LTA610x

350nA, Precision, Nano Power, Zero-drift Amplifiers

General Description

The LTA610x family of single- and dual-channel operational amplifiers provides input offset voltage correction for very low offset and drift through the use of patented fast step response chopper-stabilized techniques, while consuming nanowatt-level power per channel.

The LTA610x series are perfectly suitable for "Always ON" sensing applications in wireless and wired devices that require low input offset voltage. LTA6102 has the characteristics of low initial offset voltage, low offset drift and 4kHz bandwidth. This amplifier can be used for terminal devices that monitor current consumption, temperature, gas or strain gauges. The LTA6102 zero drift operational amplifier uses proprietary automatic calibration technology to provide low offset voltage, while also achieving minimal drift over time and temperature changes. In addition to having low offset voltage and ultra-low static current, the LTA6102 amplifier also has picoampere level input bias current, which can reduce common errors in various applications.

Features and Benefits

- Quiescent Current: 350nA per amplifier (typ., V_S = 3.3 V)
- Low offset voltage: ±20μV
- Offset voltage drift: ±0.1μV/℃
- Input voltage noise density at 100Hz: 280nV/ √ Hz
- Gain bandwidth: 4kHz
- Power supply voltage: 1.8~5.5V
- Rail-to-Rail Input/Output
- EMI Hardened

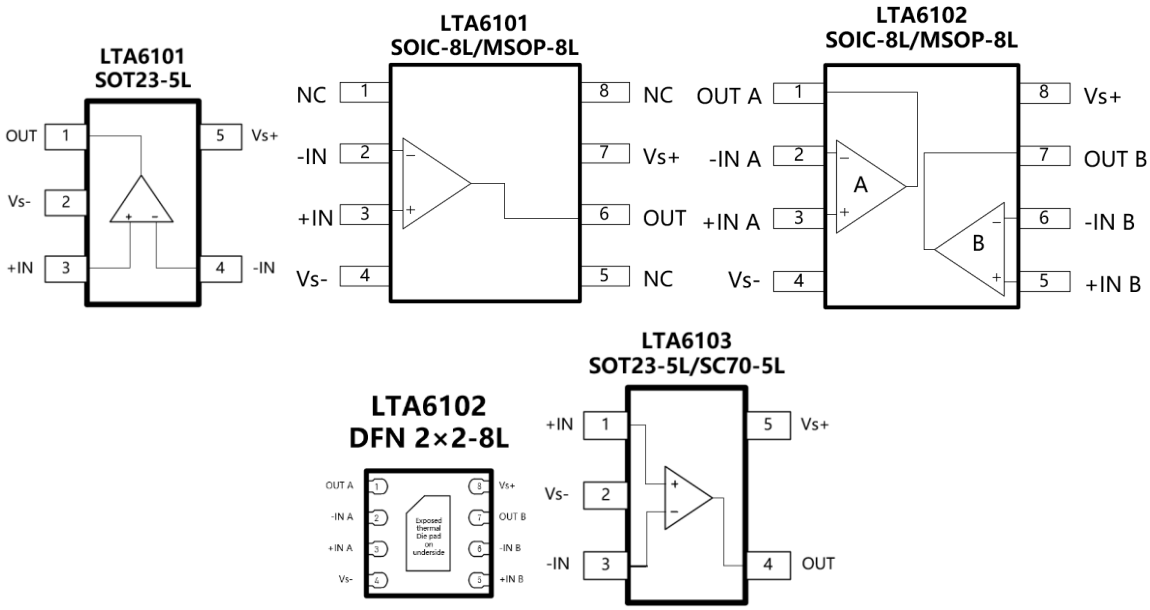
Applications

- Battery-Powered Instruments
- Gas Detection
- Power Analytics
- Fault Monitoring
- Temperature Measurements
  --High Impedance Thermistors
  --RTD's, Thermocouples
- Current Sensing
  --Shunt Resistor
  --Current Transformer
- Strain Gauges
  --Electronic Scales
  --Pressure Sensors

Ordering Information

Type Number	Package Name	Package Quantity	ECO Class	Operating Temperature Range	Mark Code
LTA6101XT5/R6	SOT23-5L	3000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U01
LTA6101XS8/R8	SOIC-8L	4000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U01
LTA6102XF8/R6	DFN2x2-8L	3000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U02
LTA6102XS8/R8	SOIC-8L	4000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U02
LTA6102XV8/R6	MSOP-8L	3000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U02
LTA6103XT5/R6	SOT23-5L	3000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U03
LTA6103XC5/R6	SC70-5L	3000	Green (RoHS & no Sb/Br)	-40℃ to +125℃	U03

Pin Configuration (Top View)



PIN Name	Description
-IN A	Inverting input, channel A
+IN A	Non-inverting input, channel A
OUT A	Output, channel A
V_{S-}	Negative power supply
-IN B	Inverting input, channel B
+IN B	Non-inverting input, channel B
OUT B	Output, channel B
V_{S+}	Positive power supply

Absolute Maximum Ratings

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

Parameter	Absolute Maximum Rating
Supply Voltage, V_{S+} to V_{S-}	5.5V
Signal Input Terminals: Voltage	V_{s-} - 0.5V to V_{s+} + 0.5V
Output Short-Circuit	Continuous
Storage Temperature Range, T_{stg}	-40℃ to 125℃
Junction Temperature, T_J	150℃
Lead Temperature Range (Soldering 10 sec)	260℃

ESD Ratings

Parameter	Level	UNIT
Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	±2000	V
Charged device model (CDM), per JESD22-C101	±1000	V

