Current Shunt Monitors –16 V to 105 V Common-Mode Range

1 FEATURES

- **Wide Common-Mode Voltage: -16 V to 105 V**
- **Low Error: 3.5% Overtemperature (Maximum)**
- **Bandwidth: Up to 550 kHz**
- **Three Transfer Function Available:**
  - RSA193A: 20V/V
  - RSA193B: 50V/V
  - RSA193C: 100V/V
- **Complete Current-Sense Solution**

2 APPLICATIONS

- **Welding Equipment**
- **Body Control Modules**
- **Load Health Monitoring**
- **Telecom Equipment**
- **HEV/EV Powertrain**
- **Power Management**
- **Battery Chargers**

3 DESCRIPTIONS

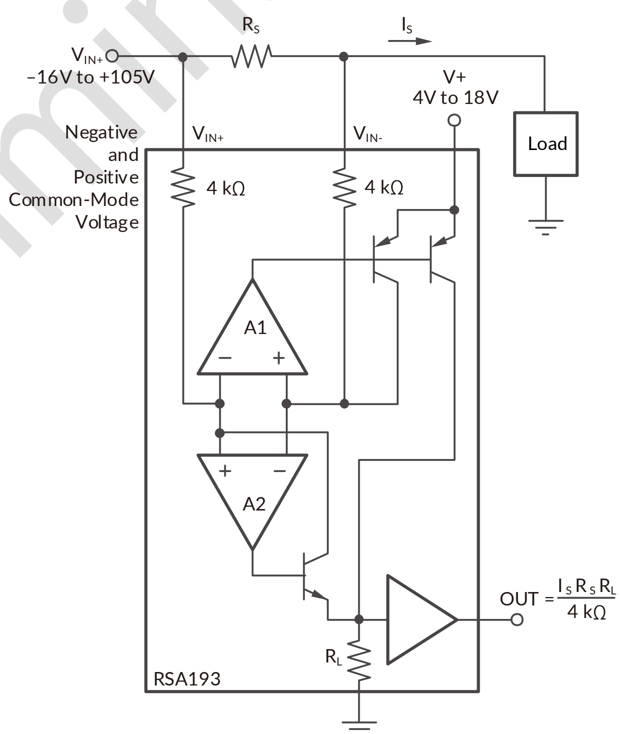
The RSA193 current shunt monitor with voltage output can sense drops across shunts at common-mode voltages from –16 V to 105 V, independent of the RSA193 supply voltage. They are available with three output voltage scale: 20V/V, 50V/V and 100V/V. The 550 kHz bandwidth simplifies use in current control loops and monitoring DC motor health.

The RSA193 operate from a single 4 V to 18 V supply. They are specified over the extended operating temperature range (–40°C to 125°C), and are offered in a space-saving SOT23-5 package.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RSA193	SOT23-5	2.90mm×1.60mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



Simplified Schematic

Table of Contents

4 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

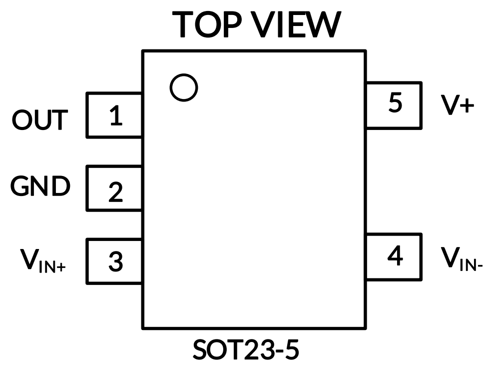
Version	Change Date	Change Item
A.0	2025/08/01	Preliminary version completed
A.0.1	2025/10/10	Add RSA193A/ RSA193B/ RSA193C
A.0.2	2026/01/30	1. Update ESD Ratings 2. Update Electrical Characteristics

5 PACKAGE/ORDERING INFORMATION [1]

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking [2]	MSL [3]	Package Qty
RSA193AXF	SOT23-5	5	1	-40°C ~125°C	193A	MSL1	Tape and Reel, 3000
RSA193BXF	SOT23-5	5	1	-40°C ~125°C	193B	MSL1	Tape and Reel, 3000
RSA193CXF	SOT23-5	5	1	-40°C ~125°C	193C	MSL1	Tape and Reel, 3000

NOTE:
(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.
(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

6 PIN CONFIGURATION AND FUNCTIONS



PIN DESCRIPTION

NAME	PIN	I/O (1)	DESCRIPTION
	SOT23-5		
GND	2	GND	Ground
OUT	1	O	Output voltage
V+	5	Analog	Power supply, 4 to 18 V
V_{IN+}	3	I	Connect to supply side of shunt resistor
V_{IN-}	4	I	Connect to load side of shunt resistor

(1) I = Input, O = Output.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
Supply voltage			18	V
Differential input voltage range, analog inputs (V_{IN+} – V_{IN-})		-18	18	V
Common-mode voltage range (2)		-16	110	V
Analog output voltage range (2)	OUT	GND-0.3	(V+)+0.3	V
Input current into any pin (2)			5	mA
Package thermal impedance, θ_{JA} (3)	SOT23-5		230	°C/W
Junction temperature, T_J (4)			150	°C
Storage temperature, T_{stg}		-65	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 voltage at any pin may exceed the voltage shown if the current at that pin is limited to 5 mA.
(3) The package thermal impedance is calculated in accordance with JESD-51.
(4) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), ANSI/ESDA/JEDEC JS-001-2023	±2000	V
		Charged-Device Model (CDM), ANSI/ESDA/JEDEC JS-002-2022	±1000	V

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

7.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V_{CM}	Common-mode input voltage		12		V
V_+	Operating supply voltage		12		V
T_A	Operating free-air temperature	-40		125	°C

7.4 Electrical Characteristics

V_S = 12 V, V_{IN+} = 12 V, V_{SENSE} = 100 mV (unless otherwise noted) Full = −40°C to 125°C.

PARAMETER		TEST CONDITIONS	T_A	MIN(1)	TYP(2)	MAX(1)	UNIT
INPUT							
V_{SENSE}	Full-Scale Input Voltage	$V_{SENSE} = V_{IN+} - V_{IN-}$	25°C		0.15	(V_S−0.2)/ Gain	V
V_{CM}	Common-Mode Input		Full	−16		105	V
CMR	Common-Mode Rejection	V_{IN+} = −16 V to 105 V	25°C	80	98		dB
		V_{IN+} = 12 V to 105 V	25°C	110	125		
			Full	100			
V_{OS}	Offset Voltage, RTI		25°C		±0.8	±2.2	mV
			Full			3	
dV_{OS}/dT	Offset Voltage vs Temperature		Full		2.5		μV/°C
PSR	Offset Voltage vs Power Supply	V_S = 4 V to 18 V, V_{IN+} = 18 V	25°C		5	30	μV/V
			Full			100	
I_B	Input Bias Current	V_{IN-} pin	25°C		±6	±15	μA
			Full			±20	
OUTPUT (V_{SENSE} ≥ 20 mV)							
G	Gain	RSA193A	25°C		20		V/V
		RSA193B	25°C		50		V/V
		RSA193C	25°C		100		V/V
Gain Error		V_{SENSE} = 20 mV to 100 mV	25°C		±0.2%	±1%	
			Full			±2%	
Total Output Error (3)			25°C		±0.75%	±2.7%	
			Full			±3.5%	
Nonlinearity Error		V_{SENSE} = 20 mV to 100 mV	25°C		±0.04%	±0.2%	
R_O	Output Impedance		25°C		1.5		Ω
Maximum Capacitive Load		No sustained oscillation	25°C		10		nF
OUTPUT (V_{SENSE} < 20 mV) (6)							
V_{OUT}	Output Voltage	All devices, −16 V ≤ V_{CM} < 0	25°C		300		mV
		All devices, V_S < V_{CM} ≤ 105 V			300		
		RSA193A, 0 V ≤ V_{CM} ≤ V_S, V_S=5 V				0.5	V
VOLTAGE OUTPUT (4)							
Swing to V+ Power-Supply Rail		R_L = 100 kΩ to GND	Full		V+ − 0.1	V+ − 0.2	V
Swing to GND (5)		R_L = 100 kΩ to GND	Full		V_{GND} + 3	V_{GND} + 50	mV
FREQUENCY RESPONSE							
BW	Bandwidth	RSA193A, C_{LOAD} = 5 pF	25°C		550		kHz
Phase Margin		C_{LOAD} < 10 nF	25°C		40		°
SR	Slew Rate				0.65		V/μs
ts	Settling Time (1%)	V_{SENSE} = 10 mV to 100 mV_{PP}, C_{LOAD} = 5 pF	25°C		10		μs
NOISE, RTI							
Voltage Noise Density			25°C		40		$nV/\sqrt{Hz}$

