

36V, High-precision, low-noise, rail-to-rail, zero-drift operational amplifier

General Description

The LTA8191 (single-channel) and LTA8192 (dual-channel) are high-voltage, high-precision, low-noise, fast-settling, rail-to-rail output, zero-drift operational amplifiers. The input common-mode voltage range includes the negative power supply rail. Additionally, these amplifiers offset only 1 μ V(typical) and an ultra-low temperature drift of 0.005 μ V/ $^{\circ}$ C.

It supports both single and dual power supply configurations. When powered by a single supply, the voltage range is +4.5V to +36V; with dual supplies, the voltage range is ± 2.25 V to ± 18 V.

The main package types of LTA8191 are SOT23-5L, MSOP-8L and SOIC-8L. For LTA8192, it could support SOIC-8L. All package types operate within a temperature range of -40° C to 125° C.

Features and Benefits

- Low Offset Voltage: 8 μ V maximum
- Zero Drift: 0.005 μ V/ $^{\circ}$ C
- Low Noise: 9nV/ $\sqrt{\text{Hz}}$
- 0.1Hz to 10Hz Noise: 0.19 μ V_{P-P}
- High DC Accuracy:
 - Open-loop Gain (A_{VOL}): 161 dB
 - Power Supply Rejection Ratio (PSRR): 141 dB
 - Common-mode Rejection Ratio (CMRR): 139 dB
- Gain-bandwidth Product: 12MHz
- Quiescent Current: 2.5 mA (typical)
- Operating Power Supply Range: ± 2.25 V to ± 18 V
- Output Rail-to-rail
- MUX-friendly Inputs
- RFI/EMI filtered Inputs
- The input can reach the negative power rail

Applications

- Bridge amplifier
- Sensor applications
- Temperature measurement
- Electronic scale
- Medical equipment
- Battery test
- Analog input module
- DC power supply, ac source, electronic load

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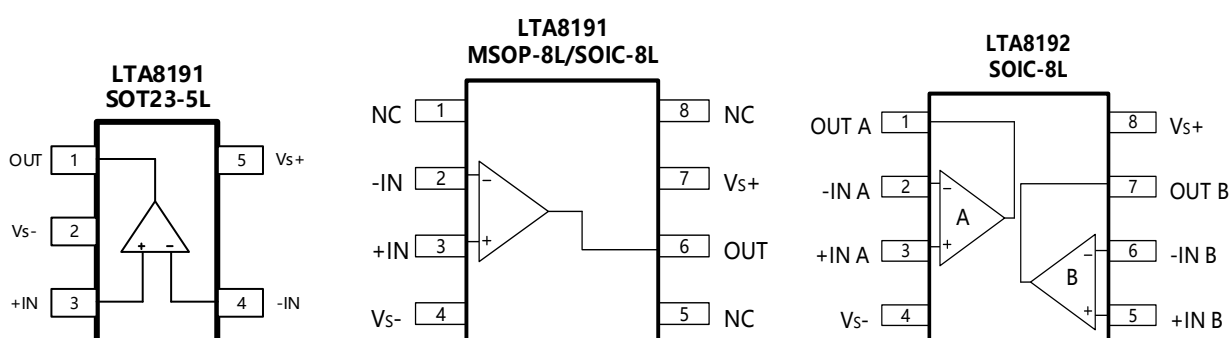
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Ordering Information

Part Number	Package Type	Package Size	Package Quantity	ECO Class	Mark Code
LTA8191XT5/R6	SOT23-5L	2.92 mm * 1.60 mm	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	Z91
LTA8191XS8/R8	SOIC-8L	4.90 mm * 3.92 mm	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	ZHV91
LTA8191XV8/R6	MSOP-8L	3.00 mm * 3.00 mm	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	ZHV91
LTA8192XS8/R8	SOIC-8L	4.90 mm * 3.92 mm	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	ZHV92

Pin Configuration (Top View)



PIN Name	Description
OUT A	Amplifier output A.
-IN A	Inverting input of the amplifier A.
+IN A	Non-inverting input of the amplifier A.
Vs-	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 Vs+ and Vs- is from 4.5 V to 36 V.
+IN B	Non-inverting input of the amplifier B.
-IN B	Inverting input of the amplifier B.
OUT B	Amplifier output B.
Vs+	Positive power supply. The voltage is from 4.5 V to 36 V. Split supplies are possible as long as the voltage between Vs+ and Vs- is from 4.5 V to 36 V.
NC	No Connection

