

General Description

The LTA809xHV family (LTA8091HV, LTA8092HV and LTA8094HV) is a new generation of high voltage (48 V), low noise, rail-to-rail precision operational amplifiers. These devices offer outstanding dc precision and ac performance, including low offset, low offset drift, 23.2MHz bandwidth, and 9 nV/ $\sqrt{\text{Hz}}$ input voltage noise density at 10 kHz. Unique features such as differential input-voltage range to the whole supply rail, high slew rate (25 V/ μs) make the LTA809xHV high-performance operational amplifiers for high-voltage industrial and medical applications.

The robust design of the LTA809xHV family provides ease-of-use to the circuit designer: integrated RF/EMI rejection filter, no phase reversal in overdrive conditions, and high electrostatic discharge (ESD) protection. The LTA809xHV are optimized for operation at voltages from +4.5 V (± 2.25 V) to +48 V (± 24 V) over the extended temperature range of -40°C to $+85^\circ\text{C}$.

The LTA8091HV (single) is available in both SOT23-5L and SOIC-8L packages. The LTA8092HV (dual) is offered in SOIC-8L, MSOP-8L and DFN3x3-8L packages. The quad-channel LTA8094HV is offered in both SOIC-14L and TSSOP-14L packages.

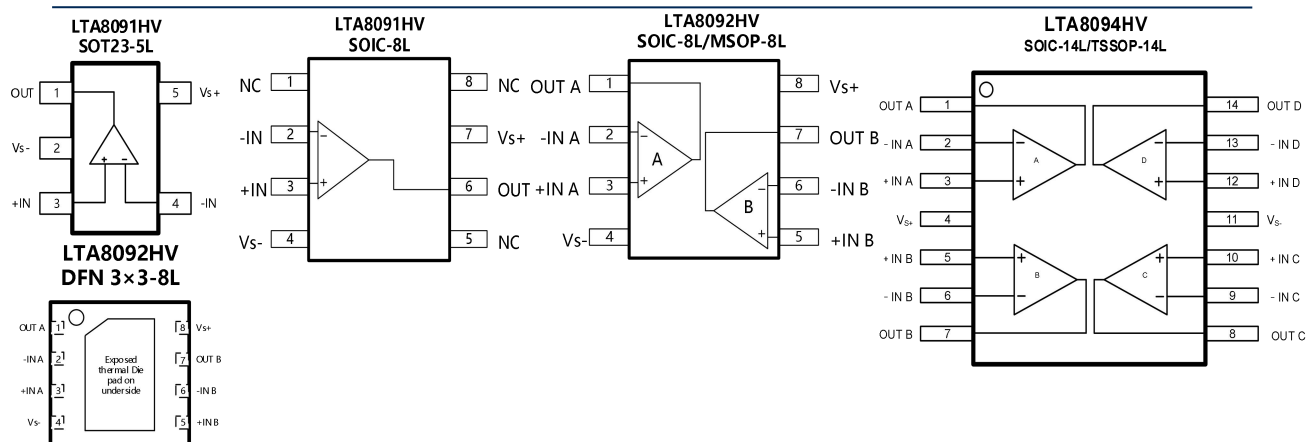
Features and Benefits

- Wide Supply: ± 2.25 V to ± 24 V, 4.5 V to 48 V
- Wide Bandwidth: 23.2 MHz GBW
- High Slew Rate: 25 V/ μs
- Low Noise: 9 nV/ $\sqrt{\text{Hz}}$ at 10 kHz
- Low Offset Voltage: 0.5 mV Maximum at $V_S = 36\text{V}$, $V_{\text{cm}} = 0.0$ to 32.0V
- Low Offset Voltage Drift: 4 $\mu\text{V}/^\circ\text{C}$
- High Common-Mode Rejection: 122 dB
- Input Bias Current: ± 0.08 nA
- EMI/RFI Filtered Inputs

Applications

- High-Side and Low-Side Current Sensing
- Audio Preamplifier
- High Precision Comparator
- Multiplexed Data-Acquisition Systems
- High-Resolution ADC Driver Amplifiers
- SAR ADC Reference Buffers
- Test and Measurement Equipment
- Programmable Logic Controllers

Pin Configuration (Top View)



CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.
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Table of Content

General Description 1

Features and Benefits 1

Applications 1

Pin Configuration (Top View) 1

Table of Content 2

Pin Description 3

Ordering Information 3

Limiting Value 3

ESD Ratings 3

Electrical Characteristics 4

Typical Performance Characteristics 6

Tape and Reel Information 8

Package Outlines 9

Important Notice 15

Pin Description

Symbol	Description
-IN	Inverting input of the amplifier. The voltage range is from V_{S-} to V_{S+} .
+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

Type Number	Package Name	Package Quantity	Eco Class	Marking Code
LTA8091HVT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	V91
LTA8091HVYS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	VH-91
LTA8092HVYS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	VH-92
LTA8092HVVY8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	VH-92
LTA8092HVVYF8/R10	DFN3x3-8L	Tape and Reel, 5 000	Green (RoHS & no Sb/Br)	VH-92
LTA8094HVYS14/R5	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	VH-94
LTA8094HVT14/R6	TSSOP-14L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	VH-94

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 °C 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 ANSI/ESDA/JEDEC JS-001	$\pm 2\,000$	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	$\pm 2\,000$	

