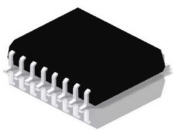
FEATURES

- Hybrid (GaAs+Si) Linear Hall Current Sensor
  - Primary conductor resistance (0.9mΩ)
- High bandwidth and fast response
  - Bandwidth: 250kHz
  - Typical response time: 1.8μs
- High precision, differential Hall common-mode rejection
  - Differential Hall effectively resists external magnetic field interference
  - Near-zero magnetic hysteresis
- Flexible installation, high reliability
  - Capable of AC/DC current sensing, analog output
  - Compliant 3.3V/5V power supply
  - Fixed or Ratiometric Output
  - Wide ambient temperature range: -40°C~125°C
  - Isolation voltage V_{ISO}: 3500Vrms

PACKAGE

16-Pin SOIC



DESCRIPTION

The AACS37002 current sensor IC(SOIC-16 Package) is a compound semiconductor GaAs-based sensor with precise temperature compensation algorithms, featuring high integration, high precision, high bandwidth, fast response speed, high linearity, and low temperature drift. It provides a cost-effective solution for current detection in industrial control, new energy, automotive electronics, and other fields.

The sensor uses a differential Hall structure to effectively suppress external stray magnetic fields and has strong anti-interference capabilities, ensuring accurate measurement in complex magnetic noise environments.

The sensor only requires low-voltage side power supply, reducing the inconvenience of needing to power both high and low voltages in isolated operational amplifiers. The product can be calibrated before shipment according to customer needs, eliminating the need for secondary programming and calibration on the client side.

APPLICATIONS

- Photovoltaic
- Industrial Power Supplies
- Motor Control
- OBC/DC-DC
- Charging Stations

APPLICATION CIRCUITS

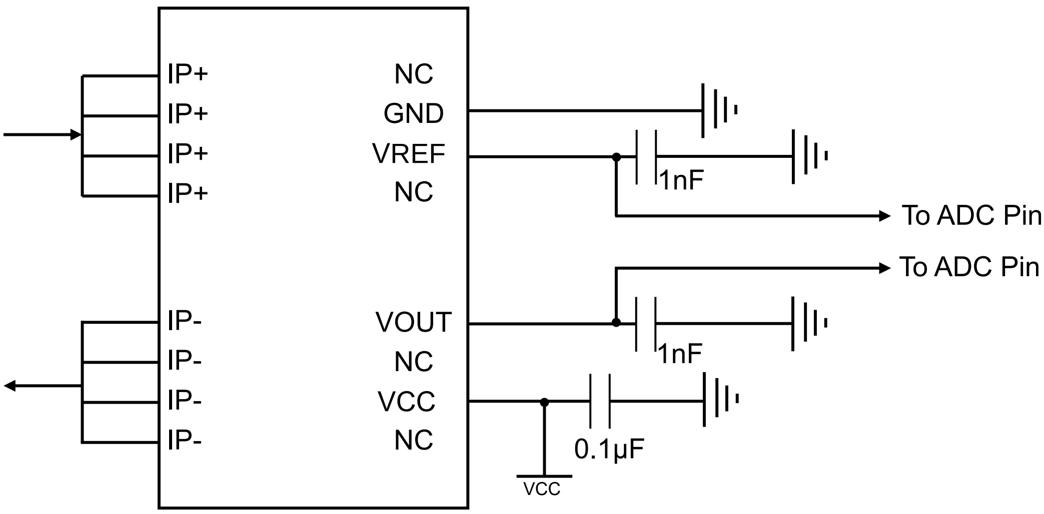


Figure 1. Typical application circuit diagram
(Decoupling capacitors should be placed as close as possible to the chip pins)

SELECTION GUIDE

Part Number	Output	I_{PR}(A)	Sensitivity(mV/A)		Temp. Range T_A (°C)	Packing
			V_{CC}=3.3V(*=3.3)	V_{CC}=5V(*=5)		
AACS37002D*-AU12FB-T	Fixed	±12	110	166.7	–40 to 125°C	Tape or reel packaging, 1000pcs/reel
AACS37002D*-AU20FB-T		±20	66	100		
AACS37002D*-AU30FB-T		±30	44	66.7		
AACS37002D*-AU30FU-T		30	88	133.3		
AACS37002D*-AU40FB-T		±40	33	50		
AACS37002D*-AU50FB-T		±50	26.4	40		
AACS37002D*-AU65FB-T		±65	20.3	30.8		
AACS37002D*-AU12RB-T	Ratiometric	±12	110	166.7		
AACS37002D*-AU20RB-T		±20	66	100		
AACS37002D*-AU30RB-T		±30	44	66.7		
AACS37002D*-AU30RU-T		30	88	133.3		
AACS37002D*-AU40RB-T		±40	33	50		
AACS37002D*-AU50RB-T		±50	26.4	40		
AACS37002D*-AU65RB-T		±65	20.3	30.8		

Unidirectional output mode is available for 20A and above, please contact us if you need other ranges, new ranges will be added without prior notice.

