

General Description

The LTC855xQ family of amplifiers provides input offset voltage correction for very low offset and drift through the use of patented fast step response chopper stabilized techniques. This method constantly measures and compensates the input offset, eliminating drift over time and temperature and the effect of $1/f$ noise. This design breakthrough allows the combination of a gain bandwidth product of 1.5 MHz and a high slew rate of $0.95 \text{ V}/\mu\text{s}$, while only drawing $184 \mu\text{A}$ supply current. These devices are unity gain stable and have good Power Supply Rejection Ratio (PSRR) and Common Mode Rejection Ratio (CMRR).

The LTC855xQ series are perfectly suited for applications that require precision amplification of low level signals, in which error sources cannot be tolerated, even in which high bandwidth and fast transition are needed. The rail-to-rail input and output swings make both high-side and low-side sensing easy. The LTC855xQ series can operate with a single supply voltage as low as 1.8 V for 2-cell battery applications.

The LTC855xQ op-amps have enhanced EMI protection to minimize any electromagnetic interference from external sources, and have high electro-static discharge (ESD) protection. All models are specified over the extended industrial temperature range of -40°C to $+125^\circ\text{C}$.

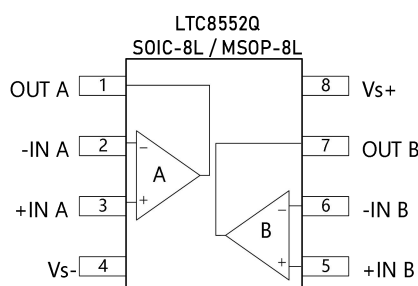
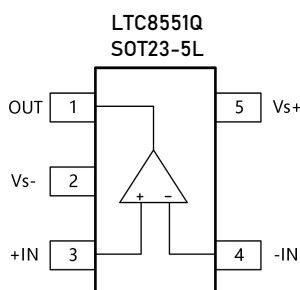
Features and Benefits

- AEC-Q100 grade 1 applications
- Low Offset Voltage: $\pm 4 \mu\text{V}$ typically
- Low Offset Voltage Drift: $\pm 5 \mu\text{V}$ at -40°C
- High Common-Mode Rejection Ratio: 100 dB (Minimum)
- High Power Rejection Ratio: 100 dB (Minimum)
- Gain Bandwidth: 1.5 MHz
- Slew Rate: $0.95 \text{ V}/\mu\text{s}$
- Settling Time to 0.1% with 1V Step: $1.2 \mu\text{s}$
- Low Noise: $19 \text{ nV}/\sqrt{\text{Hz}}$ at 1 kHz
- Low Quiescent Current: $184 \mu\text{A}$ per amplifier at $V_S = 2\text{V}$
- Rail-to-Rail Input and Output

Application

- Resistor thermal detectors
- Precision current sensing
- Temperature, position and pressure sensors
- Medical equipment
- Electronic scales
- Strain gage amplifiers
- Thermocouple amplifiers
- Driving A/D Converters

Pin Configuration (Top View)



Pin Description

Symbol	Description
-IN	Inverting input of the amplifier. The voltage range is from $V_{S-} - 0.1$ to $V_{S+} + 0.1V$.
+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 1.8V to 5.5V. Split supplies are possible as long as the voltage between V_{S+} and V_{S-} is from 1.8V to 5.5V.
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 1.8V to 5.5V.
OUT	Amplifier output.

Ordering Information

Type Number	Package Name	Package Quantity	Eco Class	Marking Code
LTC8551QT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	AZ1Q
LTC8552QS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	QZ2 X
LTC8552QV8/R6	MSOP-8L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	QZ2X

Limiting Value - In accordance with the Absolute Maximum Rating System (IEC 60134).

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	10 V
Signal Input Terminals: Voltage, Current	$V_{S-} - 0.5V$ to $V_{S+} + 0.5 V$, ± 20 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 AEC-Q100-002	$\pm 2\ 000$	V
	Charged device model (CDM), per AEC-Q100-011	$\pm 2\ 000$	

