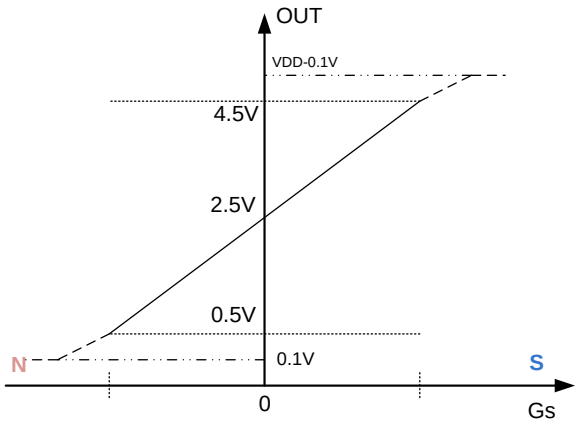
High Frequence and Low Noise Programmable Linear Output Hall Effect Sensor

Features

- Ratiometric rail-to-rail output
- Programmability at end-of-line
- Wide device bandwidth, 150kHz (Typ.)
- Low noise, 20 mV(p-p) (Typ. Sen=1.0 mV/Gs)
- Wide sensitivity range
  - 0.64mV/Gs to 6.4mV/Gs
- Wide ambient temperature range
  - -40℃ to 150℃
- Resistant to mechanical stress
- 3-pin SIP and SOT89-3 package are available

Output state



Applications

- BLDC motor current monitoring
- Over current detection
- Weight and liquid level sensing
- Angular position
- Damper controls

Description

The SC4621 is designed specifically for angular position, over current detection and AC/DC current measurement which require both high accuracy and increased sensor bandwidth. 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 SC4621 enables it to acount for manufacturing tolerances in the final current sensing module assembly.

Both the quiescent voltage output and magnetic sensitivity are user adjustable. The quiescent voltage output is typically equal to $V_{DD}/2$, and the sensitivity adjusted between 0.64 mV/Gs and 6.4 mV/Gs.

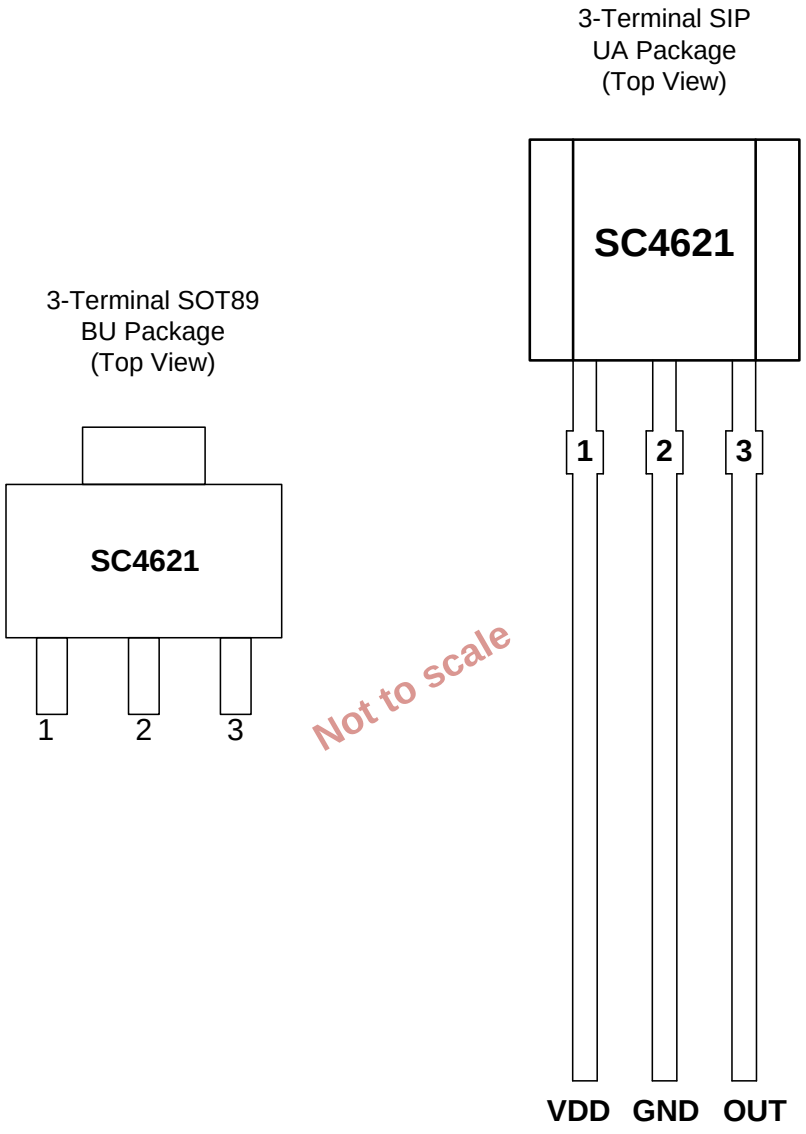
Each Bi-CMOS monolithic circuit integrates a Hall element, temperature-compensating circuitry to reduce the intrinsic sensitivity drift of the Hall element, a small-signal high-gain amplifier, a low-impedance output stage, a proprietary dynamic offset cancellation technique and trimming unit.