Limiting Value

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	40 V (± 20 V)
Signal Input Terminals: Voltage	$V_{S-} - 0.3$ to $V_{S+} + 0.3$
Signal Input Terminals: Current	± 10 mA
Signal Differential Input Voltage	$V_{S+} - V_{S-} + 0.2$
Storage Temperature Range, T_{stg}	-65°C to $+150^{\circ}\text{C}$
Junction Temperature, T_J	150°C
Operation Temperature T_{JL}	-55°C to $+150^{\circ}\text{C}$

Thermal Information

Thermal Metric		Package	Level	Unit
θ_{JA}	Package Thermal Resistance	SOIC-8L	125	$^{\circ}\text{C}/\text{W}$
		MSOP-8L	216	
		SOT23-5L	190	

ESD Ratings

Parameter	Item	Value	Unit
Electrostatic Discharge Voltage	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	$\pm 4\ 000$	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	$\pm 1\ 000$	

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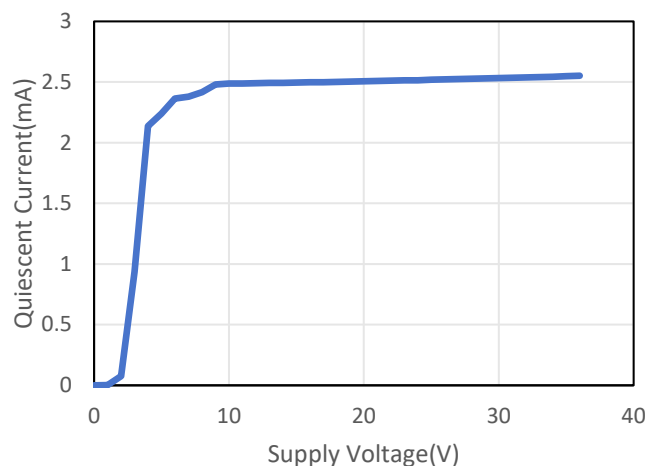
Electrical Characteristics

Unless otherwise noted, $T_A = 25^\circ\text{C}$, $V_S = \pm 18.0\text{ V}$, $V_{CM} = V_S/2$, $V_O = V_S/2$, $R_L = 10\text{ k}\Omega$, connect to $V_S/2$.

