SA59102

High Accuracy Current Sense Amplifier

General Description

The SA59102 is a current-sense amplifier, served as a voltage-output, current-shunt monitor. The device can sense a shunt voltage drop with a common mode voltage varying from -0.3V to 26V, independent of the supply voltage. The gain can be fixed at 100V/V. The SA59102 has a low offset zero-drift architecture, which can allow the device to function very well in measuring the low voltage drop in the power management unit.

The SA59102 operates from a 3V to 5V power supply. The device is provided in a SOT363 package, and specified over the extended industrial temperature range of -40 ℃ to 125 ℃.

Ordering Information

SA59102 □(□□)□

- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Note
SA59102AHA	SOT363	

Features

- Voltage-output, Current-shunt Monitor
- Wide Common Mode Operation Range: -0.3V~26V
- Gain=100V/V
- Amplifier's Output Referenced to VREF input
- Shunt Drop Range: -20mV to 20mV （VCC=5V，V_{REF}=2.5V）
- Low Offset Voltage: ±50μV (Maximum)
- 0.5μV/°C Offset Drift (Maximum)
- ±0.5% Gain Error (Maximum)
- 10ppm/ ℃ Gain Drift (Maximum)
- Quiescent Current: 100μA (Maximum)
- Packages: SOT363

Applications

DC Bus Monitoring for:

- Body Control Module
- Valve Control
- Motor Control
- Electronic Stability Control
- Wireless Charging Transmitters

Typical Application

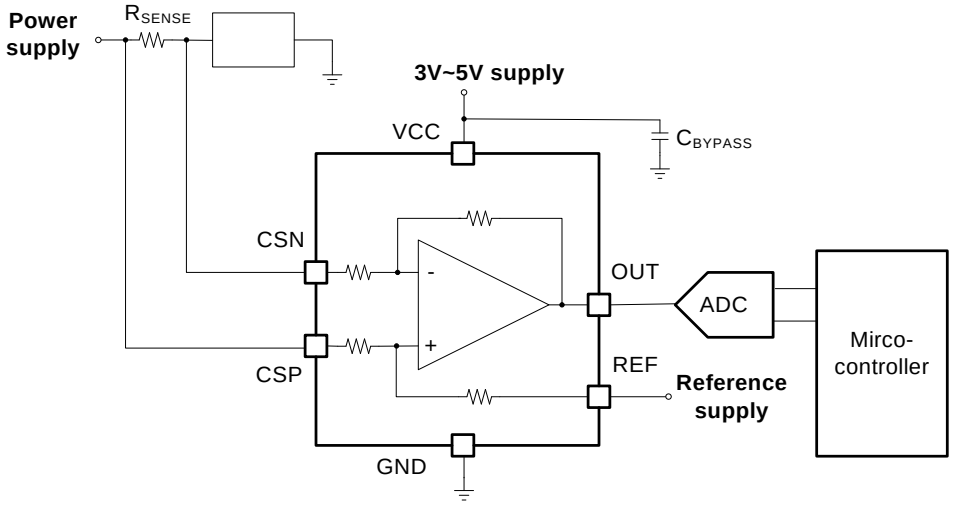
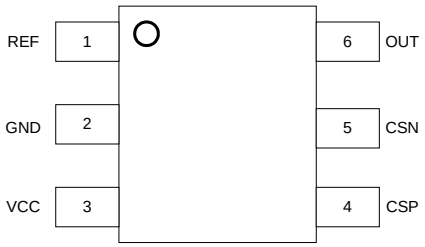


Figure 1. Typical application

Figure. 1 shows the basic connections of the SA59102. The two input pin CSN and CSP should be connected to the shunt resistor as closely as possible to minimize any resistance in series with the sense resistor. A bypass capacitor connected to the power-supply is required for stability concern.

Pinout (Top View)



(SOT363)

Top mark: **b*xyz*** (Device code: **b**, ***x=year code, y=week code, z= lot number code*****)**

Name	Number	Description
REF	1	Reference voltage input.
GND	2	Ground.
VCC	3	Power supply.
CSP	4	Connect to supply side of shunt resistor.
CSN	5	Connect to load side of shunt resistor.
OUT	6	Output voltage.

