# High Precision Current sensor with Common Mode Magnetic Field suppression Up to 3000V Isolation

## 1. Features

- Differential Hall sensing rejects common-mode fields and nearly zero magnetic hysteresis
- Industry-leading noise performance with greatly improved bandwidth for fast control loops or where high-speed current monitored: 400 KHZ bandwidth and 1.2us response time
- Two versions respectively support 3.3V & 5V applications
- Supports proportional and fixed output modes, and the fixed mode is convenient for customers to ADC differential sample Vref and Vout voltage to reduce external common-mode interference
- Supports bidirectional and unidirectional output mode
- Support self-test and a variety of diagnostic functions: OVP, OTP, OCD, broken wire, etc
- High accuracy
  -Sensitivity error: ±2.5% from -40°C to 125°C
  -Non-linearity: ±1% Max
  -Symmetry: ±1% Max
- Adjustable fast overcurrent fault output with 1uS typical response time
- Package: SOP8

## 2. Applications

- Solar inverter
- Industrial power
- Motor driver
- OBC/DCDC/PTC Heater

## 3. Description

The SC4671 current sensor is a cost-effective isolated current sensing solution in the industrial and automotive applications. The device consists of a precise, low-offset, linear Hall sensor circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which is sensed by the integrated Hall IC and converted into a proportional voltage. The current is sensed differentially in order to reject common-mode fields, improving accuracy in magnetically noisy environments. SOP8 is for 20A ~ 50A and size-limit applications.

The OCD interface provides a fast output signal in case a current exceeds the threshold set by VOC pin or pre-set in SOP8 part.

The package construction provides high isolation by magnetically coupling the field generated by the current in the conductor to the monolithic Hall sensor IC which has no physical connection to the integrated current conductor. The SOP8 package is optimized for lower noise with 3000 VRMS dielectric withstand voltage and 1.2mΩ conductor resistance.

Fig.1 Package Outline

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# 4. Terminal Configuration

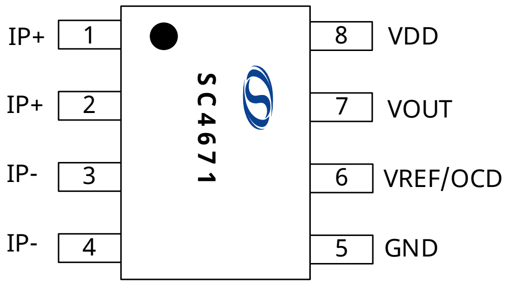



Fig. 2: Terminal Configuration

| No. | Name | Type | Description |
|---|---|---|---|
| 1、2 | IP+ | - | Current flows into the chip, positive direction |
| 3、4 | IP- | - | Current flows out of the chip, negative direction |
| 5 | GND | G | Ground |
| 6 | VREF/OCD | O | |
| 7 | VOUT | - | Analog output |
| 8 | VDD | - | Supply voltage |