Electrical Characteristics

$V_S = 1.8\text{ V to }5.5\text{ V}$, $T_A = +25\text{ }^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40\text{ }^\circ\text{C to }+125\text{ }^\circ\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
V _{OS}	Input offset voltage			±4	±20	μV
V _{OS} TC	Offset voltage drift	T _A = -40 °C		±5	±24	μV
		T _A = +125 °C		±10	±50	
PSRR	Power supply rejection ratio	V _S = 2.0 to 5.5 V, V _{CM} < V _{S+} - 2V	100	125		dB
		T _A = -40 to +125 °C	96			
INPUT BIAS CURRENT						
I _B	Input bias current			±70		pA
		T _A = +85 °C		±150		
		T _A = +125 °C		±700		
I _{OS}	Input offset current			±100		pA
NOISE						
V _n	Input voltage noise	f = 0.01 to 1 Hz		0.1		μV _{P-P}
		f = 0.1 to 10 Hz		0.45		
e _n	Input voltage noise density	f = 10 kHz		15		nV/√ Hz
		f = 1 kHz		19		
I _n	Input current noise density	f = 1 kHz		10		fA/√ Hz
INPUT VOLTAGE						
V _{CM}	Common-mode voltage range		V _{S-} -0.1		V _{S+} +0.1	V
CMRR	Common-mode rejection ratio	V _S = 5.5 V, V _{CM} = -0.1 to 5.5 V	100	125		dB
		V _{CM} = 0 to 5.3 V, T _A = -40 to +125 °C	94			
		V _S = 2.0 V, V _{CM} = -0.1 to 2.0 V	92	122		
		V _{CM} = 0 to 1.8 V, T _A = -40 to +125 °C	90			
INPUT IMPEDANCE						
R _{IN}	Input resistance		100			GΩ
C _{IN}	Input capacitance	Differential		2.0		pF
		Common mode		3.5		
OPEN-LOOP GAIN						
A _{VOL}	Open-loop voltage gain	R _L = 20 kΩ, V _O = 0.05 to 3.5 V	100	120		dB
		T _A = -40 to +125 °C	94			
		R _L = 2 kΩ, V _O = 0.15 to 3.5 V	97	115		
		T _A = -40 to +125 °C	90			
FREQUENCY RESPONSE						
GBW	Gain bandwidth product			1.5		MHz
SR	Slew rate	G = +1, C _L = 100 pF, V _O = 1.5 to 3.5 V		0.95		V/μs
t _s	Settling time	To 0.1%, G = +1, 1 V step		1.2		μs
		To 0.01%, G = +1, 1 V step		1.5		
t _{OR}	Overload recovery time	V _{IN} × Gain > V _S		35		μs

