MSKSEMI 美森科
SEMICONDUCTOR

ESD TVS TSS MOV GDT PLED

MSAD8605 / MSAD8606 / MSAD8608

Product specification

GENERAL DESCRIPTION

The MSAD860x families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (8MHz), a slew rate of 6.5V/us, and a quiescent current of 510uA/amplifier at 5V. The op-amps are unity gain stable and feature an ultra-low input bias current.

The MSAD860x are designed to provide optimal performance in low-voltage systems. They offset voltage are 2.5mV for the provide rail-to-rail I/O, and the maximum input devices. Their capacitive load capability is also good at low supply voltages. The operating range is from 2.2 V to 5.5 V.

The MSAD860x families of operational amplifiers are specified at the full temperature range of -40°C to +85°C under single or dual power supplies of 2.2V to 5.5V.

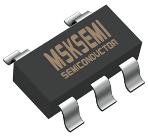
FEATURES

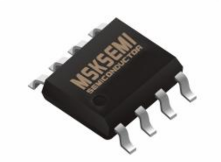
- Input Offset Voltage：2.5mV (MAX)
- Supply Current：510μA/ch
- Supply Range：2.2V to 5.5V
- Gain Bandwidth：8MHz
- Slew rate: 6.5V/μs
- Rail-to-Rail Input and Output
- Micro size Packages：
- MSAD8605ARTZ-REEL7：SOT-23-5
- MSAD8606ARZ：SOP-8
- MSAD8608ARZ-REEL7：SOP-14

Applications

- Photodiode Amplification
- Active Filter and Buffer
- Battery Powered Electronics
- Sensors
- Cellular and Cordless Phones
- Test Equipment
- Driving A/D Converters

Reference News

Type No	SOT-23-5	MARKING
MSAD8605ARTZ-REEL7		B3A

Type No	SOP-8	MARKING
MSAD8606ARZ		MSKSEMI 8606ARZ ● MS**

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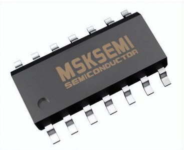
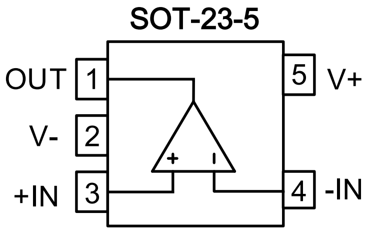
MSAD8608ARZ-REEL7		MSKSEMI 8608ARZ ● MS**

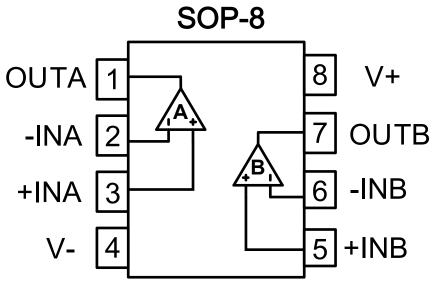
Pin Configuration and Functions (Top View)

Pin Description



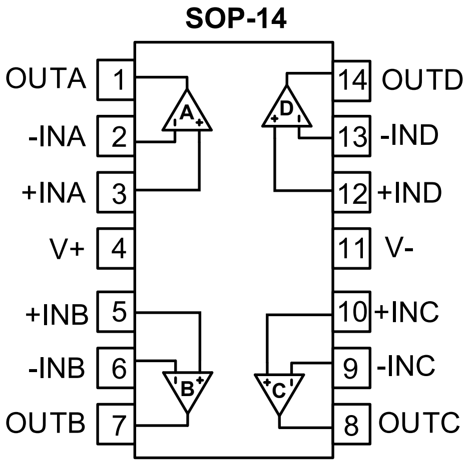
PIN		I/O	DESCRIPTION
NAME	Number		
+IN	3	I	Positive (noninverting) input
-IN	4	I	Negative (inverting) input
NC	-	-	No Connection
OUT	1	O	Output
V+	5	-	Positive (highest) power supply
V-	2	-	Negative (lowest) power supply

Pin Description



PIN		I/O	DESCRIPTION
NAME	Number		
+INA	3	I	Noninverting input, channel A
+INB	5	I	Noninverting input, channel B
-INA	2	I	Inverting input, channel A
-INB	6	I	Inverting 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 Description