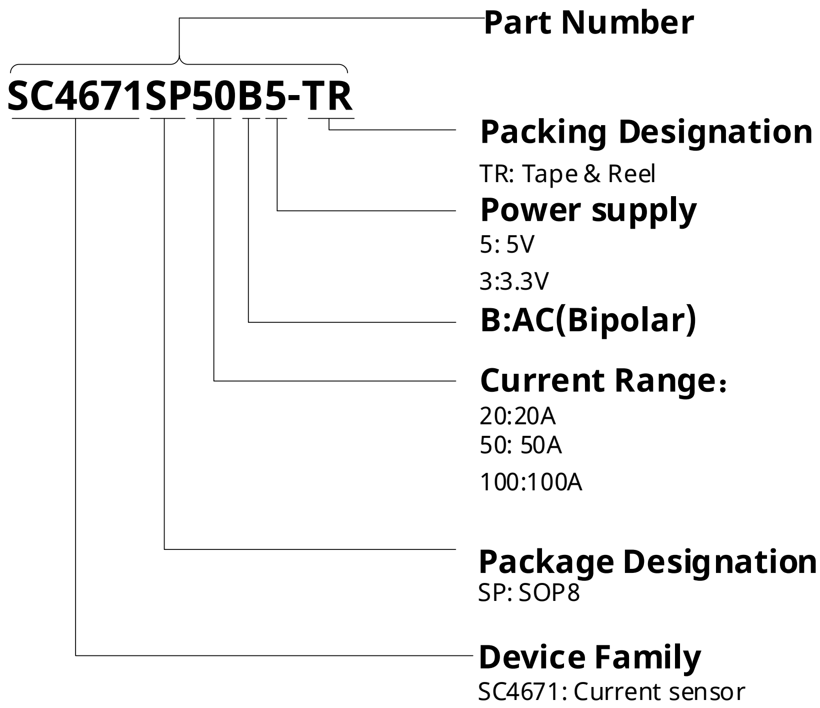
## 5. Ordering Information

| Part number | Primary Current(A) | Power Supply(V) | Sensitivity (mV/A) | Zero Current Output Voltage(V) | Package | Packing |
|---|---|---|---|---|---|---|
| SC4671SP20B5 | ±20 | 5 | 100 | 2.5 | SOP8 | 4000pcs/Reel |
| SC4671SP30B5 | ±30 | 5 | 66.7 | 2.5 | SOP8 | 4000pcs/Reel |
| SC4671SP50B5 | ±50 | 5 | 40 | 2.5 | SOP8 | 4000pcs/Reel |

*Note:*

*If you have 3.3V supply, unidirectional output or other application need, please contact Semiment engineer. The SC4671 supports multiple power supply and output modes.*

### Ordering Information Format:



# 6. Absolute Maximum Ratings

| Symbol | Parameter | Test Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{DD\_abs1}$ | Positive Supply Voltage (DC) | $V_{DD}$=0 to 10V | - | 6.5 | V |
| $V_{DDR\_abs}$ | Negative Supply Voltage | $V_{DD}$=0 to -1.0V | - | -0.2 | V |
| $V_{OUT\_abs}$ | Positive $V_{OUT}$ Voltage | $V_{OUT}$=0 to 10V | - | $V_{DD}$+0.2 | V |
| $V_{OUTR\_abs}$ | Negative $V_{OUT}$ Voltage | $V_{DD}$=0 to -1.0V | - | -0.3 | V |
| $T_A$ | Operating Temperature Range | | -40 | 125 | ℃ |
| $T_{STG}$ | Storage Temperature Range | | -55 | 165 | ℃ |
| $T_J$(max) | Maximum Junction Temperature | | - | 165 | ℃ |

*Note:*
*Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

# 7. ESD Protection

| Symbol | Parameter | Test conditions | Min. | Max. | Units |
|---|---|---|---|---|---|
| $V_{ESD\_HBM}$ | HBM | Refer to ANSI/ESDA/JEDEC JS-001 standard | -8 | +8 | kV |
| $V_{ESD\_CDM}$ | CDM | Refer to ANSI/ESDA/JEDEC JS-002 standard | -2 | +2 | V |

# 8. Isolation Characteristics

| Symbol | Parameter | Test Conditions | Typ | Unit |
|---|---|---|---|---|
| $V_{SURGE}$ | Dielectric Surge Strength Test Voltage | Tested ±5 pulses at 2/minute in compliance to IEC 61000-4-5 1.2μs (rise) / 50μs (width). | 6000 | V |
| $V_{ISO}$ | Dielectric Strength Test Voltage | Agency type-tested for 60 seconds per UL standard 60950-1 (edition 2); production-tested at VISO for 1 second, in accordance with UL 60950-1 (edition 2). | 3000 | VRMS |
| VWVBI | Working Voltage for Basic Isolation | Maximum approved working voltage for basic (single) isolation according to UL 60950-1 (edition 2) | 600 | Vpk or VDC |
| | | | 424 | VRMS |
| DCL | Clearance | Minimum distance through air from IP leads to signal leads. | 4.2 | mm |
| DCR | Creepage | Minimum distance along package body from IP leads to signal leads. | 4.2 | mm |
| CTI | Comparative Tracking Index | Material Group II | >=600 | V |

