LTA6681, LTA6682

50MHz, Zero-Crossover, Low-Distortion, RRIO, Operational Amplifier

General Description

The LTA668x series of zero-crossover, rail-to-rail, high-performance, CMOS operational amplifiers are optimized for very low voltage, single-supply applications. Rail-to-rail input or output, low-noise (8nV/√Hz) and high-speed operation (50MHz gain bandwidth) make these devices an excellent choice for driving sampling analog-to-digital converters (ADCs). Applications include audio, signal conditioning and sensor amplification.

Special features include an excellent common-mode rejection ratio (CMRR), no input stage crossover distortion, high input impedance and rail-to-rail input and output swing. The input common-mode range includes both the negative and positive supplies.

The LTA6681 (single version) is available in the micro size SOT23-5L and SOT23-6L. The LTA6682 (dual version) is available in the micro size SOIC-8L and DFN3x3-8L. All versions are specified for operation from −40°C to +125°C. Single and dual versions have identical specifications for maximum design flexibility.

Features and Benefits

- Gain bandwidth: 50 MHz
- Zero-crossover distortion topology:
  - Excellent THD+N: 0.0004%
  - CMRR: 90 dB (minimum)
  - Rail-to-rail input and output
- Input 100 mV beyond supply rail
- Low noise: 8 nV/√ Hz at 10 kHz
- Slew rate: 55 V/µs
- Fast settling: 400 ns to 0.01%
- Precision:
  - Low offset: 0.1 mV
  - Low input bias current: 0.2 pA
- 2.5V to 5.5V operation

Applications

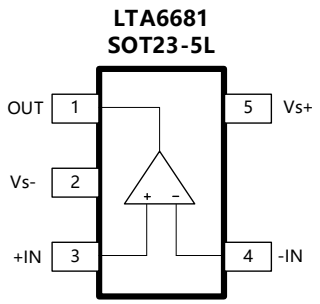
- Signal conditioning
- Data acquisition
- Process control
- Active filters
- Test equipment
- Audio
- Wide band amplifiers

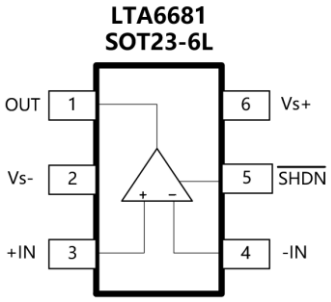
Table of Content

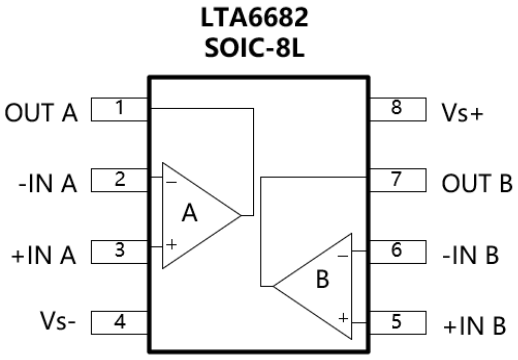
Ordering Information

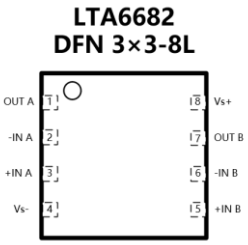
Part Number	Package Type	Package Quantity	ECO Class	Mark Code
LTA6681XT5/R6	SOT23-5L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	S81
LTA6681XT6/R6	SOT23-6L	Tape and Reel, 3 000	Green (RoHS & no Sb/Br)	S81
LTA6682XS8/R8	SOIC-8L	Tape and Reel, 4 000	Green (RoHS & no Sb/Br)	S82
LTA6682XF8/R10	DFN3x3-8L	Tape and Reel, 5 000	Green (RoHS & no Sb/Br)	S82

Pin Configuration (Top View)









PIN Name	SOT23-5L	SOT23-6L	SOIC-8L	DFN3x3-8L	Description
OUT	1	1	1, 7	1, 7	Amplifier output.
V_{S-}	2	2	4	4	Negative power supply.
+IN	3	3	3, 5	3, 5	Non-inverting input of the amplifier.
-IN	4	4	2, 6	2, 6	Inverting input of the amplifier.
V_{S+}	5	6	8	8	Positive power supply.
$\overline{SHDN}$		5			Switch control pin.

Limiting Value

In accordance with the Absolute Maximum Ratin System (IEC60134).

