

# AFF755B

## MagnetoResistive Field Sensor

The AFF755B is a low noise magnetic field sensor based on the Anisotropic MagnetoResistive (AMR) effect.

The sensor contains a Wheatstone bridge including a flip coil for offset correction. This measurement principle also reduces the temperature coefficient of the offset by a factor of 100.

This sensor is ideally suited for the detection of weak magnetic fields ( $< 20 \mu\text{G}$  resp.  $< 2 \text{ nT}$ ) including the earth magnetic field.

The voltage necessary for driving the required flip-current of 150 mA is smaller than 0.5 V. This allows the serial connection of 3 sensors for a 3-axis measurement with typical supply voltages available in battery powered devices.

The AFF755B is available as a SO8 package (RoHS-conform) for SMD assembly.

### Product Overview

Article description	Package	Delivery Type
AFF755BHA-AD	SO8	Tape on reel (4000)
AFF755BMA-AD	LGA	Tape on reel (5000)

### Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{\text{CC}}$	Supply voltage	1.2	5.0	9.0	V
$R_{\text{B}}$	Bridge resistance	2.2	2.5	2.8	$\text{k}\Omega$
S	Sensitivity (in range $\pm 160 \text{ A/m}$ )	13.0	15.0	17.0	$\frac{\text{mV/V}}{\text{kA/m}}$
$I_{\text{F}}$	Flip current (required)	$\pm 150$	-	-	mA
$R_{\text{F}}$	Flip coil resistance	-	1.5	2.0	$\Omega$

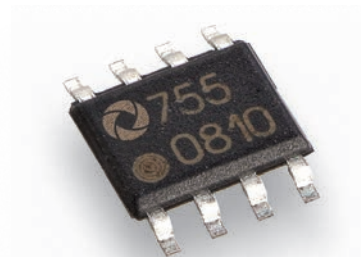
### Absolute Maximum Ratings

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
$V_{\text{CC}}$	Supply voltage	-20.0	+20.0	V
$I_{\text{Fmax}}$	Maximum flip current <sup>1)</sup>	-1.0	+1.0	A
$P_{\text{F}}$	Maximum flip power dissipation	-	50	mW
$T_{\text{amb}}$	Ambient temperature	-40	+125	$^{\circ}\text{C}$
$T_{\text{stg}}$	Storage temperature	-40	+150	$^{\circ}\text{C}$
$V_{\text{isolation}}$	Voltage between bridge and flip coil	-250	+250	V
MSL	Moisture sensitivity level	-	2	-

<sup>1)</sup> 10  $\mu\text{s}$  pulse, 400  $\mu\text{s}$  pause.

Stresses beyond those listed under "Absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



### Features

- Based on the Anisotropic MagnetoResistive (AMR) effect
- Contains one Wheatstone Bridge
- Integrated flip coil
- Temperature range from  $-40 \text{ }^{\circ}\text{C}$  to  $+125 \text{ }^{\circ}\text{C}$

### Advantages

- Extreme sensitivity
- Wide range of magnetic field strength
- Low power consumption
- Low flip coil resistance
- Very good signal to noise ratio

### Applications

- Compass
- Electronic navigation systems
- Battery powered applications
- Magnetometry
- Measurement of terrestrial magnetic field
- Traffic detection



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## Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$H_{ext}$	Operating magnetic field range		-400	-	+400	A/m
$B_{RES}$	Resolution	$V_{CC} = 5\text{ V}; BW = 50\text{ Hz}$	-	2.0	-	nT

## Electrical Data of MR-Bridge

$T_{amb} = 25\text{ °C}; V_{CC} = 5\text{ V};$  unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{CC}$	Supply voltage		1.2	5.0	9.0	V
S	Sensitivity	In the operating range of $\pm 160\text{ A/m}$	13.0	15.0	17.0	$\frac{\text{mV/V}}{\text{kA/m}}$
$TC_S$	Temperature coefficient of Sensitivity <sup>1)</sup>	See Fig. 3	-0.32	-0.36	-0.40	%/K
$R_B$	Bridge resistance <sup>2)</sup>		2.2	2.5	2.8	k $\Omega$
$TC_{RB}$	Temperature coefficient of $R_B$ <sup>3)</sup>		0.22	0.26	0.30	%/K
$V_{off}$	Offset voltage per $V_{CC}$		-0.5	-	+0.5	mV/V
$TC_{Voff}$	Temperature coefficient of $V_{off}$ <sup>4)</sup>		-1.0	-	+1.0	$\mu\text{V/V/K}$
$H_{off}$	Magnetic offset per $V_{CC}$		-	0.15	-	A/m/V
N	Noise level	$f > 100\text{ Hz}$	-	10	20	nV/ $\sqrt{\text{Hz}}$
$\epsilon_{Lin,80}$	Linearity error @ $\pm 80\text{ A/m}$	$-80 \leq H_{ext} \leq +80\text{ A/m}$	-	0.15	0.25	% of FS
$\epsilon_{Lin,240}$	Linearity error @ $\pm 480\text{ A/m}$	$-240 \leq H_{ext} \leq +240\text{ A/m}$	-	0.80	0.90	% of FS
$\epsilon_{Lin,400}$	Linearity error @ $\pm 800\text{ A/m}$	$-400 \leq H_{ext} \leq +400\text{ A/m}$	-	2.30	2.70	% of FS

