
High Precision Current sensor with Common Mode Magnetic Field suppression Up to 5000V 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: $\pm 2.5\%$ from -40°C to 125°C
 - Non-linearity: $\pm 1\%$ Max
 - Symmetry: $\pm 1\%$ Max
- Adjustable fast overcurrent fault output with 1uS typical response time
- Package: SOW16

2. Applications

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

3. Description

The SC4671W 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. SOW16 is for 50A ~ 100A 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 SOW16 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 SOW16 package is optimized for lower noise with 5000 VRMS dielectric withstand voltage and 0.85m Ω conductor resistance.



Fig.1 Package Outline

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4. Terminal Configuration

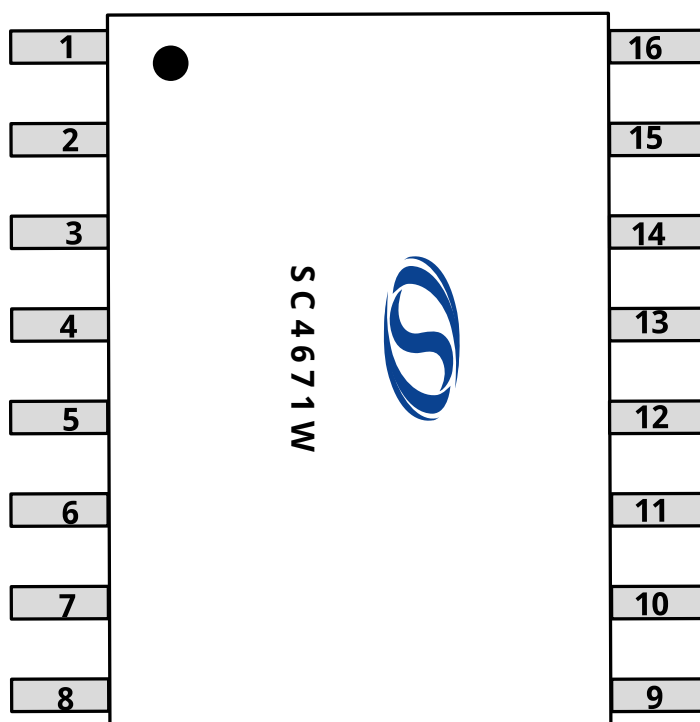


Fig. 2: Terminal Configuration

Terminal		Description
Name	Number	
IP+	1、2、3、4	Input of current
IP-	5、6、7、8	Output of current
OCD	9	Overcurrent fault, open-drain
VDD	10	supply voltage
VOC	11	Overcurrent fault operation point input
VOUT	12	analog output
VREF	13	VREF
GND	15	GND pin

