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

1. Features

- High bandwidth and fast response time
- 400kHz bandwidth with 1.2us response time
- High-precision current measurement:
 - Sensitivity error: $\pm 2.5\%$ from -40°C to 125°C
 - Non-linearity: $\pm 1\%$ Max
 - Symmetry: $\pm 1\%$ Max
- Differential Hall sets can immune stray field
- Adjustable fast overcurrent fault output with 1us typical response time
- Fixed output with VREF
- Two versions respectively support 3.3V & 5V applications
- Supports bidirectional and unidirectional output mode
- Supports proportional and fixed output modes
- High isolation level that meets UL standards
- Withstand isolation voltage (VISO): 5000Vrms
- Maximum surge isolation withstand voltage (VIOSM): 10kV
- Creepage distance/Clearance distance: 8mm
- Support self-test and a variety of diagnostic functions: OVP, OTP, OCD, broken wire, etc.
- Working temperature: $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$
- Primary internal resistance: 1.2m Ω
- 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 1.2m Ω conductor resistance.



Fig.1 Package Outline

CONTENTS

1. Features	1	10.2 SC4671SP30B5 PERFORMANCE	
2. Applications	1	CHARACTERISTICS.....	8
3. Description	1	10.3 SC4671SP50B5 PERFORMANCE	
4. Terminal Configuration	3	CHARACTERISTICS.....	9
5. Ordering Information.....	4	11. Functional Description	10
6. Absolute Maximum Ratings	5	11.1 Overview	10
7. ESD Protection	5	11.2 Power-on Reset Operation	11
8. Isolation Characteristics.....	5	11.3 Power-on Time.....	11
9. Specifications	6	11.4 Response Time.....	11
9.1 General Electrical Specification	6	11.5 Transfer Function	12
9.2 Electrical Characteristics (V_{OCD} & V_{REF})	7	12. Typical Application	14
10. Performance Characteristics	8	13. Package Information	15
10.1 SC4671SP20B5 PERFORMANCE		14. Revision History.....	16
CHARACTERISTICS.....	8		

