DESCRIPTION:

The aHSM1 is an integrated Hall magnetic sensor circuit cell for 0.35µm CMOS process that performs an optimized spinning-current Hall biasing and signal readout function. The aHSM1 incorporates Hall-effect devices, current sources, digital circuits, and analogue switches. The Hall devices may be either horizontal or vertical; accordingly, the aHSM1 may respond to a magnetic field component that is either perpendicular to or parallel with the chip plane, or to all three components of a magnetic field vector.

KEY FEATURES:

- **Responds to x, y or/and z component of a magnetic field**
- **Modulation of the Hall voltage by the spinning-current technique**
- **Amplifier and demodulator not included**
- **Small cell size**
- **Low residual offset and 1/f noise**
- **0.35µm bulk CMOS technology**

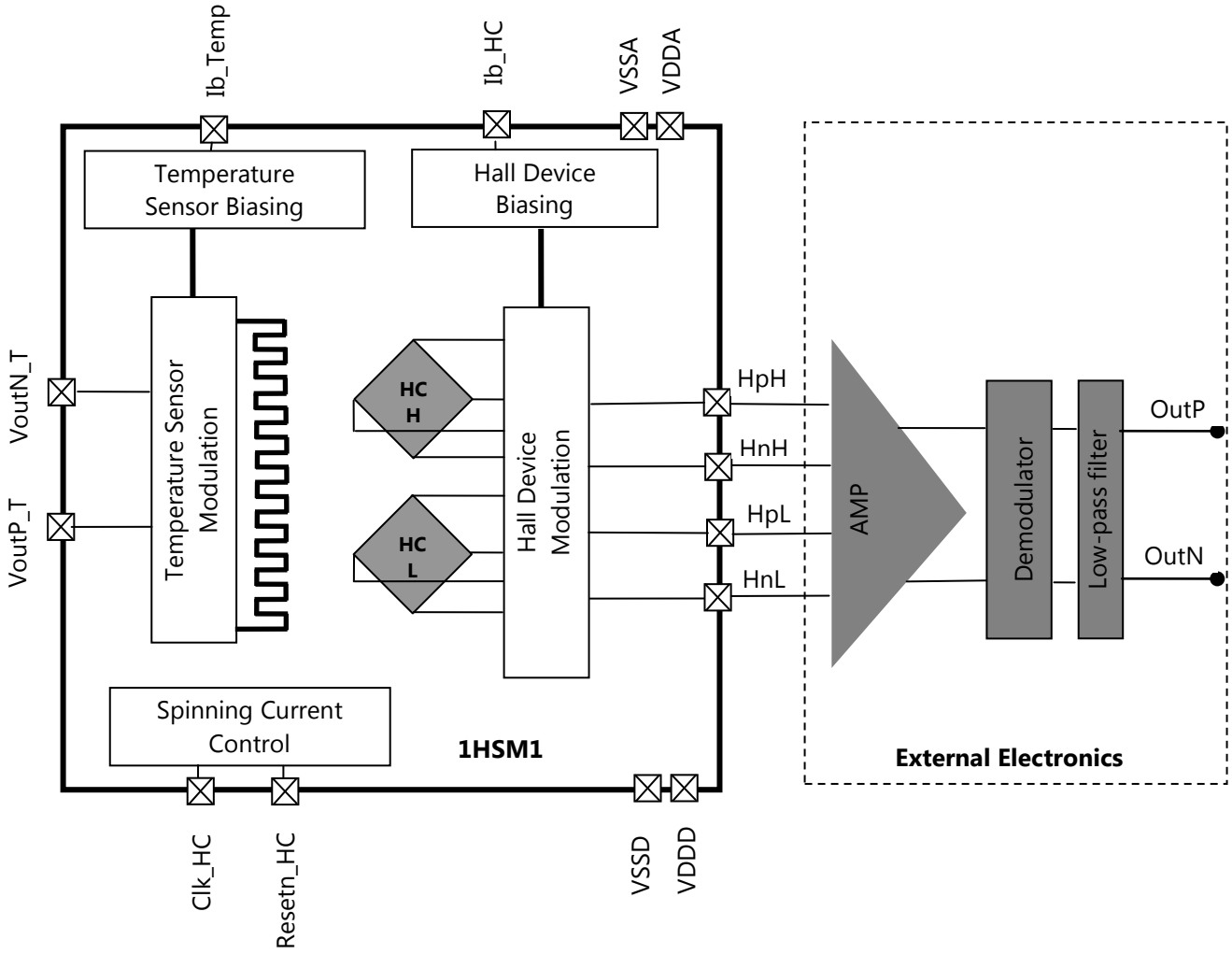

Figure 1. **Block diagram of a single-axis Hall spinning-current system. The 1HSM1 is a single-axis version of the aHSM1. HC-H and HC-L are Hall elements or clusters of Hall elements, which could be either horizontal or vertical Hall devices. The block External Electronics may be either integrated on the same CMOS chip or implemented off-chip.**

The output voltage(s) of the aHSM1 is an AC amplitude-modulated Hall-voltage signal for each measured magnetic field component. After an external amplification, demodulation and low-pass filtering, the recovered Hall voltage is free from offset and 1/f noise.

