

General Description

The LTA8291, LTA8292 and LTA8294 (LTA829x) are a family of low power, 48 V wide supply voltage, low noise, rail-to-rail output operational amplifiers capable of operating on supplies ranging from +4.5 V (± 2.25 V) to +48 V (± 24 V). This new generation of high-voltage CMOS operational amplifiers, in conjunction with the LTA828x, LTA827x and LTA826x, provide a family of bandwidth, noise, and power options to meet the needs of a wide variety of applications. The LTA829x devices offer outstanding dc precision and ac performance, including low offset (± 1.8 mV maximum), low offset drift (± 2 μ V/ $^{\circ}$ C typically), 22 MHz bandwidth, and 4 nV/ $\sqrt{\text{Hz}}$ input voltage noise density at 10 kHz. Unique features such as differential input-voltage range to the negative supply rail, high output current (± 45 mA), high capacitive load drive of up to 1 nF, and high slew rate (20 V/ μ s) make the LTA829x high-performance operational amplifiers for high-voltage industrial applications.

The robust design of the LTA829x family provides ease-of-use to the circuit designer: integrated RF/EMI rejection filter, no phase reversal in overdrive conditions, and high electro-static discharge (ESD) protection. The LTA829x 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 $^{\circ}$ C to $+125$ $^{\circ}$ C.

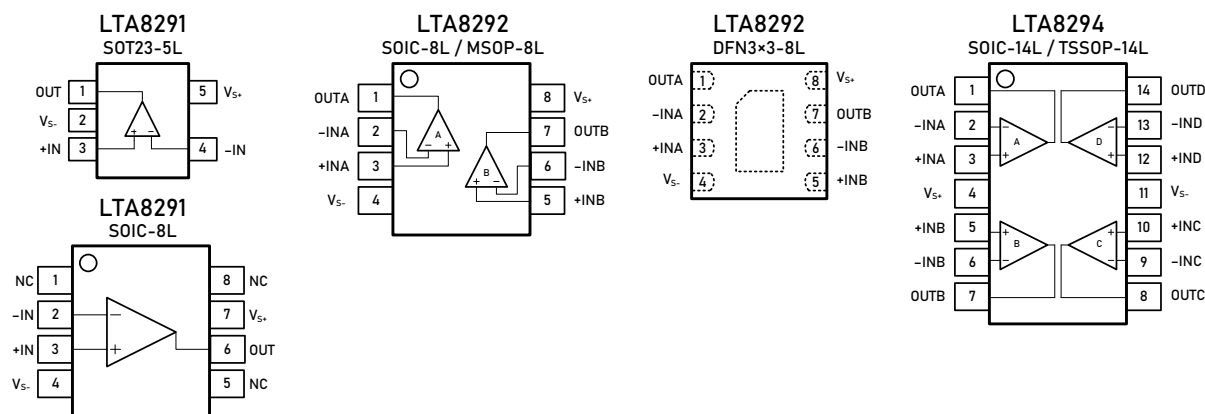
Features and Benefits

- Wide Supply: ± 2.25 V to ± 24 V, 4.5 V to 48 V
- Wide Bandwidth: 22 MHz GBW
- High Slew Rate: 20 V/ μ s
- Low Noise: 4 nV/ $\sqrt{\text{Hz}}$ at 10 kHz
- Low Offset Voltage: ± 1.8 mV Maximum
- Low Offset Voltage Drift: ± 2 μ V/ $^{\circ}$ C
- High Common-Mode Rejection: 115 dB
- Low Bias Current: ± 10 pA
- 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)



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

Type Number	Package Name	Package Quantity	Eco Class	Marking Code
LTA8291XT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	H91
LTA8291XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	HV-91
LTA8292XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	HV-92
LTA8292XV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	HV92
LTA8292XF8/R10	DFN3x3-8L	Tape and Reel, 5 000	Green (RoHS & no Sb/Br)	HV92
LTA8294XS14/R5	SOIC-14L	Tape and Reel, 2 500	Green (RoHS & no Sb/Br)	HV-94
LTA8294XT14/R6	TSSOP-14L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	HV-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	2 000	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	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, $T_A = -40\text{ }^\circ\text{C to }+125\text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
Input offset voltage	V _{OS}			±0.5	±1.8	mV
Offset voltage drift	V _{OS} TC	T _A = −40 to +125 °C		±2		μV/°C
Power supply rejection ratio	PSRR	V _S = 4.5 to 48 V, V _{CM} = 0.1 V		5		μV/V
		T _A = −40 to +125 °C		10		
INPUT BIAS CURRENT						
Input bias current	I _B			10		pA
		T _A = −40 to +85 °C		150		
		T _A = −40 to +125 °C		600		
Input offset current	I _{OS}			5		pA
NOISE						
Input voltage noise	V _n	f = 0.1 to 10 Hz		3.6		μV _{P-P}
Input voltage noise density	e _n	f = 1 kHz		8		nV/√Hz
		f = 10 kHz		4		
Input current noise density	I _n	f = 1 kHz		5		fA/√Hz
INPUT VOLTAGE						
Common-mode voltage range	V _{CM}		V _{S-}		V _{S+} −1.5	V
Common-mode rejection ratio	CMRR	V _S = 40 V, V _{CM} = 0 to 38 V		115		dB
		V _{CM} = 0.1 to 38 V, T _A = −40 to +125 °C		102		
		V _S = 5 V, V _{CM} = 0 to 3 V		95		
		V _{CM} = 0.1 to 3 V, T _A = −40 to +125 °C		83		
INPUT IMPEDANCE						
Input capacitance	C _{IN}	Differential		2		pF
		Common mode		3.5		
OPEN-LOOP GAIN						
Open-loop voltage gain	A _{VOL}	V _S = 40 V, V _O = 0.1 to 39.9 V		126		dB
		T _A = −40 to +125 °C		118		
		V _S = 5 V, V _O = 0.1 to 4.9 V		116		
		T _A = −40 to +125 °C		108		
FREQUENCY RESPONSE						
Gain bandwidth product	GBW			22		MHz
Slew rate	SR	V _S = 40 V, G = +1, 10 V step		20		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		0.9		μs
		To 0.01%, V _S = 40 V, G = +1, 5 V step		2		
Overload recovery time	t _{OR}	V _{IN} × Gain > V _S		0.3		μs