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

ESD Ratings

Parameter	Level	UNIT
Human body model (HBM), per ANSI/ESDA/JEDEC JS-001	±8 000	V
Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002	±2 000	V

Thermal Information

Thermal Metric		Package	Level	Unit
θ_{JA}	Package Thermal Resistance	SOT23-5L	190	°C/W
		SOT23-6L	200	
		SOIC-8L	125	
		DFN3x3-8L	94	

Electrical Characteristics

V_S = 5.0 V, T_A = + 25 °C, V_{CM} = V_S/2, V_O = V_S /2, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OFFSET VOLTAGE						
Input offset voltage	V_{OS}			0.1		mV
Offset voltage drift	V_{OS} TC	T_A = -40 to +125 °C		2	3.5	μV/°C
Power supply rejection ratio	PSRR	V_S = 2.5 to 5.5 V	85	94		dB
		T_A = -40 to +125 °C	81	90		
INPUT BIAS CURRENT						
Input bias current	I_B			0.2	10	pA
		T_A =-40 to +125 °C		30	100	
Input offset current	I_{OS}			5	20	pA
NOISE						
Input voltage noise density	e_n	f = 1 kHz		14		nV/√Hz
	e_n	f = 10 kHz		8		
	e_n	f = 100 kHz		6.5		
	En	f = 0.1 Hz to 10 Hz		8		μVpp
INPUT VOLTAGE RANGE						
Common-mode voltage range	V_{CM}		V_{S-}		V_{S+} +0.1	V
Common-mode rejection ratio	CMRR	(V_{S-}) ≤ V_{CM} ≤ (V_{S+})+0.1 V, at T_A =-40 to +125 °C	90	110	120	dB
OPEN-LOOP GAIN						
Open-loop voltage gain	A_{VOL}	R_L = 10 kΩ, 100mV＜V_O＜(V_{S+})-100mV	100	110		dB
		R_L = 10 kΩ, 100mV＜V_O＜(V_{S+})-100mV at T_A = -40 to +125 °C	85	95		
		R_L = 600 Ω, 200mV＜V_O＜(V_{S+})-200mV	100	105		
		R_L = 600 Ω, 200mV＜V_O＜(V_{S+})-200mV at T_A = -40 to +125 °C	80	90		
FREQUENCY RESPONSE						
Gain bandwidth product	GBW	V_S = 5V		50		MHz
Slew Rate	SR	V_S = 5V，4-V step G = +1		55		V/μs
Settling time 0.1%	t_S	V_S = 5V，4-V step G = +1		200		ns
Settling time 0.01%		V_S = 5V，4-V step G = +1		400		
Overload recovery time	T_{OR}	V_S = 5V，V_{IN} x Gain > V_S		100		ns
Total harmonic distortion + noise	THD+N	V_S = 5V，R_L= 600Ω，V_O= 4V_{PP} G= 1, f= 1kHZ		0.0004		%
OUTPUT						
Voltage output swing from rail		R_L = 10 kΩ, V_S = 5.5V, at T_A = -40 to +125 °C	V_{S+} - 8	V_{S+} - 5		mV
Open-loop output impedance		f= 1MHZ, I_O = 0 mA		7		Ω

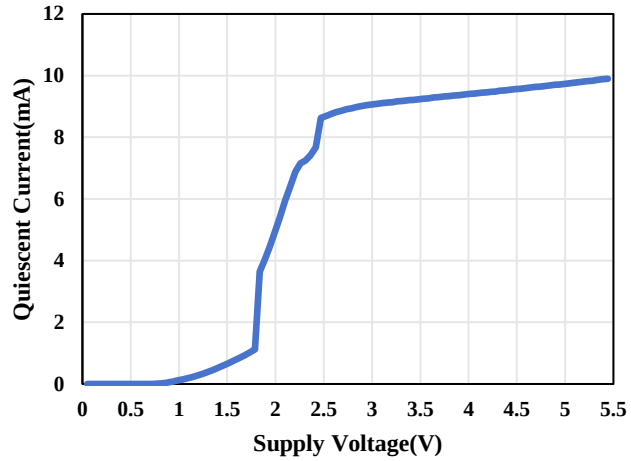
Electrical Characteristics (Cont.)

V_S = 5.0 V, T_A = + 25 °C, V_{CM} = V_S/2, V_O = V_S /2, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.

