Determination of the Crystal Drive Level (Crystal Power)

To ensure that the crystal is not overdriven in its circuit environment, it may be necessary to measure the power that is applied to the crystal.

The most reliable way to do this is to measure the crystal power (often called drive level) by a miniature current probe. A typical configuration of a crystal circuit and the correct position to insert the current probe is shown in Fig. 1.

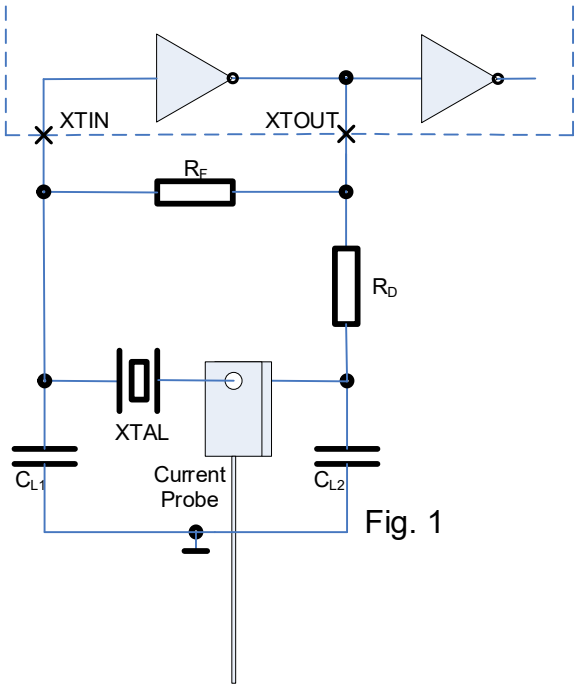

Fig. 1

The crystal power level can be determined as follows:

- calculate the loaded series resistance R_L at the original circuit conditions, using the parameters R_1 and C_0 of the individual crystal* in the circuit using formula (1):

$$R_L = R_S * \left(1 + \frac{C_0}{C_L}\right)^2 \qquad (1)$$

- the crystal current I_{CSpp} is measured with the current probe. Note that the RMS current I_{CSRMS} must be calculated from the peak to peak current I_{CSpp} to calculate the crystal power correctly.
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$$P_{Crystal} = R_L * (I_{CSRMS})^2 = R_L * \left(\frac{I_{CSpp}}{2 * \sqrt{2}}\right)^2 = R_L * \frac{(I_{CSpp})^2}{8} \qquad (2)$$

* NOTE: To determine the equivalent data of the individual crystal which is used to determine the crystal drive level (like C_0 and R_S) special crystal measurement equipment is required. Also, if the effective load capacitance C_L (including stray capacitances) is not exactly known, this can only be determined using special crystal test equipment. You may ask typical C_0 and R_S from your crystal supplier.