# 9.Specifications

## 9.1 General Electrical Specification

*Valid through full operating temperature range, $T_A$ = – 40°C to 125°C, $C_{BYPASS}$ = 0.1μF, and $V_{DD}$= 5 V, unless otherwise specified.*

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{DD}$ | Supply Voltage | 5V device only | 4.5 | 5 | 5.5 | V |
| $I_{DD}$ | Supply Current | No load on $V_{OUT}$ or $V_{REF}$; $V_{DD}$ = 5 V | - | 9 | - | mA |
| $C_{BYPASS}$ | Supply Bypass Capacitor | $V_{DD}$ to GND recommended | 0.1 | - | - | μF |
| $R_{VREF}$ | Reference Resistive Load | $V_{REF}$ to GND, $V_{REF}$ to $V_{DD}$ | 1 | - | - | KΩ |
| $C_{VREF}$ | Reference Capacitive Load | $V_{REF}$ to GND | - | - | 6 | nF |
| $T_{PO}$ | Power-On Delay | $V_{DD}$=0V to 5V, Time from $V_{DD}$=90% to $V_{OUT}$=90% | - | 77 | - | us |
| $V_{POR(H)}$ | Power-On Reset Voltage | $V_{DD}$=0V to 5.5V | - | 2.9 | - | V |
| $V_{POR(L)}$ | | $V_{DD}$=5.5V to 0V | - | 2.6 | - | V |
| $U_{VLOH}$ | Under-voltage Protection | $V_{DD}$=0V to 5.5V | - | 4.1 | 4.3 | V |
| $U_{VLOL}$ | | $V_{DD}$=5V to 0V | - | 3.25 | - | V |
| $V_{OVPH}$ | Overvoltage Protection (OVP) Threshold | $V_{DD}$ rising | - | 6.4 | - | V |
| $V_{OVPH}$ | | $V_{DD}$ rising | - | 5.9 | - | V |
| $Td_{OVD(E)}$ | OVP Delay Time | Time from $V_{DD}$ rising ≥ $V_{OVP(EN)}$ until OVP asserts | - | 54 | - | us |
| $Td_{OVD(D)}$ | | Time from $V_{DD}$ falling ≤ $V_{OVP(DIS)}$ until OVP clears | - | 7.6 | - | us |
| $I_{OUT}$ | $V_{OUT}$ Load Current | $V_{DD}$ =4.5V--5.5V, $V_{OU}$T=0.5V--4.5V, $I_{load}$=-10--10mA | - | 9 | - | mA |
| $R_{OUT}$ | $V_{OUT}$ Output Resistance | $V_{OUT}$=VQ, $I_{load}$=5mA | - | 11 | - | Ω |
| $I_{LEAK}$ | Output Leakage Current | High Impedance Mode | - | 6 | 20 | uA |
| $R_{Load\ L}$ | Output Load Resistance | $V_{OUT}$ to GND, RL=10k to 1k, B=+BMAX | 1 | - | - | kΩ |
| $R_{Load\ H}$ | | $V_{OUT}$ to $V_{DD}$, RL=10k to 1k, B=-BMAX | 1 | - | - | kΩ |
| Clamp _lo | Clamped Output Voltage (EE_Clamp level=1) | B=-BMAX, RL=5k to $V_{DD}$ EE_CL=enable | - | 5 | - | %$V_{DD}$ |
| Clamp _hi | | B=+BMAX, RL=5k to GND EE_CL=enable | - | 95 | - | %$V_{DD}$ |
| Clamp _lo | | B=-BMAX, RL=5k to $V_{DD}$ EE_CL=enable | - | 7.5 | - | %$V_{DD}$ |
| Clamp _hi | | B=+BMAX, RL=5k to GND EE_CL=enable | - | 92.5 | - | %$V_{DD}$ |
| CLACC | Clamped Output Accuracy | B=+BMAX, RL=5k to GND EECL=enable | - | - | 1 | %$V_{DD}$ |
| $V_{OOR}$ | Output Operating Range | 5V linear operating range | 0.5 | | 4.5 | V |
| Fc | Chopping Frequency | | - | 2 | - | MHz |
| $T_{rr}$ | Refresh rate | Guaranteed by design | 0.8 | 1 | 2 | us |