POWER SUPPLY							
V_S	Operating Voltage		Full	4		18	V
I_Q	Quiescent Current	V_{OUT} = 2 V	25°C		960	1200	µA
			Full			1400	
		V_{SENSE} = 0 mV	25°C		300	800	
			Full			1000	
TEMPERATURE RANGE							
Operating Temperature				–40		125	°C
Storage Temperature				–65		150	°C

NOTE:
(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(2) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.
(3) Total output error includes effects of gain error and V_{OS}.
(4) See Figure 6.
(5) Specified by design.
(6) For details on this region of operation, see Section 8.4.2.

7.5 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = 25°C, V_S = 12 V, V_{IN+} = 12 V, and V_{SENSE} = 100 mV (unless otherwise noted)

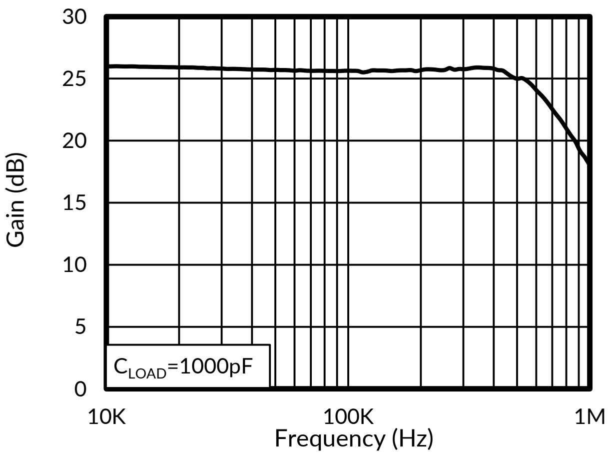


Figure 1. Gain vs Frequency

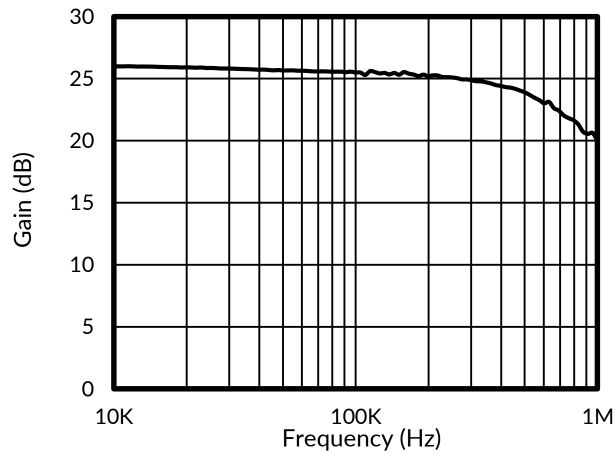


Figure 2. Gain vs Frequency

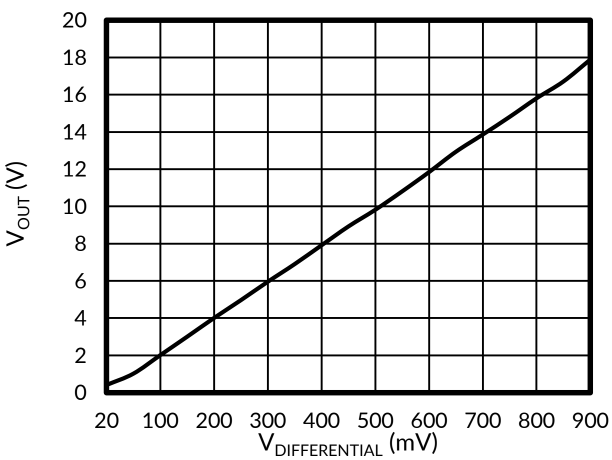


Figure 3. Gain Plot

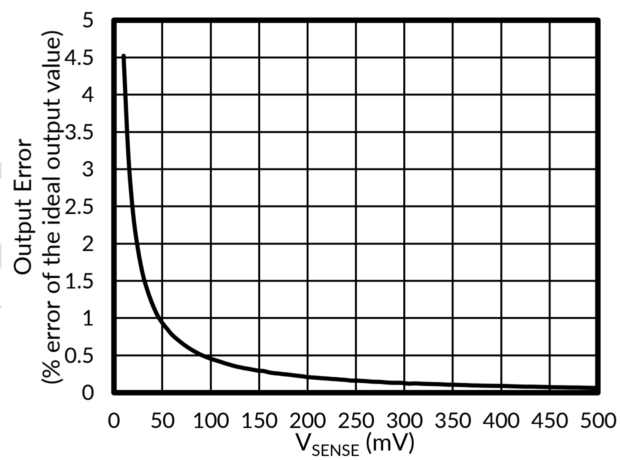


Figure 4. Output Error vs Vsense

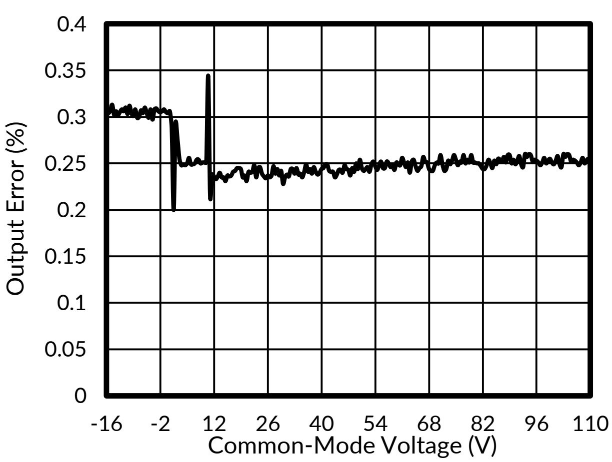


Figure 5. Output Error vs Common-Mode Voltage

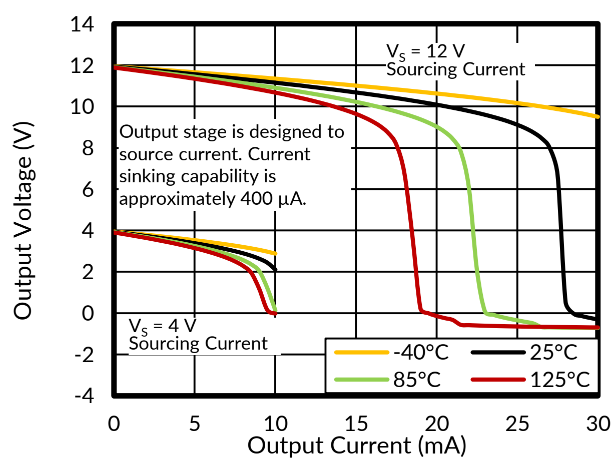


Figure 6. Positive Output Voltage Swing vs Output Current

Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = 25°C, V_S = 12 V, V_{IN+} = 12 V, and V_{SENSE} = 100 mV (unless otherwise noted)