$$1) \quad TC_S = 100 \cdot \frac{S_{(T_2)} - S_{(T_1)}}{S_{(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = 25\text{ °C}; T_2 = 125\text{ °C}.$$

2) Bridge resistance between pins 2 and 5, 4 and 6.

$$3) \quad TC_{RB} = 100 \cdot \frac{R_{B(T_2)} - R_{B(T_1)}}{R_{B(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = 25\text{ °C}; T_2 = 125\text{ °C}.$$

$$4) \quad TC_{Voff} = \frac{V_{off(T_2)} - V_{off(T_1)}}{T_2 - T_1} \quad \text{with } T_1 = 25\text{ °C}; T_2 = 125\text{ °C}.$$

## Electrical Data of Flip Coil and Test Connectors

$T_{amb} = 25\text{ °C}; V_{CC} = 5\text{ V};$  unless otherwise specified.

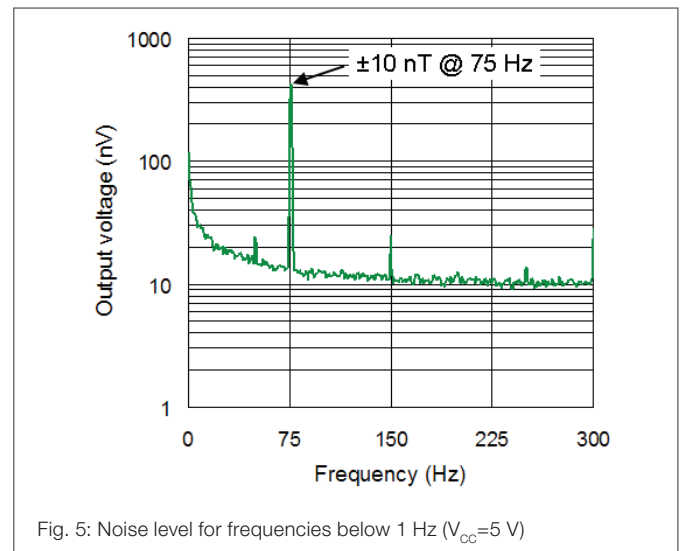
