ITE5921

Linear Hall Effect Sensor

Features

- ◆ Wide supply range: 2.8V to 5.5V
- ◆ Zero magnetic field output level as low as 300mV
- ◆ Operating current<0.8mA
- ◆ Wide temperature range: -40℃ to 85℃
- ◆ Magnetic sensitivity option:

	Quiescent Output	Sensitivity
ITE5921	V_{CC}-0.3V	1.6mV/Gs@Vcc=3.3V 2.3mV/Gs @Vcc=5V

Applications

- ◆ Magnetic axis keyboard
- ◆ Game pad
- ◆ Position sensing
- ◆ Human computer interaction

Typical Application

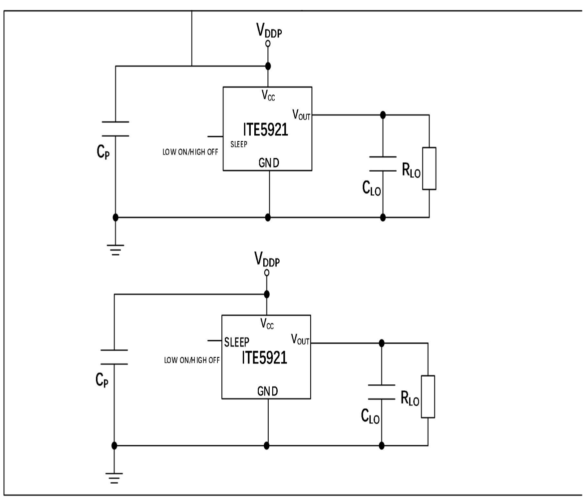


Fig.1 Recommended application circuit for ITE5921

For hash applications with supply disturbance, a Cp placed close to the IC is recommended (see Fig.1)., C_P =100nF, R_L=20kΩ, and C_L=1nF.

Description

The ITE5921 is a linear Hall-effect sensor IC with on-chip Hall and signal conditioning circuit. It integrates on-chip customized Hall devices to ensure low power consumption and high sensitivity performance of the chip. Simultaneously, high-precision signal conditioning circuits ensure parameter consistency and drift across the entire temperature range. The on-chip Hall sensor converts the magnetic flux passing through the chip into Hall signal voltage, and the internal signal conditioning circuit further amplifies the weak Hall signal voltage to the chip output. The S pole is defined as the positive pole. When the S pole of a magnet appears on the chip marking surface, the output voltage will increase as the distance between the magnet and the marking surface decreases (magnetic field increases).
The sensing chip consumes a working current of 0.7mA during operation, and the output level of zero magnetic field can be customized according to the application, with a minimum of 300mV, which can maximize the magnetic field detection range and output voltage swing. The operating temperature range is -40℃ to 85℃, suitable for various consumer and industrial application environments.

Definition of Magnetic Field Direction

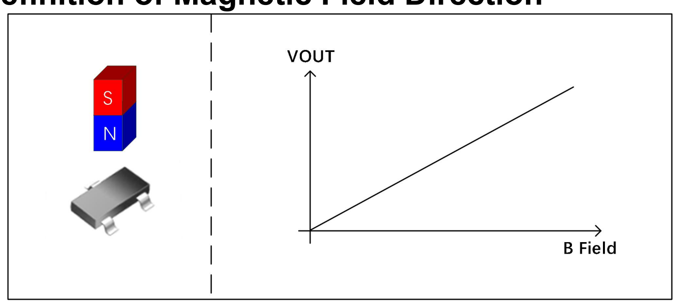
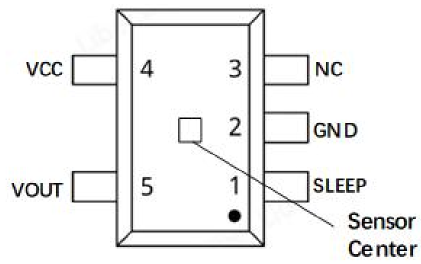


Fig. 2 **The relationship between magnetic field and output voltage of ITE5921**

The output of the chip varies with the magnetic field as shown in Figure 2. When the N pole of the magnet is facing the SOT23-5L packaging chip screen printing surface, the output VOUT voltage increases as the distance between the magnet and the chip screen printing surface decreases. The voltage of VOUT at zero magnetic field can be customized as needed, with a minimum of 0.2V.

