



Crystals and Padding Capacitors

for ACS4050, ACS4060

Crystal Selection

The following specifications need to be used for crystals suitable for ACS4050 and ACS4060:

- Frequency
- Calibration tolerance
- Temperature tolerance
- Load capacitance

Other specifications such as *package* should be considered by the user in the context of the specific application.

Frequency

The data sheets for ACS4050 and ACS4060 give full information of crystal frequencies required. Most E1 applications use 32.768MHz and most T1 applications use 30.880MHz. It is important that this is the fundamental frequency of the crystal.

Calibration Tolerance

This is the allowed error of the crystal from the specified frequency at a fixed temperature, usually 25°C. For this application the tolerance should not exceed ± 25 ppm.

Temperature Tolerance

This is the allowed change in frequency of the crystal over the temperature range of the crystal. For this application the tolerance should not exceed ± 25 ppm. Acapella/Semtech usually specifies crystals for the temperature range -40°C to +85°C, although other ranges are available.

Note, the combined calibration and temperature tolerances give an allowed variation of ± 50 ppm from the specified frequency, over the complete temperature range.

Load Capacitance

For the ACS4050 and ACS4060, the crystal requires a load capacitance. Typically crystals have standard loads of 15pF, 20pF and 30pF.

Any of these values can be used, or any intermediate value, but Acapella/Semtech recommends that values close to 30pF, or greater, are not used – as this could result in overloading the internal oscillator of the IC.

Padding Capacitor Selection

As can be seen in the data sheets for the ACS4050 and ACS4060, the crystal is connected to the IC along with two *padding* capacitors. These capacitors are connected one from each side of the crystal to ground. The capacitors should be equal value, and the total capacitance on each side of the crystal should be twice the crystal load capacitance.

When determining the padding capacitor value, allowance must be made for internal IC capacitance, and any stray capacitance from leads and track on the PCB.

The following values are given as a guide. The user should determine whether these values are correct in the specific application.

Crystal load capacitance	Capacitor values	Expected change from required frequency
15pF	22pF	-20ppm
20pF	27pF	+20ppm
30pF	47pF	+15ppm

In very rough figures, an increase of 1pF in the capacitor values gives a decrease of 10ppm in the frequency – however, only use this as a guide.