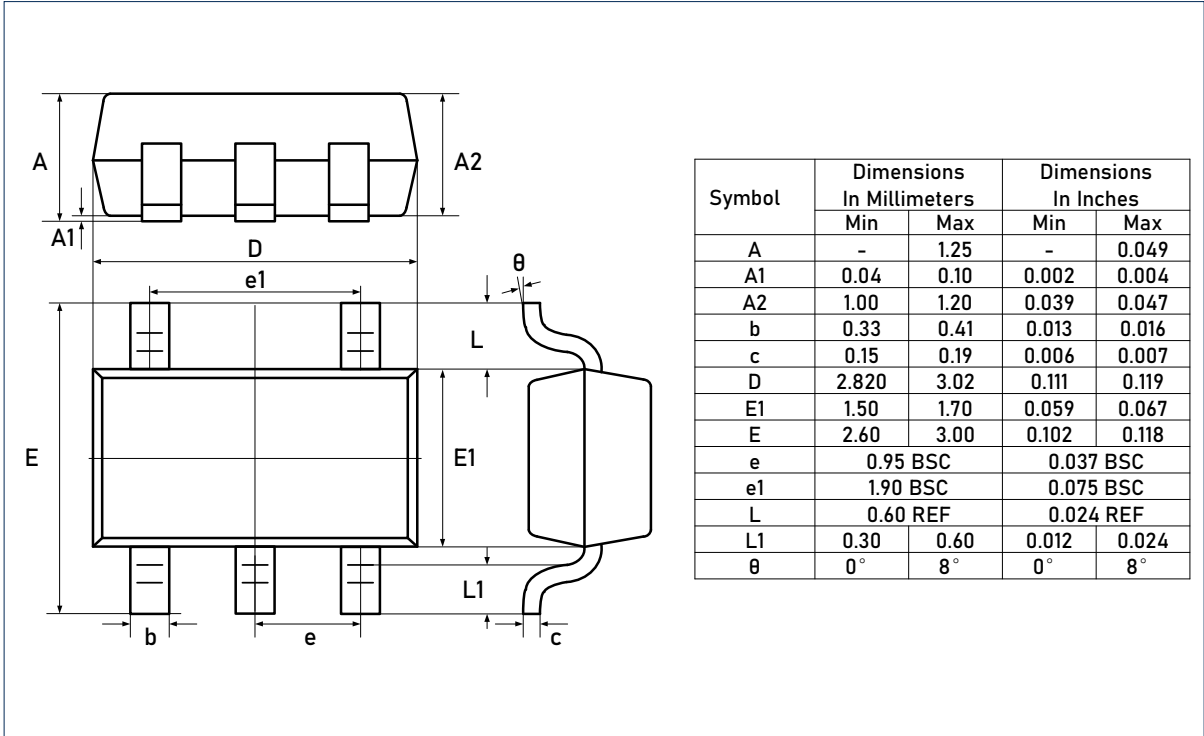


* All dimensions are nominal

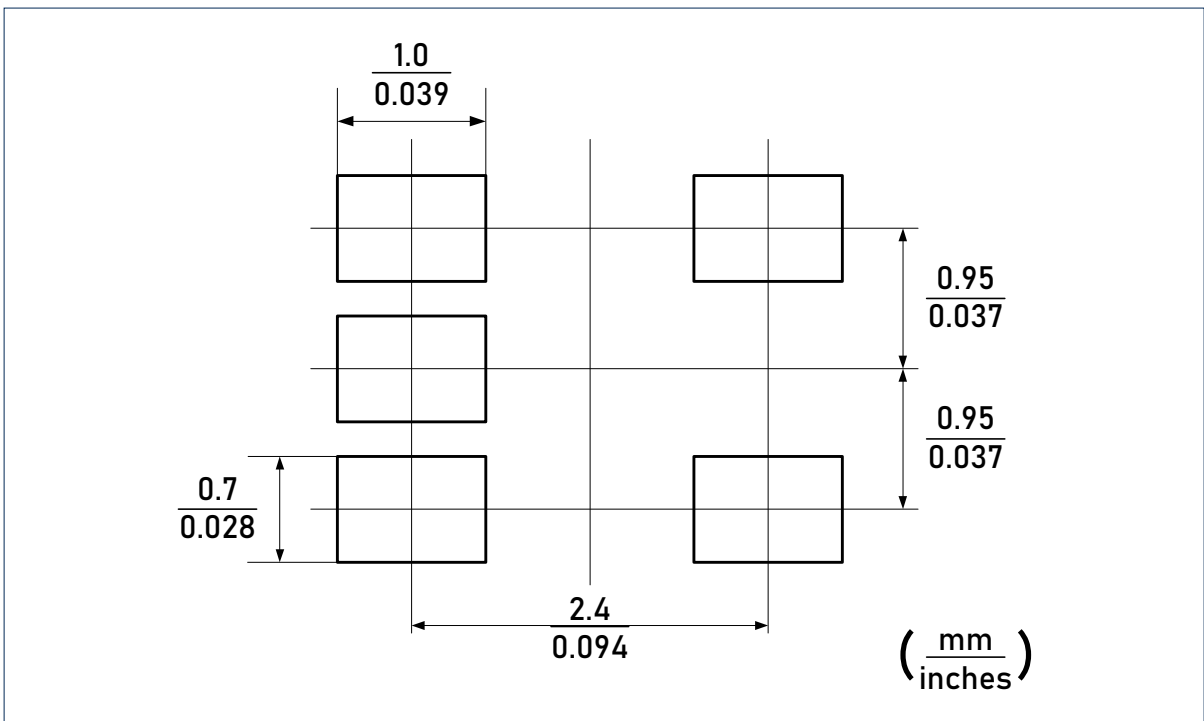
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTA8151XT5/R6	SOT23	