Thermal Information

Thermal Metric		Package	Level	Unit
θ_{JA}	Package Thermal Resistance	SOT23-5L	190	℃/W
		DFN2x2-8L	80	
		SC70-5	333	
		MSOP-8L	216	
		SOIC-8L	125	

Electrical Characteristics

V_S = 1.8V~5.5V , V_{cm}=V_{out}=V_s/2， R_L≥10MΩ（connect to V_s/2）, T_A = 25℃, unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
DC PERFORMANCE						
Input Offset Voltage	V_{OS}	V_s=3.3V		±20		μV
Input Offset Voltage vs Temperature	dV_{os} / dT	T_A=-40℃ to 125℃, V_s=3.3V		±0.1		μV/℃
Input Bias Current	I_B	T_A=25℃		10		pA
		T_A=125℃		300		
Input Offset Current	I_{OS}			20		pA
Open-loop Voltage Gain	A_{VOL}	V_S=3.3V, T_A=25℃	91	100		dB
		V_S=3.3V, T_A=-40~125℃	89	102		
		V_S=1.8V, T_A=25℃	80	83		
		V_S=1..8V, T_A=-40~125℃	79	89		
NOISE and DISTORTION PERFORMANCE						
Input Voltage Noise Density	e_n	f= 100 Hz		280		nV/ √ Hz
Input Voltage Noise	En	f=0.1Hz to 10Hz		4		μVpp
INPUT CHARACTERISTICS						
Input Common Mode Voltage Range	V_{CM}	T_A=25℃	0		V_S	V
		T_A=-40℃ to 125℃	0		V_S	
Common Mode Rejection Ratio	CMRR	V_S=3.3V, T_A=25℃, Vcm=0.0 to 3.3V		107		dB
		Vcm=0.0 to 3.3V, T_A=-40℃ to 125℃		106		
		V_S=1.8V, T_A=25℃, Vcm=0.0 to 1.8V		103		
		Vcm=0.0 to 1.8V, T_A=-40℃ to 125℃		101		
DYNAMIC PERFORMANCE						
Gain-Bandwidth	GBW	G=+100, V_S=3.3V		4		kHz
Phase margin	PM	G=+100, V_S=3.3V		71		°
Slew Rate	SR	V_S=3.3V, 1Vpp, f=200Hz		2		V/ms
OUTPUT CHARACTERISTICS						
High Output Voltage Swing	V_{OH}	R_L=100kΩ to V_S/2	V_S-12	V_S-6		mV
		R_L=2.00kΩ to V_S/2	V_S-120	V_S-65		
Low Output Voltage Swing	V_{OL}	R_L=100kΩ to V_S/2		2	6	mV
		R_L=2.00kΩ to V_S/2		18	35	
Output Current	I_{source}		12	16	22	mA
	I_{sink}		30	47	60	

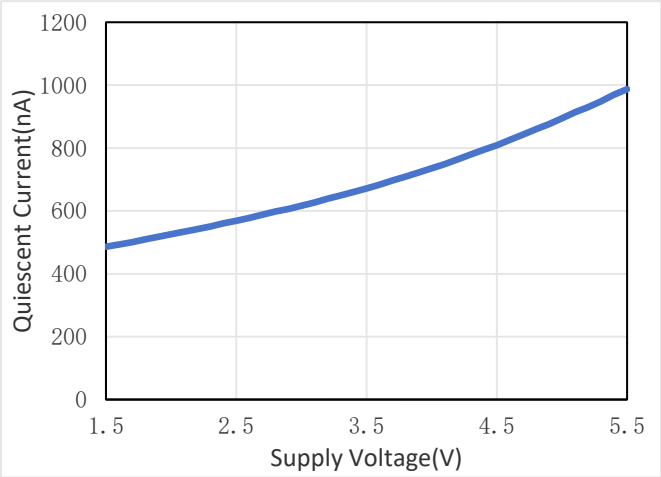
Electrical Characteristics (Cont.)

V_S = 1.8V~5.5 V , V_{cm}=V_{out}=V_s/2， R_L≥10MΩ（connect to V_s/2）, T_A = 25℃, unless otherwise noted.

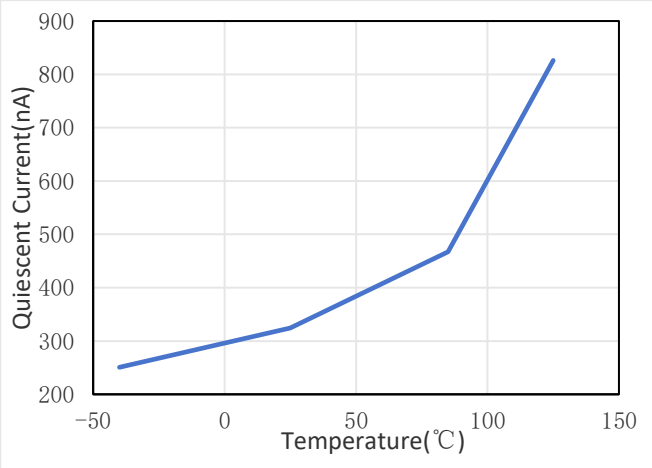
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
POWER SUPPLY						
Operating Supply Voltage	V_S	T_A= -40℃ to +125 ℃	1.8		5.5	V
Power Supply Rejection Ratio	PSRR	V_S= 1.8V to 3.3V	105	110		dB
		T_A= -40℃ to +125 ℃	102	109		
Quiescent Current (Per amplifier)	I_Q	V_s=3.3V		350	500	nA
		V_s=3.3V, T_A= -40℃ to +125 ℃	250		850	
		V_s=5V		460	860	
		V_s=5V, T_A= -40℃ to +125 ℃	300		1000	

