

Application Note No. 110

Using Infineon's Silicon Microphone SMM310
together with Infineon's Microphone Filter
BGF200

RF & Protection Devices



Never stop thinking

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Revision History: 2007-09-03, Rev. 1.1

Previous Version:

Page	Subjects (major changes since last revision)

1 Overview

Infineon's microphone filter and ESD protection device BGF200 can not only be used together with electret condenser microphones, but also with Infineon's silicon microphone SMM310. Please note that Infineon's silicon microphone SMM310 does not rely on BGF200, because the SMM310 provides also sufficient insensitivity against electromagnetic interference from mobile phones. However, when there is a long unshielded cable, wire or trace (longer than approximately 1 inch) between the microphone and the microphone preamplifier, as it can be in mobile phones for instance, Infineon's BGF200 is the ideal device to suppress electromagnetic interference from GSM or UMTS transmitters as well as to protect the microphone preamplifier from ESD events that are injected into the unshielded cable.

Unlike electret condenser microphones Infineon's silicon microphone SMM310 does not need any external bias circuit and therefore pin A3 of BGF200 must be left open. On pin A2 of BGF200 an AF (audio frequency) bypass capacitor of at least 1 μF is required to provide sufficient AF grounding for the filter as well as to block DC (see [Figure 3](#)). On the other hand, as this capacitor acts as a high-pass filter, it also helps to suppress low-frequency wind noise. Therefore, do not connect pin A2 directly to ground. [Figure 4](#) shows the frequency response of Infineon's microphone filter BGF200 with two different bypass capacitors (680nF and 1 μF). When a 680nF bypass capacitor is used, the lower 3 dB cut-off frequency is already 160Hz, while for a 1 μF bypass capacitor the lower cut-off frequency is 130 Hz. Thus, one can calculate the lower 3dB cut-off frequency $f_{3\text{dB}}$ for the bypass capacitance C as follows:

$$f_{3\text{dB}} = 130\text{Hz} \times \sqrt{\frac{1\mu\text{F}}{C}} \quad (1)$$

Since most microphone amplifiers have differential inputs, BGF200 offers also a differential output that can be directly connected—through AC coupling capacitors—to the microphone preamplifier. [Figure 1](#) shows the schematic of BGF200 where one can see the integrated on-chip ESD protection diodes connected to pin C3 to protect the microphone preamplifier from ESD events of up to $\pm 15\text{ kV}$ as per the IEC 61000-4-2 specification [\[1\]](#).

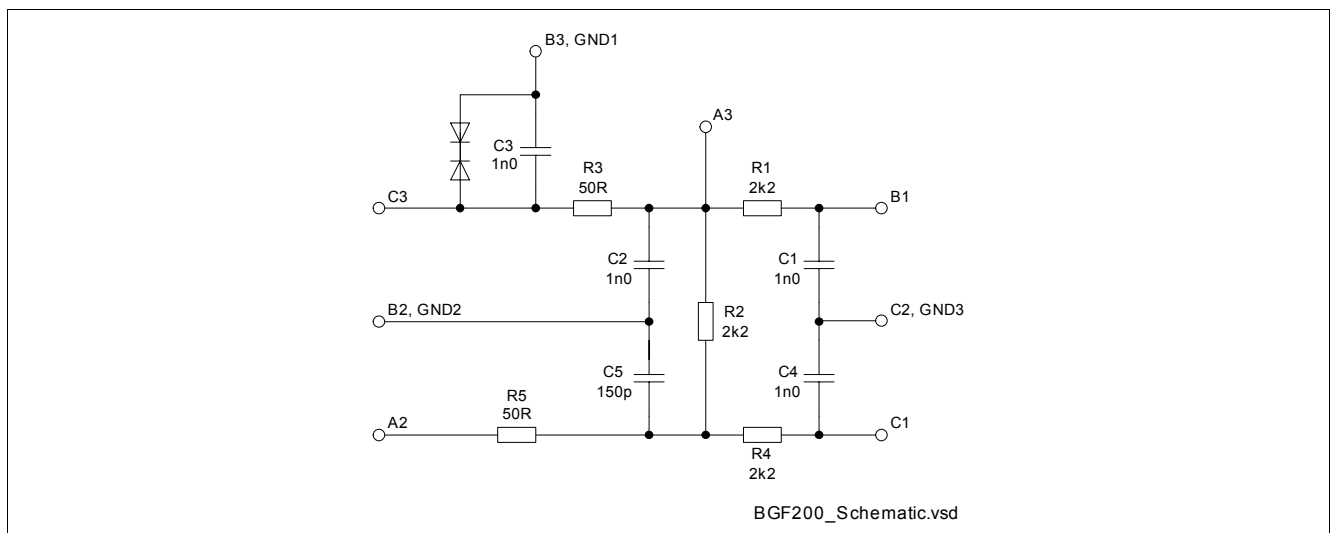


Figure 1 Schematic of BGF200 (microphone filter and ESD protection device)

[Figure 2](#) shows a typical application example for Infineon's silicon microphone SMM310 when the microphone is placed close to the preamplifier. The microphone's internal capacitance C_{EMC} between the microphone's output and ground is approximately 30 pF and therefore one should also place a 30 pF capacitance between the

preamplifier's IN- pin and ground for proper suppression of RF common mode signals. The AC coupling capacitors C_{CO} are typically 100 nF.

