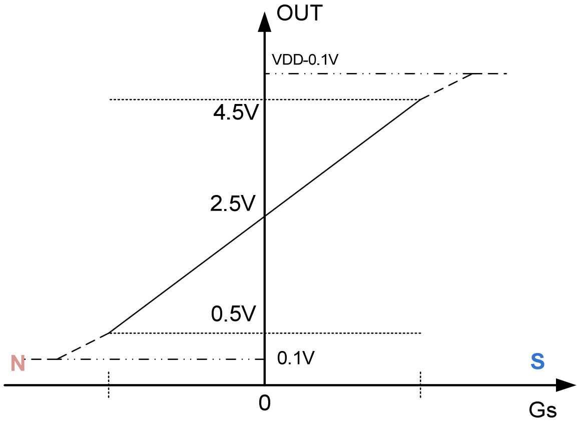
Programmable Linear Output Hall Effect Sensor

Features

- Ratiometric rail-to-rail output
- Programmability at end-of-line
- Wide sensitivity range
  - 8mV/Gs to 24mV/Gs
- Temperature-stable quiescent voltage output and sensitivity
- Output voltage and sensitivity are independent with VDD over the range of 4.5V—5.5V
- Wide ambient temperature range: -40℃ to 150℃
- Resistant to mechanical stress
- Under voltage lock-out (UVLO)
- Precise recoverability after temperature cycling
- 3-pin SIP package for easy integration

Output state



Applications

- Current sensor for solar energy will flow box
- Angular position
- Over current detection circuit
- Damper controls

Description

The SC4616 is designed specifically for angular position, and DC current measurement etc. The accuracy of this device is enhanced via programmability on the output pin for end-of-line optimization without the added complexity and cost of a fully programmable device. The programmable nature of the SC4616 enables it to acount for manufacturing tolerances in the final current sensing module assembly.

This ratiometric Hall effect device provides a voltage output that is proportional to the applied magnetic field. Both the quiescent voltage output and magnetic sensitivity are user adjustable. The quiescent voltage output can be set to 2.5V, and the sensitivity adjusted between 8.0 mV/Gs and 24.0 mV/Gs. Programming selections also exist for output polarity and temperature compensation.

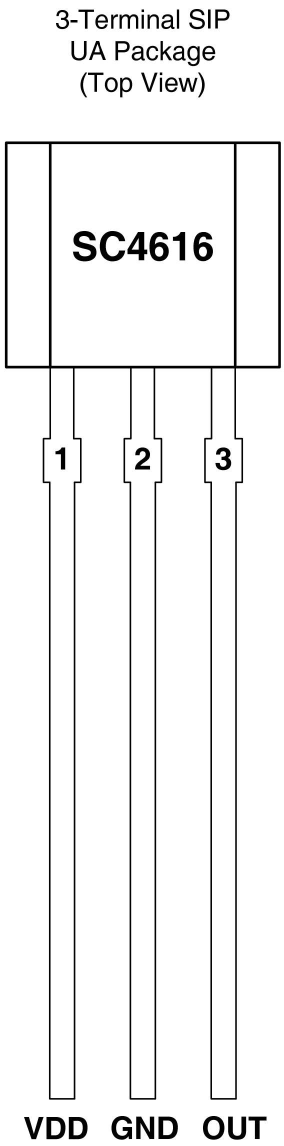
Each Bi-CMOS monolithic circuit integrates a Hall element, temperature-compensating circuitry to reduce the intrinsic sensitivity drift of the Hall element, a small-signal high-gain amplifier, a low-impedance output stage, a proprietary dynamic offset cancellation technique and trimming unit.

It is packaged in a thin 3-pin SIP package to allow for easy integration with a magnetic core to create a highly accurate current sensing module.