The aHSM1 incorporates also a high-resolution temperature sensor, whose output signal is an AC amplitude-modulated voltage proportional with the local chip temperature.

Notation of the type numbers: The aHSM1 is a generic notation for a family of the following devices:

Type number	**aHSM1**	**1HSM1**	**xHSM1**	**yHSM1**	**zHSM1**	**3HSM1**
Sensitive axis	any	one out of x, y, z	x-axis	y-axis	z-axis	x, y and z
Hall device	any	Horizontal or Vertical	Vertical	Vertical	Horizontal	Horizontal and Vertical

Note: Two-axis versions of the xHSM1, with any two of the X, Y and Z axes are also available.

ABSOLUTE MAXIMUM RATINGS:

Parameter	**Value**	**Remark**
Supply voltage range	-0.5V to +6V	*Any terminal to substrate*
Operating temperature range	-40°C to +125°C	

CHARACTERISTICS OF THE xHSM1 AND yHSM1:

Unless otherwise noted, the specifications apply for the supply voltage Vdd-Vss = 5V, Hall reference current Ib-HC = 0.2mA, clock frequency Clk-HC = 1MHz at the environment temperature T = 20°C.

Parameter	**Value**	**Remark**
Sensitivity axis	Parallel	*With respect to the chip surface*
Dimensions of the cell	ca. 0.1mm^2	*Without bonding pads*
Common voltage (HpH + HnH)/2	3.3V±10%	*With respect to VSSA*
Common voltage (HpL + HnL)/2	1.7V±10%	*With respect to VSSA*
Magnetic sensitivity, raw	0.063V/T±10%	*HpH/B, HnH/B, HpL/B, HnL/B *)*
Magnetic sensitivity, gain 200	12.6V/T±10%	*With external electronics **)*
NVsd ***), f < 1kHz	$1\mu V/\sqrt{Hz}$	*With external electronics **); Figure 2*
NEMFsd ****), f < 1kHz	$80nT/\sqrt{Hz}$	*With external electronics **)*