Electrical Characteristics

$V_S = 4.5\text{ V to }48\text{ V}$, $T_A = +25\text{ }^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.
 Boldface limits apply over the specified temperature range, $T_A = -40\text{ }^\circ\text{C to }+85\text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
Input offset voltage	V_{OS}	$V_S = 36V, V_{cm} = 0.0 \sim 32.0V$	-0.5		0.5	mV
		$V_S = 36V, V_{cm} = 32.0 \sim 36.0V$	-8		8	
Offset voltage drift	$V_{OS\ TC}$	$T_A = -40\text{ to }+85^{\circ}C$	3	4	4	$\mu V/^{\circ}C$
Power supply rejection ratio	PSRR	$V_S = 6 \sim 48.0V, T_A = 25^{\circ}C$	110		134	dB
		$T_A = -40\text{ to }+85^{\circ}C$	83		134	
INPUT BIAS CURRENT						
Input bias current	I_B	$T_A = 25^{\circ}C$	-0.08		0.08	nA
Input bias current	I_{OS}	$T_A = 25^{\circ}C$	-0.1		0.1	nA
INPUT VOLTAGE						
Common-mode voltage range	V_{CM}	$T_A = 25^{\circ}C$	-0.4		$V_S + 0.3$	V
		$T_A = -40^{\circ}C\text{ to }85^{\circ}C$	-0.4		$V_S + 0.2$	
Common-mode rejection ratio	CMRR	$V_S = 36.0V, T_A = 25^{\circ}C, V_{cm} = 0.0 \sim 32.0V$	113	122		dB
		$T_A = -40\text{ to }+85^{\circ}C$	110			
OPEN-LOOP GAIN						
Open-loop voltage gain	A_{VOL}	$V_S = 36\text{ V}, T_A = 25^{\circ}C$	110	120		dB
		$V_S = 12\text{ V}, T_A = 25^{\circ}C$	110	115		
OUTPUT						
High output voltage swing	V_{OH}	$R_L = 2\text{ k}\Omega$	$V_S - 482$	$V_S - 465$	$V_S - 448$	mV
		$R_L = 10\text{ k}\Omega$	$V_S - 124$	$V_S - 118$	$V_S - 114$	
Low output voltage swing	V_{OL}	$R_L = 2\text{ k}\Omega$	457	467	472	mV
		$R_L = 10\text{ k}\Omega$	109	113	115	
Short-circuit current	I_{Source}		14	17	20	mA
	I_{Sink}		32	35	38	mA
POWER SUPPLY						
Operating supply voltage	V_S	$T_A = 25^{\circ}C$	4.5		48	V
		$T_A = -40\text{ to }+85^{\circ}C$	6.0		48	
Quiescent current (per amplifier)	I_Q	$V_S = 5\text{ V}, T_A = 25^{\circ}C$		2.6		mA
		$V_S = 5\text{ V}, T_A = -40\text{ to }+85^{\circ}C$		4.3		
		$V_S = 40\text{ V}, T_A = 25^{\circ}C$		3.1		
		$V_S = 40\text{ V}, T_A = -40\text{ to }+85^{\circ}C$		5.3		
FREQUENCY RESPONSE						
Gain bandwidth product	GBW	$V_S = 48V$		23.2		MHz
Total harmonic distortion	THD	$f = 1\text{ kHz}, V_0 = 3.5\text{ V}_{rms}$		112		dB
Slew rate	SR	$V_S = 2V_{pp}$				$V/\mu s$
		SR+		25		
		SR-		-29		

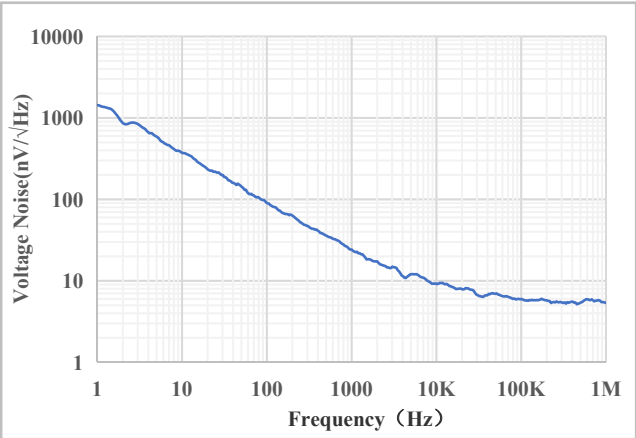
Electrical Characteristics (continued)

$V_S = 4.5\text{ V to }48\text{ V}$, $T_A = +25\text{ }^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.
Boldface limits apply over the specified temperature range, $T_A = -40\text{ }^\circ\text{C to }+85\text{ }^\circ\text{C}$.

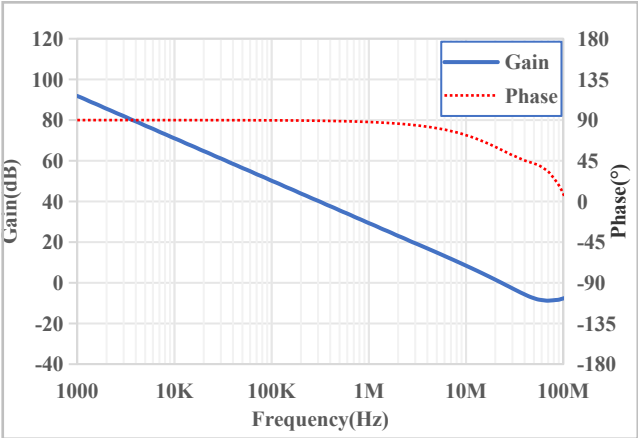
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Settling time	t_s	To 0.1%, $V_S=40\text{V}$, $G=+1,5\text{V step}$		0.5		μs
		To 0.01%, $V_S=40\text{V}$, $G=+1,5\text{V step}$		1		
Overload recovery time	t_{OR}	$V_{IN} \times \text{Gain} > V_S$		0.1		μs
NOISE						
Input voltage noise	V_n	$f = 0.1\text{-}10\text{Hz}$		18		μV_{P-P}
Input voltage noisedensity	e_n	$f = 1\text{kHz}$		22		$\text{nV}/\sqrt{\text{Hz}}$
		$f = 10\text{kHz}$		9		
Input current noise density	I_n	$f = 1\text{kHz}$		34		$\text{fA}/\sqrt{\text{Hz}}$
THERMAL CHARACTERISTICS						
Operating temperature range	T_A		-40		+85	$^\circ\text{C}$
Package Thermal Resistance	θ_{JA}	SOT23-5L		190		$^\circ\text{C}/\text{W}$
		MSOP-8L		201		
		DFN3x3-8L		94		
		SOIC-8L		125		
		TSSOP-14L		112		
		SOIC-14L		115		

Typical Performance Characteristics

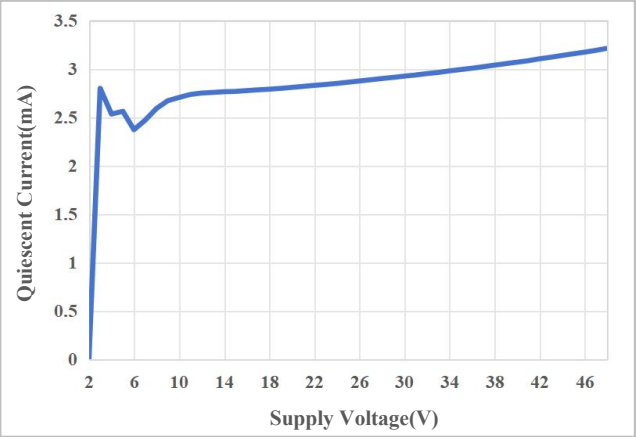
At $T_A = +25^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