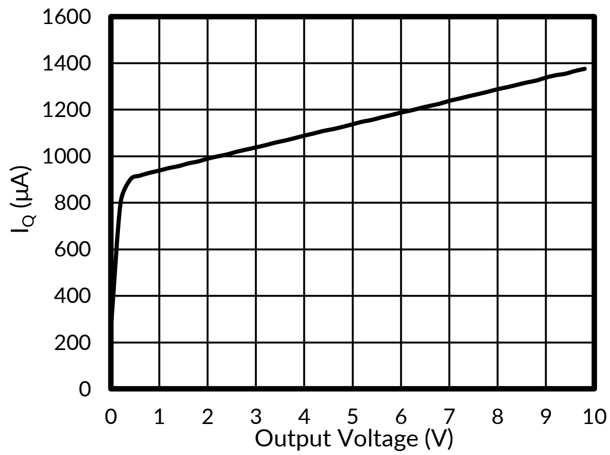


Figure 7. Quiescent Current vs Output Voltage

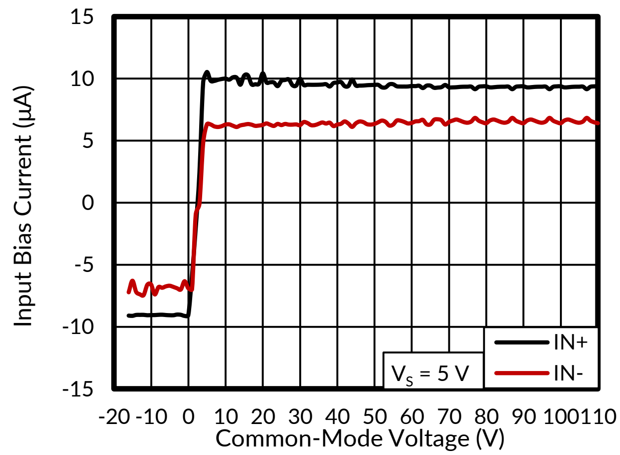


Figure 8. Input Bias Current vs Common Mode Voltage

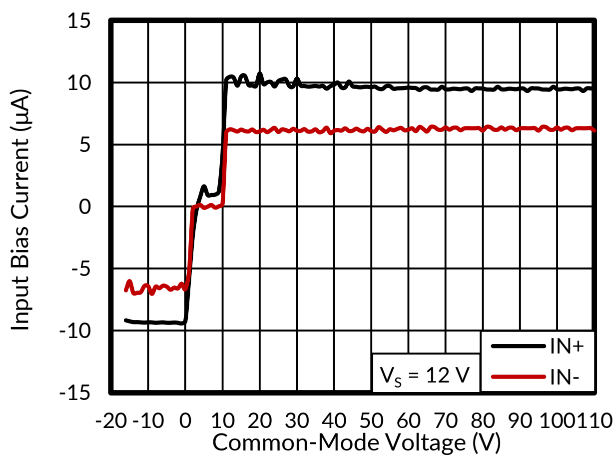


Figure 9. Input Bias Current vs Common Mode Voltage

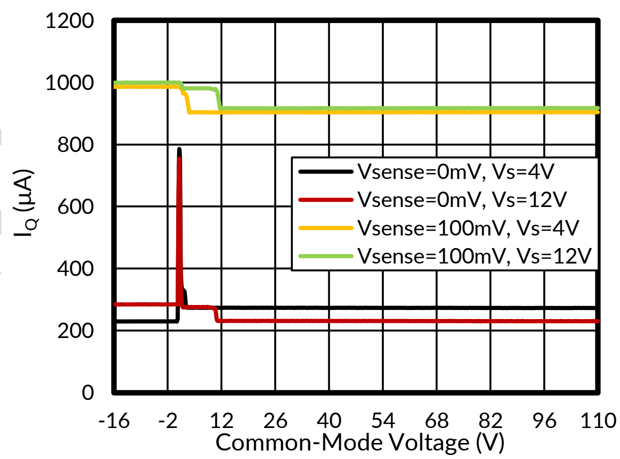


Figure 10. Quiescent Current vs Common Mode Voltage

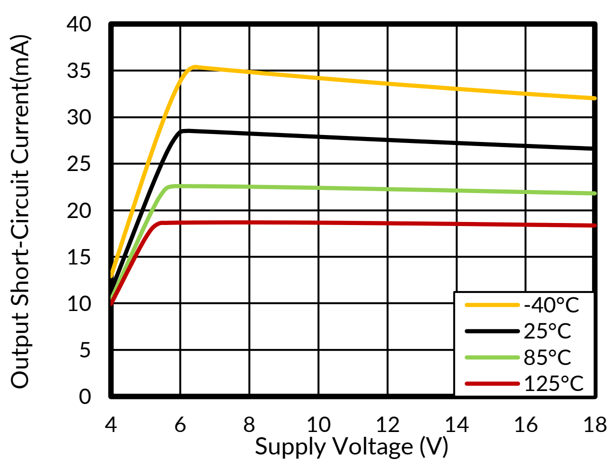


Figure 11. Output Short Circuit Current vs Supply Voltage

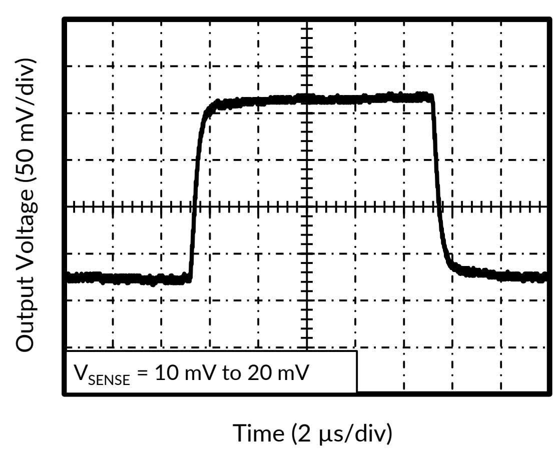


Figure 12. Step Response

Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

T_A = 25°C, V_S = 12 V, V_{IN+} = 12 V, and V_{SENSE} = 100 mV (unless otherwise noted)