Block Diagram

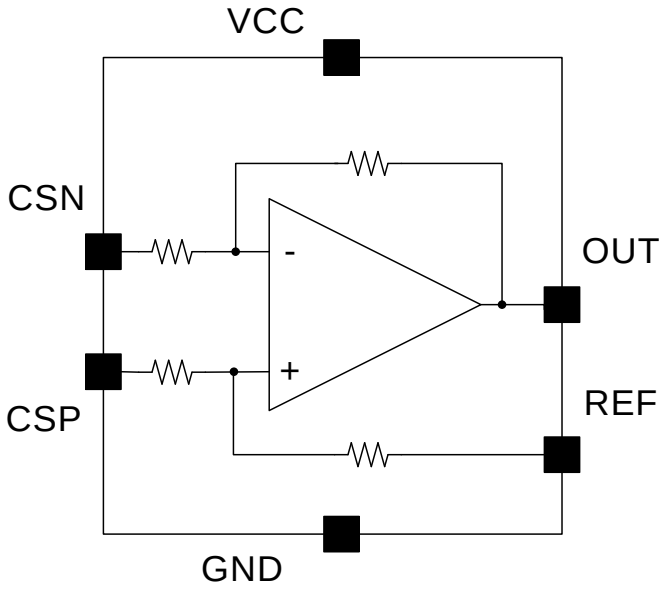


Figure 2. Block Diagram

Absolute Maximum Ratings

VCC ---------- -0.3V to 5.5V
CSP, CSN
Common-mode ---------- -0.3V to 26V
Differential ---------- -26V to 26V
REF ---------- -0.3V to VCC
OUT ---------- -0.3V to VCC
Junction Temperature ---------- -40℃ to +150℃
Storage Temperature ---------- -65℃ to +150℃

Recommended Operating Conditions

CSP, CSN (Differential) ---------- -20mV to +20mV
VCC ---------- 5V
REF ---------- 2.5V
Junction Temperature Range ---------- -40℃ to +125℃

Electrical Characteristics

T_A=25 ℃, V_{CC}=5V, CSP=12V, and V_{REF}=2.5V, unless otherwise noted.

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Input						
Common-mode Input	V_{CM}	T= -40 ℃ to 125 ℃	-0.3		26	V
Common-mode Rejection Ratio	CMRR	CSP=CSN=0V to 26 V, V_{SENSE}=0mV, T= -40 ℃ to 125 ℃	105	140		dB
Offset Voltage, RTI (Note 1)	V_{OS}	V_{SENSE}=0mV, T=25 ℃		±1	±50	μV
Offset Voltage vs Temperature	dV_{OS}/dT	T= -40 ℃ to 125 ℃		0.1	0.5	μV/°C
Offset Voltage vs Power Supply	PSR	V_{CC}=3V to 5V, V_{CM}=12V, V_{SENSE}=0mV, T=25 ℃		±0.1	±6	μV/V
Input Bias Current	I_B	V_{SENSE}=0mV, T=25 ℃	30	38	45	μA
Input Offset Current	I_{OS}	V_{SENSE}=0mV, T=25 ℃		±0.02		μA
Output						
Gain				100		V/V
Gain Error		V_{SENSE}= -20mV to 20mV, T= -40 ℃ to 125 ℃		±0.02%	±0.5%	
		V_{CC} = 3.3V, V_{REF} = 0V V_{SENSE} = 1 mV to 30 mV, T = -40 ℃ to 125 ℃		±0.02%	±0.5%	
Gain Error vs Temperature				3	10	ppm/ ℃
Nonlinearity Error		T=25 ℃		±0.01%		
Maximum Capacitive Load		No sustained oscillation, T=25 ℃		1		nF
Voltage Output						
Output Voltage Swing to V_{CC} Power-supply Rail		R_{LOAD}=10kΩ to GND, T= -40 ℃ to 125 ℃		(V_{CC})- 0.05	(V_{CC})- 0.2	V
Output Voltage Swing to GND		R_{LOAD}=10kΩ to GND, T= -40 ℃ to 125 ℃		(V_{GND}) +0.005	(V_{GND}) +0.05	V
Frequency Response						
Bandwidth	BW	C_{LOAD}=10pF, T=25 ℃		28		kHz
Slew Rate	SR	T=25 ℃		0.4		V/μs
Noise, RTI						
Voltage Noise Density (Note 2)		T=25 ℃		36		nV / $\sqrt{Hz}$
Power Supply						
Operation Voltage	V_{CC}		3		5	V
Quiescent Current	I_Q	V_{SENSE}=0mV, T=25 ℃		80	100	μA
		V_{SENSE}=0mV T= -40 ℃ to 125 ℃			100	μA

