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1.Introduction

1.1 Features

- High operating bandwidth: DC to 240 kHz
- Background dynamic offset compensation and factory-programmed temperature compensation provides ±15mV offset and 1% sensitivity drift
- High performance sensor frontend guarantees low noise and high resolution
- Wide temperature range: -40℃ to 150℃

1.2 Applications

- Current sensing in high frequency inverters and DC/DC converters
- Brush-less DC motors
- Position sensing

1.3 Description

The SiD6901 is a programmable linear Hall-effect sensor IC with on-chip Hall and temperature sensors. It features with temperature stable Hall signal conditioning chains with background dynamic offset and package stress compensation. The sensor offers a high bandwidth up to 240 kHz and a fast response time of 2 µs. The sensitivity and offset drift is 1% and 20mV over wide temperature range from -40℃ to 150℃.

The on-chip Hall sensor converts the magnetic flux through the chip to Hall signal voltage. The internal signal conditioning chain amplifies the voltage with the predefined gain. The undervoltage detection, overvoltage detection, power-on reset, output clamps and build-in diagnostic test make it suitable for safety-critical automotive applications.

2.Functional description

2.1 Pin configuration (Top view)

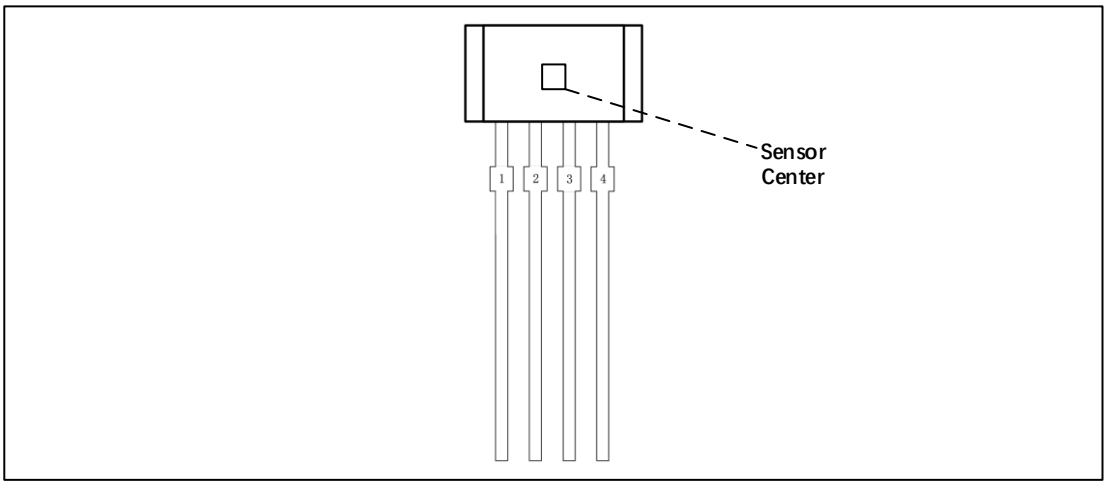


Fig.1 Pin Configuration and Center of Sensitive Area

Table 1 Pin Description

Pin name	Number	Function
VCC	1	Supply voltage
GND	2	Ground
VOUT	3	Output voltage
VREF/NC	4	Reference voltage/NC

