MSKSEMI SEMICONDUCTOR 美森科

ESD TVS TSS MOV GDT PLED

LTC855X-MS

Product specification

Ultra Low Noise Rail-to-Rail I/O CMOS Precision OPERATIONAL AMPLIFIERS

GENERAL DESCRIPTION

The LTC8551-MS family represents a newgenerati on of low-noise operational amplifiers,offering outst anding dc precision and acperformance.Rai-to-Rail input and output,lowoffset (2μV),low noise(6nVNH z),quiescentcurrent of 600 μA,and a 6-MHz bandw idthmake this part very attractive for a variety ofpr ecision and portable applications

In addition,this device has a reasonably widesuppl y range(2V to 5.5V)with excellent PSRRmaking it attractive for applications that rundirectly from batt eries without regulation.

The LTC8551-MS(single),LTC8552-MS(dual)andLTC 8554-MS (quad)families of operationalamplifiers ar e specified for operation from-55℃to+125℃.

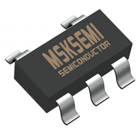
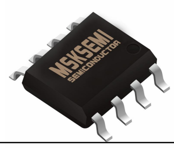
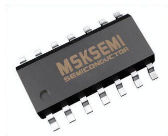
FEATURES

- Input Offset Voltage:2μV (Typical)
- Zero Drift:0.03μV/C (Typical)
- Ultra Low Noise:6nV/VHz at 1kHz
- Supply Range:2V to 5.5V
- Gain Bandwidth:6 MHz
- Slew rate:5V/us
- Quiescent current:600μA (Vs=5V)
- Rail-to-Rail Input and Output
- Micro size Packages:
  LTC8551-MS:SOT-23-5
  LTC8552-MS:SOP-8
  LTC8554-MS:SOP-14

APPLICATIONS

- ADC Buffer
- Audio Equipment
- Medical Instrumentation
- Handheld Test Equipment
- Active Filtering
- Sensor Signal Conditioning

Reference News

MODEL	Op Temp(℃)	PACKAGE OUTLINE	Marking	Minimum packaging(PCS)
LTC8551-MS	−25℃~125℃	 SOT-23-5	MSKSEMI LTC8551	3000
LTC8552-MS	−25℃~125℃	 SOP-8	MSKSEMI LTC8552	2500
LTC8554-MS	−25℃~125℃	 SOP-14	MSKSEMI LTC8554	2500

TYPICAL APPLICATION

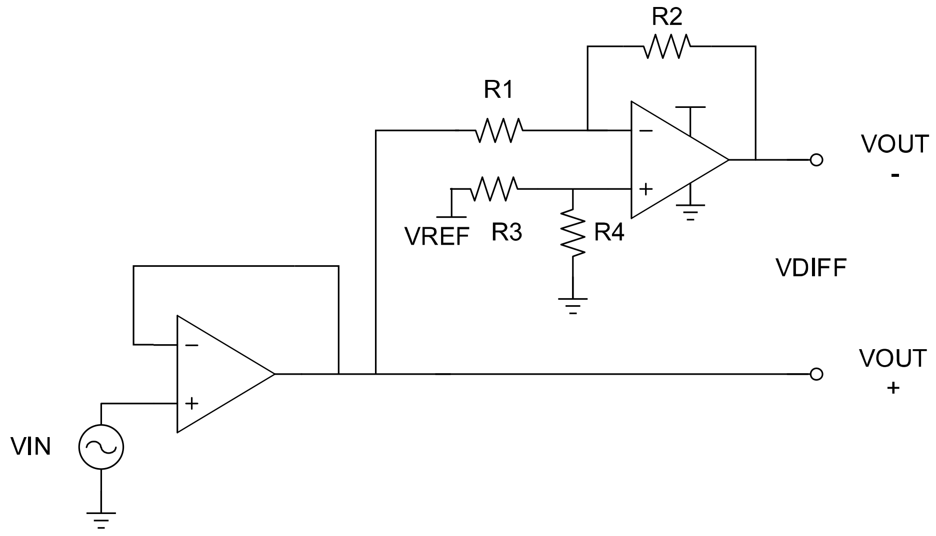
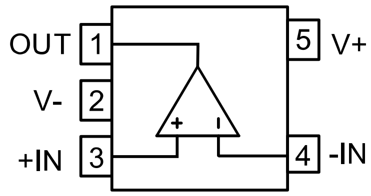