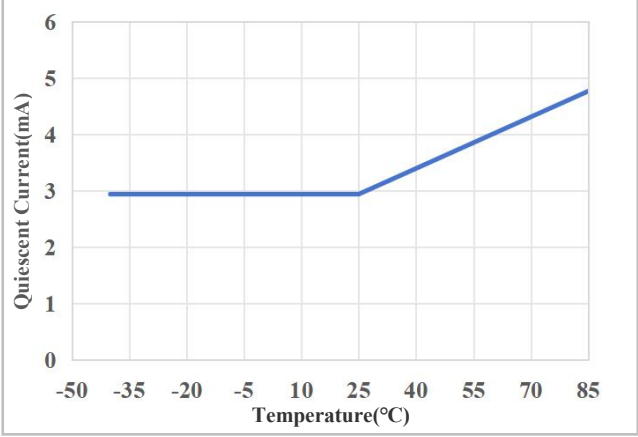
Input Voltage Noise Spectral Density as a function of Frequency



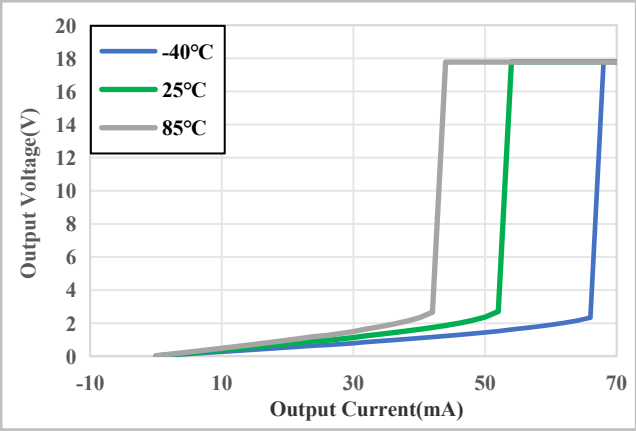
Open-loop Gain and Phase as a function of Frequency



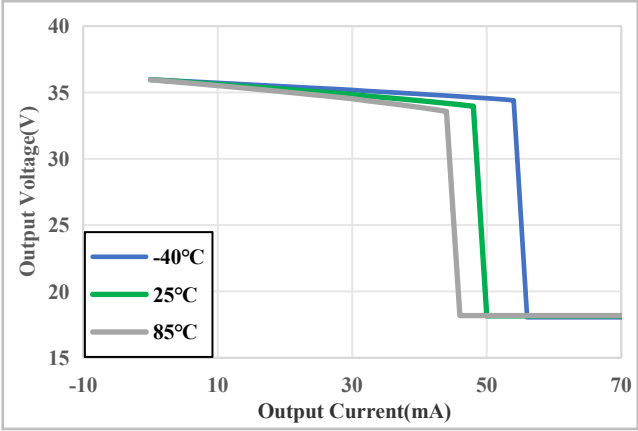
Quiescent Current as a function of Supply Voltage



Quiescent Current as a function of Temperature ($V_S=30\text{V}$)



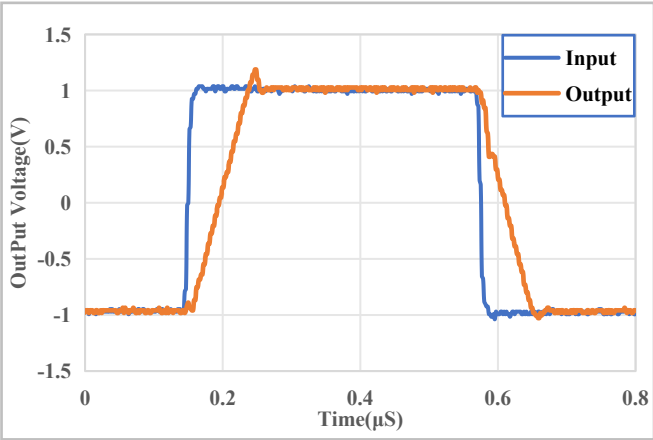
Output Voltage Swing as a function of Output Current ($V_S=36\text{V}$)



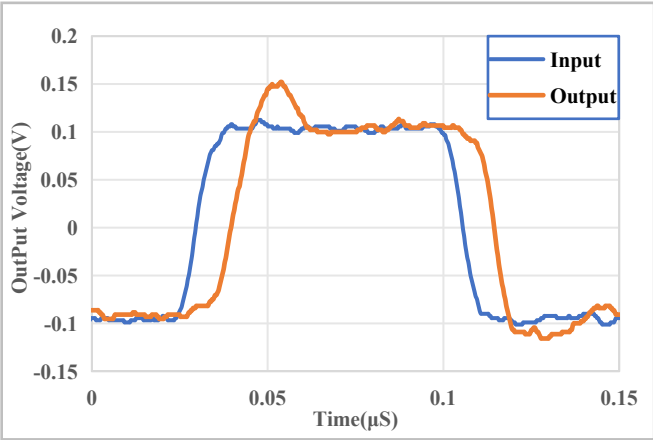
Output Voltage Swing as a function of Output Current ($V_S=36\text{V}$)

Typical Performance Characteristics (continued)

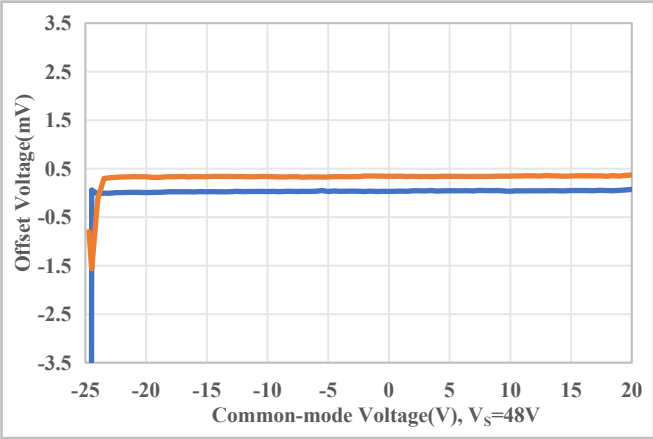
At $T_A = +25^{\circ}\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