NAMING CONVENTION

AACS37002 D 5 - A U 20 R B - T

Contains lead
- T: Lead-free process

Output directionality
- B: Bidirectional
- U: Unidirectional

Output mode
- F: Fixed
- R: Ratiometric

Current sensing range

Packing
- U：Tube
- R：Tape Reel

Pin Assignment
- A：10-legVCC，12-legOUT，15-legGND，14-legVREF
- B：14-legVCC，12-legOUT，9-legGND，11-legFILTER
- C：10-legVCC，12-legOUT，15-legGND，13-legVREF

Supply voltage
- 3：3.3V
- 5：5V

Insulation level
- D：3000~5000V
- E：1000~2000V
- F：1000V or less

Product model

1. ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
Supply Voltage	V_{CC}	V	T_A=25°C	-0.3		6.5
Output Current	I_{OUTmax}	mA	T_A=25°C	-45		45
Output Voltage	V_{OUTmax}	V	T_A=25°C	0.1		V_{CC}-0.1
Storage temperature	T_S	°C		-55		165
Operating Ambient Temperature	T_A	°C		-40		125
Maximum Junction Temperature	T_{Jmax}	°C				150

2. ESD CHARACTERISTICS

Characteristic	Symbol	Unit	Test Conditions	Min.
Human Body Model	V_{HBM}	kV	ESD between any two pins	±6
Charged Device Model	V_{CDM}	kV	ESD between any two pins	±1

3. ISOLATION CHARACTERISTICS

Characteristic	Symbol	Unit	Test Conditions	Min.
Dielectric Surge Voltage	V_{SURGE}	V	Test method refers to IEC61000-4-5,1.2us/50us waveform.	4000
Dielectric Strength Test Voltage	V_{ISO}	V_{RMS}	60s isolation withstand voltage parameters, according to UL62368-1, test 3.5kV/1s before delivery to verify the insulation performance, and verify the partial discharge is less than 5pc.	3500
Working Voltage for Basic Isolation	V_{WVBI}	V_{PK} or V_{CC}	Maximum approved working voltage for basic (single) isolation according to UL60950-1.	700
	V_{WVBI}	V_{RMS}	Maximum approved working voltage for basic (single) isolation according to UL60950-1.	495
Clearance	D_{CL}	mm	Minimum Air Clearance	8.2
Creepage	D_{CR}	mm	Minimum Creepage Distance	8.2
Insulation Distance	DTI	um	Minimum Internal Distance Through the Insulation Layer	90
Comparative Tracking Index	CTI	V	CTI I	>600

4. TERMINAL LIST & FUNCTIONAL BLOCK

Number	Symbol	Test Conditions
1,2,3,4	IP+	Primary Side Positive Voltage
5,6,7,8	IP-	Primary Side Negative Voltage
9,16	NC	Not Connected
10	VCC	Power Supply
11,13	NC	Not Connected
12	VOUT	Output Voltage
14	VREF	Reference Voltage
15	GND	Ground

