Fraunhofer Institut Mikroelektronische Schaltungen und Systeme

Linear Array of Hall-Sensors with 32 Elements INS1_4Z5

Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme

Grenzstraße 28
D - 01109 Dresden
Phone: +49 (0) 3 51 / 88 23-0
Fax: +49 (0) 3 51 / 88 23-266
Internet: http://www.ims.fhg.de

Contact:
Ines Schedwill & Heiko Menzel
Phone: +49 (0) 3 51 / 88 23-238
E-Mail: schedwil@imsdd.fhg.de
menzel@imsdd.fhg.de

TÜV CERT DIN EN ISO 9001 Zertifikat: 09 100 5263

Features

- **32 spinning-current-hall-sensors**
- **low offset**
- **151,2 µm pitch**
- **integrated analog multiplexer**
- **integrated amplifier**
- **analog output**
- **random sensor access**

Description

The INS1_4Z5 (fig. 1) is a magnetic field detection device with 32 linear arranged hall-sensor-elements (pitch 151,2 µm).

Each sensor is a spinning-current hall-element with 8 measuring directions. The spinning current system reduces sensor-offset-voltage for high precision magnetic field detection.

The INS_4Z5 chip is fabricated in CMOS technology for low current applications.

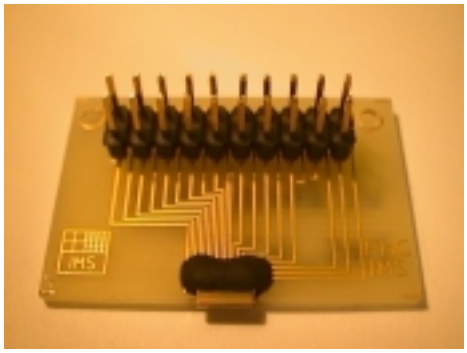

Fig. 1: Photo of INS1_4Z5

For random access the spinning-current directions and sensors are seperatly addressable. The control-logic works up to 600 kHz external clock resulting a maximum measuring-rate of 37500 values/second.

A data-ready output (DR) signals the end of a sensor measuring cycle and the validity of output voltage on output SEOUT. The DR output offers an easy synchronisation of external devices like analog to digital converter (start of conversion) or address-latch (latch new address) for asynchronous sensor addressing.

Applications

- **high precision magnetic pattern detection**
- **high resolution absolute position detection**
- **distance measurement**

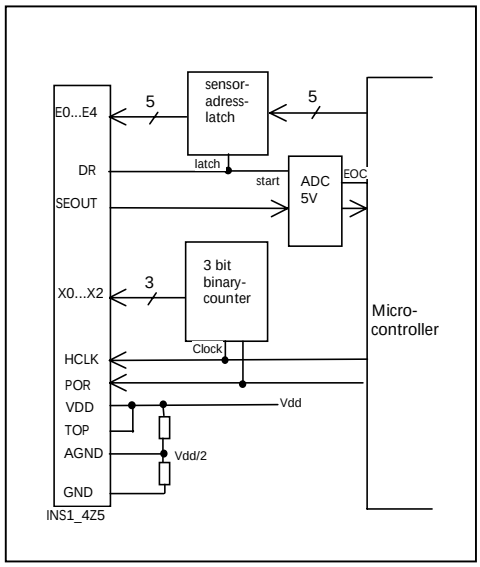

Fig. 2: Typical application

Measuring cycle

While measuring one sensor, the sensor address must be stable on inputs E0 ... E4.

One measuring cycle consits of 2 x 8 direction measurings of spinning current elements, corresponding to 16 clock-periods of HCLK. With each clock-period a new spinning current direction must be addressed in order to achieve a maximum offset-stability. This can easily be done using a standard binary-counter like 74HC93 clocked parallel to HCLK as counter for X0 ... X2.

After 16 clock periods of HCLK the DR output signals with a high-low edge that result is switched to output SEOUT. The low-high edge of DR signals that data is now valid on output SEOUT. DR can be used to start external analog to digital conversion and to latch a new address (if an adress-latch is used for asynchronous sensor-adressing). The new sensor address must be applied to the address-inputs E0 ... E5 within the 1st half-period of HCLK after DR low-high edge. (Use standard latch devices like 74HC174 for automatic latch of new sensor-addresses with output DR).