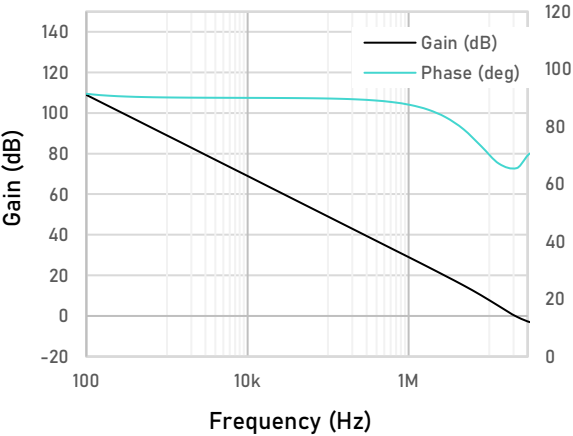
Electrical Characteristics (continued)

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

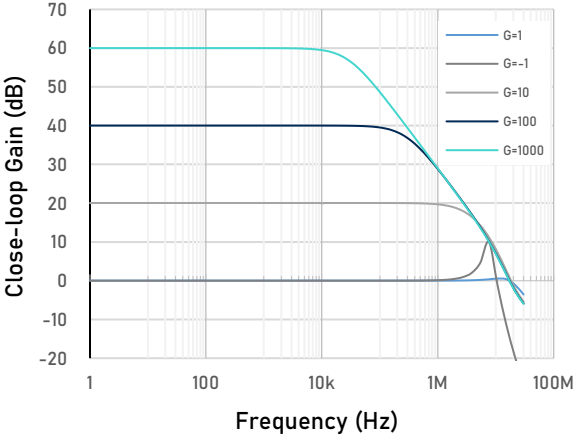
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OUTPUT						
High output voltage swing	V _{OH}	V _S = ±20 V, R _L = 10 kΩ		V _{S+} -95		mV
		V _S = ±20 V, R _L = 2 kΩ		V _{S+} -260		
Low output voltage swing	V _{OL}	V _S = ±20 V, R _L = 10 kΩ		V _{S-} +55		mV
		V _S = ±20 V, R _L = 2 kΩ		V _{S-} +240		
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		4.2		mA
		V _S = 40 V		7.1		
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		
		DFN3x3-8L		94		

Typical Performance Characteristics

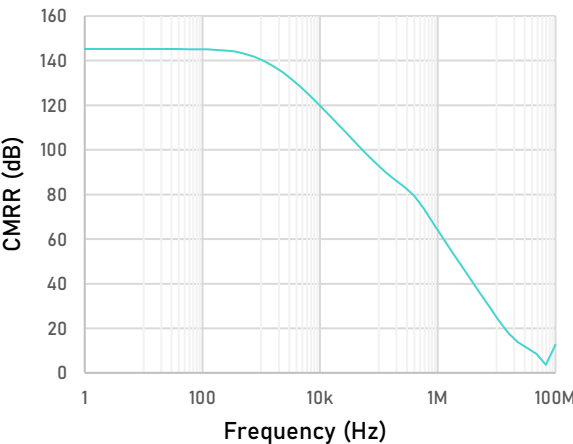
At $T_A = +25\text{ }^{\circ}\text{C}$, $V_{CM} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



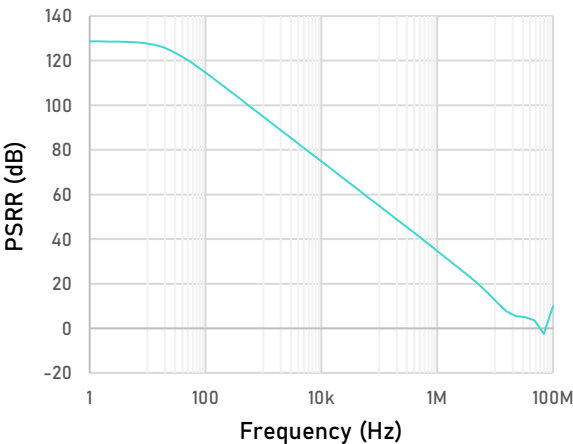
Open-loop Gain and Phase as a function of Frequency



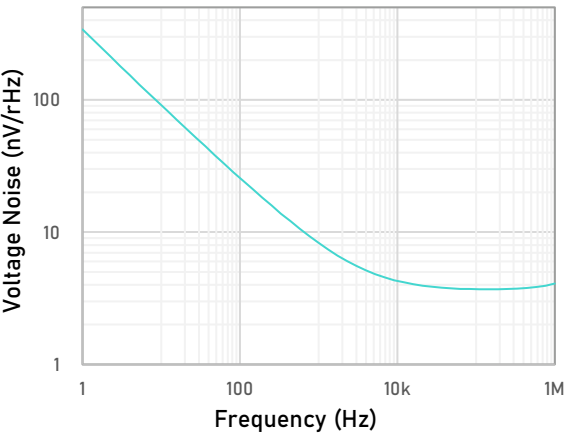
Close-loop Gain as a function of Frequency