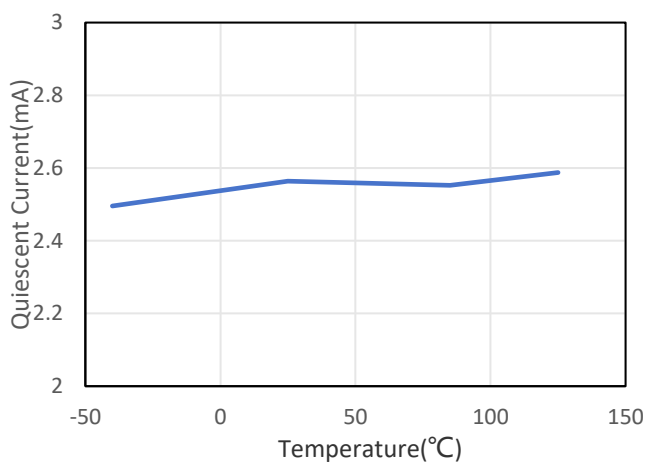
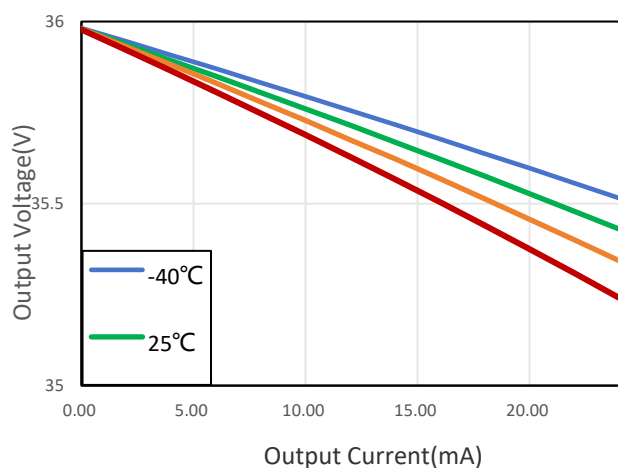
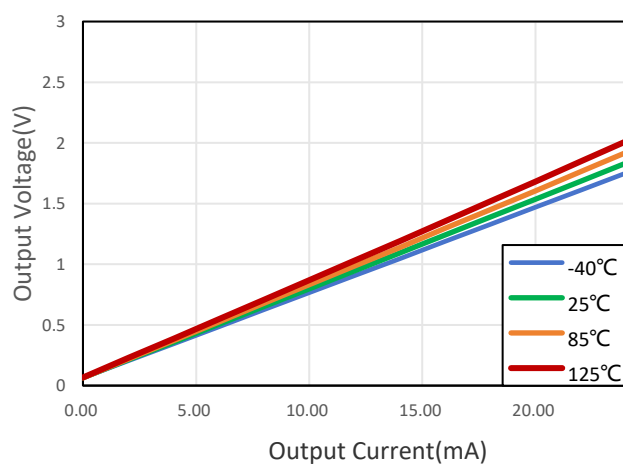
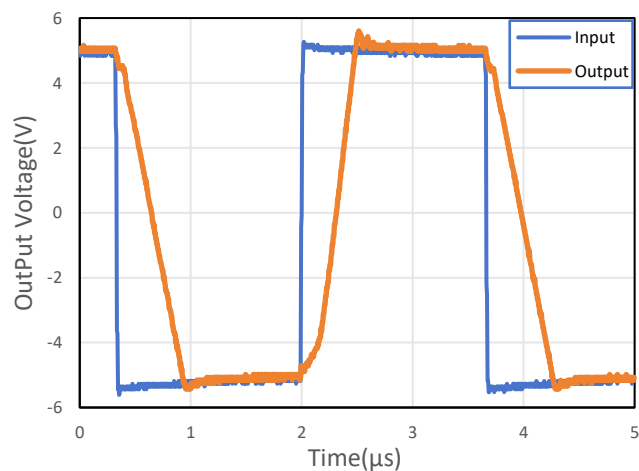
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
DC PERFORMANCE						
Input Offset Voltage	V _{OS}	T _A =25°C		±1	±8	μV
		T _A =-40°C to +125°C		±1	±14	μV
Input Offset Voltage vs Temperature	dV _{OS} / dT	T _A =-40°C to +125°C		0.005		μV/°C
Input Bias Current	I _B	V _{CM} = V _S /2		±0.13	±0.3	nA
		T _A = 0°C to +85°C			±1.5	
		T _A =-40°C to +125°C			±5	
Input Offset Current	I _{OS}			±200		pA
Large voltage gain	A _{VOL}	V _S -0.5V<V _O <V _S +0.5V		161		dB
		T _A =-40°C to +125°C		157		
NOISE and DISTORTION PERFORMANCE						
Input voltage noise	V _n	f = 0.1 Hz to 10 Hz		0.19		μV _{P-P}
Input Voltage Noise Density	e _N	f = 1kHz		9		nV/√Hz
INPUT CHARACTERISTICS						
Input Common Mode Voltage Range	V _{CM}	T _A = -40°C to +125°C	V _{S-} -0.1		V _{S+} -2.6	V
Common Mode Rejection Rate	CMRR	V _S =36V, V _{CM} =0 to 34.5V	131	139		dB
		T _A = -40°C to +125°C	128			
DYNAMIC PERFORMANCE						
Unity-gain Bandwidth	UGB	G = +1		7.5		MHz
Gain-Bandwidth Product	GBP	G = +100		12		MHz
Slew Rate	SR	G = +1, 10V step		21		V/μs
Total Harmonic Distortion + Noise	THD+N	G = 1, f = 1 kHz, V _O = 3.5 V _{RMS}		0.0001		%
Overload Recovery Time	t _{OR}	V _{IN} × Gain=V _S		440		ns
Settling Time	t _S	To 0.1%, V _S =36V, G=+1, 5V step		0.98		μs
		To 0.01%, V _S =36V, G=+1, 5V step		1.37		
OUTPUT CHARACTERISTICS						
High Output Voltage Swing	V _{OH}	R _L = 10 kΩ		(V _{S+})-65		mV
		T _A = -40°C to +125°C			(V _{S+})-150	
Low Output Voltage Swing	V _{OL}	R _L = 10 kΩ		(V _{S-})+200		mV
		T _A = -40°C to +125°C			(V _{S-})+350	
Short-circuit Current	I _{source}			75		mA
	I _{sink}			85		
POWER SUPPLY						
Operating Supply Voltage	V _S	T _A = -40 to +125 °C	4.5		36	V
Power Supply Rejection Ratio	PSRR	V _S = 4.5V to 36V, T _A = 25°C	132	141		dB
		T _A = -40°C to +125°C	127			
Quiescent Current per amplifier	I _Q			2.5	3.6	mA
		T _A = -40°C to +125°C			3.8	

