SGM830
-4V to 80V, 1MHz, High-Precision Current-Sense Amplifier

GENERAL DESCRIPTION

The SGM830 is a high-accuracy, fixed-gain, voltage-output, current-sense amplifier featuring a wide common-mode voltage range from -4V to 80V. This negative common-mode voltage enables operation below ground level, useful in scenarios like the flyback period of a solenoid.

The SGM830 provides low offset voltage, small gain error and excellent DC CMRR. Its small-signal bandwidth can reach up to 1MHz, with an AC CMRR of 70dB at 50kHz. These characteristics make accurate current measurement without large transients and related recovery disturbances on the output voltage. It is suitable for both DC current measurement and high speed applications such as fast over-current protection.

The device is powered from a single 2.7V to 18V supply, and draws 1.2mA (TYP) of supply current. There are five fixed gain options: 20V/V, 50V/V, 100V/V, 200V/V, and 500V/V, providing more flexibility to fit the gain requirements in various applications.

The SGM830 is available in a Green SOT-23-5 package.

TYPICAL APPLICATION

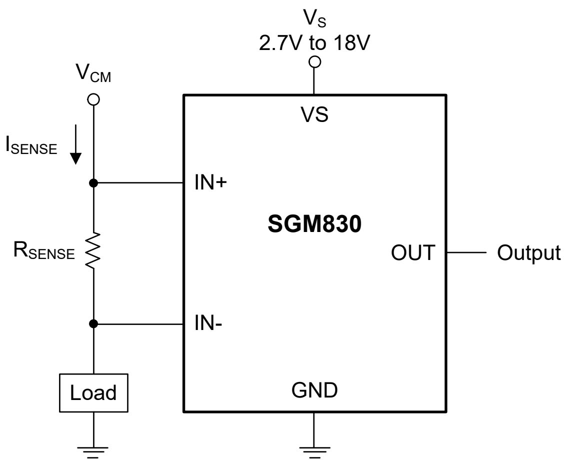


Figure 1. Typical Application Circuit

FEATURES

- **Wide Common-Mode Voltage:**
  - **Operational Voltage: -4V to 80V**
  - **Survival Voltage: -20V to 85V**
- **Excellent CMRR:**
  - **130dB DC CMRR**
  - **70dB AC CMRR at 50kHz**
- **Gain Error:**
  - **+25℃: ±0.2% (MAX) of SGM830A/B/C/D**
  - **+25℃: ±0.3% (MAX) of SGM830E**
  - **-40℃ to +125℃: ±0.4% (MAX) of SGM830A/B/C/D**
  - **-40℃ to +125℃: ±0.65% (MAX) of SGM830E**
- **Offset:**
  - **+25℃: ±170μV (MAX) of All Models**
  - **-40℃ to +125℃: ±500μV (MAX) of SGM840A**
  - **-40℃ to +125℃: ±300μV (MAX) of SGM840B/C/D**
  - **-40℃ to +125℃: ±400μV (MAX) of SGM840E**
- **Available Gains:**
  - **SGM830A: 20V/V**
  - **SGM830B: 50V/V**
  - **SGM830C: 100V/V**
  - **SGM830D: 200V/V**
  - **SGM830E: 500V/V**
- **High Bandwidth: 1MHz**
- **Slew Rate: 5V/μs**
- **Low Quiescent Current: 1.2mA (TYP)**
- **Available in a Green SOT-23-5 Package**

APPLICATIONS

Active Antenna Systems (AAS)
Radio Remote Unit (RRU)
Solenoid and Valve Controls
48V Rack Servers
48V Power Supply Units (PSU)
Telecom Equipment
Power Supplies

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM830A (Gain = 20V/V)	SOT-23-5	-40℃ to +125℃	SGM830AXN5G/TR	1WL XXXXX	Tape and Reel, 3000
	SOT-23-5 (L-Type)	-40℃ to +125℃	SGM830AXN5LG/TR	1WP XXXXX	Tape and Reel, 3000
SGM830B (Gain = 50V/V)	SOT-23-5	-40℃ to +125℃	SGM830BXN5G/TR	1WM XXXXX	Tape and Reel, 3000
	SOT-23-5 (L-Type)	-40℃ to +125℃	SGM830BXN5LG/TR	1WQ XXXXX	Tape and Reel, 3000
SGM830C (Gain = 100V/V)	SOT-23-5	-40℃ to +125℃	SGM830CXN5G/TR	1L5 XXXXX	Tape and Reel, 3000
	SOT-23-5 (L-Type)	-40℃ to +125℃	SGM830CXN5LG/TR	1L4 XXXXX	Tape and Reel, 3000
SGM830D (Gain = 200V/V)	SOT-23-5	-40℃ to +125℃	SGM830DXN5G/TR	1WN XXXXX	Tape and Reel, 3000
	SOT-23-5 (L-Type)	-40℃ to +125℃	SGM830DXN5LG/TR	1WR XXXXX	Tape and Reel, 3000
SGM830E (Gain = 500V/V)	SOT-23-5	-40℃ to +125℃	SGM830EXN5G/TR	1WO XXXXX	Tape and Reel, 3000
	SOT-23-5 (L-Type)	-40℃ to +125℃	SGM830EXN5LG/TR	1WS XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

XXXXX

- Vendor Code
- Trace Code
- Date Code - Year

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_S .... -0.3V to 22V
Analog Inputs, V_{IN+}, V_{IN-}
Differential V_{IN+} - V_{IN-} .... -12V to 12V
Common-Mode .... -20V to 85V
Output .... GND - 0.3V to V_S + 0.3V
Package Thermal Resistance
SOT-23-5, θ_{JA} .... 152.1℃/W
SOT-23-5, θ_{JB} .... 41.3℃/W
SOT-23-5, θ_{JC} .... 86.4℃/W
Junction Temperature ....+150℃
Storage Temperature Range .... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ....+260℃
ESD Susceptibility [(1) (2)]
HBM .... ±6000V
CDM .... ±2000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Input Common-Mode Range, V_{CM} ...... -4V to 80V, 48V (TYP)
Operating Supply Range, V_S .... 2.7V to 18V, 5V (TYP)
Differential Sense Input Range, V_{SENSE} .... 0V to V_S/Gain
Operating Junction Temperature Range ...... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

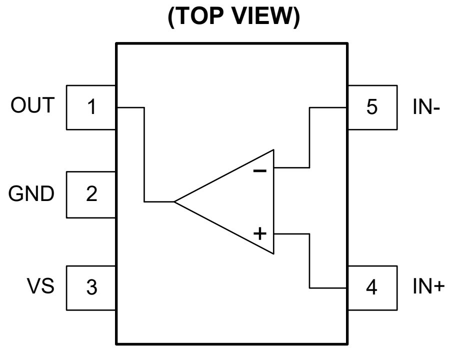
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

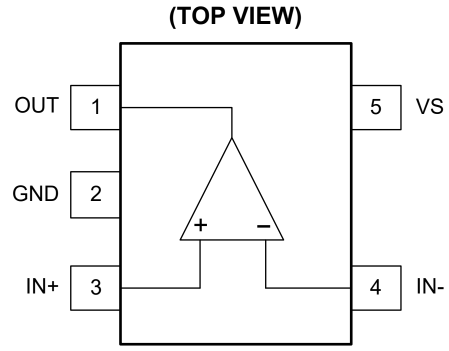
DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



SOT-23-5



SOT-23-5 (L-Type)

PIN DESCRIPTION

PIN		NAME	FUNCTION
SOT-23-5	SOT-23-5 (L-Type)		
1	1	OUT	Output Voltage.
2	2	GND	Ground.
3	5	VS	2.7V to 18V Power Supply.
4	3	IN+	Connect it to supply side of shunt resistor.
5	4	IN-	Connect it to load side of shunt resistor.

ELECTRICAL CHARACTERISTICS

(T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN+} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.)