Figure 3 shows an application example when there is a long cable between the silicon microphone and the preamplifier. For this purpose Infineon's microphone filter BGF200 is used to suppress electromagnetic interference injected into the cable from GSM or UTMS transmitters in mobile phones for instance. Furthermore, the microphone filter BGF200 also prevents the preamplifier from being damaged due to ESD events injected into the cable. Therefore, BGF200 should be placed as close as possible to the preamplifier. Infineon's silicon microphone SMM310 can withstand ESD events of ± 4 kV—as defined by the Human Body Model [2]—between any two pins. Furthermore, Infineon's SMM310 has a metal cover which is connected to ground and is therefore much more robust against electrostatic air discharges on the sound inlet hole than electret condenser microphones. Typically, the ESD robustness is 10kV when electrostatic air discharges as per the IEC 61000-4-2 specification occur directly at the sound inlet hole of the microphone.

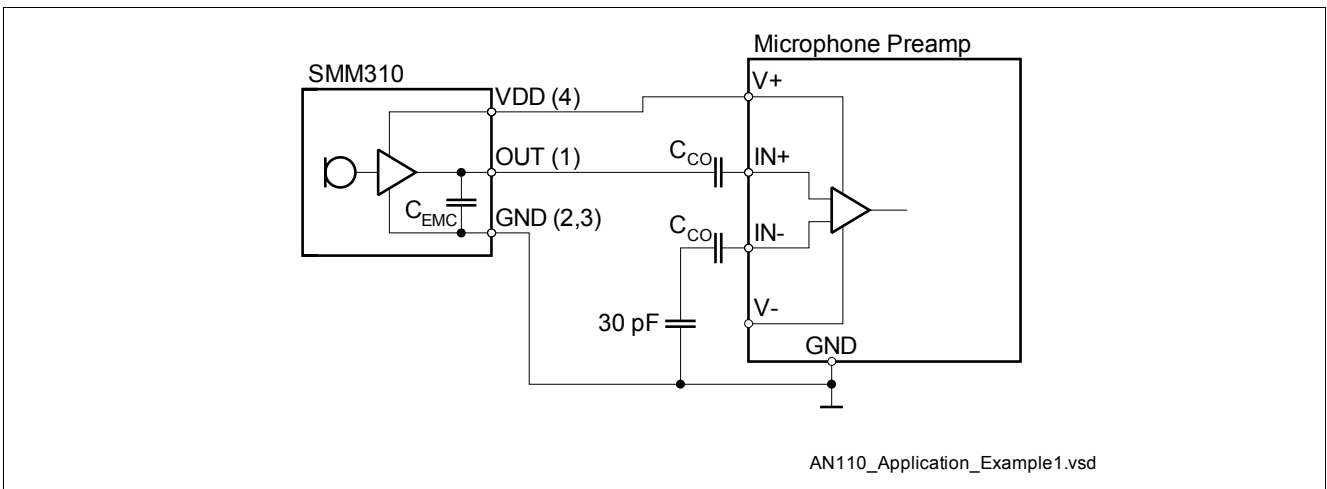


Figure 2 Typical application example for Infineon's silicon microphone SMM310

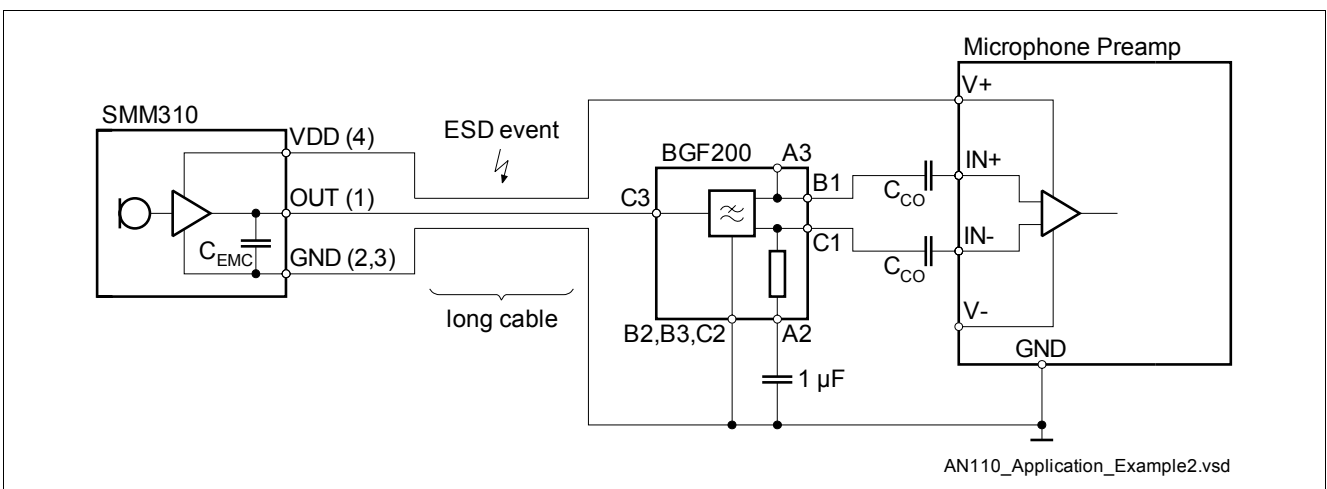


Figure 3 Typical application example for Infineon's silicon microphone SMM310 together with Infineon's microphone filter BGF200