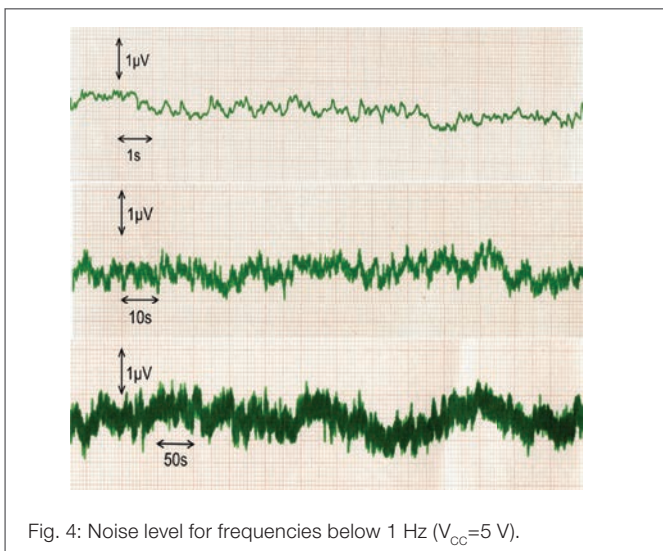
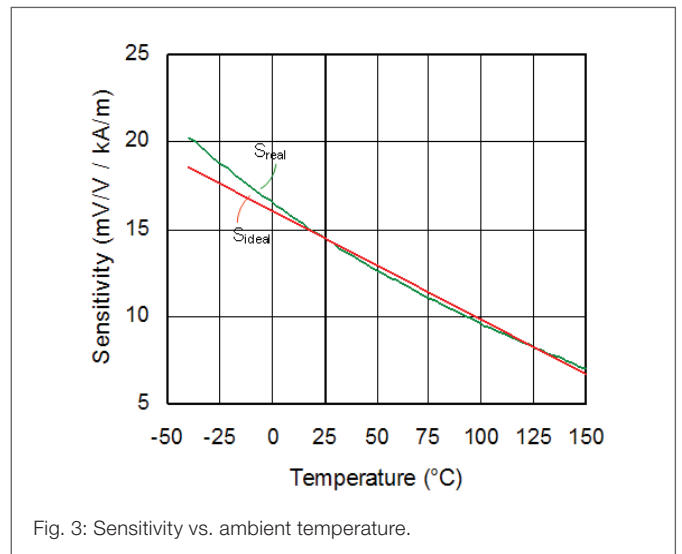
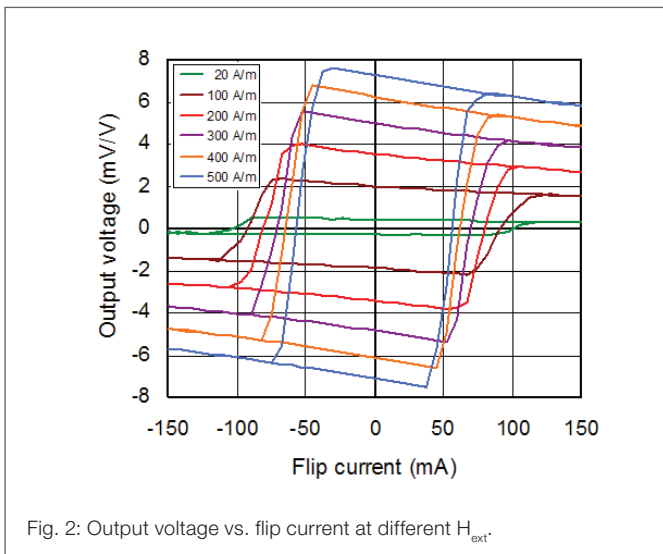
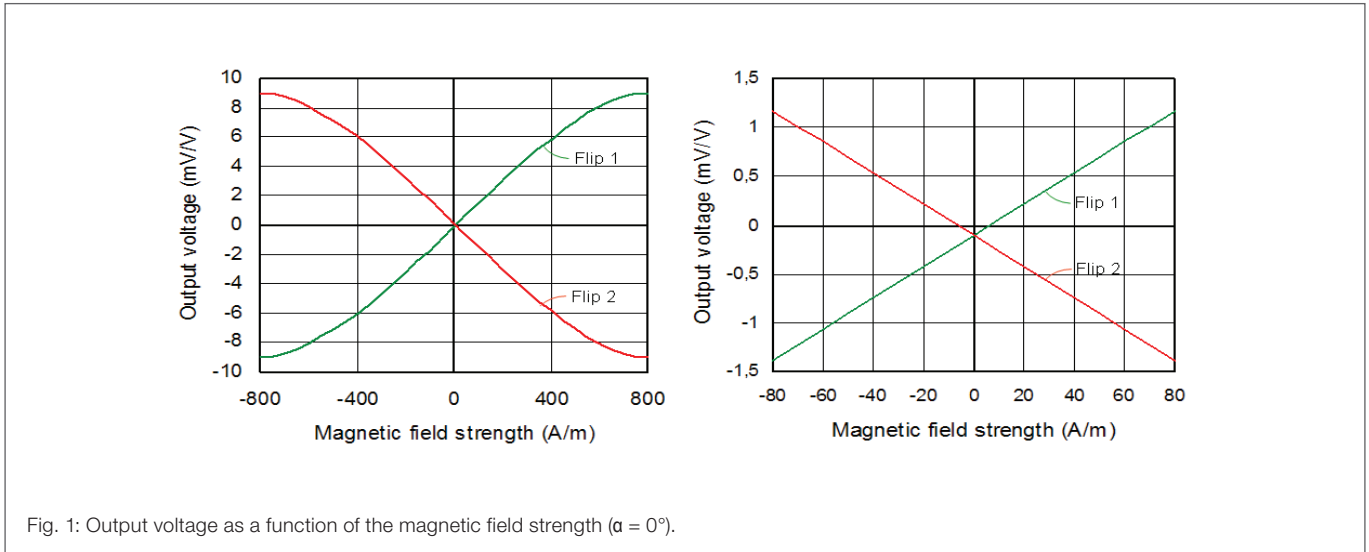
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_F$	Flip current (required)	1 $\mu\text{s}$ on, 1 ms off	$\pm 150$	-	-	mA
$t_{IF}$	Flip pulse duration		-	1.0	2.0	$\mu\text{s}$
$I_{Fmax}$	Flip current (maximum)	10 $\mu\text{s}$ on, 400 $\mu\text{s}$ off	-	-	$\pm 1.0$	A
$R_F$	Flip coil resistance		-	1.5	2.0	$\Omega$
$TC_{RF}$	Temperature coefficient of RF <sup>5)</sup>		0.30	0.35	0.40	%/K
$I_{test}$	Test current		-	-	200	mA
$H_{test}$	Magnetic field strength per test current		0.25	0.35	0.45	A/m/mA