4. Terminal Configuration

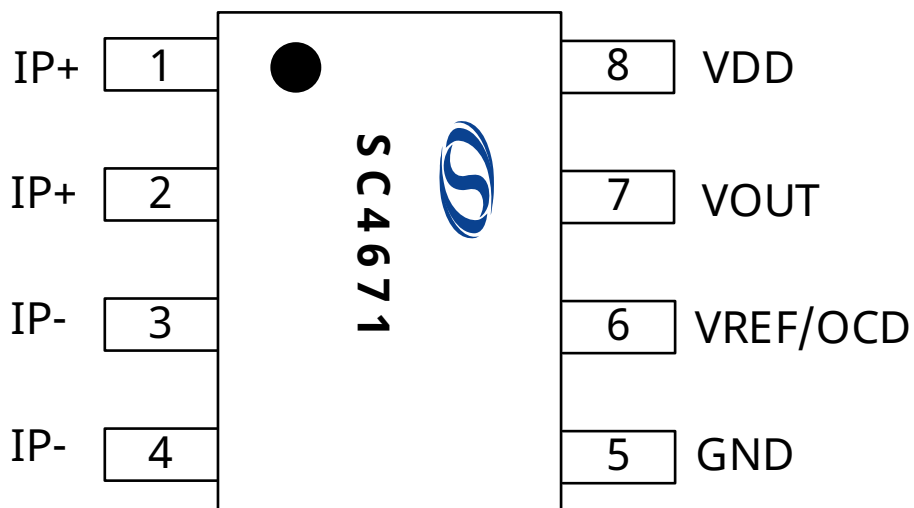


Fig.2 Terminal Configuration

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

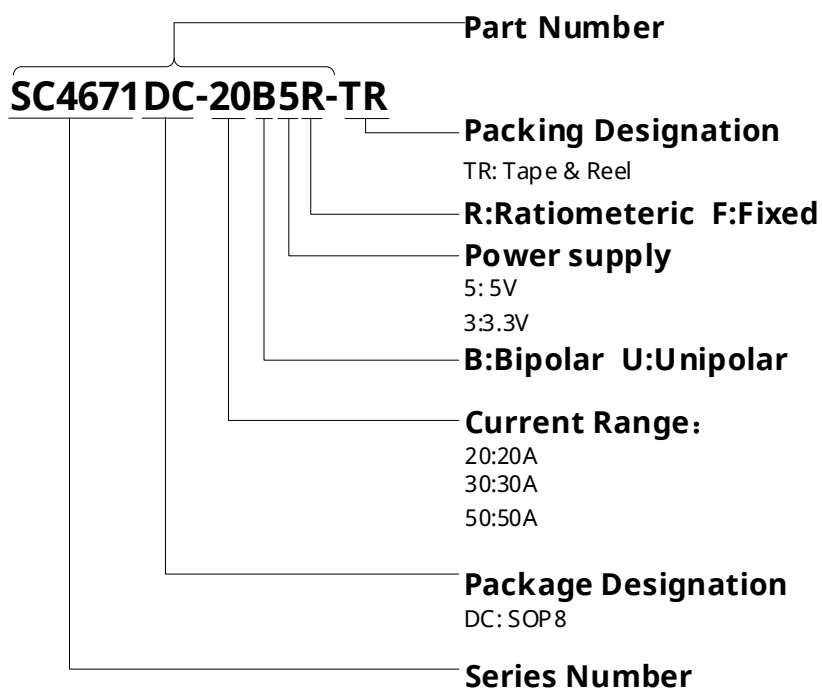
5. Ordering Information

Part number	Primary Current(A)	Power Supply(V)	Sensitivity (mV/A)	Zero Current Output Voltage(V)	Package	Packing
SC4671DC-20B5F-TR	±20	5	100	2.5	SOP8	4000pcs/Reel
SC4671DC-30B5F-TR	±30	5	66.7	2.5	SOP8	4000pcs/Reel
SC4671DC-50B5F-TR	±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	°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	Ratings	Value	Units
Electrostatic discharge	Human body model (HBM), per AEC-Q100-002-RevD •All pins	±8	kV
	Charged device model (CDM), per AEC-Q100-011-RevB •All pins	±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
VVVBI	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, $T_A = -40^{\circ}\text{C}$ to 125°C , $C_{\text{BYPASS}} = 0.1\mu\text{F}$, and $V_{\text{DD}} = 5\text{V}$, 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} ; $V_{\text{DD}} = 5\text{V}$	-	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	-	-	$\text{k}\Omega$
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	$V_{\text{OUT}} = V_Q$, $I_{\text{load}} = 5\text{mA}$	-	11	-	Ω
I_{LEAK}	Output Leakage Current	High Impedance Mode	-	6	20	μA
$R_{\text{Load L}}$	Output Load Resistance	V_{OUT} to GND, $R_L = 10\text{k}$ to 1k , $B = +B_{\text{MAX}}$	1	-	-	$\text{k}\Omega$
$R_{\text{Load H}}$		V_{OUT} to V_{DD} , $R_L = 10\text{k}$ to 1k , $B = -B_{\text{MAX}}$	1	-	-	$\text{k}\Omega$
Clamp_lo	Clamped Output Voltage (EE_Clamp level=1)	$B = -B_{\text{MAX}}$, $R_L = 5\text{k}$ to V_{DD} EE_CL=enable	-	5	-	$\%V_{\text{DD}}$
Clamp_hi		$B = +B_{\text{MAX}}$, $R_L = 5\text{k}$ to GND EE_CL=enable	-	95	-	$\%V_{\text{DD}}$
Clamp_lo		$B = -B_{\text{MAX}}$, $R_L = 5\text{k}$ to V_{DD} EE_CL=enable	-	7.5	-	$\%V_{\text{DD}}$
Clamp_hi		$B = +B_{\text{MAX}}$, $R_L = 5\text{k}$ to GND EE_CL=enable	-	92.5	-	$\%V_{\text{DD}}$
CLACC	Clamped Output Accuracy	$B = +B_{\text{MAX}}$, $R_L = 5\text{k}$ to GND EECL=enable	-	-	1	$\%V_{\text{DD}}$
V_{OOR}	Output Operating Range	5V linear operating range	0.5		4.5	V
F_c	Chopping Frequency		-	2	-	MHz
T_{rr}	Refresh rate	Guaranteed by design	0.8	1	2	μs