5	3 000	178	9.0	3.3	3.2	1.5	4.0	8.0	Q3

Package Outlines

DIMENSIONS, SOT23-5L



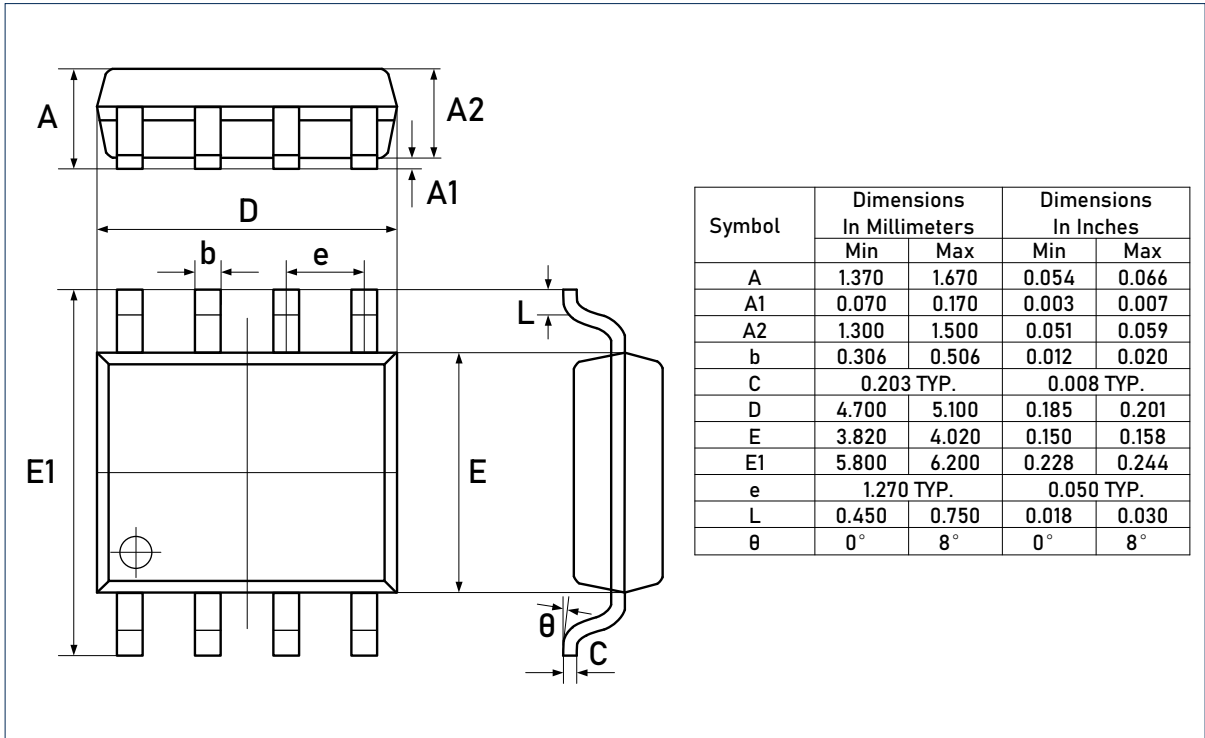
RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L