2.2 Block diagram

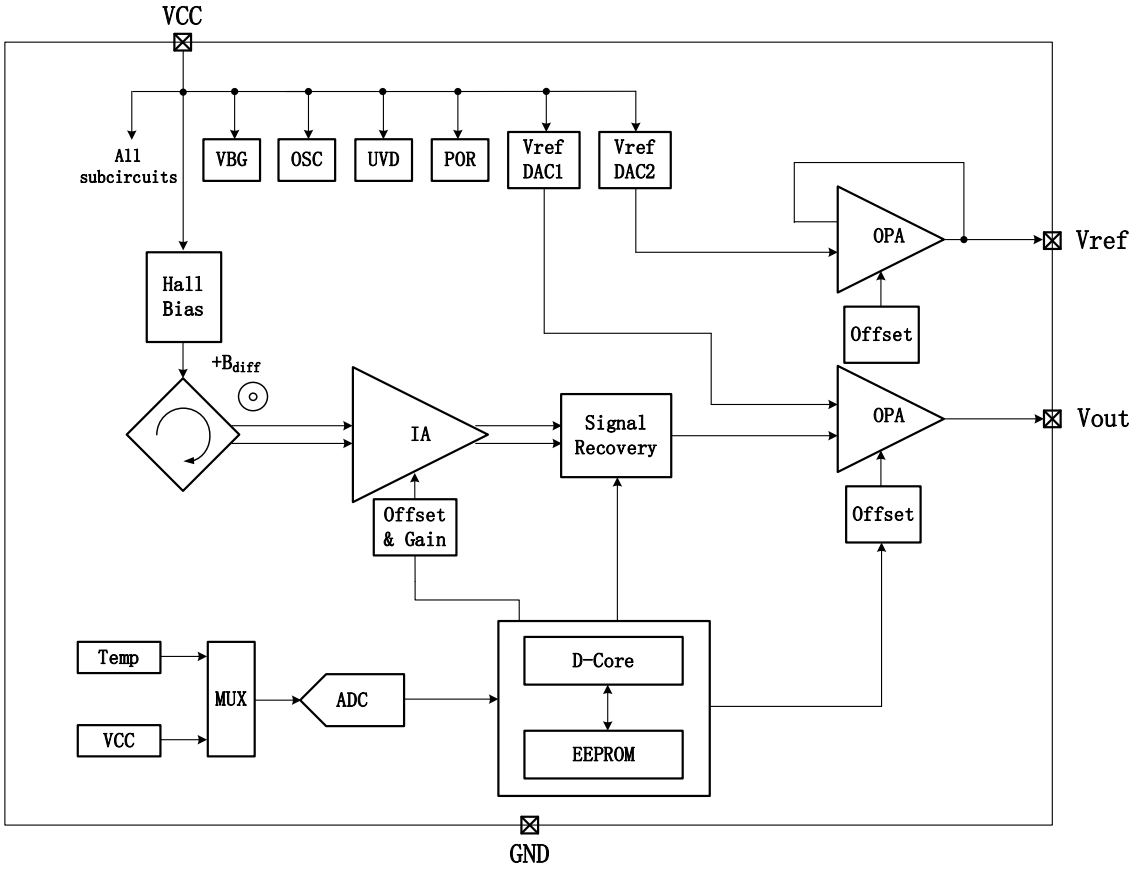


Fig.2 Functional Block Diagram SiD6901

The sensor IC is shown in Fig.2. The main path comprises a Hall probe, signal chain with instrumentation amplifier (IA), signal recovery circuit and operational amplifier (OPA). The background dynamic offset compensation circuits in signal chain and Hall probe continuously null out the Hall offset and circuits offset. The on-chip temperature and VCC sensors ensure the IC accuracy. The EEPROM in digital core (D-core) offers programmability of sensitivity and output common-mode voltage.

3.Specification

3.1 Absolute maximum ratings

Table 2 Absolute maximum ratings

Parameter	Symbol	Values		Unit	Note
		Min	Max		
Supply voltage	V_{CC}		16	V	t < 96h
Reverse supply voltage	V_{RCC}		-0.5	V	
Output voltage	V_{OUT}		16	V	t < 96h
Output reverse voltage	V_{ROUT}		-0.5	V	
Output current	I_O	-	10	mA	
Junction temperature range	TA	-40	190	℃	t < 96h
Thermal resistance junction ambient	R_{thJA}	-	300	K/W	
Thermal resistance junction lead	R_{thJL}	-	100	K/W	
EEPROM Endurance	N_{CYCLE}		500		

3.2 Operating range

Table 3 Recommended operating conditions

Parameter	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Supply voltage	VCC	4.5	5	5.5	V	
Output current	I_O	-	10	-	mA	Sink or source
Junction temperature range	T_J	-40	-	170	℃	t<1000h