PIN		I/O	DESCRIPTION
NAME	**Number**		
+INA	3	I	Noninverting input, channel A
+INB	5	I	Noninverting input, channel B
+INC	10	I	Noninverting input, channel C
+IND	12	I	Noninverting input, channel D
-INA	2	I	Inverting input, channel A
-INB	6	I	Inverting input, channel B
-INC	9	I	Inverting input, channel C
-IND	13	I	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

TYPICAL APPLICATION

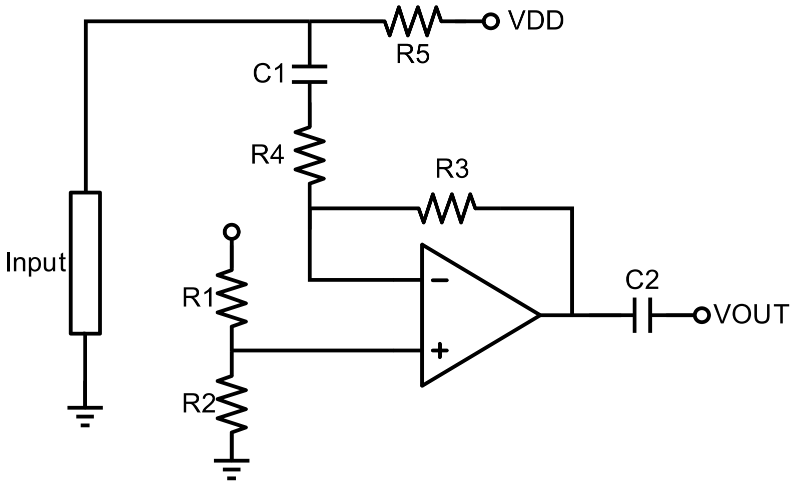


Figure 1. Typical Application

ORDER INFORMATION

P/N	PKG	QTY
MSAD8605ARTZ-REEL7	SOT-23-5	3000
MSAD8606ARZ	SOP-8	2500
MSAD8608ARZ-REEL7	SOP-14	2500

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	-40	85	°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)	±2000	V
		Charged-Device Model (CDM)	±500	V
		Machine Model	100	V

Recommended Operating Conditions

		MIN	MAX	UNIT
Supply voltage， Vs= (V+) - (V-）	Single-supply	2.2	5.5	V
	Dual-supply	±1.1	±2.75	V

ELECTRICAL CHARACTERISTICS (V_S = +5V)

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

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNIT
OFFSET VOLTAGE						
V_{OS}	Input Offset Voltage		-2.5	0.8	2.5	mV
dV_{OS}/dT	Input Offset Voltage Average Drift	T_A = -40°C to 85°C		0.6		μV/°C
INPUT CURRENT						
I_B	Input Bias Current			10		pA
I_{OS}	Input Offset Current			5		pA
NOISE						
V_N	Input Voltage Noise	f=0.1Hz to 10Hz		4		μV_{PP}
e_n	Input Voltage Noise PSD	f=1kHz		8		nV/√Hz
INPUT VOLTAGE						
V_{CM}	Common-Mode Voltage Range		V_{S-}		V_{S+}+0.1	V
CMRR	Common-Mode Rejection Ratio	V_{CM}=0.1V to 4V	85	95		dB
FREQUENCY RESPONSE						
GBW	Gain-Bandwidth Product			8		MHz
SR	Slew Rate	G = +1, V_{IN}=2V Step		6		V/μs
t_S	Settling Time	G = +1, V_{IN}=2V Step		0.6		μs
OUTPUT						
A_V	Open-Loop Voltage Gain	V_{OUT}=0.5V to 4.8V	95	105		dB
V_{OH}	High output voltage swing	R_L=10kΩ			5	mV
V_{OL}	Low output voltage swing	R_L=10kΩ			5	mV
I_{SC}	Output Short-Circuit Current	Source Current		26		mA
		Sink Current		50		mA
C_L(1)	Capacitive Load Drive	G = +1, V_{IN}=0.2V Step			1000	pF

POWER SUPPLY						
PSRR	Power-Supply Rejection Ratio	V_S=2.5V to 5.5V	90	100		dB
V_S	Operating Voltage Range	I_O=0A	2.2		5.5	V
I_Q	Quiescent Current/Amplifier	I_O=0A		510	600	μA

(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 = ±2.5V, G=+1, V_{IN}=V_{OUT}= V_S /2, unless otherwise noted.