Typical Performance Characteristics

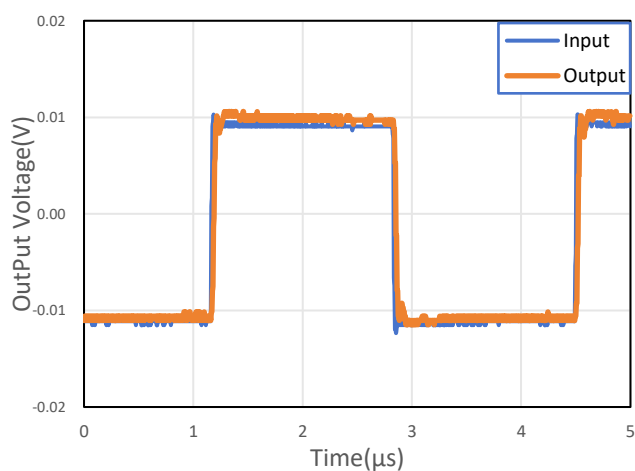
At $T_A = +25^\circ\text{C}$, $V_S = \pm 18.0\text{ V}$, $V_{CM} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.



Quiescent Current vs. Supply Voltage

Quiescent Current vs. Temperature ($V_S=36\text{V}$)Output High Voltage Swing as a function of Output Current ($V_S=36\text{V}$)Output Low Voltage Swing as a function of Output Current ($V_S=36\text{V}$)

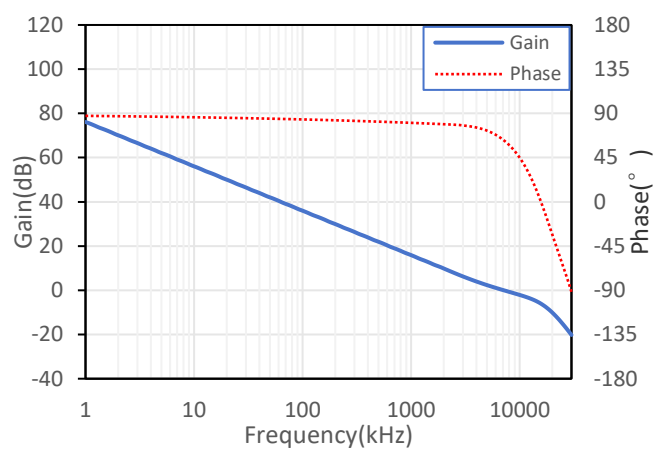
Large-Signal Step Response



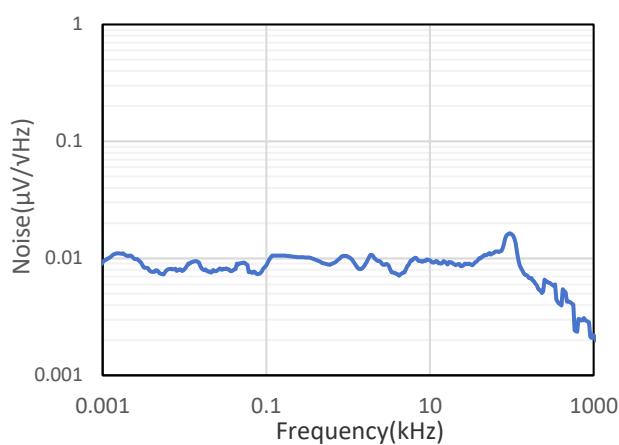
Small-Signal Step Response

Typical Performance Characteristics (Cont.)

At $T_A = +25\text{ }^{\circ}\text{C}$, $V_S = \pm 18.0\text{ V}$, $V_{CM} = V_S / 2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S / 2$, unless otherwise noted.