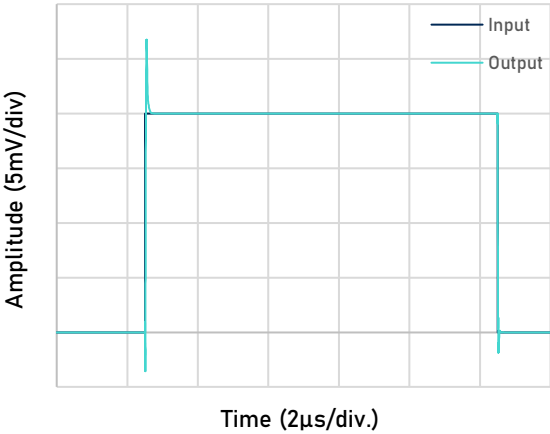
CMRR as a function of Frequency



PSRR as a function of Frequency



Input Voltage Noise Spectral Density as a function of Frequency



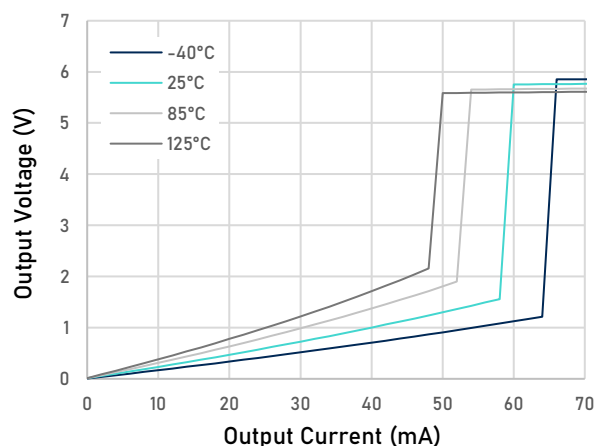
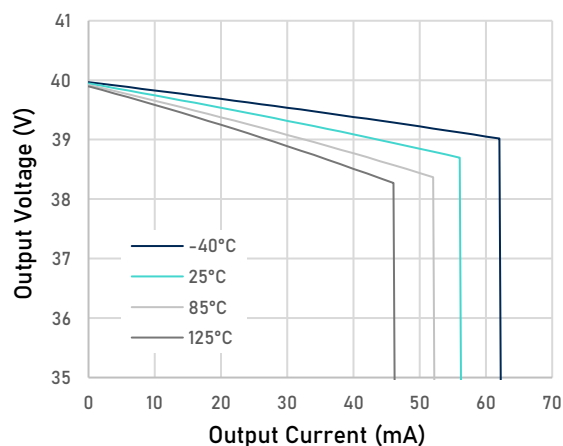
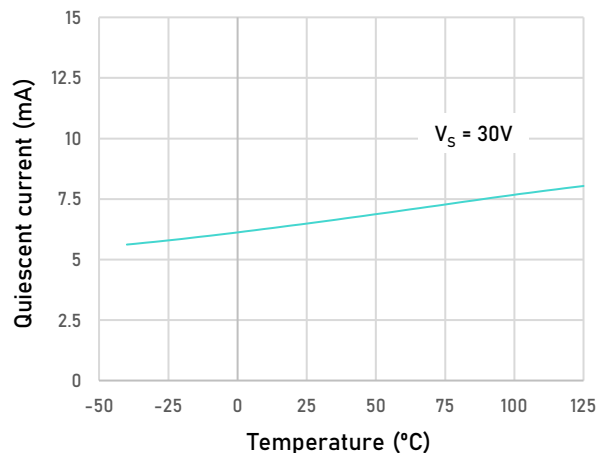
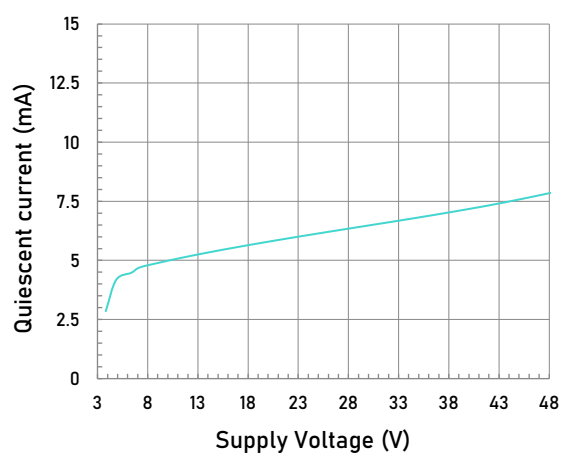
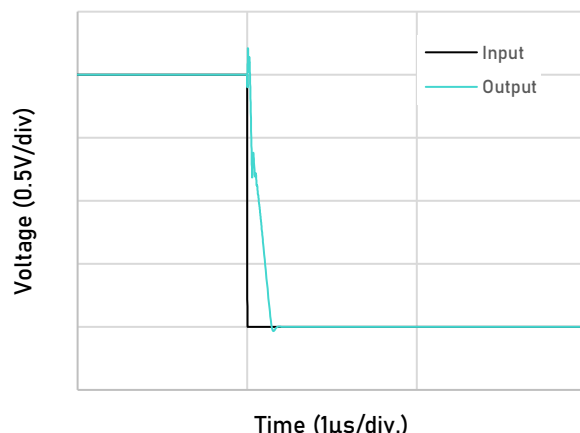
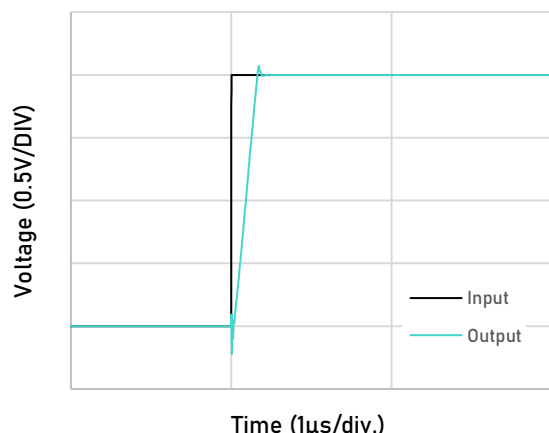
Small-Signal Step Response

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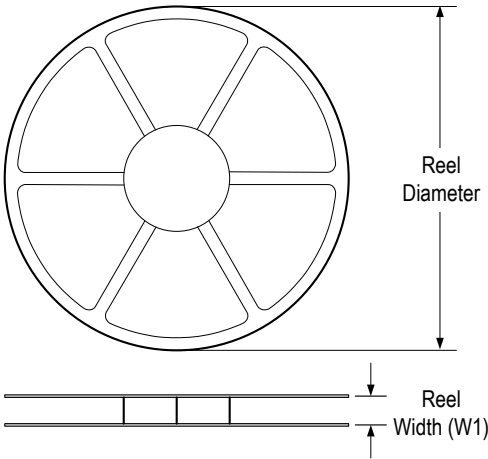
Typical Performance Characteristics (Continued)

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.