Device Information

Part Number	Packing	Mounting	Ambient, T_A	Marking
SC4616UA	Bulk, 1000 pieces/bag	SIP3	-40℃ to 150℃	4616

Terminal configuration and functions



Terminal		Type	Description
Name	Number		
VDD	1	PWR	4.5V to 5.5 V power supply
GND	2	Ground	Ground terminal
OUT	3	OUT	Push-Pull Output

Absolute Maximum Ratings

over operating free-air temperature range

Parameter	Symbol	Min.	Max.	Unit
Power supply voltage	V_{DD}	-0.5	6.0	V
Output terminal voltage	V_{OUT}	-0.3	6.0	V
Supply current	I_{DD}	--	20	mA
Output current	I_{OUT}	--	3	mA
Operating ambient temperature	T_A	-40	125	℃
Operating junction temperature	T_J	-50	165	℃
Storage temperature	T_{STG}	-65	170	℃

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.

ESD Protection

Human Body Model (HBM) tests according to: standard EIA/JESD22-A114-B HBM

Parameter	Symbol	Min.	Max.	Units
HBM ESD stress voltage	V_{ESD}	-4000	4000	V
MM ESD stress voltage		-400	400	V

Electrical Characteristics

T_A = -40℃ to 125 ℃ V_{DD} = 5V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Electrical Characteristics						
Supply Voltage	V_{DD}	Operating voltage	4.5	5	5.5	V
Supply Current	I_{DD}	V_{DD}=5.0V, T_A=25℃	3.0	5.0	9.0	mA
Under-voltage Threshold[1]	V_{UVLOHI}	T_A = 25℃	--	4.0	--	V
	$V_{UVLOLOW}$	T_A = 25℃	--	3.7	--	V
Power-On Time[2]	t_{PO}	T_A = 25℃, V_{OUT} to 2.5V	--	6.0	10	uS
Internal Bandwidth	BW_I	Output signal -3dB	3.0	5.0	--	kHz
Chopping Frequency[3]	f_C	T_A = 25℃	--	500	--	kHz
Output Characteristics						
Output Load Capacitance	C_L	VOUT to GND	--	--	10	nF
Output Load Capability	I_{Source}	V_{OUT} to V_{DD}	1.0	--	--	mA
	I_{Sink}	V_{OUT} to GND	1.5	--	--	mA
Output Voltage Range	$V_{OUT(H)}$	T_A=25℃, B=1000Gs	4.8	4.9	4.99	V
	$V_{OUT(L)}$	T_A=25℃, B=-1000Gs	0.01	0.1	0.2	V
Step Response Time	t_{RESP}	Delay the output signal reaching 90%	120	200	--	uS
Output Referred Noise[4]	V_N	T_A=25℃, Sens=16.0mV/Gs	--	30	--	$mV_{(p-p)}$
Pre-Programming Target						
Pre-Programming Quiescent Voltage Output	$V_{OUT(Q)init}$	T_A=25℃, B=0 Gs	--	2.5	--	V
Pre-Programming Sensitivity	$Sens_{init}$	T_A=25℃	--	8.0	--	mV/Gs
Linearity Sensitivity Error	Lin_{ERR}		--	1.0	--	%

[1] On power-up, the output of the SC4616 will be held low until V_{DD} exceeds V_{UVLOHI}. Once powered, the output will remain valid unitl V_{DD} drops below V_{UVLOLO} when the output will be pulled low

[2] See Characteristic Definitions

[3] f_C varies up to approximately 20% over the full operating ambient temperature range and process

[4] Values is derived as 6 sigma value from the spectral noise density.