Typical Characteristics

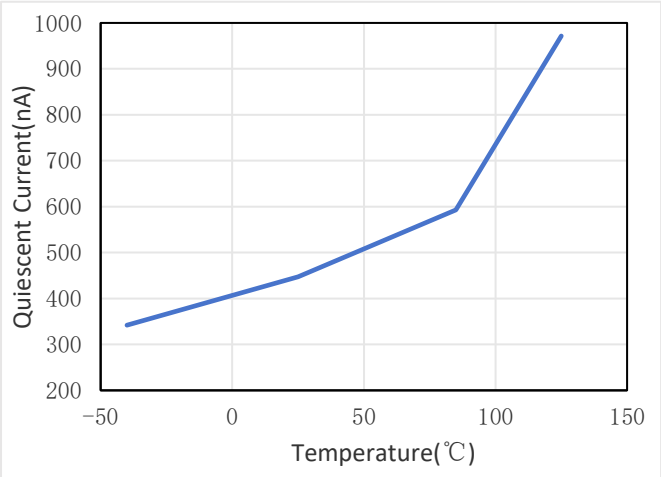
V_S = 1.8V~5.5 V , V_{cm}=V_{out}=V_s/2， R_L≥10MΩ（connect to V_s/2）, T_A = 25℃, unless otherwise noted.



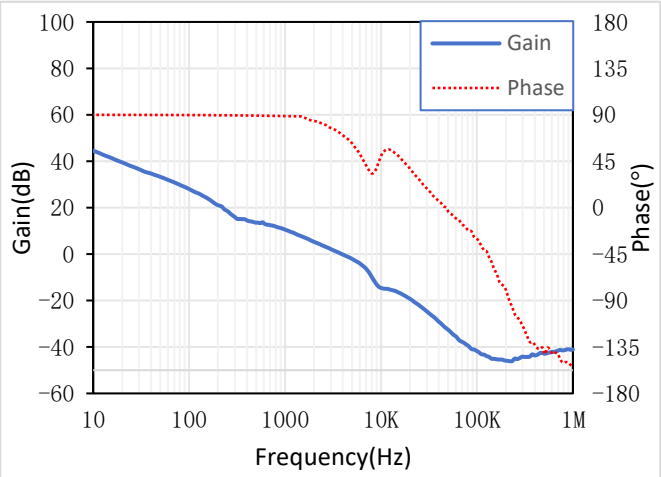
Quiescent Current as a function of Supply Voltage



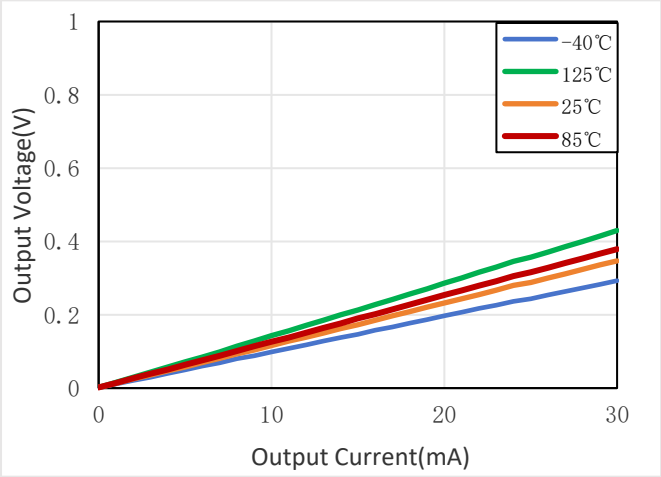
Quiescent Current as a function of Temperature (V_S=3.3V)



Quiescent Current as a function of Temperature (V_S=5V)

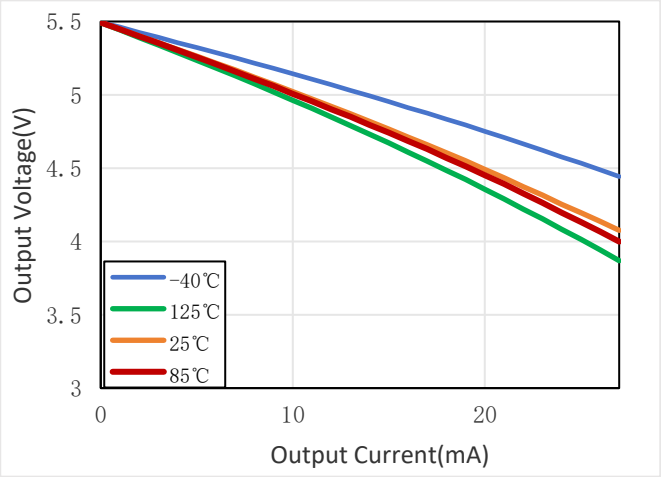


Open-Loop Gain and Phase vs. Frequency



Output Voltage Swing as a function of Output Current

(Sinking, V_S = 5.5 V)