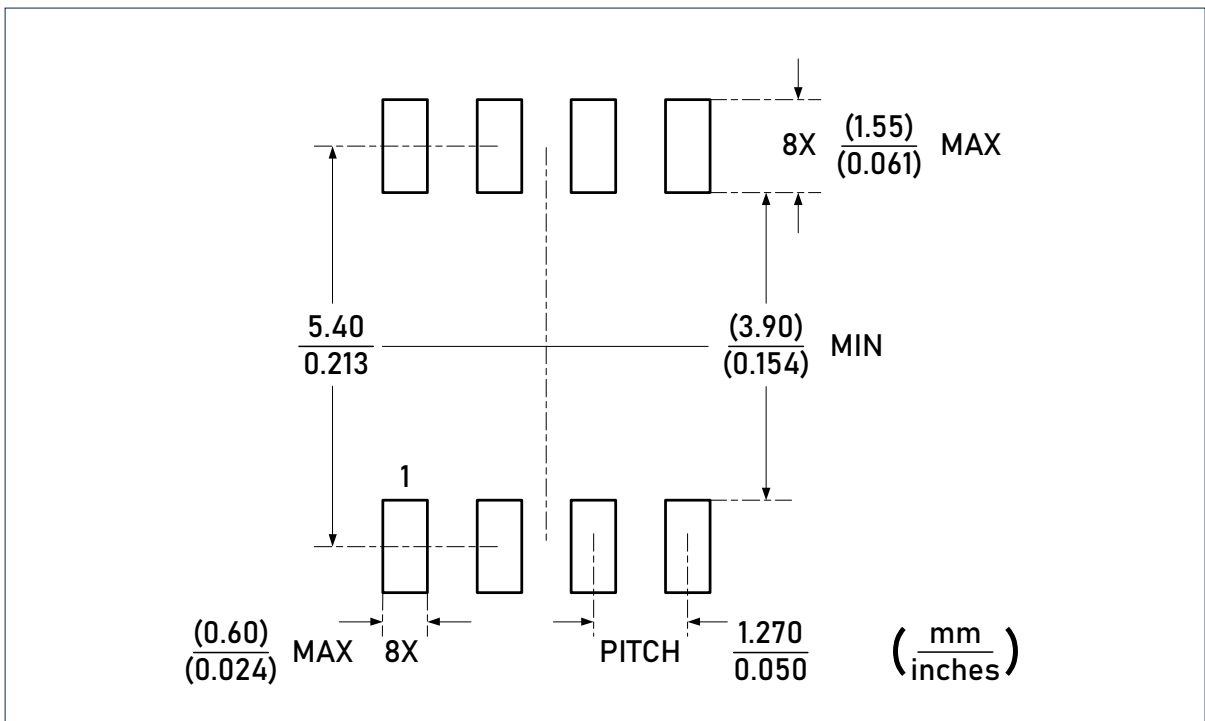
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Package Outlines (continued)