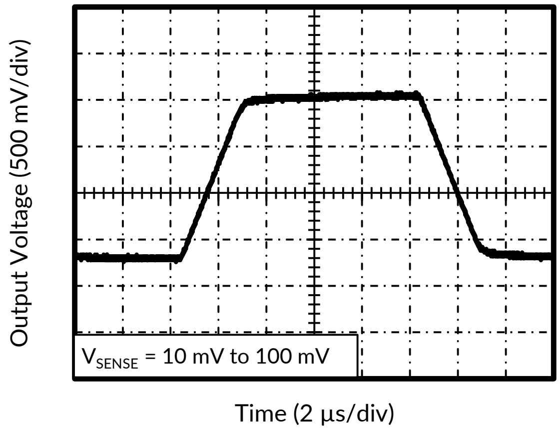


Figure 13. Step Response

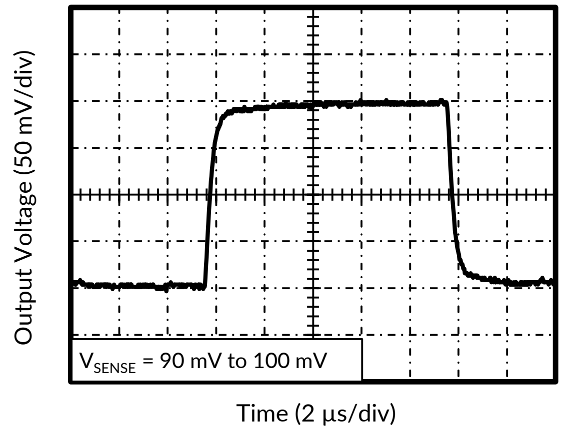


Figure 14. Step Response

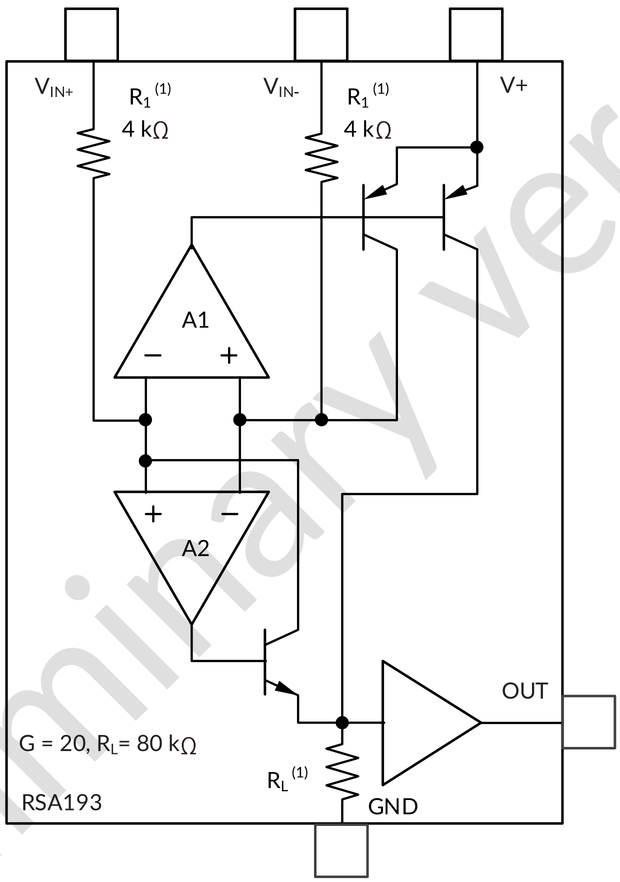
8 DETAILED DESCRIPTION

8.1 Overview

The RSA193 current shunt monitors with voltage output can sense drops across shunts at common mode voltages from −16 V to 105 V, independent of the RSA193 supply voltage. They are available with three output voltage scale: 20V/V, 50V/V and 100V/V. The 550 kHz bandwidth simplifies use in current control loops.

The RSA193 devices operate from a single 4 V to 18 V supply, drawing a typical of 960µA of supply current. They are specified over the extended operating temperature range (−40°C to 125°C), and are offered in a space-saving SOT23-5 package.

8.2 Functional Block Diagram



(1) Nominal resistor values are shown. ±15% variation is possible. Resistor ratios are matched to ±1%.

8.3 Feature Description

8.3.1 Basic Connection

Figure 15 shows the basic connection of the RSA193. The input pins, V_{IN+} and V_{IN-}, should be connected as closely as possible to the shunt resistor to minimize any resistance in series with the shunt resistance.

Power-supply bypass capacitors are required for stability. Applications with noisy or high-impedance power supplies may require additional decoupling capacitors to reject power-supply noise. Connect bypass capacitors close to the device pins.

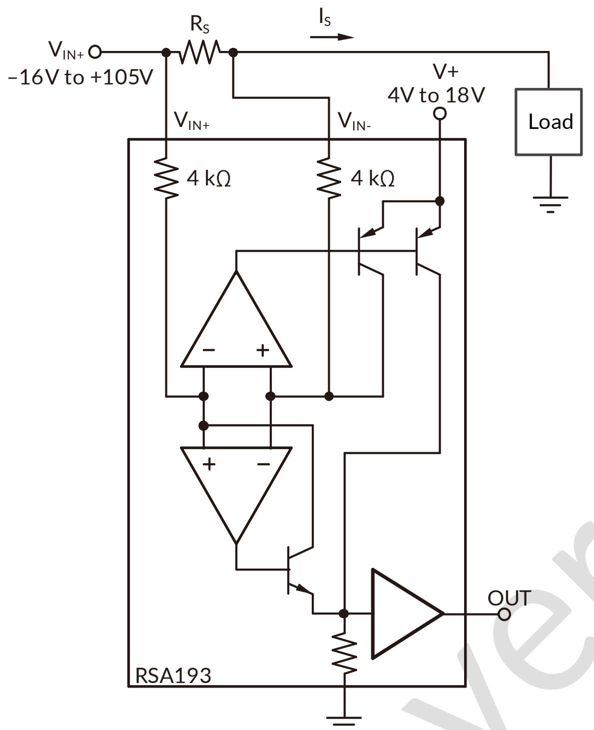


Figure 15. RSA193 Basic Connections

8.3.2 Selecting R_S

The value chosen for the shunt resistor, R_S, depends on the application and is a compromise between small-signal accuracy and maximum permissible voltage loss in the measurement line. High values of R_S provide better accuracy at lower currents by minimizing the effects of offset, while low values of R_S minimize voltage loss in the supply line. For most applications, best performance is attained with an R_S value that provides a full-scale shunt voltage range of 50 mV to 100 mV. Maximum input voltage for accurate measurements is 500 mV.

8.3.3 Inside the RSA193

The RSA193 uses a new, unique, internal circuit topology that provides common mode range extending from –16V to 105V while operating from a single power supply. The common mode rejection in a classic instrumentation amplifier approach is limited by the requirement for accurate resistor matching. By converting the induced input voltage to a current, the RSA193 provides common mode rejection that is no longer a function of closely matched resistor values, providing the enhanced performance necessary for such a wide common mode range. A simplified diagram (see Figure 15) shows the basic circuit function. When the common mode voltage is positive, amplifier A2 is active.

The differential input voltage, $V_{IN+} – V_{IN-}$ applied across R_S, is converted to a current through a 4 kΩ resistor. This current is converted back to a voltage through R_L, and then amplified by the output buffer amplifier. When the common mode voltage is negative, amplifier A1 is active. The differential input voltage, $V_{IN+} – V_{IN-}$ applied across R_S, is converted to a current through a 4 kΩ resistor. This current is sourced from a precision current mirror whose output is directed into R_L, converting the signal back into a voltage and amplified by the output buffer amplifier.

