

General Description

The LTC854xQ family of single-, dual-channel operational amplifiers are specifically designed for general purpose cost-sensitive systems and applications. Featuring rail-to-rail input and output (RRIO) swings, and low quiescent current (typical 80 μ A) combined with a wide bandwidth (1.2MHz) and low noise (45nV/ $\sqrt{\text{Hz}}$ at 1kHz) makes this family very attractive for variety of battery-powered applications that require a good balance between cost and performance, such as audio outputs, consumer electronics, smoke detectors, portable medical devices and white goods. The low input bias current supports these amplifiers to be used in applications with mega-ohm source impedances.

The robust design of the LTC854xQ provide ease-of-use to the circuit designer: unity-gain stability with capacitive loads of up to 500pF, integrated RF/EMI rejection filter, no phase reversal in overdrive conditions, and high electro-static discharge (ESD) protection. The LTC854xQ amplifiers are optimized for operation at voltages as low as +2V ($\pm 1\text{V}$) and up to +5.5V ($\pm 2.75\text{V}$), and over the extended temperature range of -40°C to $+125^{\circ}\text{C}$.

The LTC8541Q (single) is available in SOT23-5L and SC70-5L packages. The LTC8542Q (dual) is offered in SOIC-8L and MSOP-8L packages.

Features and Benefits

- Optimized for AEC-Q100 Grade 1 Applications
- General Purpose Amplifiers for Cost-Sensitive Systems
- 1.2MHz GBW for Unity-Gain Stable
- Low Input Offset Voltage: $\pm 4.5\text{mV}$ Maximum
- Single 2V to 5.5V Supply Voltage Range
- Rail-to-Rail Input and Output
- Internal RF/EMI Filter
- Extended Temperature Range: -40°C to $+125^{\circ}\text{C}$

Applications

- Automotive Headlighting
- On-Board Charger (OBC)
- Body Electronics
- Inverter and Motor Control
- Battery Management System (BMS)

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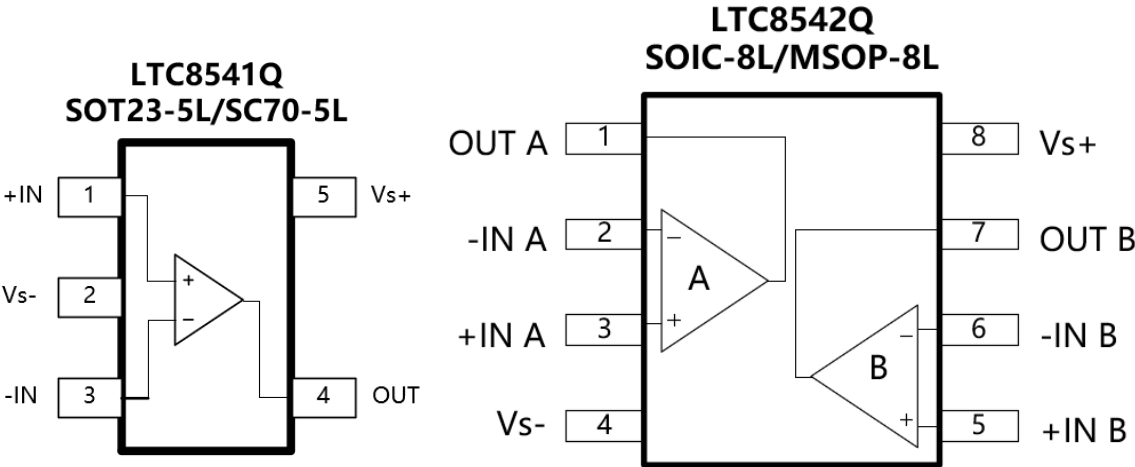
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Pin Configurations (Top View)



Pin Description

Symbol	Description
-IN	inverting input of the amplifier. The voltage range is from (Vs- - 0.1V) to (Vs+ + 0.1V).
+IN	Non-inverting input of the amplifier. This pin has the same voltage range as -IN.
Vs+	Positive power supply.
Vs-	Negative power supply.
OUT	Amplifier output.

Ordering Information

Type Number	Package Name	Package Quantity	Marking Code
LTC8541QT5/R6	SOT23-5L	Tape and Reel, 3 000	Q41
LTC8541QC5/R6	SC70-5L	Tape and Reel, 3 000	Q41
LTC8542QS8/R8	SOIC-8L	Tape and Reel, 4 000	Q42X
LTC8542QV8/R8	MSOP-8L	Tape and Reel, 4 000	Q42X

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

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	10.0 V
Signal Input Terminals: Voltage, Current	$V_{S-} - 0.5\text{ V}$ to $V_{S+} + 0.5\text{ V}$, $\pm 10\text{ mA}$
Output Short-Circuit	Continuous
Storage Temperature Range, T_{stg}	$-65\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$
Junction Temperature, T_J	150 $^{\circ}\text{C}$
Lead Temperature Range (Soldering 10 sec)	260 $^{\circ}\text{C}$

ESD Ratings

Parameter	Item	Level	Unit
Electrostatic Discharge Voltage	Human body model (HBM), per AEC-Q100-002	$\pm 2\text{ }000$	V
	Charged device model (CDM), per AEC-Q100-011	$\pm 2\text{ }000$	

Electrical Characteristics

$V_S = 5.0\text{ V}$, $T_A = +25\text{ }^\circ\text{C}$, $V_{CM} = V_S/2$, $V_O = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.