Pin Configuration



SOT23-5L

Fig.3 Pin configuration and center of sensitive area

Pin Function

PIN NAME	FUNCTION
VCC	Supply voltage
GND	Ground
VOUT	Output voltage
NC	No connect
SLEEP	Sleep mode Enable pin

Device Information

PART NUMBER	PACKAGE	MARKING
ITE5921A5L	SOT23-5L	5921 YWAXXD

Functional Block Diagram

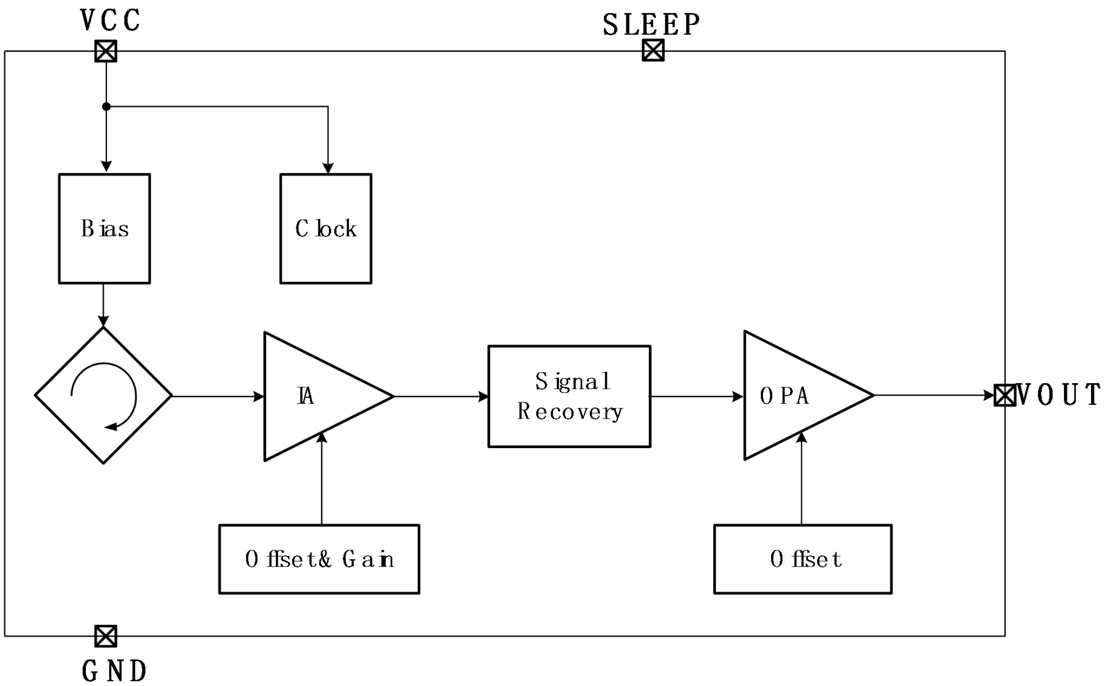


Fig.4 Functional block diagram ITE5921

The sensor IC is shown in Fig.4. 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.

Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply voltage	V_{CC}	-	9	V
Reverse supply voltage	V_{RCC}	-	-0.5	V
Output voltage	V_{OUT}	-	9	V
Output reverse voltage	V_{ROUT}	-	-0.5	V
Output current	I_O	-	1	mA
Junction temperature	T_J	-	150	℃
Storage temperature	T_S	-55	150	K/W

Exceeding these ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. (TA=25℃)

Operating Range

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply voltage	VCC	2.8	3.3	5.5	V
Output current (1)	I_O	-	40	-	mA
Ambient temperature range	T_A	-40	-	85	℃