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
SC4621UA	Bulk, 1000 pieces/bag	3-pin SIP	-40℃ to 150℃	4621
SC4621BU	Bulk, 1000 pieces/reel	3-pin SOT89	-40℃ to 150℃	4621

Terminal configuration and functions



Terminal Functions

Terminal		Type	Description
Name	Number		
VDD	1	PWR	Power supply
GND	2	Ground	Ground terminal
OUT	3	OUT	Output terminal

Absolute Maximum Ratings

over operating free-air temperature range

Parameter	Symbol	Min.	Max.	Unit
Power supply voltage	V_{DD}	-10.5	10.5	V
Output terminal voltage	V_{OUT}	-0.3	10.5	V
Supply current	I_{DD}	--	20	mA
Output current	I_{OUT}	--	3	mA
Operating ambient temperature	T_A	-40	150	℃
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 in High Sensitivity Range	V_{DDH}	Sens=1.5 to 6.4mV/Gs	4.5	5	5.5	V
Supply Voltage in Low Sensitivity Range	V_{DDL}	Sens=0.64 to 1.5mV/Gs	3.3	5	5.5	V
Supply Current in High Sensitivity Range	I_{DDH}	V_{DD}=5.0V, T_A=25℃	7.0	11.0	15.0	mA
Supply Current in Low Sensitivity Range	I_{DDL}	V_{DD}=5.0V, T_A=25℃	4.0	7.0	10.0	mA
Power-On Time[1]	t_{PO}	T_A = 25℃, V_{DD} = 5.0V	--	5.0	10	uS
Internal Bandwidth	BW_I	Output signal -3dB	100	150	--	kHz
Output Characteristics						
Output Load Capacitance	C_L	VOUT to GND	--	--	1.0	nF
Output Capability	I_{Source}	V_{OUT} to V_{DD}	--	2.0	3.0	mA
	I_{Sink}	V_{OUT} to GND	--	1.5	2.0	mA
Output Voltage Range	$V_{OUT(H)}$	T_A=25℃, B=Max	4.65	4.75	--	V
	$V_{OUT(L)}$	T_A=25℃, B=-Max	--	0.25	0.35	V
Response Time	t_{RESP}	Delay time of the output signal reaching 90%	--	3.0	--	uS
Output Referred Noise[2]	V_N	T_A=25℃, Sens=1.0mV/Gs	--	20	40	$mV_{(p-p)}$
Pre-Programming Target						
Pre-Programming Quiescent Voltage Output	$V_{OUT(Q)init}$	T_A=25℃, B=0 Gs	2.48	2.5	2.52	V
Pre-Programming Sensitivity	$Sens_{init}$	T_A=25℃	--	1.5	--	mV/Gs
Linearity Sensitivity Error	Lin_{ERR}	T_A=25℃	--	1.0	--	%

