LTA8191 LTA8192

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 1μV(typical) and an ultra-low temperature drift of 0.005 μV/℃.

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 ±2.25V to ±18V.

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℃ to 125℃.

Features and Benefits

- Low Offset Voltage: 8μV maximum
- Zero Drift: 0.005μV/℃
- Low Noise: 9nV/√Hz
- 0.1Hz to 10Hz Noise: 0.19μV_{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: ±2.25V to ±18V
- 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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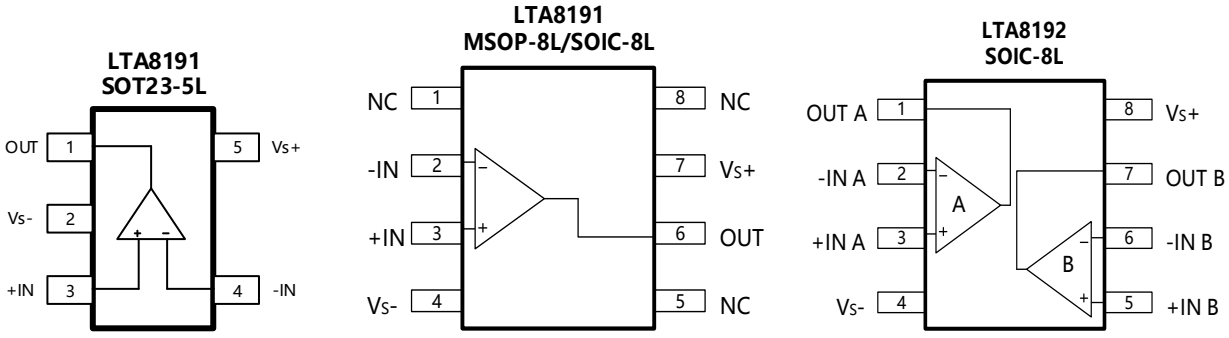
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Ordering Information

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 V_{S+} and V_{S-} 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 V_{S+} and V_{S-} is from 4.5 V to 36 V.
NC	No Connection

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Limiting Value

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	40 V (±20V)
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 °C
Junction Temperature, T_J	150 °C
Operation Temperature T_{JL}	–55 °C to +150 °C

Thermal Information

Thermal Metric		Package	Level	Unit
θ_{JA}	Package Thermal Resistance	SOIC-8L	125	℃/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	±4 000	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	±1 000	

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Electrical Characteristics

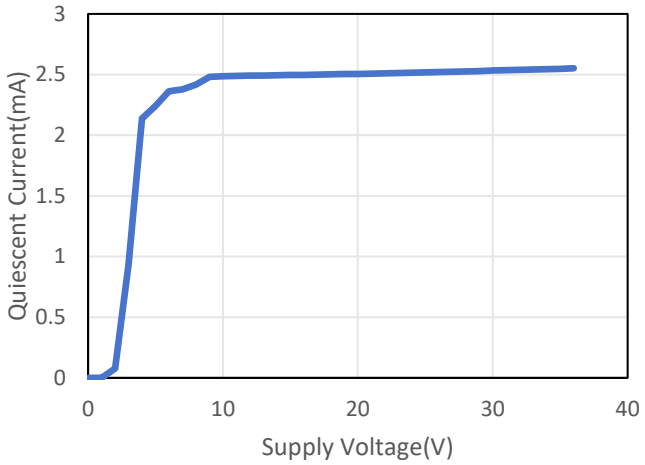
Unless otherwise noted, T_A=25℃, V_S = ±18.0 V, V_{CM}=V_S/2, V_O=V_S/2, R_L=10kΩ, connect to V_S/2.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
DC PERFORMANCE						
Input Offset Voltage	V_{OS}	T_A=25℃		±1	±8	μV
		T_A=-40℃ to + 125℃		±1	±14	μV
Input Offset Voltage vs Temperature	dV_{os} / dT	T_A=-40℃ to + 125℃		0.005		μV/℃
Input Bias Current	I_B	V_{CM} = V_S/2		±0.13	±0.3	nA
		T_A= 0℃ to + 85℃			±1.5	
		T_A=-40℃ to + 125℃			±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℃ to + 125℃		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℃ to +125℃	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℃ to +125℃	128			
DYNAMIC PERFORMANCE						
Unity-gain Bandwidth	UGB	G = +1, C_L = 100pF		10		MHz
Gain-Bandwidth Product	GBP	G = +100, C_L = 100pF		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} x 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℃ to +125℃			(V_{S+})-150	
Low Output Voltage Swing	V_{OL}	R_L = 10 kΩ		(V_{S-})+200		mV
		T_A = −40℃ to +125℃			(V_{S-})+350	
Short-circuit Current	I_{source}			75		mA
	I_{sink}			85		
POWER SUPPLY						
Operating Supply Voltage	Vs	T_A = -40 to +125 ℃	4.5		36	V
Power Supply Rejection Ratio	PSRR	V_S = 4.5V to 36V, T_A = 25℃	132	141		dB
		T_A = −40℃ to +125℃	127			
Quiescent Current per amplifier	I_Q			2.5	3.6	mA
		T_A = −40℃ to +125℃			3.8	