Electrical Characteristics (continued)

Quiescent Voltage Output programming						
Quiescent Voltage Output Range	$V_{OUT(Q)}$	B=0 Gs, T_A=25℃	2.4	2.5	2.6	V
Quiescent Voltage Output Programming Bits			--	6	--	Bits
Average Quiescent Voltage Output Step Size	$Step_{V(Q)}$	T_A=25℃	--	4	--	mV
Sensitivity Programming						
Sensitivity Range	Sens	T_A=25℃	8.0		24	mV/Gs
Sensitivity Programming Bits				9		Bits
Average Sensitivity Step Size	$Step_{SEN}$	T_A=25℃	--	40	--	uV/Gs
Drift Characteristics						
Quiescent Voltage Ouput Drift	$\triangle V_{OUT(Q)}$	Sens=10.0mV/Gs	--	20	40	mV
Sensitivity Drift	△Sens	Sens=10.0mV/Gs	--	2	--	%

Function Description Overview

Power-On Time: When the supply is ramped to its operating voltage, the device output requires a finite time to react to an input magnetic field. Power-On Time is defined as the time it takes for the output voltage to begin responding to an applied magnetic fild after the power supply has reached its minimum specified operating voltage, V_{DD}(min).

Quiescent output voltage: In the quiescent state (that is, with no significant magnetic field: B=0), the output, $V_{OUT(Q)}$, equals a ratio of the supply voltage, V_{DD}, thoughout the entire operating range of V_{DD} and the ambient temperature, TA.

Quiescent output voltage drift through temperature range: Due to internal component tolerances and thermal considerations, the quiescent voltage output may drift from its nominal value through the operating ambient temperature. For purposes of specificantion, the quiescent output voltage drift through temperature range, $\Delta \mathbf{V}_{\mathbf{OUT(Q)}}$ is defined as:

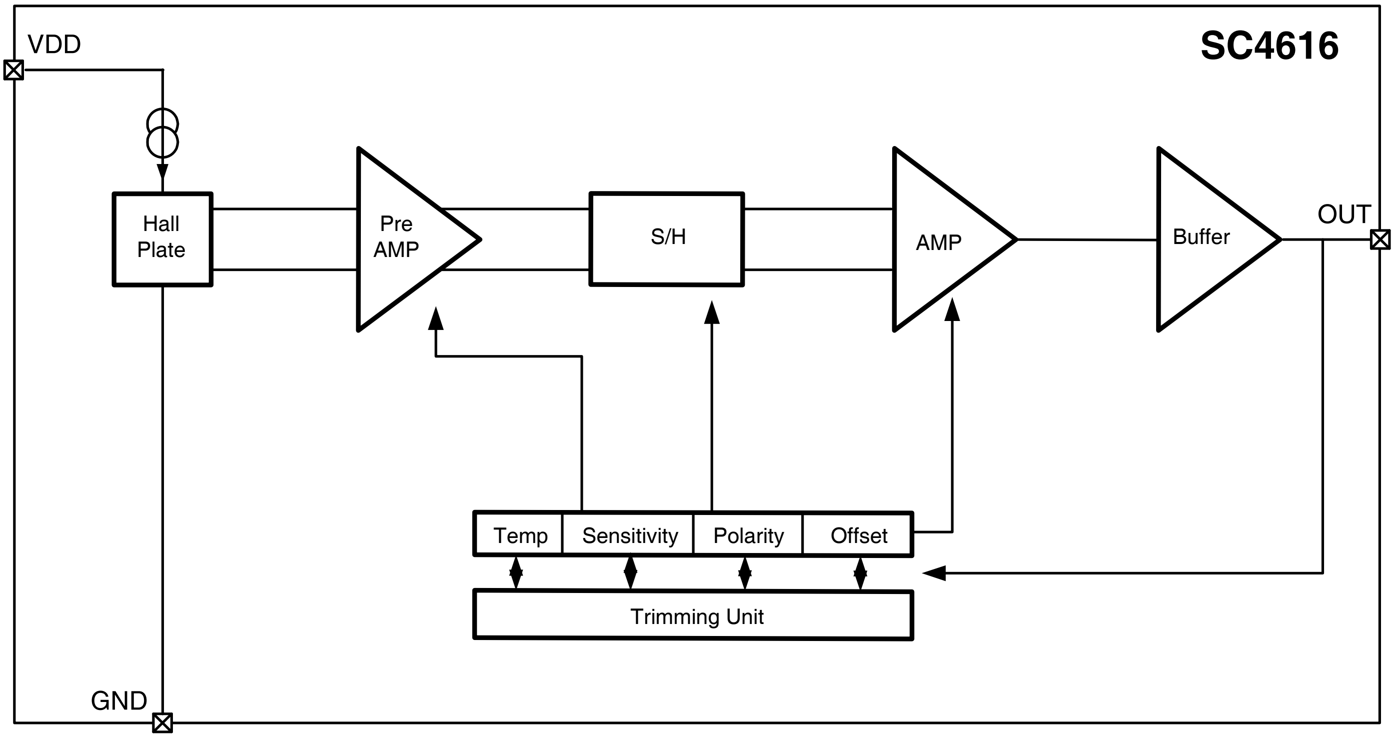
$$\Delta V_{OUT(Q)} = \Delta V_{OUT(Q)TA} - \Delta V_{OUT(Q)25℃}$$