Figure 1.Typical Application

Pin Configuration and Functions (Top View)

Pin Description

SOT-23-5



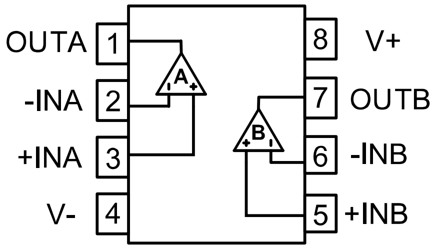
LTC8551-MS

PIN		I/O	DESCRIPTION
NAME	Number		
+IN	3	I	Positive (noninverting) input
-IN	4	I	Negative (inverting) input
OUT	1	O	Output
V-	2	_	Positive (highest) power supply
V+	5	_	Negative (lowest) power supply

Pin Configuration and Functions (Top View)

Pin Description

SOP-8



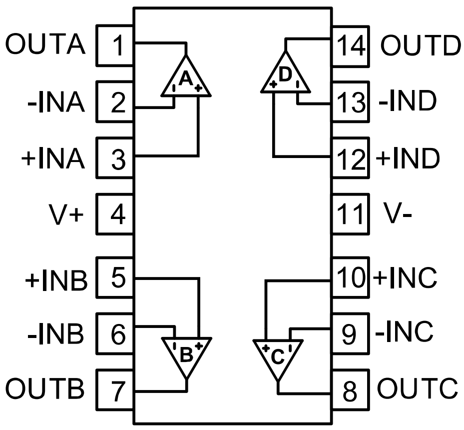
LTC8552-MS

PIN		I/O	DESCRIPTION
NAME	Number		
+INA	3		Noninverting input, channel A
+INB	5		Noninverting input, channel B
-INA	2		Inverting input, channel A
-INB	6		nverting input, channel B
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
V-	4	—	Negative (lowest) power supply
V+	8	—	Positive (highest) power supply

Pin Configuration and Functions (Top View)

Pin Description

SOP-14



LTC8554-MS

PIN		I/O	DESCRIPTION
NAME	Number		
+INA	3		Noninverting input, channel A
+INB	5		Noninverting input, channel B
+INC	10		Noninverting input, channel C
+IND	12		Noninverting input, channel D
-INA	2		Inverting input, channel A
-INB	6		Inverting input, channel B
-INC	9		Inverting input, channel C
-IND	13		Inverting input, channel D
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
OUTC	8	O	Output, channel C
OUTD	14	O	Output, channel D
V-	4		Negative(lowest) power supply
V+	11	—	Positive(highest) power supply

SPECIFICATIONS

Absolute Maximum Ratings[1]

		MIN	MAX	UNIT
Voltage	Supply Voltage		6	V
	Signal Input Terminals Voltage[2]	(V-) - 0.5	(V+) + 0.5	V
	Signal Input Terminals Voltage[3]	(V-) - 0.5	(V+) + 0.5	V
Current	Signal Input Terminals Current[2]	-10	10	mA
	Signal output Terminals Current[3]	-200	200	mA
	Output Short-Circuit[4]	Continuous		
θ_{JA}	Operating Temperature Range	-55	125	°C
	Storage Temperature Range	-65	150	°C
	Junction Temperature	-40	150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Input terminals are diode clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current limited to 10mA or less.

(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±200mA or less.

(4) Short-circuit to ground, one amplifier per package.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM)	±4000	V
		Charged-Device Model (CDM)	±500	V
		Machine Model	100	V

Recommended Operating Conditions

		MIN	MAX	UNIT
Supply voltage, Vs= (V+) - (V-)	Single-supply	2	5.5	V
	Dual-supply	±1	±2.75	V

ELECTRICAL CHARACTERISTICS(V_S = +5V)

At T_A = 25°C, V_{CM}=V_{OUT}= V_S /2, unless otherwise noted.