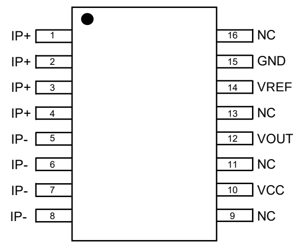


Figure 2. Pinout Diagram

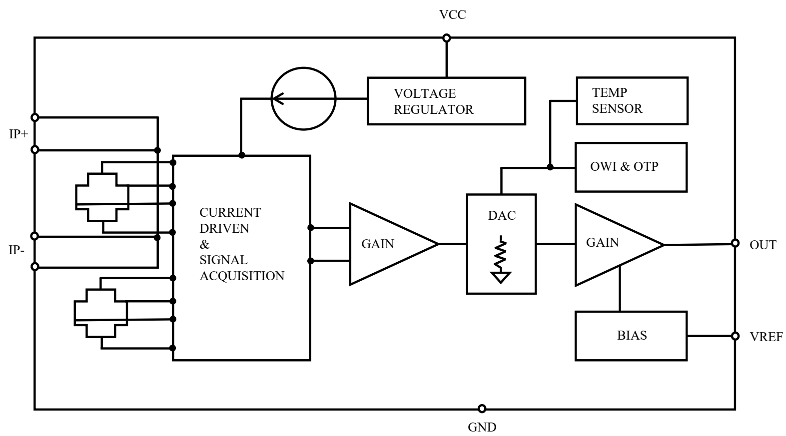


Figure 3. Functional Block Diagram

5. COMMON ELECTRICAL CHARACTERISTICS

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125°C, V_{CC}=5V / 3V

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
Operating Voltage	V_{CC}	V	V_{CC}=3.3V（AACS37002D3)	3	3.3	3.6
			V_{CC}=5V（AACS37002D5)	4.5	5	5.5
Operating Current	I_{CC}	mA	No-load, V_{CC}=3.3V	–	7.5	15
			No-load, V_{CC}=5V	/	10	15
Primary conductor resistance	R_P	mΩ	T_A=25°C	/	0.9	/
Power-On Time	T_{PO}	ms	Chip power-on(V_{CC}>4.5V)，V_{OUT} and V_{BIAS} stable time	/	1	/
Output Capacitive Load	C_L	nF	/	–	–	10
Output Resistive Load	R_L	kΩ	/	4.7	–	–
Reference Resistive Load	R_{LREF}	kΩ	/	10		
Output Voltage Range	V_S	V	T_A=25°C，C_L=1nF，R_L=10KΩ to V_{CC} / V_{GND}	0.1		V_{CC}-0.1
Common Mode Field Rejection	*CMFR*	dB		–	40	–
Rise Time	T_R	µs	T_A=25°C，C_L=1nF	–	1.2	–
Output Response Time	T_R	µs	T_A=25°C，C_L=1nF，30A range	–	1.8	–
Internal Bandwidth	*BW*	kHz	T_A=25°C，V_{CC}=3.3V / 5V，C_L=1nF，3dB，30A range	–	250	–
Output Noise	V_N	mVrms	T_A=25°C，V_{CC}=3.3V /5V，C_L=1nF，30A range		10	
Nonlinearity	E_{LIN}	%		–	±0.1	±0.3
Reference Voltage	V_{REF}	V	Fixed output, Bipolar, $V_{CC=}$5V	2.49	2.5	2.51
			Fixed output, Bipolar, $V_{CC=}$3.3V	1.64	1.65	1.66
			Fixed output, Unipolar, $V_{CC=}$5V	0.49	0.5	0.51
			Ratiometric output		V_{CC}×0.5	
Ratiometric Output Sensitivity Error	S_{ERR}	%	T_A=25°C, V_{CC}=3.0~3.6V or V_{CC}=4.85~5.15V		0.7	

AACS37002D*-AU12FB-T/RB-T DEVICE PERFORMANCE CHARACTERISTICS

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125 (Depending on the supply voltage, select *=3.3V/5V)

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	-12	/	12
Sensitivity (V_{CC}=3.3V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	110	/
Sensitivity (V_{CC}=5V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	166.7	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Bipolar, I_{PR}=0A，V_{CC}=3.3V，Fixed output F	1.64	1.65	1.66
			Bipolar, I_{PR}=0A，V_{CC}=5V，Fixed output F	2.49	2.5	2.51
			Bipolar, I_{PR}=0A, Ratiometric output R	/	V_{CC}*0.5	/
ACCURACY PERFORMANCE						
Tatal Output Error	E_{TOT}	%	I_P=I_{PRmax}，T_A=25°C ~ +125°C	–2.5	±1	2.5
			I_P=I_{PRmax}，T_A=-40°C ~ +25°C	/	±3	/
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + 100 \times V_{OE}$ /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P=I_{PRmax}，T_A=25°C ~ +125°C	–2	±1	2
			I_P=I_{PRmax}，T_A=-40°C ~ +25°C	/	±2.8	/
Offset Error	V_{OE}	mV	I_P=0A，T_A=25°C ~ +125°C	–15	±5	15
			I_P=0A，T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT CHARACTERISTICS						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Total Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

AACS37002D*-AU20FB-T/RB-T DEVICE PERFORMANCE CHARACTERISTIC

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125°C, V_{CC}=5V / 3V

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	-20	/	20
Sensitivity (V_{CC}=3.3V)	Sens	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	66	/
Sensitivity (V_{CC}=5V)	Sens	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	100	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Bipolar, I_{PR}=0A, V_{CC}=3.3V, Fixed output F	1.64	1.65	1.66
			Bipolar, I_{PR}=0A, V_{CC}=5V, Fixed output F	2.49	2.5	2.51
			Bipolar, I_{PR}=0A, Ratiometric output R	/	V_{CC}*0.5	/
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2.5	±1	2.5
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±3	/
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + 100 \times V_{OE}$ /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2	±1	2
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±2.8	/
Offset Error	V_{OE}	mV	I_P=0A, T_A=25°C ~ +125°C	–15	±5	15
			I_P=0A, T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT CHARACTERISTIC						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Total Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