[1] See Characteristic Definitions

[2] 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℃	0.5	2.5	4.5	V
Quiescent Voltage Output Programming Bits			--	10	--	Bits
Average Quiescent Voltage Output Step Size	$Step_{V(Q)}$	T_A=25℃	--	4	--	mV
Sensitivity Programming						
Sensitivity Range	Sens	T_A=25℃	0.64		6.4	mV/Gs
Sensitivity Programming Bits				9		Bits
Average Sensitivity Step Size	$Step_{SEN}$	T_A=25℃	--	0.25	--	%
Drift Characteristics						
Quiescent Voltage Ouput Drift	$\triangle V_{OUT(Q)}$	T_A=-40℃ to 125℃	--	10	20	Gs
Sensitivity Drift	△Sens	Sens=2.0mV/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, $\Delta V_{OUT(Q)}$ is defined as:

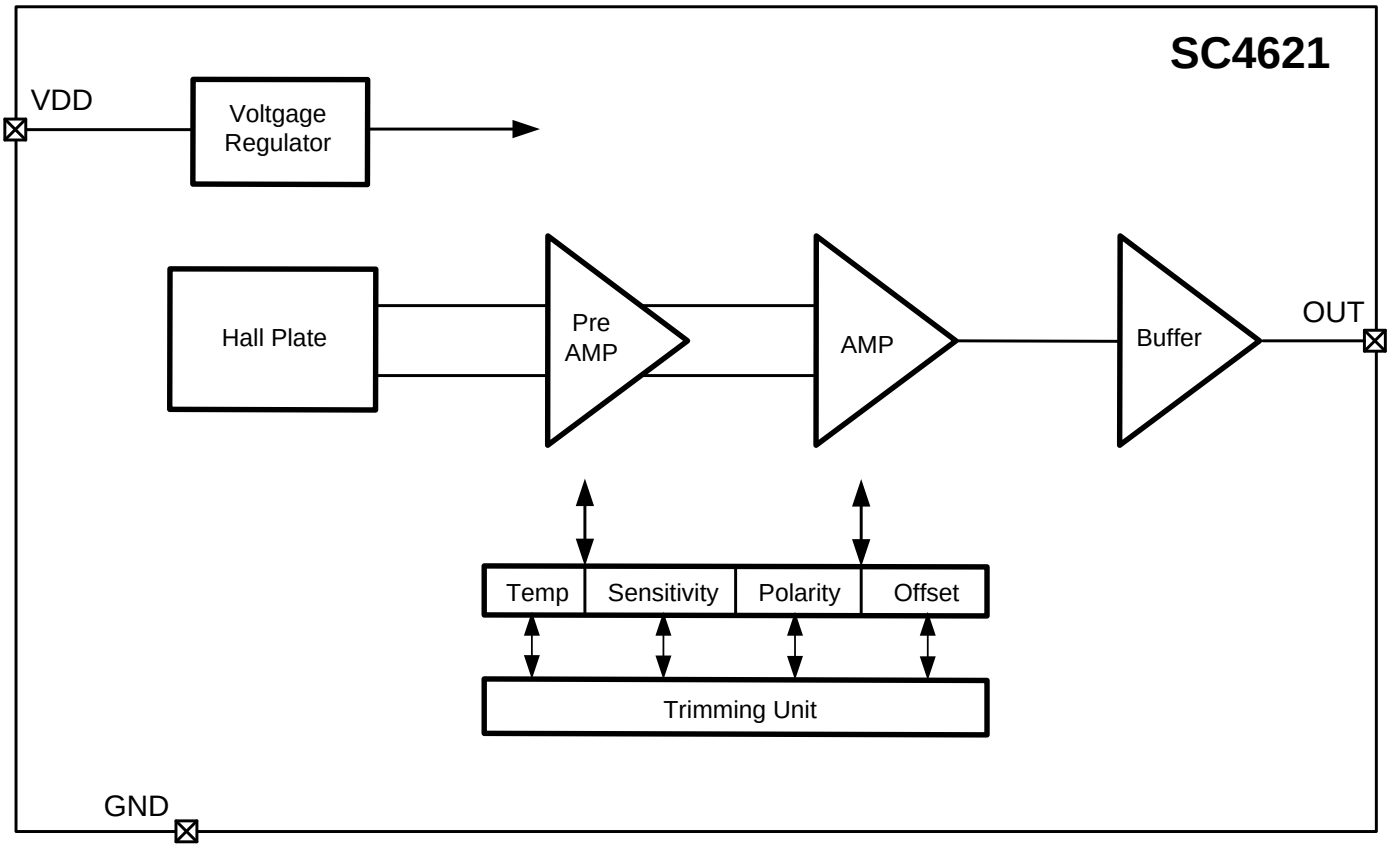
$$\Delta V_{OUT(Q)} = \Delta V_{OUT(Q)TA} - \Delta V_{OUT(Q)25℃}$$