DIMENSIONS, SOIC-8L



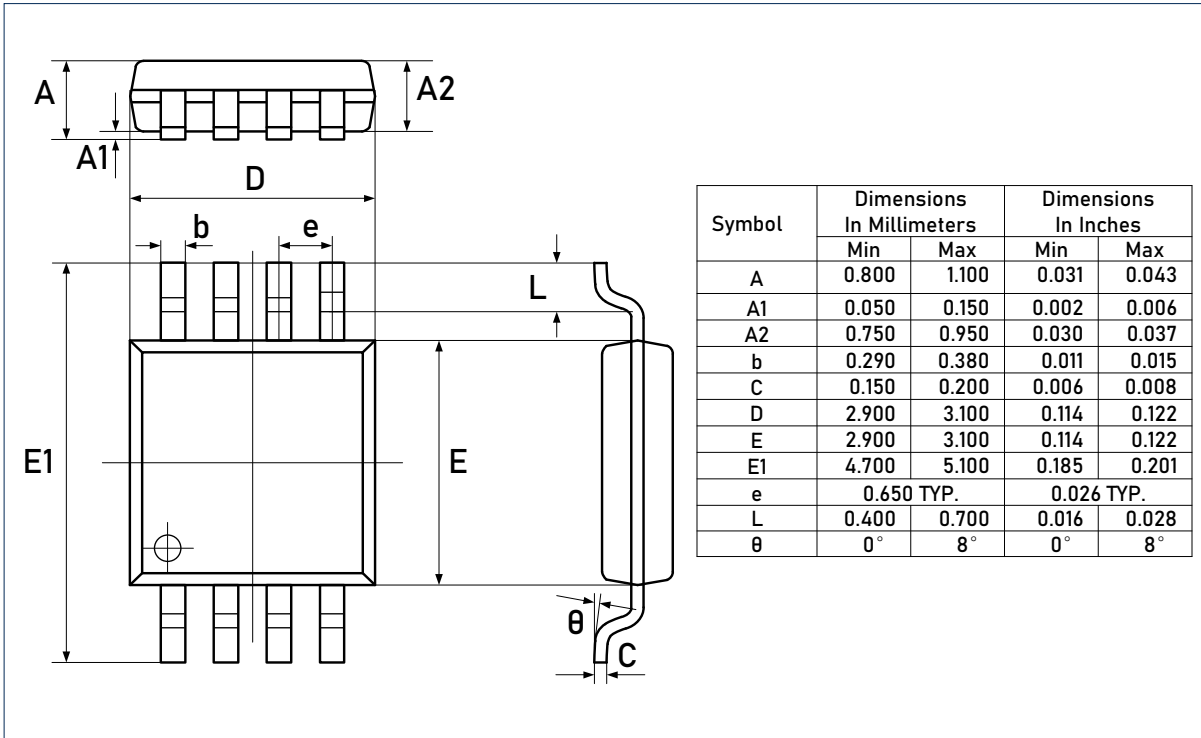
RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L



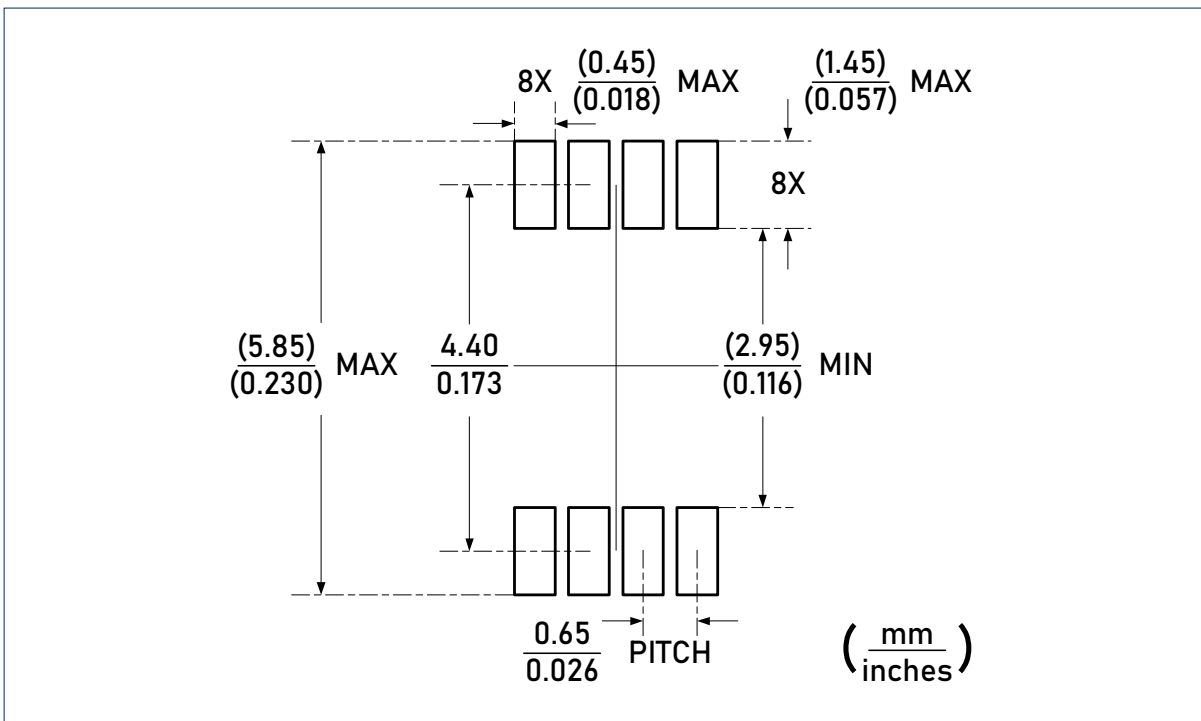
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Package Outlines (continued)