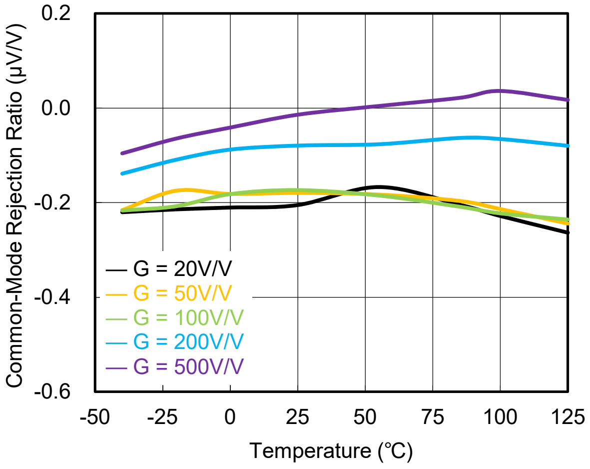
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Characteristics						
Input Common-Mode Range (1)	V_{CM}	T_A = -40℃ to +125℃	-4		80	V
Common-Mode Rejection Ratio, Input Referred	CMRR	V_{CM} = -4V to 80V, T_A = -40℃ to +125℃	118	130		dB
		f = 50kHz		70		
Offset Voltage, Input Referred (2)	V_{OS}	T_A = +25℃		±20	±170	μV
		T_A = -40℃ to +125℃, SGM830A			±500	
		T_A = -40℃ to +125℃, SGM830B/C/D			±300	
		T_A = -40℃ to +125℃, SGM830E			±400	
Input Bias Current	I_B	I_{B+}, I_{B-}, V_{SENSE} = 0V		25	100	nA
Output Characteristics						
Gain	G	SGM830A		20		V/V
		SGM830B		50		
		SGM830C		100		
		SGM830D		200		
		SGM830E		500		
Gain Error	G_{ERR}	GND + 200mV ≤ V_{OUT} ≤ V_S - 200mV, SGM830A/B/C/D		±0.02	±0.20	%
		GND + 200mV ≤ V_{OUT} ≤ V_S - 200mV, SGM830E		±0.02	±0.30	
		T_A = -40℃ to +125℃, SGM830A/B/C/D			±0.40	
		T_A = -40℃ to +125℃, SGM830E			±0.65	
Nonlinearity Error	NL_{ERR}			0.01		%
Maximum Capacitive Load		No sustained oscillations, no isolation resistor		500		pF
Output Voltage Swing to V_S (Power Supply Rail)		R_{LOAD} = 10kΩ, T_A = -40℃ to +125℃		V_S - 0.04	V_S - 0.1	V
Output Voltage Swing to Ground		R_{LOAD} = 10kΩ, V_{SENSE} = -10mV, T_A = -40℃ to +125℃		0.005	0.02	V
Dynamic Performance						
Bandwidth	BW	C_{LOAD} = 5pF, V_{SENSE} = 200mV, SGM830A		1000		kHz
		C_{LOAD} = 5pF, V_{SENSE} = 80mV, SGM830B		950		
		C_{LOAD} = 5pF, V_{SENSE} = 40mV, SGM830C		800		
		C_{LOAD} = 5pF, V_{SENSE} = 20mV, SGM830D		800		
		C_{LOAD} = 5pF, V_{SENSE} = 8mV, SGM830E		400		
Slew Rate	SR	Rising edge		5		V/μs
Settling Time		V_{OUT} = 4V ± 0.1V step, output settles to 0.5%		6		μs
		V_{OUT} = 4V ± 0.1V step, output settles to 5%		1		
Noise						
Input Voltage Noise Density	V_{EN}			250		nV/√Hz
Power Supply						
Supply Voltage	V_S	T_A = -40℃ to + 125℃	2.7		18	V
Quiescent Current	I_Q			1.2	1.8	mA
		T_A = -40℃ to + 125℃			2.0	
Power Supply Rejection Ratio, Input Referred	PSRR	V_S = 2.7V to 18V, T_A = -40℃ to +125℃		±3.0	±25	μV/V

NOTES:
1. Common-mode voltage at both V_{IN+} and V_{IN-} must not exceed the specified common-mode input range.
2. Calculate the offset voltage with the measured values of V_{OUT1} and V_{OUT2}: SGM830A/B: V_{OUT1} = 0.5V, V_{OUT2} = 1.5V; SGM830C/D/E: V_{OUT1} = 1V, V_{OUT2} = 3V.

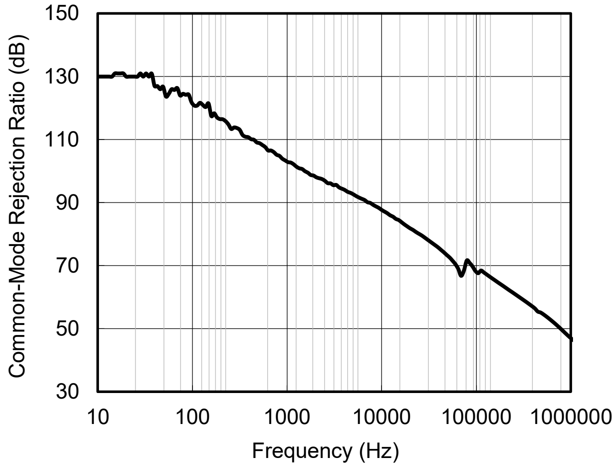
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN-} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.

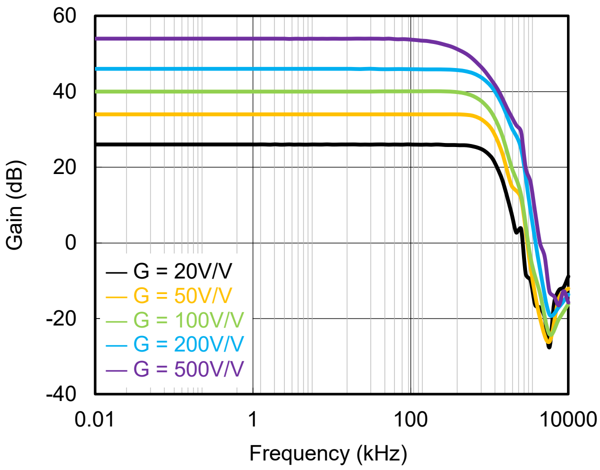
Common-Mode Rejection Ratio vs. Temperature



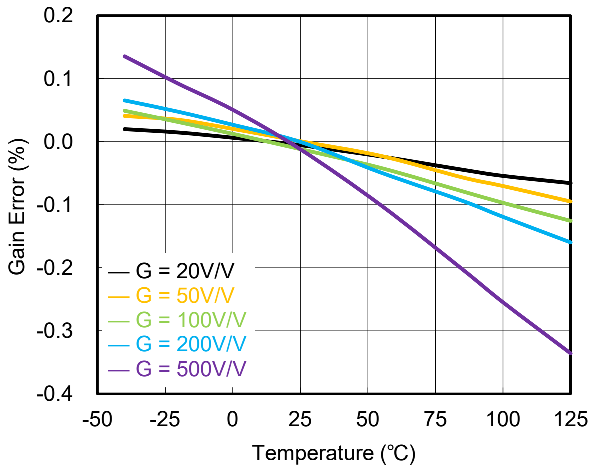
Common-Mode Rejection Ratio vs. Frequency