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

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{SAT(H)}$	Saturation voltage	$R_L = 10\text{k}\Omega$ to GND	$V_{DD}-0.25$	-	-	V
$V_{SAT(L)}$		$R_L = 10\text{k}\Omega$ 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	$T_A = 25^{\circ}\text{C}$, $CL = 1\text{nF}$	-	3	-	μs
t_{pd}	Propagation Delay	$T_A = 25^{\circ}\text{C}$, $CL = 1\text{nF}$	-	2	-	μs
$t_{RESPONSE}$	Response Time	$T_A = 25^{\circ}\text{C}$, $CL = 1\text{nF}$	-	3.6	-	μs
f	Frequency Bandwidth	Small signal -3 dB; $CL = 1\text{nF}$	-	-	400	KHZ
IND	Noise Density	Input-referenced noise density; $T_A = 25^{\circ}\text{C}$, $CL = 6\text{nF}$; $V_{DD} = 5\text{V}$ @ SOP8	-	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	%
PSRR	Power supply rejection ratio	$T_A = 25^{\circ}\text{C}$, DC to 1 kHz, 100 mV pk-pk ripple around $V_{DD} = V_{DD(typ)}$, $I_p = 0\text{ A}$	-	-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 SC4671DC-20B5F-TR PERFORMANCE CHARACTERISTICS

PERFORMANCE CHARACTERISTICS						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_P	Optimized Accuracy Range		-20	-	20	A
Sens	Sensitivity	Over full range of I_P , $T_A = 25^{\circ}\text{C}$		100		mV/A
$V_{\text{OUT(Q)}}$	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	$I_P = \text{IPR (max)}$, $T_A = 25^{\circ}\text{C}$ to 125°C	-2.5	-	2.5	%
		$I_P = \text{IPR (max)}$, $T_A = -40^{\circ}\text{C}$ to 25°C	-2.5	-	2.5	%
E_{TOTAL}	Total output error	$I_P = \text{IPR (max)}$, $T_A = 25^{\circ}\text{C}$ to 125°C	-3.5		3.5	%
		$I_P = \text{IPR (max)}$, $T_A = -40^{\circ}\text{C}$ to 25°C	-3.5		3.5	%

10.2 SC4671DC-30B5F-TR PERFORMANCE CHARACTERISTICS

PERFORMANCE CHARACTERISTICS						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_P	Optimized Accuracy Range		-30	-	30	A
Sens	Sensitivity	Over full range of I_P , $T_A = 25^{\circ}\text{C}$		66.7		mV/A
$V_{\text{OUT(Q)}}$	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	$I_P = \text{IPR (max)}$, $T_A = 25^{\circ}\text{C}$ to 125°C	-2.5	-	2.5	%
		$I_P = \text{IPR (max)}$, $T_A = -40^{\circ}\text{C}$ to 25°C	-2.5	-	2.5	%
E_{TOTAL}	Total output error	$I_P = \text{IPR (max)}$, $T_A = 25^{\circ}\text{C}$ to 125°C	-3.5	-	3.5	%
		$I_P = \text{IPR (max)}$, $T_A = -40^{\circ}\text{C}$ to 25°C	-3.5	-	3.5	%

10.3 SC4671DC-50B5F-TR PERFORMANCE CHARACTERISTICS

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
$V_{OUT(Q)}$	Zero Current Output Voltage	Bidirectional, $I_P = 0\text{A}$, $T_A = 25^\circ\text{C}$		2.5		V
V_{RE}	Reference Voltage Error	$V_{REF \text{ actual}} - V_{REF \text{ ideal}}$, $T_A = -40^\circ\text{C}$ to 125°C	-10	-	10	mV
V_{OE}	Offset Error	$V_{OUT(Q)} - V_{REF}$, $T_A = -40^\circ\text{C}$ to 125°C , $I_P = 0\text{A}$	-15	-	15	mV
E_{TOT}	Sensitivity Error	$I_P = I_{PR} \text{ (max)}$, $T_A = 25^\circ\text{C}$ to 125°C	-2.5	-	2.5	%
		$I_P = I_{PR} \text{ (max)}$, $T_A = -40^\circ\text{C}$ to 25°C	-2.5	-	2.5	%
E_{TOTAL}	Total output error	$I_P = I_{PR} \text{ (max)}$, $T_A = 25^\circ\text{C}$ to 125°C	-3.5	-	3.5	%
		$I_P = I_{PR} \text{ (max)}$, $T_A = -40^\circ\text{C}$ 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.