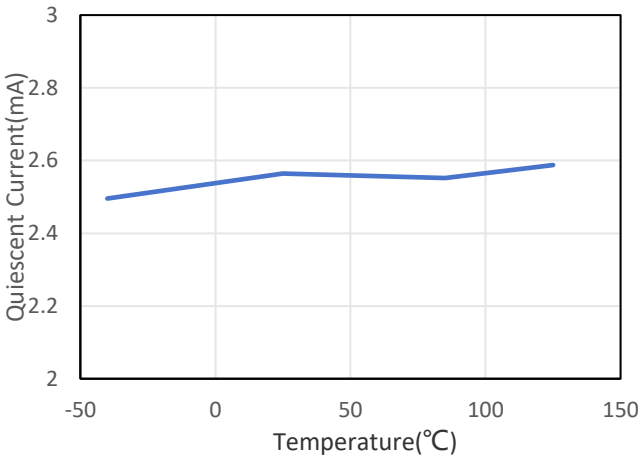
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Typical Performance Characteristics

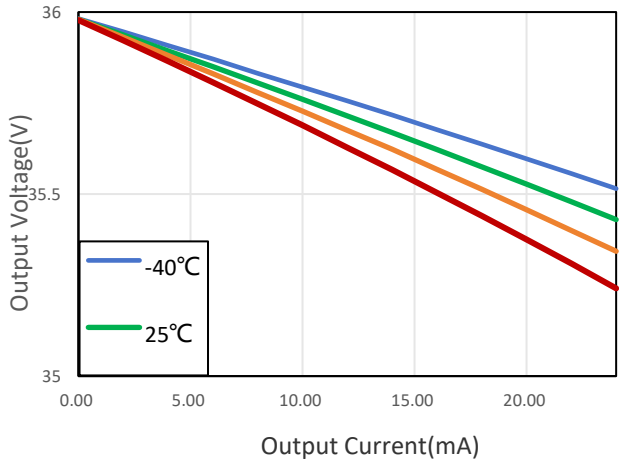
At T_A = +25 °C, V_S = ±18.0 V, V_{CM} = V_S /2, and R_L = 10 kΩ connected to V_S /2, unless otherwise noted.