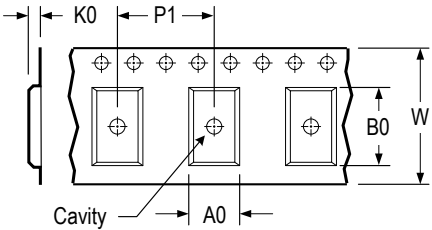


Tape and Reel Information

REEL DIMENSIONS

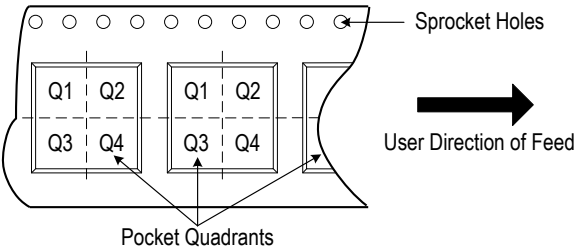


TAPE DIMENSIONS



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

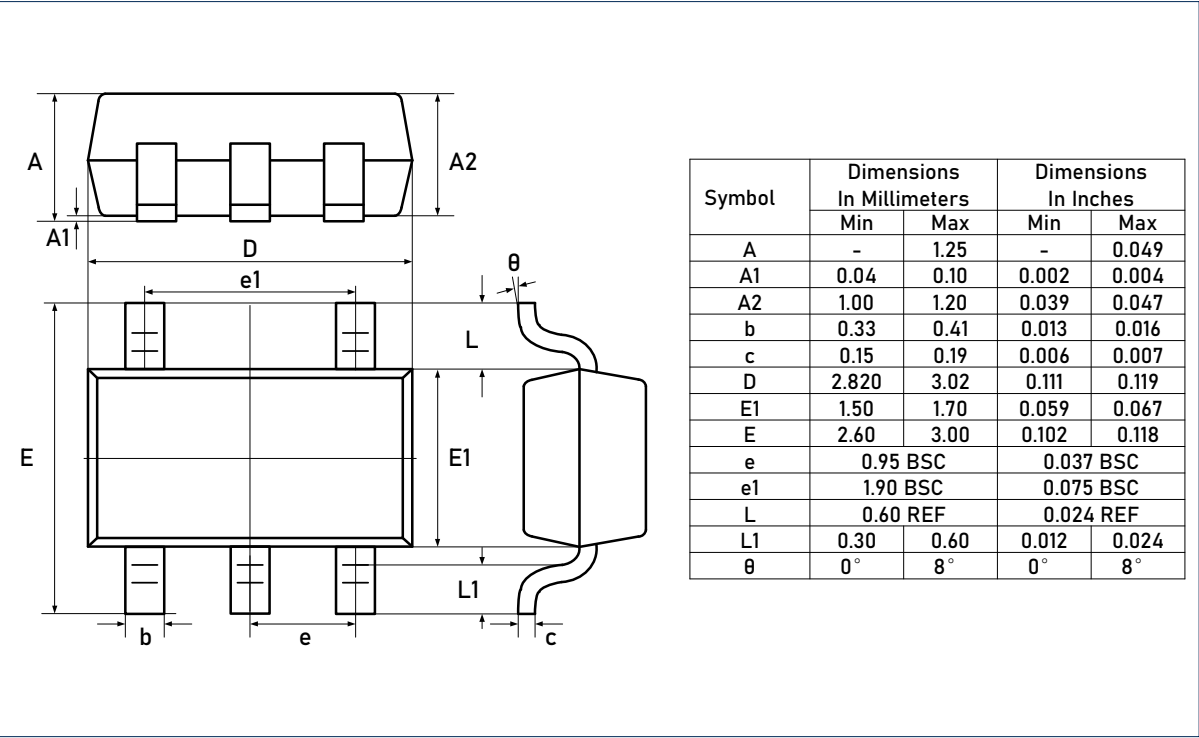


* All dimensions are nominal

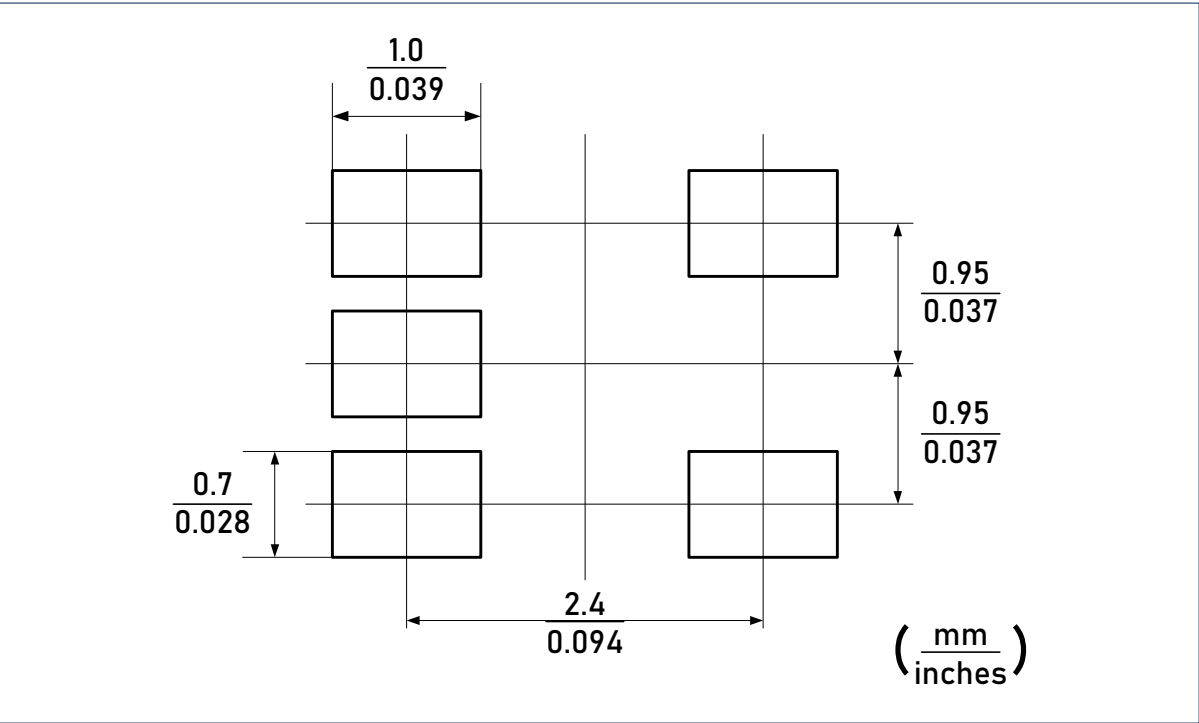
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTA8291XT5/R6	SOT23	5	3 000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTA8291XS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA8292XS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA8292XV8/R6	MSOP	8	3 000	330	12.5	5.0	3.5	2.0	8.0	12.0	Q1
LTA8292XF8/R10	DFN3x3	8	5 000	330	12.5	3.3	3.3	1.1	8.0	12.0	Q1
LTA8294XS14/R5	SOIC	14	2 500	330	16.5	6.5	9.5	2.0	8.0	16.0	Q1
LTA8294XT14/R6	TSSOP	14	3 000	330	16.5	6.9	5.5	1.3	8.0	16.0	Q1