AACS37002D*-AU30FB-T/RB-T DEVICE PERFORMANCE CHARACTERISTICS

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125 (Depending on the supply voltage, select *=3.3V/5V)

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	-30	/	30
Sensitivity (V_{CC}=3.3V)	Sens	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	44	/
Sensitivity (V_{CC}=5V)	Sens	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	66.7	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Bipolar, I_{PR}=0A, V_{CC}=3.3V, Fixed output F	1.64	1.65	1.66
			Bipolar, I_{PR}=0A, V_{CC}=5V, Fixed output F	2.49	2.5	2.51
			Bipolar, I_{PR}=0A, Ratiometric output R	/	V_{CC}*0.5	/
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2.5	±0.8	2.5
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±2.7	/
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + 100 \times V_{OE}$ /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2	±0.7	2
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±2.6	/
Offset Error	V_{OE}	mV	I_P = 0 A, T_A=25°C ~ +125°C	–15	±5	15
			I_P = 0 A, T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT CHARACTERISTIC						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Total Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

AACS37002D*-AU30FU-T/RU-T DEVICE PERFORMANCE CHARACTERISTIC

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125°C, V_{CC}=5V / 3V

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	0	/	30
Sensitivity (V_{CC}=3.3V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	88	/
Sensitivity (V_{CC}=5V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	133.3	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Unipolar, I_{PR}=0A, V_{CC}=3.3V, Fixed output F	0.32	0.33	0.34
			Unipolar, I_{PR}=0A, V_{CC}=5V, Fixed output F	0.49	0.5	0.51
			Unipolar, I_{PR}=0A, Ratiometric output F	/	V_{CC}*0.1	/
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2.5	±0.7	2.5
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±2.5	/
TOTAL OUTPUT ERROR COMPONENTS: E_{TOT} = E_{SENS} + 100 × V_{OE} /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P = I_{PRmax}, V_{CC}=3.3V, T_A=25°C ~ +125°C	–2	±1	2
			I_P = I_{PRmax}, V_{CC}=5V, T_A=25°C ~ +125°C	–2	±0.7	2
			I_P = I_{PRmax}, V_{CC}=3.3V, T_A=-40°C ~ +25°C	/	±2.4	/
			I_P = I_{PRmax}, V_{CC}=5V, T_A=-40°C ~ +25°C	/	±2.6	/
Offset Error	V_{OE}	mV	I_P = I_{PRmax}, V_{CC}=3.3V, T_A=-40°C ~ +125°C	–10	±5	10
			I_P = I_{PRmax}, V_{CC}=5V, T_A=-40°C ~ +125°C	–15	±5	15
			I_P = 0 A, T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT CHARACTERISTIC						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Total Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

AACS37002D*-AU40FB-T/RB-T DEVICE PERFORMANCE CHARACTERISTIC

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125°C, V_{CC}=5V / 3V

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	-40	/	40
Sensitivity (V_{CC}=3.3V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	33	/
Sensitivity (V_{CC}=5V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	50	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Bipolar, I_{PR}=0A, V_{CC}=3.3V, Fixed output F	1.64	1.65	1.66
			Bipolar, I_{PR}=0A, V_{CC}=5V, Fixed output F	2.49	2.5	2.51
			Bipolar, I_{PR}=0A, Ratiometric output R	/	V_{CC}*0.5	/
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	%	I_P=I_{PRmax}, V_{CC}=3.3V, T_A=25°C ~ +125°C	–1.2	±1	1.2
			I_P=I_{PRmax}, V_{CC}=5V, T_A=25°C ~ +125°C	–2.5	±1	2.5
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±3	/
TOTAL OUTPUT ERROR COMPONENTS: E_{TOT} = E_{SENS} + 100 × V_{OE} /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–1	±1	1
			I_P=I_{PRmax}, V_{CC}=3.3V, T_A=-40°C ~ +25°C	/	±2.6	/
			I_P=I_{PRmax}, V_{CC}=5V, T_A=-40°C ~ +25°C	/	±2.8	/
Offset Error	V_{OE}	mV	I_P=0A, V_{CC}=3.3V, T_A=25°C ~ +125°C	–15	±5	15
			I_P=0A, V_{CC}=5V, T_A=25°C ~ +125°C	–15	±5	15
			I_P=0A, T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT CHARACTERISTIC						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Total Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