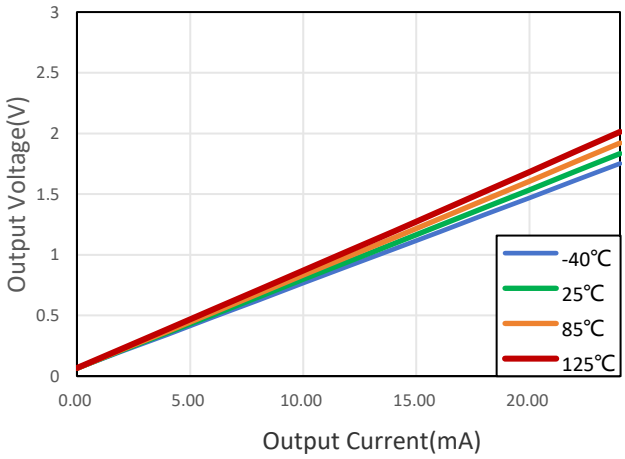
Quiescent Current vs. Supply Voltage



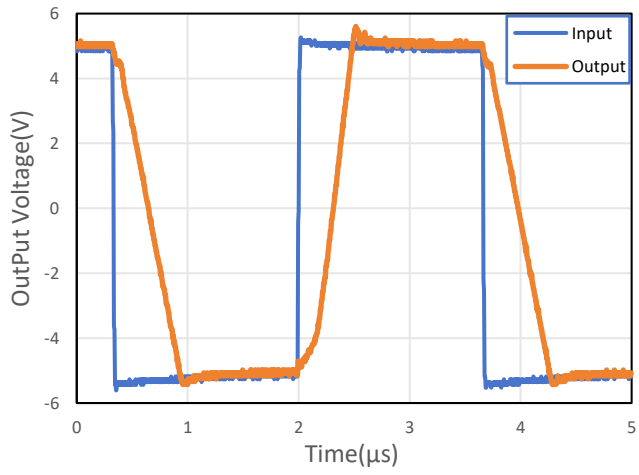
Quiescent Current vs. Temperature (V_S=36V)



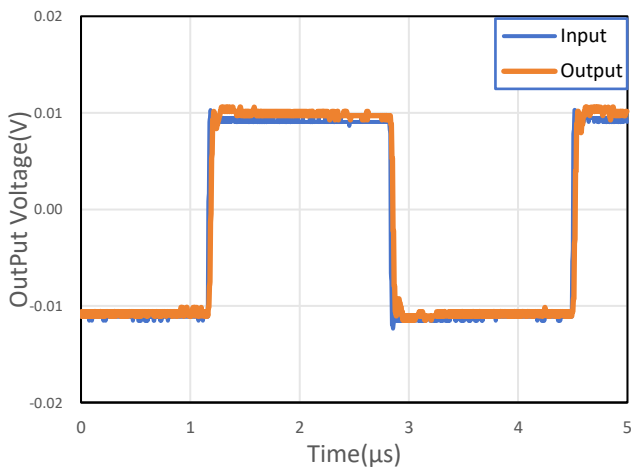
Output High Voltage Swing as a function of Output Current (V_S=36V)



Output Low Voltage Swing as a function of Output Current (V_S=36V)



Large-Signal Step Response

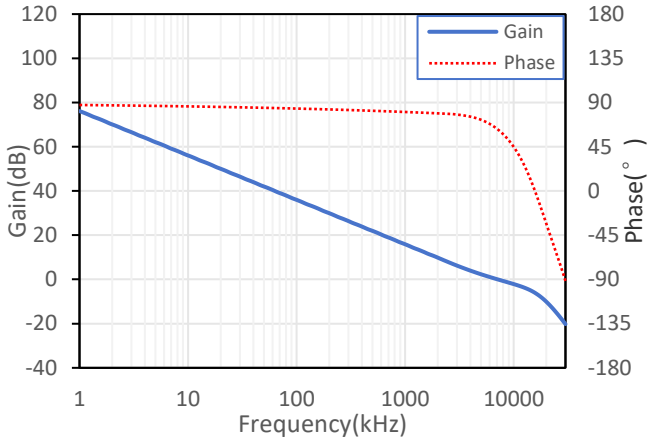


Small-Signal Step Response

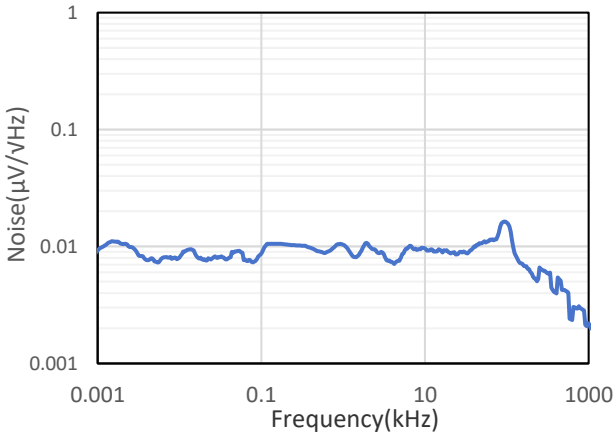
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Typical Performance Characteristics (Cont.)