DIMENSIONS, MSOP-8L



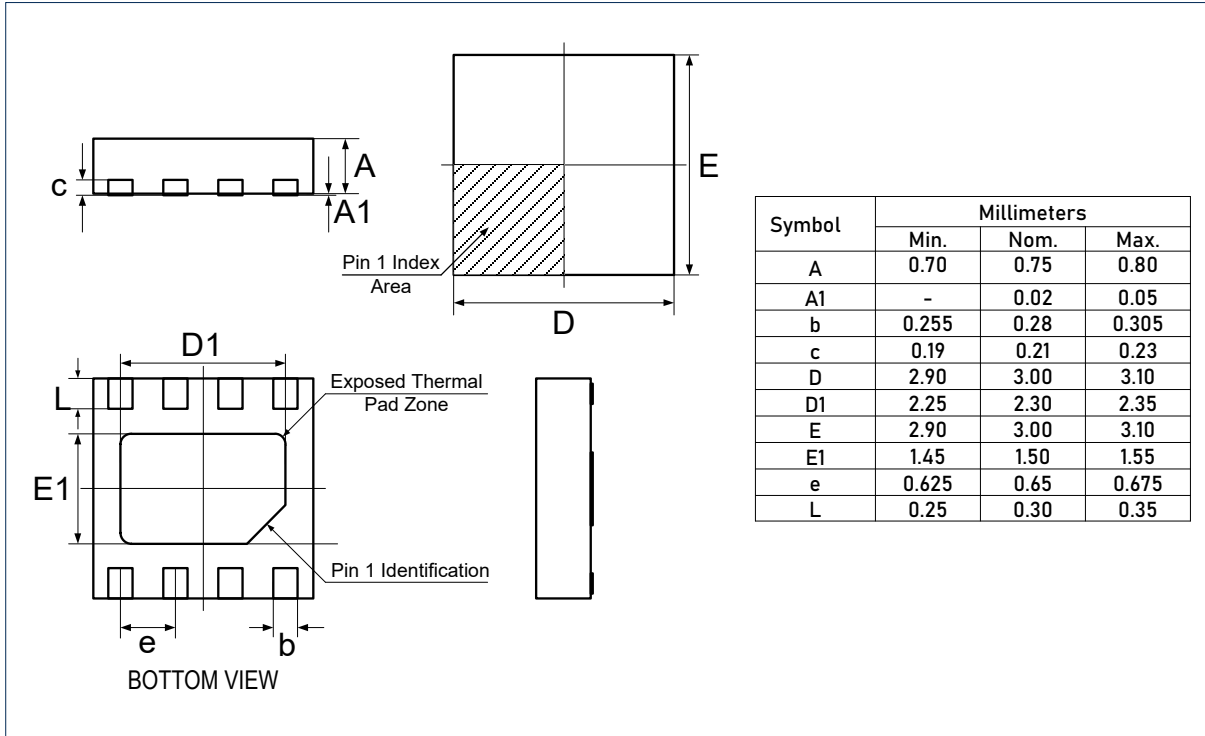
RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