Boldface limits apply over the specified temperature range, $T_A = -40\text{ to }+125\text{ }^\circ\text{C}$.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
DC PERFORMANCE						
Input offset voltage	V _{OS}			±0.1	±4.5	mV
		T _A = -40 to +125 °C			±4.8	
Input Offset Voltage vs Temperature	dV _{OS} /dT	T _A = -40 to +125 °C		±1.5		µV/°C
Input bias current	I _B			1		pA
		T _A = +85 °C		150		
		T _A = +125 °C		500		
Input offset current	I _{OS}			1		pA
Open-loop voltage gain	A _{VOL}	R _L = 10 kΩ, V _O = 0.05 to 3.5 V	60	105		dB
		T _A = -40 to +125 °C	90	100		
		R _L = 2kΩ, V _O = 0.15 to 3.5 V	85	100		
		T _A = -40 to +125 °C	80	90		
NOISE and DISTORTION PERFORMANCE						
Input voltage noise	V _n	f = 0.1 to 10 Hz		3		µV _{P-P}
Input voltage noise density	e _n	f = 10 kHz		20		nV/√ Hz
		f = 1 kHz		45		
INPUT VOLTAGE						
Common-mode voltage range	V _{CM}		V _{S-} - 0.1		V _{S+} + 0.1	V
Common-mode rejection ratio	CMRR	V _S = 5.5 V, V _{CM} = -0.1 to 3 V	70	105		dB
		V _{CM} = -0.1 to 3 V, T _A = -40 to +125 °C	65			
		V _S = 2.0 V, V _{CM} = -0.1 to 0.5 V	65	100		
		V _{CM} = -0.1 to 0.5 V, T _A = -40 to +125 °C	60			
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product	GBW			1.2		MHz
Slew Rate	SR	G = +1, C _L = 100 pF, V _O = 1.5 to 3.5 V		1.1		V/µs
OUTPUT CHARACTERISTICS						
High output voltage swing	V _{OH}	R _L = 10 kΩ	V _{S+} -20		V _{S+} - 6	mV
		R _L = 2 kΩ	V _{S+} - 350		V _{S+} - 110	
Low output voltage swing	V _{OL}	R _L = 10 kΩ	V _{S-} +3		V _{S-} +25	mV
		R _L = 2 kΩ	V _{S-} +60		V _{S-} +250	
Short- circuit current	I _{SC}	Source current through 10Ω		35		mA
		Sink current through 10Ω		52		

Electrical Characteristics (Cont.)

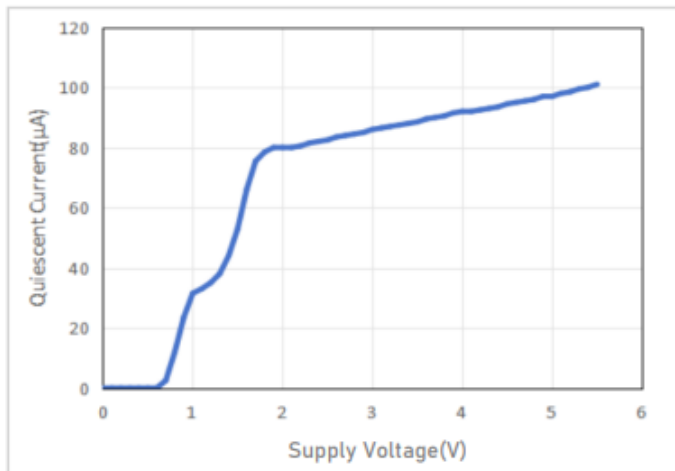
$V_S = 5.0\text{ V}$, $T_A = +25\text{ }^\circ\text{C}$, $V_{CM} = V_S/2$, $V_O = V_S/2$, and $R_L = 10\text{ k}\Omega$ connected to $V_S/2$, unless otherwise noted.

Boldface limits apply over the specified temperature range, $T_A = -40\text{ to }+125\text{ }^\circ\text{C}$.

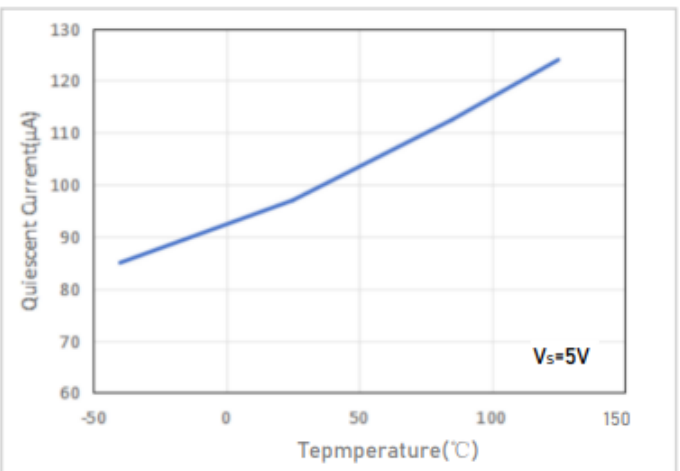
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
POWER SUPPLY						
Operating supply voltage	V _S	T _A = -40 to +125 °C	2.0		5.5	V
Power supply rejection ratio	PSRR	V _S = 2.0 to 5.5 V, V _{CM} < V _{S+} -2 V	80	110		dB
		T _A = -40 to +125 °C	75			
Quiescent current (per amplifier)	I _Q	V _S = 2.0 V		80	120	μA
		V _S = 2.0 V, T _A = -40 to +125 °C			150	
		V _S = 5.5 V		95	140	
		V _S = 5.5 V, T _A = -40 to +125 °C			180	
THERMAL CHARACTERISTICS						
Operating temperature range	T _A		-40		+125	°C
Package Thermal Resistance	θ _{JA}	SOT23-5L		190		°C/W
		SC70-5L		333		
		SOIC-8L		125		
		MSOP-8L		201		