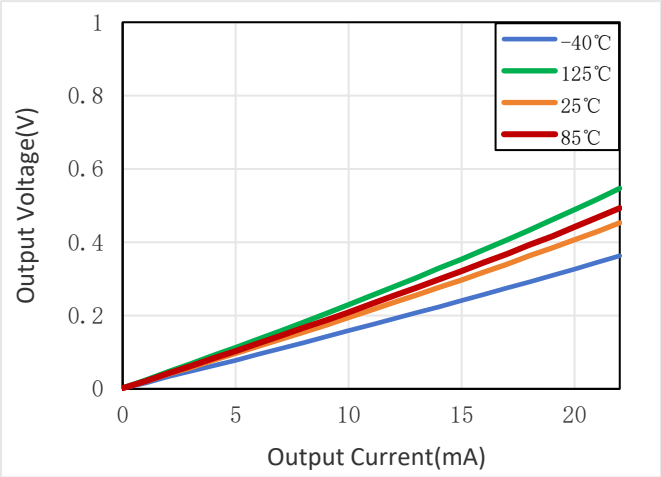


Output Voltage Swing as a function of Output Current

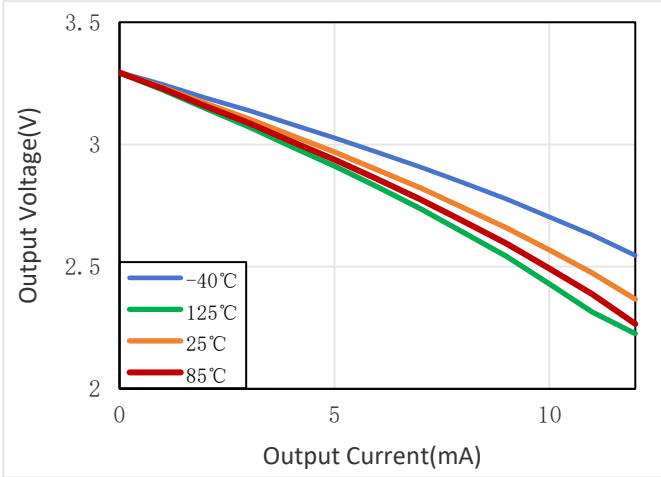
(Sourcing, V_S = 5.5 V)

Typical Characteristics (Cont.)

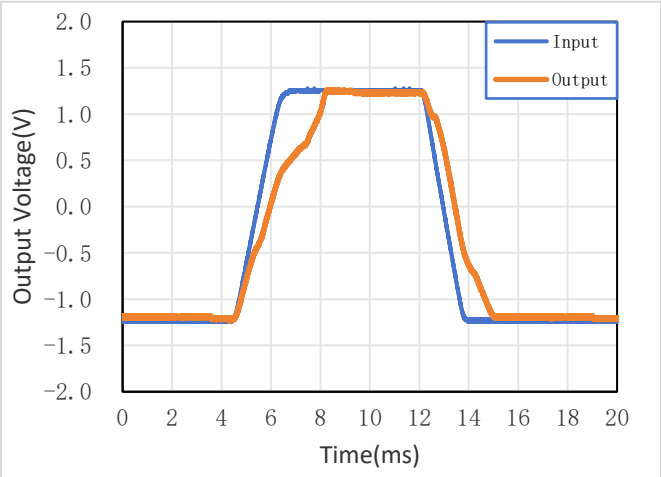
V_S = 1.8V~5.5 V , V_{cm}=V_{out}=V_s/2， R_L≥10MΩ（connect to V_s/2）, T_A = 25℃, unless otherwise noted.



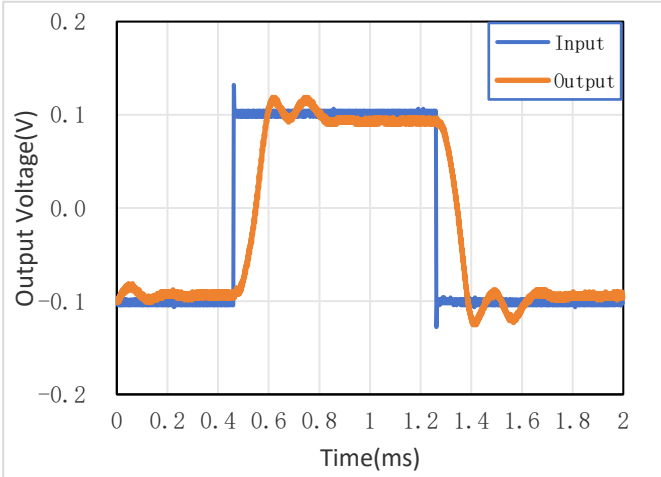
Output Voltage Swing as a function of Output Current (Sinking, V_S = 3.3 V)



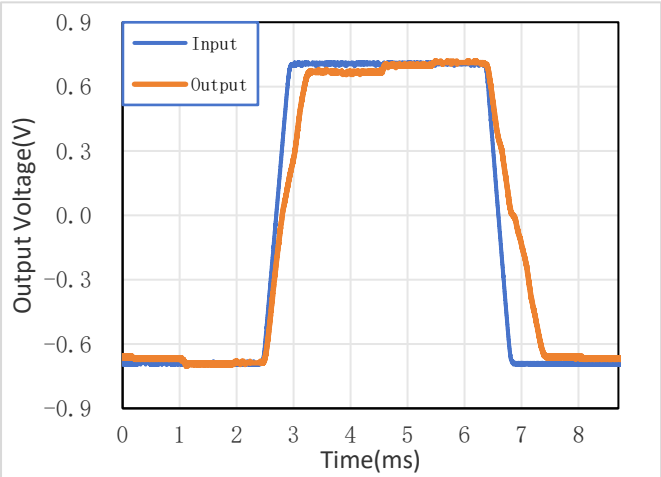
Output Voltage Swing as a function of Output Current (Sourcing, V_S = 3.3 V)