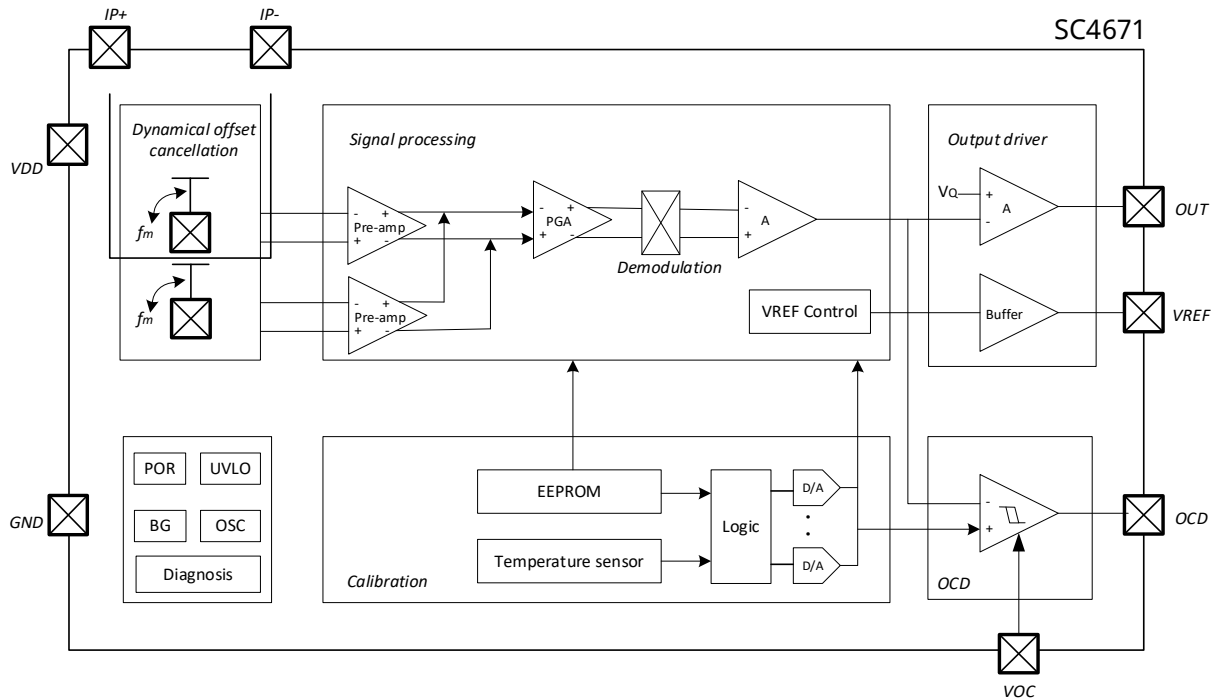


Fig.3 Function Block Diagram

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 (R_L , C_L).

11.3 Power-on Time

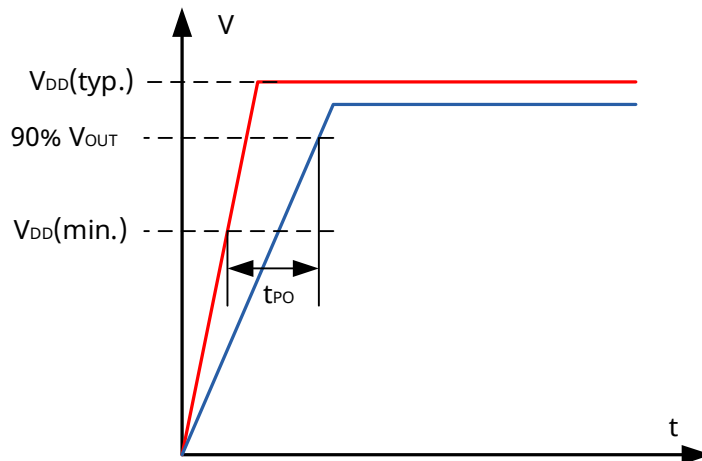


Fig.4 Power-on time

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.