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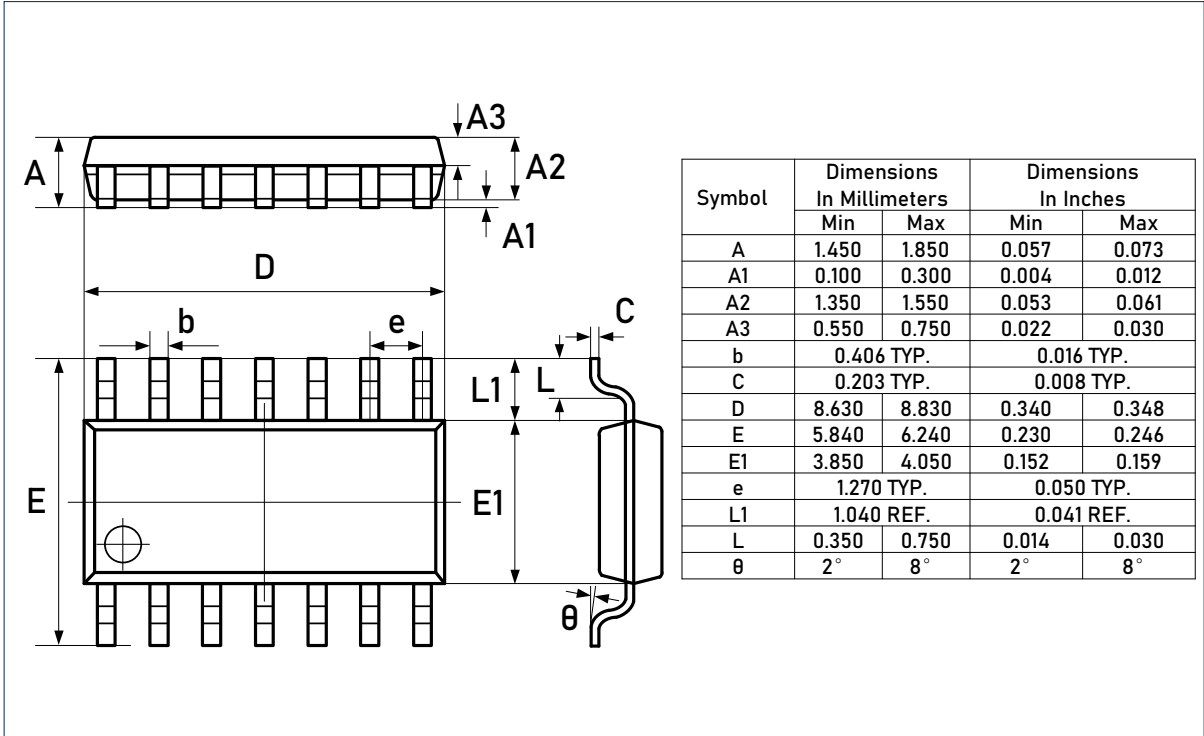
Package Outlines (continued)