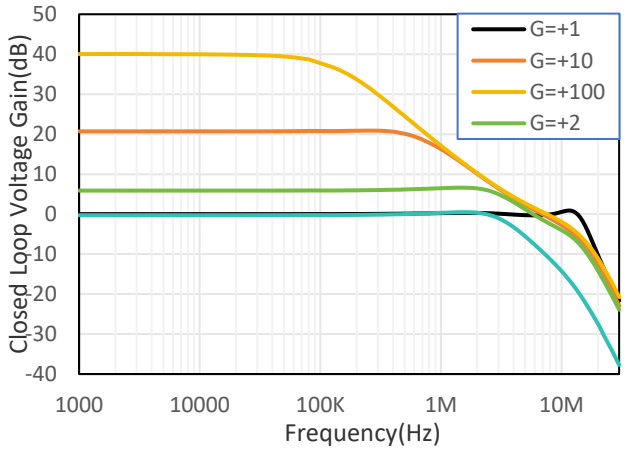
At T_A = +25 °C, V_S = ±18.0 V, V_{CM} = V_S /2, and R_L = 10 kΩ connected to V_S /2, unless otherwise noted.



Open-Loop Gain and Phase vs. Frequency



Voltage Noise Density vs. Frequency

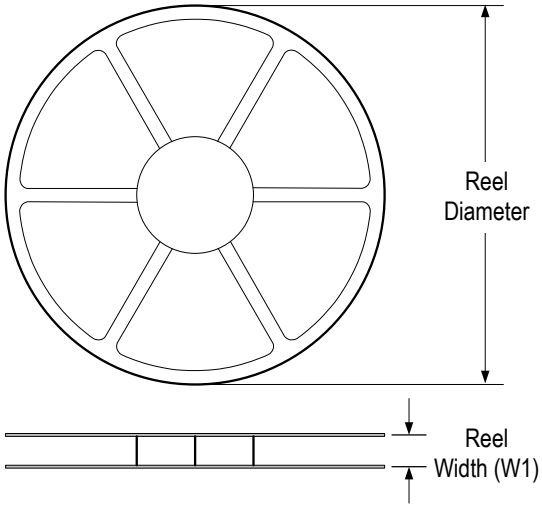


Closed Loop Voltage Gain vs. Frequency

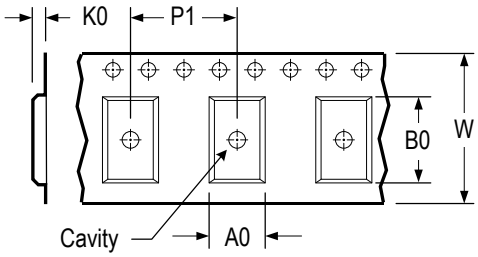
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Tape and Reel Information

REEL DIMENSIONS

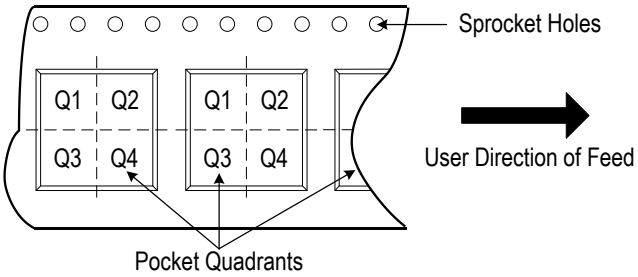


TAPE DIMENSIONS



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



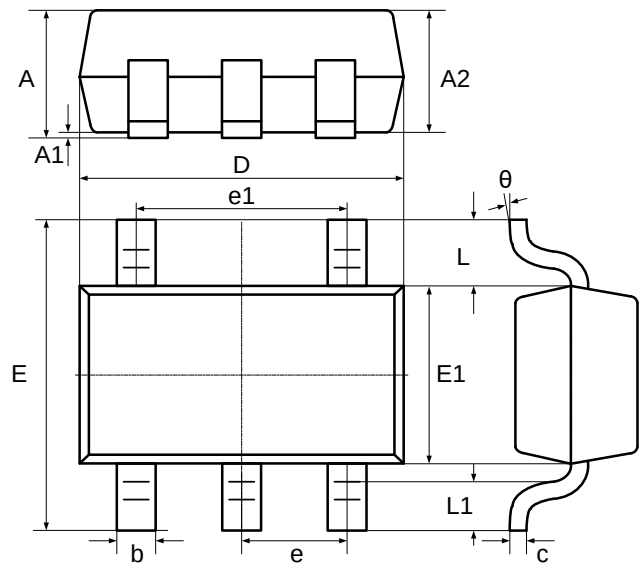
* All dimensions are nominal

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
LTA8191XT5/R6	SOT23	5	3 000	178	9.5	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