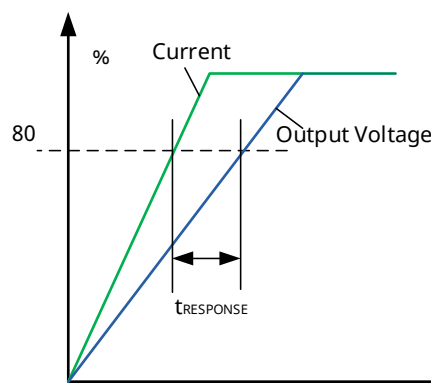


Fig.5 Response time

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.

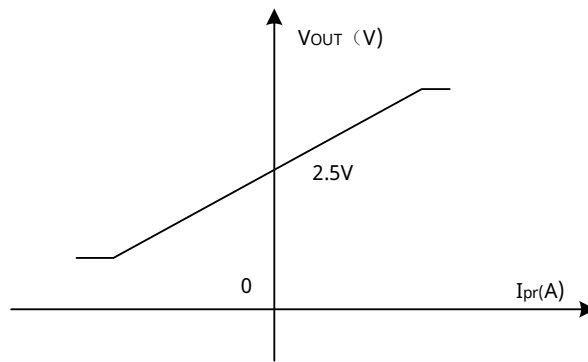


Fig.6 Sensitivity

11.6 Overcurrent Fault(OCD)

As the output swings, if the sensed current exceeds its comparator threshold, the overcurrent fault pin triggers with an active low flag. This is internally compared with either the factory-programmed thresholds or the VOC voltage when $V_{VOC} > 0.1V$. This flag trips symmetrically for the positive and negative OCD operating point.

The implementation for the OCD circuitry is accurate over temperature and does not require further temperature compensation because it is dependent on the Sens and V_{OFF} parameters that are factory trimmed flat over temperature.

11.7 Voltage Overcurrent PIN(VOC)

The fault trip points can be set using the VOC pin as the direct analog input for the fault trip point, for bidirectional devices, the VOC pin voltage can be set using resistor dividers from V_{REF} . The fault performance is valid when V_{VOC} is within the VOC operating voltage range or $< 0.1V$. If voltage is beyond the defined valid performance region, the device responds with varied results. For a 5V bidirectional device: If the VOC pin is set to 0.5V, the minimum trip point, $I_{FAULT(MIN)}$ is selected; if the VOC pin is set to 1.75V, the maximum trip point, $I_{FAULT(max)}$ is selected, as defined in the Performance Characteristic table, All voltages between 0.5 and 1.75V for the 5V option, and between 0.33 and 1.321V for the 3.3V option, can be used to linearly select a trip point between the minimum and maximum levels. When $V_{oc} < 0.1V$, the internal EEPROM fault level is used.

The resulting equation for the fault is:

$$OCF_{\%FS}[\%] = \frac{V_{OC(VCC)}[V]}{2} * 100[\%] * 0.45$$

$$I_{OCF}[A] = OCF_{\%FS}[\%] * I_{PR}[A]$$

Table 1: $V_{OC(CC)}$ Thresholds and Corresponding Percentage of the Full-Scale Output for Bidirectional and Unidirectional Operational Modes

VOC(3.3V)(V)	VOC(5V)(V)	Fault Operation Point %FS	
		Bidirectional	Unidirectional
<0.1		100%(factory default)	50%(factory default)
0.330	0.500	23%	11.5%
0.466	0.75	34%	17%
0.661	1	45%	22.5%
0.826	1.25	56%	28%
0.991	1.5	68%	34%
1.156	1.75	80%	40%