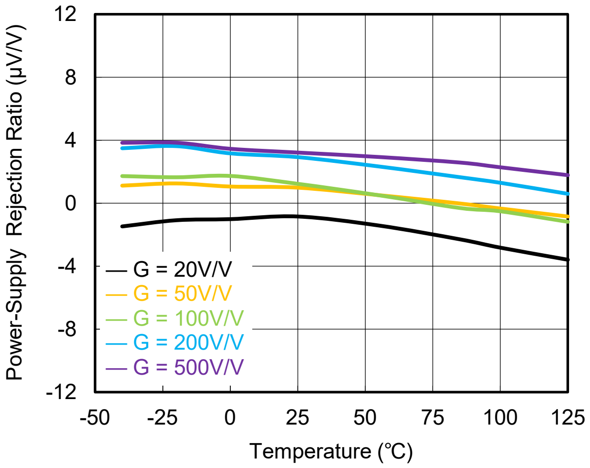
Gain vs. Frequency



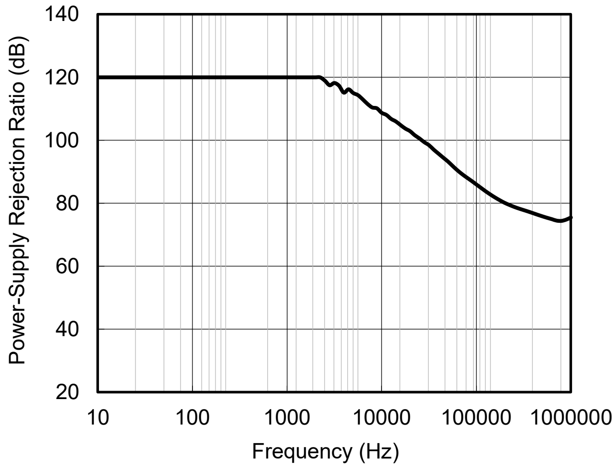
Gain Error vs. Temperature



Power-Supply Rejection Ratio vs. Temperature

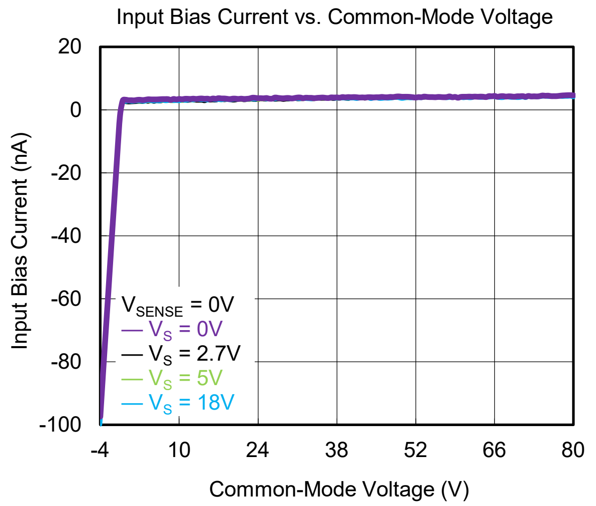


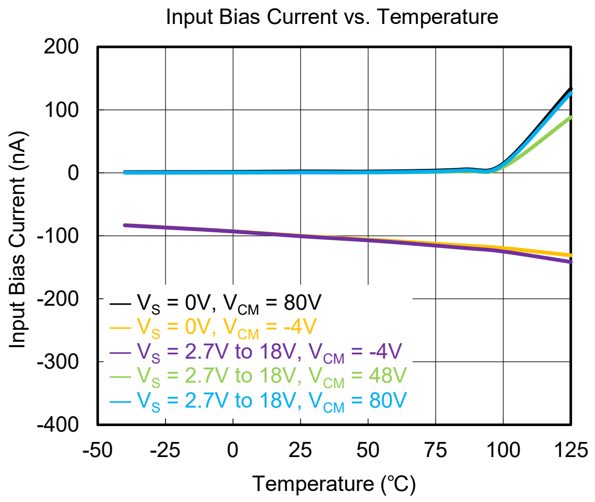
Power-Supply Rejection Ratio vs. Frequency

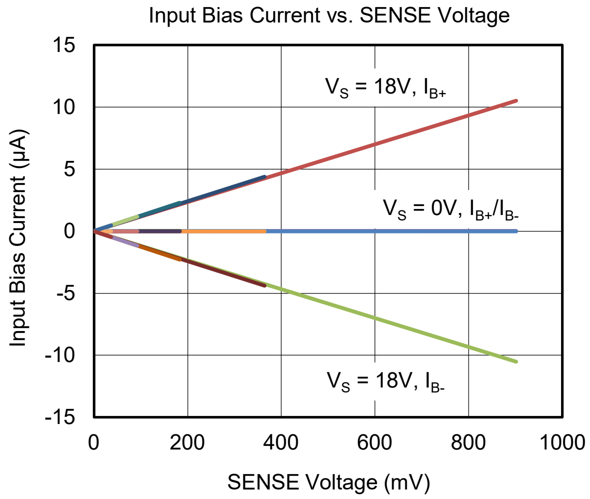


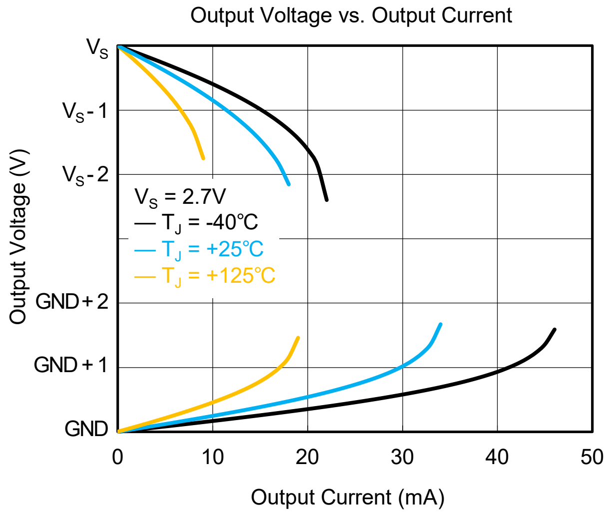
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

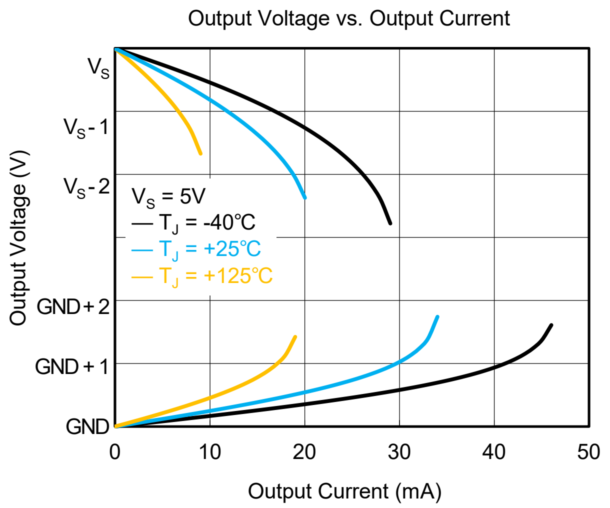
T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN-} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.