$$5) \quad TC_{RF} = 100 \cdot \frac{R_{F(T_2)} - R_{F(T_1)}}{R_{F(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = 25\text{ °C}; T_2 = 125\text{ °C}.$$

## Dynamic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f	Frequency range		1	-	-	MHz

Typical Performance Graphs



Typical Performance Graphs

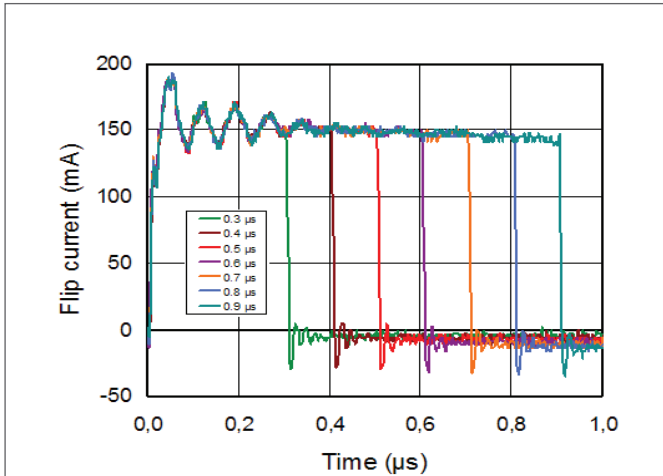


Fig. 6: Typically used flip pulses at different pulse durations (measured with Tektronix CT-1 Current Transducer).

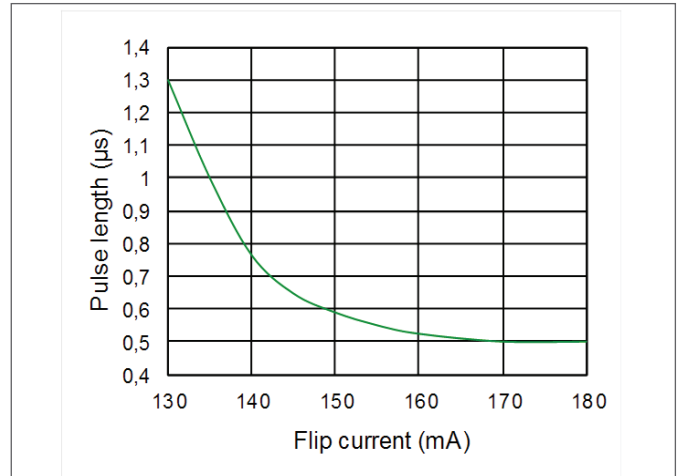


Fig. 7: Flip pulse length vs. flip current magnitude to achieve maximum resolution (see Fig. 10).

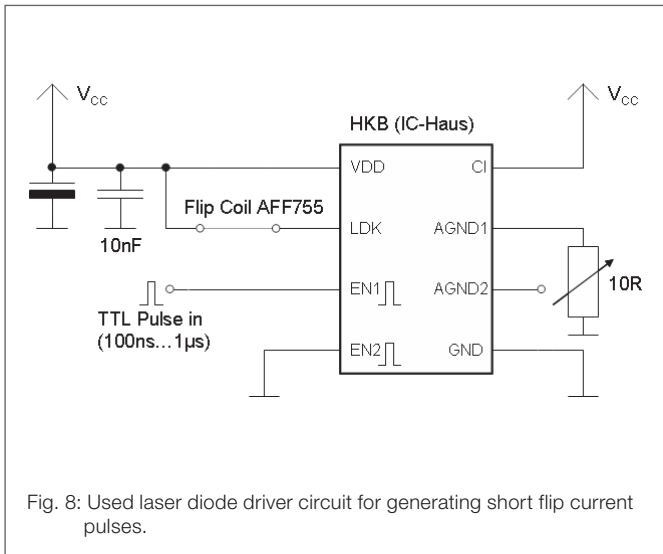


Fig. 8: Used laser diode driver circuit for generating short flip current pulses.

