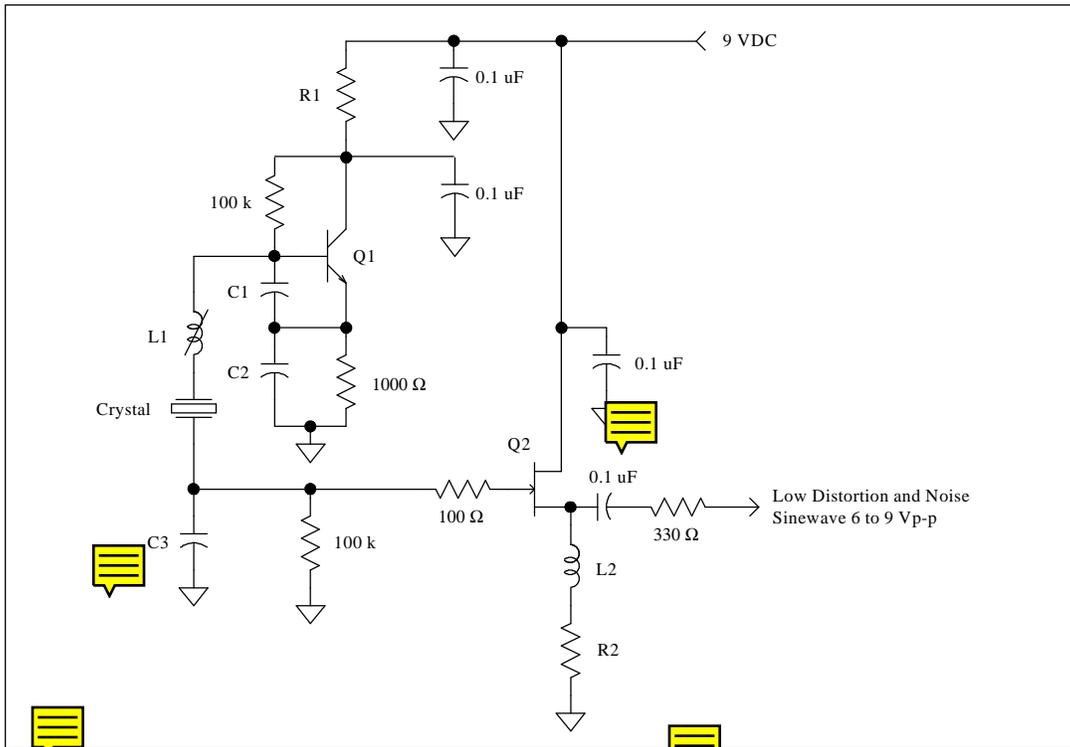


# Low Distortion Crystal Oscillator



Part	Value
Q1	2N4401, 2N3904, 2N2222, or other general purpose NPN transistor
Q2	2N4416, 2N4858, U310, or other low capacity N-channel JFET
R1	10k nominal, select this value to get desired output level.
R2	470 ohm to save power and drive a higher load, 100 ohm to drive a lower impedance load.
C1	100 pF for 10 MHz, 220 pf for 5 MHz, 1000pF for 1 MHz. The value is not critical.
C2	220 pF for 10 MHz, 470 pF for 5 MHz, 2200 pF for 1 MHz. The value is not critical.
C3	33 pF for 10 MHz, 68 pF for 5 MHz, 330 pF for 1 MHz. Select a value with 500 ohm reactance at the crystal frequency.
L1	Select to center crystal frequency. A more complex network including a varactor diode and trimmer cap may be added.
L2	100 uH for 10 Mhz, 470 uH for 5 MHz, 1 mH for 1 MHz. Choose a large value for the operating frequency.

This crystal oscillator is designed to operate with fundamental crystals with less than 1 mW dissipated in the crystal. The signal current is filtered by the crystal and develops a voltage across a capacitor with about 500 ohm of reactance. The resulting sinewave has low distortion and phase noise. A JFET buffer is included to drive lower impedance loads. Further buffering with an emitter follower and a voltage step-down transformer or matching network is recommended for driving 50 ohm loads. C3 may be reduced for larger output voltage or to allow lower drive level or it may be increased when lower output levels are desired. The 1k emitter resistor may be replaced with a choke when using overtone crystals. Select the choke to resonate with C2 at a frequency slightly above the fundamental frequency for third overtone crystals. High-Q overtone crystals should be driven at much lower levels than fundamental crystals so select a smaller value for C3 and set the output level as low as possible. Measure the drive level when the crystal's rated current or power is known. The drive level may be determined by temporarily connecting a 100 ohm across C3 and measuring the signal level on the source of the FET. The crystal current is simply  $V/100$ .