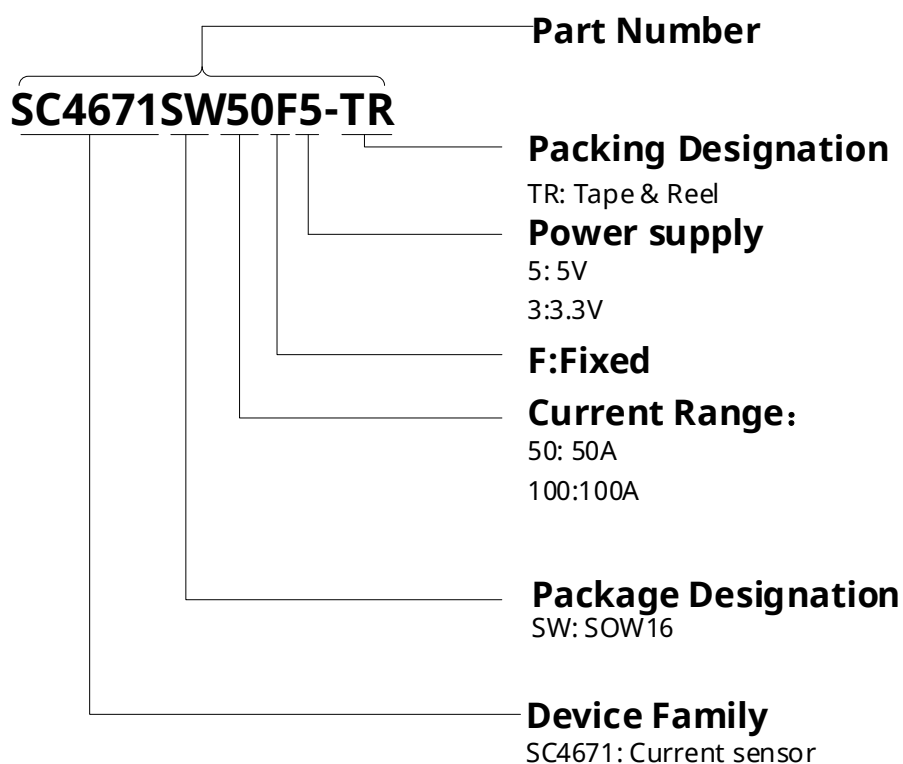
5. Ordering Information

Part number	Primary Current(A)	Power Supply(V)	Sensitivity (mV/A)	Zero Current Output Voltage(V)	Package	Packing
SC4671SW50F5	±50	5	40	2.5	SOW16	1000pcs per Reel
SC4671SW100F5	±100	5	20	2.5	SOW16	1000pcs per Reel

Note:

If you have 3.3V supply, unidirectional output or other application need, please contact Semiment engineer. The SC4671W 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	°C
T_{STG}	Storage Temperature Range		-55	165	°C
$T_J(max)$	Maximum Junction Temperature		-	165	°C

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 1.2 μ s (rise) / 50 μ s (width).	10000	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).	5000	VRMS
VWVBI	Working Voltage for Basic Isolation	Maximum approved working voltage for basic (single) isolation according to UL 60950-1 (edition 2)	1097	Vpk or VDC
			1550	VRMS
DCL	Clearance	Minimum distance through air from IP leads to signal leads.	8	mm
DCR	Creepage	Minimum distance along package body from IP leads to signal leads.	8	mm
CTI	Comparative Tracking Index	Material Group II	≥ 600	V

9. Specifications

9.1 General Electrical Specification

Valid through full operating temperature range, $T_A = -40^{\circ}\text{C}$ to 125°C , $C_{\text{BYPASS}} = 0.1\mu\text{F}$, and $V_{\text{DD}} = 5\text{ V}$, unless otherwise specified.