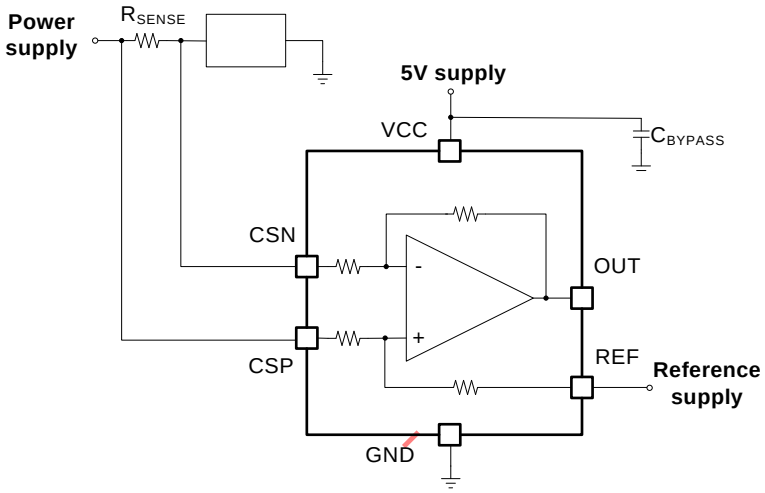
Note 1: RTI = referred to input.
Note 2: Guaranteed by design.

Detailed Description

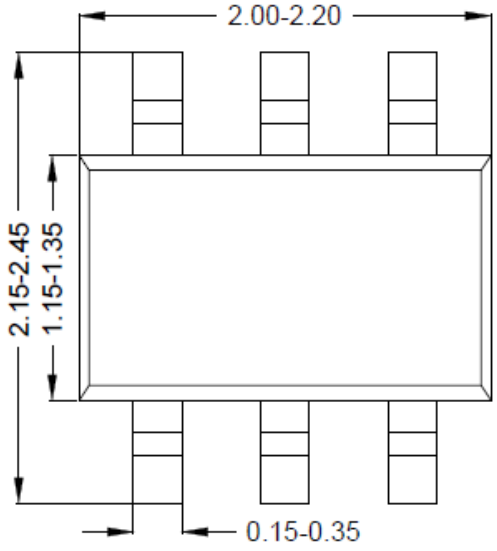
The SA59102 is a current sense amplifier. It is commonly used for over-current detection, voltage feedback control loops, or as a power monitor. This device is intended to operate as Analog Front END (AFE) for ADC or microcontroller requiring high-common mode signal translation to low-side referenced inputs.

REF Input

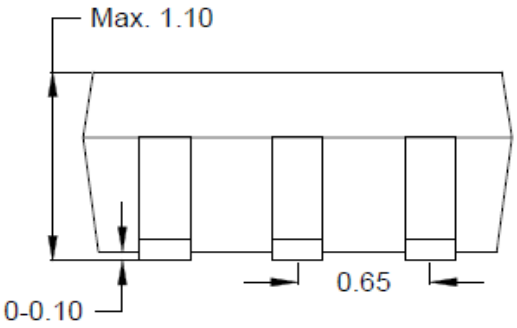
The SA59102 device measures the voltage developed across a current-sensing resistor when current passes through the device. With the REF pin connected to a reference voltage (for example 2.5V), the output voltage is biased upwards by this reference level. The output rises above the reference voltage for positive differential input signals and falls below the reference voltage for negative differential input signals. To be noticed that, the output should be high-clamped by VCC and low-clamped by GND.