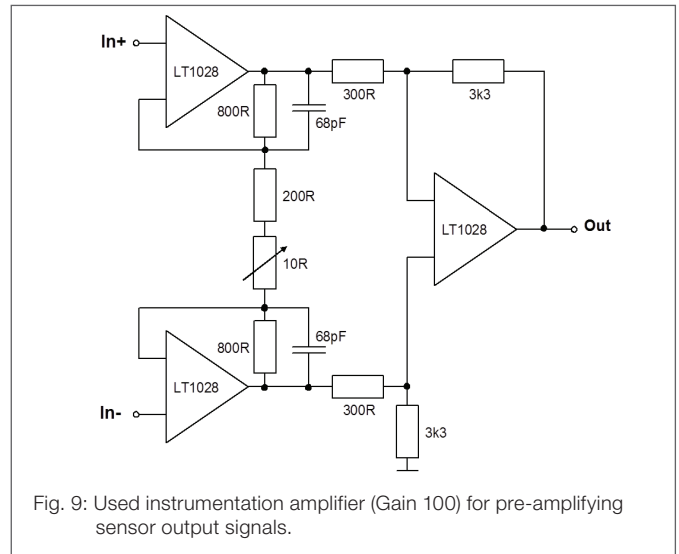


Fig. 9: Used instrumentation amplifier (Gain 100) for pre-amplifying sensor output signals.

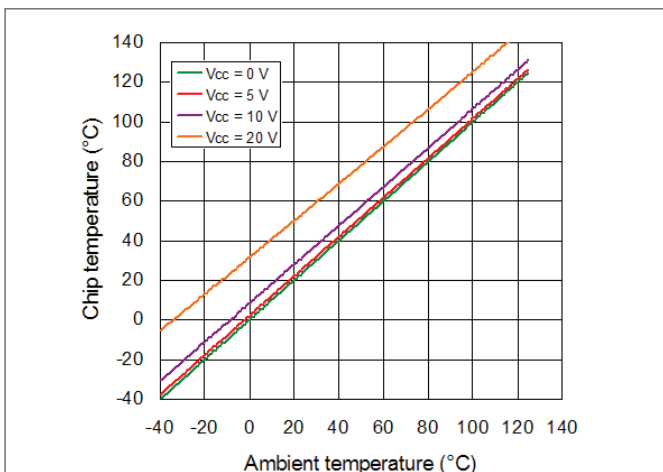
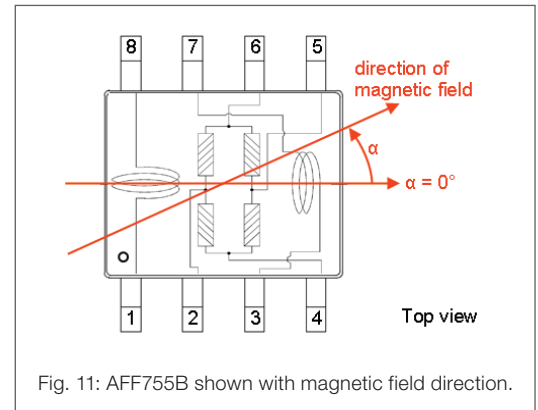


Fig. 10: Chip temperature vs. ambient temperature at different supply voltages.

