

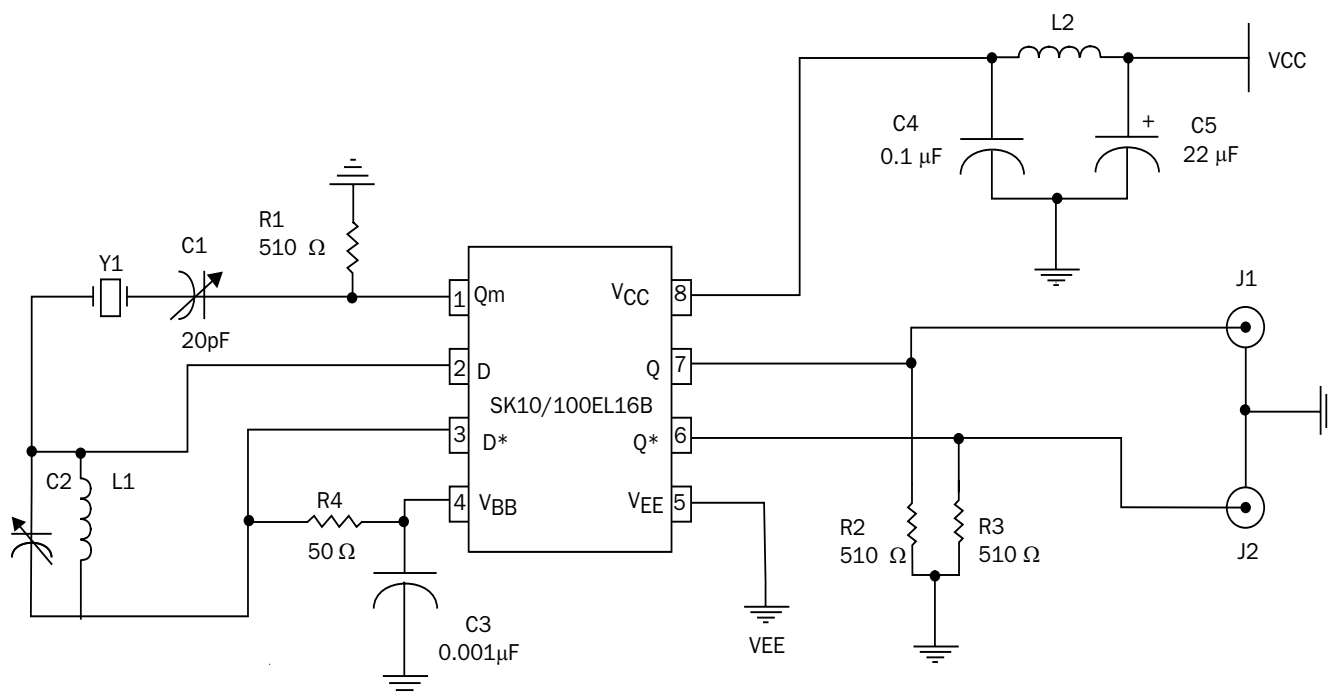
**Voltage Controlled and Overtone Crystal Oscillators**

Crystal oscillators are used to provide reference frequency clocks for applications such as SONET, Gigabit Ethernet, or fiber channel. Crystal oscillator manufacturers can design oscillators with accurate signal waveforms of  $\pm 10$  ppm or better of the reference frequency. In this application note only examples of overtone and voltage controlled crystal oscillators are provided in figures 1, 2, 3, and 4, respectively.

These reference clocks can also be obtained with a PLL based IC devices. Some of the most popular reference frequencies are 155.52 MHz (OC-3) and 622.08 MHz (OC-12) which can be obtained using Semtech's PLL based devices mentioned in Table 1.