Valid through the full operate temperature range, $V_{\text{DD}}=5\text{V}$, $C_{\text{BY}}=0.1\mu\text{F}$, 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} ; $V_{\text{DD}} = 5\text{ V}$	-	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	-	-	k Ω
C_{VREF}	Reference Capacitive Load	V_{REF} to GND	-	-	6	nF
T_{PO}	Power-On Delay	$V_{\text{DD}}=0\text{V}$ to 5V , Time from $V_{\text{DD}}=90\%$ to $V_{\text{OUT}}=90\%$	-	77	-	μs
$V_{\text{POR(H)}}$	Power-On Reset Voltage	$V_{\text{DD}}=0\text{V}$ to 5.5V	-	2.9	-	V
$V_{\text{POR(L)}}$		$V_{\text{DD}}=5.5\text{V}$ to 0V	-	2.6	-	V
U_{VLOH}	Under-voltage Protection	$V_{\text{DD}}=0\text{V}$ to 5.5V	-	4.1	4.3	V
U_{VLOL}		$V_{\text{DD}}=5\text{V}$ 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
$T_{\text{d OVD(E)}}$	OVP Delay Time	Time from V_{DD} rising $\geq V_{\text{OVP(EN)}}$ until OVP asserts		54	-	μs
$T_{\text{d OVD(D)}}$		Time from V_{DD} falling $\leq V_{\text{OVP(DIS)}}$ until OVP clears		7.6		μs
I_{OUT}	V_{OUT} Load Current	$V_{\text{DD}} = 4.5\text{V} \sim 5.5\text{V}$, $V_{\text{OUT}} = 0.5\text{V} \sim 4.5\text{V}$, $I_{\text{load}} = -10 \sim 10\text{mA}$	-	9	-	mA
R_{OUT}	V_{OUT} Output Resistance	$V_{\text{OUT}} = V_{\text{Q}}$, $I_{\text{load}} = 5\text{mA}$	-	11	-	Ω
I_{LEAK}	Output Leakage Current	High Impedance Mode	-	6	20	μA
$R_{\text{Load L}}$	Output Load Resistance	V_{OUT} to GND, $R_{\text{L}} = 10\text{k}$ to 1k , $B = +B_{\text{MAX}}$	1	-	-	k Ω
$R_{\text{Load H}}$		V_{OUT} to V_{DD} , $R_{\text{L}} = 10\text{k}$ to 1k , $B = -B_{\text{MAX}}$	1	-	-	k Ω
Clamp_lo	Clamped Output Voltage (EE_Clamp level=1)	$B = -B_{\text{MAX}}$, $R_{\text{L}} = 5\text{k}$ to V_{DD} EE_CL=enable	-	5	-	% V_{DD}
Clamp_hi		$B = +B_{\text{MAX}}$, $R_{\text{L}} = 5\text{k}$ to GND EE_CL=enable	-	95	-	% V_{DD}
Clamp_lo		$B = -B_{\text{MAX}}$, $R_{\text{L}} = 5\text{k}$ to V_{DD} EE_CL=enable	-	7.5	-	% V_{DD}
Clamp_hi		$B = +B_{\text{MAX}}$, $R_{\text{L}} = 5\text{k}$ to GND EE_CL=enable	-	92.5	-	% V_{DD}
CLACC	Clamped Output Accuracy	$B = +B_{\text{MAX}}$, $R_{\text{L}} = 5\text{k}$ to GND EECL=enable	-	-	1	% V_{DD}
V_{OOR}	Output Operating Range	5 V linear operating range	0.5		4.5	V
Fc	Chopping Frequency		-	2	-	MHz
T_{rr}	Refresh rate	Guaranteed by design	0.8	1	2	μs

9.2 Electrical Characteristics

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

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
VSAT(H)	Saturation voltage	$R_L = 10\text{k}\Omega$ to GND	$V_{\text{CC}} - 0.25$	-	-	V
VSAT(L)		$R_L = 10\text{k}\Omega$ to V_{DD}	-	-	0.15	V
VOOR	Output Range	5V linear operation range	0.5	-	4.5	V
IOUT	Output Drive		5	-	-	mA
t_r	Rise Time	$T_A = 25^{\circ}\text{C}$, $C_L = 1\text{nF}$	-	3	-	us
t_{pd}	Propagation Delay	$T_A = 25^{\circ}\text{C}$, $C_L = 1\text{nF}$	-	2	-	us
t_{RESPONSE}	Response Time	$T_A = 25^{\circ}\text{C}$, $C_L = 1\text{nF}$	-	3.6	-	us
f	Frequency Bandwidth	Small signal -3 dB; $C_L = 1\text{nF}$	-	-	400	KHZ
IND	Noise Density	Input-referenced noise density; $T_A = 25^{\circ}\text{C}$, $C_L = 6\text{nF}$; $V_{\text{DD}} = 5 \text{ V}$	-	120	-	$\mu\text{A}/\sqrt{\text{Hz}}$
E_{LIN}	Nonlinearity	Over full range of I_p	-1	-	1	%
E_{SYM}	Symmetry	Over full range of I_p	-1	-	1	%
R_{pu}	Fault pull up Resistance		4.7	-	-	$\text{k}\Omega$
I_{ft}	Overcurrent threshold		50		200	%IP
I_{hys}	Overcurrent hysteresis	$T_A = 25^{\circ}\text{C}$, IP 50A, threshold=100%		10		%IP
T_{re}	Overcurrent response time	4.7k pull up		1.2		us
VOC	Overcurrent accuracy			± 6		%IP
PSRR	Power supply rejection ratio	$T_A = 25^{\circ}\text{C}$, DC to 1kHz, 100 mV pk-pk ripple around $V_{\text{DD}} = V_{\text{DD}(\text{typ})}$, $I_p = 0 \text{ A}$	-	-50	-	dB
CMFR	Common-mode magnetic field rejection ratio		-	> 40	-	dB