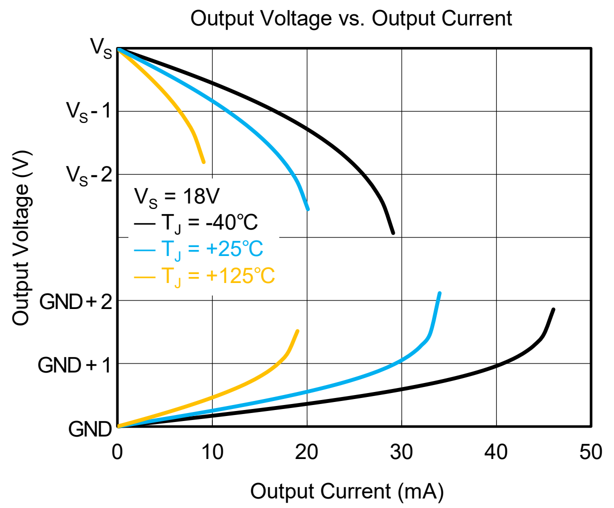






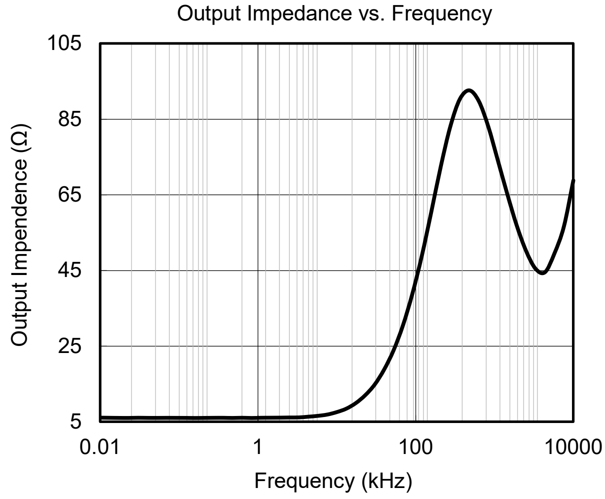


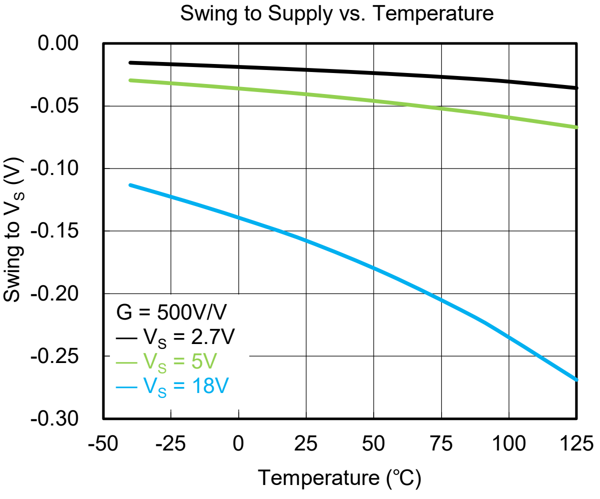


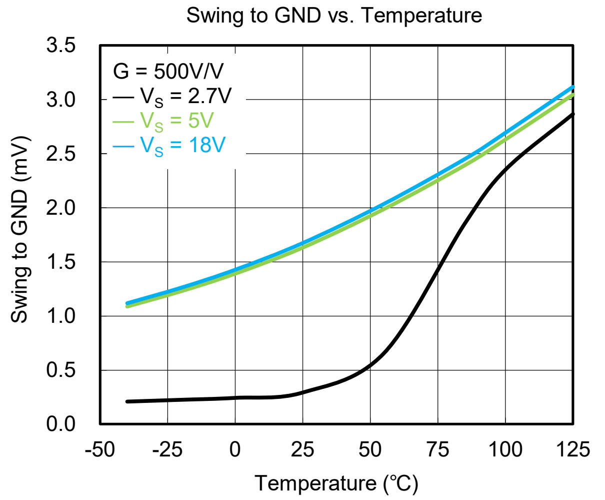


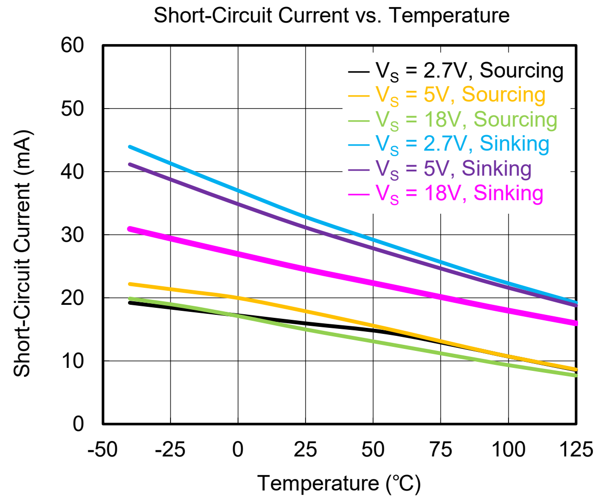
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

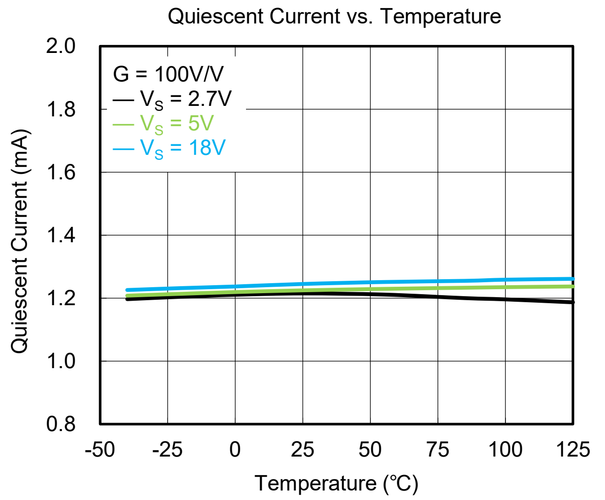
T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN-} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.

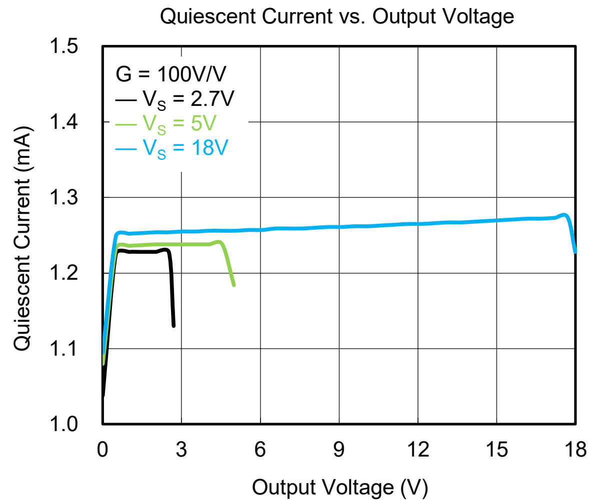








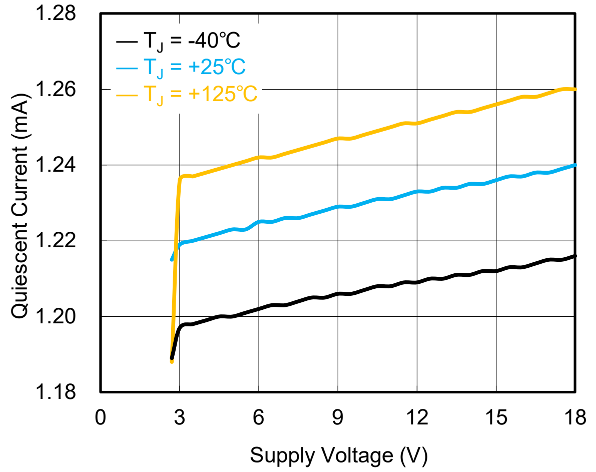




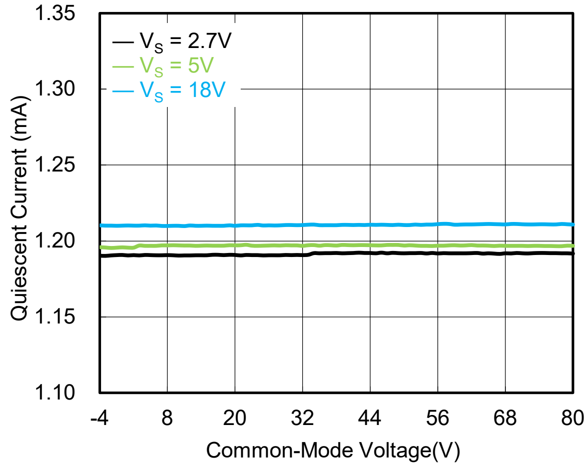
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN-} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.