AACS37002D*-AU50FB-T/RB-T DEVICE PERFORMANCE CHARACTERISTIC

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125°C, V_{CC}=5V / 3V

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	-50	/	50
Sensitivity (V_{CC}=3.3V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	26.4	/
Sensitivity (V_{CC}=5V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	40	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Bipolar, I_{PR}=0A, V_{CC}=3.3V, Fiexed output F	1.64	1.65	1.66
			Bipolar, I_{PR}=0A, V_{CC}=5V, Fiexed output F	2.49	2.5	2.51
			Bipolar, I_{PR}=0A, Ratiometric output R	/	V_{CC}*0.5	/
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	%	I_P=I_{PRmax}, V_{CC}=3.3V, T_A=25°C ~ +125°C	–1.2	±1	1.2
			I_P=I_{PRmax}, V_{CC}=5V, T_A=25°C ~ +125°C	–2.5	±1	2.5
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±3	/
TOTAL OUTPUT ERROR COMPONENTS: $E_{TOT} = E_{SENS} + 100 \times V_{OE}$ /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–1	±1	1
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±2.8	/
Offset Error	V_{OE}	mV	I_P=0 A, T_A=25°C ~ +125°C	–15	±5	15
			I_P=0 A, T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT CHARACTERISTIC						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Taotal Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

AACS37002D*-AU65FB-T/RB-T DEVICE PERFORMANCE CHARACTERISTIC

Unless otherwise noted, all refer to general test conditions: T_A=-40°C ~ +125°C, V_{CC}=5V / 3V

Characteristic	Symbol	Unit	Test Conditions	Min.	Typ.	Max.
NOMINAL PERFORMANCE						
Current Sensing Range	I_{PR}	A	/	-65	/	65
Sensitivity (V_{CC}=3.3V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	20.3	/
Sensitivity (V_{CC}=5V)	*Sens*	mV/A	$I_{PRmin} < I_{PR} < I_{PRmax}$	/	30.8	/
Zero Current Output Voltage	$V_{IOUT(Q)}$	V	Bipolar, I_{PR}=0A, V_{CC}=3.3V, Fiexed output F	1.64	1.65	1.66
			Bipolar, I_{PR}=0A, V_{CC}=5V, Fiexed output F	2.49	2.5	2.51
			Bipolar, I_{PR}=0A, Ratiometric output R	/	V_{CC}*0.5	/
ACCURACY PERFORMANCE						
Total Output Error	E_{TOT}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2.5	±1	2.5
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±3	/
TOTAL OUTPUT ERROR COMPONENT: $E_{TOT} = E_{SENS} + 100 \times V_{OE}$ /(Sens * I_P)						
Sensitivity Error	E_{SENS}	%	I_P=I_{PRmax}, T_A=25°C ~ +125°C	–2	±1	2
			I_P=I_{PRmax}, T_A=-40°C ~ +25°C	/	±2.8	/
Offset Error	V_{OE}	mV	I_P=0A, T_A=25°C ~ +125°C	–15	±5	15
			I_P=0A, T_A=-40°C ~ +25°C	/	±18	/
LIFETIME DRIFT PERFORMANCE						
Sensitivity Error Lifetime Drift	E_{SENS_drift}	%	After reliability test, T_A=25°C	/	±1	/
Total Output Lifetime Drift	E_{TOT_drift}	%	After reliability test, T_A=25°C	/	±1	/

6. PARAMETER DESCRIPTION

6.1 Sensitivity *Sens*

The change in sensor IC output in response to a 1A change through the primary conductor. The sensitivity is the product of the magnetic circuit sensitivity (G/A) (1G = 0.1 mT) and the linear IC amplifier gain (mV/G). The linear IC amplifier gain is programmed at the factory to optimize the sensitivity (mV/A) for the full-scale current of the device.

6.2 Sensitivity error E_{SENS}

Sensitivity error E_{SENS} refers to the percentage deviation between the actual measured sensitivity and the ideal sensitivity.

For example, when V_{CC} = 5V,

$$E_{Sens}=\frac{Sens_{Meas(5V)}-Sens_{Ideal(5V)}}{Sens_{IDEAL(5V)}}\times 100\%$$

6.3 The sensitivity temperature drift of $\Delta Sens_{TC}$ (%)

Over the entire operating temperature range is defined as:

$$\Delta SensT_C=\frac{SensTA-Sens_{EXPECTED(TA)}}{Sens_{EXPECTED(TA)}}\times 100\%$$

6.4 Senturation output voltage $V_{OUT\text{-}SAT(H/L)}$

When I_{OUT}=**2.0/0.5mA**, $V_{OUT\text{-}SAT(H)}$ is the maximum output of the chip under the positive(negative) magnetic fields.