10. Performance Characteristics

Valid through full operating temperature range, $T_A = -40^{\circ}\text{C}$ to 125°C , $C_{\text{BYPASS}} = 0.1\mu\text{F}$, and $V_{\text{DD}} = 5\text{V}$ respectively for different version, unless otherwise specified

10.1 SC4671SW50F5 PERFORMANCE CHARACTERISTICS

SC4671SW50F5 PERFORMANCE CHARACTERISTICS						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_P	Optimized Accuracy Range		-50	-	50	A
Sens	Sensitivity	Over full range of I_P , $T_A = 25^{\circ}\text{C}$		40		mV/A
$V_{\text{IOUT(Q)}}$	Zero Current Output Voltage	Bidirectional, $I_P = 0\text{A}$, $T_A = 25^{\circ}\text{C}$		2.5		V
VRE	Reference Voltage Error	$V_{\text{REF actual}} - V_{\text{REF ideal}}$, $T_A = -40^{\circ}\text{C}$ to 125°C	-10	-	10	mV
VOE	Offset Error	$V_{\text{IOUT(Q)}} - V_{\text{REF}}$, $T_A = -40^{\circ}\text{C}$ to 125°C , $I_P = 0\text{A}$	-15	-	15	mV
E_{SENS}	Sensitivity Error	$I_P = \text{IPR}(\text{max})$, $T_A = 25^{\circ}\text{C}$ to 125°C	-2.5	-	2.5	%
		$I_P = \text{IPR}(\text{max})$, $T_A = -40^{\circ}\text{C}$ to 25°C	-2.5	-	2.5	%
E_{TOTAL}	Total output error	$I_P = \text{IPR}(\text{max})$, $T_A = 25^{\circ}\text{C}$ to 125°C	-3.5		3.5	%
		$I_P = \text{IPR}(\text{max})$, $T_A = -40^{\circ}\text{C}$ to 25°C	-3.5		3.5	%

10.2 SC4671SW100F5 PERFORMANCE CHARACTERISTICS

SC4671SW100F5 PERFORMANCE CHARACTERISTICS						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_P	Optimized Accuracy Range		-100	-	100	A
Sens	Sensitivity	Over full range of I_P , $T_A = 25^{\circ}\text{C}$		20		mV/A
$V_{\text{IOUT(Q)}}$	Zero Current Output Voltage	Bidirectional, $I_P = 0\text{A}$, $T_A = 25^{\circ}\text{C}$		2.5		V
VRE	Reference Voltage Error	$V_{\text{REF actual}} - V_{\text{REF ideal}}$, $T_A = -40^{\circ}\text{C}$ to 125°C	-10	-	10	mV
VOE	Offset Error	$V_{\text{IOUT(Q)}} - V_{\text{REF}}$, $T_A = -40^{\circ}\text{C}$ to 125°C , $I_P = 0\text{A}$	-15	-	15	mV
E_{TOT}	Sensitivity Error	$I_P = \text{IPR}(\text{max})$, $T_A = 25^{\circ}\text{C}$ to 125°C	-2.5	-	2.5	%
		$I_P = \text{IPR}(\text{max})$, $T_A = -40^{\circ}\text{C}$ to 25°C	-2.5	-	2.5	%
E_{TOTAL}	Total output error	$I_P = \text{IPR}(\text{max})$, $T_A = 25^{\circ}\text{C}$ to 125°C	-3.5	-	3.5	%
		$I_P = \text{IPR}(\text{max})$, $T_A = -40^{\circ}\text{C}$ to 25°C	-3.5	-	3.5	%

11. Functional Description

11.1 Overview

The SC4671W 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, SC4671W series could help customers to reduce PCB size with its extreme compact size. Comparing with the solution of shunt resistor + isolated amplifier, SC4671W series only need low side power supply, eliminating the complexity of high side power supply design.