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:

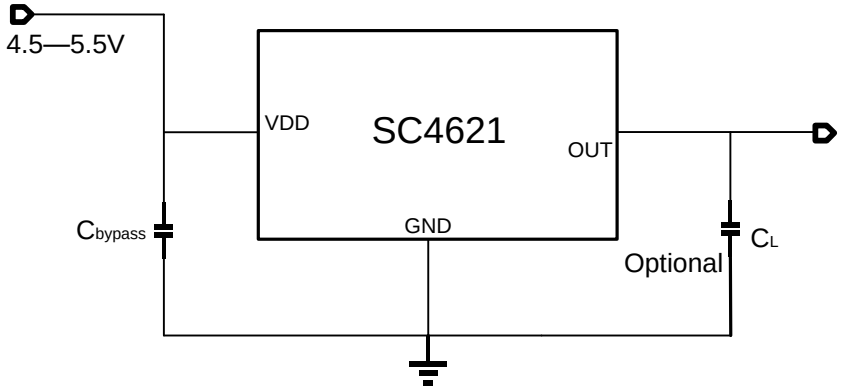
$$Sens = \frac{\mathrm{VOUT(B+)} - \mathrm{VOUT(B-)}}{\mathrm{B(+)} - \mathrm{B(-)}}$$

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

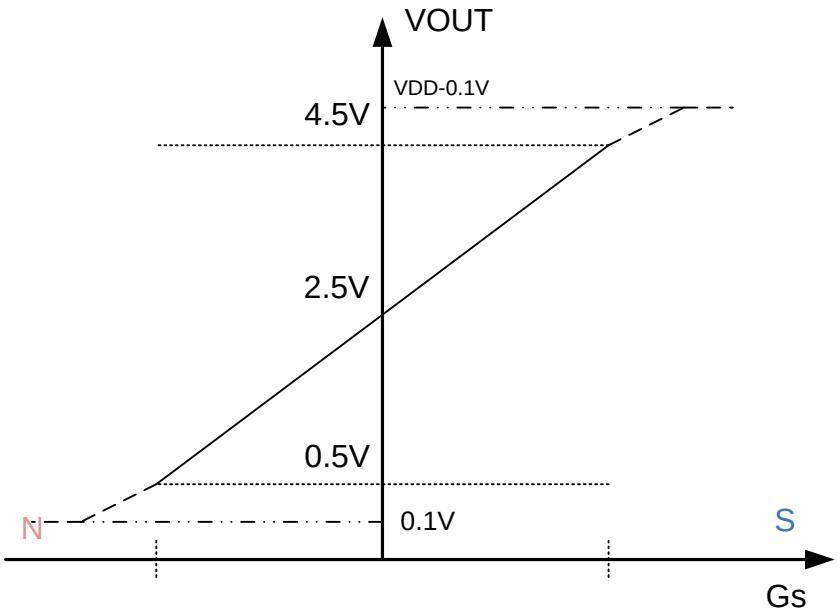
Functional Block Diagram



Typical Application Drawing



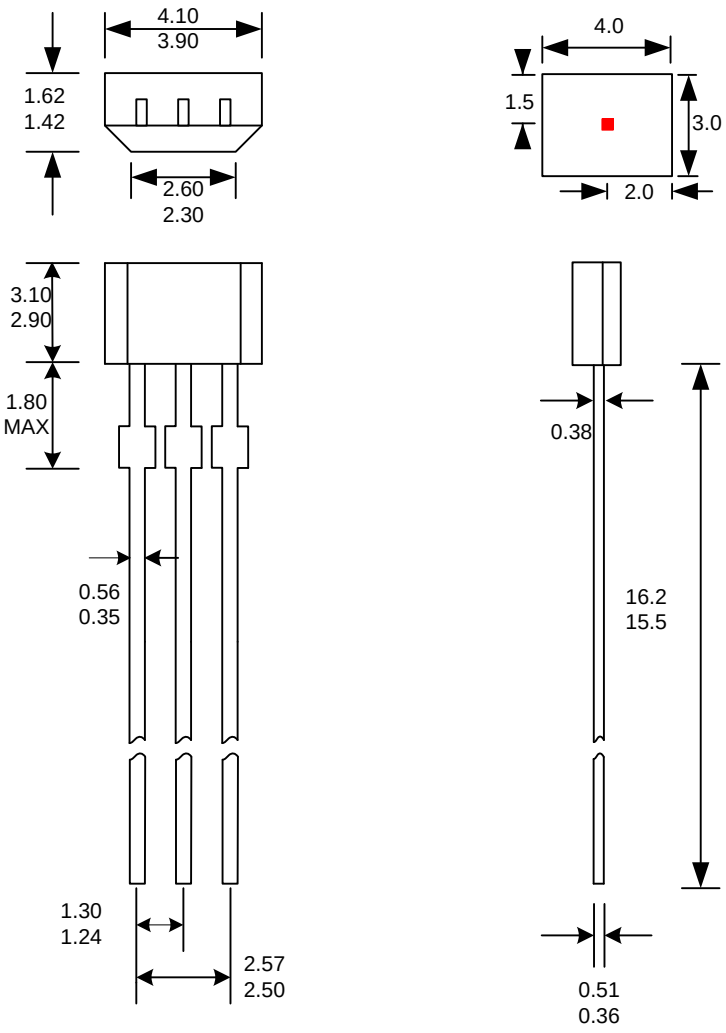
In the quiescent state (that is, with no significant magnetic field: B=0), the output, $V_{OUT(Q)}$, equals to half of the