6.5 Zero current output voltage $V_{IOUT(Q)}$

I_p=**0**, Output voltage of the sensor $V_{IOUT(Q)}$.

For bipolar devices, the output voltage $V_{IOUT(Q)}=V_{CC}\times 0.5$,

For unipolar devices, the output voltage $V_{IOUT(Q)}=V_{CC}\times 0.1$.

Variation in $V_{IOUT(Q)}$ can be attributed to the resolution of the linear IC quiescent voltage trim and thermal drift.

6.6 Offset voltage V_{OE}

Used to measure the influence of external non-magnetic factors. Under zero-current conditions, in ratiometric output mode, it is the difference between the actual output voltage and the theoretical output voltage. In fixed output mode, it is the difference between the actual output voltage and the actual V_{REF} voltage.

6.7 Offset temperature drift $V_{OUT(Q)TC}$ (V)

Due to internal circuit tolerance and heat dissipation, static output voltage due to internal circuit tolerance and heat dissipation $V_{OUT(Q)}$ differential static output voltage V_{OE}. May shift with operating temperature $V_{OUT(Q)TC}$.

Defined:

$$\Delta V_{OUT(Q)T_C}=V_{OUT(Q)(TA)}-V_{OUT(Q)EXPECTED(TA)}$$

$V_{OUT(Q)TC}$ should be calculated using actual measurements versus predicted values, not programmed target values.

6.8 Noise V_N

Noise is the macroscopic sum of thermal noise and shot noise inside the current sensor.

Dividing the noise (mV) by the sensitivity (mV/A) gives the smallest current that the device can resolve.

6.9 Symmetry E_{SYM}

Definition: The relationship between the actual output voltage $V_{IOUT(Q)}$ and the forward half-range $V_{IOUT+\text{half-scale amperes}}$ and reverse half-range $V_{IOUT-\text{ half-scale amperes}}$ outputs.

The formula is defined as follows:

$$E_{SYM}=100\%\times\left(\frac{V_{IOUT+\text{half-scale amperes}}-V_{IOUT(Q)}}{V_{IOUT(Q)}-V_{IOUT-\text{half-scale amperes}}}\right)$$

6.10 Nonlinearity E_{LIN}

The design output of the device varies linearly with the measured current.

Ideally, under the same supply voltage and ambient temperature conditions, the output sensitivity of the device is the same for two different current sizes I1(half scale current) and I2(full scale current). In practical application, there is a difference in sensitivity for the measurement of two different current sizes I1 and I2, and nonlinear sensitivity error E_{LIN} describes the difference digitally.
In the chip, positive current nonlinearity E_{LINPOS} and negative current nonlinearity E_{LINNEG} are defined as follows:

$$E_{LINPOS}=100\,(\%)\times\{1-(Sens_{IPOS2}\,/\,Sens_{IPOS1})\}$$

$$E_{LINNEG}=100\,(\%)\times\{1-(Sens_{INEG2}/\,Sens_{INEG1})\}$$

When

$$Sens_{Ix}=\left(V_{IOUT(Ix)}-V_{IOUT(Q)}\right)/\,Ix$$

I_{POSx}、I_{NEGx} is positive current and negative current

$$I_{POS2}=2\times I_{POS1}\quad,\quad I_{NEG2}=2\times I_{NEG1}$$

Due to the hysteresis effect of the magnetic core, there is magnetic saturation at high currents, so when the measured current exceeds 200A, the nonlinear error increases.
[Reference sensitivity error]

6.11 Proportional output sensitivity error S_{ERR}

The proportional output sensitivity error S_{ERR} is defined based on the supply voltage Vcc:

S_{ERR}=*(1-(Sens*$_{Vcc}$*/Sens*$_{5V}$*)/(Vcc/5V))×100%*

S_{ERR}=*(1-(Sens*$_{Vcc}$*/Sens*$_{3.3V}$ *)/(Vcc/3.3V))×100%*

Proportional output error of static voltage V_{0zero}

Error between the ratio of V_{out1} and V_{out0} value at V_{CC}=5V and the theoretical ratio when Vcc varies from 4.5V to 5.5V,or at V_{CC}=3.3V and the theoretical ratio when V_{CC} varies from 3.0V to 3.6V.

V_{0zero}=*(1-(Vout1/Vout0)/(*V_{CC}*/5V))×100%*

V_{0zero}=*(1-(Vout1/Vout0)/(*V_{CC}*/3.3V))×100%*

6. PARAMETER DESCRIPTION (CONTINUED)

6.12 Non-linearity Error ρ [%F.S.] (%)

Definition: The ratio of the maximum vertical difference between the B-Vout curve (fitted by the least squares method) and the measured curve, to the full scale output voltage difference(VH-VL).