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
OFFSET VOLTAGE						
V_{OS}	Input Offset Voltage			2	10	µV
dV_{OS}/dT	Input Offset Voltage Average Drift	T_A = -55°C to 125°C		0.03		µV/°C
INPUT CURRENT						
I_B	Input Bias Current			500		pA
I_{OS}	Input Offset Current			50		pA
NOISE						
V_N	Input Voltage Noise	f=0.1Hz to 10Hz		0.3		$µV_{PP}$
e_n	Input Voltage Noise Density	f=1kHz		6		nV/√Hz
INPUT VOLTAGE						
V_{CM}	Common-Mode Voltage Range		V_{S-}-0.1		V_{S+}+0.1	V
CMRR	Common-Mode Rejection Ratio	V_{CM}=0.1V to 4V	110	130		dB
FREQUENCY RESPONSE						
GBW	Gain-Bandwidth Product	C_L=100pF		6		MHz
SR	Slew Rate	G = +1, V_{IN}=2V Step		5		V/us
t_S	Settling Time to 0.1%	G = +1, V_{IN}=2V Step		0.7		us
THD+N	Total Harmonic Distortion +Noise	G=1,V_O=1V_{RMS}, f=1kHz, R_L=10kΩ		0.0004		%
OUTPUT						
A_V	Open-Loop Voltage Gain	V_{OUT}=0.1V to 4.9V R_L=10kΩ	135	150		dB
V_{OH}	High output voltage swing	R_L=10kΩ		10	20	mV
		R_L=2kΩ		50	60	mV

V_{OL}	Low output voltage swing	R_L=10kΩ		10	20	mV
		R_L=2kΩ		35	45	mV
I_{SC}	Output Short-Circuit Current	Source current		30		mA
		Sink current		65		mA
C_L (1)	Capacitive Load Drive	G = +1, V_{IN}=0.2V Step			560	pF
POWER SUPPLY						
PSRR	Power-Supply Rejection Ratio	V_S=1.5V to 5.5V	110	130		dB
V_S	Operating Voltage Range		2		5.5	V
I_Q	Quiescent Current/Amplifier	I_O=0A		600	700	uA

(1) Capacitive load drive means that above a given maximum value, the output waveform will oscillate under the step response.

TYPICAL CHARACTERISTICS

At T_A = 25°C, V_S = +5V, G=+1, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