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

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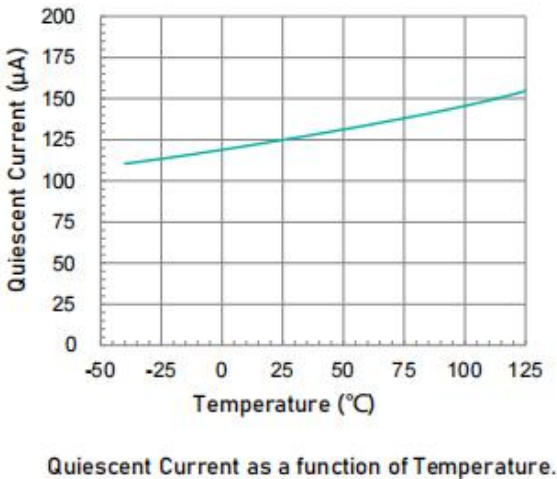
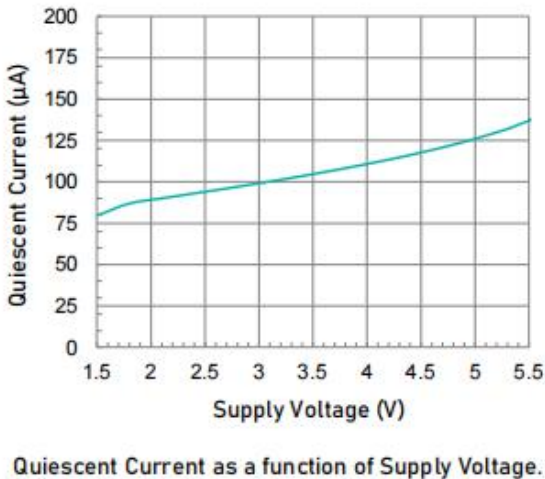
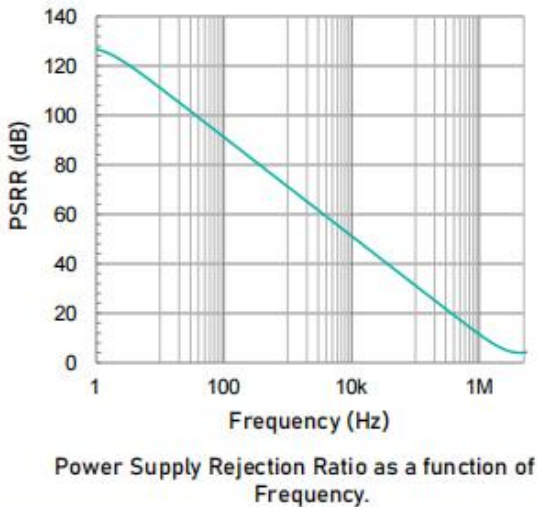
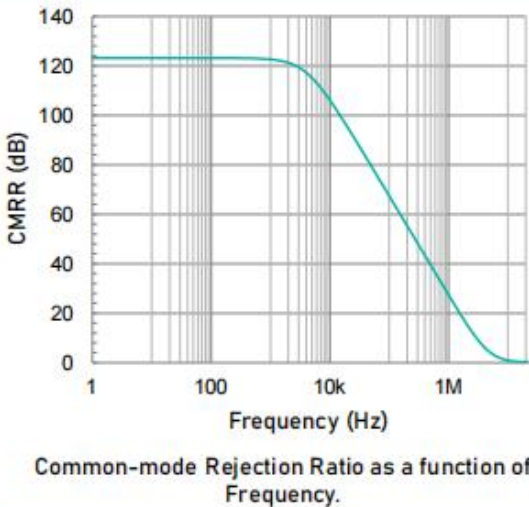
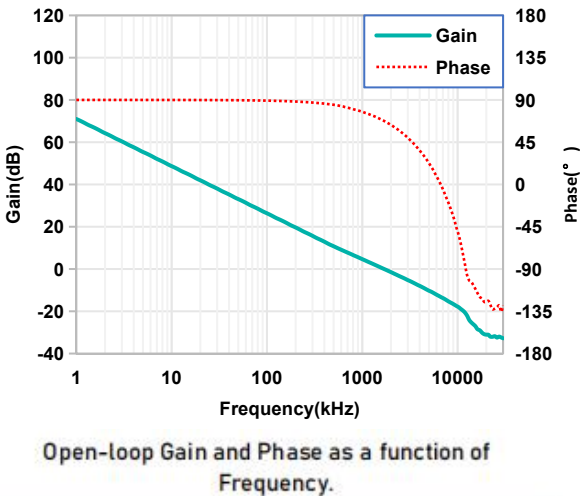
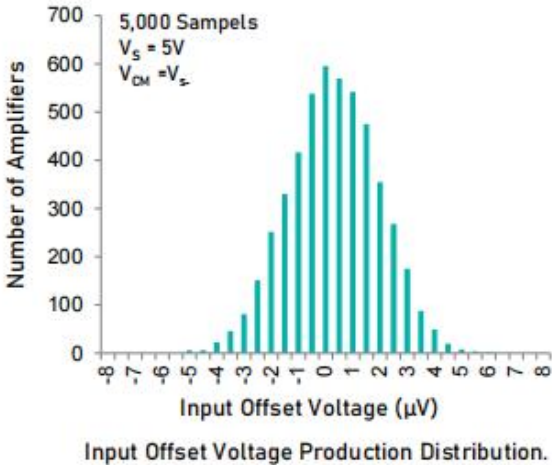
Electrical Characteristics (continued)

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Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
OUTPUT						
V _{OH}	High output voltage swing	R _L = 20 kΩ	V _{S+} -10	V _{S+} -8		mV
		R _L = 2 kΩ	V _{S+} -100	V _{S+} -60		
V _{OL}	Low output voltage swing	R _L = 20 kΩ		V _{S-} +8	V _{S-} +10	mV
		R _L = 2 kΩ		V _{S-} +40	V _{S-} +66	
Z _{OUT}	Open-loop output impedance	f = 350 kHz, I _o = 0		2		kΩ
I _{SC}	Short-circuit current	Source current through 10Ω		43		mA
		Sink current through 10Ω		55		
POWER SUPPLY						
V _S	Operating supply voltage	T _A = 0 to +70 °C	1.8		5.5	V
		T _A = -40 to +125 °C	2.0		5.5	
I _q	Quiescent current (per amplifier)	V _S = 2V	120	184	280	μA
		V _S = 5V	120	227	360	
THERMAL CHARACTERISTICS						
T _A	Operating temperature range		-40		+125	°C
θ _{JA}	Package Thermal Resistance	SOT23-5L		190		°C/W
		MSOP-8L		216		
		SOIC-8L		125		