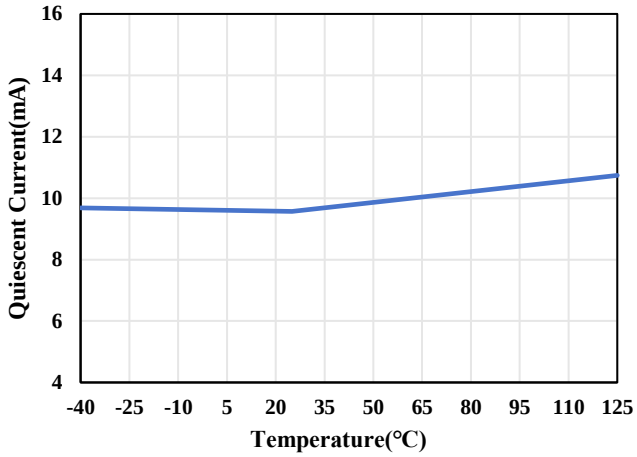
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Short-circuit current	I_{source}			60		mA
	I_{sink}			65		
POWER SUPPLY						
Specified voltage range	V_S	T_A = -40 to +125 °C	2.5		5.5	V
Quiescent current (per amplifier)	I_Q	I_O = 0mA		9.5	11	mA
		At T_A = -40 to +125 °C		10	14	

Typical Characteristics

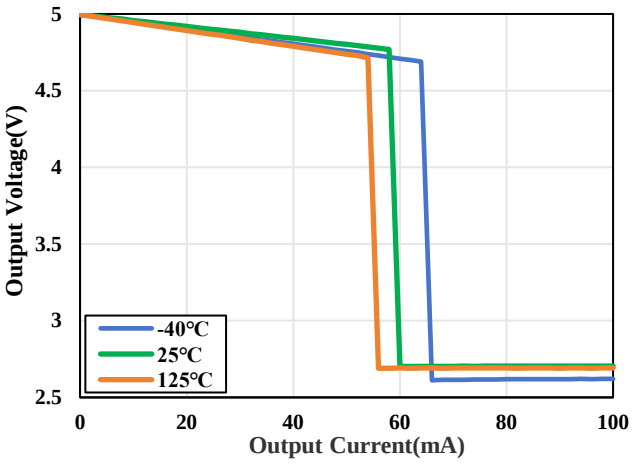
V_S = 5.0 V, T_A = + 25 °C, V_{CM} = V_S/2, V_O = V_S /2, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.



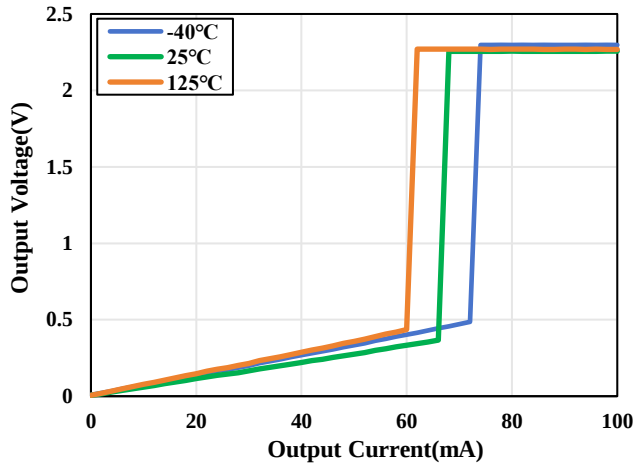
Quiescent Current as a function of Supply Voltage



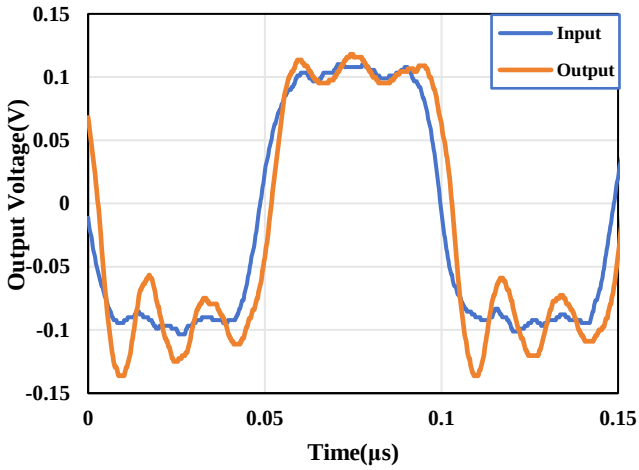
Quiescent Current as a function of Temperature（V_S=5V）