Large-Signal Step Response



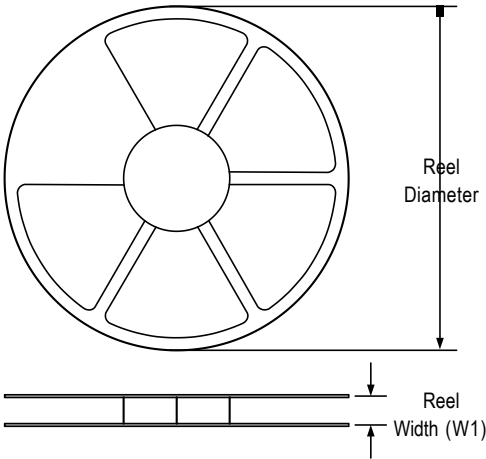
Small-Signal Step Response



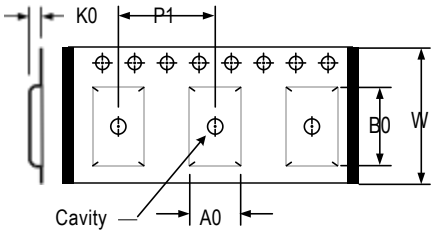
Common-mode Voltage vs Offset Voltage

Tape and Reel Information

REEL DIMENSIONS

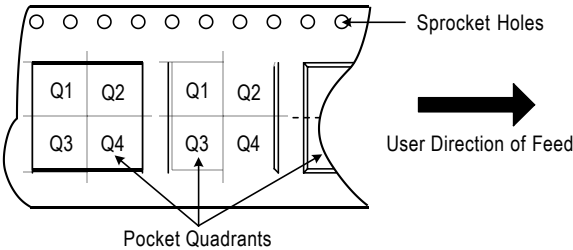


TAPE DIMENSIONS



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

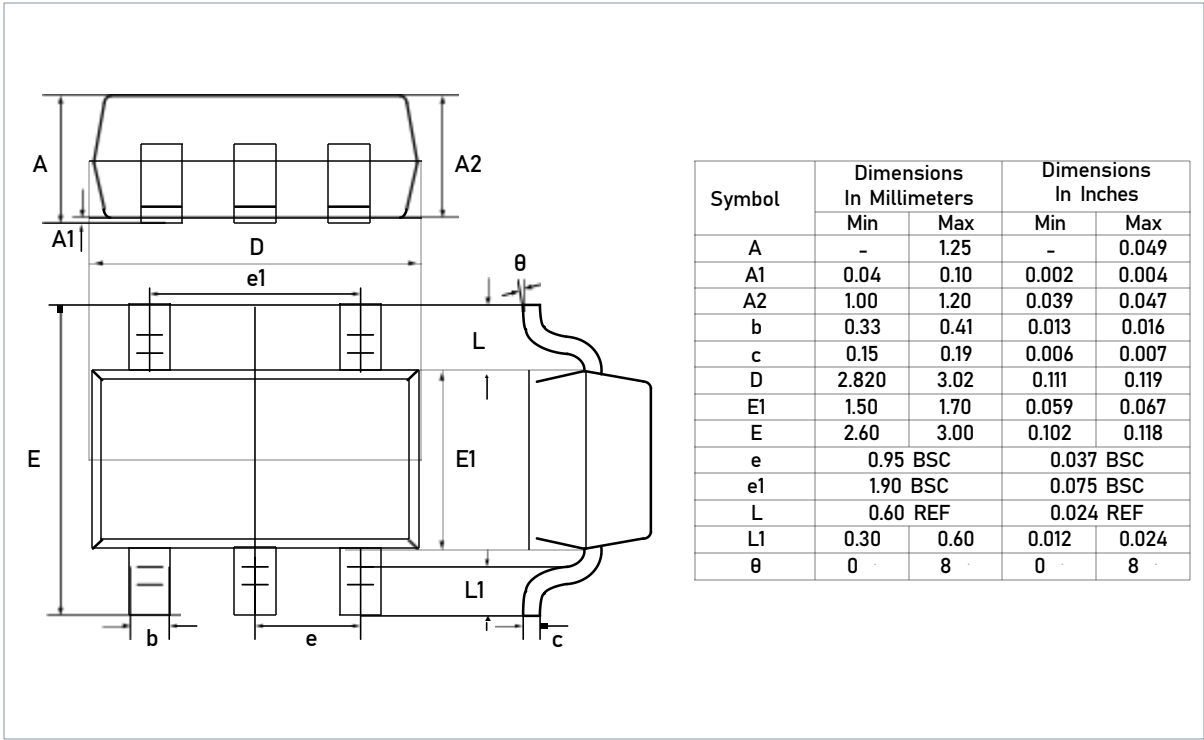


* All dimensions are nominal

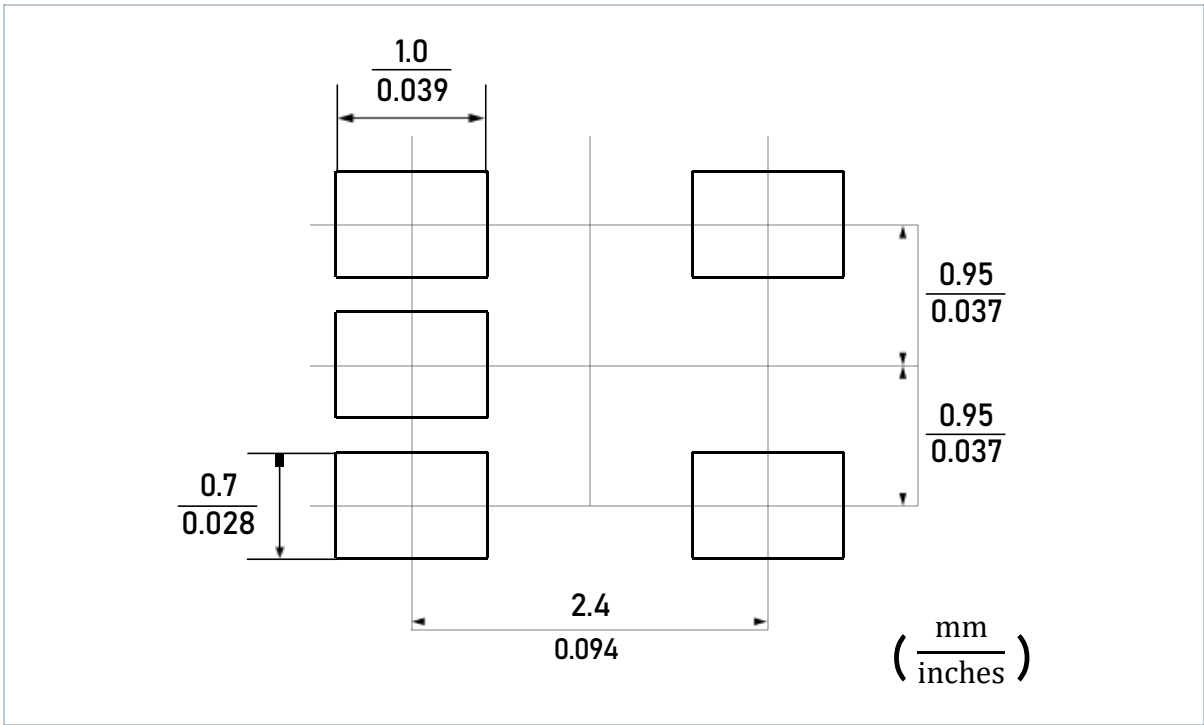
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTA8091HVT5/R6	SOT23	5	3 000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTA8091HVYS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA8092HVYS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA8092HVV8/R6	MSOP	8	3 000	330	12.5	5.0	3.5	2.0	8.0	12.0	Q1
LTA8092HVV8/R10	DFN3x3	8	5 000	330	12.5	3.3	3.3	1.1	8.0	12.0	Q1
LTA8094HVYS14/R5	SOIC	14	2 500	330	16.5	6.5	9.5	2.0	8.0	16.0	Q1
LTA8094HVT14/R6	TSSOP	14	3 000	330	16.5	6.9	5.5	1.3	8.0	16.0	Q1