3.3 Electric characteristics

Table 4 Electrical characteristics

Parameter	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Supply						
Supply current	I_S	-	15	19	mA	
Power-on Time	T_{PO}		80		μs	
Undervoltage threshold	V_{UVOH}	-	4.2	-	V	VCC rising
	V_{UVOL}	-	3.8	-	V	VCC falling
Power on reset	V_{PORH}	-	3.9	-	V	VCC rising
	V_{PORL}	-	3.4	-		VCC falling
Output						
Output clamp voltage	V_{CLAMP}	0.3	-	4.7	V	With clamp on
Output response time	t_{RESP}	-	2	-	μs	B=B(max step), CL=1nF
Output Noise	V_{Noise}	-	10	-	mV_{pp}	TA =25℃ SNST=2 mV/Gs
		-	1	-	mV_{rms}	
Output saturation voltage	V_{SATH}	-	4.8	-	V	V_{OUT} to V_{CC}
	V_{SATL}	-	0.2	-	V	V_{OUT} to GND
Output clamp voltage	V_{CLPH}	-	4.7	-	V	V_{OUT} to V_{CC}
	V_{CLPL}	-	0.3	-	V	V_{OUT} to GND
Output load resistor	R_{LOU}	10	-	-	kΩ	V_{OUT} to V_{CC}
	R_{LOD}	10	-	-	kΩ	V_{OUT} to GND
Reference load resistor	R_{LRU}	20	-	-	kΩ	V_{REF} to V_{CC}
	R_{LRD}	20	-	-	kΩ	V_{REF} to GND
Output load capacitor	C_L		1	5	nF	
Nonlinearity	E_{LIN}	-0.5	-	0.5	%	B≤2000Gs
		-1.1	-	1.1	%	B≤3000Gs
Bandwidth	BW		240		kHz	-3dB, CL=1nF
Quiescent output						
Number of fine programmable bits for V_{REF}	B_{REF_Fine}	-	9	-	bit	
Reference voltage	V_{REF}	2.49	2.5	2.51	V	
Programmable reference voltage range	V_{REF_P}	2.35	-	2.65	V	

Reference voltage temperature drift	V_{REF_TC}	-15	-	15	mV	-40℃ ~ 150℃
Number of fine programmable bits for V_{OQ}	B_{OUT_Fine}	-	9	-	bit	
Output voltage	V_{OQ}	2.48	2.5	2.52	V	
Programmable output voltage range	V_{OQ_P}	2.3	-	2.7	V	
Output voltage temperature drift	V_{OQ_TC}	-20	-	20	mV	-40℃ ~ 150℃

3.4 Magnetic characteristics

Table 5 Magnetic characteristics

Parameter	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Sensitivity						
Default selection of coarse sensitivity	S_{00}	-	1.73	-	mV/Gs	
	S_{01}	-	5.19	-	mV/Gs	
	S_{10}	-	10.9	-	mV/Gs	
	S_{11}	-	20.1	-	mV/Gs	
Programmable range of coarse sensitivity	S_{00_PR}	0.5	-	1.56	mV/Gs	
	S_{01_PR}	1.56	-	6.23	mV/Gs	
	S_{10_PR}	6.23	-	13.0	mV/Gs	
	S_{11_PR}	13.0	-	24.0	mV/Gs	
Coase programming bits	B_{COARSE}	-	2	-	bit	
Fine programming bits	B_{FINE}	-	9	-	bit	
Sensitivity error	S_{ERR}	-1.0	-	1.0	%	25℃
Sensitivity drift	S_{ERR_TC}	-1.2	-	1.2	%	-40℃ ~ 25℃
		-1.0	-	1.0	%	25℃ ~ 150℃