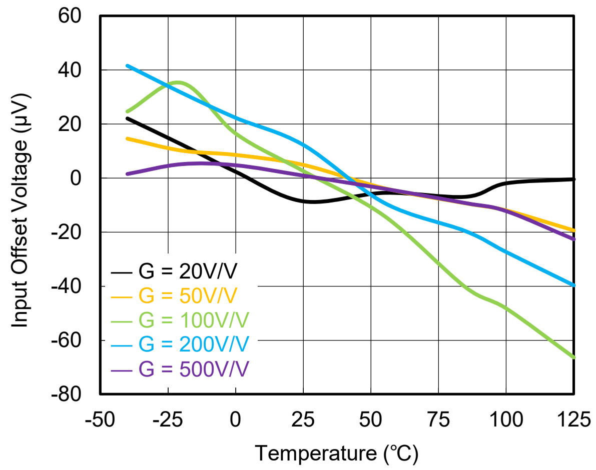
Quiescent Current vs. Supply Voltage



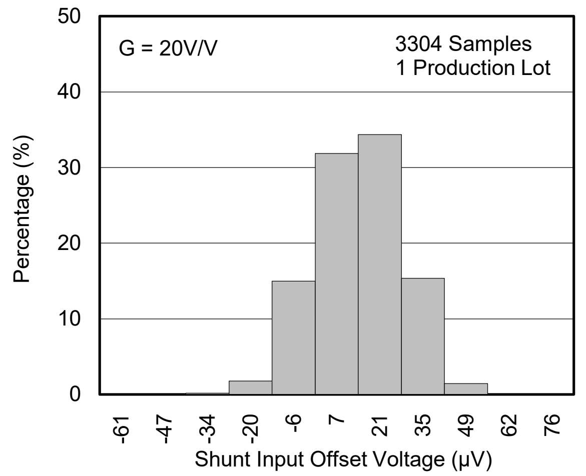
Quiescent Current vs. Common-Mode Voltage



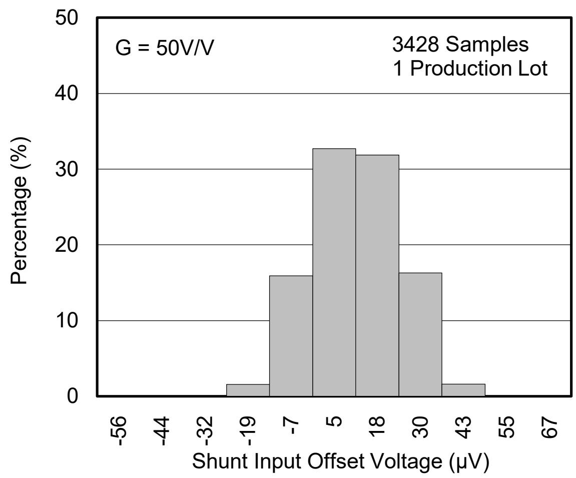
Input Offset Voltage vs. Temperature



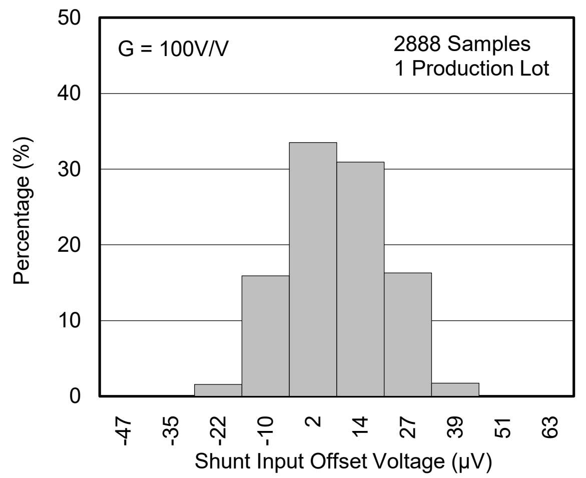
Input Offset Production Distribution



Input Offset Production Distribution



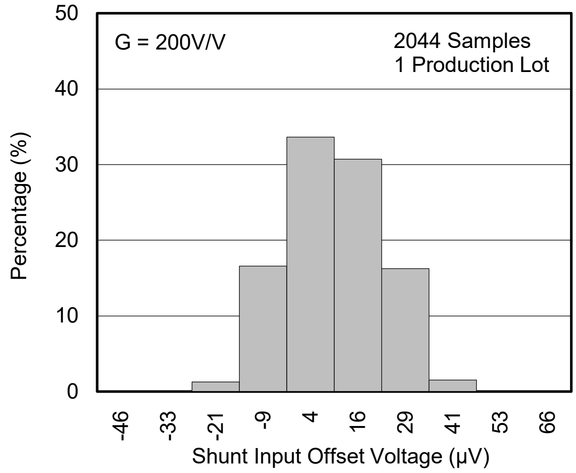
Input Offset Production Distribution



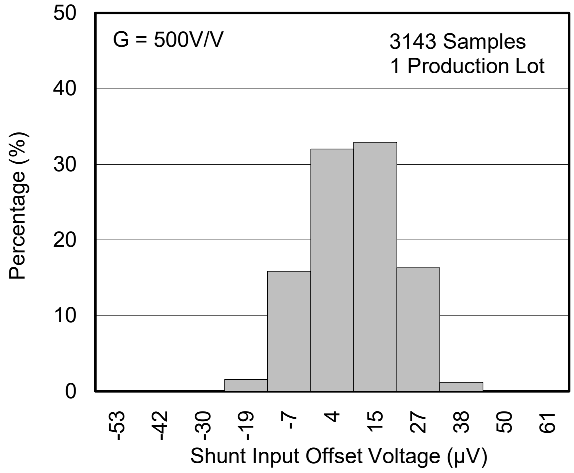
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN-} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.