Package Outlines

DIMENSIONS, SOT23-5L

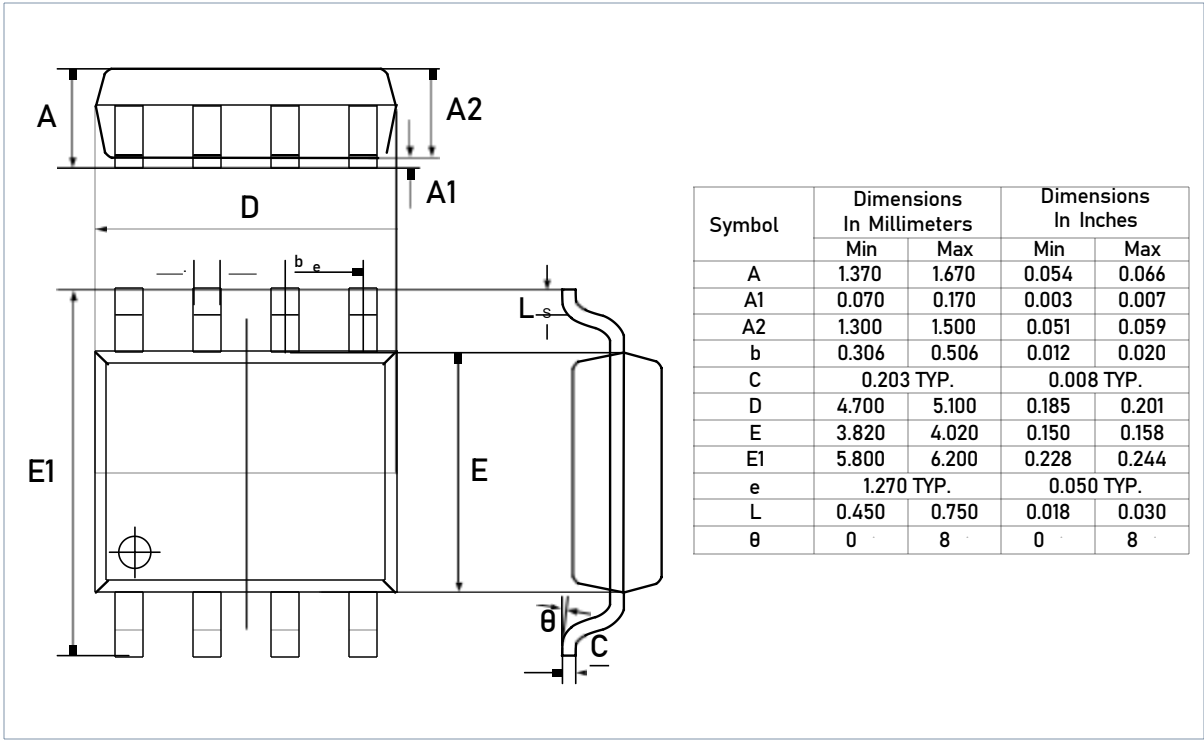


RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L

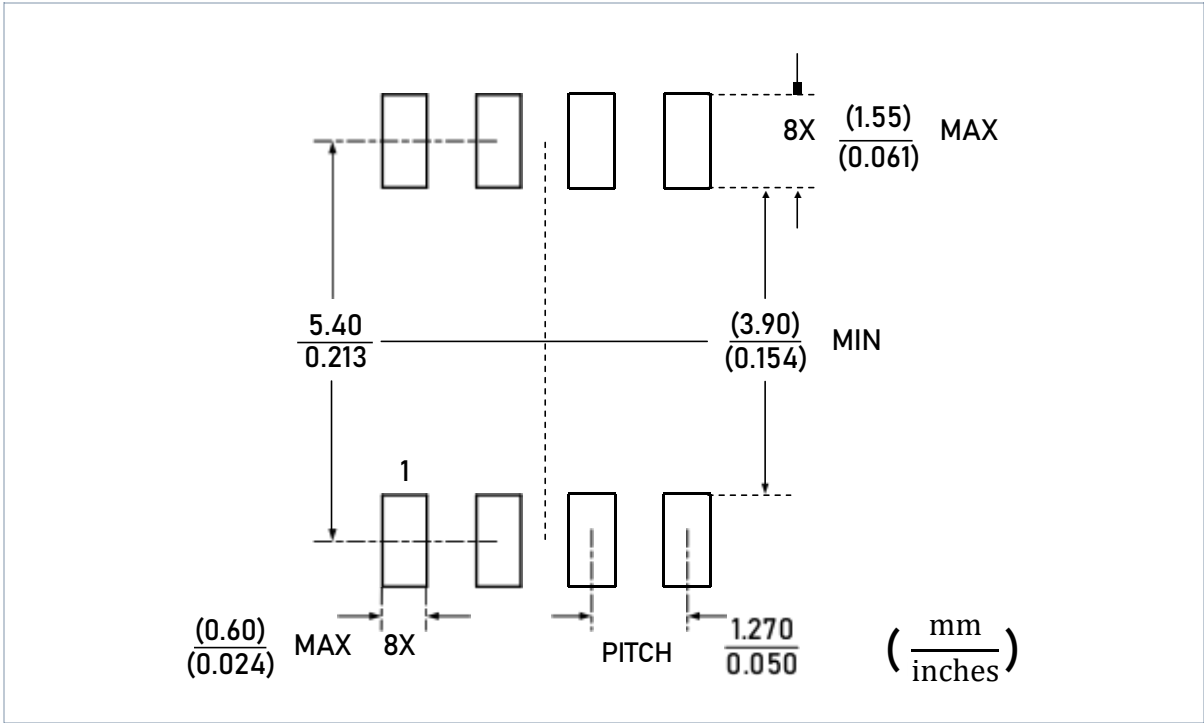


Package Outlines (continued)