## 9.2 Electrical Characteristics ($V_{OCD}$ & $V_{REF}$)

*Valid through full operating temperature range, $T_A$ = – 40°C to 125°C, $C_{BYPASS}$ = 0.1 Mf, and $V_{DD}$ = 5 V, unless otherwise specified.*

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{SAT(H)}$ | Saturation voltage | RL = 10kΩ to GND | $V_{DD}$-0.25 | - | - | V |
| $V_{SAT(L)}$ | | RL = 10kΩ to $V_{DD}$ | - | - | 0.15 | V |
| $V_{OOR}$ | Output Range | 5V linear operation range | 0.5 | - | 4.5 | V |
| $I_{OUT}$ | Output Drive | | 5 | - | - | mA |
| $t_r$ | Rise Time | $T_A$ = 25°C, CL = 1nF | - | 3 | - | us |
| $t_{pd}$ | Propagation Delay | $T_A$ = 25°C, CL = 1nF | - | 2 | - | us |
| $t_{RESPONSE}$ | Response Time | $T_A$ = 25°C, CL = 1nF | - | 3.6 | - | us |
| f | Frequency Bandwidth | Small signal –3 dB; CL = 1nF | - | - | 400 | kHZ |
| IND | Noise Density | Input-referenced noise density; $T_A$ = 25°C, CL = 6nF; $V_{DD}$ = 5V @ SOP8 | - | 120 | - | μA/√Hz |
| $E_{LIN}$ | Nonlinearity | Over full range of Ip | -1 | - | 1 | % |
| $E_{SYM}$ | Symmetry | Over full range of Ip | -1 | - | 1 | % |
| PSRR | Power supply rejection ratio | TA = 25°C, DC to 1 kHz, 100 mV pk-pk ripple around $V_{DD}$ = $V_{DD\ (typ)}$, Ip = 0 A | - | -50 | - | dB |
| CMFR | Common-mode magnetic field rejection ratio | | - | 40 | - | dB |

# 10.Performance Characteristics

Valid through full operating temperature range, $T_A$ = – 40°C to 125°C, $C_{BYPASS}$ = 0.1μF, and $V_{DD}$ = 5V respectively for different version, unless otherwise specified

## 10.1 SC4671SP20B5 PERFORMANCE CHARACTERISTICS

| SC4671SP20B5 PERFORMANCE CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| $I_P$ | Optimized Accuracy Range | | -20 | - | 20 | A |
| Sens | Sensitivity | Over full range of IP, $T_A$ = 25°C | | 100 | | mV/A |
| $V_{OUT(Q)}$ | Zero Current Output Voltage | Bidirectional, IP = 0A, $T_A$ = 25°C | | 2.5 | | V |
| VRE | Reference Voltage Error | $V_{REF\ actual}$ – $V_{REF\ ideal}$, $T_A$ = –40°C to 125°C | -10 | - | 10 | mV |
| VOE | Offset Error | $V_{IOUT(Q)}$-$V_{REF}$, $T_A$ = –40°C to 125°C, Ip=0A | -15 | - | 15 | mV |
| $E_{SENS}$ | Sensitivity Error | IP =IPR (max), $T_A$ = 25°C to 125°C | -2.5 | - | 2.5 | % |
| | | IP =IPR (max), TA = -40°C to 25°C | -2.5 | - | 2.5 | % |
| $E_{TOTAL}$ | Total output error | IP =IPR (max), TA = 25°C to 125°C | -3.5 | | 3.5 | % |
| | | IP =IPR (max), TA = -40°C to 25°C | -3.5 | | 3.5 | % |