*) B: Magnetic field component parallel with the sensitivity axis

**) Amplification 200x + Demodulation + Low-pass filtering fh = 1kHz

***) NVsd: Noise voltage spectral density

****) NEMFsd: Noise-equivalent magnetic field spectral density: NEMFsd = NVsd / S, S = 12.6V/T.

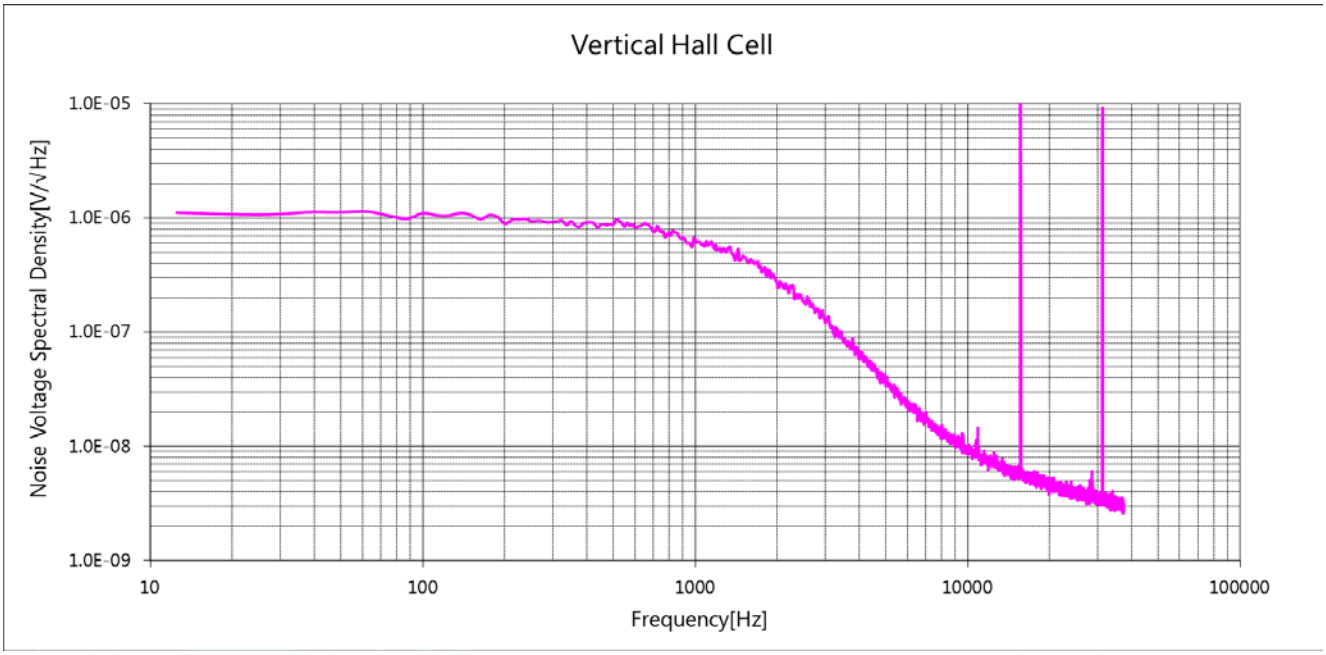

Figure 2. **Noise voltage spectral density of the xHSM1 and xHSM1 combined with External Electronics as shown in Figure 1, with the amplifier gain 200x and a first-order low-pass filter with the bandwidth 1kHz. The noise contribution of External Electronics is about 20%.**

CHARACTERISTICS OF THE zHSM1:

Unless otherwise noted, the specifications apply for the supply voltage Vdd-Vss = 5V, Hall reference current Ib-HC = 0.2mA, clock frequency Clk-HC = 1MHz at the environment temperature T = 20°C.

Parameter	Value	Remark
Sensitivity axis	Perpendicular	*With respect to the chip surface*
Area of the cell	ca. 0.1mm^2	*Without bonding pads*
Common voltage (HpH + HnH)/2	3.3V±10%	*With respect to VSSA*
Common voltage (HpL + HnL)/2	1.7V±10%	*With respect to VSSA*
Magnetic sensitivity, raw	0.055V/T±10%	*HpH/B, HnH/B, HpL/B, HnL/B *)*
Magnetic sensitivity, gain 200	11V/T±10%	*With external electronics **)*
NVsd ***), f < 1kHz	0.8µV/$\sqrt{Hz}$	*With external electronics **); Figure 2*
NEMFsd ****), f < 1kHz	73nT/$\sqrt{Hz}$	*With external electronics **)*