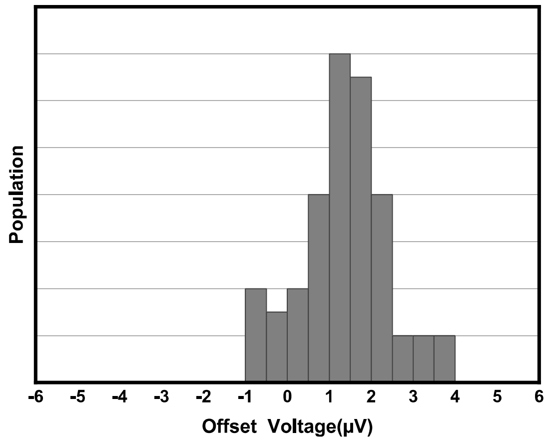


Figure 2. Offset Voltage Production Distribution

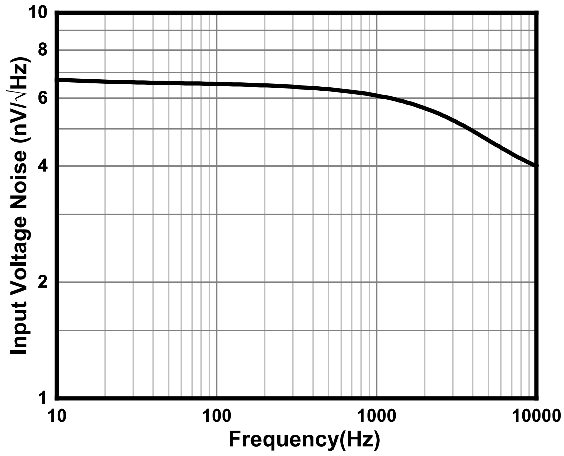


Figure 3. Input Voltage Noise Spectral Density

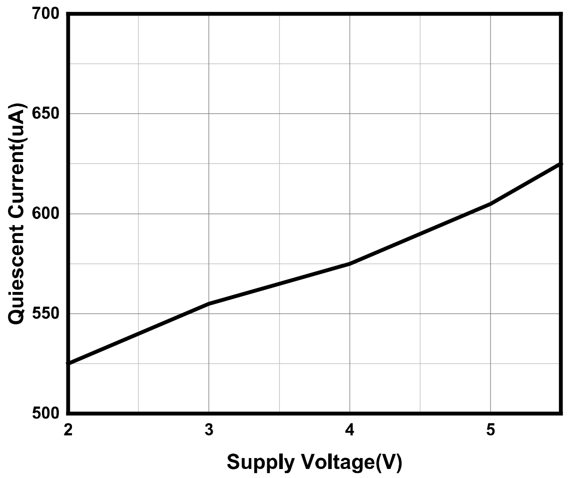


Figure 4. Quiescent Current vs Supply Voltage

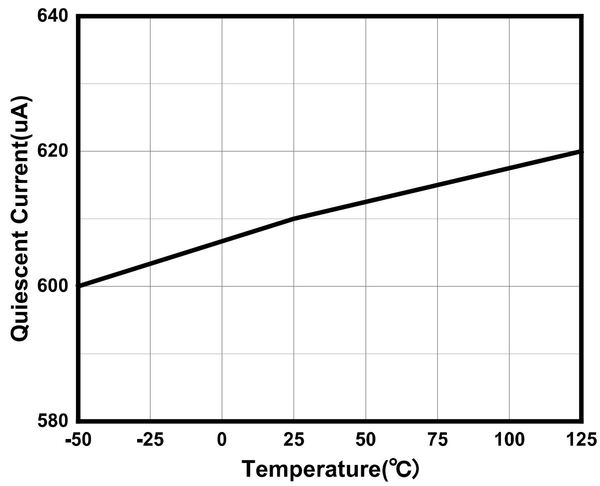


Figure 5. Quiescent Current vs Temperature

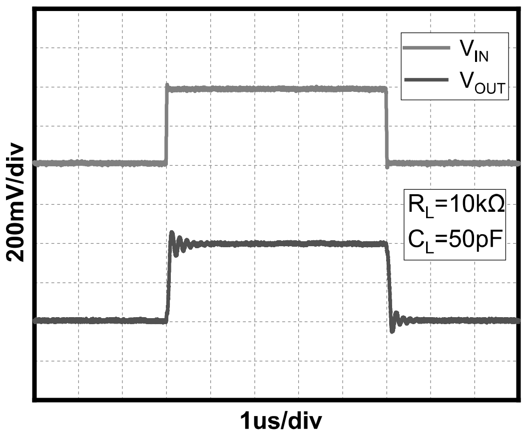


Figure 6. Small-Signal Step Response(V_S=5V)

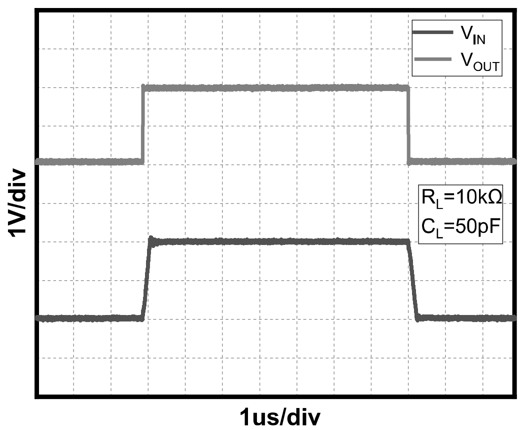


Figure 7. Large-Signal Step Response(V_S=5V)

TYPICAL CHARACTERISTICS

At T_A = 25°C, V_S = +5V, G=+1, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

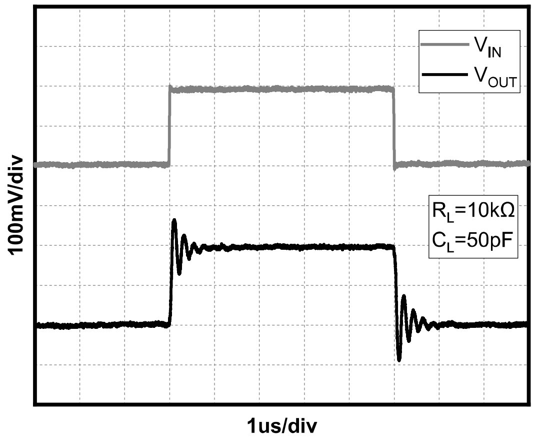


Figure 8. Small-Signal Step Response(V_S=2V)