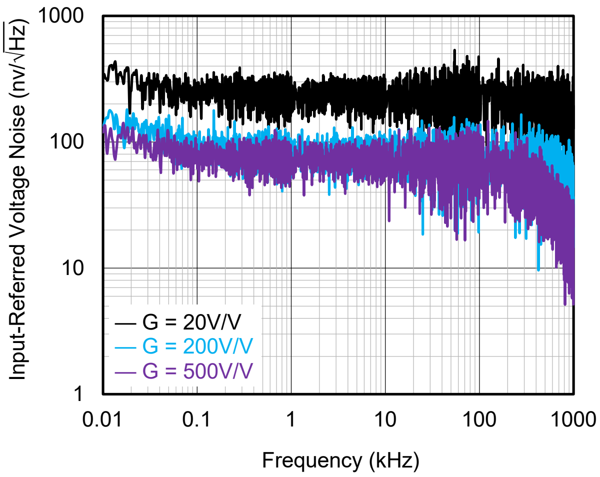
Input Offset Production Distribution



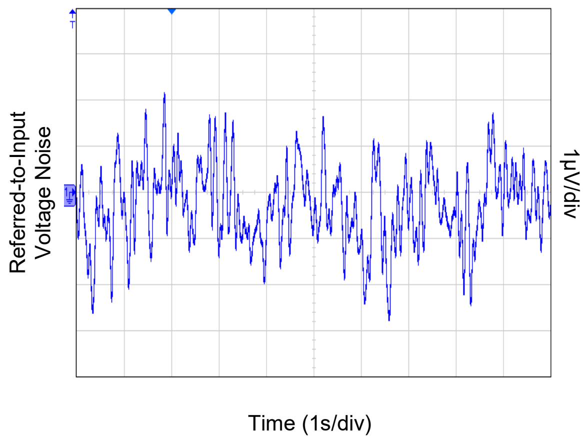
Input Offset Production Distribution



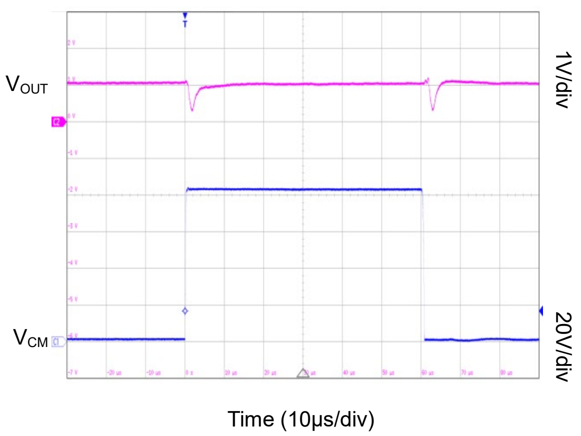
Input Referred Noise vs. Frequency



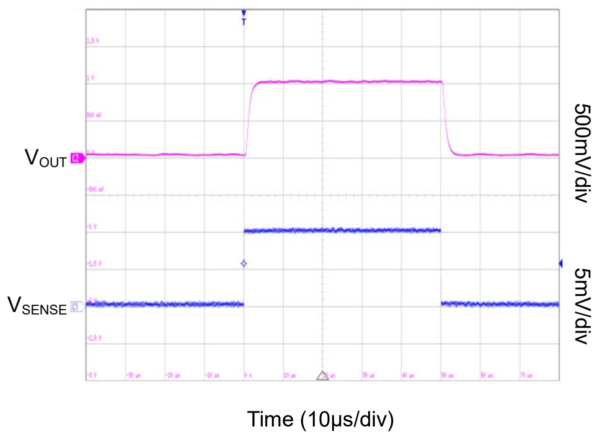
Input Referred Noise



Common-Mode Voltage Fast Transient Pulse



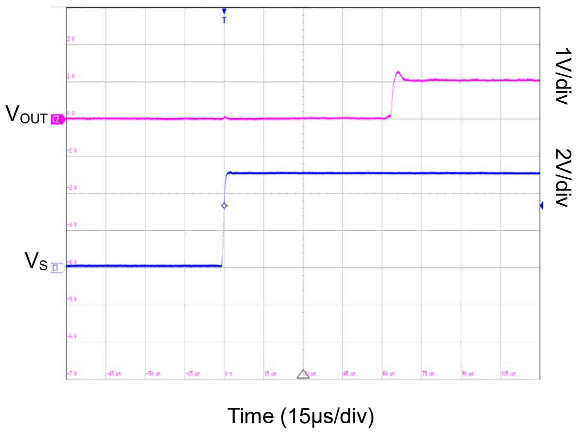
SGM830C Step Response



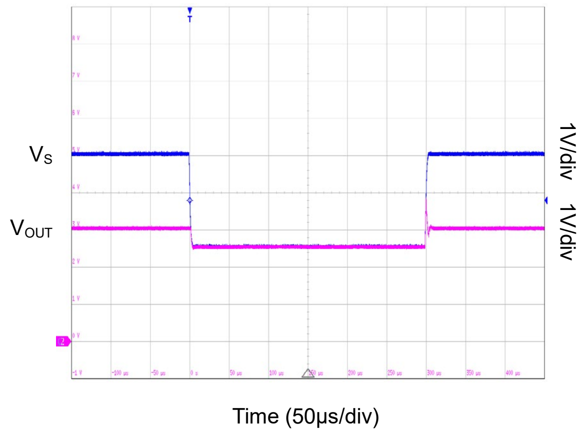
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_S = 5V, V_{SENSE} = V_{IN+} - V_{IN-} = 0.5V/Gain, V_{CM} = V_{IN-} = 48V, unless otherwise noted.

Startup Response



Supply Transient Response



FUNCTIONAL BLOCK DIAGRAM

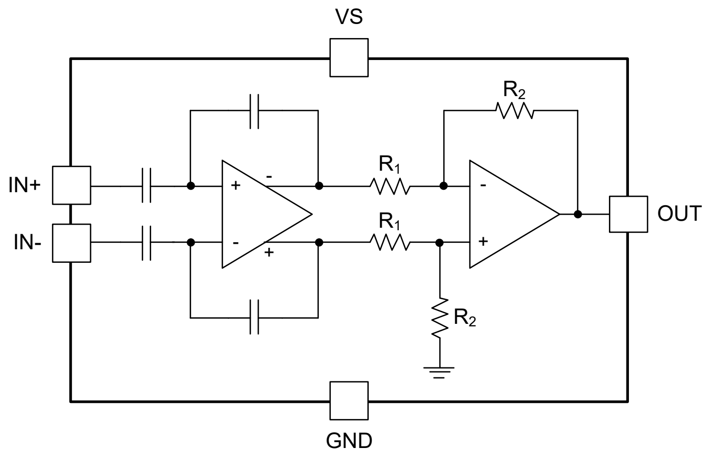


Figure 2. Functional Block Diagram

DETAILED DESCRIPTION

Overview

The SGM830 is a high-precision current-sense amplifier delivering an analog voltage output, combining wide common-mode range operation with zero-drift architecture for enhanced accuracy. Its superior common-mode rejection capability effectively mitigates output disturbances caused by rapid common-mode transients. The device employs a capacitive coupled chopper amplifier topology, achieving ultra-low bias currents down to 25nA (TYP) while supporting common-mode voltages up to 80V. Designers can select from multiple gain variants to optimize the full-scale output voltage range according to specific application current measurement requirements.

The SGM830 features an extensive supply voltage range of 2.7V to 18V, accommodating diverse system requirements. Its output stage delivers a broad output swing, with the SGM830A variant (20V/V gain) supporting up to 0.9V differential input at 18V supply.

High Precision Current Measurement

The SGM830 employs a zero-drift input architecture, delivering exceptional precision with low offset voltage (±170μV, MAX) and low offset drift across a wide temperature range from -40℃ to +125℃. The internal gain resistor has excellent temperature stability, ensuring that the gain error remains within ±0.4% of SGM830A/B/C/D and ±0.65% of SGM830E over the full operating temperature range. These characteristics enhance measurement accuracy, particularly for low current-sense voltages, and enable the use of smaller shunt resistors to minimize power loss.

Low Input Bias Current

The SGM830 features an ultra-low input bias current of just 25nA (TYP), even when operating at common-mode voltage up to 80V. This exceptionally low current draw enables highly accurate current measurements in applications demanding minimal leakage, ensuring precision sensing performance.

Large Input Common-Mode Voltages

The SGM830 uses a capacitive feedback amplifier on the input front end which makes the input common-mode voltage range no longer restricted by the power supply voltage (V_S). DC common-mode voltages are blocked from downstream circuits, resulting in very high common-mode rejection. The SGM830 can support wide common-mode voltages from -4V to 80V. This allows for the SGM830 to be used for both low-side and high-side current-sensing applications.

Multiple Fixed Gain Options

The SGM830 offers five fixed-gain options (20V/V, 50V/V, 100V/V, 200V/V, and 500V/V) to accommodate various system requirements. Designers should select the appropriate gain based on their target signal-to-noise ratio and application needs.

The device features a precision closed-loop architecture with gain determined by an internal resistor network. This network provides excellent ratio matching between resistors while allowing for wider absolute value tolerances. Due to these manufacturing variations, external resistance should not be used to modify the effective gain. Refer to Table 1 for detailed specifications of the gain resistor values.

Table 1. Internal Gain Selection Resistor

Gain (V/V)	R_1 (kΩ)	R_2 (kΩ)
20	25	500
50	10	500
100	10	1000
200	5	1000
500	2	1000

Low V_{SENSE} Operation

The SGM830 delivers high-performance operation throughout its entire valid V_{SENSE} range. Its zero-drift input architecture ensures minimal offset voltage and drift, enabling precise measurement of low V_{SENSE} levels across the extended temperature range of -40°C to +125°C. This capability proves especially advantageous when employing low-resistance shunts for current sensing applications, as it substantially reduces power dissipation across the shunt resistor.

The amplifier maintains excellent accuracy even at minimal input voltages, making it ideal for precision current monitoring in power-sensitive designs. The combination of low offset characteristics and wide temperature operation ensure reliable performance in demanding environments.

DETAILED DESCRIPTION (continued)

Input-Signal Bandwidth

The SGM830 features a gain-dependent -3dB bandwidth, offering selectable gain options of 20V/V, 50V/V, 100V/V, 200V/V, and 500V/V. Its multistage architecture delivers high bandwidth across all gain settings, ensuring fast response times essential for over-current detection and protection.

Bandwidth performance is influenced by the applied V_{SENSE} voltage, as illustrated in Figure 3. The plot depicts the frequency response versus output voltage for each gain configuration. Higher V_{SENSE} voltages and lower gain settings yield increased bandwidth.

System designers must assess error tolerance for high-frequency current sensing applications based on specific requirements. Final performance validation should be conducted within the target application to confirm compliance with system specifications.

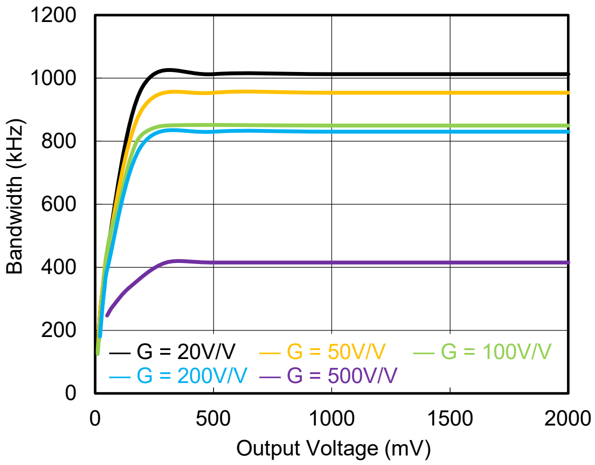


Figure 3. Bandwidth vs. Output Voltage

Unidirectional Operation

The SGM830 accurately monitors the voltage drop across a current-shunt resistor, enabling precise current measurement in power delivery systems. This device operates exclusively in unidirectional mode, designed specifically for monitoring current flow from power supply to system load (see Figure 4).