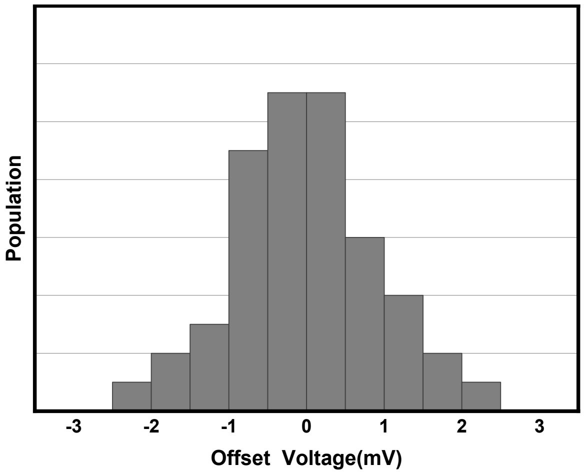


Figure 2. Offset Voltage Production Distribution

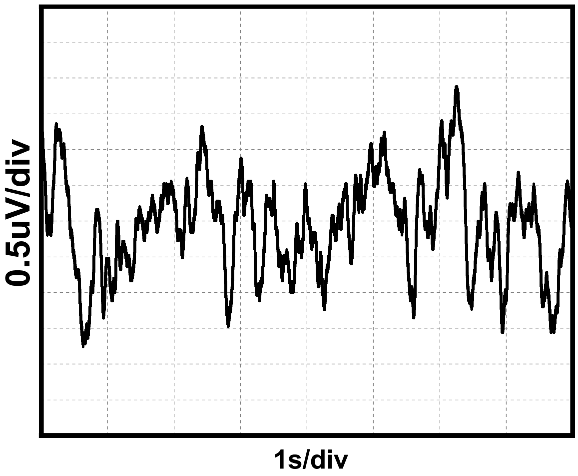


Figure 3. 0.1Hz to 10Hz Noise

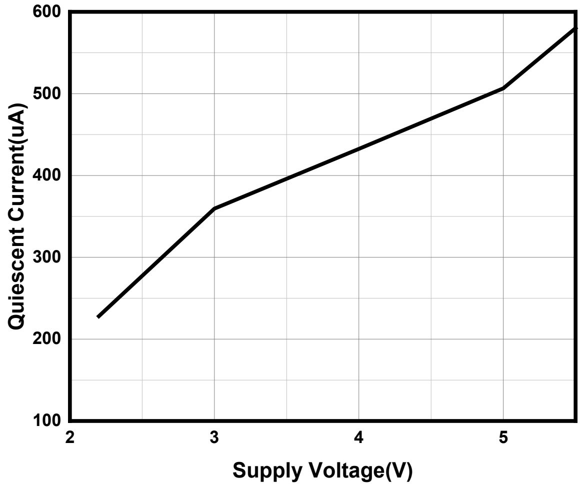


Figure 4. Quiescent Current vs Supply Voltage

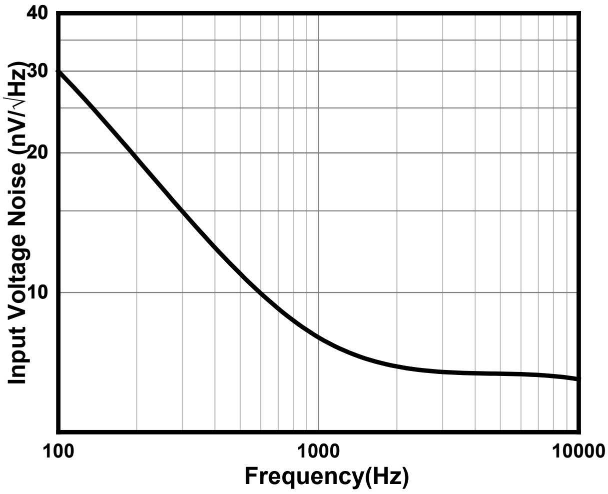


Figure 5. Input Voltage Noise Spectral Density

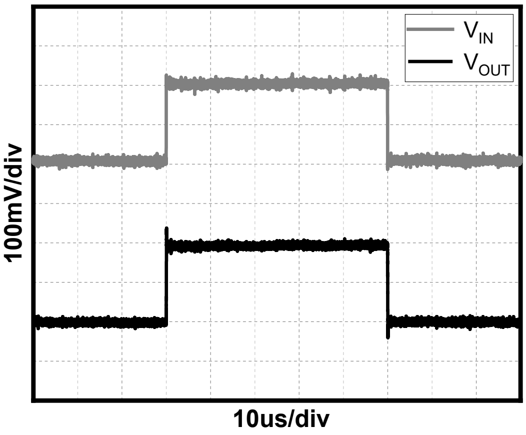


Figure 6. Small-Signal Step Response

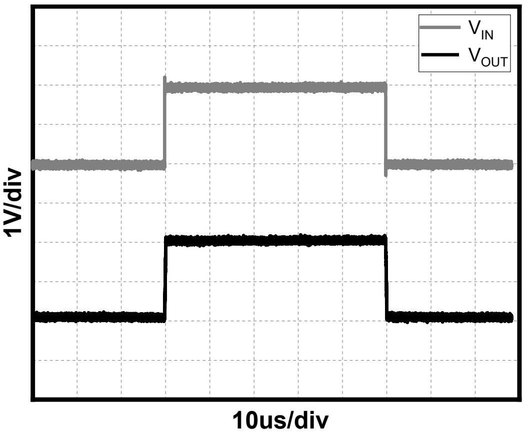


Figure 7. Large-Signal Step Response

Detailed Description

Overview

Th MSAD860x devices are a high-bandwidth, unity-gain stable, rail-to-rail operational amplifier available in single and dual-channel versions that operate in a single-supply voltage range of 2.2V to 5.5V(±1.1V 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 MSAD860x 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 AD860x prevents phase reversal with excessive commonmode voltage. Instead, the appropriate rail limits the output voltage.

Typical Applications

1 Voltage Follower