Package Outlines

DIMENSIONS, SOT23-5L

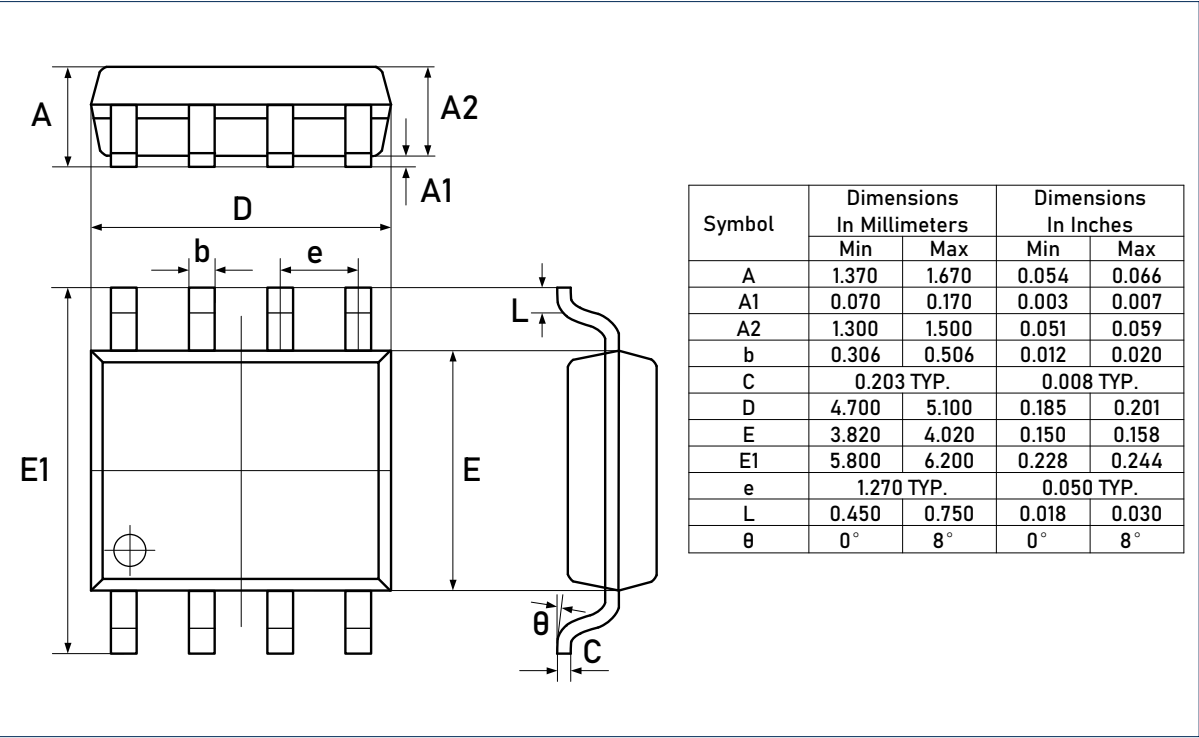


RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L

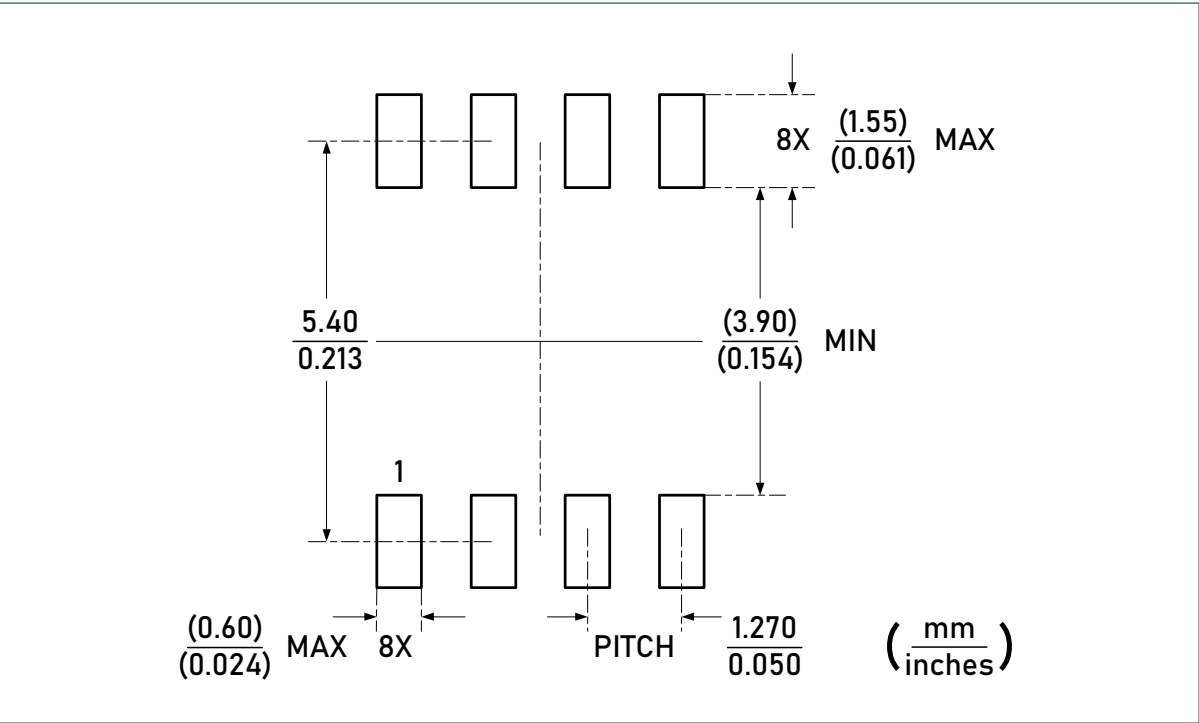


Package Outlines (continued)

