

Current Sensor Analysis: ACS712

Prepared by Siddhart Patel

November 19, 2024

Contents

1	Introduction	2
2	Specifications	2
3	Zero Current Output Voltage	2
4	Calculations for Sensitivity	2
5	Conclusion	3

1 Introduction

The ACS712 is a widely used current sensor capable of measuring both AC and DC currents. In this document, we analyze the ACS712-20A-T variant, which has a maximum current measuring capability of **20A**. This document summarizes key information derived from the datasheet and experimental observations.

2 Specifications

- **Minimum measurable current:** 0.4A.
- **Sensitivity:** The sensitivity changes based on the measuring range:
 - -5A: **185 mV/A**
 - -20A: **100 mV/A**
 - -30A: **66 mV/A**

3 Zero Current Output Voltage

From the datasheet, the output voltage of the sensor at zero current is expressed as:

$$V_{\text{OUT}}(0) = V_{CC} \times 0.5$$

For a typical V_{CC} of 5V:

$$V_{\text{OUT}}(0) = 2.5\text{V}$$

Conclusion: When no load is applied, the sensor outputs a voltage equal to half of the supply voltage.

4 Calculations for Sensitivity

The sensitivity defines the output voltage change per unit of current. The voltage output for a given current can be calculated as:

$$V_{\text{OUT}} = V_{CC} \times 0.5 + (\text{Sensitivity} \times \text{Current})$$

Example Calculations

For a measured current of 7A, the output voltage is calculated as follows:

- For –5A range:

$$V_{\text{OUT}} = 2.5\text{V} + (0.185 \text{ V/A} \times 1 \text{ A}) = 2.685 \text{ V}$$

- For –20A range:

$$V_{\text{OUT}} = 2.5\text{V} + (0.100 \text{ V/A} \times 1 \text{ A}) = 2.600 \text{ V}$$

- For –30A range:

$$V_{\text{OUT}} = 2.5\text{V} + (0.066 \text{ V/A} \times 1 \text{ A}) = 2.566 \text{ V}$$

5 Conclusion

The ACS712-20A-T current sensor provides a flexible and accurate method for measuring currents with varying sensitivity based on the range. The sensor outputs a voltage of 2.5V at zero load, with linear changes in output voltage corresponding to the applied current. This behavior is consistent with the datasheet specifications and makes it suitable for a variety of current measurement applications.