## 10.2 SC4671SP30B5 PERFORMANCE CHARACTERISTICS

| SC4671SP30B5 PERFORMANCE CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| $I_P$ | Optimized Accuracy Range | | -30 | - | 30 | A |
| Sens | Sensitivity | Over full range of IP, $T_A$ = 25°C | | 66.7 | | mV/A |
| $V_{OUT(Q)}$ | Zero Current Output Voltage | Bidirectional, IP = 0A, $T_A$ = 25°C | | 2.5 | | V |
| VRE | Reference Voltage Error | $V_{REF\ actual}$ – $V_{REF\ ideal}$, $T_A$ = –40°C to 125°C | -10 | - | 10 | mV |
| VOE | Offset Error | $V_{IOUT(Q)}$-$V_{REF}$, $T_A$ = –40°C to 125°C, Ip=0A | -15 | - | 15 | mV |
| $E_{TOT}$ | Sensitivity Error | IP =IPR (max), $T_A$ = 25°C to 125°C | -2.5 | - | 2.5 | % |
| | | IP =IPR (max), $T_A$ = -40°C to 25°C | -2.5 | - | 2.5 | % |
| $E_{TOTAL}$ | Total output error | IP =IPR (max), $T_A$ = 25°C to 125°C | -3.5 | - | 3.5 | % |
| | | IP =IPR (max), $T_A$ = -40°C to 25°C | -3.5 | - | 3.5 | % |

## 10.3 SC4671SP50B5 PERFORMANCE CHARACTERISTICS

| SC4671SP50B5 PERFORMANCE CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| $I_P$ | Optimized Accuracy Range | | -50 | - | 50 | A |
| Sens | Sensitivity | Over full range of IP, $T_A$ = 25°C | | 40 | | mV/A |
| $V_{OUT(Q)}$ | Zero Current Output Voltage | Bidirectional, IP = 0A, $T_A$ = 25°C | | 2.5 | | V |
| $V_{RE}$ | Reference Voltage Error | $V_{REF\ actual}$ − $V_{REF\ ideal,}$ $T_A$ = −40°C to 125°C | -10 | - | 10 | mV |
| $V_{OE}$ | Offset Error | $V_{OUT(Q)}$-$V_{REF}$, $T_A$ = −40°C to 125°C, Ip=0A | -15 | - | 15 | mV |
| $E_{TOT}$ | Sensitivity Error | IP =IPR (max), $T_A$ = 25°C to 125°C | -2.5 | - | 2.5 | % |
| | | IP =IPR (max), $T_A$ = -40°C to 25°C | -2.5 | - | 2.5 | % |
| $E_{TOTAL}$ | Total output error | IP =IPR (max), $T_A$ = 25°C to 125°C | -3.5 | - | 3.5 | % |
| | | IP =IPR (max), $T_A$ = -40°C to 25°C | -3.5 | - | 3.5 | % |

# 11. Functional Description

## 11.1 Overview

The SC4671 series current sensors can accurately measure the AC/DC current while minimizing the overall measurement cost. The current sensor based on the Hall principle can be widely used in all current monitoring scenarios of consumer, industrial and automotive applications. Comparing with current transformers, SC4671 series could help customers to reduce PCB size with its extreme compact size. Comparing with the solution of shunt resistor + isolated amplifier, SC4671 series only need low side power supply, eliminating the complexity of high side power supply design.