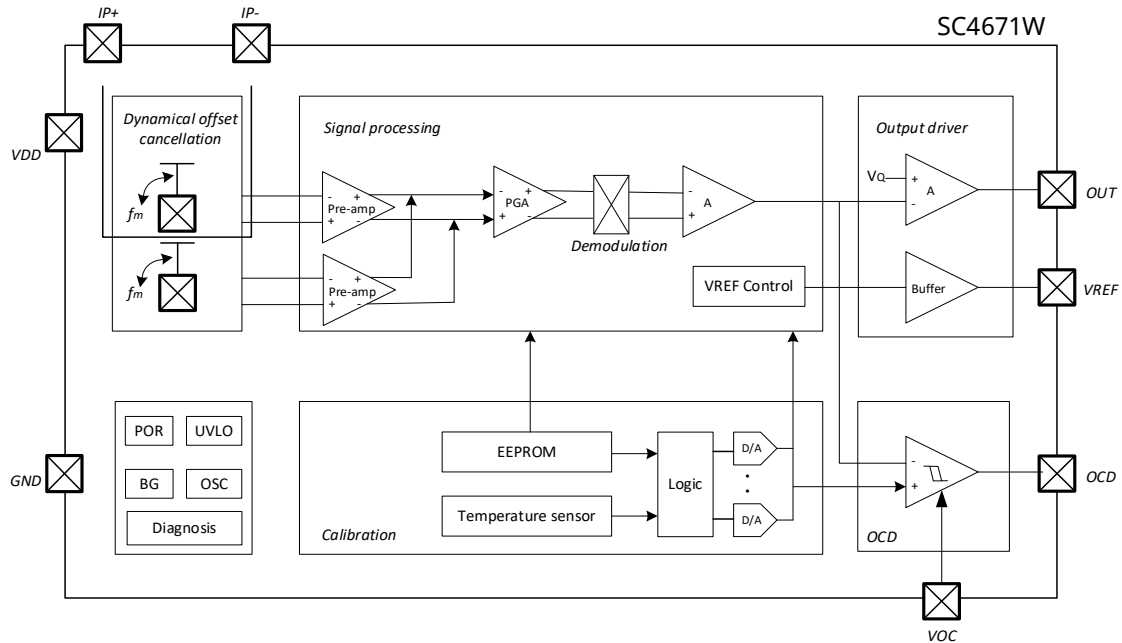


Fig. 3: Function Block Diagram

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 (R_L , C_L).

11.3 Power-on Time

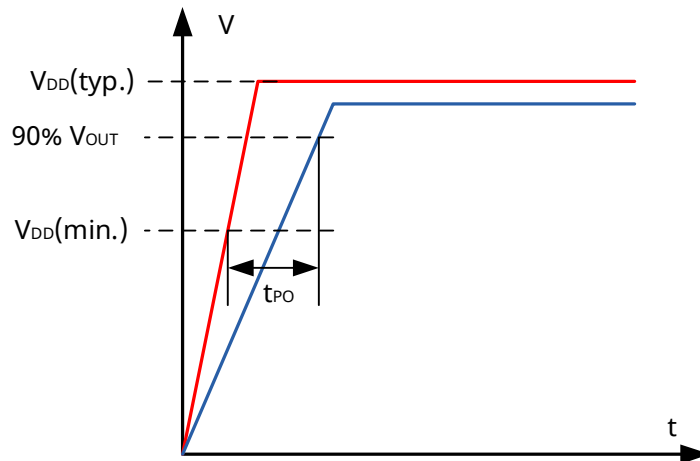


Fig. 4: Power-on time

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.