DIMENSIONS, SOIC-8L

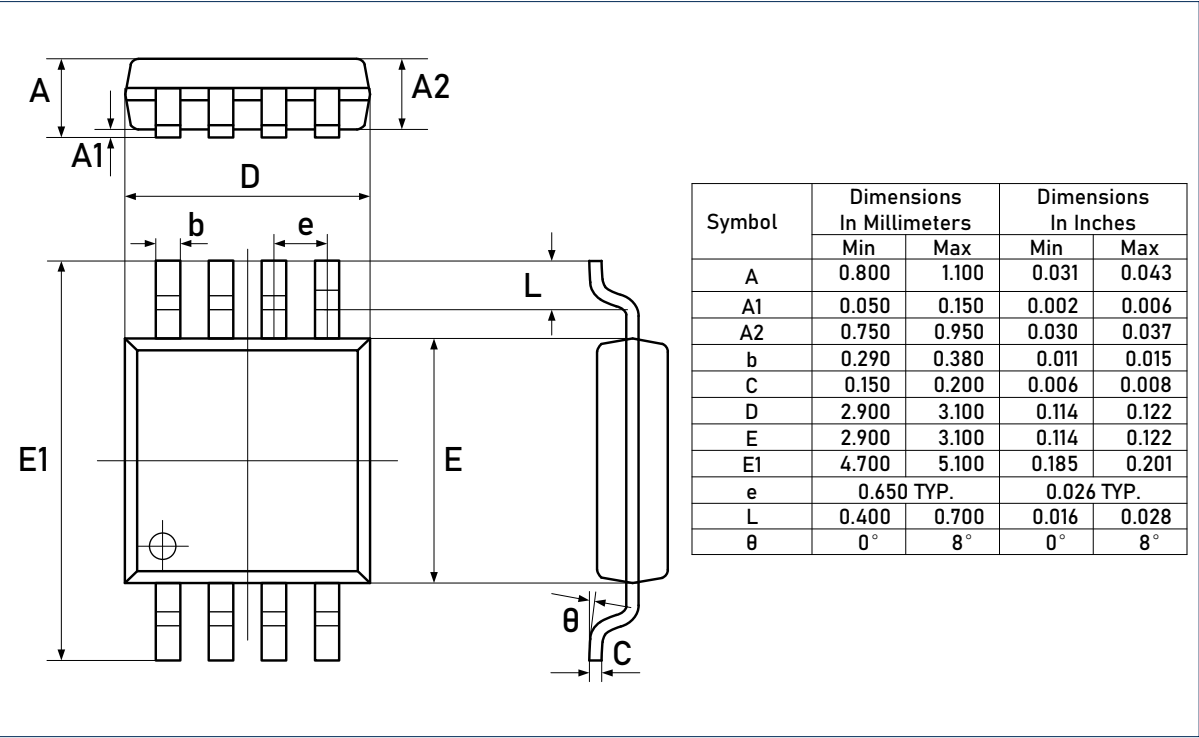


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

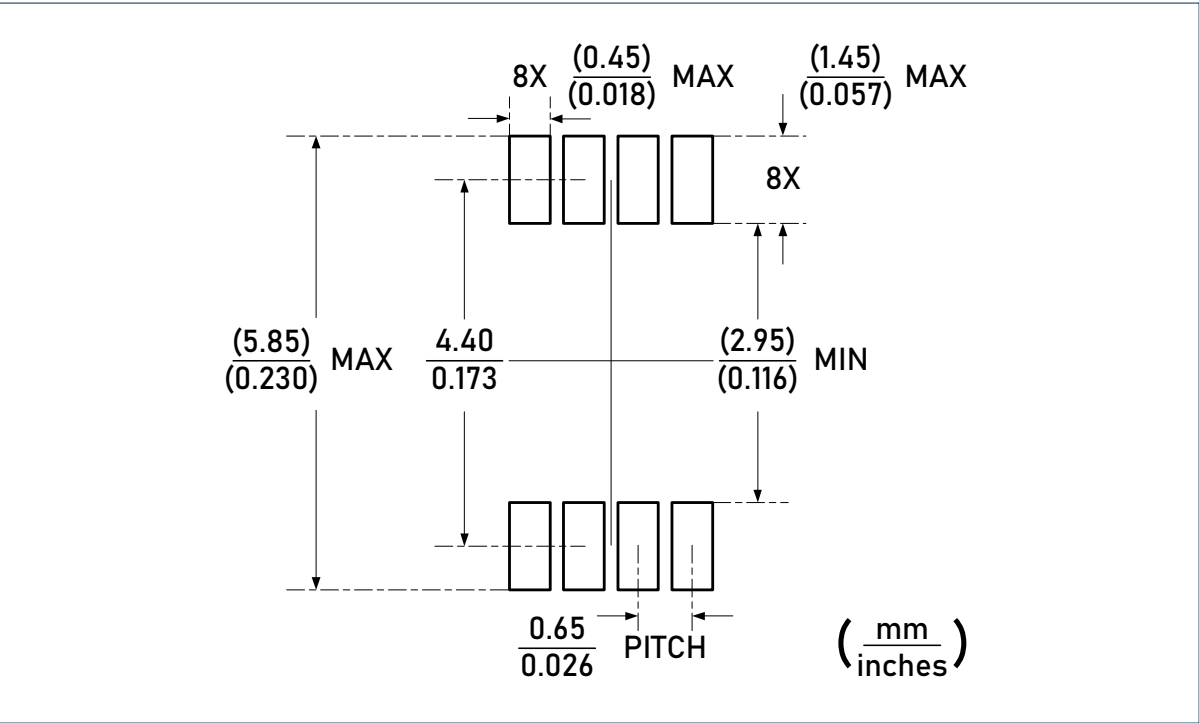


Package Outlines (continued)

DIMENSIONS, MSOP-8L



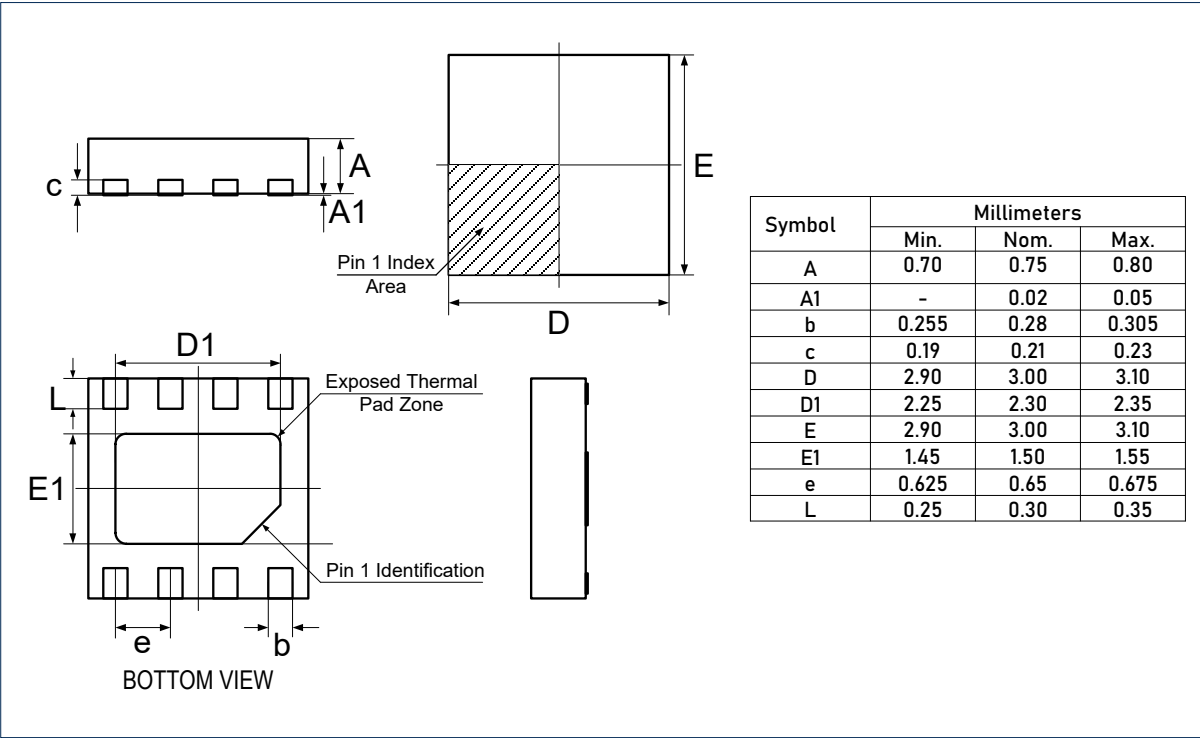
RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