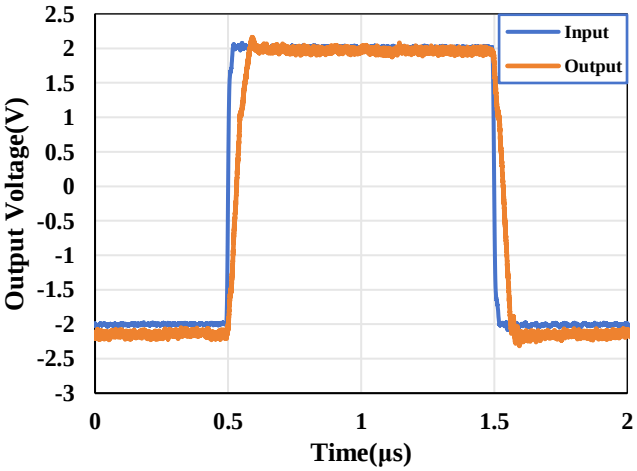
Output Voltage Swing as a function of Output Current (Sourcing, V_S = 5V)



Output Voltage Swing as a function of Output Current (Sinking, V_S =5V)



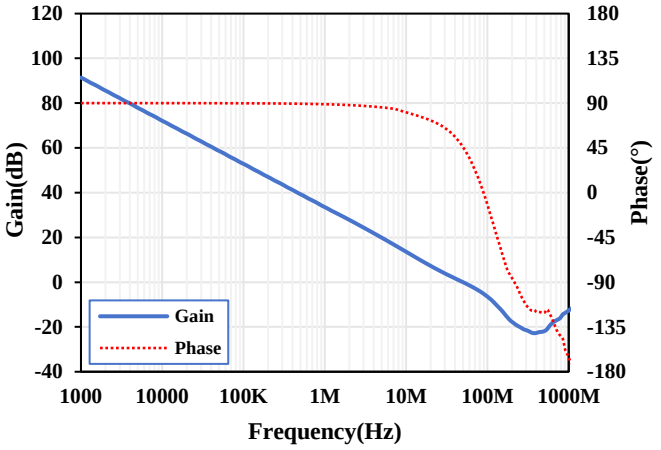
Small-Signal Step Response



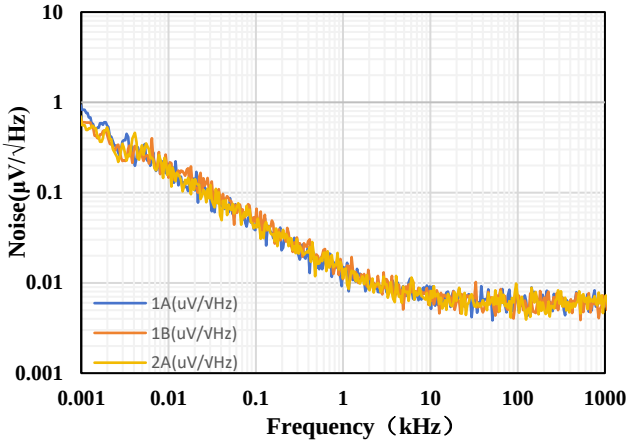
Large-Signal Step Response

Typical Characteristics (Cont.)

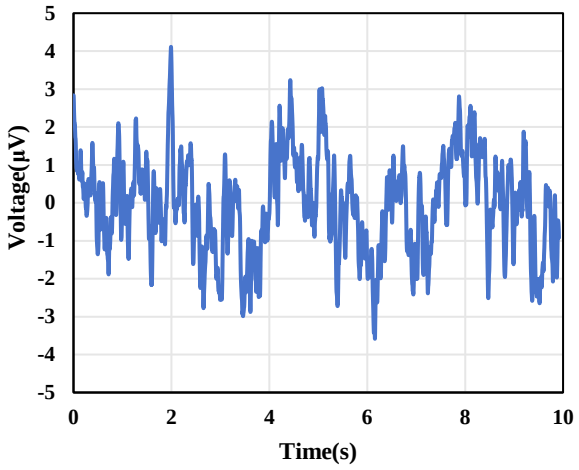
V_S = 5.0 V, T_A = + 25 °C, V_{CM} = V_S/2, V_O = V_S /2, and R_L = 10 kΩ connected to V_S/2, unless otherwise noted.