Typical Performance Characteristics

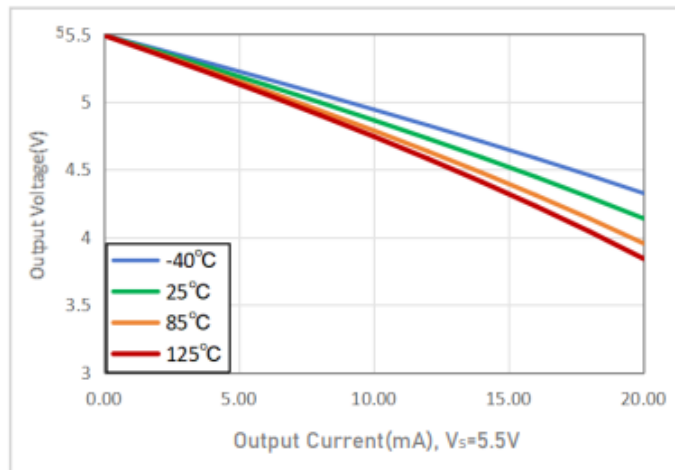
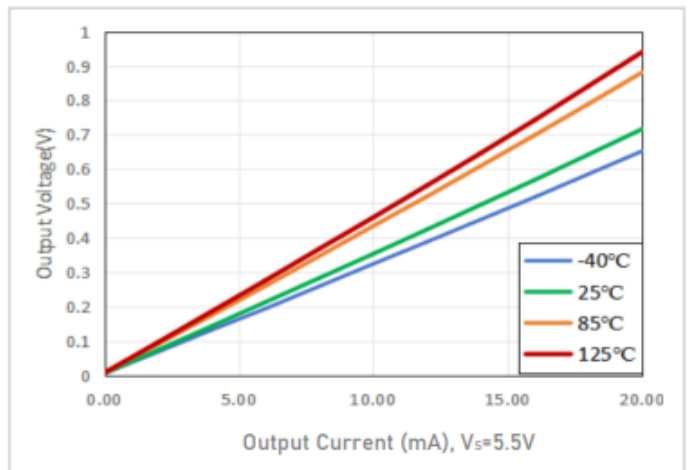
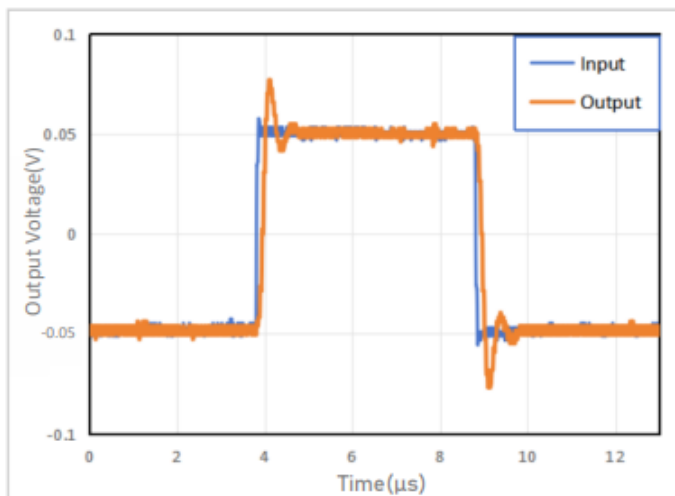
At $T_A = 25^\circ\text{C}$, $V_S = 5.0\text{ V}$, $V_{CM} = V_S / 2$ and $R_L = 10\text{ k}\Omega$ connected to $V_S / 2$, unless otherwise noted.



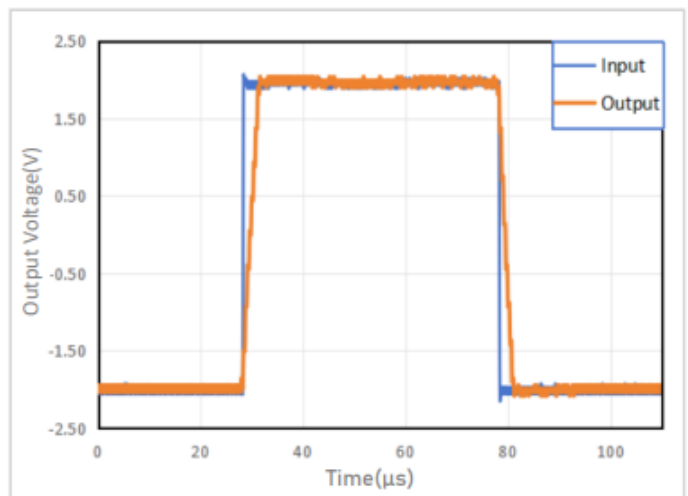
Quiescent Current as a function of Supply Voltage



Quiescent Current as a function of Temperature

Output Voltage Swing as a function of Output Current
(Sourcing, $V_S = 5.5\text{V}$)Output Voltage Swing as a function of Output Current
(Sinking, $V_S = 5.5\text{V}$)