## AFF755B in SO8-Housing

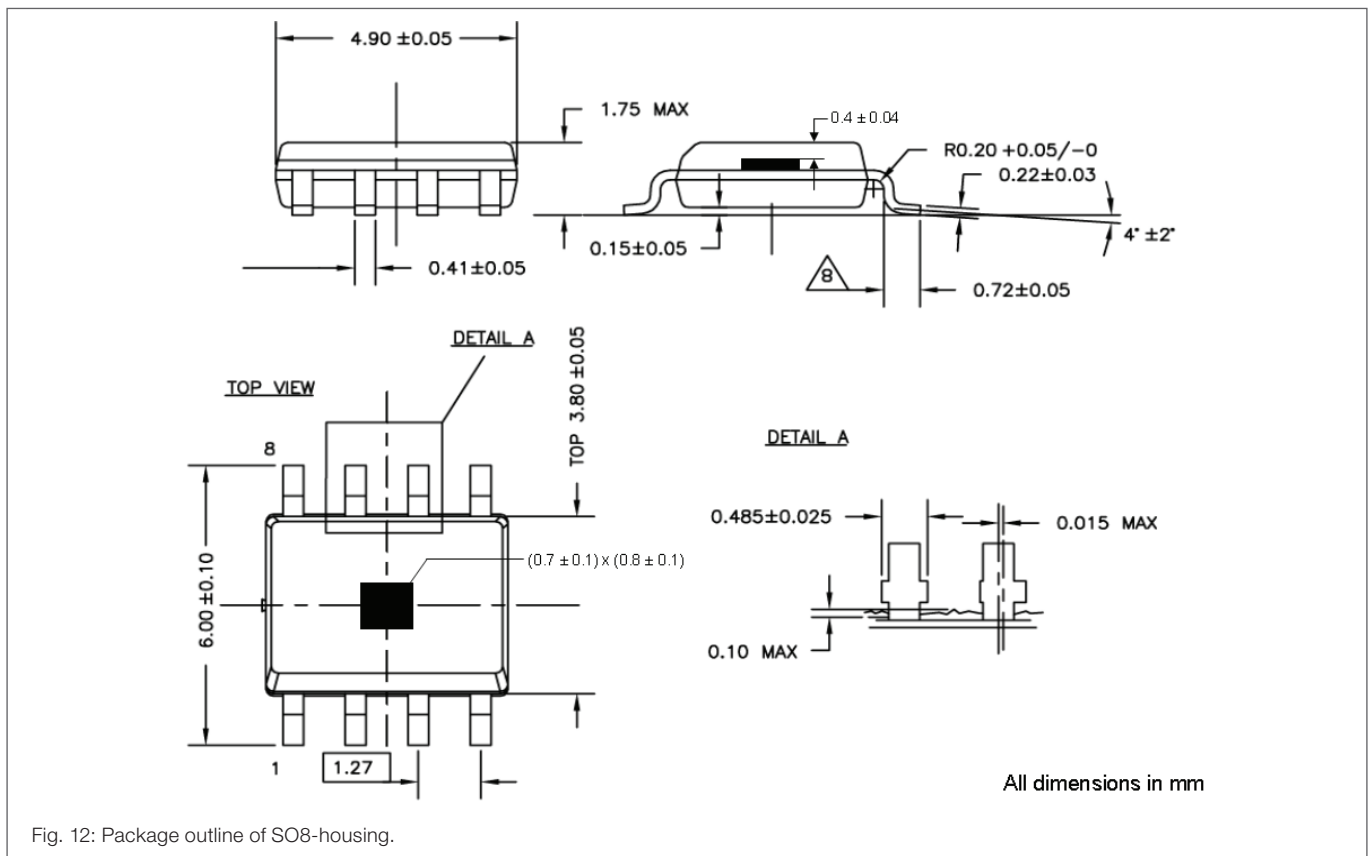
### Pinning

Pin	Symbol	Parameter
1	$+I_F$	Flip coil
2	$-V_{out}$	Negative output voltage
3	$I_{test}$	Test connector
4	GND	Ground
5	$+V_{out}$	Positive output voltage
6	$V_{CC}$	Supply voltage
7	$I_{test}$	Test connector
8	$-I_F$	Flip coil



Pin 1 is marked by a point on housing.

### Dimensions



### Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{th-j-a}$	Thermal resistance from junction to ambient <sup>1)</sup>	210	K/W

<sup>1)</sup>  $R_{th-j-a}$  is specified for device in SO8 package, soldered to printed circuit board on worst case mounting conditions.

### General Information

#### Product Status

Article	Status
AFF755B	The product is in series production.
<b>Note</b>	The status of the product may have changed since this data sheet was published. The latest information is available on the internet at <a href="http://www.sensitec.com">www.sensitec.com</a> .

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#### Sensitec GmbH

Georg-Ohm-Str. 11 · 35633 Lahnau · Germany  
Tel. +49 6441 9788-0 · Fax +49 6441 9788-17  
[www.sensitec.com](http://www.sensitec.com) · [sensitec@sensitec.com](mailto:sensitec@sensitec.com)



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#### Sensitec GmbH

Georg-Ohm-Str. 11 · 35633 Lahnau · Germany  
Tel. +49 6441 9788-0 · Fax +49 6441 9788-17  
www.sensitec.com · sensitec@sensitec.com