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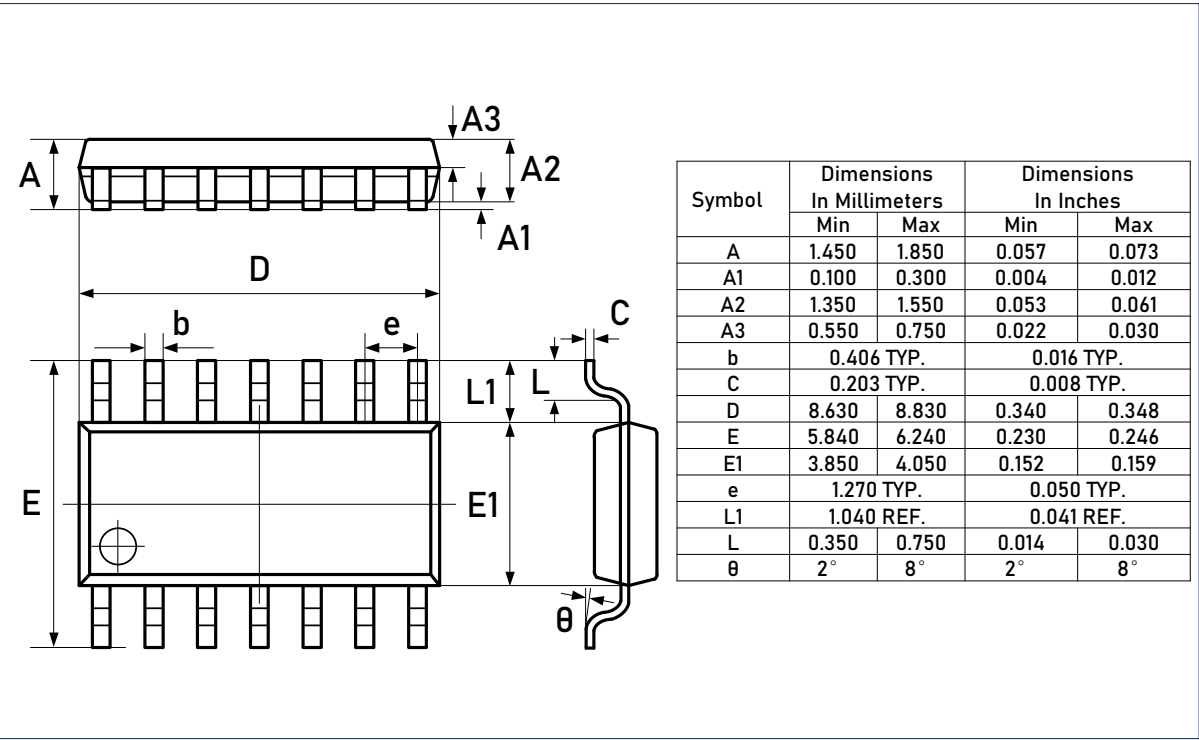
Package Outlines (continued)

DIMENSIONS, DFN3x3-8L

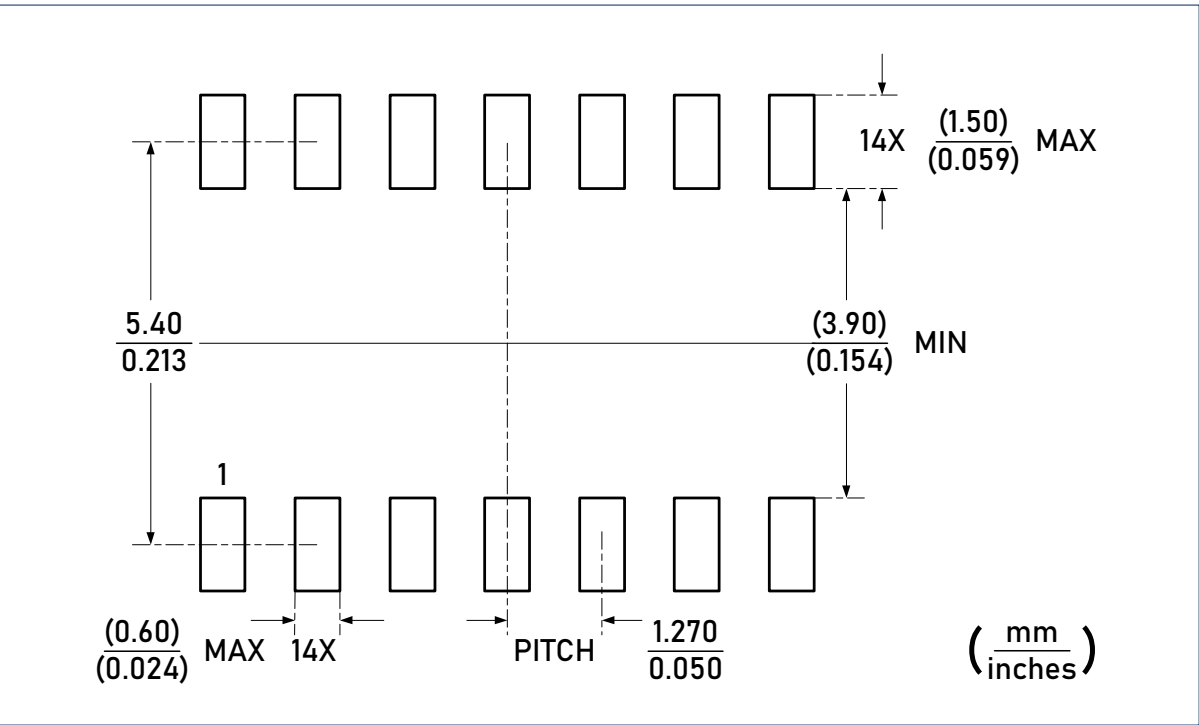


Package Outlines (continued)