Sensitivity: The presence of a South polarity magnetic field perpendicular to the branded surface of the package increases the output voltage from its quiescent value toward the supply voltage rail. The amount of the output voltage increase is proportional to the magnitude of the magnetic field applied. Conversely, the application of a North polarity field will decrease the output voltage from its quiescent value. This proportionality is specified as the magnetic sensitivity, Sens (mV/Gs), of the device and is defined as:

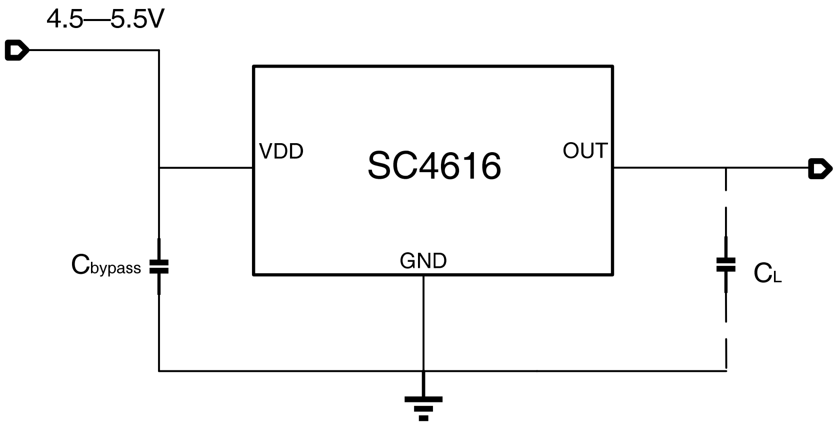
$$Sens = \frac{\mathrm{VOUT(B+)} - \mathrm{VOUT(B-)}}{\mathrm{B(+)} - \mathrm{B(-)}}$$

Where B(+) and B(-) are two magnetic fields with opposite polarities.