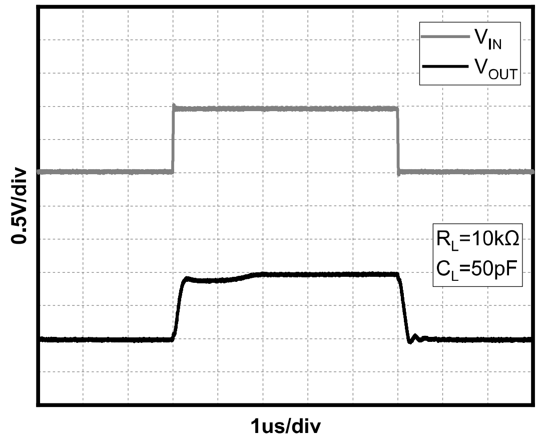


Figure 9.Large-Signal Step Response(V_S=2V)

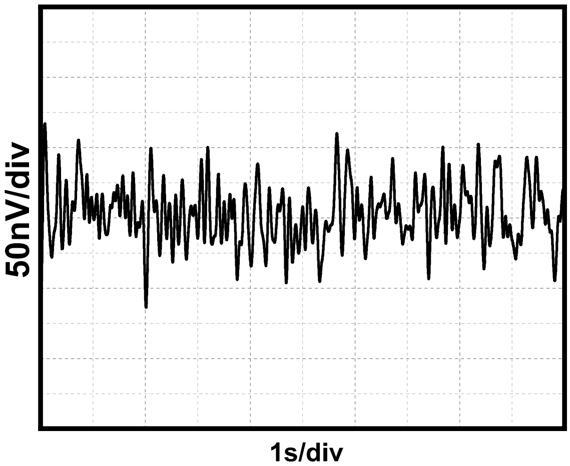


Figure 10. 0.1Hz to 10Hz Noise

Detailed Description

Overview

The LTC8551-MS LTC8552-MS/LTC8554-MS devices are a low noise,unity-gain stable,rai-to-rail precision operational amplifier that operate in a single-supply voltage range of 2V to 5.5V(±1V to±2.75V).A high supply voltage of 6V(absolute maximum)can permanently damage the amplifier.Rail-to-rail input and output wobbles significantly increase the dynamic range,especially in low-supply applications.Good layout practices require that a 0.1uF capacitor be used where it is tightly threaded through the power supply pin.

Phase Reversal Protection

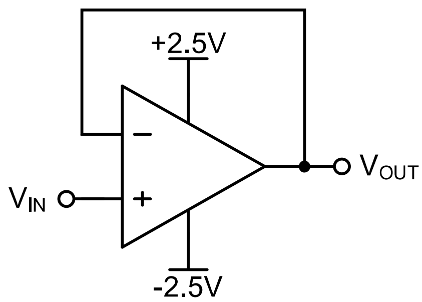
The LTC8551-MS LTC8552-MS/LTC8554-MS devices have internal phase-reversal protection.Many op amps exhibit phase reversal when the input is driven beyond the linear common-mode range.This condition is most often encountered in noninverting circuits when the input is driven beyond the specified common-mode voltage range,causing the output to reverse into the opposite rail.The input of the LTC8551-MS LTC8552-MS/LTC8554-MS prevents phase reversal with excessive commonmode voltage.Instead,the appropriate rail limits the output voltage.

Typical Applications

1 Voltage Follower

As shown in Figure 11,the voltage gain is 1.With this circuit,the output voltage Vour is configured to be equal to the input voltage Viw.Due to the high input impedance and low output impedance,the circuit can also stabilize the output voltage,the output voltage expression is