DIMENSIONS, SOIC-14L

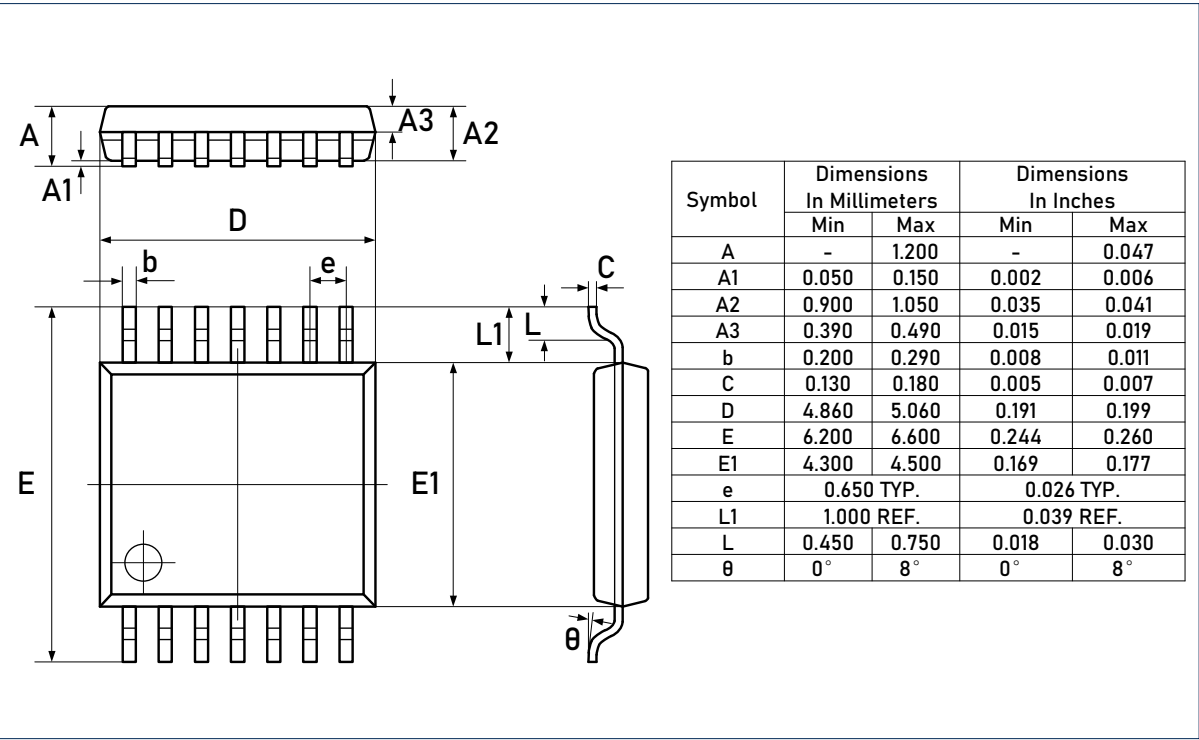


RECOMMENDED SOLDERING FOOTPRINT, SOIC-14L

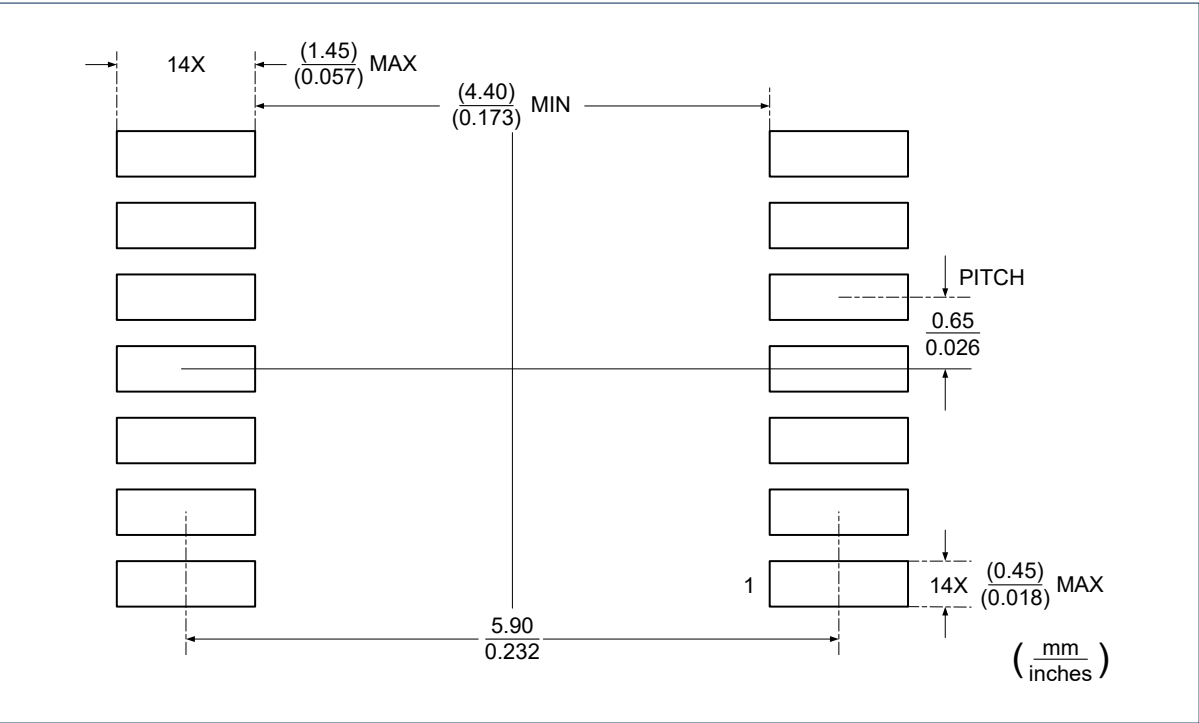


Package Outlines (continued)

DIMENSIONS, TSSOP-14L



RECOMMENDED SOLDERING FOOTPRINT, TSSOP-14L



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