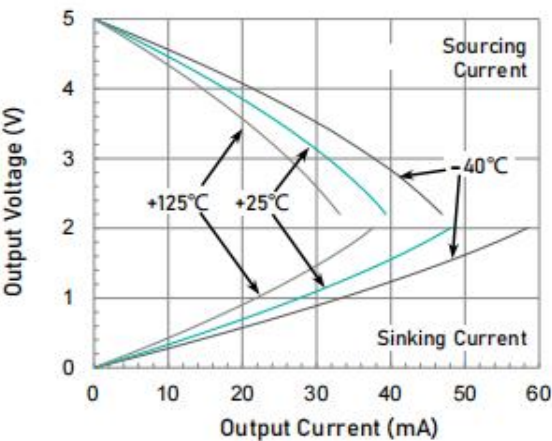
Typical Performance Characteristics

$V_S = 1.8\text{ V to }5.5\text{ V}$, $T_A = +25\text{ }^\circ\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40\text{ }^\circ\text{C to }+125\text{ }^\circ\text{C}$.

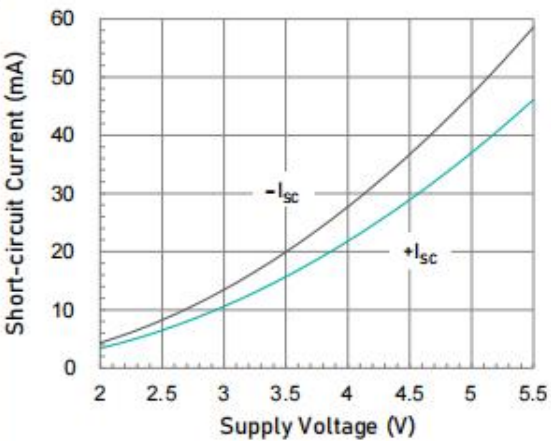


Typical Performance Characteristics (continued)

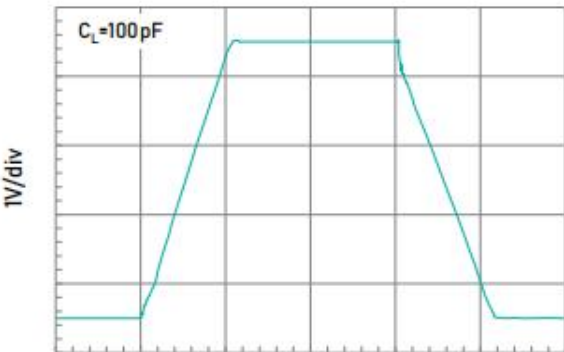
$V_S = 1.8\text{ V to }5.5\text{ V}$, $T_A = +25\text{ }^{\circ}\text{C}$, $V_{CM} = V_{OUT} = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted. Boldface limits apply over the specified temperature range, $T_A = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$.



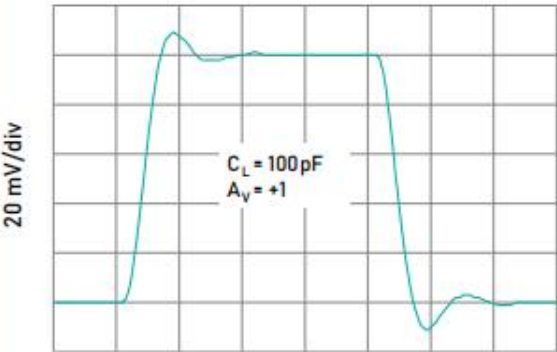
Output Voltage Swing as a function of Output Current.



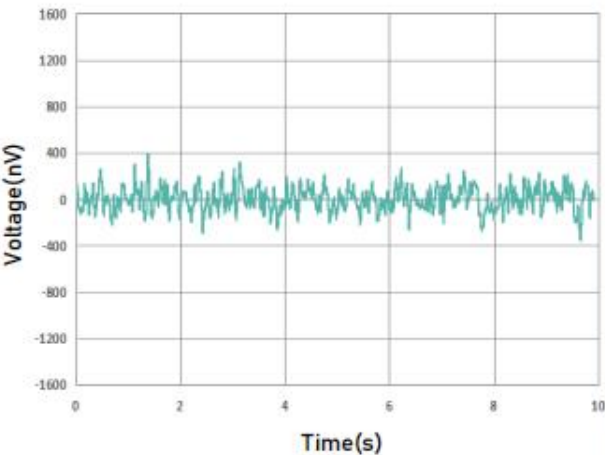
Short-circuit Current as a function of Supply Voltage.