Note:
(1) Ensured by design

ESD and Latch-up

SYMBOL	DEFINITION	VALUE	UNIT
V_{HBM}	Electrostatic discharge-Human body model (HBM), JS-001-2017	±4	kV
V_{CDM}	Electrostatic discharge- Charged Device Model (CDM), JS-002-2018	±1	kV
I_{LU}	Latch-up current, JESD78F.02-2023	±150	mA

Electrical Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply						
Supply current	I_{CC}	V_{CC}=3.3V	-	0.7	1	mA
Shutdown current	$I_{CC\text{-}SHDN}$	SLEEP = ”H”	-	0.1	1	mA
Power-on time	T_{PO}		-	10	-	μs
Awake time	T_{WK}	SLEEP= ”L”	-	7	-	μs
Sleep						
Sleep current	I_{sl}	V_{CC}=3.3V	-	0.5	1	μA
Sleep Logic ‘1’ input voltage	V_{IH}		0.8*Vcc	-	-	V
Sleep Logic ‘0’ input voltage	V_{IL}		-	-	0.2*Vcc	V
Output						
Output Delay	t_D	B=B(max step), CL=1nF	-	15	-	μs
Output Noise	V_{Noise}	T_A =25℃, C_L=1nF, SNST=1.6 mV/Gs @VCC=3.3V	-	10	-	mV_{pp}
			-	5	-	mV_{rms}
Nonlinearity	E_{LIN}	B≤1000Gs	-	1	-	%
Bandwidth(2)	BW	-3dB, C_L=1nF	-	20	-	kHz
Quiescent output						
Zero magnetic field output voltage	V_{OQ0}	customizable	-	V_{CC}-0.3	-	V
Output voltage temperature drift	$\lvert V_{OQ\_TC} \rvert$	-40℃ ~ 85℃	-	±1*Vcc	-	V
Output saturation voltage	V_{SATH}	V_{CC}=5V	4.9	-	-	V
		V_{CC}=3.3V	3.2	-	-	V
	V_{SATL}	V_{OUT} to GND	-	-	0.1	V
Output load resistance	R_{LD}	V_{OUT} to GND	4.7	-	-	kΩ
Output load capacitance	C_L		-	-	1	nF

Note:
(1) The parameter values are obtained under the corresponding test conditions mentioned above.
(2) Ensured by design.

Magnetic Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Sensitivity						
Sensitivity	S_1	ITE5921@V_{CC}=3.3V	1.3	1.6	1.9	mV/Gs
		ITE5921@V_{CC}=5V	2.0	2.3	2.6	mV/Gs
Sensitivity temperature coefficient	S_{TC0}	TA=-40℃ ~ 85℃ versus 25℃	-	0.2	-	%/℃

Functional Description

Power-On Time

Power-On Time (T_{PO}) is defined as the time it takes for the output voltage to settle within ±10% of its steady-state value under an applied magnetic field after the power supply has reached its minimum specified operating voltage(VCC (min)) as shown in Fig. 5.

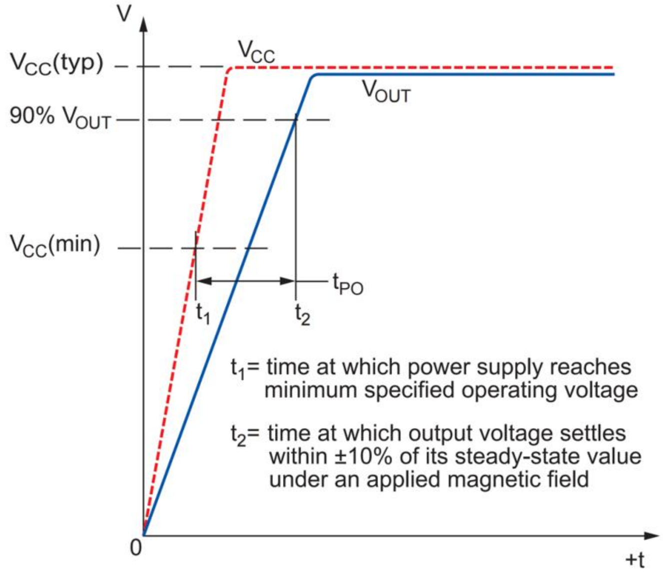


Fig. 5 Power-On Time Definition

Low-Power Sleep Mode Design

For battery-powered applications where power is critical, the sensor can be duty-cycled using the SLEEP pin. This will ensure the average current consumption remains low to meet the system level power targets. In duty-cycled applications, the start-up time must be very fast so the external ADC can sample the signal faster and shutdown the device quickly to minimize average power. With very fast start-up and power-off times, the ITE5921 enables low average power consumption for the system.