$$Vour=Vin \tag{1}$$



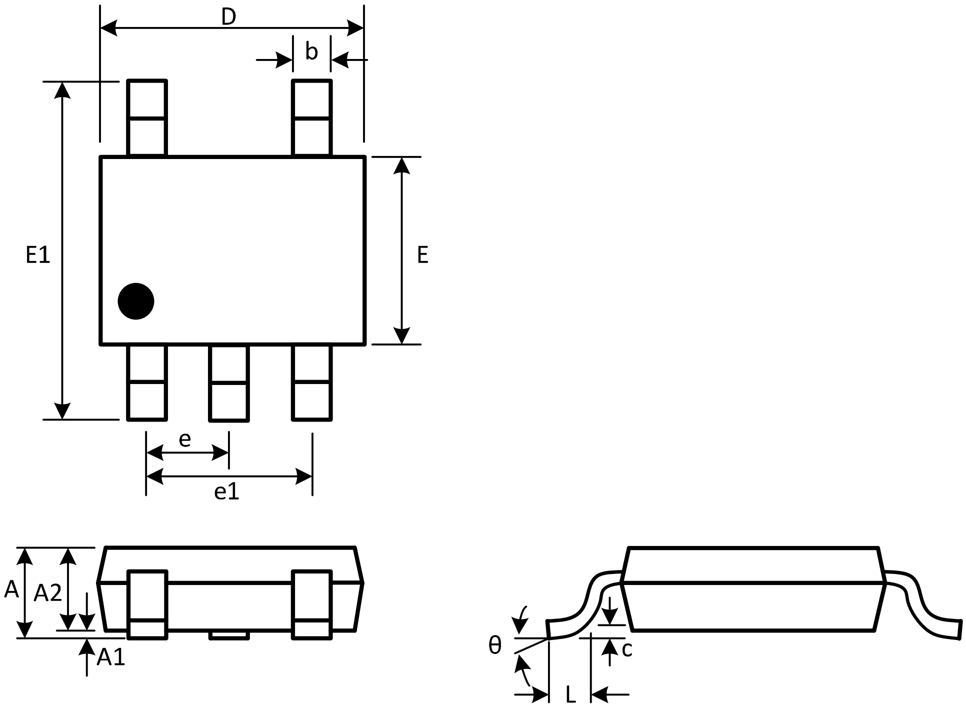
2 Inverting Proportional Amplifier

As shown in Figure 12,for a reverse-phase proportional amplifier,the input voltage Vin is amplified by a voltage gain that depends on the ratio of R1 to R2.The output voltage Vour is inversely with the input voltage Vin.The input impedance of the circuit is equal to R1,and the output voltage expression is

$$V_{OUT}=-\frac{R2}{R1}V_{IN} \tag{2}$$

PACKAGE DESCRIPTION

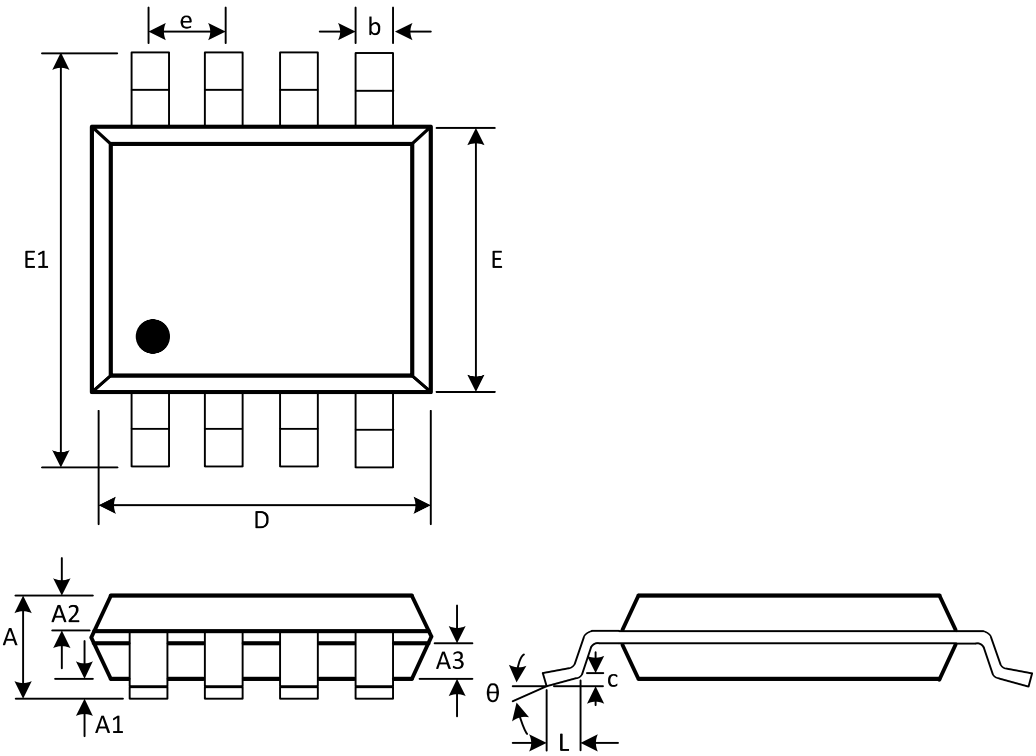
SOT23-5



(Unit: mm)