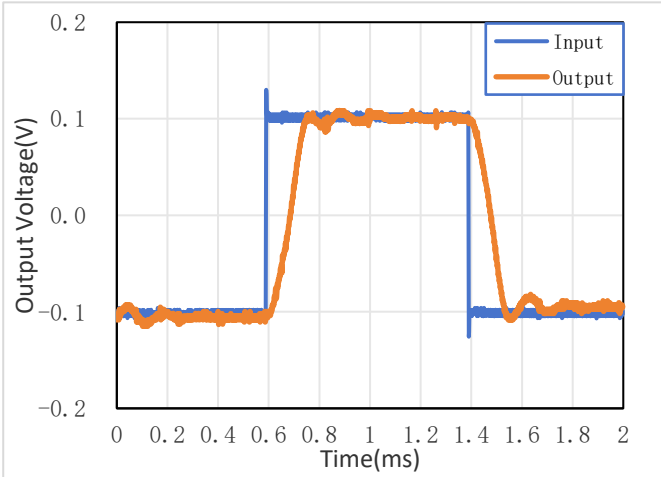
Large-Signal Step Response (V_S=3.3V)



Small-Signal Step Response (V_S=3.3V)



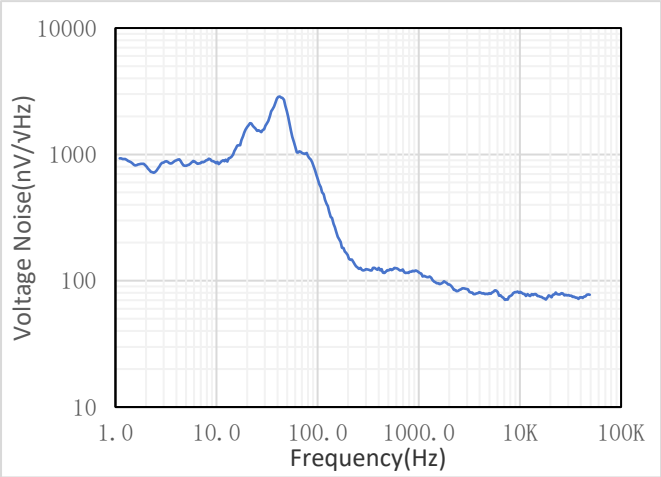
Large-Signal Step Response (V_S= 1.8V)



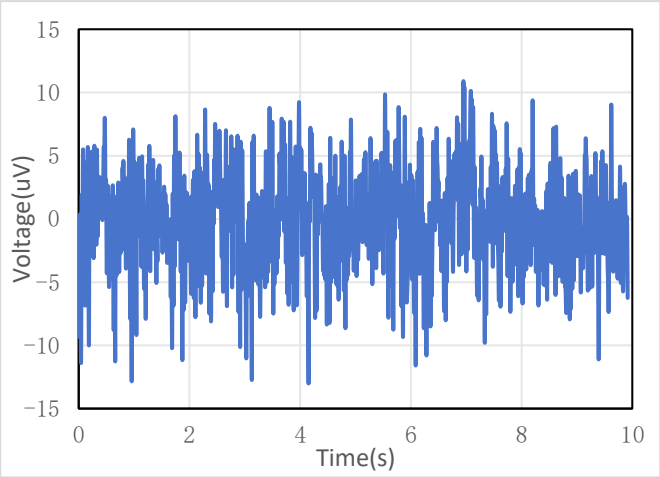
Small-Signal Step Response (V_S=1.8V)

Typical Characteristics (Cont.)

V_S = 1.8V~5.5 V , V_{cm}=V_{out}=V_s/2， R_L≥10MΩ（connect to V_s/2）, T_A = 25℃, unless otherwise noted.