4.Application Notes

4.1 Application circuits

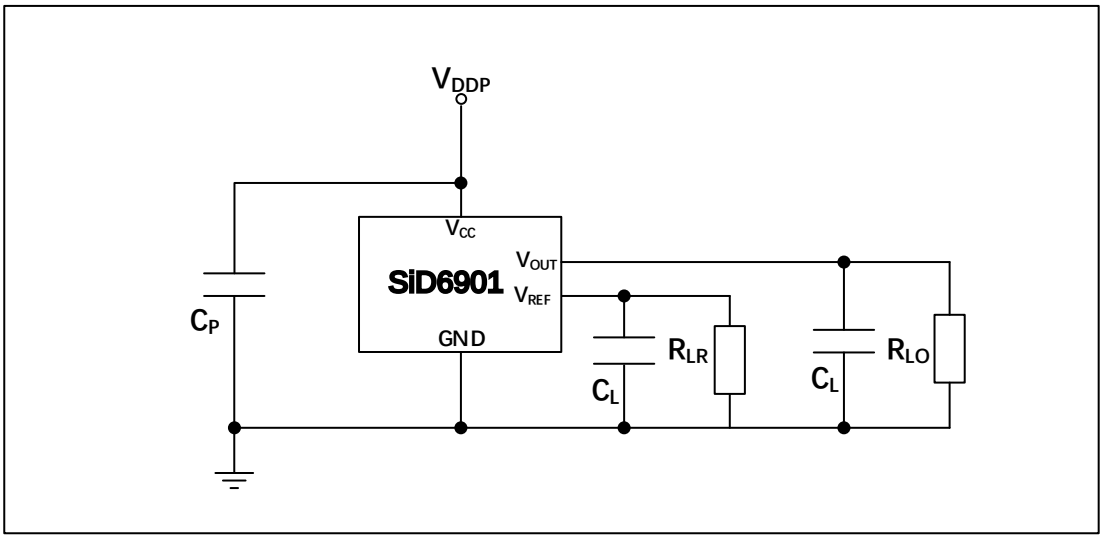
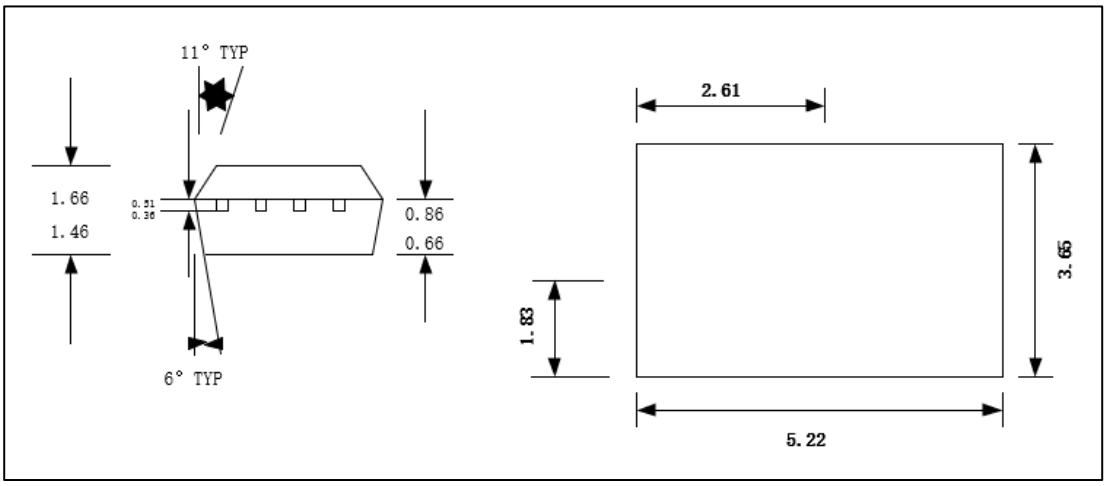


Fig.3 Recommended application circuit for SiD6901

For hash applications with supply disturbance, a Cp placed close to the IC is recommended (see Fig.3)., C_P = 100nF, R_{LR} = 20kΩ, and C_{LR} = 100nF, R_{LO} = 10kΩ, and C_{LO} = 1nF.

