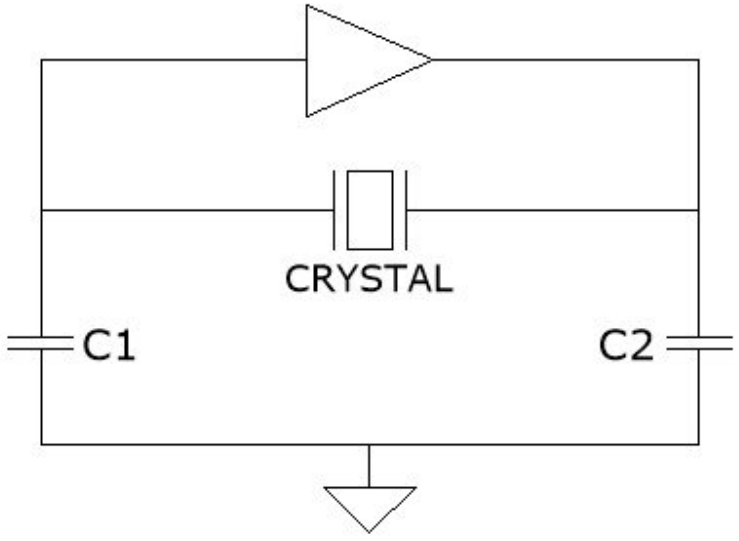
A common mistake when specifying load capacitance is assuming that the value of the external capacitors directly equals the crystal's load capacitance. This isn't the case.

The capacitors connected to ground on both sides of the crystal create the necessary phase shift within the closed-loop network. This ensures that the gate input and gate output are in phase, a crucial condition for sustained oscillation.

The challenge is that the value of stray capacitance (C stray) varies depending on the specific application. Factors like circuit trace layout, pin-to-pin capacitance of the microprocessor (or other digital device), distance between oscillator input pins and the crystal, PCB material, and crystal grounding all influence C stray. Measuring this stray capacitance is also tricky, as measuring equipment often overwhelms these small capacitance values.

A practical approach is to suggest the customer try a crystal with a standard load capacitance (Cl) and then adjust the value to fine-tune the frequency.

C stray typically ranges from 2pF to 8pF. If the customer is unsure about the appropriate load capacitance, the equation below can be used with the values of C1, C2, and assuming a C stray of 5pF. For instance, if the customer is using two 29pF capacitors, the calculation would look like this:



$$Cl = \frac{C_1 \times C_2}{C_1 + C_2} + C_{Stray}$$

$$Cl = \frac{29 \times 29}{29 + 29} + 5$$

$$Cl = \frac{841}{58} + 5$$

$$Cl = 14.5 + 5 = 19.5pF$$

In this scenario, the recommended load capacitance would be 20pF.

Need more information?
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