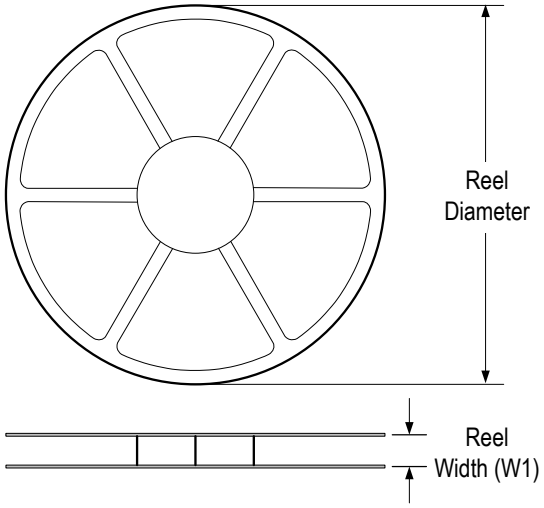
Voltage Noise vs Frequency



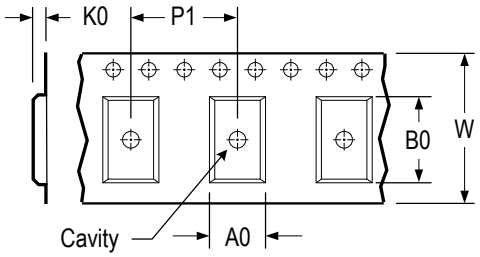
0.1Hz to 10Hz Input Voltage Noise

Tape and Reel Information

REEL DIMENSIONS

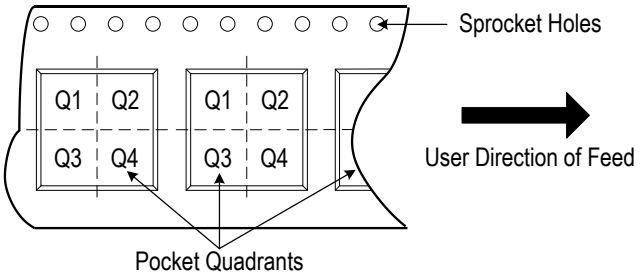


TAPE DIMENSIONS



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

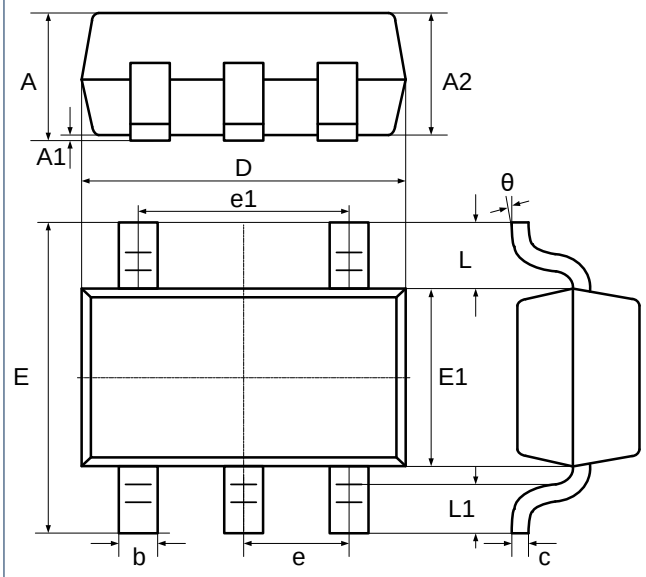


* All dimensions are nominal

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
LTA6101XT5/R6	SOT23	5	3000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTA6101XS8/R8	SOIC	8	4000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA6102XF8/R6	DFN2x2	8	3000	178	9.5	2.25	2.25	1.0	4.0	8.0	Q1
LTA6102XS8/R8	SOIC	8	4000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA6102XV8/R6	MSOP	8	3000	330	12.5	5.0	3.5	2.0	8.0	12.0	Q1
LTA6103XT5/R6	SOT23	5	3000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTA6103XC5/R6	SC70	5	3000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3

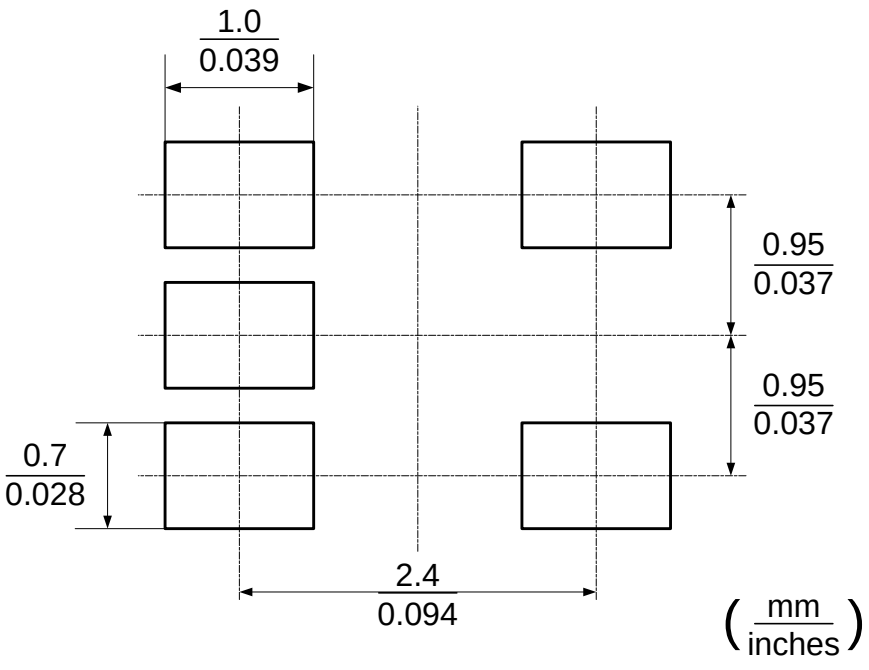
Package Outlines

DIMENSIONS, SOT23-5L



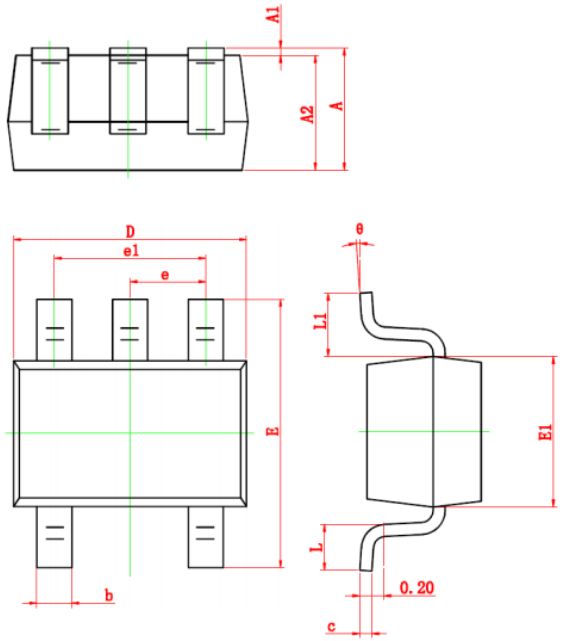
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075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



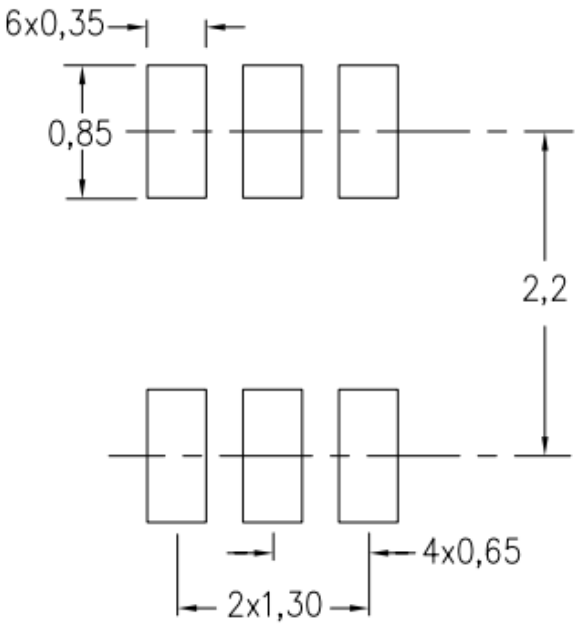
Package Outlines (Cont.)