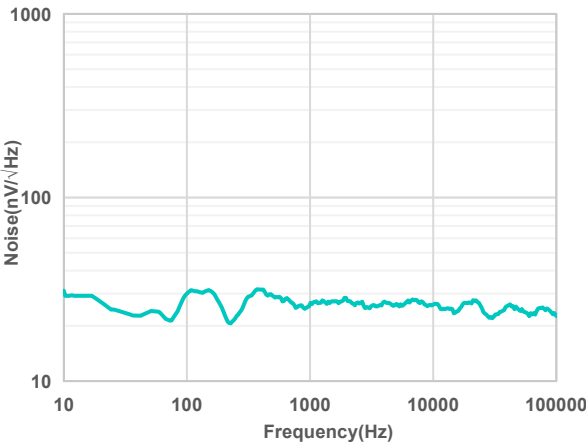
Large Signal Step Response (4V Step).



Small Signal Step Response (100mV Step).



0.1Hz to 10Hz Noise.



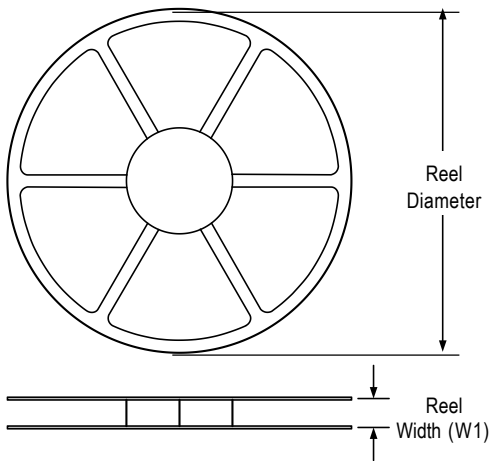
Noise vs Frequency.

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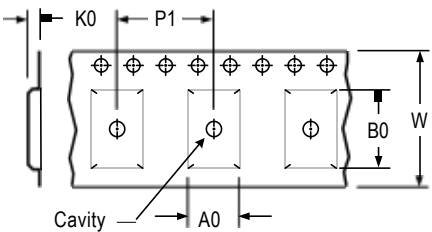


Tape and Reel Information

REEL DIMENSIONS

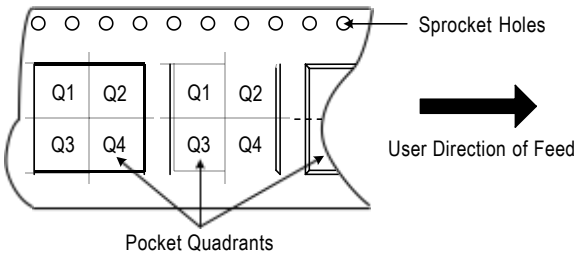


TAPE DIMENSIONS



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 ORIENTATION IN TAPE

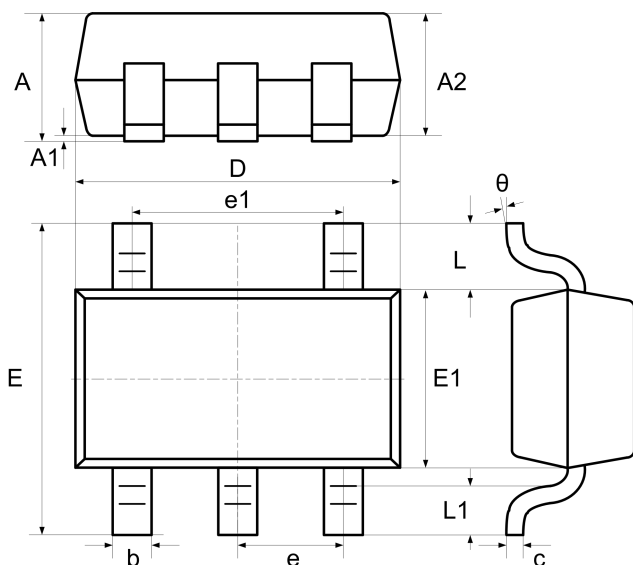


* All dimensions are nominal

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
LTC8551QT5/R6	SOT23	5	3 000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTC8552QS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTC8552QV8/R6	MSOP	8	3 000	330	12.5	5.0	3.0	3.0	8.0	12.0	Q1