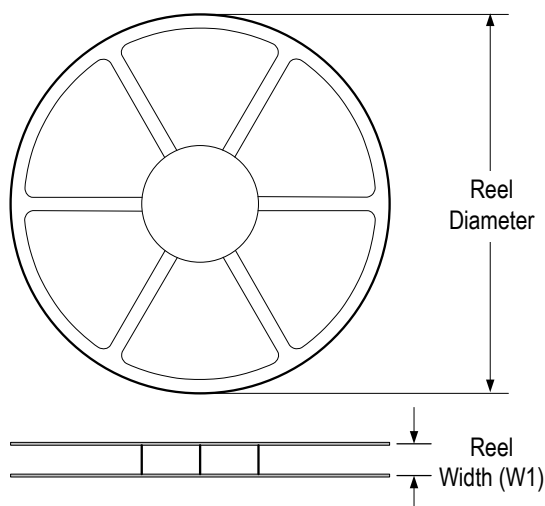
Open-Loop Gain and Phase vs. Frequency



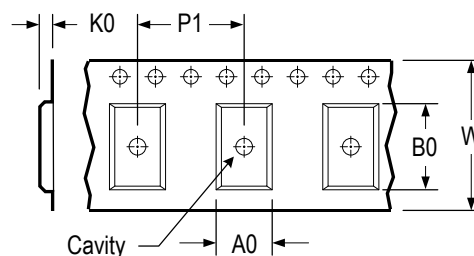
Voltage Noise Density vs. Frequency

Tape and Reel Information

REEL DIMENSIONS

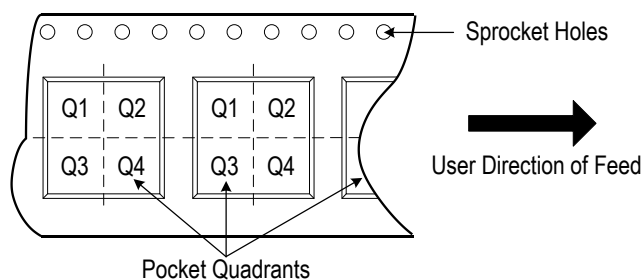


TAPE DIMENSIONS



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

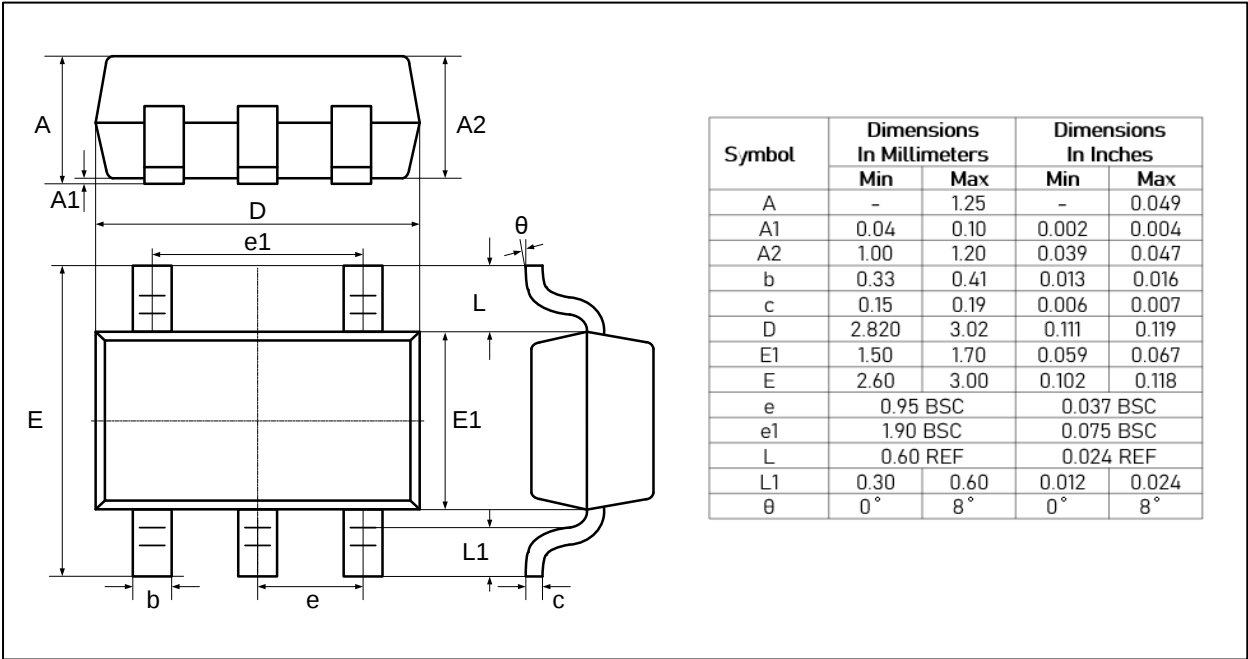