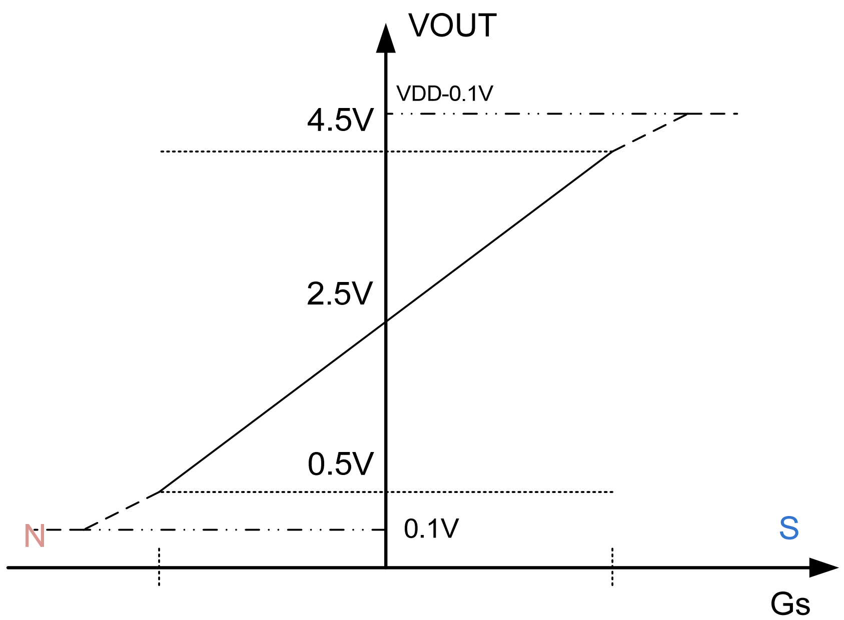
Functional Block Diagram



Typical Application Drawing



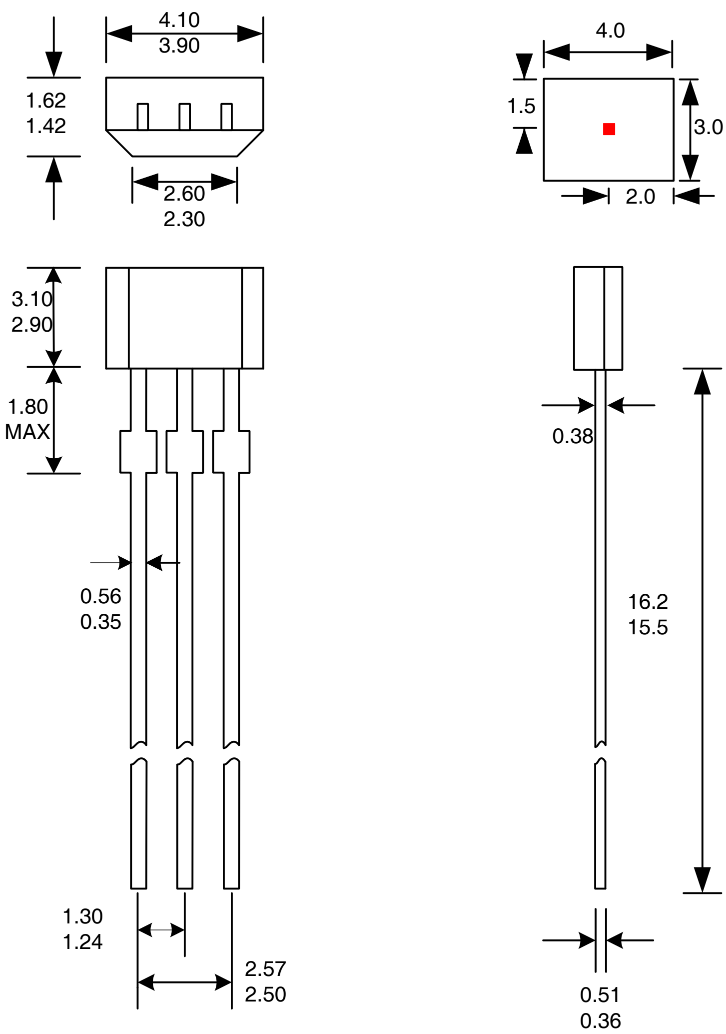
In the quiescent state (that is, with no significant magnetic field: B=0), the output, $V_{OUT(Q)}$, equals to half of the supply voltage, V_{DD}, throughout the entire operating range of V_{DD}. The presence of a South polarity magnetic field perpendicular to the branded surface of the package increases the output voltage from its quiescent value toward the supply voltage rail. The amount of the output voltage increase is proportional to the magnitude of the magnetic field applied. Conversely, the application of a North polarity field will decrease the output voltage from its quiescent value. This proportionality is specified as the magnetic sensitivity, Sens (mV/Gs), of the device.



Mechanical Dimensions

3-Terminal
UA Package

Dimension:mm



Notes:
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.