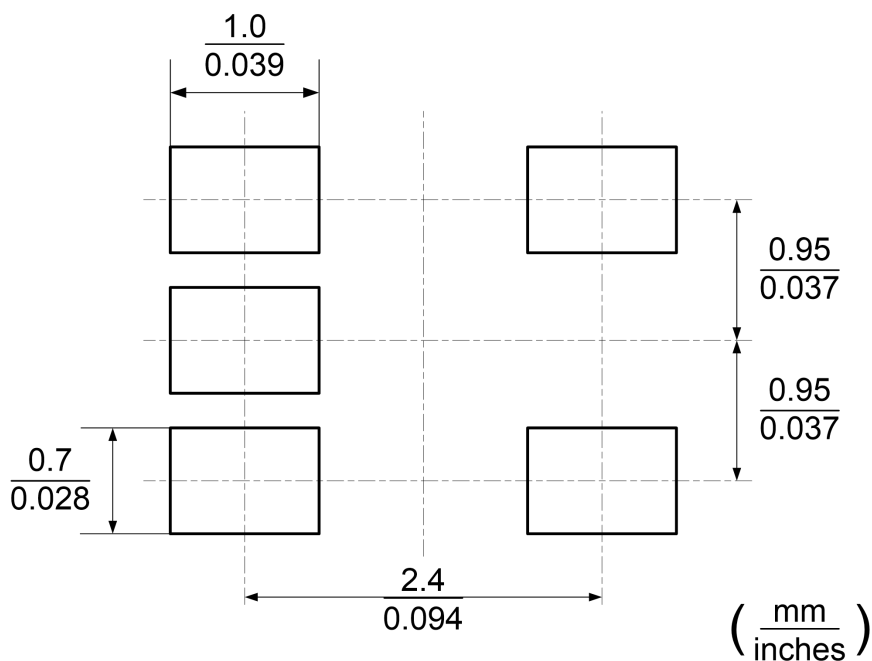
Package Outlines

DIMENSIONS, SOT23-5L



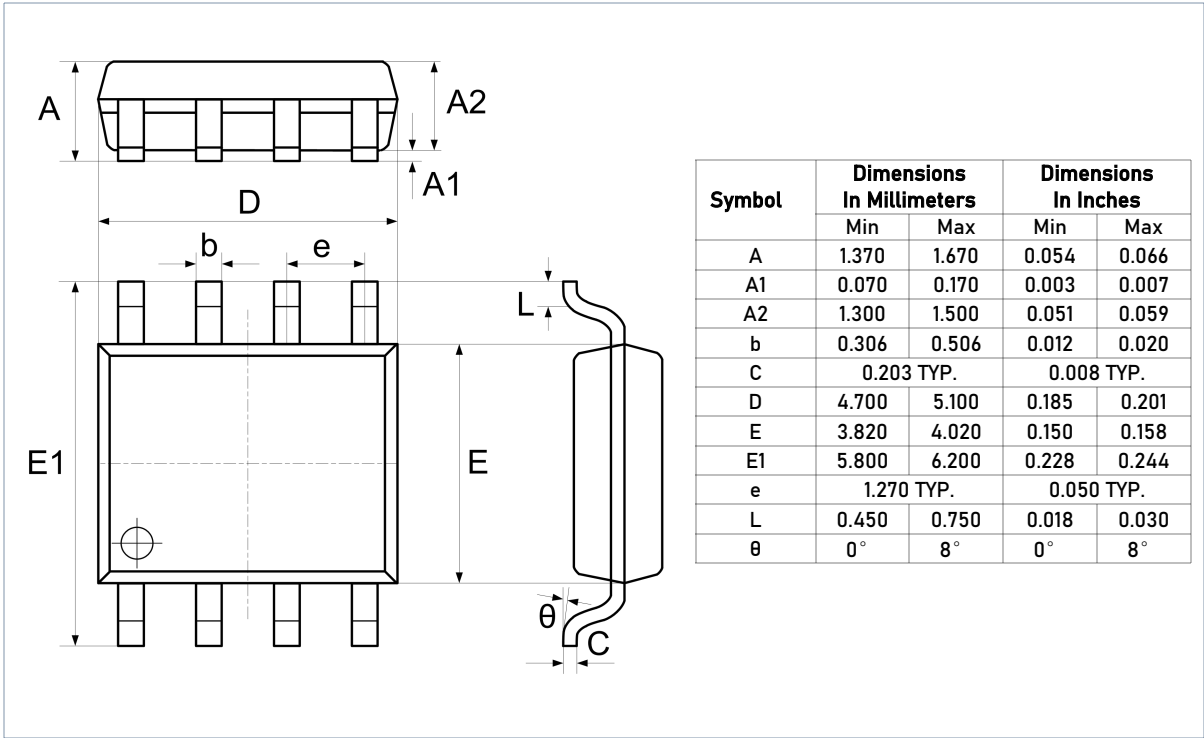
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 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