DIMENSIONS, SOIC-8L

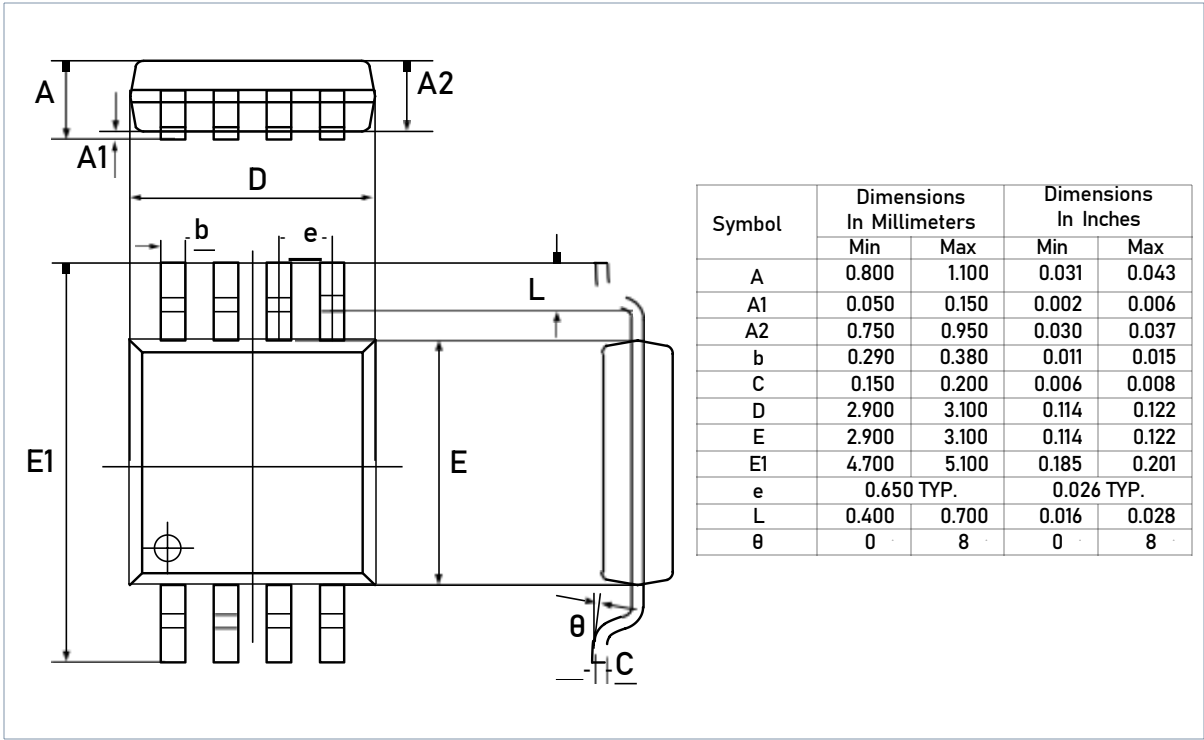


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

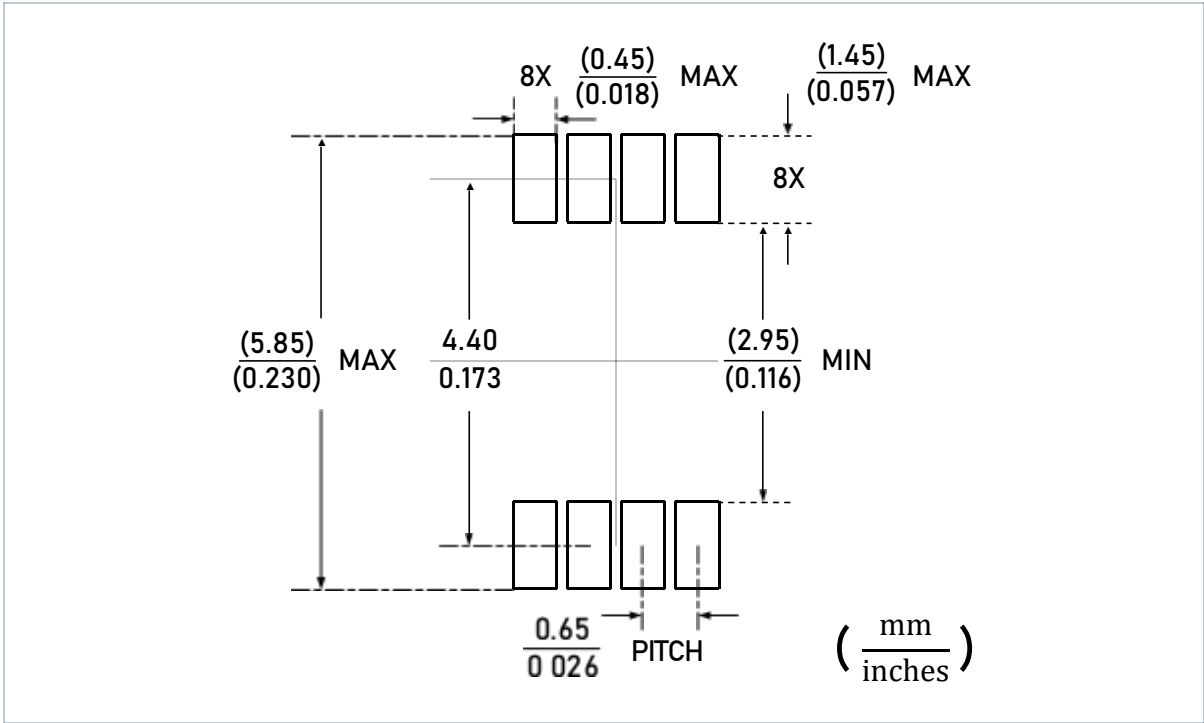


Package Outlines (continued)