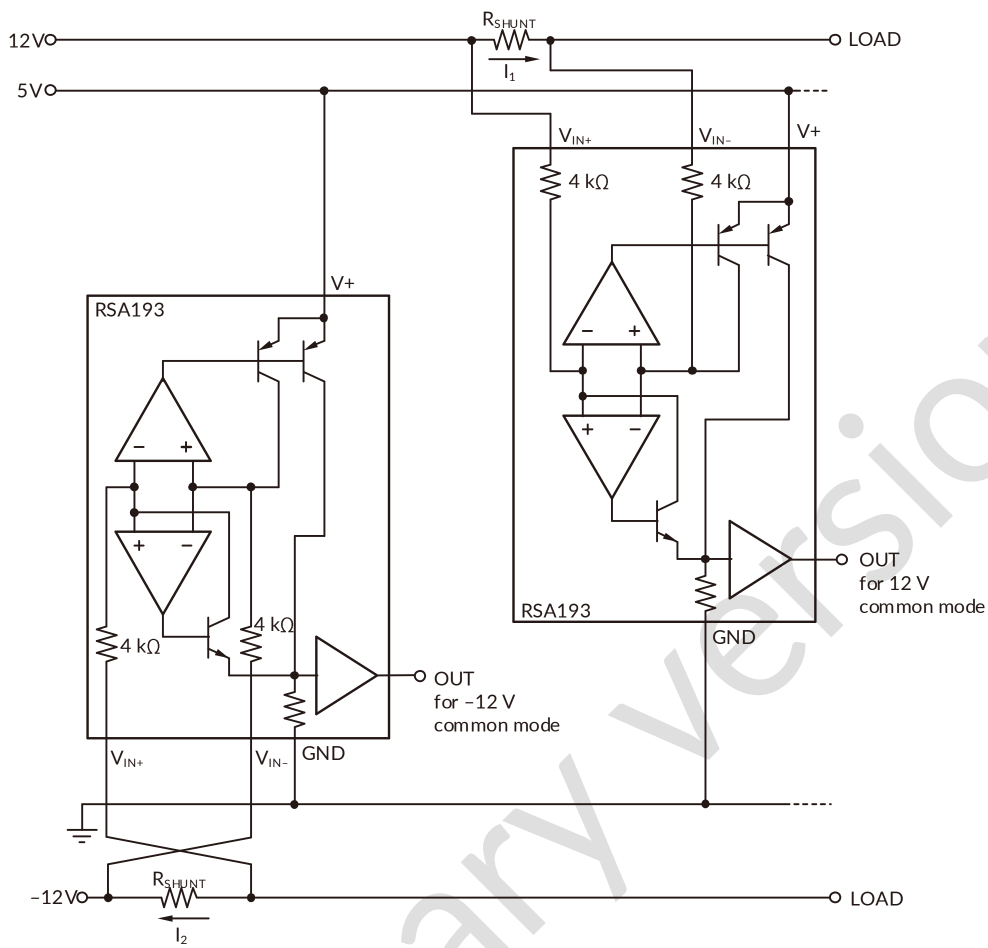


Figure 16. Monitor Bipolar Output Power-Supply Current

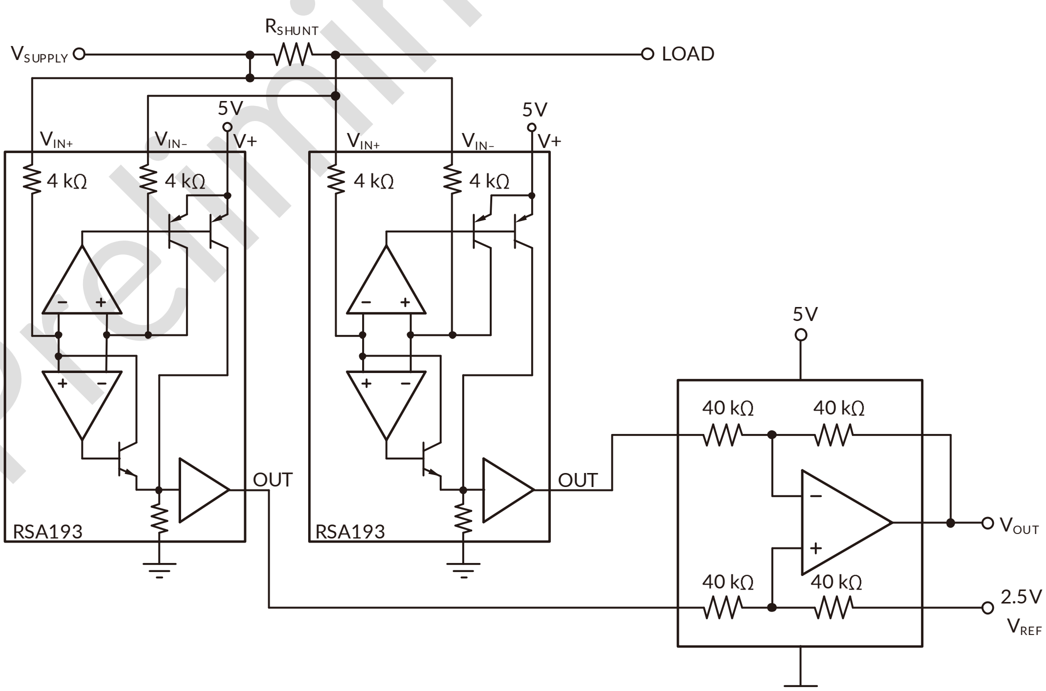


Figure 17. Bidirectional Current Monitoring

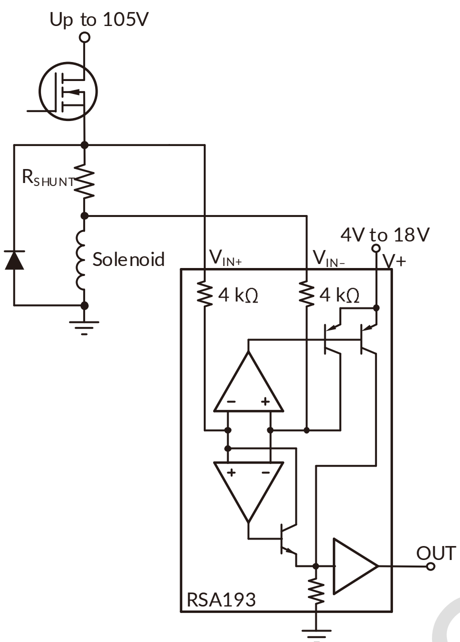


Figure 18. Inductive Current Monitor Including Flyback

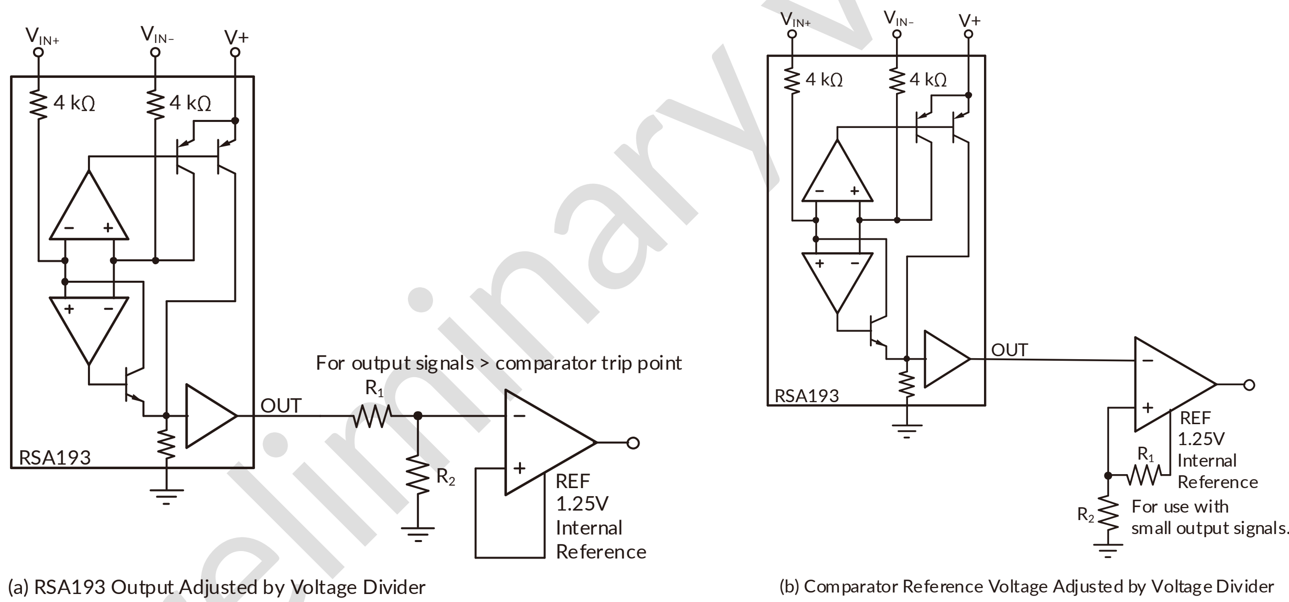


Figure 19. RSA193 With Comparator

8.4 Device Functional Modes

8.4.1 Input Filtering

An obvious and straightforward location for filtering is at the output of the RSA193; however, this location negates the advantage of the low output impedance of the internal buffer. The only other option for filtering is at the input pins of the RSA193, which is complicated by the internal 4 kΩ ± 30% input impedance (see Figure 20). Using the lowest possible resistor values minimizes both the initial shift in gain and effects of tolerance. The effect on initial gain is given by:

$$\text{Gain Error \%} = 100 - \left(100 \times \frac{4\text{ k}\Omega}{4\text{ k}\Omega + R_{FILT}}\right) \quad (1)$$