supply voltage, V_{DD}, throughout the entire operating range of V_{DD}. The presence of a South polarity magnetic field perpendicular to the branded surface of the package increases 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.



Package Designator

3-Terminal
UA Package

Dimension:mm



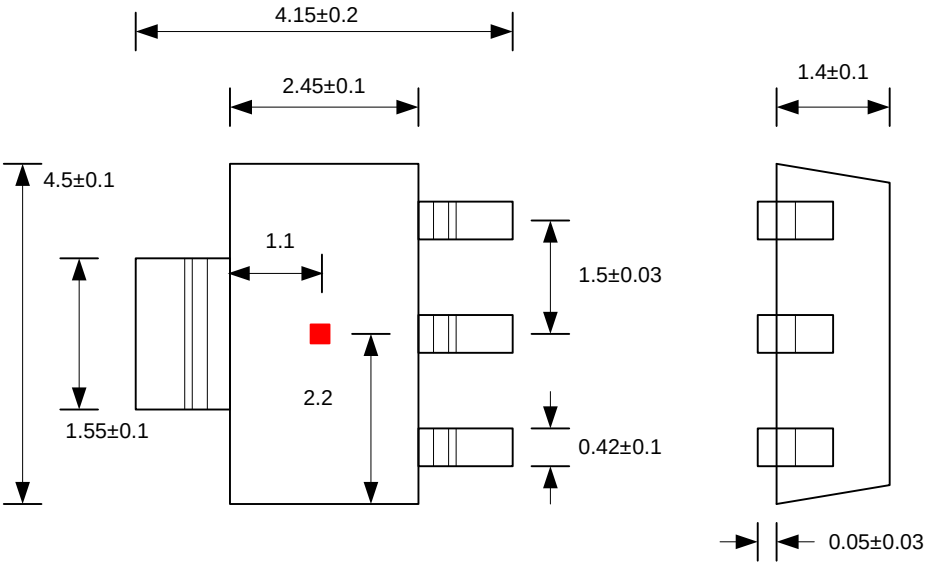
Notes:
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

Package Designator

4-Terminal
BU Package

Dimention: 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.