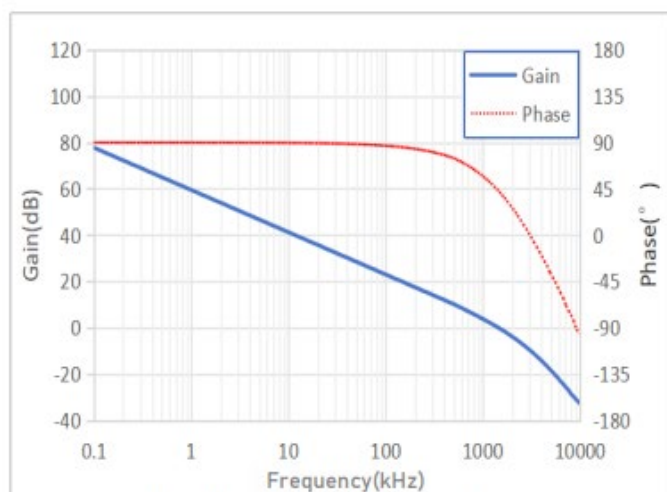
Small-Signal Step Response



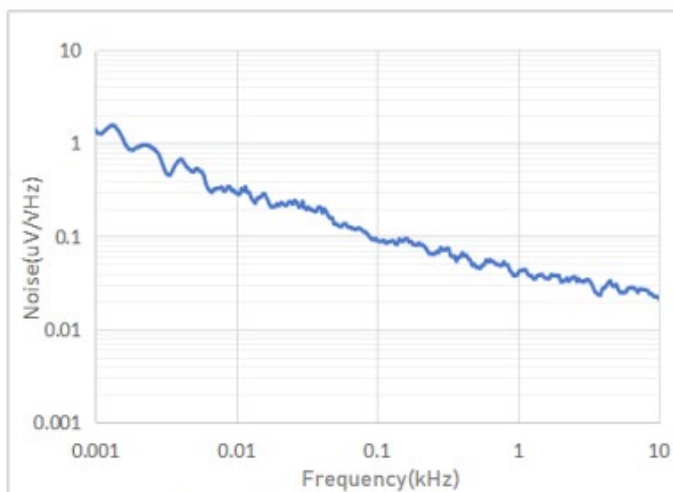
Large-Signal Step Response

Typical Performance Characteristics (Cont.)

At $T_A = 25^\circ\text{C}$, $V_S = 5.0\text{ V}$, $V_{CM} = V_S / 2$ and $R_L = 10\text{ k}\Omega$ connected to $V_S / 2$, unless otherwise noted.