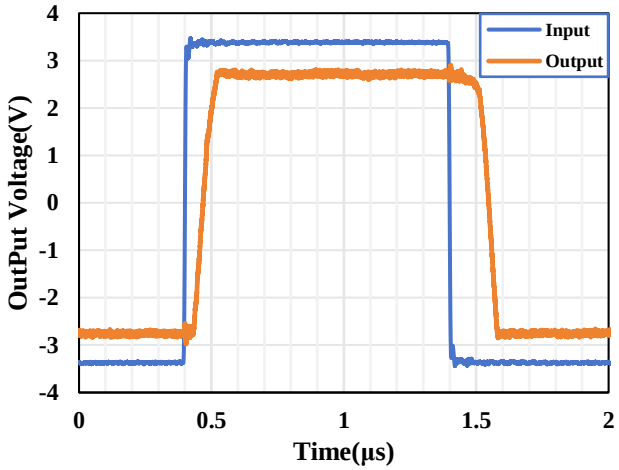
Open-Loop Gain and Phase vs Frequency



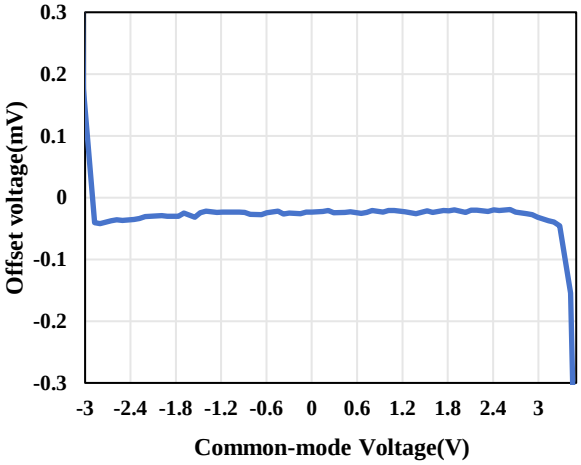
Voltage Noise Density vs Frequency



0.1-Hz to 10-Hz Input Voltage Noise



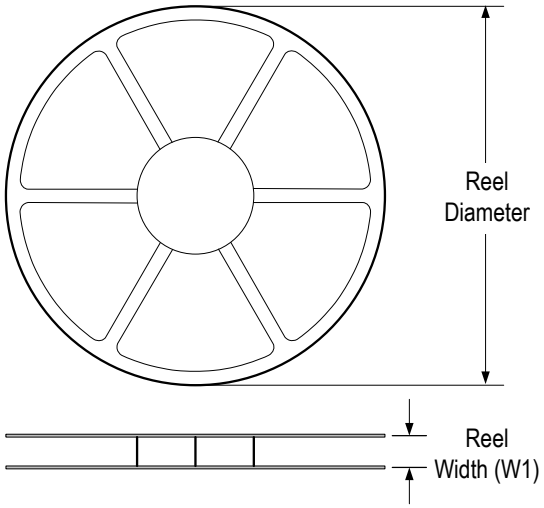
Overdrive Recovery (Vs =5.5V)



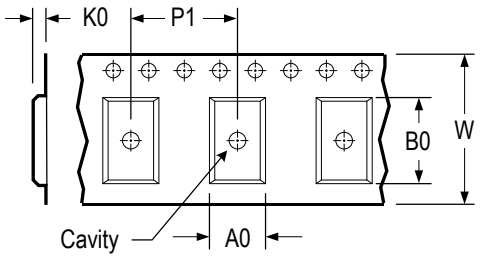
Offset Voltage vs Common Mode Voltage (Vs =5.5V)