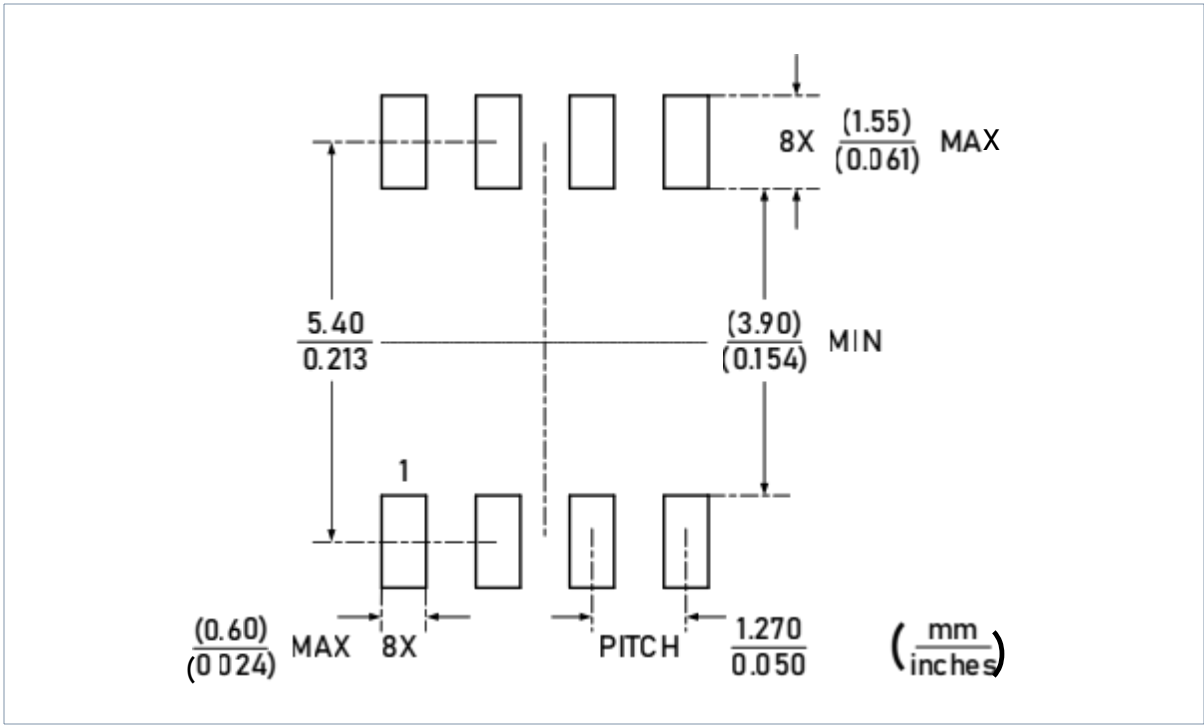


Package Outlines (continued)