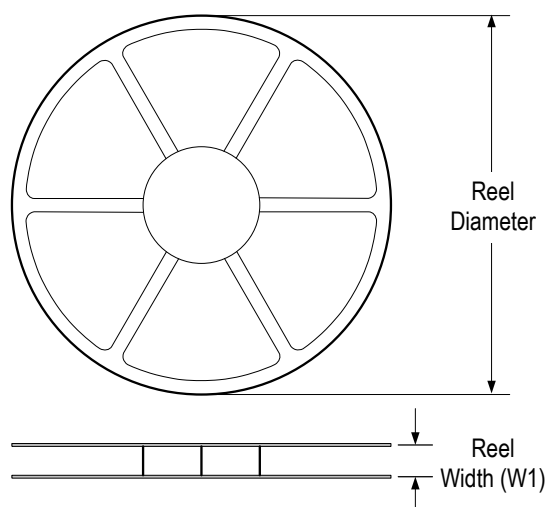
Open-Loop Gain and Phase vs. Frequency



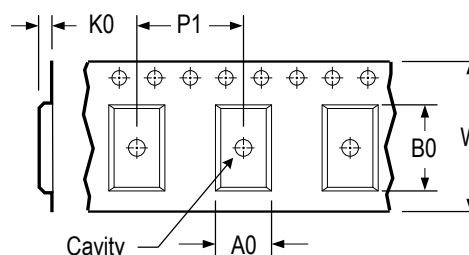
Voltage Noise Density vs. Frequency

Tape and Reel Information

REEL DIMENSIONS

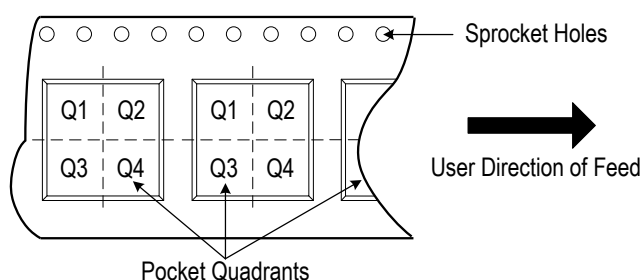


TAPE DIMENSIONS



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

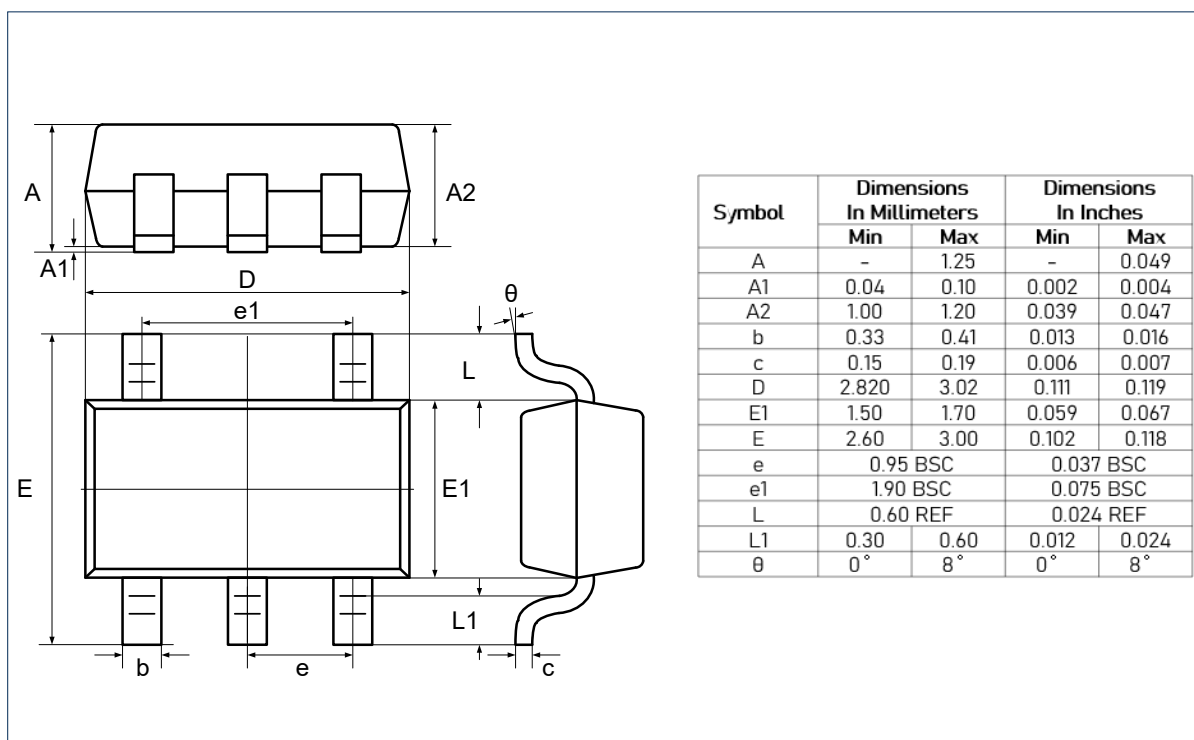


* All dimensions are nominal

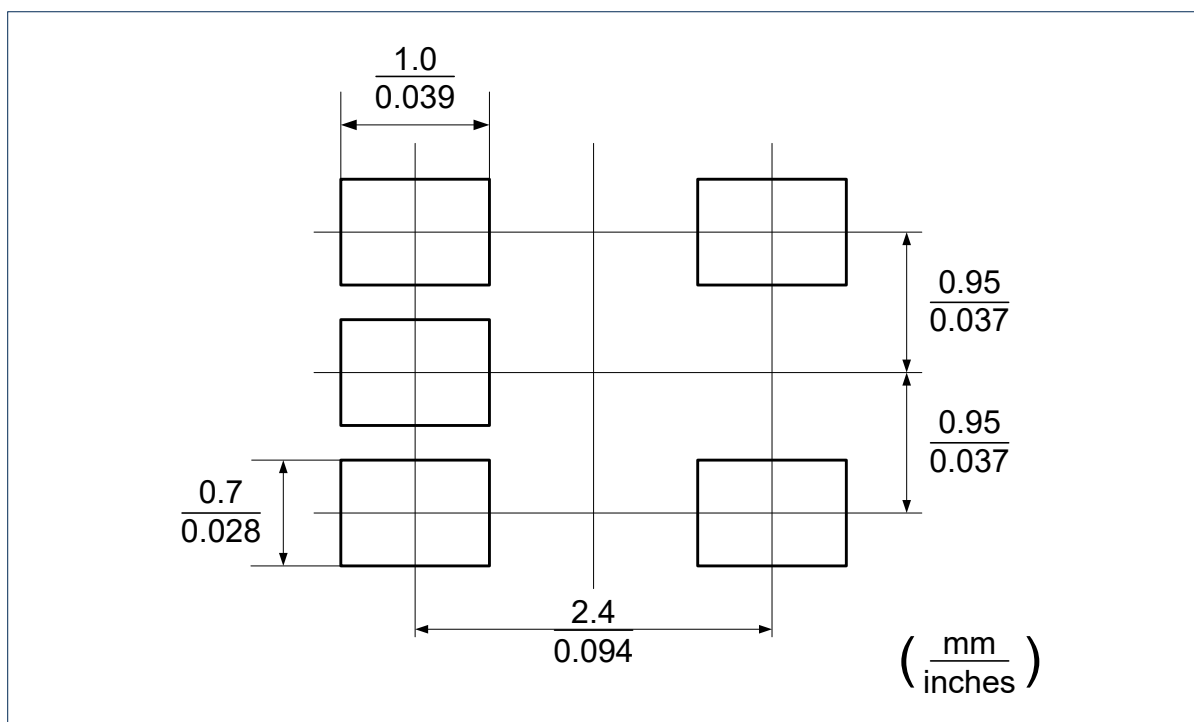
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
LTC8541QT5/R6	SOT23	5	3 000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTC8541QC5/R6	SC70	5	3 000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTC8542QS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTC8542QV8/R8	MSOP	8	4 000	330	12.5	5.0	3.5	2.0	8.0	12.0	Q1