DIMENSIONS, MSOP-8L



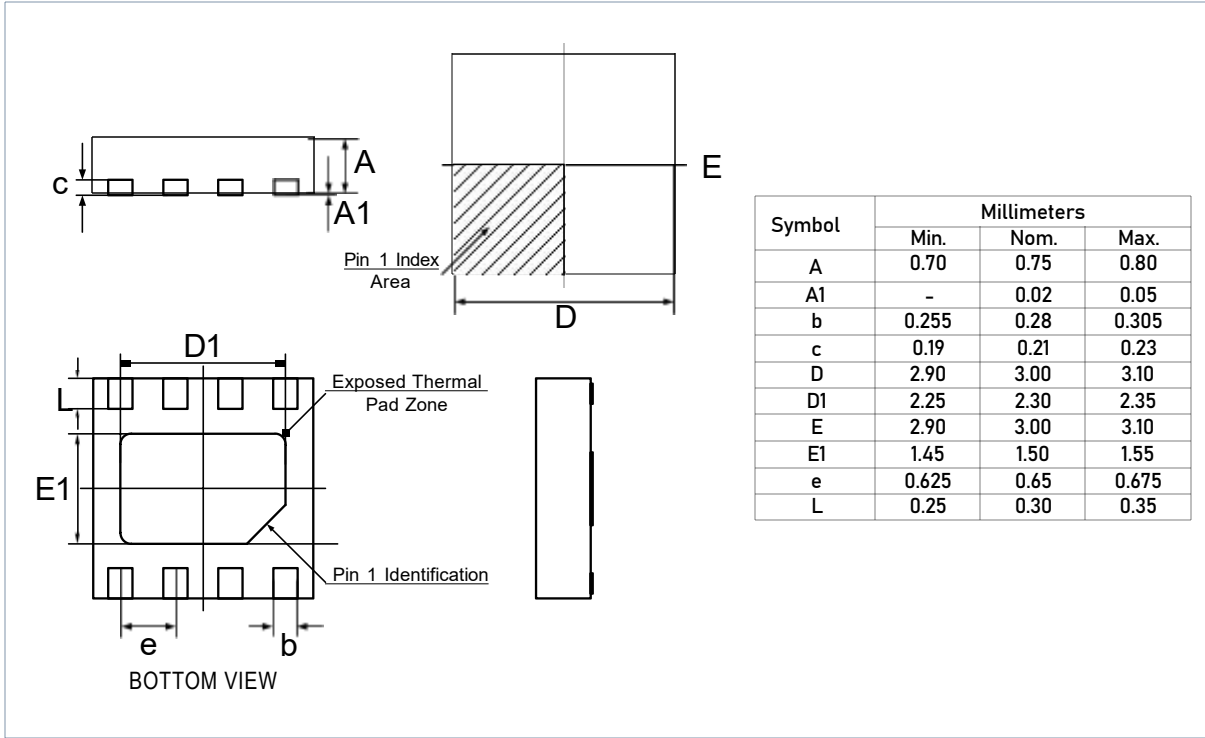
RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



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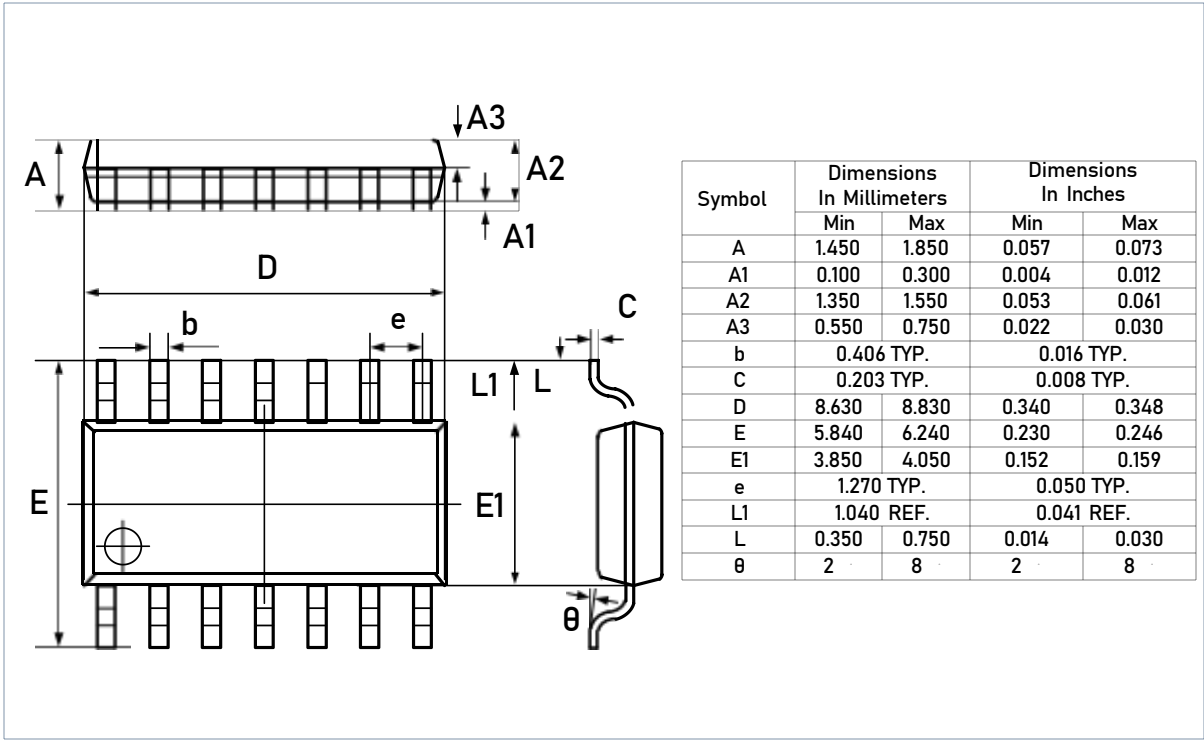
Package Outlines (continued)

DIMENSIONS, DFN3x3-8L

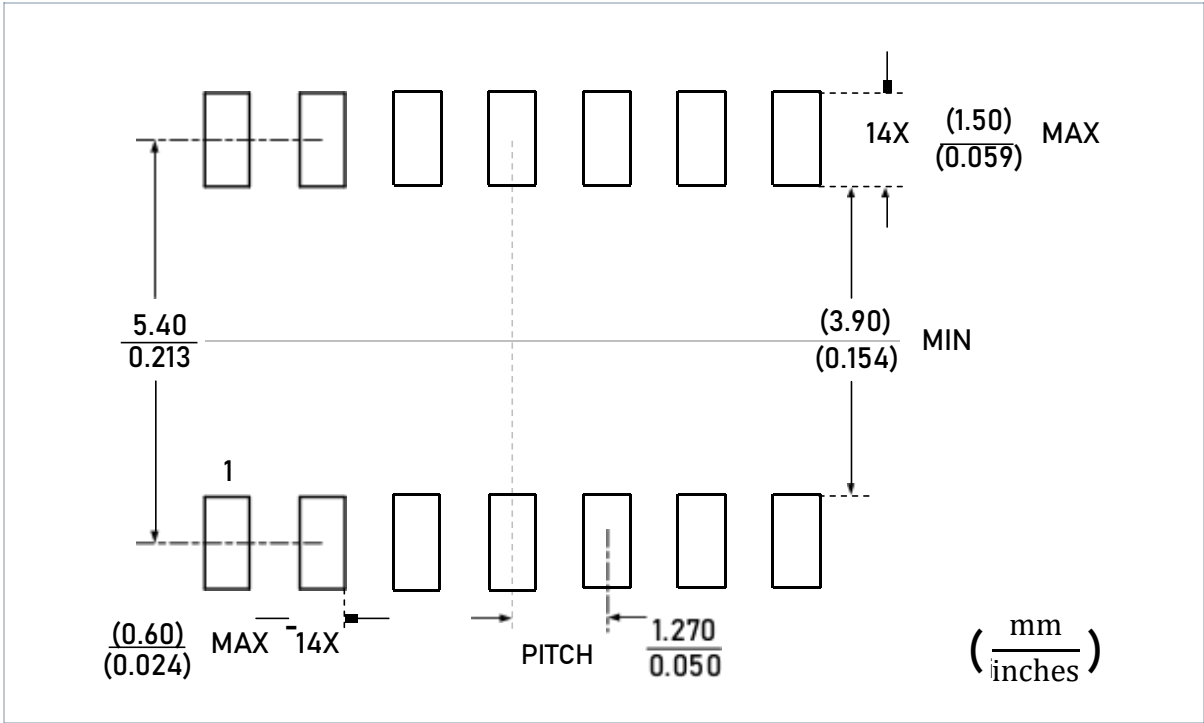


Package Outlines (continued)