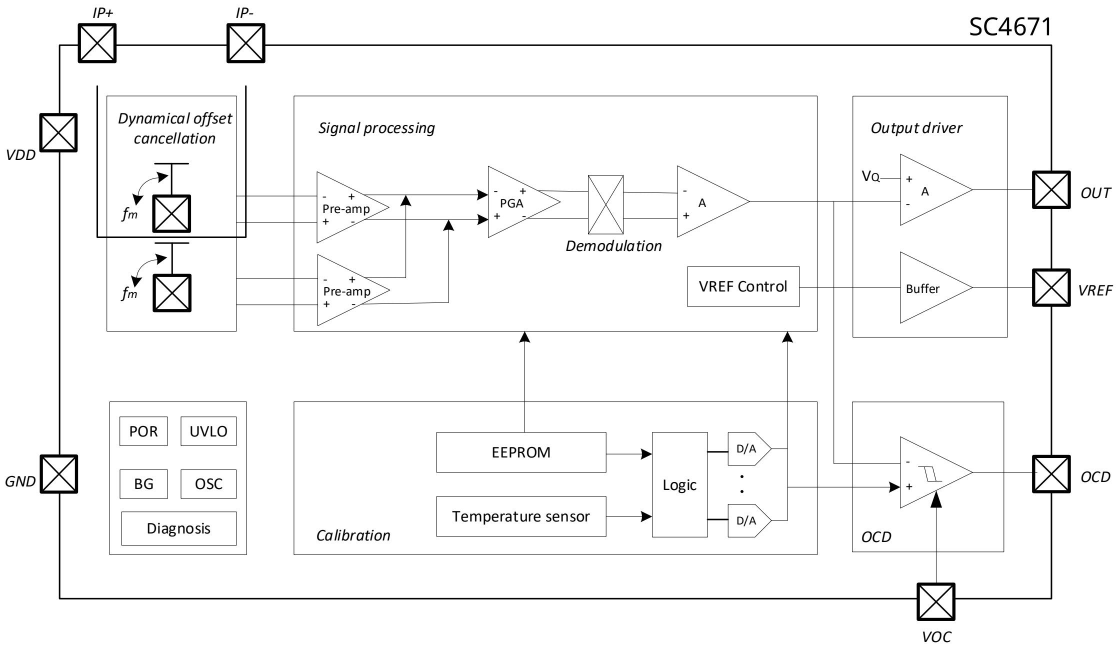



Fig. 3: Function Block Diagram

## 11.2 Power-on Reset Operation

The descriptions in this section assume: temperature = 25°C, with the labeled test conditions. The provided graphs in this section show $V_{OUT}$ moving with $V_{DD}$. The voltage of $V_{OUT}$ during a high-impedance state will be most consistent with a known load (RL, CL).

## 11.3 Power-on Time

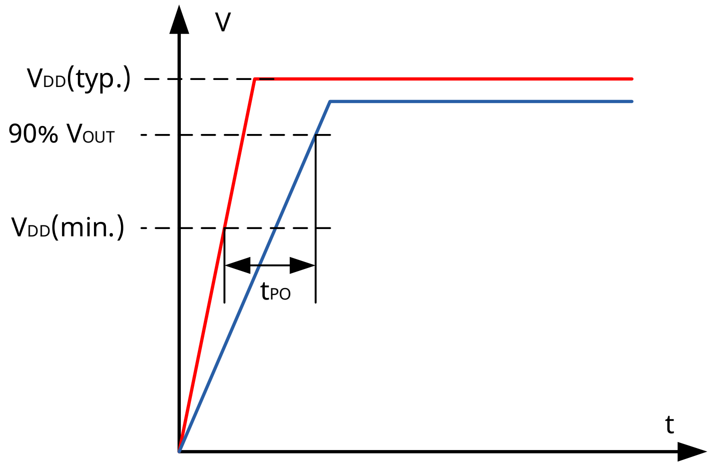



Fig. 4: Power-on time

## 11.4 Response Time

Response time is a term used to define the time difference between the moment when the magnetic field reaches 80% of its target value and the moment when the output voltage of the IC reaches 80% of its target value. This difference is measured and expressed in micro seconds. The Response time is related to the sensitivity of the IC and the size of the output load capacitance.

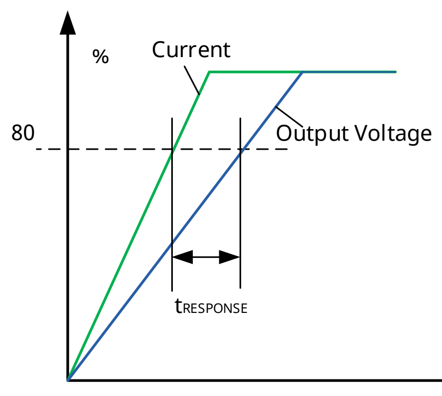



Fig. 5: Response time

# 11.5 Transfer Function

The ideal first-order transfer function of the SC4671 is given by Equation 1, where the output voltage $V_{OUT}$ is a linear function of input current IP. The accuracy of the device is quantified both by the error terms in the transfer function parameters, as well as by nonidealities that introduce additional error terms not in the simplified linear model.

$$V_{OUT} = (I_P \times Sens) + V_{REF}$$

- $V_{OUT}$ is the output voltage.
- IP is the isolated input current.
- Sens is the sensitivity of the SC4671.
- $V_{REF}$ is the zero current reference output voltage.