DIMENSIONS, DFN3x3-8L

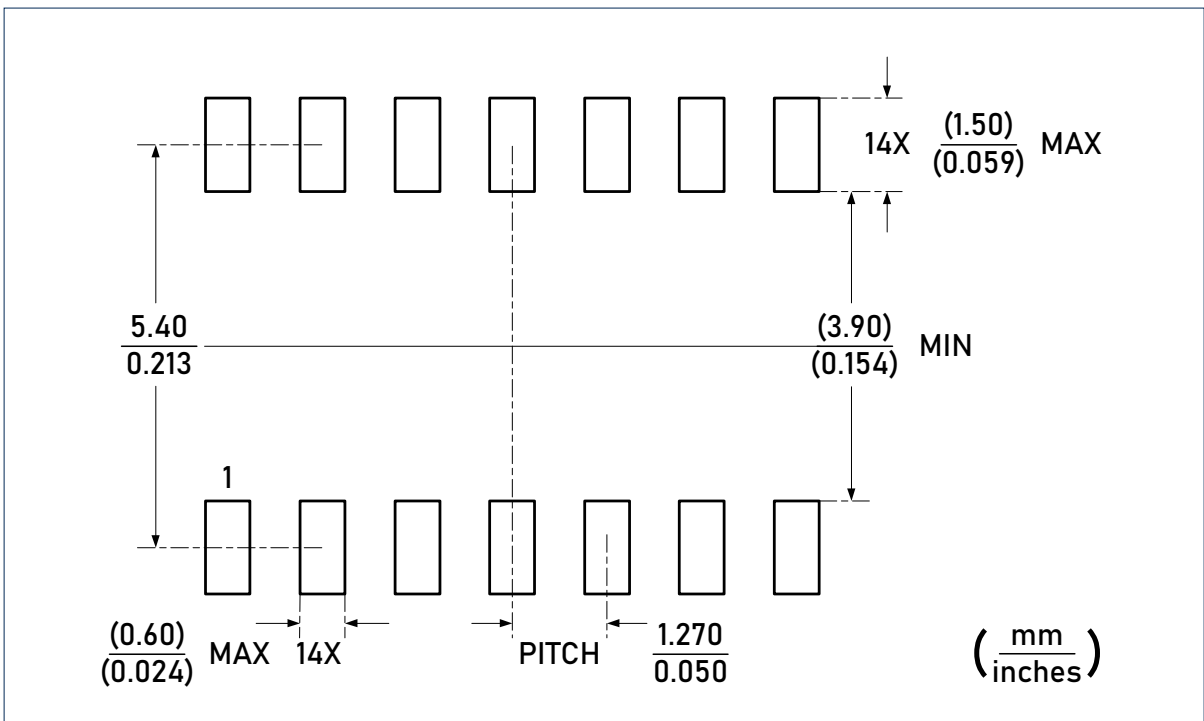


Package Outlines (continued)

DIMENSIONS, SOIC-14L



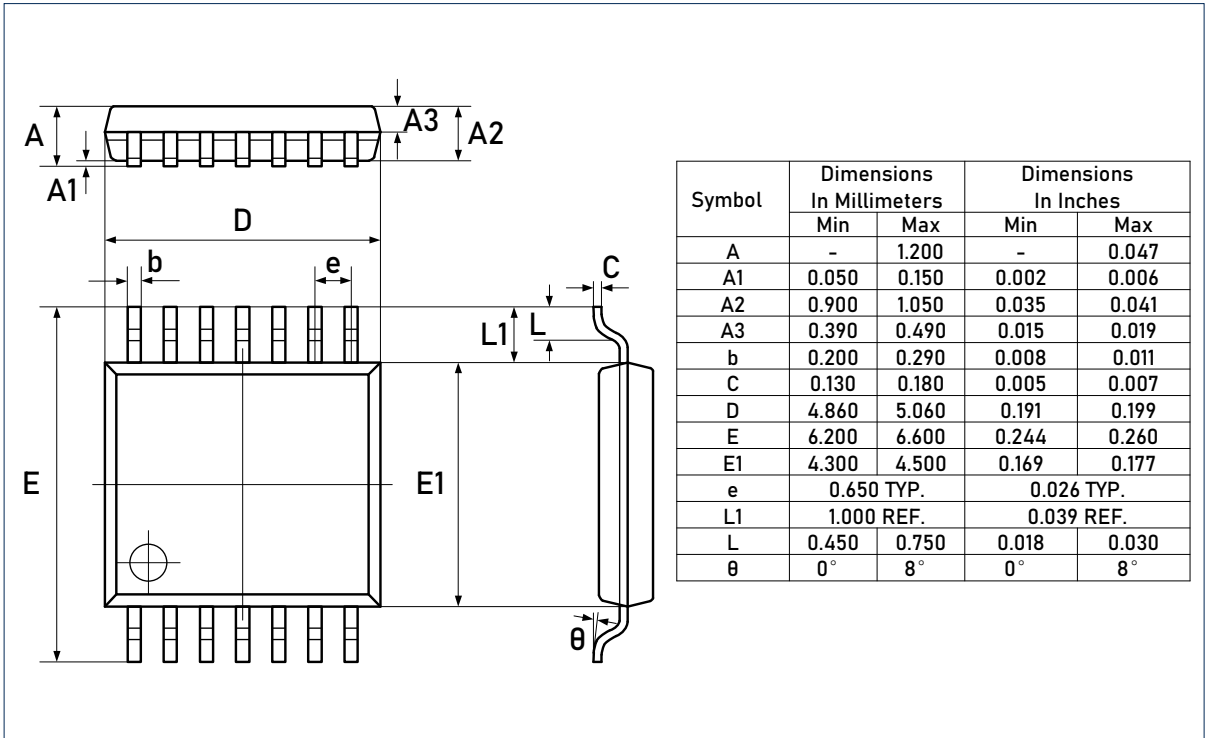
RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