Total effect on gain error can be calculated by replacing the 4 kΩ term with 4 kΩ – 30% (or 2.8 kΩ) or 4 kΩ + 30% (or 5.2 kΩ). The tolerance extremes of R_{FILT} can also be inserted into the equation. If a pair of 100 Ω 1% resistors are used on the inputs, the initial gain error is 2.44%. Worst-case tolerance conditions always occur at the lower excursion of the internal 4 kΩ resistor (2.8 kΩ), and the higher excursion of R_{FILT}, 3% in this case.

The specified accuracy of the RSA193 must then be combined in addition to these tolerances. While this discussion treats accuracy worst-case conditions by combining the extremes of the resistor values, it is appropriate to use geometric mean or root sum square calculations to total the effects of accuracy variations.

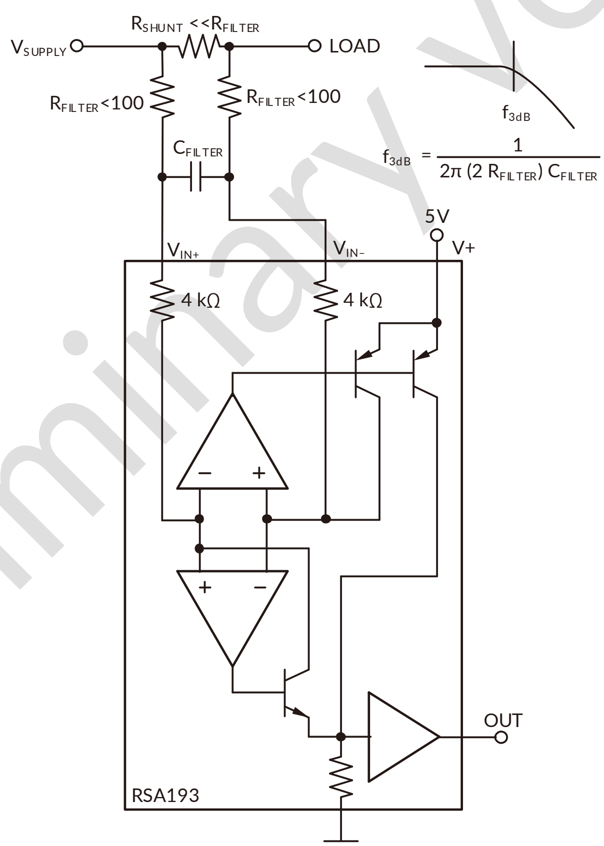


Figure 20. Input Filter

8.4.2 Accuracy Variations as a Result of V_{SENSE} and Common Mode Voltage

The accuracy of the RSA193 current shunt monitors is a function of two main variables: V_{SENSE} (V_{IN+} – V_{IN-}) and common mode voltage, V_{CM}, relative to the supply voltage, V_S. V_{CM} is expressed as (V_{IN+} + V_{IN-})/2; however, in practice, V_{CM} is seen as the voltage at V_{IN+} because the voltage drop across V_{SENSE} is usually small.

This section addresses the accuracy of these specific operating regions:
Normal Case 1: $V_{SENSE} \geq 20$ mV, $V_{CM} \geq V_S$
Normal Case 2: $V_{SENSE} \geq 20$ mV, $V_{CM} < V_S$
Low V_{SENSE} Case 1: $V_{SENSE} < 20$ mV, -16 V $\leq V_{CM} < 0$
Low V_{SENSE} Case 2: $V_{SENSE} < 20$ mV, 0 V $\leq V_{CM} \leq V_S$
Low V_{SENSE} Case 3: $V_{SENSE} < 20$ mV, $V_S < V_{CM} \leq 105$ V

8.4.2.1 Normal Case 1: $V_{SENSE} \geq 20$ mV, $V_{CM} \geq V_S$

This region of operation provides the highest accuracy. Here, the input offset voltage is characterized and measured using a two-step method. First, the gain is determined by (Equation 2).

$$G = \frac{V_{OUT1} - V_{OUT2}}{100mV - 20mV} \quad (2)$$

where

- V_{OUT1} = Output voltage with V_{SENSE} = 100 mV
- V_{OUT2} = Output voltage with V_{SENSE} = 20 mV

The offset voltage is then measured at V_{SENSE} = 100 mV and referred to the input (RTI) of the current shunt monitor, as shown in (Equation 3).

$$V_{OS}\ \text{RTI (Referred-To-Input)} = \left(\frac{VOUT1}{G}\right) - 100\ \text{mV} \quad (3)$$

In Typical Characteristics, the Output Error vs Common Mode Voltage curve shows the highest accuracy for the this region of operation. In this plot, V_S = 12 V; for $V_{CM} \geq 12$ V, the output error is at its minimum. This case is also used to create the $V_{SENSE} \geq 20$ mV output specifications in the Electrical Characteristics table.

8.4.2.2 Normal Case 2: $V_{SENSE} \geq 20$ mV, $V_{CM} < V_S$

This region of operation has slightly less accuracy than Normal Case 1 as a result of the common mode operating area in which the part functions, as seen in Figure 5. As noted, for this graph V_S = 12 V; for $V_{CM} < 12$ V, the Output Error increases as V_{CM} becomes less than 12 V, with a typical maximum error of 0.3% at the most negative $V_{CM} = -16$ V.

8.4.2.3 Low V_{SENSE} Case 1: $V_{SENSE} < 20$ mV, -16 V $\leq V_{CM} < 0$; and Low V_{SENSE} Case 3: $V_{SENSE} < 20$ mV, $V_S < V_{CM} \leq 105$ V

Although the RSA193 devices are not designed for accurate operation in either of these regions, some applications are exposed to these conditions; for example, when monitoring power supplies that are switched on and off while V_S is still applied to the RSA193. It is important to know what the behavior of the devices will be in these regions.

As V_{SENSE} approaches 0 mV, in these V_{CM} regions, the device output accuracy degrades. A larger-than-normal offset can appear at the current shunt monitor output with a typical maximum value of V_{OUT} = 300 mV for V_{SENSE} = 0 mV. As V_{SENSE} approaches 20 mV, V_{OUT} returns to the expected output value with accuracy as specified in Electrical Characteristics.

8.4.2.4 Low V_{SENSE} Case 2: $V_{SENSE} < 20$ mV, 0 V $\leq V_{CM} \leq V_S$

This region of operation is the least accurate for the RSA193. To achieve the wide input common mode voltage range, these devices use two operational amplifier front ends in parallel. One operational amplifier front end operates in the positive input common mode voltage range, and the other in the negative input region. For this case, neither of these two internal amplifiers dominates and overall loop gain is very low. Within this region, V_{OUT} approaches voltages close to linear operation levels for Normal Case 2. This deviation from linear operation becomes greatest the closer V_{SENSE} approaches 0 V. Within this region, as V_{SENSE} approaches 20 mV, device operation is closer to that described by Normal Case 2. The V_{OUT} maximum peak for this case is tested by maintaining a constant V_S, setting V_{SENSE} = 0 mV and sweeping V_{CM} from 0 V to V_S. The exact V_{CM} at which V_{OUT}

peaks during this test varies from part to part, but the V_{OUT} maximum peak is tested to be less than the specified V_{OUT} tested limit.