Package Outlines

DIMENSIONS, SOT23-5L

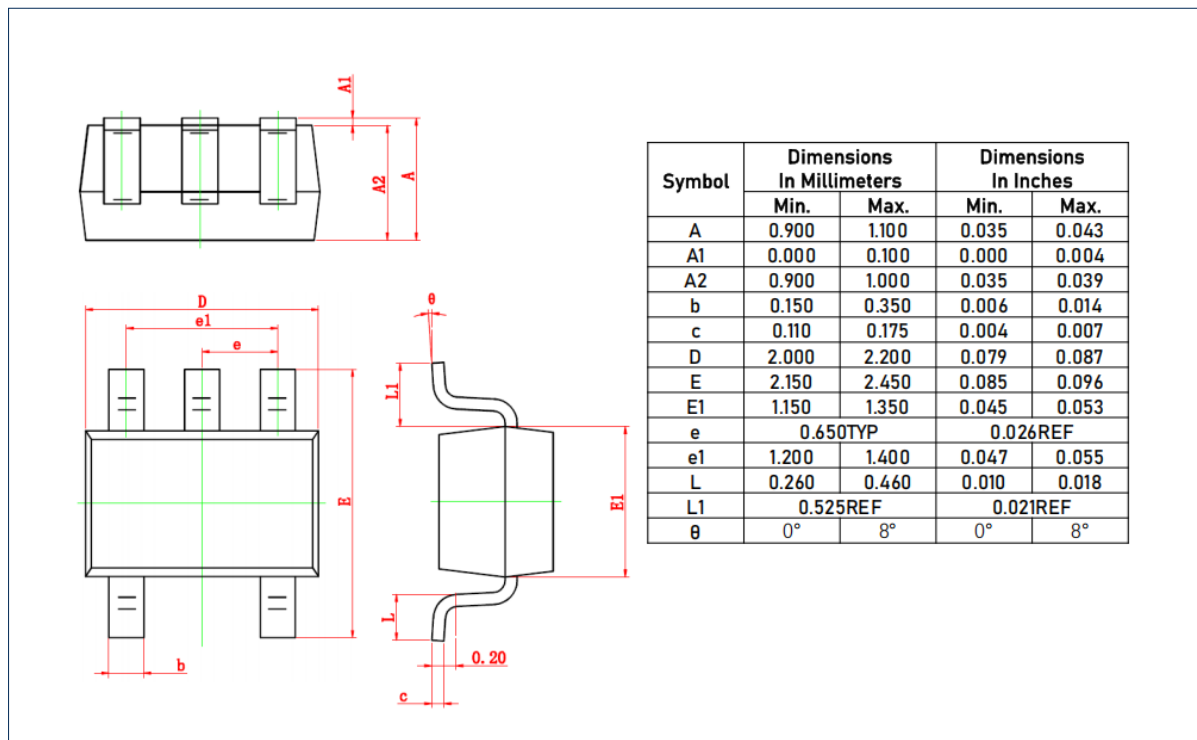


RECOMMENDED SOLDERING FOOTPRINT, SOT23-5L

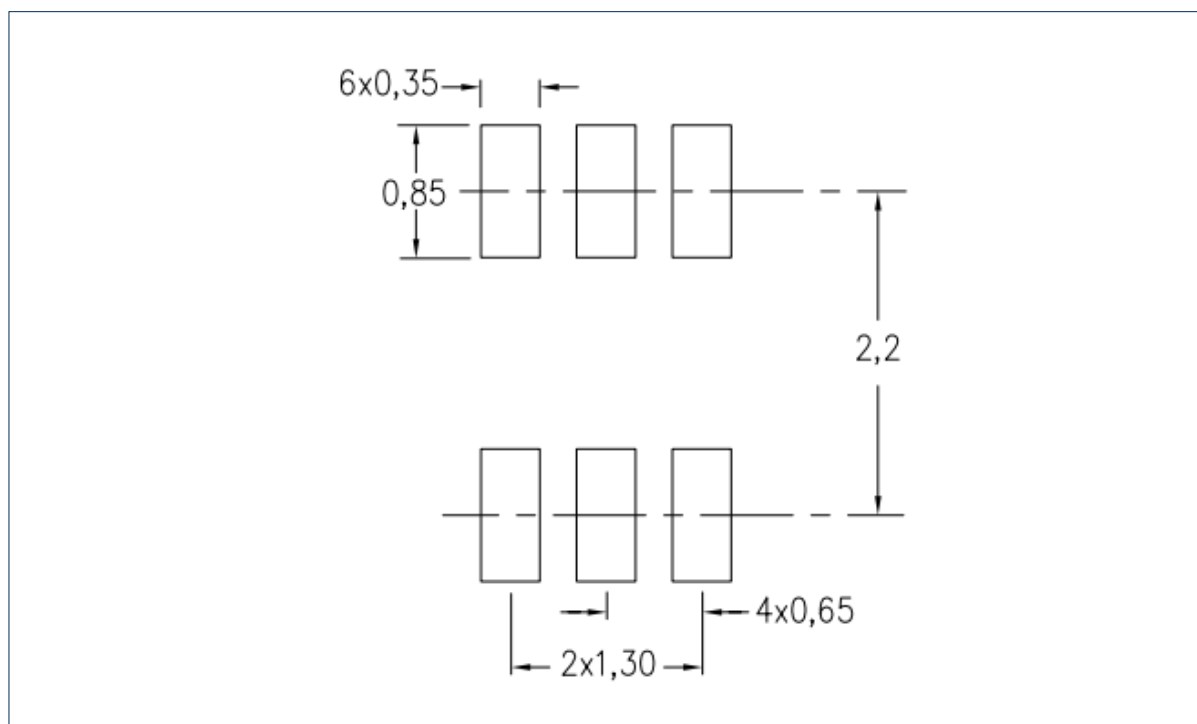


Package Outlines (Cont.)