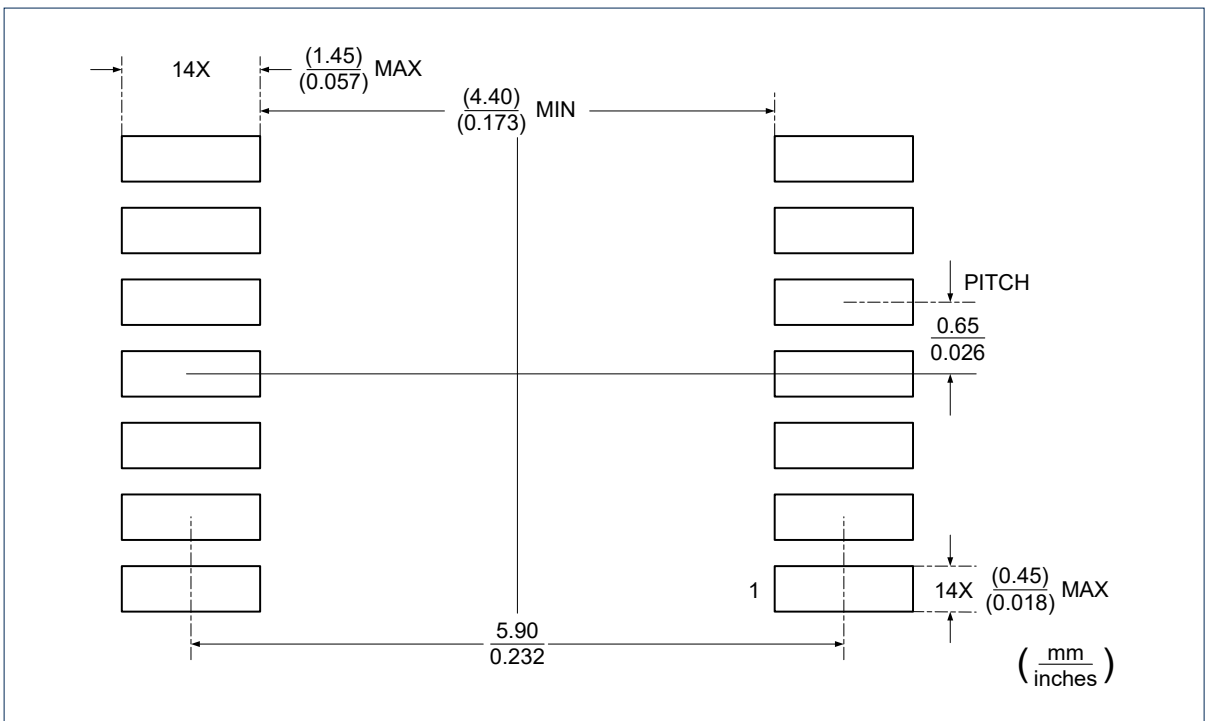
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Package Outlines (continued)

DIMENSIONS, TSSOP-14L



RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L



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