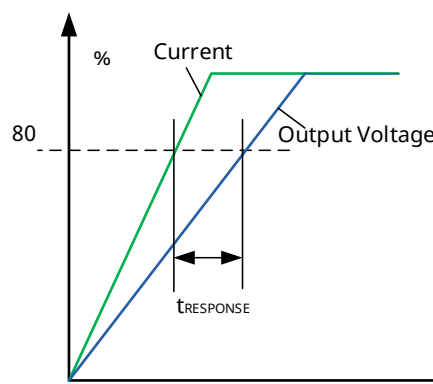


Fig. 5: Response time

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 I_P . 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.

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

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

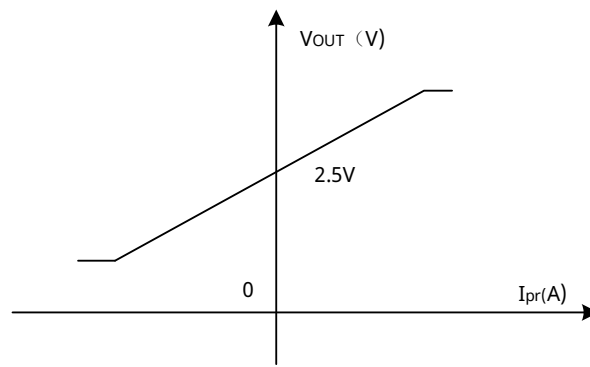


Fig. 6: Sensitivity

12. Typical Application

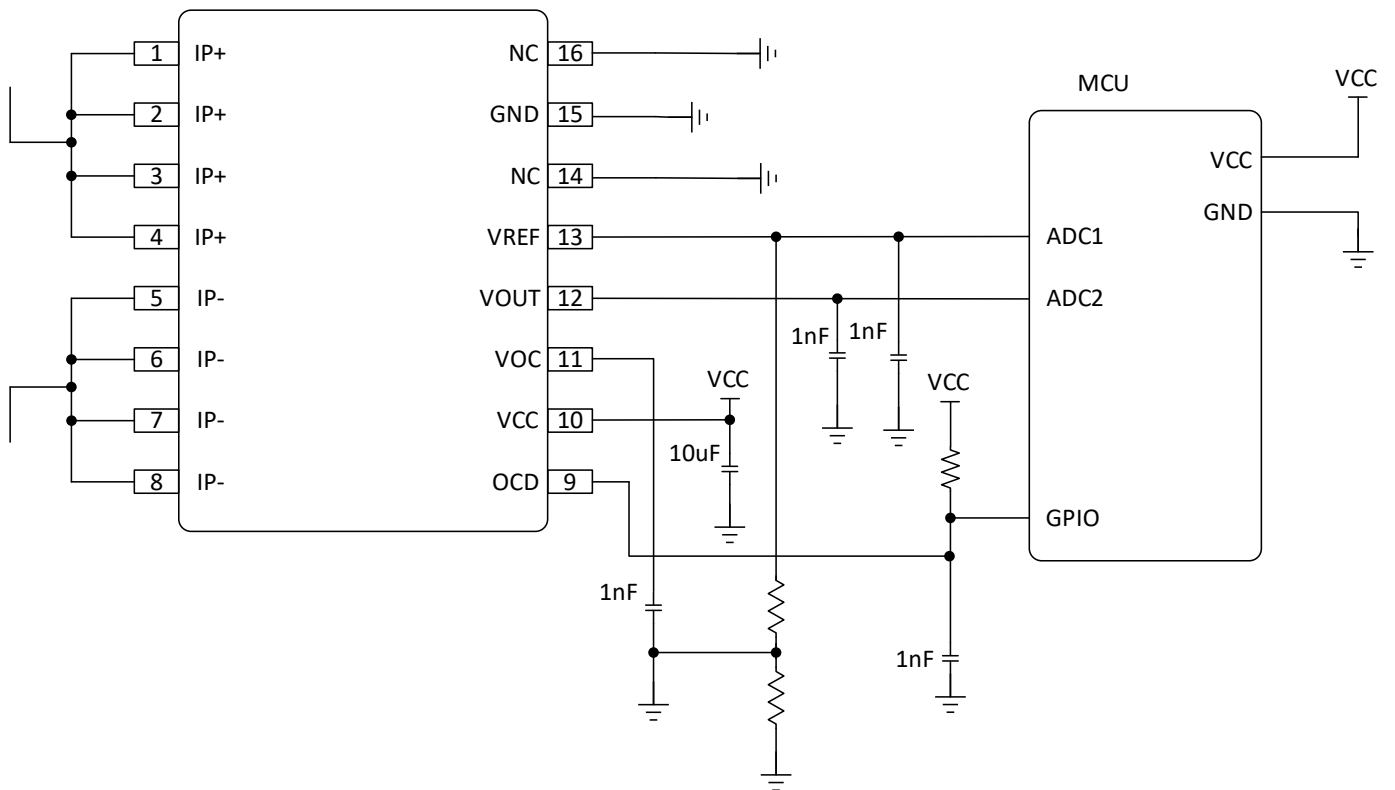
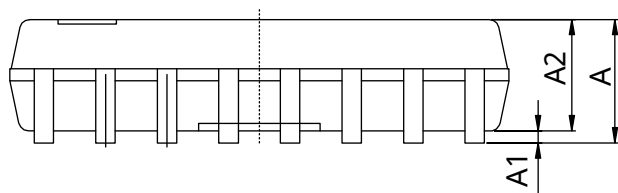
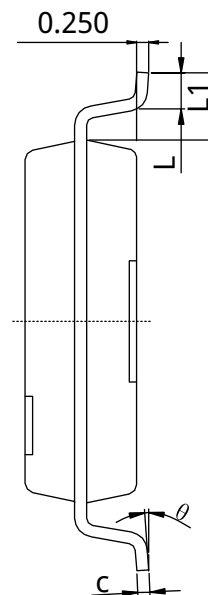