POR (Power On Reset) resets internal control unit and restarts measuring cycle.

Sensor Output Voltage and power supply

Typical power supply voltage is Vdd=5 V referred to GND. TOP is the current supply input for sensor hall-elements referred to AGND. To get highest possible hall-current, the TOP input can be connected directly to a voltage source (for example to Vdd, buffered with capacitors). For this minimum configuration AGND should be generated by 2 resistor-voltage-devider between GND and Vdd, (AGND=Vdd/2=2,5 V, TOP=Vdd=5 V, BIAS=not connected).

The output voltage SEOUT is referred to AGND.

The sensor-sensitivity is typically 75 mV/mT (Vdd=TOP=5 V, AGND=Vdd/2)

INS1_4Z5 is available directly mounted on a PCB with male-connector. Other types of boards or delivery as Die on request.

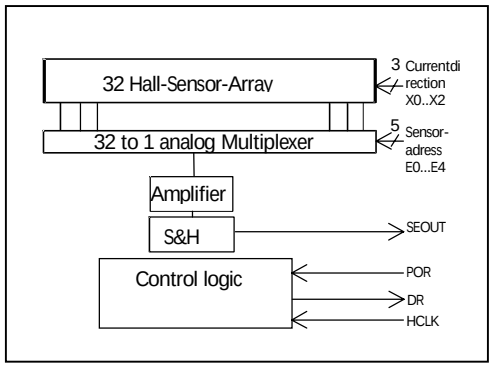

Fig. 4: Function blocks INS1_4Z5

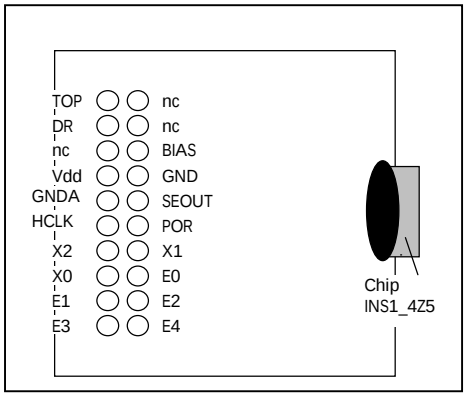

Fig. 3: Top view

pin name	Function
X0 ... X2	Address input spinning current direction
E0 ... E4	Address input Sensor adress
POR	Power on reset
HCLK	Clock input
SEOUT	Analog output (referred to AGND)
GNDA	Analog ground
Vdd	+5 V
GND	Digital ground
DR	Data ready output
TOP	Current supply Hall-elements
BIAS	Do not connect

Fig. 5: Pin description

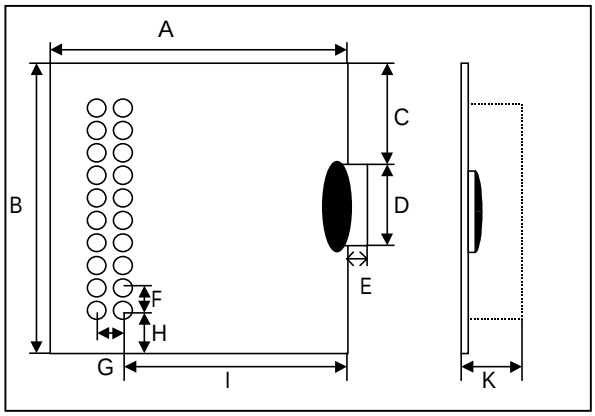

Fig. 6: Board-dimensions INS1_4Z5

Dimension	Millimeters
A	24
B	36
C	15
D	5.5
E	1
F	2.54
G	2.54
H	5.5
I	16
K	12

Fig. 7: Connections and Mechanical Dimensions INS1_4Z5
Board material: FR4

Parameter	Conditions	MIN	TYP	MAX	UNITS
Sensitivity (Vdd=VTOP=5 Vt)			75	100	mV/mT
Sensor pitch			151,2		µm
Supply voltage Vdd		4,5	5	6	V
Output Load SEOUT		20			kΩ
Frequency HCLK		100		600	KHz
Temperature Range	Storage Operation	0 0		+ 90 + 70	° C ° C

Fig. 8: Specifications (At +25 ° C and V $_{+}$ = 5 V DC unless otherwise noted