Tape and Reel Information

REEL DIMENSIONS

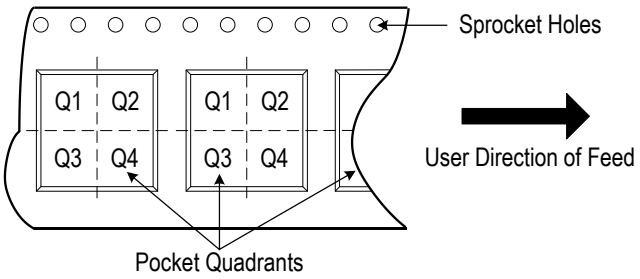


TAPE DIMENSIONS



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

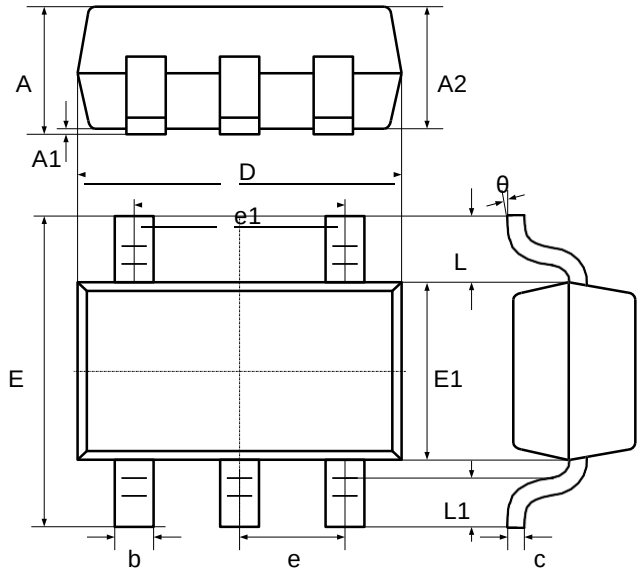


* All dimensions are nominal

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
LTA6681XT5/R6	SOT23	5	3 000	178	9.5	3.3	3.2	1.5	4.0	8.0	Q3
LTA6681XT6/R6	SOT23	6	3 000	178	9.0	3.2	3.2	1.4	4.0	8.0	Q3
LTA6682XS8/R8	SOIC	8	4 000	330	12.5	6.6	5.3	2.0	8.0	12.0	Q1
LTA6682XF8/R10	DFN3x3	8	5 000	330	12.5	3.3	3.3	1.1	8.0	12.0	Q1

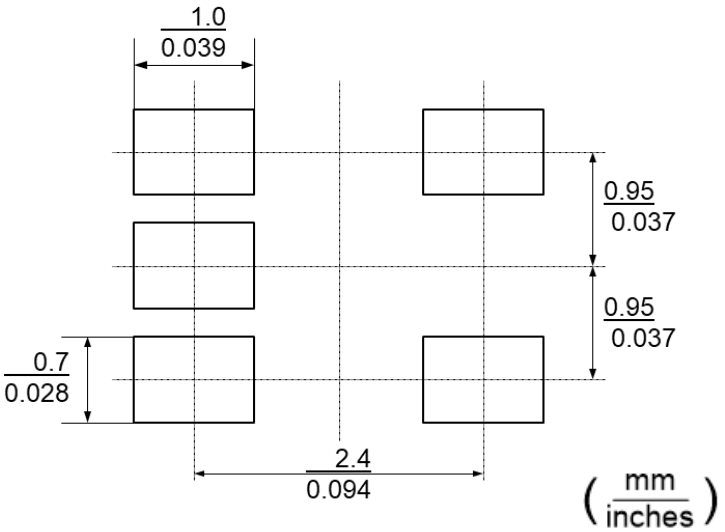
Package Outlines

DIMENSIONS, SOT23-5L



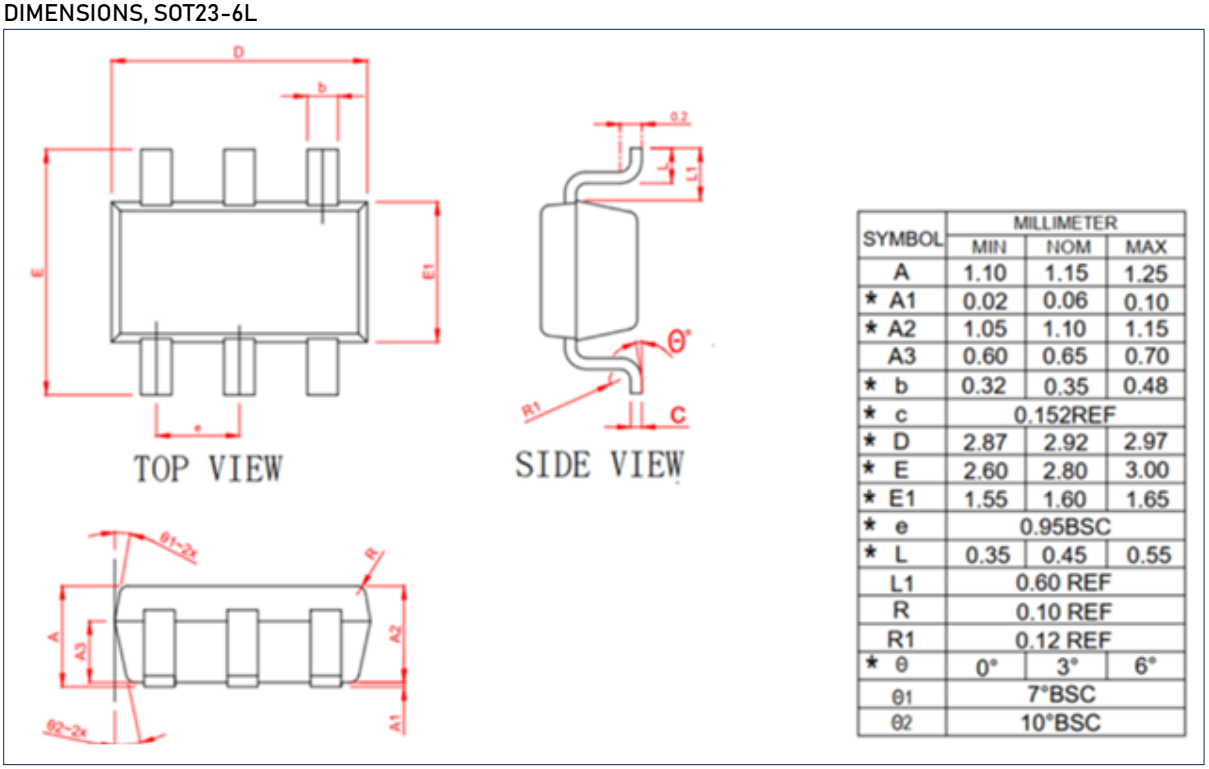
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075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