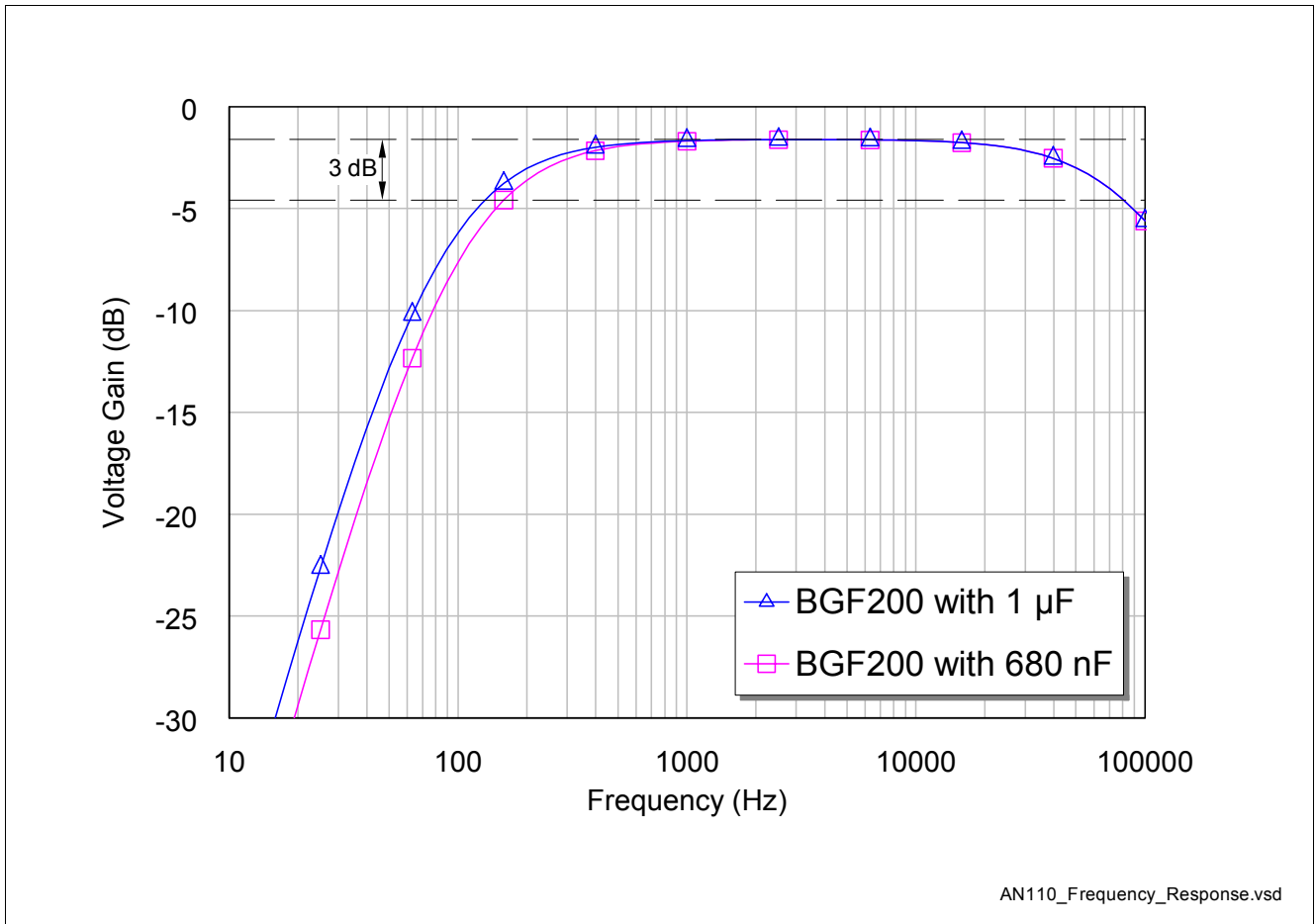


Figure 4 Frequency response of BGF200 with different bypass capacitors at pin A2

Please, feel free to contact Infineon's application experts for further recommendations and technical support.

References

- [1] IEC 61000-4-2, Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques – Section 2: “Electrostatic discharge immunity test,” International Electrotechnical Commission, 1995.
- [2] JESD22-A114D, “Electrostatic Discharge (ESD) sensitivity testing Human Body Model (HBM),” JEDEC Solid State Technology Association, March 2006.