The output stage maintains linear operation within defined boundaries, particularly near ground potential. With a maximum zero-current output voltage of GND + 200mV, proper operation requires maintaining a minimum differential input voltage of (200mV/Gain) to ensure the output remains within its linear range. This characteristic preserves measurement accuracy, especially when detecting low current levels.

The unidirectional architecture optimizes performance for typical power distribution scenarios where current flows in a single direction, while the tight output swing specification enhances measurement resolution near ground potential. Designers should verify the input signal exceeds the minimum threshold to guarantee linear amplifier response.

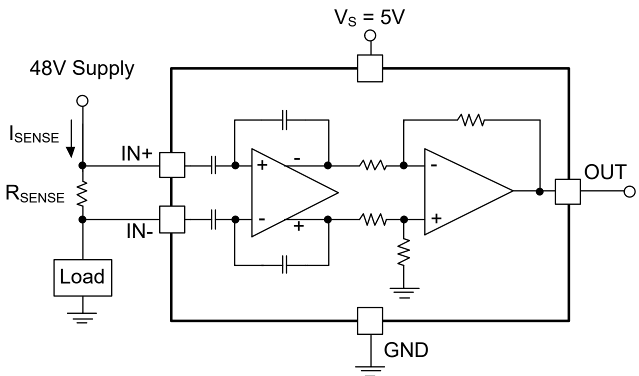


Figure 4. Unidirectional Application

APPLICATION INFORMATION

The SGM830 amplifies the voltage differential generated across a current-sensing resistor during load current flow. With its wide input common-mode voltage range and excellent common-mode rejection ratio (CMRR), the device maintains precise current measurement accuracy across a broad spectrum of supply voltages.

R_{SENSE} and Device Gain Selection

The proper resistance value selection is very critical to the current sensing system. Choose R_{SENSE} based on these criteria: the measured current range, the available gain device, the input range of the backend receiving circuit, and the measurement accuracy.

Within the range of the backend receiving circuit, the resistance of current-sensing resistor should be as large as possible. A larger current-sensing resistance develops a higher sensed voltage across the resistor. The higher the sensed voltage decreases, the smaller the error proportion caused by the input offset of the measured signal, and the higher the accuracy. However, higher resistance also leads to more power dissipation additionally, which makes the resistance drift and affects the precision of any measurement system due to the temperature coefficient. To limit the power loss, it is preferred to minimize the shunt resistance.

Still, the resistance of current-sensing resistor should not be too small. A smaller current-sensing resistance needs a higher amplifier gain to achieve the full-scale output voltage. A higher-gain amplifier has more error proportion caused by the input offset and noise, making it less suitable for precision designs.

Therefore, for the best performance, the selected current-sensing resistor should provide approximately the maximum input differential sense voltage with full-scale output voltage, while having lower power dissipation and higher accuracy. Note that the tolerance and temperature coefficient of the chosen resistors directly affect the precision of any measurement system.

Packaging of the current-sensing resistor is also an important aspect to consider. Small package size is good for space savings and improved integration, but may have poor thermal performance. Larger package size has better heat dissipation, but can be costly.

Therefore, the choice of current-sensing resistor is based on the trade-off between measurement accuracy, power consumption and cost. Generally, sense resistors of 5mΩ to 100mΩ are available with 1% accuracy or better.

The SGM830 provides 20V/V, 50V/V, 100V/V, 200V/V, 500V/V gain as available options for use. Table 2 gives the different results from optional gains. The higher gain allows a smaller current-sensing resistor resistance and achieves lower power dissipation.

Input Filtering

When measuring current in noisy environments, filters are required for accurate measurements. The SGM830 features low input bias current that makes it possible to add a filter at the input end without sacrificing the current-sense accuracy. The filter at the input position can attenuate differential noise before the input signal is amplified. Figure 5 shows the filter at the input pins.

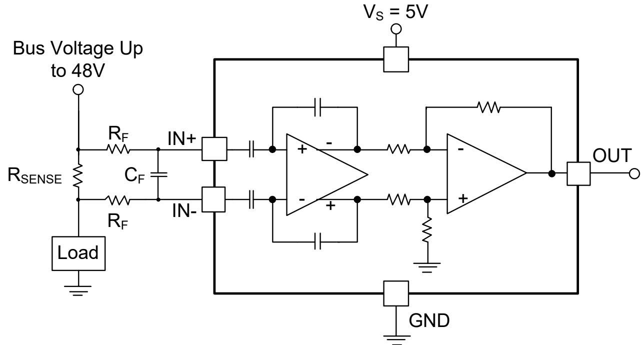


Figure 5. Filter at Input Pins

Table 2. R_{SENSE} Selection and Power Dissipation (1)

Parameter	Symbol	Equation	Results at V_S = 5V				
			A	B	C	D	E
Gain	G		20V/V	50V/V	100V/V	200V/V	500V/V
Ideal Differential Input Voltage	V_{DIFF}	$V_{DIFF} = V_{OUT}/G$	250mV	100mV	50mV	25mV	10mV
Current Sense Resistor Value	R_{SENSE}	$R_{SENSE} = V_{DIFF}/I_{MAX}$	25mΩ	10mΩ	5mΩ	2.5mΩ	1mΩ
Current-Sense Resistor Power Dissipation	P_{SENSE}	$R_{SENSE} \times I_{MAX}^2$	2.5W	1W	0.5W	0.25W	0.1W

NOTE: 1. Design example with 10A full-scale current with maximum output voltage set to 5V.

APPLICATION INFORMATION (continued)

The series resistance of filter results in additional gain error. The gain error introduced can be calculated by the Equation 1.

$$\text{Gain Error}(\%) = \left(1 - \frac{R_{DIFF}}{R_{SENSE} + 2 \times R_F + R_{DIFF}}\right) \times 100 \quad (1)$$

where:

R_{DIFF} is the differential input impedance about 85kΩ.

R_F is the added value of the series filter resistance.

The high input impedance and low bias current of the SGM830 make the design of input filters easy and flexible without impacting the accuracy of current measurement. External series resistance adds to the measurement error, so limit the value of these series resistors to 22Ω or less. For example, set R_F = 22Ω and C_F = 2.2nF to achieve a low-pass filter corner frequency of 1.64MHz without severely impacting the current-sensing bandwidth or precision. Table 3 illustrates the gain error introduced by R_F where R_{SENSE} has been neglected.

Table 3. Gain Error Factor Introduced by the External Filter Input Resistors

External Filter Resistance R_F (Ω)	Gain Error (%)
4.7	0.011
10	0.024
22	0.052

Typical Application

The SGM830 is a unidirectional current-sense amplifier designed to monitor current flow across a shunt resistor. It supports a wide common-mode voltage range of -4V to 80V on the shunt, enabling accurate current measurements in various applications. The device maintains proper functionality across this broad voltage range while precisely amplifying the small differential voltage developed across the sense resistor.

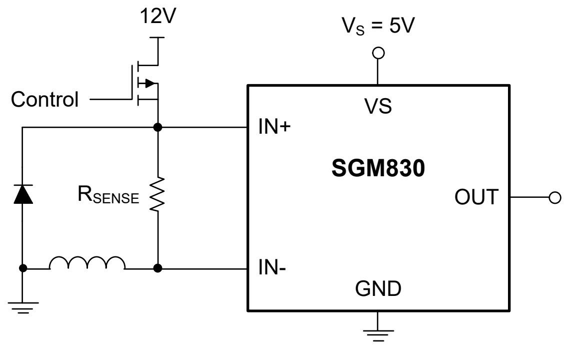


Figure 6. Current Sensing in a Solenoid Application

Design Requirements

For this application example, the common-mode voltage operates within a 0V to 24V range. The SGM830 is powered by a 5V supply, with a maximum sense current capability of 1.5A. Following the recommended design methodology for R_{SENSE} and gain selection, a 50mΩ sense resistor and 50V/V gain are chosen to optimize the output dynamic range. The corresponding design configuration is detailed in Table 4.