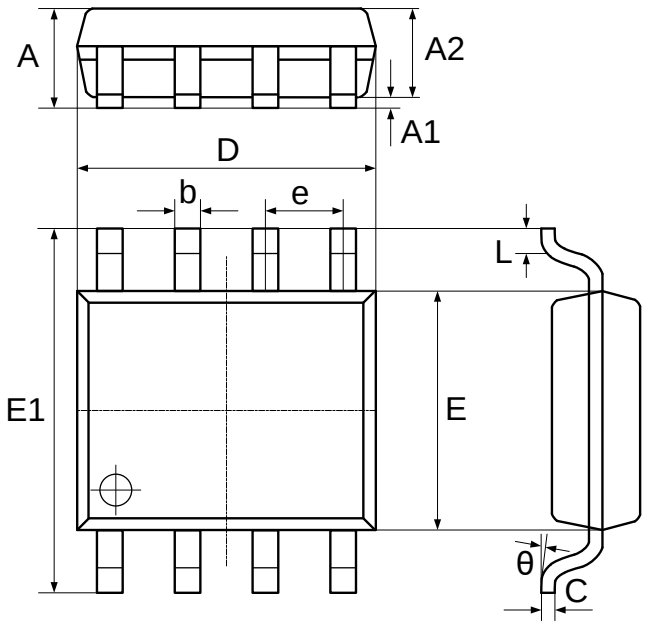
DIMENSIONS, SOT23-6L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.10	1.15	1.25
* A1	0.02	0.06	0.10
* A2	1.05	1.10	1.15
A3	0.60	0.65	0.70
* b	0.32	0.35	0.48
* c	0.152REF		
* D	2.87	2.92	2.97
* E	2.60	2.80	3.00
* E1	1.55	1.60	1.65
* e	0.95BSC		
* L	0.35	0.45	0.55
L1	0.60 REF		
R	0.10 REF		
R1	0.12 REF		
* θ	0°	3°	6°
θ1	7°BSC		
θ2	10°BSC		

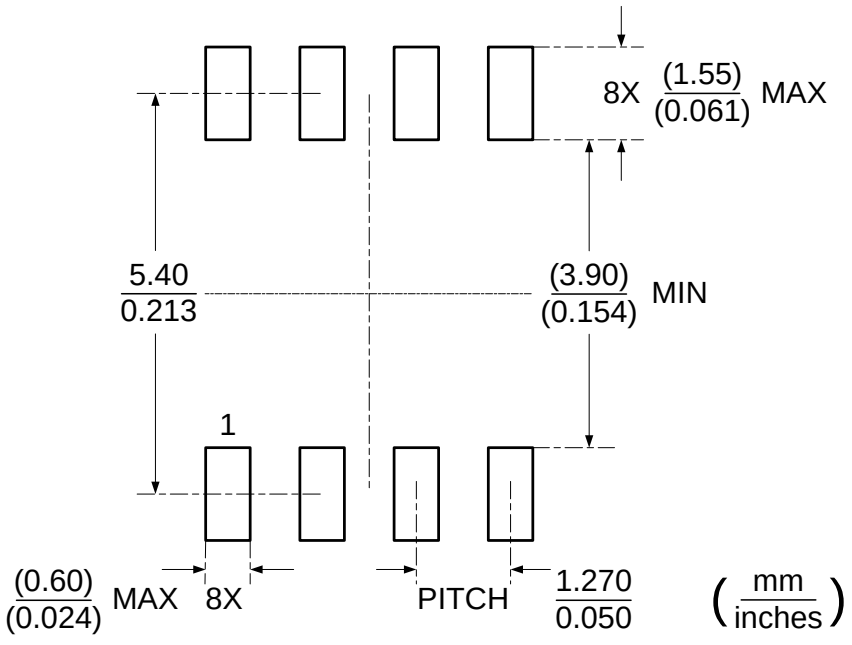
Package Outlines (Cont.)