DIMENSIONS, SOIC-8L

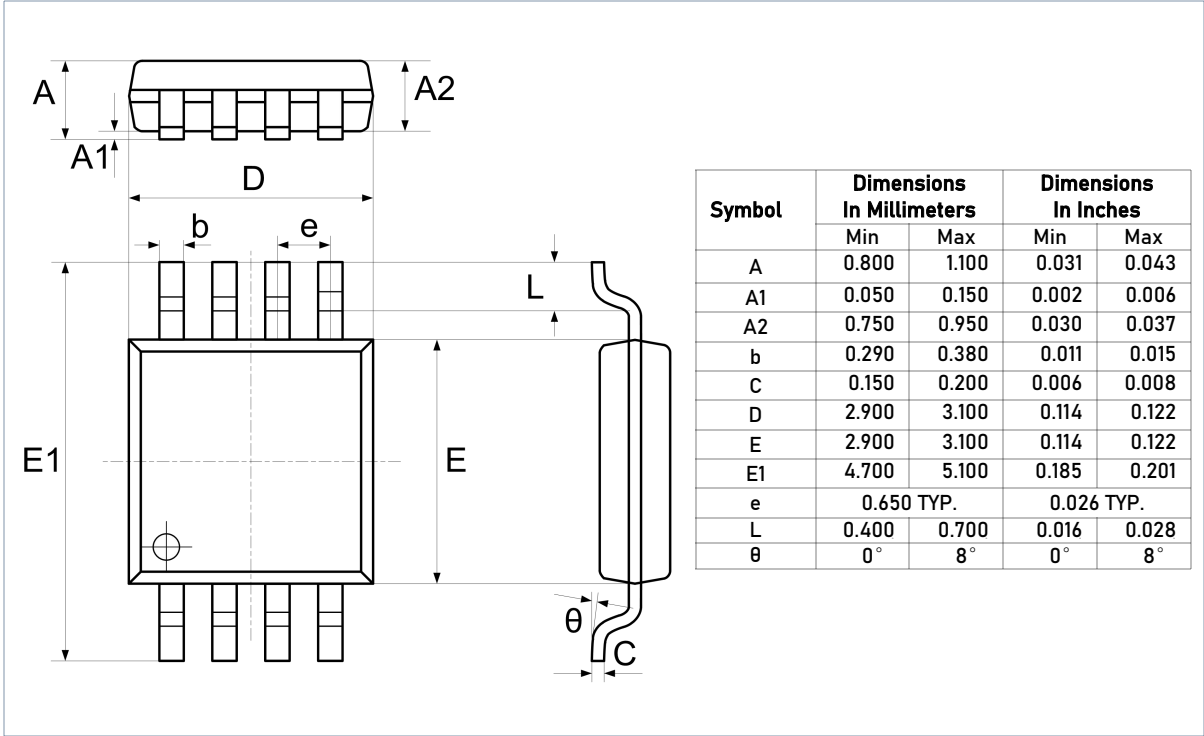


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

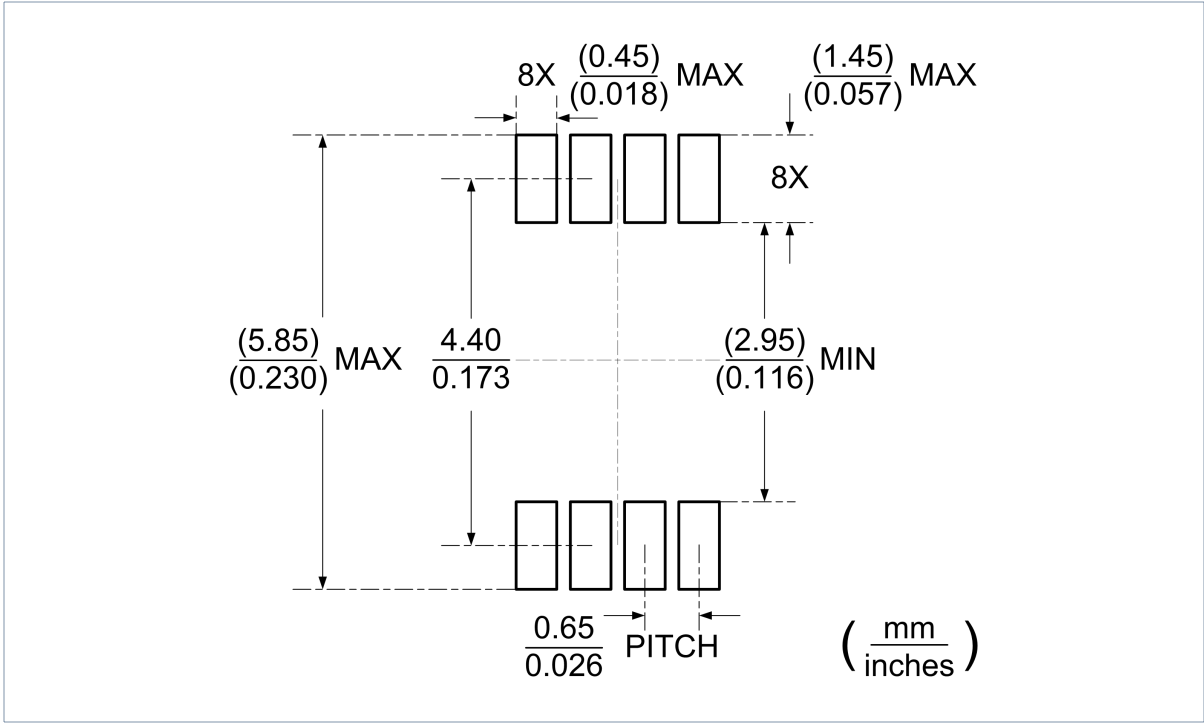


Package Outlines (continued)

DIMENSIONS, MSOP-8L



RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



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 (industrie 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.

For additional product information, or full datasheet, please contact with the Linearin's Sales Department or Representatives.