Table 4. Design Parameters

Design Parameters	Example Value
Power Supply Voltage	5V
Common-Mode Voltage Range	0V to 24V
Maximum Sense Current	1.5A
R_{SENSE} Resistor	50mΩ
Gain Option	50V/V

Power Supply Recommendations

The SGM830 series delivers accurate current measurement across an extended common-mode voltage range of -4V to 80V, maintaining this capability regardless of the supply voltage. Notably, the device's input stage operates independently from its supply rail. For example, when powered by a 5V supply, it can still accurately process signals at both -4V and 80V common-mode levels. However, the output voltage range remains constrained by the applied power supply voltage, with the maximum output swing limited to the rail-to-rail boundaries of V_S.

LAYOUT

Layout Guidelines

For optimal performance, the SGM830 requires Kelvin (4-wire) connections between its input pins and the current-sensing resistor to eliminate parasitic impedance effects, ensuring accurate measurement of only the shunt resistor's true impedance. Proper connection techniques are illustrated in Figure 7, which demonstrates both recommended and suboptimal configurations. Additionally, a 0.1μF decoupling capacitor must be placed in close proximity to the VS and GND pins to ensure stable power supply filtering, with minimal trace length being critical for effective high-frequency noise suppression and proper device operation. These layout practices maintain signal integrity while minimizing measurement errors caused by stray impedance or supply fluctuations.

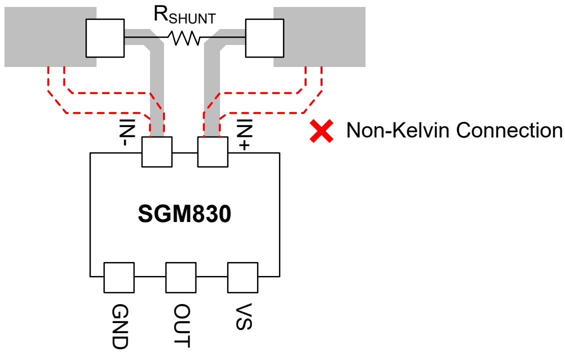


Figure 7. Shunt Connections to the SGM830

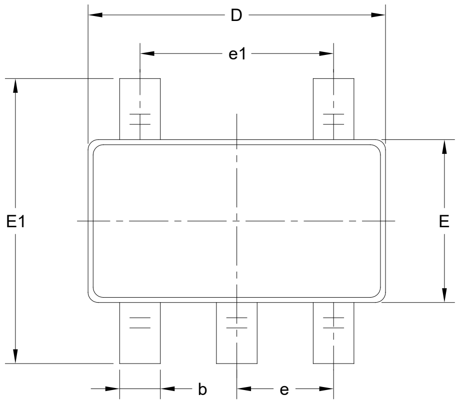
REVISION HISTORY

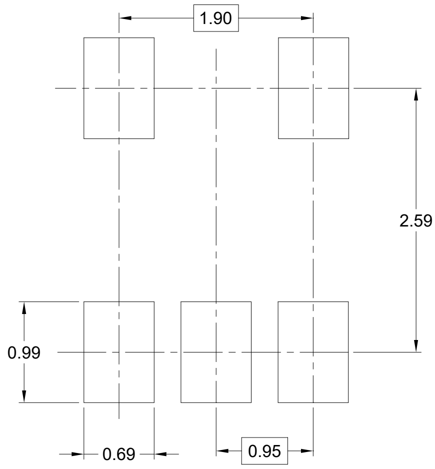
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original to REV.A (AUGUST 2025)	Page
Changed from product preview to production data	All

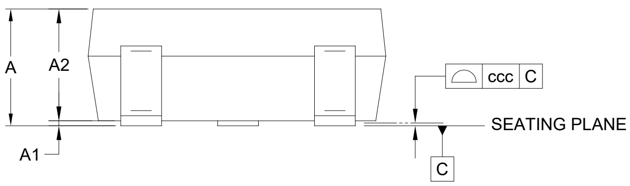
PACKAGE OUTLINE DIMENSIONS

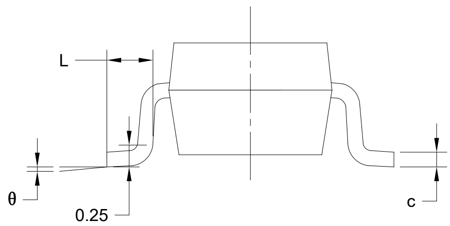
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



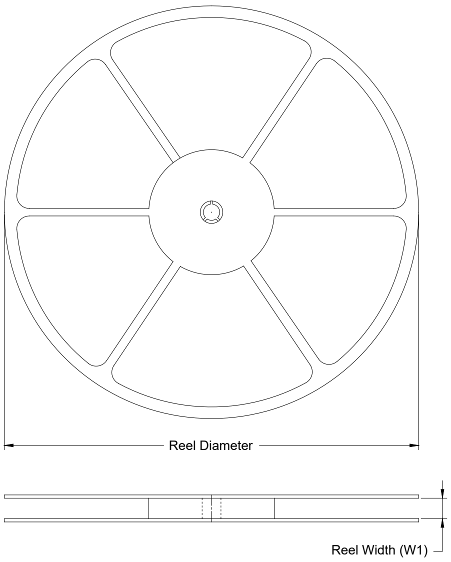


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

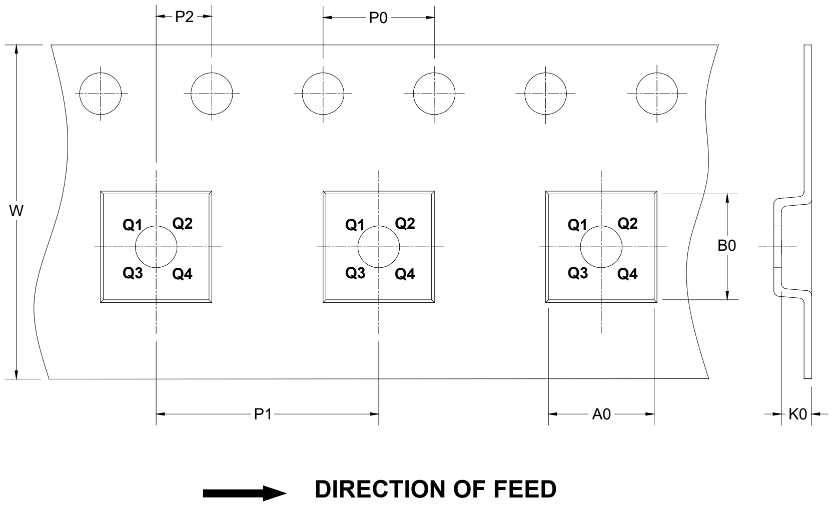
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



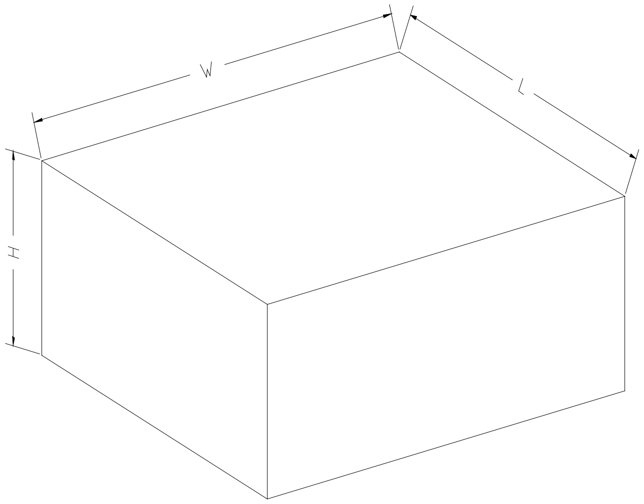
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

DD0001

CARTON BOX DIMENSIONS



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

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002