* All dimensions are nominal

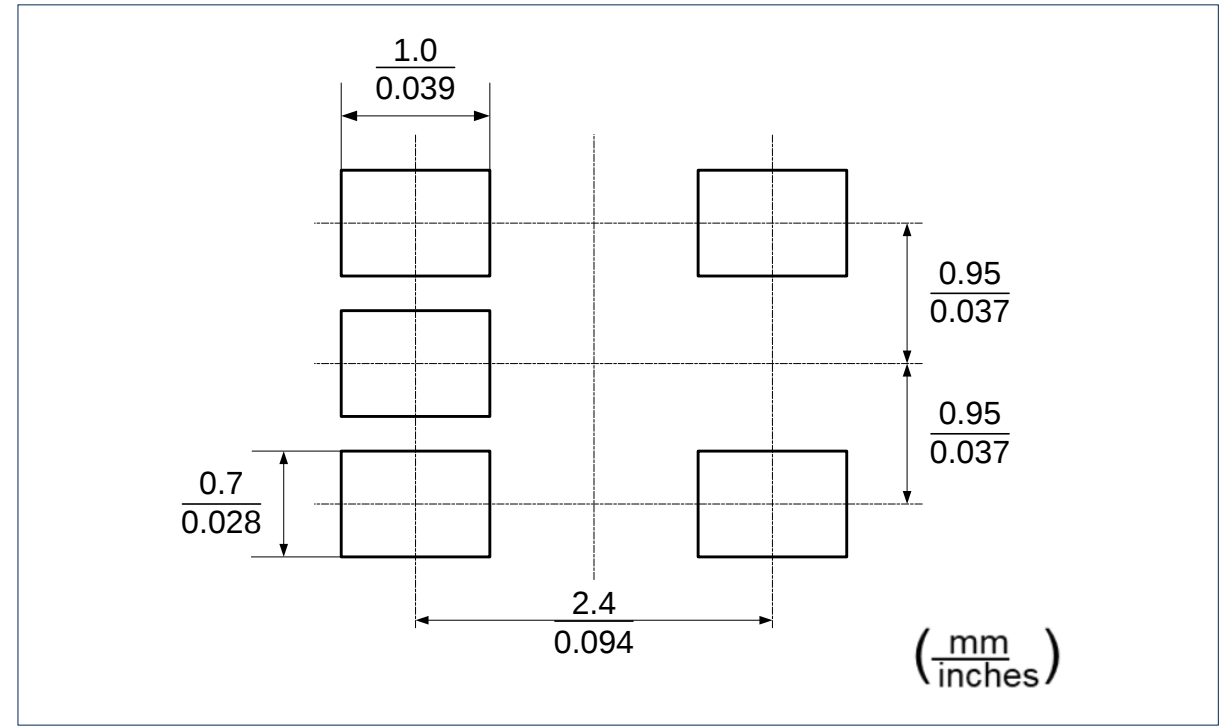
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTA8191XT5/R6	SOT23	5	3 000	178	9.0	3.3	3.2	1.5	4.0	8.0	Q3
LTA8191XS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA8191XV8/R6	MSOP	8	3 000	330	12.5	5.0	3.5	2.0	8.0	12.0	Q1
LTA8192XS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1