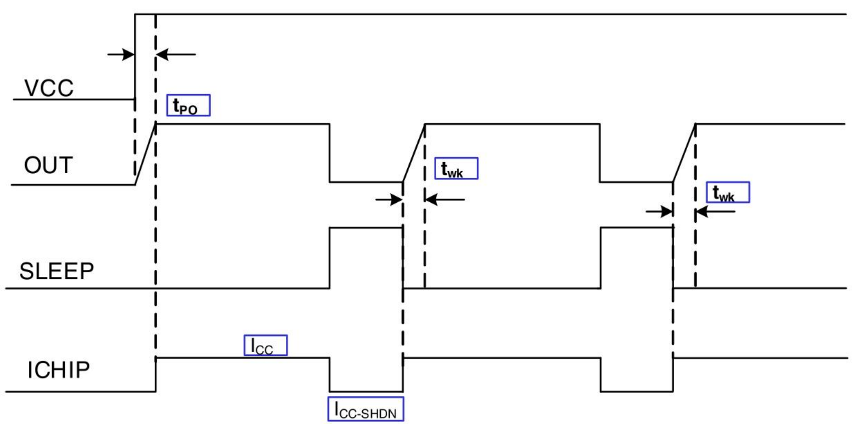
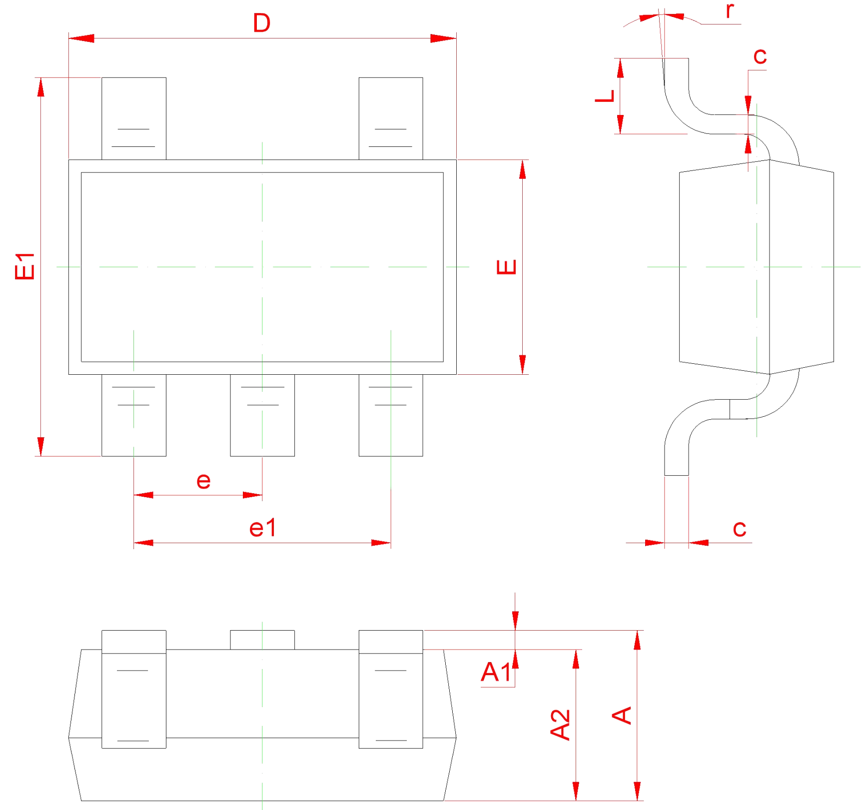


Fig.6 Sleep Mode Description

Package Information: SOT23-5L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
r	0º	8º	0º	8º

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