8.4.3 Shutdown

Because the RSA193 consume a quiescent current approximate 1 mA, they can be powered by either the output of logic gates or by transistor switches to supply power. Use a totem pole output buffer or gate that can provide sufficient drive along with 0.1 µF bypass capacitor, preferably ceramic with good high frequency characteristics. This gate should have a supply voltage of 4.3 V or greater because the RSA193 requires a minimum supply greater than 4 V. In addition to eliminating quiescent current, this gate also turns off the 10 µA bias current present at each of the inputs. An example shutdown circuit is shown in Figure 21.

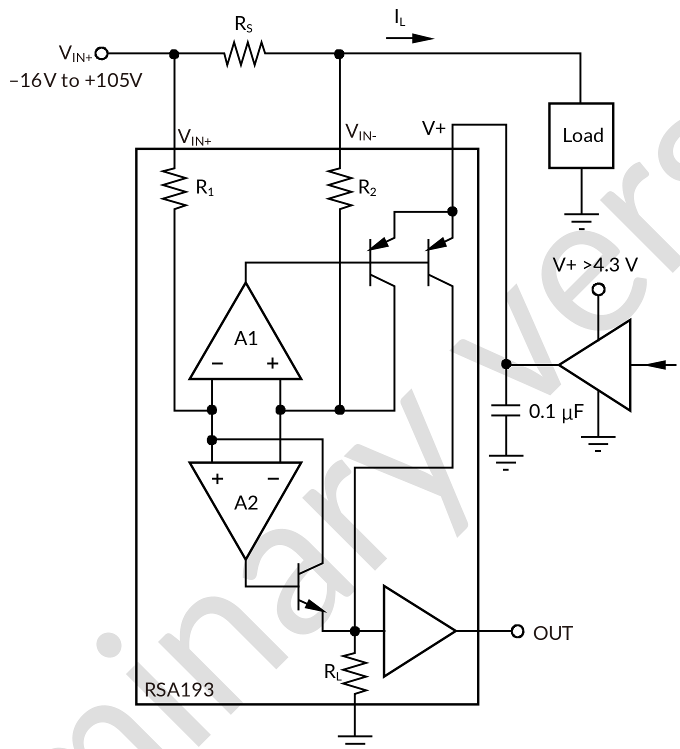


Figure 21. RSA193 Example Shutdown Circuit

8.4.4 Transient Protection

The –16 V to 105 V common mode range of the RSA193 is ideal for withstanding automotive fault conditions ranging from 12 V battery reversal up to 105 V transients, because no additional protective components are needed up to those levels. In the event that the RSA193 is exposed to transients on the inputs in excess of its ratings, then external transient absorption with semiconductor transient absorbers (zeners or Transzorbs) are necessary. RUNIC does not recommend using MOVs or VDRs except when they are used in addition to a semiconductor transient absorber. Select the transient absorber such that it never allows the RSA193 to be exposed to transients greater than 105 V (that is, allow for transient absorber tolerance, as well as additional voltage due to transient absorber dynamic impedance). Despite the use of internal zener-type ESD protection, the RSA193 does not lend itself to using external resistors in series with the inputs because the internal gain resistors can vary up to ±30%. (If gain accuracy is not important, then resistors can be added in series with the RSA193 inputs with two equal resistors on each input.)

8.4.5 Output Voltage Range

The output of the RSA193 is accurate within the output voltage swing range set by the power supply pin, V+.

9 APPLICATION AND IMPLEMENTATION

Information in the following applications sections is not part of the RUNIC component specification, and RUNIC does not warrant its accuracy or completeness. RUNIC's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The RSA193 devices measure the voltage developed across a current-sensing resistor when current passes through it. The ability to have shunt common mode voltages from −16 V to 105 V drive and control the output signal with Vs offers multiple configurations, as discussed throughout this section.

9.2 Typical Application

The device is a unidirectional, current-sense amplifier capable of measuring currents through a resistive shunt with shunt common mode voltages from −16 V to 105 V. Two devices can be configured for bidirectional monitoring and is common in applications that include charging and discharging operations where the current flow-through resistor can change directions.

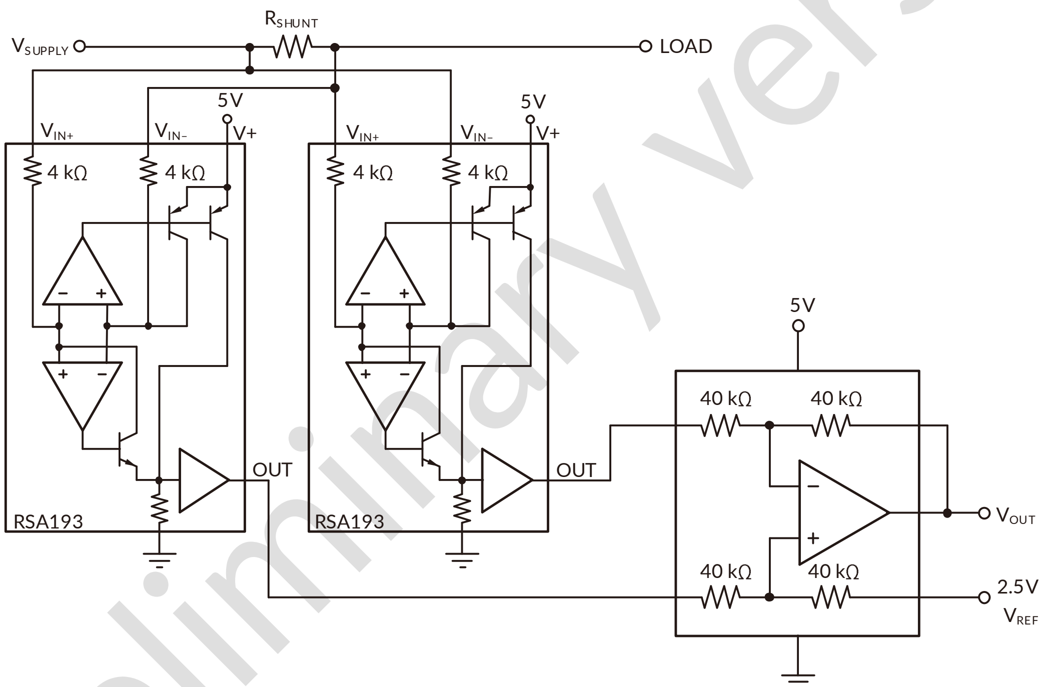


Figure 22. Bidirectional Current Monitoring

9.2.1 Design Requirements

Vsupply is set to 12 V, Vref at 2.5 V and a 10 mΩ shunt. The accuracy of the current will typically be less than 0.5% for current greater than ±2 A. For current lower than ±2 A, the accuracy will vary; use Section 8.4.2 for accuracy considerations.

9.2.2 Detailed Design Procedure

The ability to measure this current flowing in both directions is enabled by adding a unity gain amplifier with a V_{REF}, as shown in Figure 22. The output then responds by increasing above V_{REF} for positive differential signals (relative to the IN − pin) and responds by decreasing below V_{REF} for negative differential signals. This reference voltage applied to the REF pin can be set anywhere from 0 V to V+. For bidirectional applications, V_{REF} is typically set at mid- scale for equal signal range in both current directions. In some cases, however, V_{REF} is set at a voltage other than mid-scale when the bidirectional current and corresponding output signal are not required to be symmetrical.

9.2.3 Application Curve

An example output response of a bidirectional configuration is shown in Figure 23. With the REF pin connected to a reference voltage, 2.5 V in this case, 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.