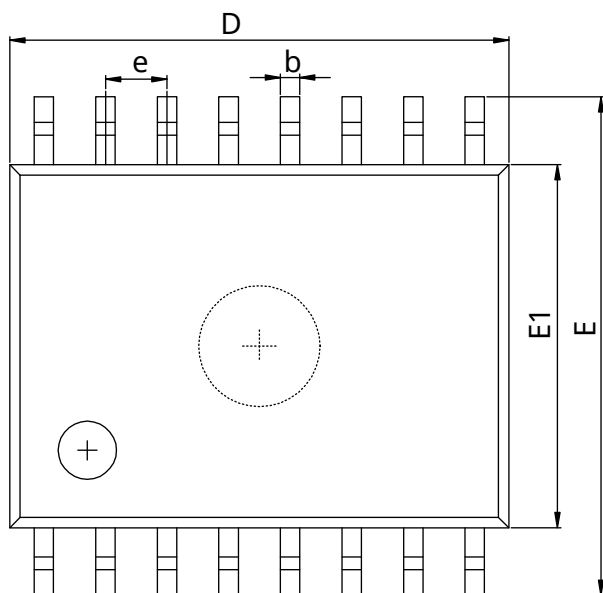


Fig. 7: Typical Application Circuit

13. Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	-	2.650	-	0.104
A1	0.100	0.300	0.004	0.012
A2	2.250	2.350	0.089	0.093
b	0.350	0.430	0.014	0.017
c	0.240	29.000	0.009	0.011
D	10.200	10.400	0.402	0.409
E	10.100	10.500	0.398	0.413
E1	7.400	7.600	0.291	0.299
e	1.270(BSC)		0.050(BSC)	
L	0.550	0.850	0.022	0.033
L1	1.400(REF)		0.060(REF)	
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