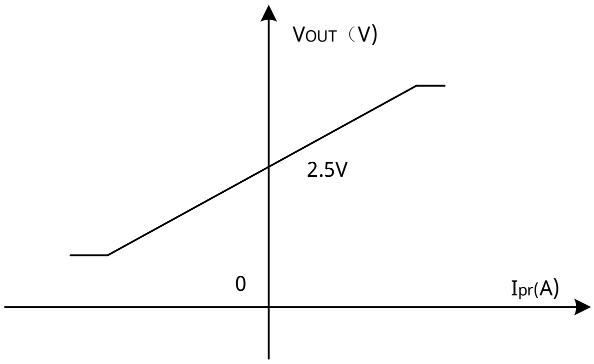



Fig. 6: Sensitivity

# 12. Typical Application

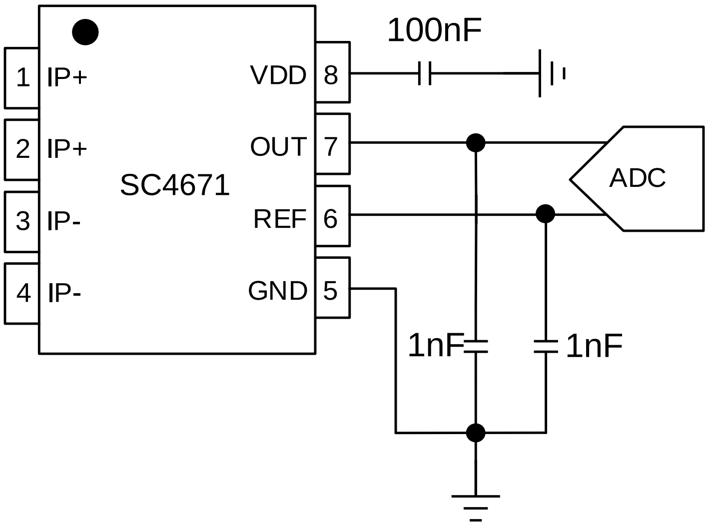
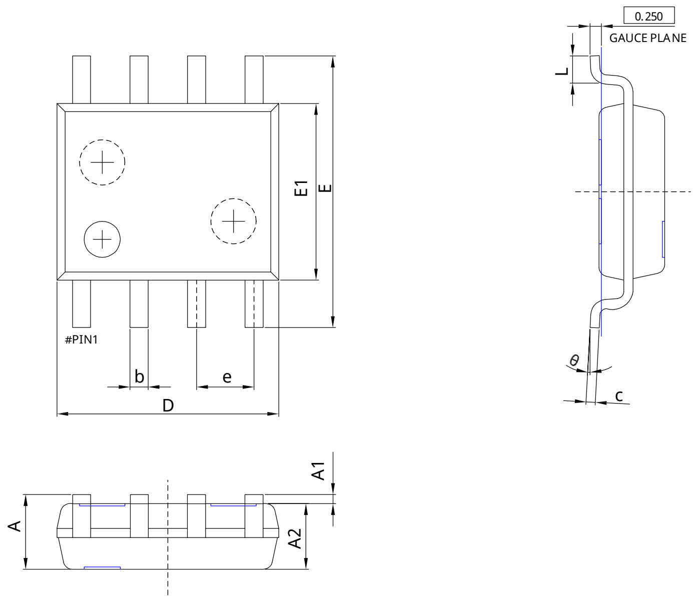



Fig. 7: Typical Application Circuit

# 13. Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.450 | 1.750 | 0.057 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.007 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.201 |
| E | 5.800 | 6.200 | 0.228 | 0.244 |
| E1 | 3.800 | 4.000 | 0.150 | 0.157 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

# 14. Revision History

| Revision | Date | Description |
|---|---|---|
| Rev0.1 | 2024-06-07 | Preliminary datasheet |
| Rev1.0 | 2024-11-27 | Release |
| Rev1.1 | 2025-03-26 | Modify the order information |
| Rev1.2 | 2025-05-12 | Update POD |