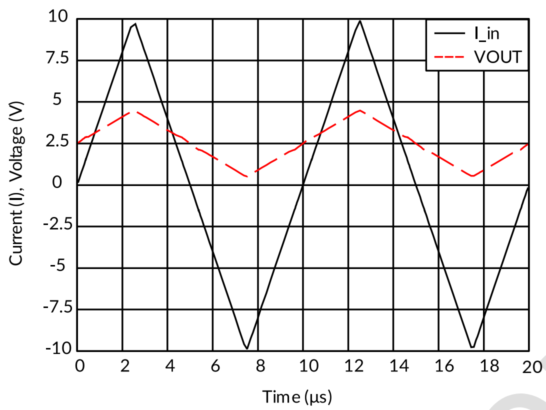


Figure 23. Output Voltage vs Shunt Input Current

10 POWER SUPPLY RECOMMENDATIONS

The input circuitry of the RSA193 device can accurately measure beyond its power-supply voltage, V +. For example, the V+ power supply can be 5 V, whereas the load power-supply voltage is up to 105 V. The output voltage range of the OUT terminal, however, is limited by the voltages on the power-supply pin.

11 LAYOUT

11.1 Layout Guidelines

11.1.1 RFI/EMI

RUNIC always recommends adhering to good layout practices. Keep traces short and, when possible, use a printed-circuit-board (PCB) ground plane with surface-mount components placed as close to the device pins as possible. Small ceramic capacitors placed directly across amplifier inputs can reduce RFI/EMI sensitivity. PCB layout should locate the amplifier as far away as possible from RFI sources. Sources can include other components in the same system as the amplifier itself, such as inductors (particularly switched inductors handling a lot of current and at high frequencies). RFI can generally be identified as a variation in offset voltage or dc signal levels with changes in the interfering RF signal. If the amplifier cannot be located away from sources of radiation, shielding may be needed. Twisting wire input leads makes them more resistant to RF fields.

11.2 Layout Example

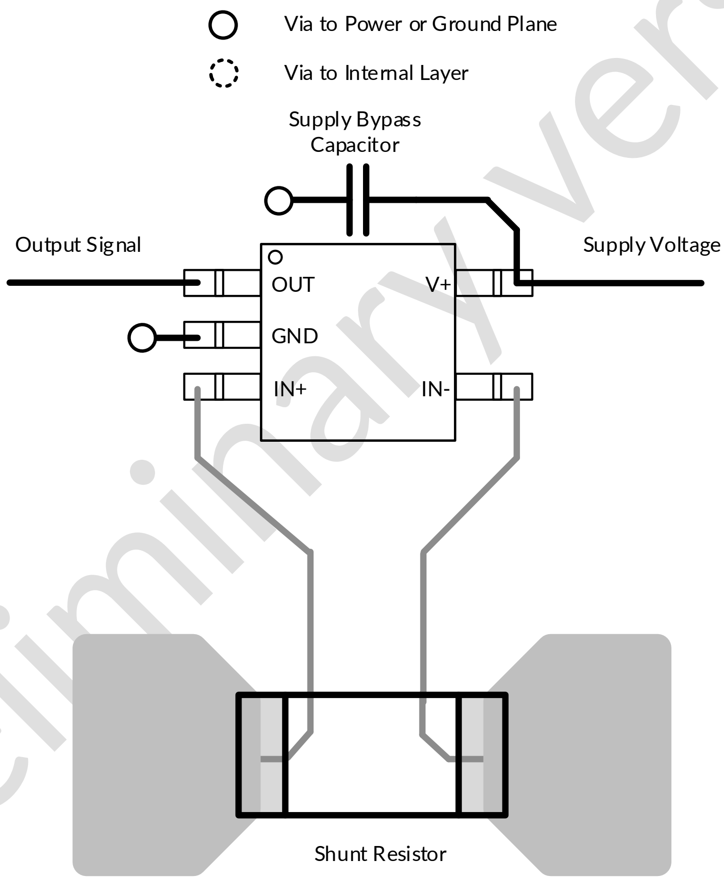
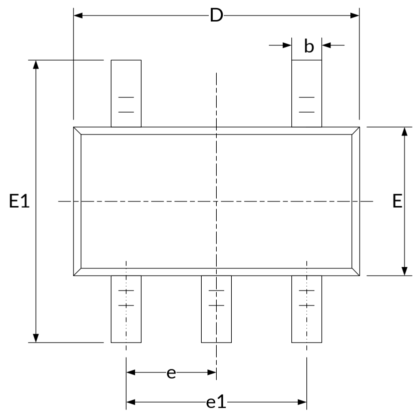
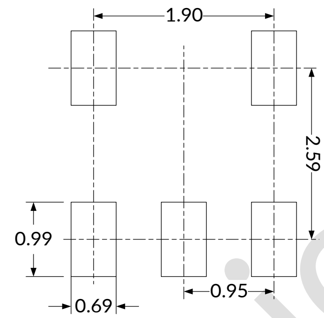


Figure 24. Recommended Layout

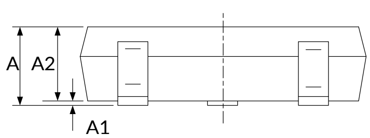
12 PACKAGE OUTLINE DIMENSIONS

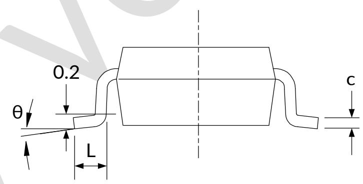
SOT23-5 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



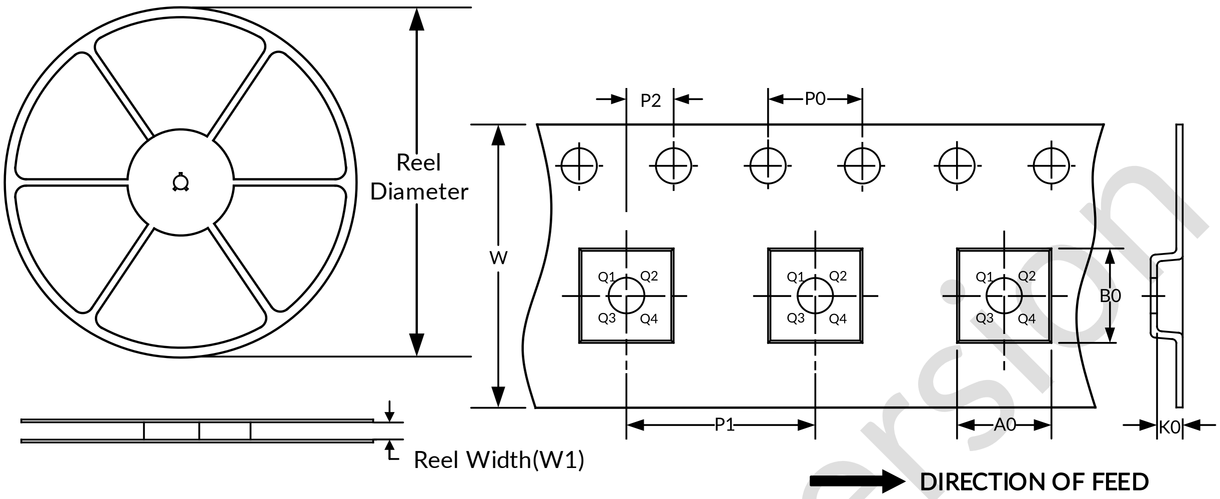


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D (1)	2.820	3.020	0.111	0.119
E (1)	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC) (2)		0.037(BSC) (2)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

NOTE:
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

13 TAPE AND REEL INFORMATION

REEL DIMENSIONS   TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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