Symbol	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
e	0.950(BSC)	
e1	1.800	2.000
E	1.500	1.700
E1	2.650	2.950
L	0.300	0.600
θ	0°	8°

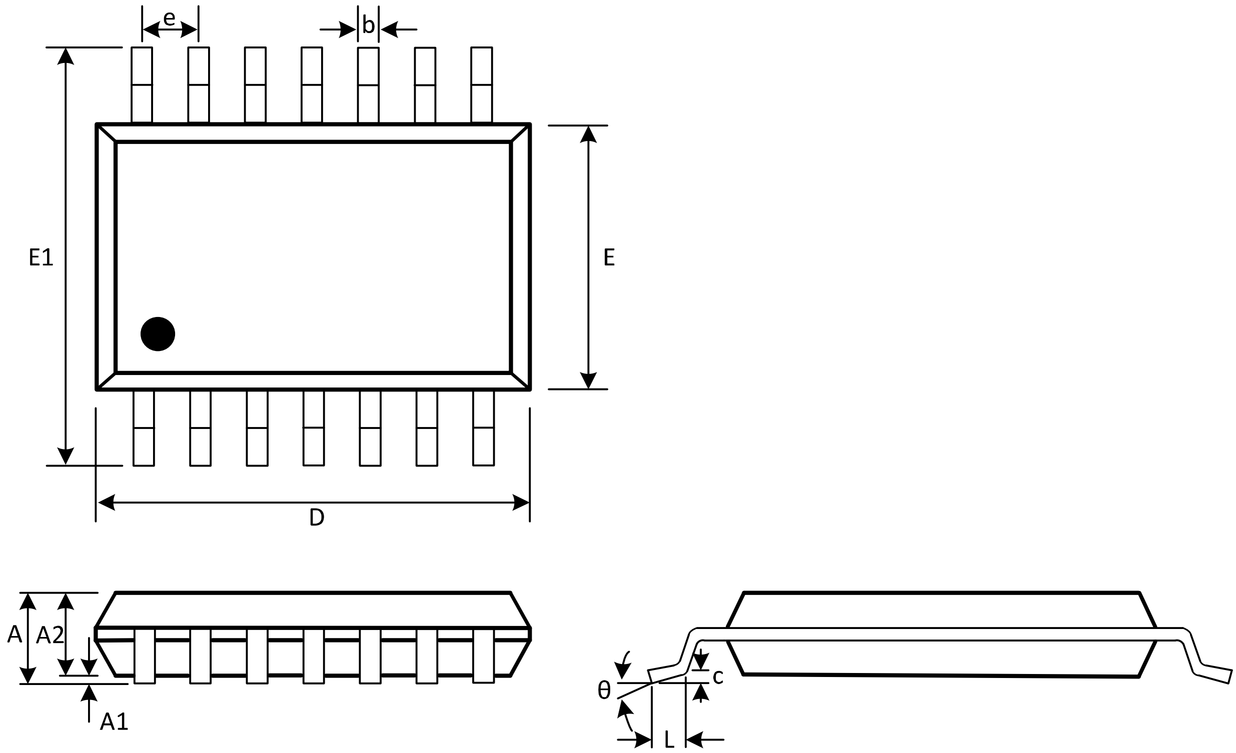
SOP-8



(Unit: mm)

Symbol	Min	Max
A	1.300	1.600
A1	0.050	0.200
A2	0.550	0.650
A3	0.550	0.650
b	0.356	0.456
c	0.203	0.233
D	4.800	5.000
e	1.270(BSC)	
E	3.800	4.000
E1	5.800	6.200
L	0.400	0.800
θ	0°	8°

SOP-14



(Unit: mm)

Symbol	Min	Max
A	1.350	1.750
A1	0.100	0.250
A2	1.350	1.550
b	0.310	0.510
c	0.100	0.250
D	8.450	8.850
e	1.270(BSC)	
E	5.800	6.200
E1	3.800	4.000
L	0.400	1.270
θ	0°	8°

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