DIMENSIONS, SC70-5L



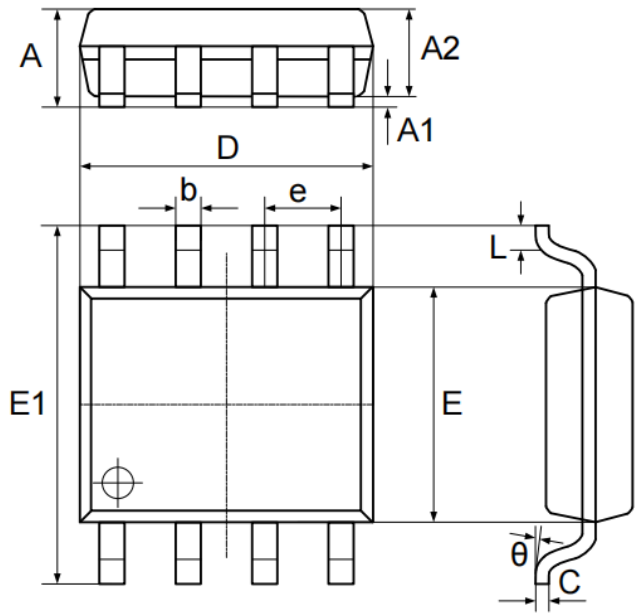
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.110	0.175	0.004	0.007
D	2.000	2.200	0.079	0.087
E	2.150	2.450	0.085	0.096
E1	1.150	1.350	0.045	0.053
e	0.650TYP		0.026REF	
e1	1.200	1.400	0.047	0.055
L	0.260	0.460	0.010	0.018
L1	0.525REF		0.021REF	
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, SC70-5L



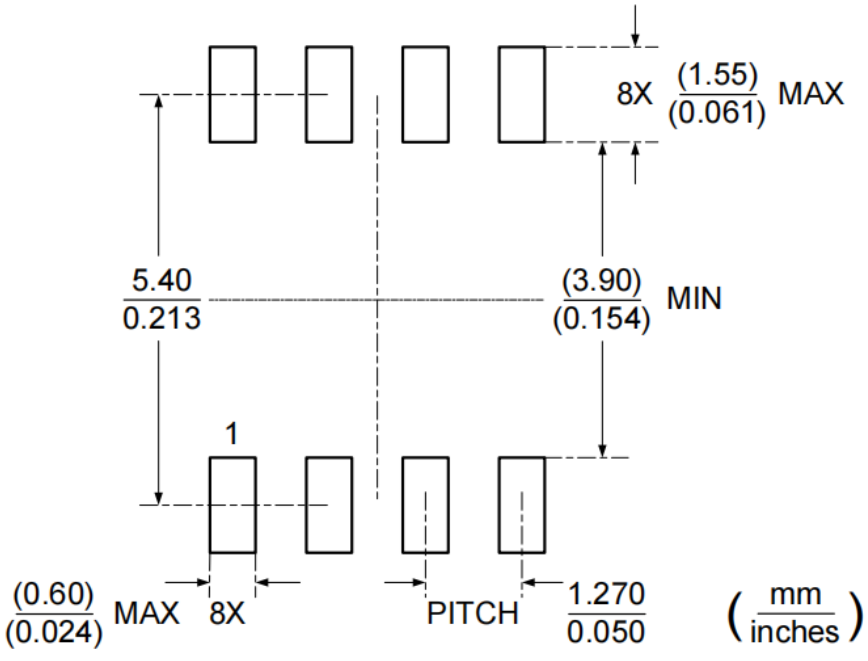
Package Outlines (Cont.)

DIMENSIONS, SOIC-8L



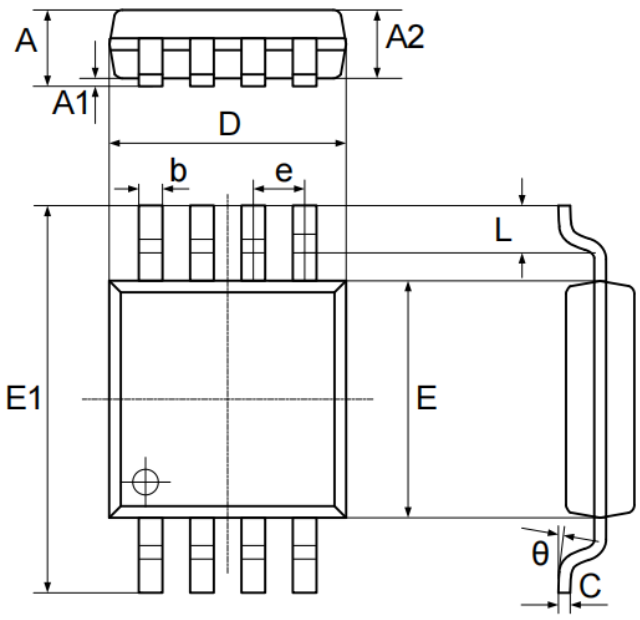
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.370	1.670	0.054	0.066
A1	0.070	0.170	0.003	0.007
A2	1.300	1.500	0.051	0.059
b	0.306	0.506	0.012	0.020
C	0.203 TYP.		0.008 TYP.	
D	4.700	5.100	0.185	0.201
E	3.820	4.020	0.150	0.158
E1	5.800	6.200	0.228	0.244
e	1.270 TYP.		0.050 TYP.	
L	0.450	0.750	0.018	0.030
θ	0°	8°	0°	8°

RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L



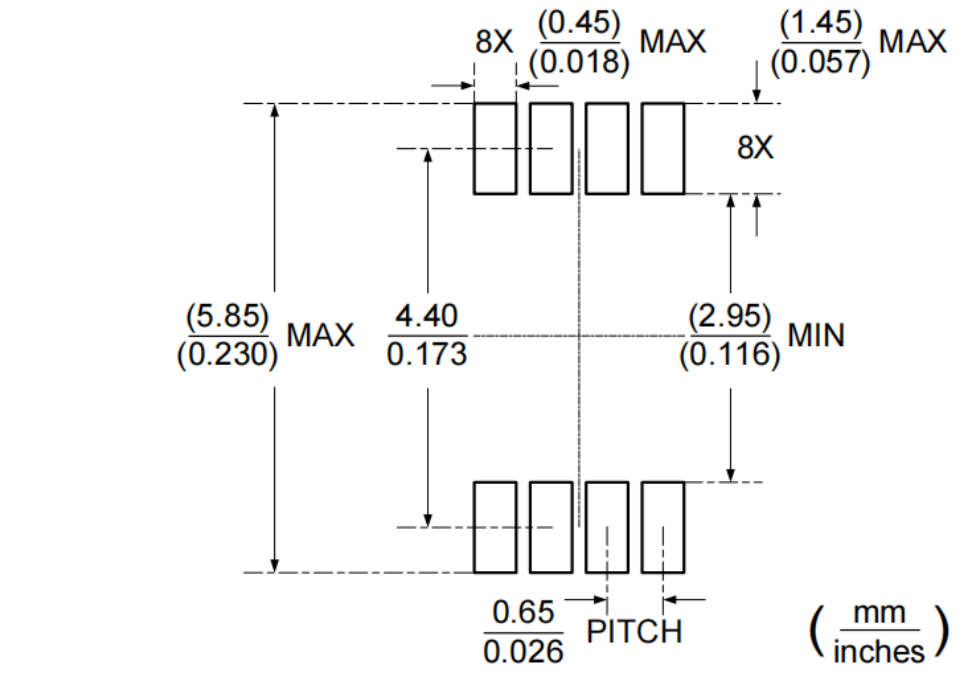
Package Outlines (Cont.)

DIMENSIONS, MSOP-8L



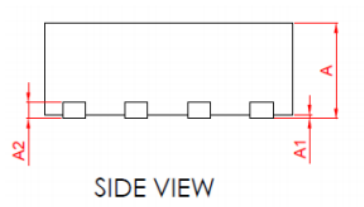
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.100	0.031	0.043
A1	0.050	0.150	0.002	0.006
A2	0.750	0.950	0.030	0.037
b	0.290	0.380	0.011	0.015
C	0.150	0.200	0.006	0.008
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
e	0.650 TYP.		0.026 TYP.	
L	0.400	0.700	0.016	0.028
θ	0°	8°	0°	8°

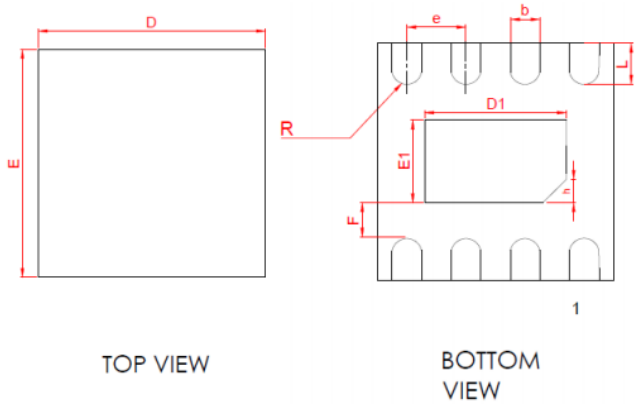
RECOMMENDED SOLDERING FOOTPRINT, MSOP-8L



Package Outlines (Cont.)

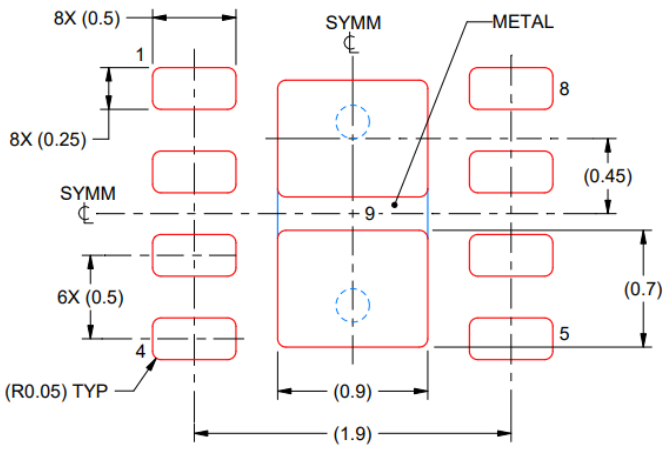
DIMENSIONS, DFN2x2-8L





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
b	0.200	0.300	0.008	0.012
A2	0.200BSC		0.008	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	1.100	1.300	0.043	0.051
E1	0.600	0.800	0.024	0.031
e	0.50REF		0.020	
L	0.300	0.400	0.012	0.016
F	0.250	0.350	0.010	0.014
h	REF0.18		0.007	

RECOMMENDED SOLDERING FOOTPRINT, DFN2x2-8L



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD 9:
87% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:25X

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.

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