*) B: Magnetic field component parallel with the sensitivity axis

**) Amplification 200x + Demodulation + Low-pass filtering fh = 1kHz

***) NVsd: Noise voltage spectral density

****) NEMFsd: Noise-equivalent magnetic field spectral density: NEMFsd = NVsd / S, S = 11V/T.

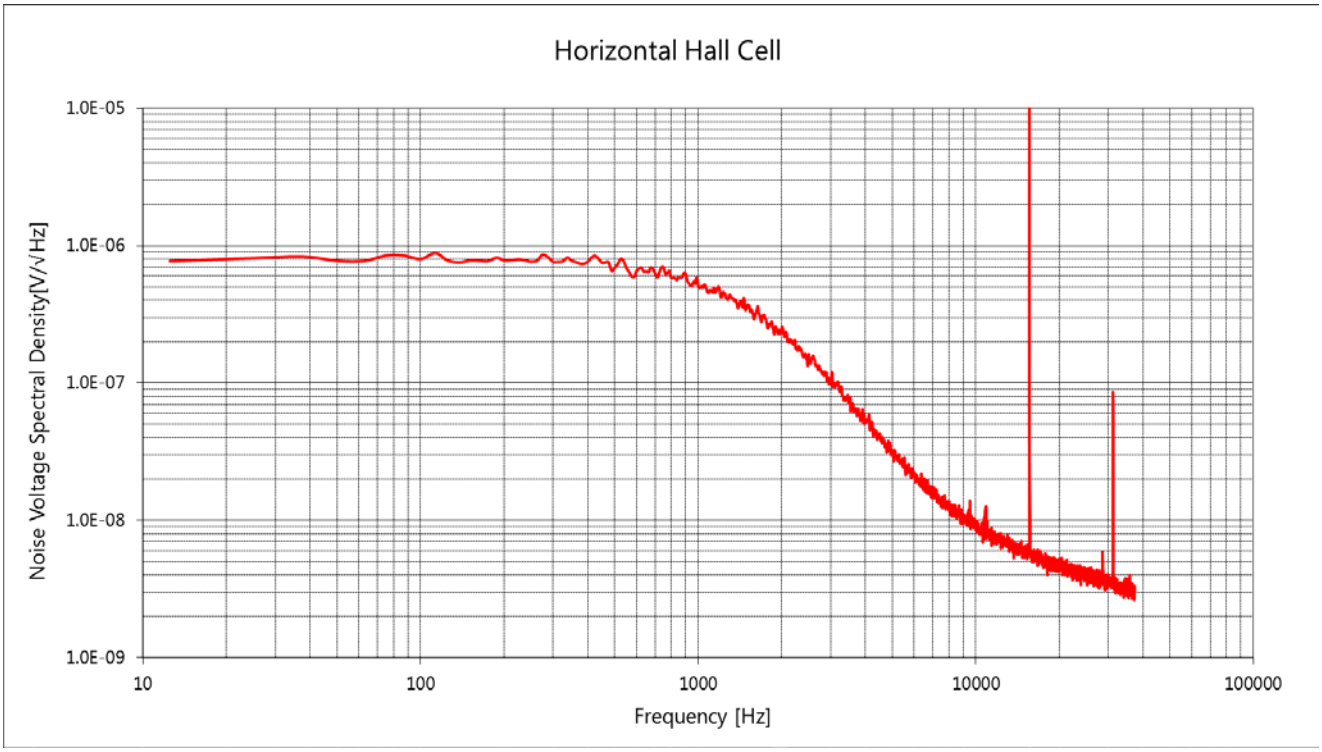

Figure 3. **Noise voltage spectral density of the zHSM1 combined with External Electronics as shown in Figure 1, with the amplifier gain 200x and a first-order low-pass filter with the bandwidth 1kHz. The noise contribution of External Electronics is about 20%.**