Application Note

AS3935 Lightning Sensor

Hardware Design Guide

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Hardware Recommendations

- **Antenna**

  The antenna is specified to have an inductance of 100uH since the sensitivity of the antenna needs to correlate with the statistical analysis of Lightning done by austriamicrosystems in cooperation with the FIT (Florida institute of technology). The following table will give an overview of recommended antennas:

Supplier	Partnumber	Properties
Coilcraft	MA5532-AE	100uH, Q=34
Premo	TR1103	100uH, Q=34
Sumida	CAS11D28-101	100uH, Q=17

  Next step is to calculate the parallel capacitor for the resonance circuit for a frequency of 500 kHz:

Resonance frequency	Capacitance calculation	Measured inductance	Calculated capacitance	Assembled Capacitance
$f_{RES} = \dfrac{1}{2\pi\sqrt{L \cdot C_R}}$	$C_R = \dfrac{1}{\left(2\pi \cdot f_{RES}\right)^2 \cdot L}$	L = 100uH	C_R = 1.013nF	C_A = 1013pF – 60pF = 953pF

  Since the internal tuning algorithm provide in total 120pF that can be put additionally to the external capacitance, it is recommended to subtract 60pF from the calculated value. It is recommended to centre the internal capacitor array of the AS3935 to 60pF in order to allow plus/minus balancing of the resonance frequency. The resonance frequency can be balanced between 485 to 515 kHz (±60pF) that allows a variation of the external components of ±15kHz. This feature allows assembling external components with lower precision that leads to a benefit in price. Furthermore it is possible to exclude soldering issues in production.

  Next step is to match the Q-factor of the antenna to a typical value of 15. Especially for the higher Q antennas it is necessary to place a resistor in parallel to the antenna. A typical value of 10kOhm is sufficient to decreases the Q from 34 to approximately 15.

- **Layout**

  ✓ Do not cross the SPI lines with the sensitive inputs of the antenna.
  ✓ Below the 500 kHz LF antenna there should not be a GND plane, to avoid Eddy currents that influence the sensitivity of the antenna.
  ✓ Long wires between the antenna and the AS3935 should be avoided, since those wires could catch up interferer that can lead to disturbers or false positives.
  ✓ It is recommended to have the antenna close to the input of the AS3935 (within ~1-2cm) and to keep the parasitic capacitance as low as possible.
  ✓ Orientation of the antenna: Since a lightning is not discharging straight, but in a zig zag pattern and the distance is very far away, the orientation should not matter.
  ✓ Make sure that the GND plane is routed carefully.
  ✓ Do not run SPI or any other interface on 500 kHz clock speed, in order to avoid any cross-coupling that leads to disturbers or detected noise on the antenna.
  ✓ Do not place any disturber or noise sources operating at 500kHz close to the antenna (e.g. DCDC converters, oscillators, interfaces etc.)

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