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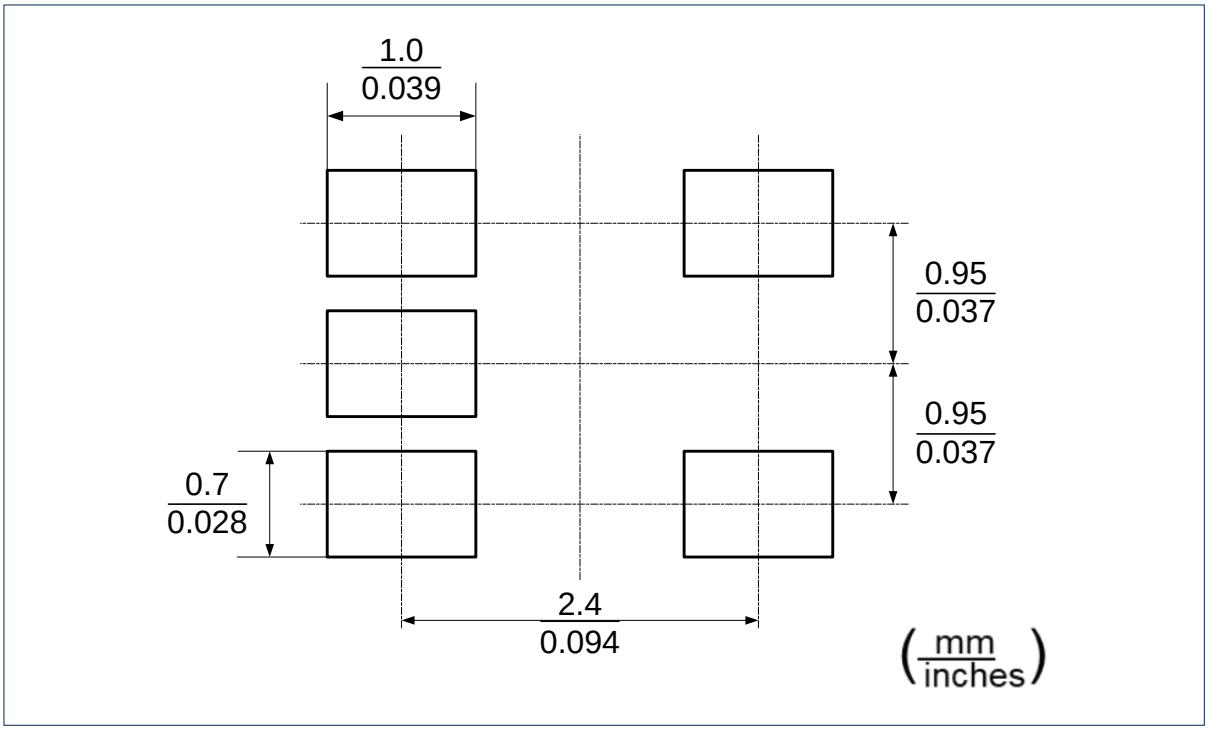
Package Outlines

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°

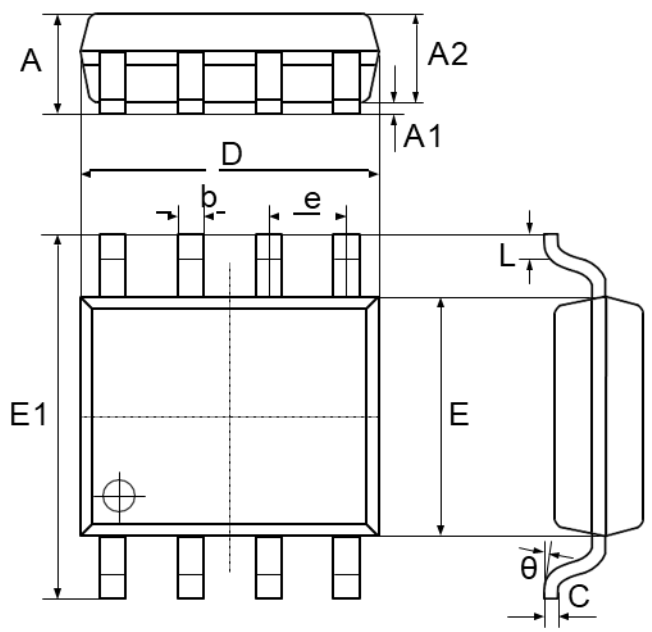
RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L



