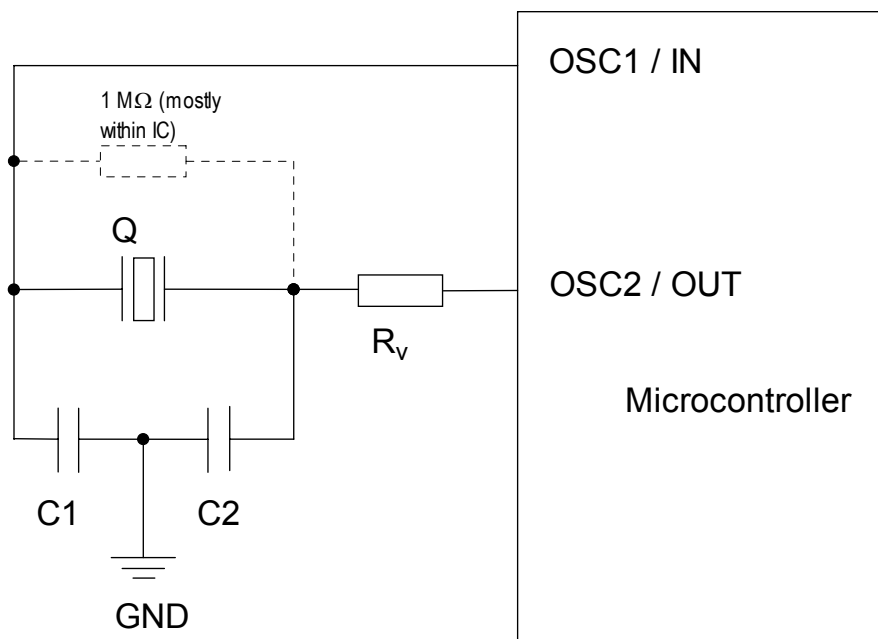


Calculation of external resistor R_v

Pierce-circuit, with external resistors



When do you need an external resistor R_v ?

Generally, we recommend an external resistor R_v for crystals with frequencies below 4 MHz. Above 4 MHz the inner resistance of the IC would be sufficient, usually.

How to evaluate the external resistor R_v ?

C_2 is in series with R_v and hence is a low-pass filter. R_v suppresses the overtones of the crystals. Thus R_v is chosen such that cutoff frequency f is:

$$f = 1 / (2 \pi R_v C_2)$$

right between fundamental frequency and third overtone. Thus, the cutoff frequency will be twice as high as the nominal fundamental frequency of the crystal.

Examples, for $C_2 = 22 \text{ pF}$:

- for a 2 MHz crystal the desired cutoff frequency is 4 MHz. Hence, $R_v = 1,8 \text{ k}\Omega$
- for a 6 MHz crystal the desired cutoff frequency is 12 MHz. Hence, $R_v = 600 \Omega$