Package Outlines

DIMENSIONS, SOT23-5L

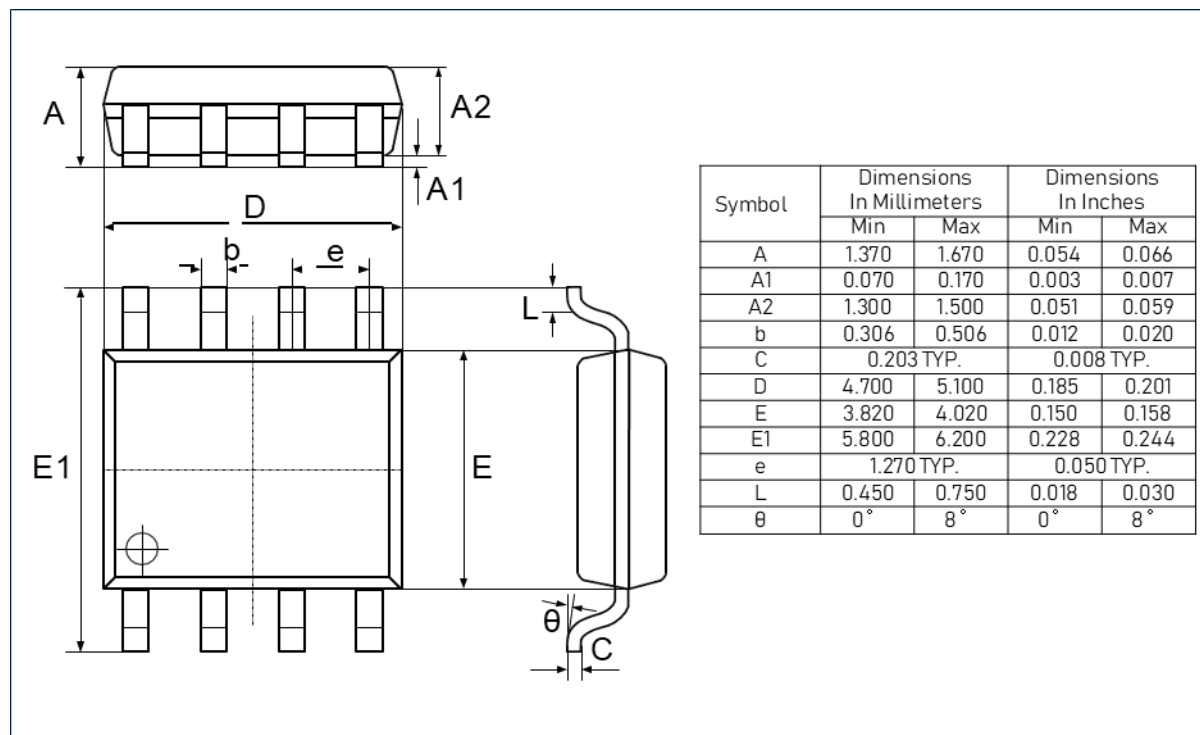


RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L

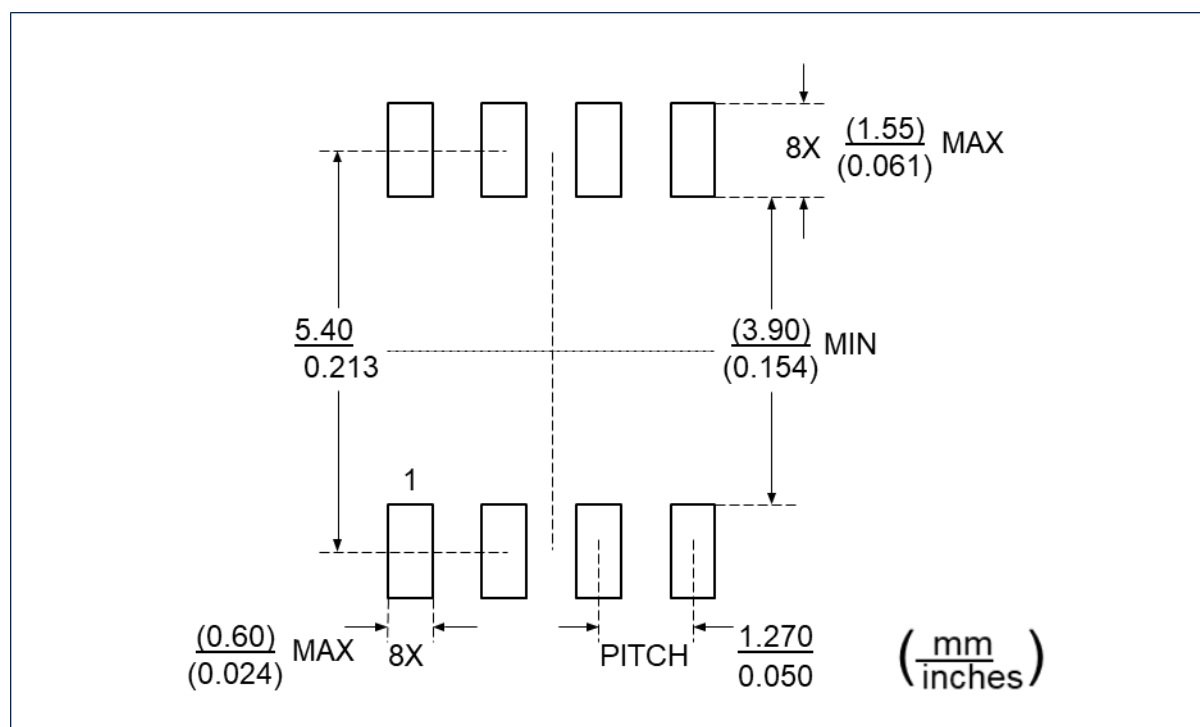


Package Outlines (Cont.)