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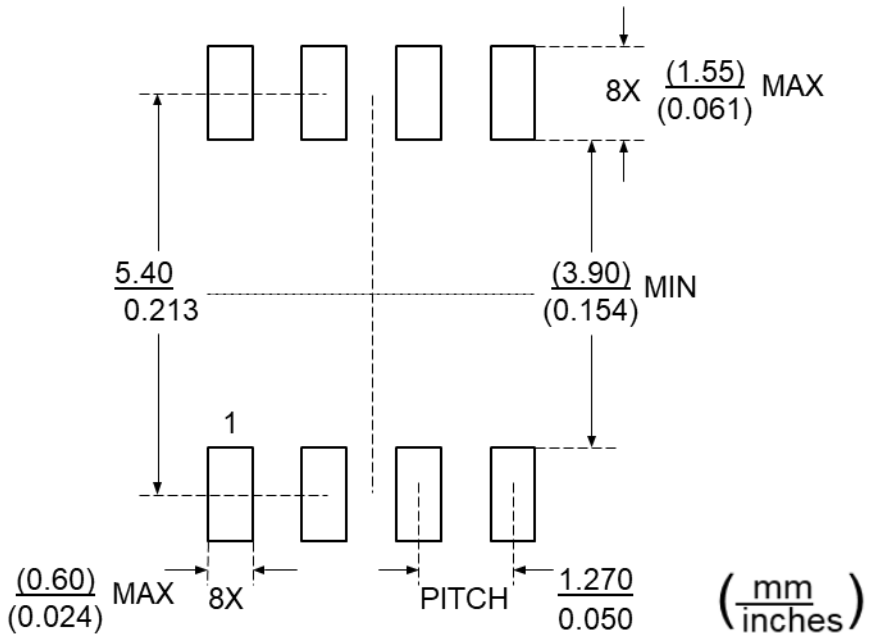
Package Outlines (Cont.)

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°

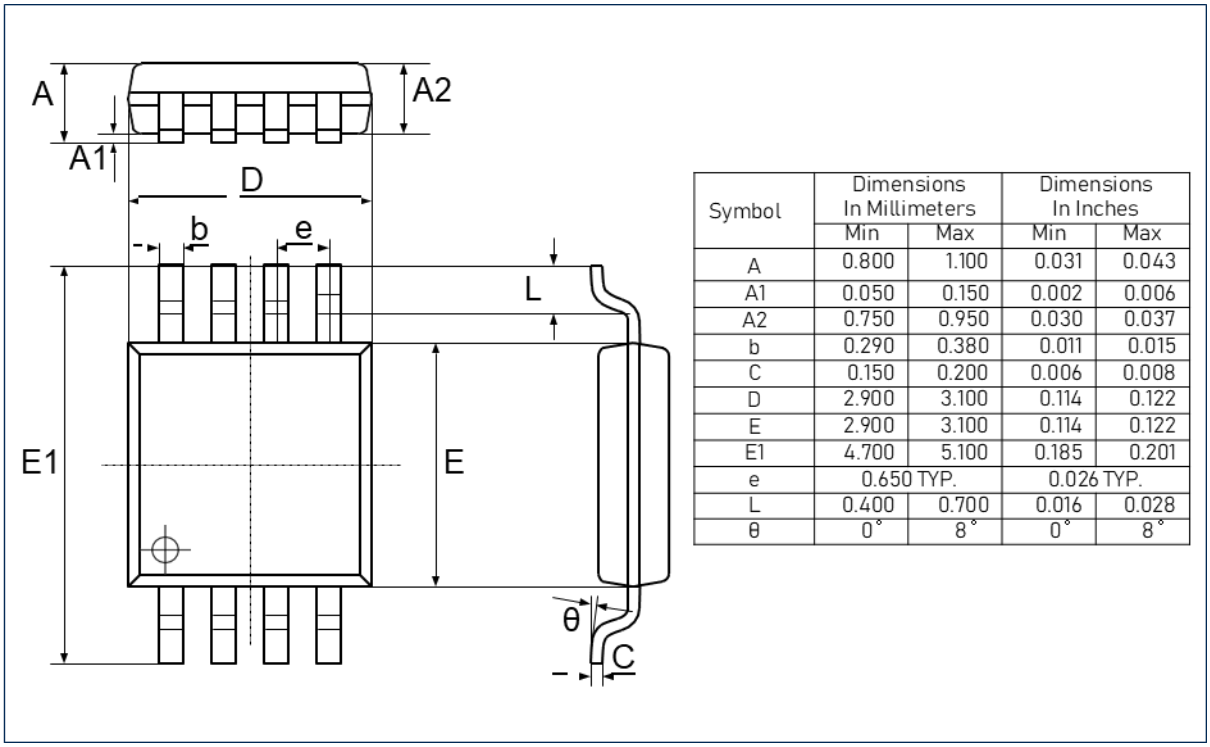
RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L