12. Typical Application

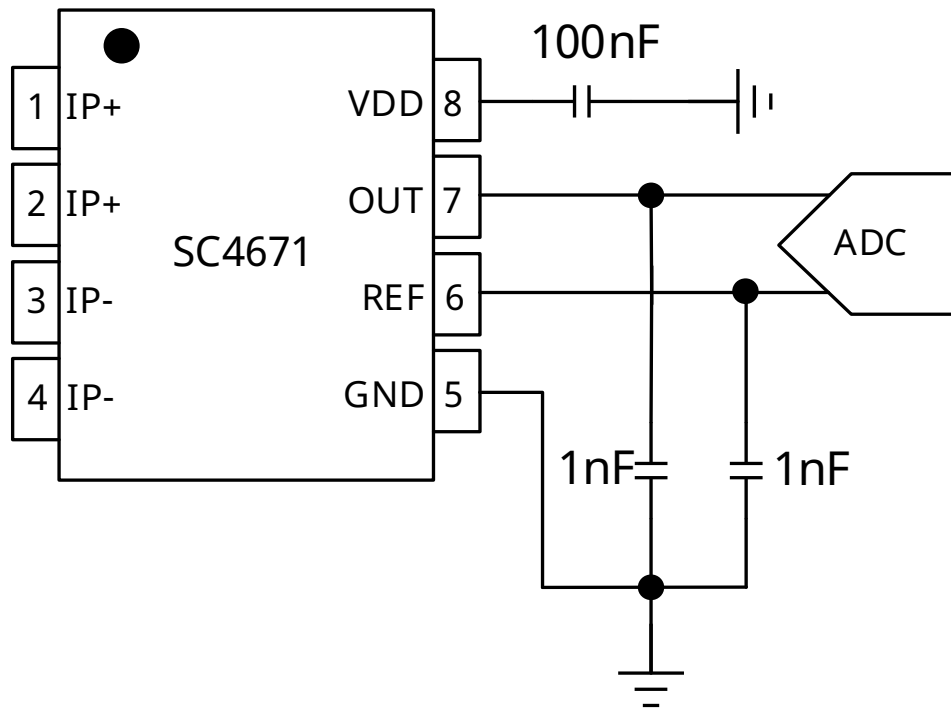
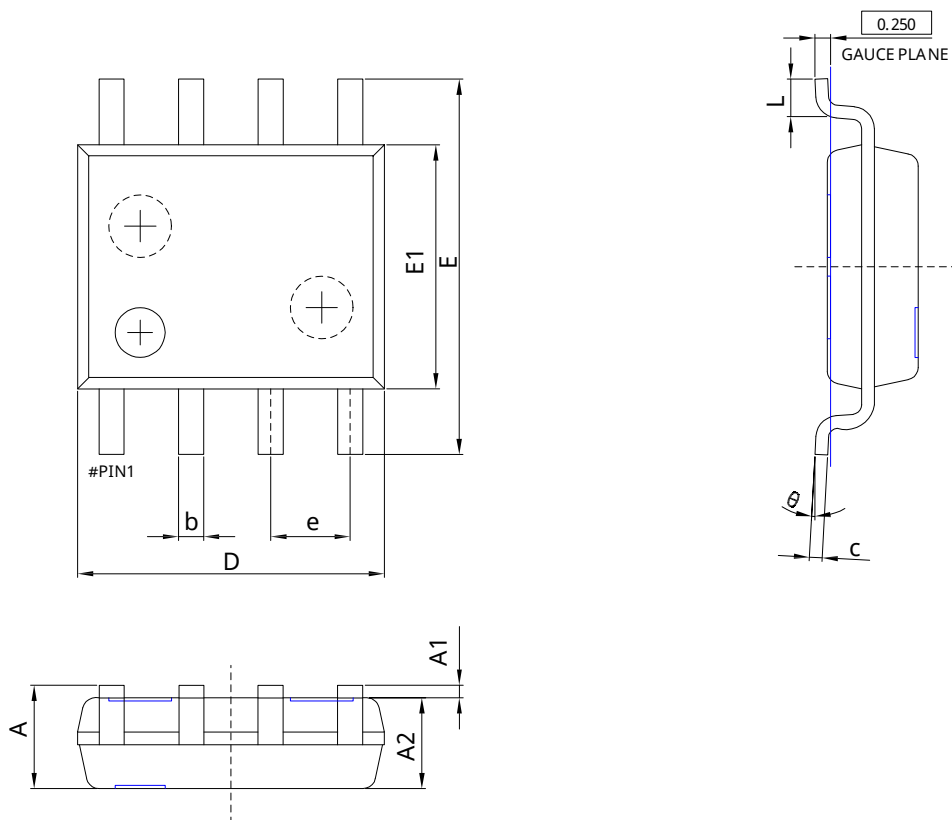


Fig.7 Typical Application Circuit

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