As shown in Figure 8, the voltage gain is 1. With this circuit, the output voltage V_{OUT} is configured to be equal to the input voltage V_{IN}. Due to the high input impedance and low output impedance, the circuit can also stabilize the output voltage, the output voltage expression is

$$V_{OUT}=V_{IN} \tag{1}$$

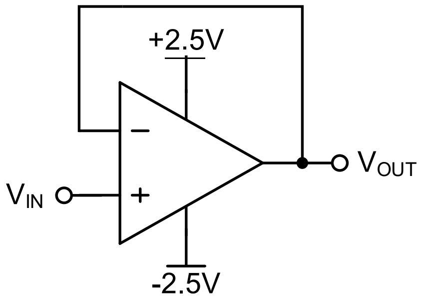


Figure 8. Voltage Follower

2 Inverting Proportional Amplifier

As shown in Figure 9, for a reverse-phase proportional amplifier, the input voltage V_{IN} is amplified by a voltage gain that depends on the ratio of R1 to R2. The output voltage V_{OUT} is inversely with the input voltage V_{IN}. The input impedance of the circuit is equal to R1, and the output voltage expression is

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

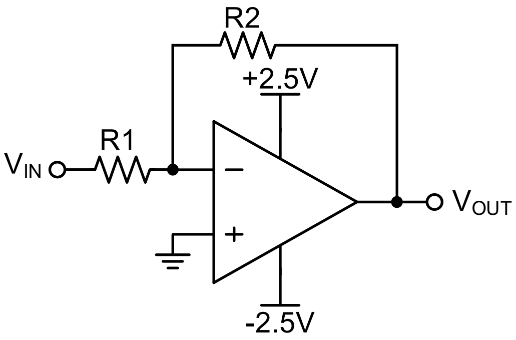


Figure 9. Inverting Proportional Amplifier

3 Noninverting Proportional Amplifier

As shown in Figure 10, for a noninverting amplifier, the input voltage V_{IN} is amplified by a voltage gain that depends on the ratio of R1 to R2. The output voltage V_{OUT} is in phase with the input voltage V_{IN}. In fact, this circuit has a high input impedance because its input side is the same as the input side of the operational amplifier. The output voltage expression is