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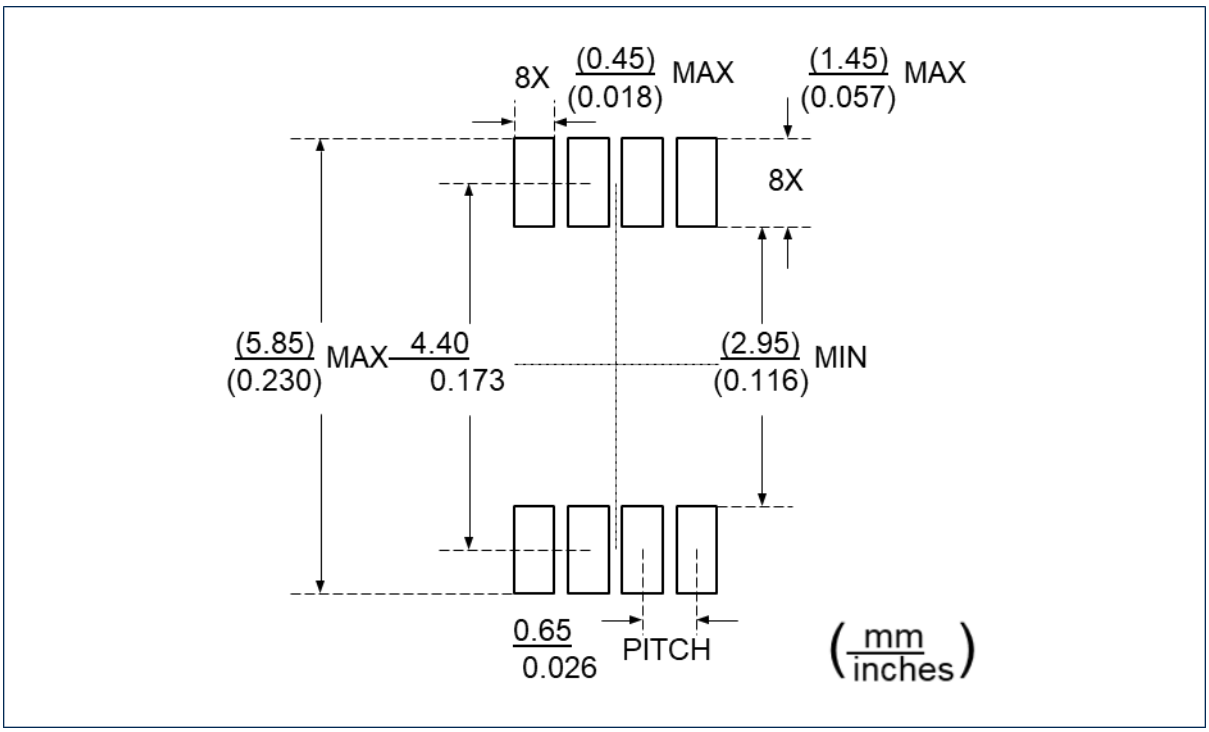
Package Outlines (Cont.)

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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