



DEFINING ELECTROSTATIC DISCHARGE (ESD) RATINGS FOR ALLEGRO INTEGRATED CURRENT SENSORS

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INTRODUCTION

Electrostatic discharge (ESD) is a sudden and momentary flow of electric current between two objects with different electrostatic potentials. This discharge is triggered by contact or induced by an electrostatic field. In electronics, ESD events can cause temporary malfunctions or even catastrophic failures in sensitive components.

ESD often occurs due to the triboelectric effect, where materials become electrically charged when rubbed against each other. For example, walking across a carpeted floor can generate a static charge on the human body. When this charged body comes into contact with an ungrounded electronic device, a rapid ESD event can occur, transferring the accumulated charge.

Proper ESD handling procedures during assembly, testing, and operation are essential to prevent premature device failures and in order to maintain product reliability. The high voltages and currents associated with an ESD event can damage sensitive semiconductor elements and can range in severity, from subtle or temporary performance degradation to complete device destruction. This technical brief will discuss the two main models used in quantifying ESD performance in addition to discussing why understanding ESD is important to Allegro integrated current sensors.

ESD TESTING AND MODELS

To assess the robustness of electronic components against ESD events, standardized testing methods have been developed. These tests simulate real-world ESD scenarios using specific discharge models. Two commonly employed models are the human body model (HBM) and the charged device model (CDM).

Human Body Model (HBM)

The HBM simulates the discharge that occurs when a human body, charged with static electricity, comes into contact with an electronic device. The model involves discharging a 100 pF capacitor, charged to a predetermined voltage (typically between 2 kV to 15 kV), through a 1.5 k Ω resistor in

series with the device. This simulates the capacitance of the human body and the discharge path through the skin.

Charged Device Model (CDM)

The CDM simulates the discharge from a charged device or component to a grounded surface. In the CDM test, the device itself is charged to a specific voltage and then discharged to ground through a low-inductance path.

ESD IMPACT ON INTEGRATED CURRENT SENSORS

Integrated current sensors, like Allegro's ACS37010 and ACS37030, incorporate sensitive analog circuitry to amplify and convert the sensed magnetic field (generated by the applied current) into a proportional output signal.

However, these sensitive analog components, amplifiers, and other supporting circuitry, can be susceptible to ESD damage. The high voltages and currents associated with ESD events can damage the Hall element, which could lead to inaccurate readings, thus affecting the accuracy and reliability of the sensor readings.

Allegro specifies ESD ratings for integrated current sensors in order to provide customers with an understanding of the device's robustness against ESD events. These ratings, often expressed in kilovolts (kV), indicate the maximum ESD voltage level the device can withstand without experiencing permanent damage or performance degradation.

Allegro current sensors use multiple design practices to enhance the ESD robustness of its products. Integrating specialized ESD protection circuits within the IC design to divert ESD currents away from sensitive components is one method Allegro uses to improve ESD performance. Layout strategies that minimize the impact of ESD events on the die are also implemented. Adhering to various ESD control measures during the manufacturing process of Allegro current sensors helps prevent ESD damage during assembly and packaging.

The table below summarizes the ESD ratings for several

Allegro integrated current sensors. The value for HBM is the highest passing voltage tested. Refer to individual device datasheets for additional information.

Table 1: ESD Ratings for Common Allegro Integrated Current Sensors

Device	Package	HBM (kV)	CDM (kV)
ACS37030/2	LZ	7	>1
ACS37010/2	LZ	12	>1
ACS37002	MA	12	>1
	LA	12	>1
	MC	12	>1

CONCLUSION

ESD events pose a threat to electronic components, and integrated current sensors are no exception. Understanding what ESD is, its potential impact on Allegro current sensors, and the importance of ESD ratings is crucial for any system designer.

By specifying ESD ratings and implementing protective measures, Allegro aims to provide customers with reliable and high-performance current sensing solutions that meet the demanding requirements of various applications.

Revision History

Number	Date	Description
-	October 31, 2024	Initial release

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