$$V_{OUT}=(1+\frac{R2}{R1})V_{IN} \tag{3}$$

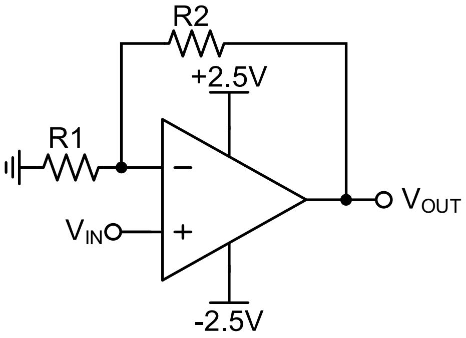


Figure 10. Noninverting Proportional Amplifier

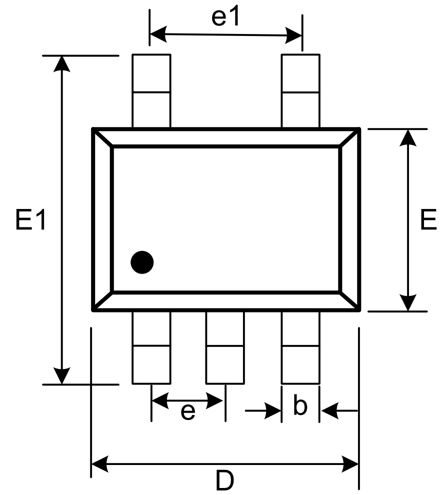
Layout Guidelines

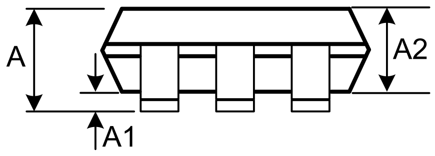
Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins.

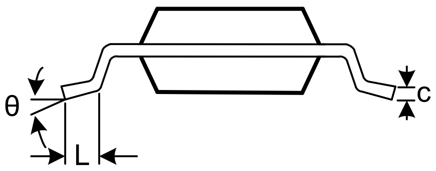
These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

PACKAGE DESCRIPTION

SOT23-5



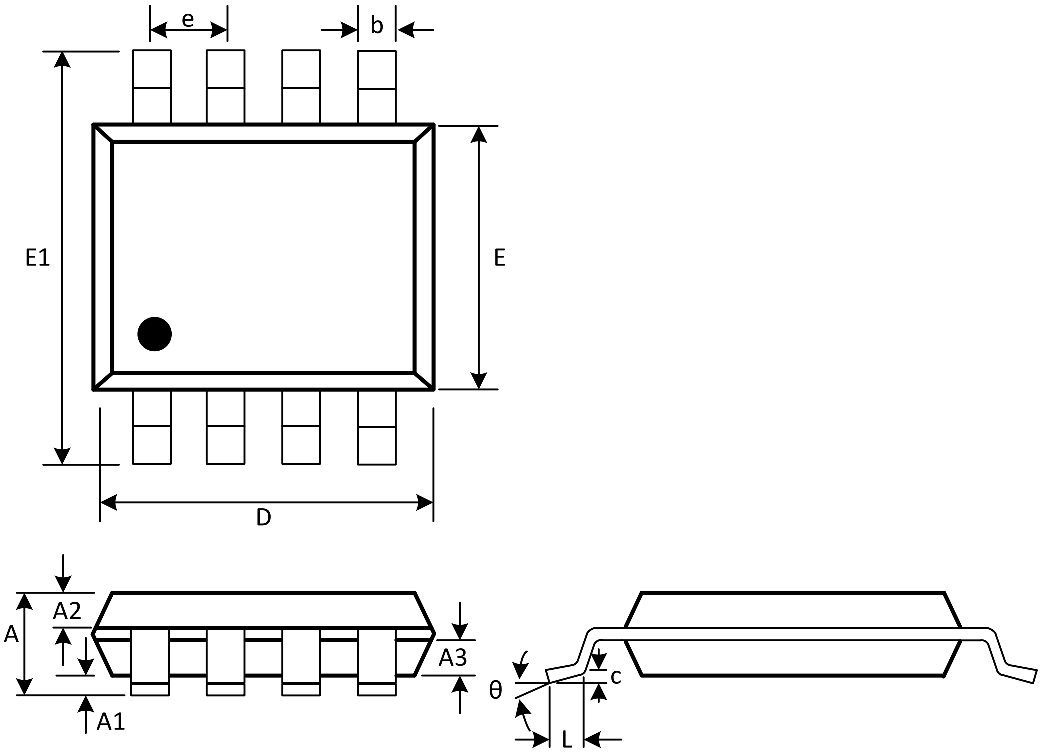




(Unit: mm)