DIMENSIONS, SOIC-14L



RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L

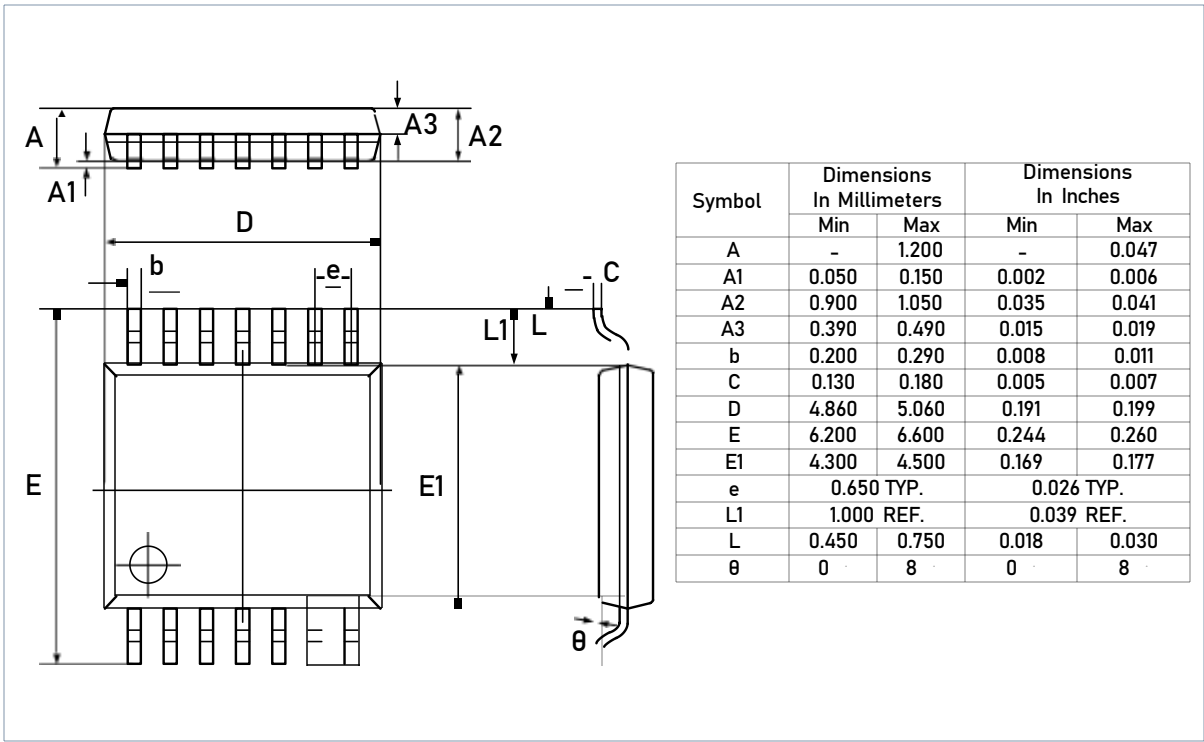


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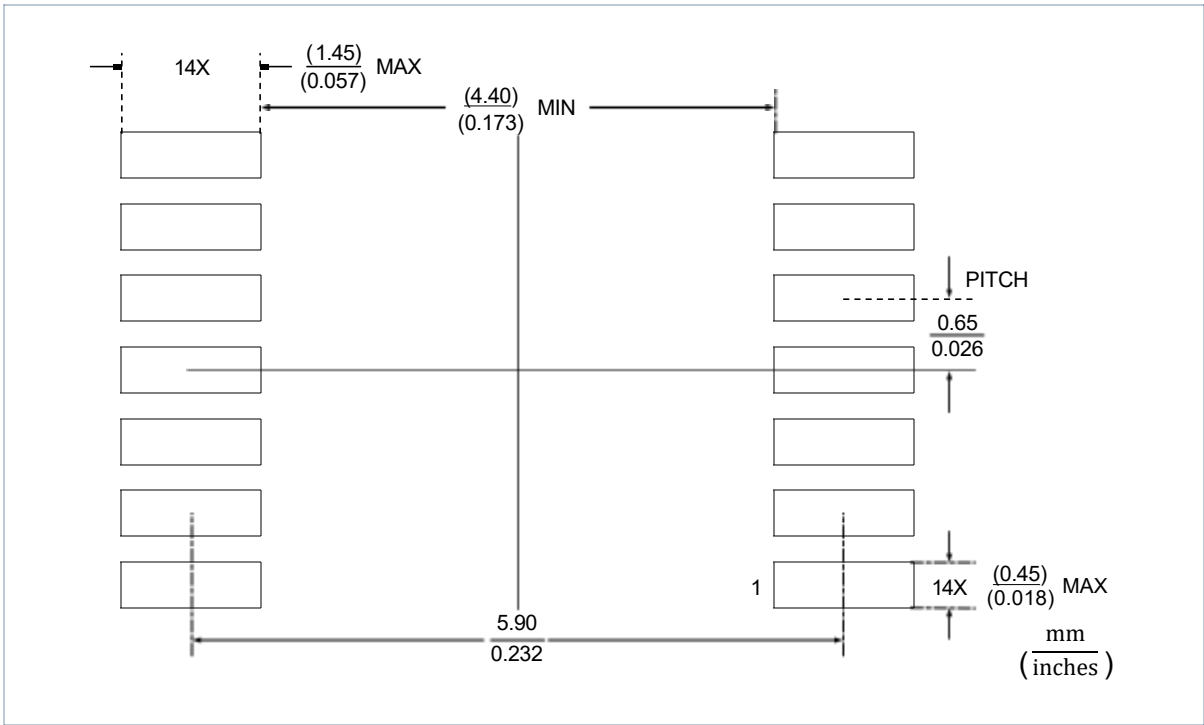


Package Outlines (continued)

DIMENSIONS, TSSOP-14L



RECOMMENDED SOLDERING FOOTPRINT, TSSOP-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 (industrial 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.

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