Non-linearity Error is calculated as:

$$\rho=100*MFD/F.S.=100*MFD/(V_H-V_L)$$

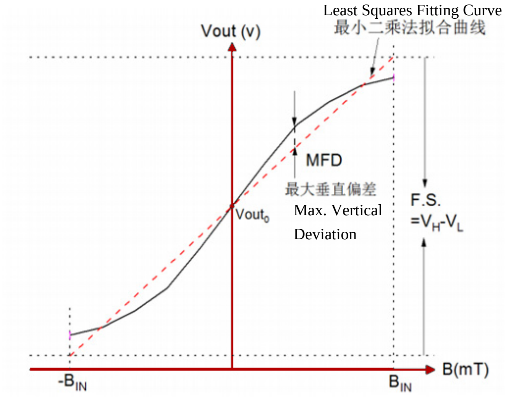


Figure 4. Schematic diagram of linearity calculation

6.13 Magnetic Offset Error(I_{ERROM})

The magnetic offset is a consequence of the residual magnetism inherent to the chip material. The magnitude of the magnetic offset error is greatest when the magnetic circuit is saturated and is typically greatest when the device is at full scale or under conditions of current overload. The magnetic offset error is highly dependent on the core material, with lower temperatures generally resulting in higher magnetic offset error.

6.14 Total output error E_{TOT}

The difference between the current measurement from the sensor IC and the actual current (I_P), relative to the actual current. This is equivalent to the difference between the ideal output voltage and the actual output voltage,divided by the ideal sensitivity, relative to the current flowing through the primary conduction path:

$$E_{TOT\,(I_P)}=+\frac{V_{IOUT}\,(I_P)-V_{IOUT(ideal)(I_P)}}{Sens_{\varphi(ideal)}\times I_{PM}}\times 100\%$$

Where: Total output error E_{TOT} contains all error sources and is a function of IP.

$$V_{IOUT\,(ideal)(IP)}=V_{IOUT\,(Q)}+(Sens_{IDEAL}\times I_P)$$

At relatively large current, E_{TOT} is mainly sensitivity error, while at relatively small current, E_{TOT} is mainly zero current sensitivity error voltage V_{OE}. As I_P approaches zero, E_{TOT} approaches infinity due to the bias voltage.

6.15 Dynamic Response Characteristic

6.15.1 Power-on Delay (T_{POD})

When the power supply is raised to the operating voltage, the device requires a limited period of time to power the internal components before it can respond to the measured magnetic field. T_{POD} is defined as the time required for the output voltage to stabilise within a stable value after the power supply reaches its minimum specified operating voltage, Vcc, under the action of an applied magnetic field, as shown in Figure 5:

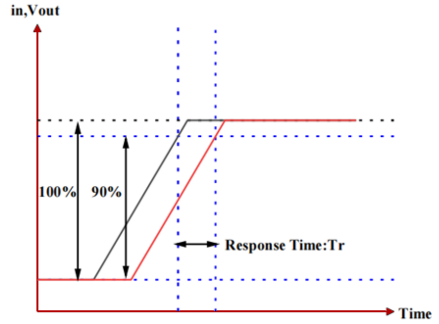


Figure 5. Schematic definition of dynamic response characteristics by time

6.15.2 Rise time (T_r)

The time interval between the sensor output voltage reaches 10% of its full-scale value and it reaches 90% of its full-scale value.

6.15.3 Propagation delay (T_{PROP})

The time interval between the sensed primary current reaches 20% of its final value and the sensor output voltage reaches 20% of its full-scale value.

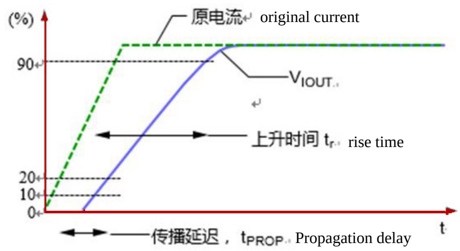


Figure 6. Rise Time (T_R) & Propagation Delay(T_{PROP})

6.15.4 Response Time ($T_{RESPONSE}$)

The time interval between the sensed primary current reaches 90% of its final value and the sensor output voltage reaches 90% of its full-scale value.