DIMENSIONS, SC70-5L

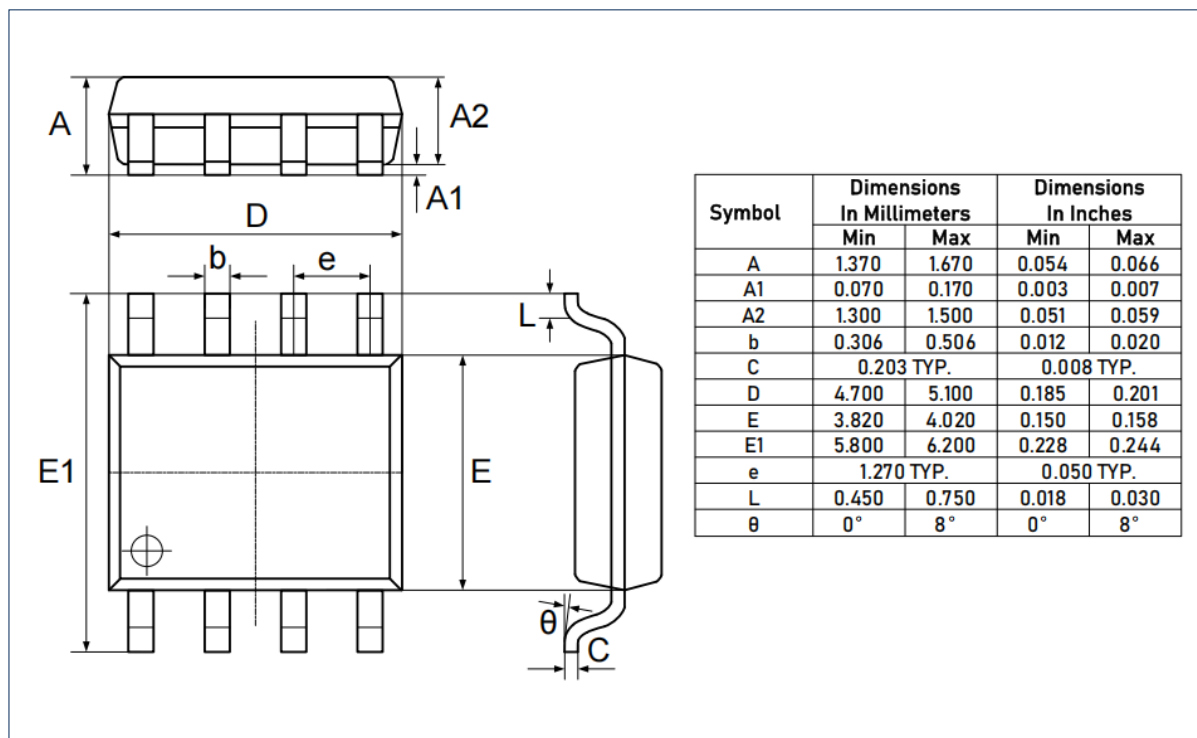


RECOMMENDED SOLDERING FOOTPRINT, SC70-5L

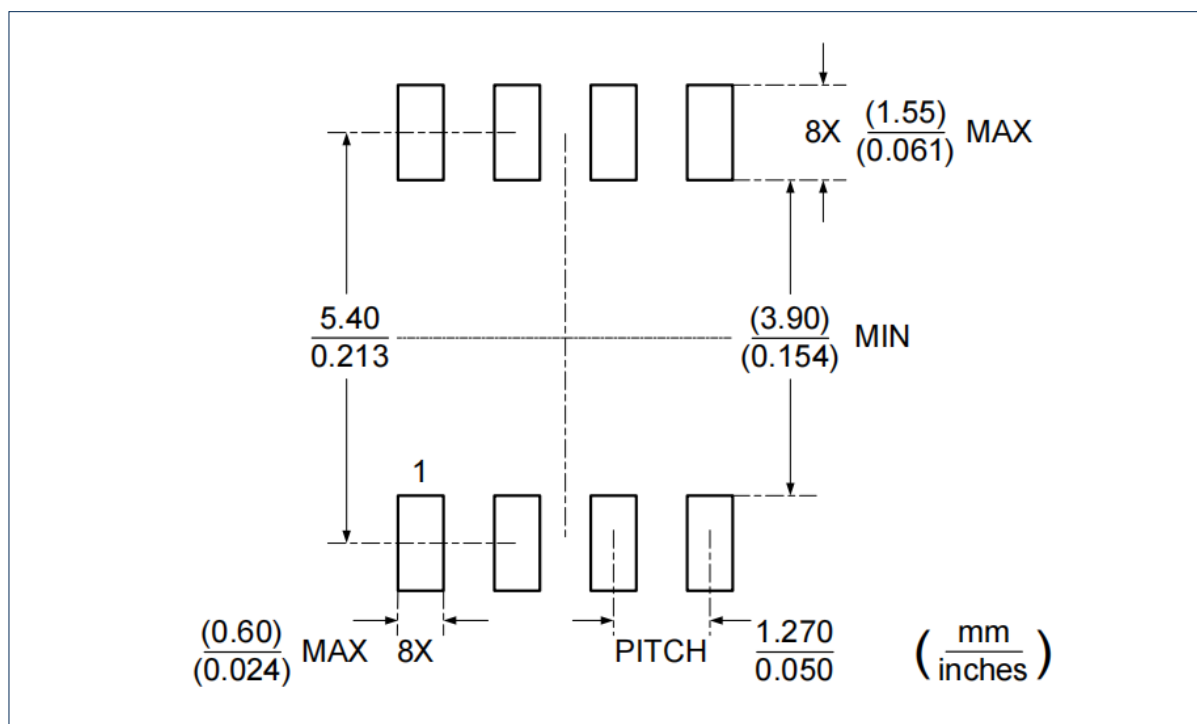


Package Outlines (Cont.)