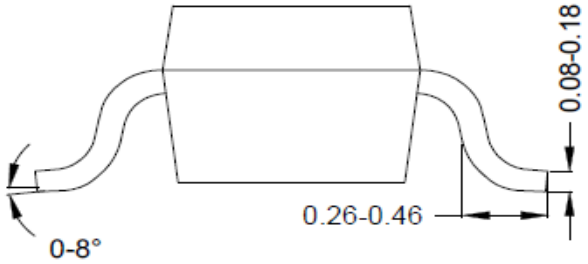
SOT363 Package Outline Drawing



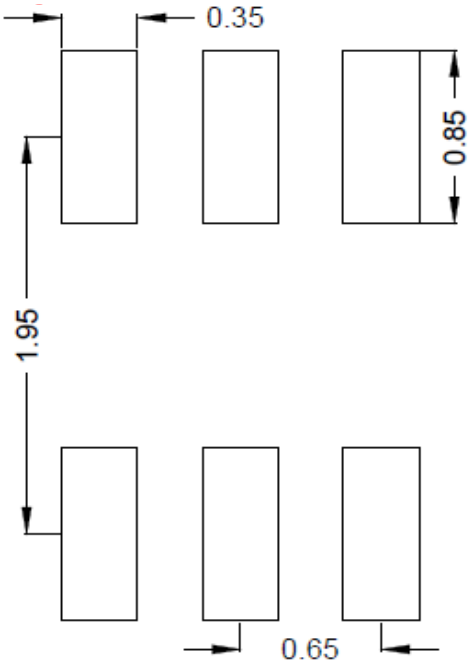
Top view



Side view A



Side view B

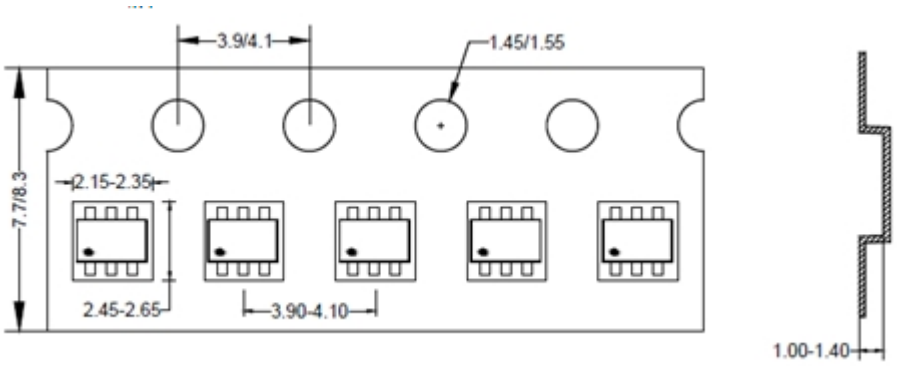


Recommended PCB layout (Reference only)

Notes: **All dimension in millimeter and exclude mold flash & metal burr.**

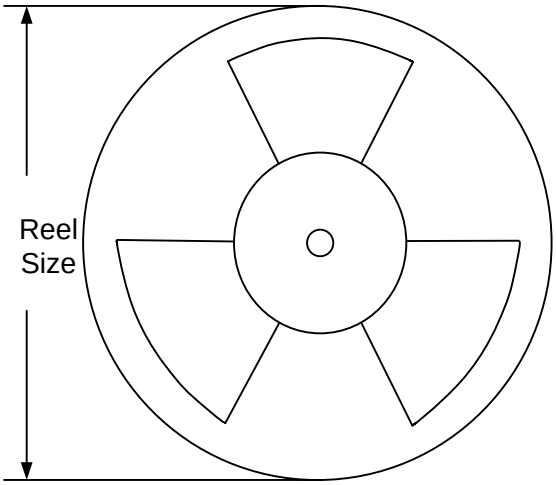
Taping & Reel Specification

1. SOT363 taping orientation



Feeding direction ⟶

2. Carrier Tape & Reel specification for packages



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel (pcs)
SOT363	8	4	7"	400	160	3000

3. Others: NA

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