Symbol	Min	Max
A	1.05	1.25
A1	0	0.1
A2	1.05	1.15
b	0.3	0.5
c	0.1	0.2
D	2.82	3.02
e	0.95(BSC)	
e1	1.9(BSC)	
E	1.5	1.7
E1	2.65	2.95
L	0.3	0.6
θ	0°	8°

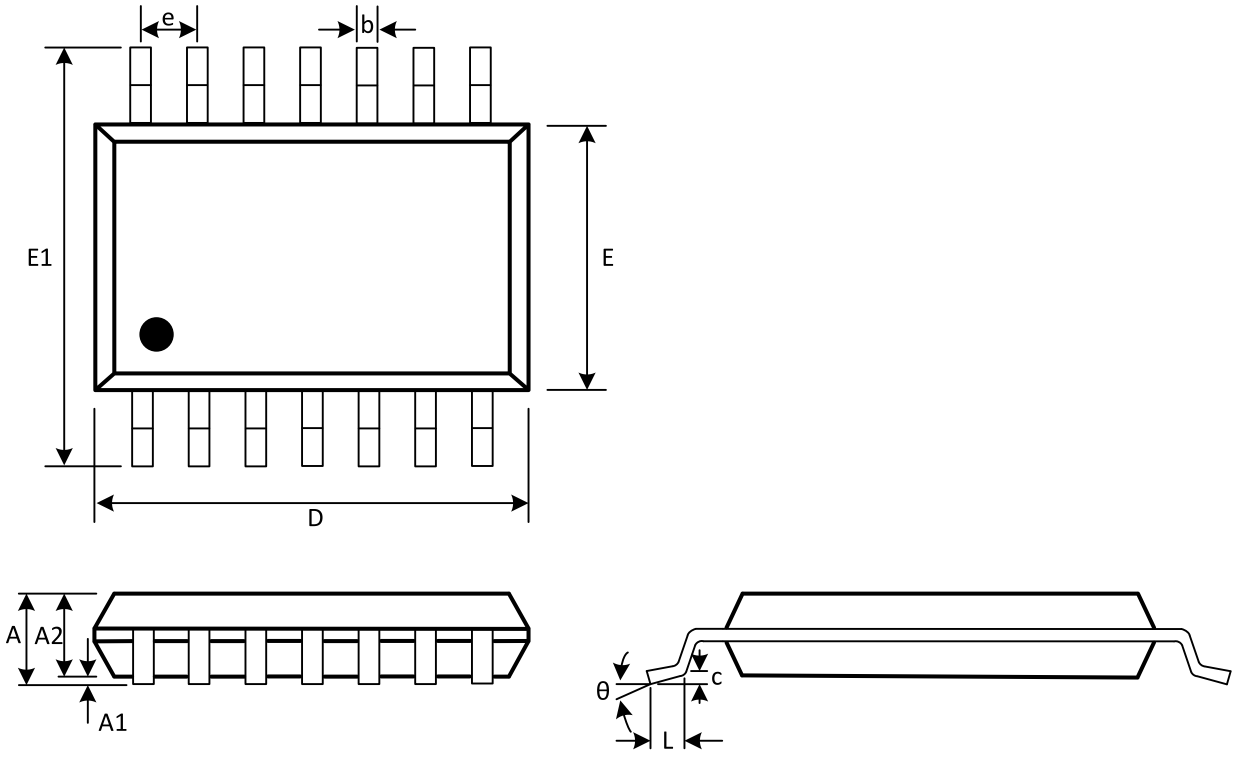
SOP-8



(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)	
E1	5.800	6.200
E	3.800	4.000
L	0.400	1.270
θ	0°	8°

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