DIMENSIONS, SOIC-8L

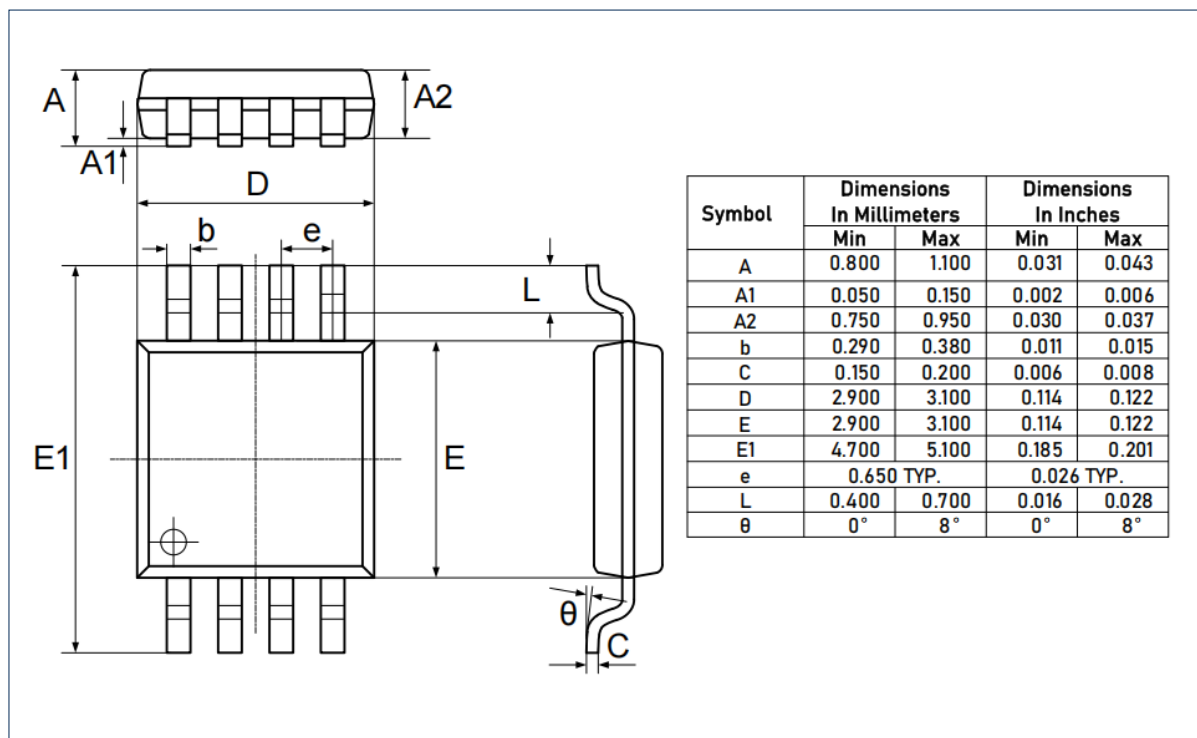


RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L

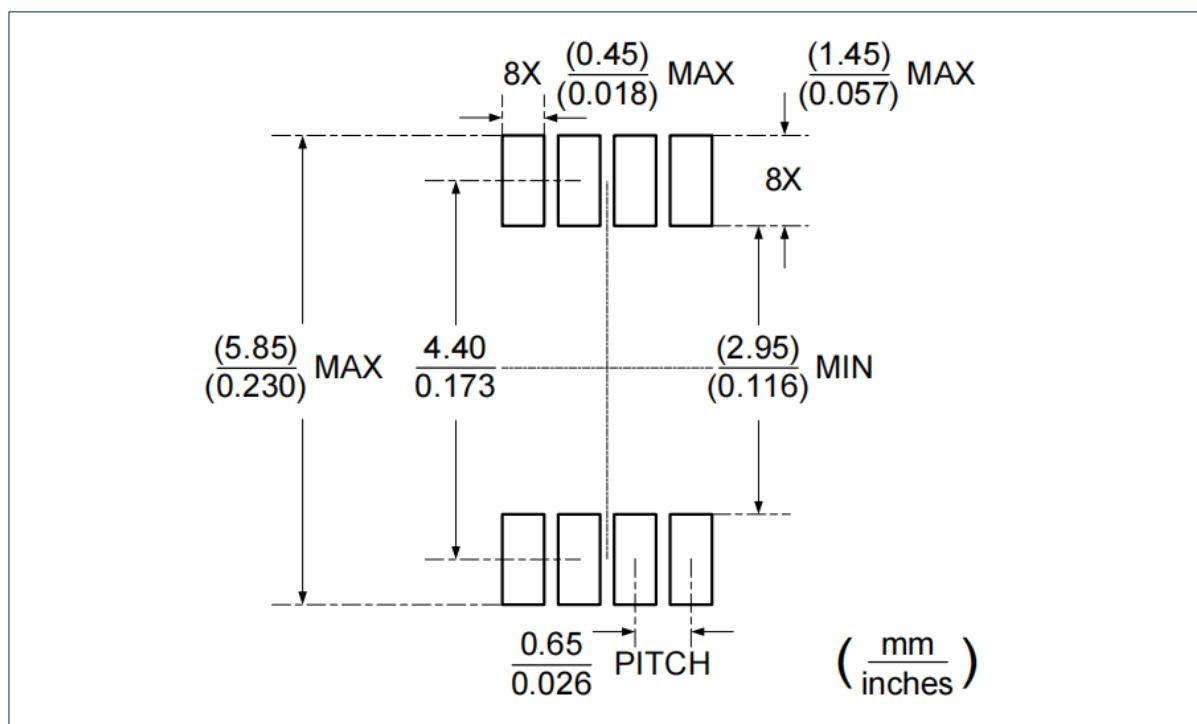


Package Outlines (Cont.)

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 (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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