4.2 Package Information



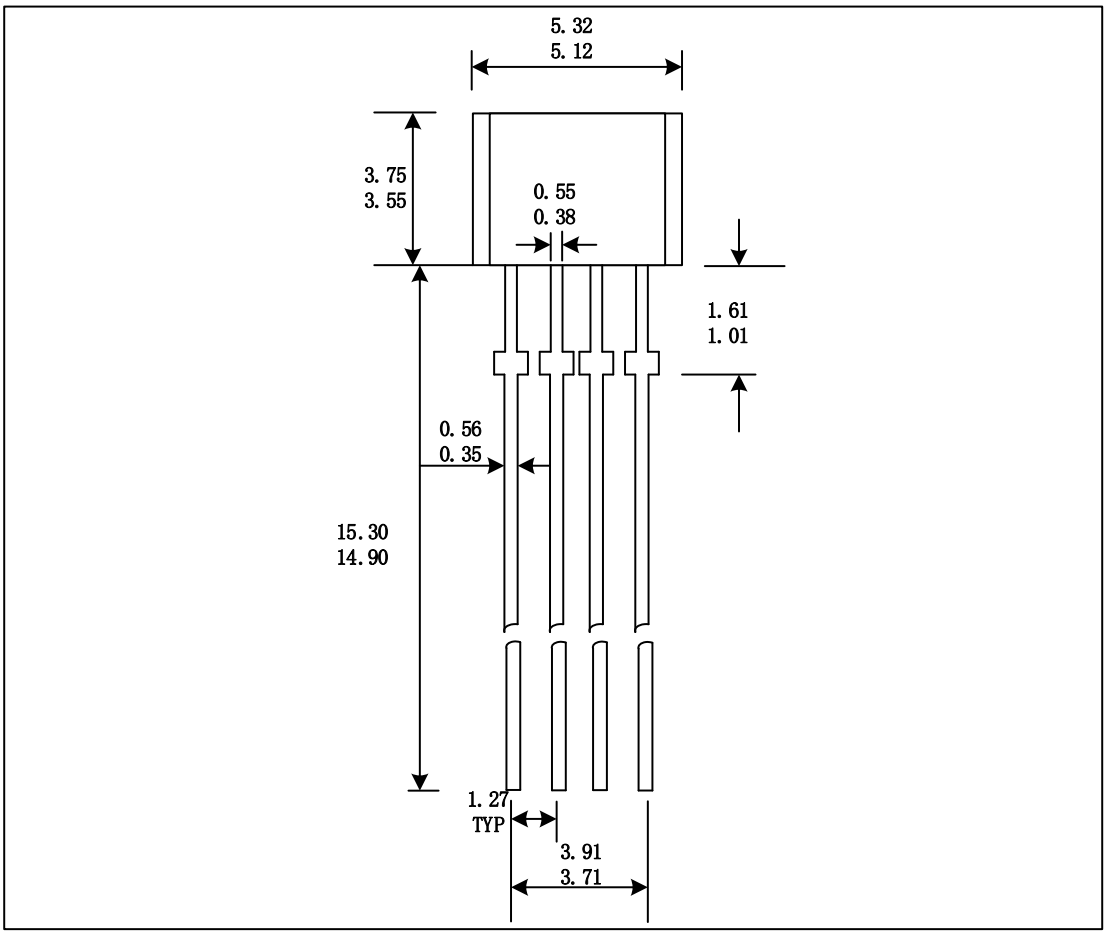
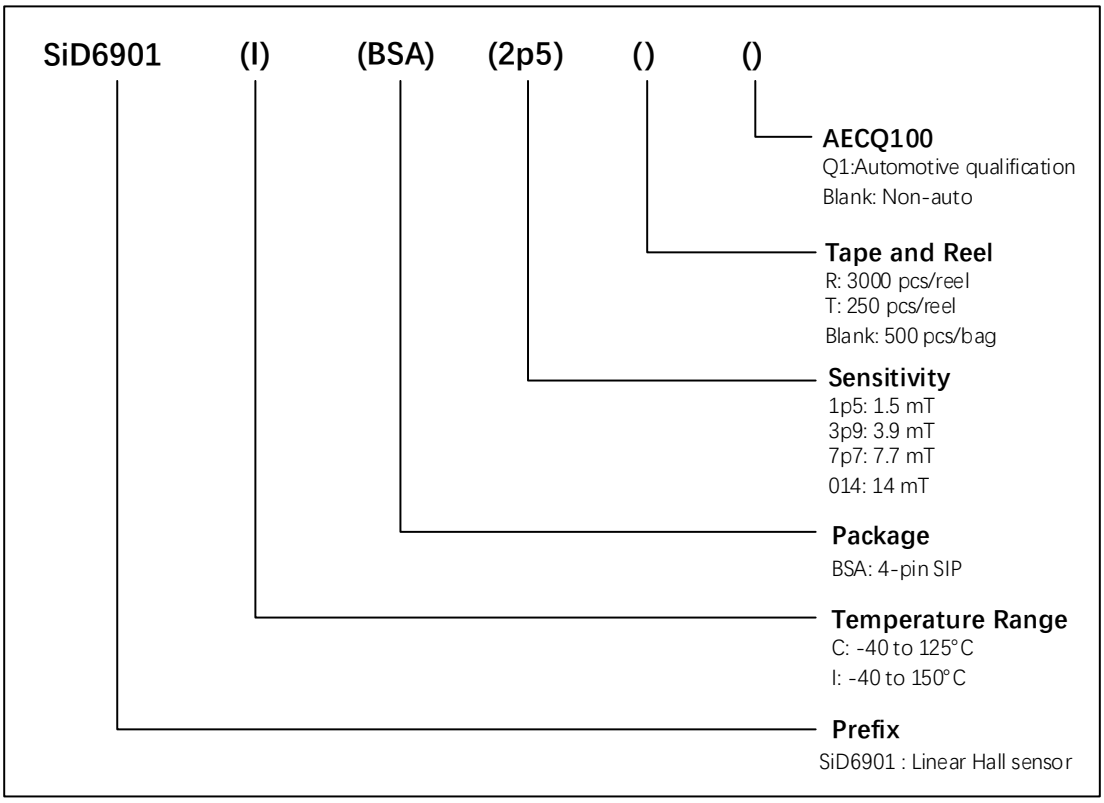


Fig.4 Package, 4-pin SIP

5.Selection Guide



6.Revision history

Issue	Date	Changes
1.0	2023.12.7	Initial release