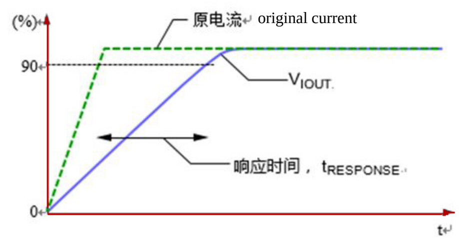
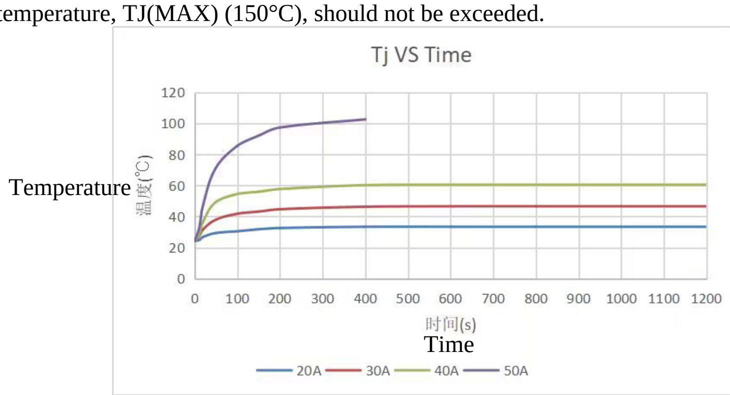


Figure 7. Response Time ($T_{RESPONSE}$)

7. CHARACTERISTIC PERFORMANCE DATA

The temperature rise of the sensor, PCB and solder joints due to the conduction current should be considered in any current sensing system. Temperature rise depends mainly on PCB layout, copper foil thickness, cooling technology and current profile, which includes peak current, current ‘on-time’ and ‘duty cycle’.

Although this data is collected using direct current (DC), this temperature profile can be used to estimate the temperature rise of the sensor under AC, and pulsed currents. The specific temperature rise is verified by the user under application-specific conditions ensuring that the maximum junction temperature, TJ(MAX) (150°C), should not be exceeded.



Test Conditions: T_A=25℃, No external cooling, input DC test for 20 minutes.

Figure 8. Temperature Rise Diagram

8. PACKAGE OUTLINE DRAWING

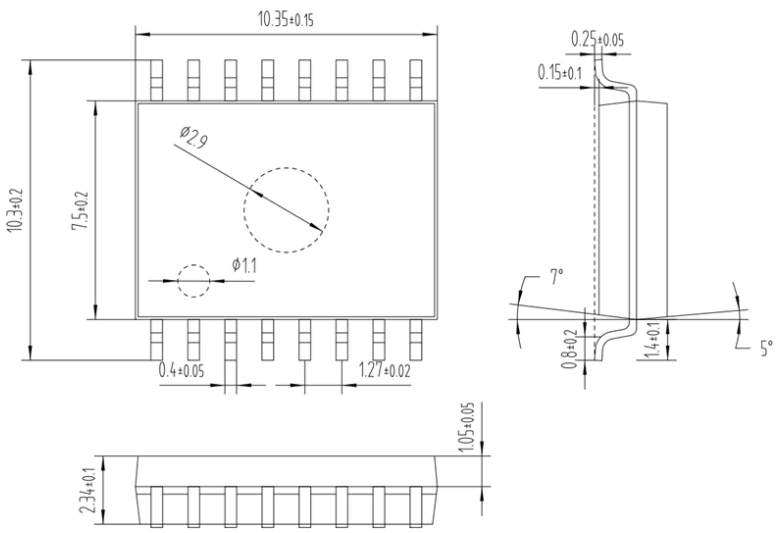


Figure 9. Package Outline **16-PIN SOIC**

9. PACKAGE AND STORAGE

9.1 Packaging specification

Reel & tube packing, 1000pcs/reel

9.2 Storage methods

9.2.1 Product should be stored at an appropriate temperature and humidity (5°C to 35°C, 40%RH to 85%RH) after the unsealing of the MBB. Keeping products away from chlorine and corrosive gas.

9.2.2 Prolonged storage, even under proper conditions, may result in degradation of the solderability and electrical properties of the product. For products that have been stored for a long period of time, their solderability should be checked before use.

9.2.3 Product are sealed in MBB with a desiccant. It is recommended to store in nitrogen atmosphere with MBB sealed. Oxygen and H2O of atmosphere oxidizes leads of products and lead solder ability get worse.

10. SAFETY WARNING

10.1 This product is sensitive to ESD (electrostatic discharge). When contacting Hall elements marked with ESD Caution the environmental requirements are as follows:

10.1.1 Electrostatic charges are unlikely to occur in the environment (for example, the relative humidity exceeds 40%RH).

10.1. 2 Wear anti-static clothing and wrist strap when touching products.

10.1. 3 Implement anti-static measures for equipment or containers that are in direct contact with products.

10.2 Do not turn the product into gas, powder or liquid by burning, crushing or chemical treatment.

10.3 Please abide by the laws and company regulations when discarding this product.