DIMENSIONS, SOIC-8L

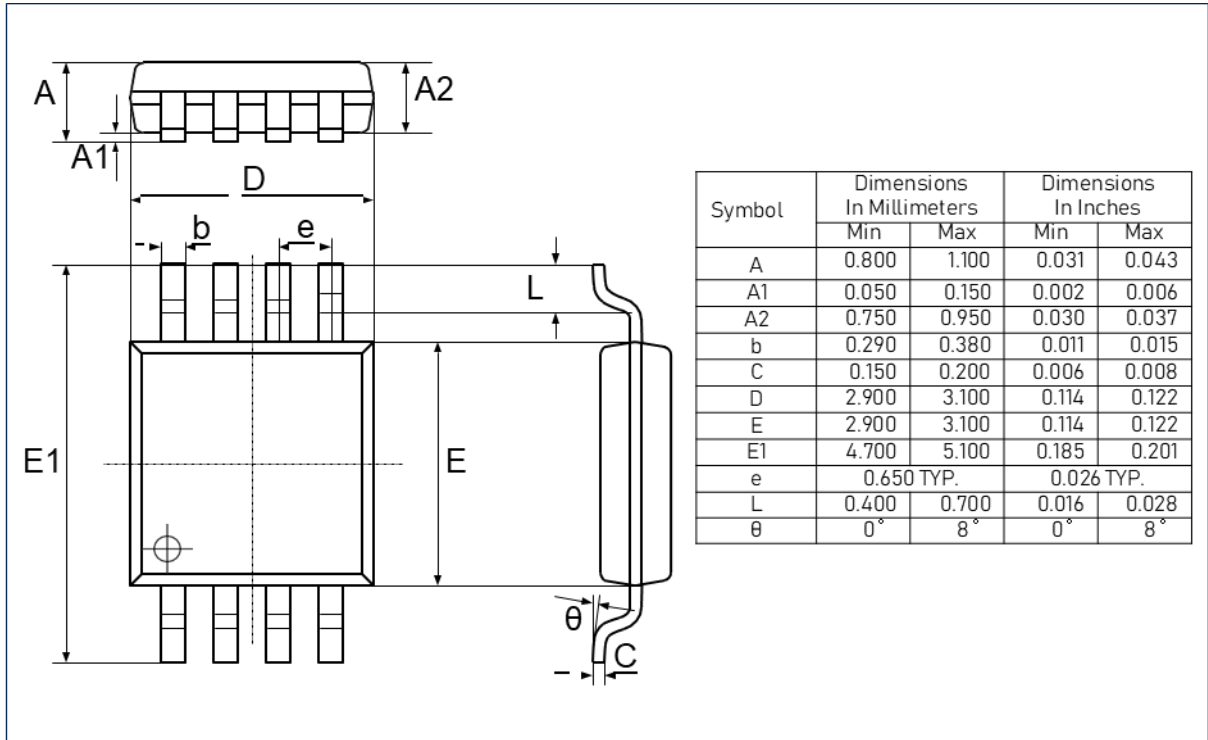


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

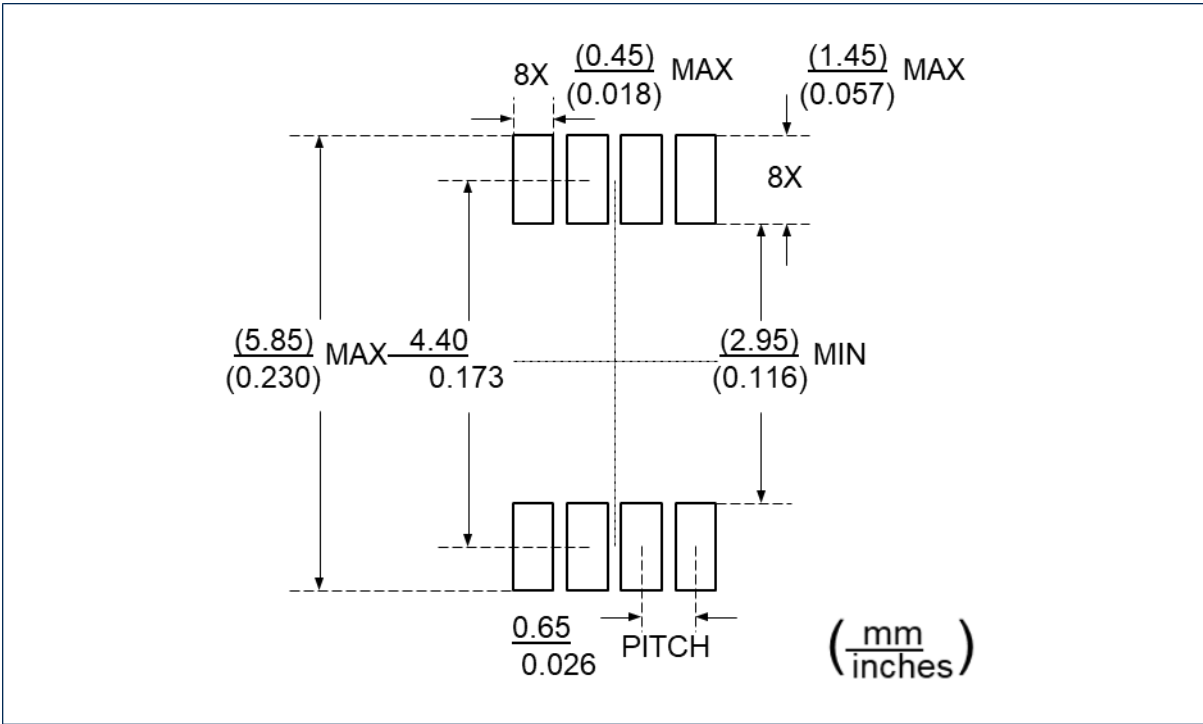


Package Outlines (Cont.)

DIMENSIONS, MSOP-8L



RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



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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 (industry 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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