DIMENSIONS, SOIC-8L



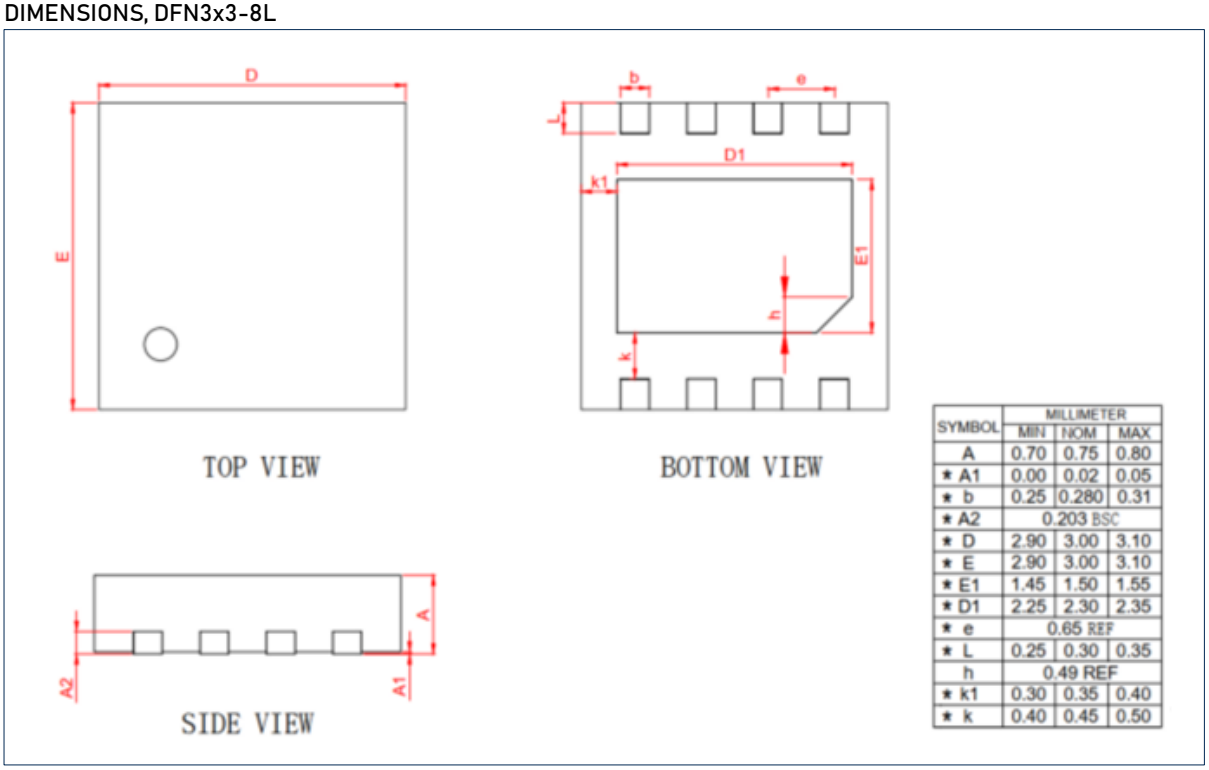
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.370	1.670	0.054	0.066
A1	0.070	0.170	0.003	0.007
A2	1.300	1.500	0.051	0.059
b	0.306	0.506	0.012	0.020
C	0.203 TYP.		0.008 TYP.	
D	4.700	5.100	0.185	0.201
E	3.820	4.020	0.150	0.158
E1	5.800	6.200	0.228	0.244
e	1.270 TYP.		0.050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

RECOMMENDED SOLDERING FOOTPRINT, SOIC-8L



Package Outlines (Cont.)

DIMENSIONS, DFN3x3-8L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
★ A1	0.00	0.02	0.05
★ b	0.25	0.280	0.31
★ A2		0.203 BSC	
★ D	2.90	3.00	3.10
★ E	2.90	3.00	3.10
★ E1	1.45	1.50	1.55
★ D1	2.25	2.30	2.35
★ e		0.65 REF	
★ L	0.25	0.30	0.35
h		0.49 REF	
★ k1	0.30	0.35	0.40
★ k	0.40	0.45	0.50

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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