Device	Function	Package Type	Operating Voltage
SK1801W	SONET OC - 3 Frequency Synthesizer	16 Pin Wide Body SOIC	3.0V to 5.5V
SK1802W	SONET OC - 12 Frequency Synthesizer	16 Pin Wide Body SOIC	3.0V to 5.5V

**Table 1**



**Figure 1: Overtone Crystal Oscillator**

## HIGH-PERFORMANCE PRODUCTS

### Overtone Crystal Oscillators

Overtone operation is accomplished by adjusting the tank circuit frequency at or near the desired frequency. Using formula 1, we can calculate the values of L1 and C1 for a desired frequency.

$$f \cong \frac{1}{2 \pi \sqrt{L_1 C_1}}$$

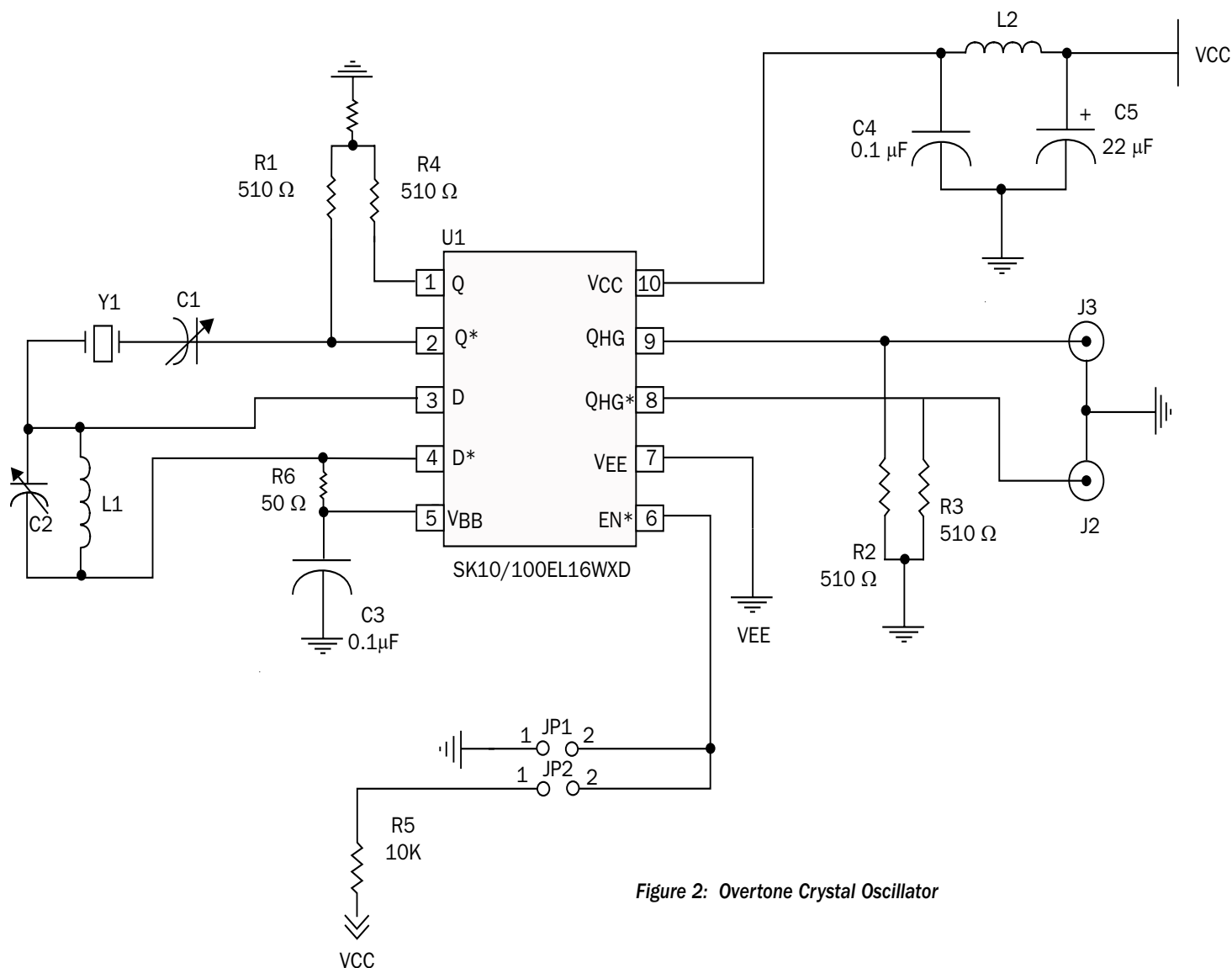
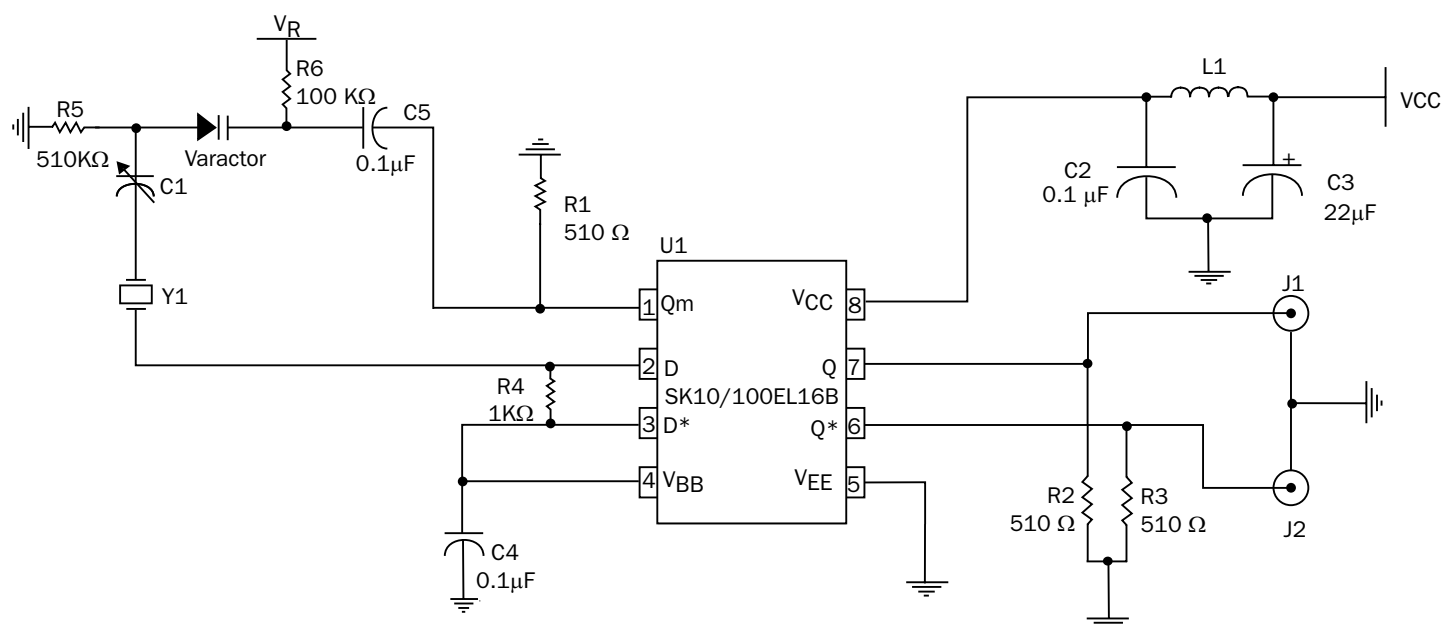


Figure 2: Overtone Crystal Oscillator

## Voltage Controlled Crystal Oscillator

A voltage-variable capacitance tuning diode is placed in series with the crystal feedback path. Changing the voltage on  $V_R$  varies the tuning diode capacitance and tunes the oscillator. The 510 K $\Omega$  resistor, R5, establishes a reference voltage for  $V_R$  and the 100 K $\Omega$  resistor, R6, isolates the tuning voltage from the feedback loop and a 0.1  $\mu$ F capacitor, C5, provides AC coupling to the tuning diode. The center frequency is set with a trimmer capacitor, C1. Deviation on either side of center is a function of the crystal frequency.



**Figure 3: Voltage Controlled Crystal Oscillator**

## HIGH-PERFORMANCE PRODUCTS

### Voltage Controlled Crystal Oscillator (con'd)

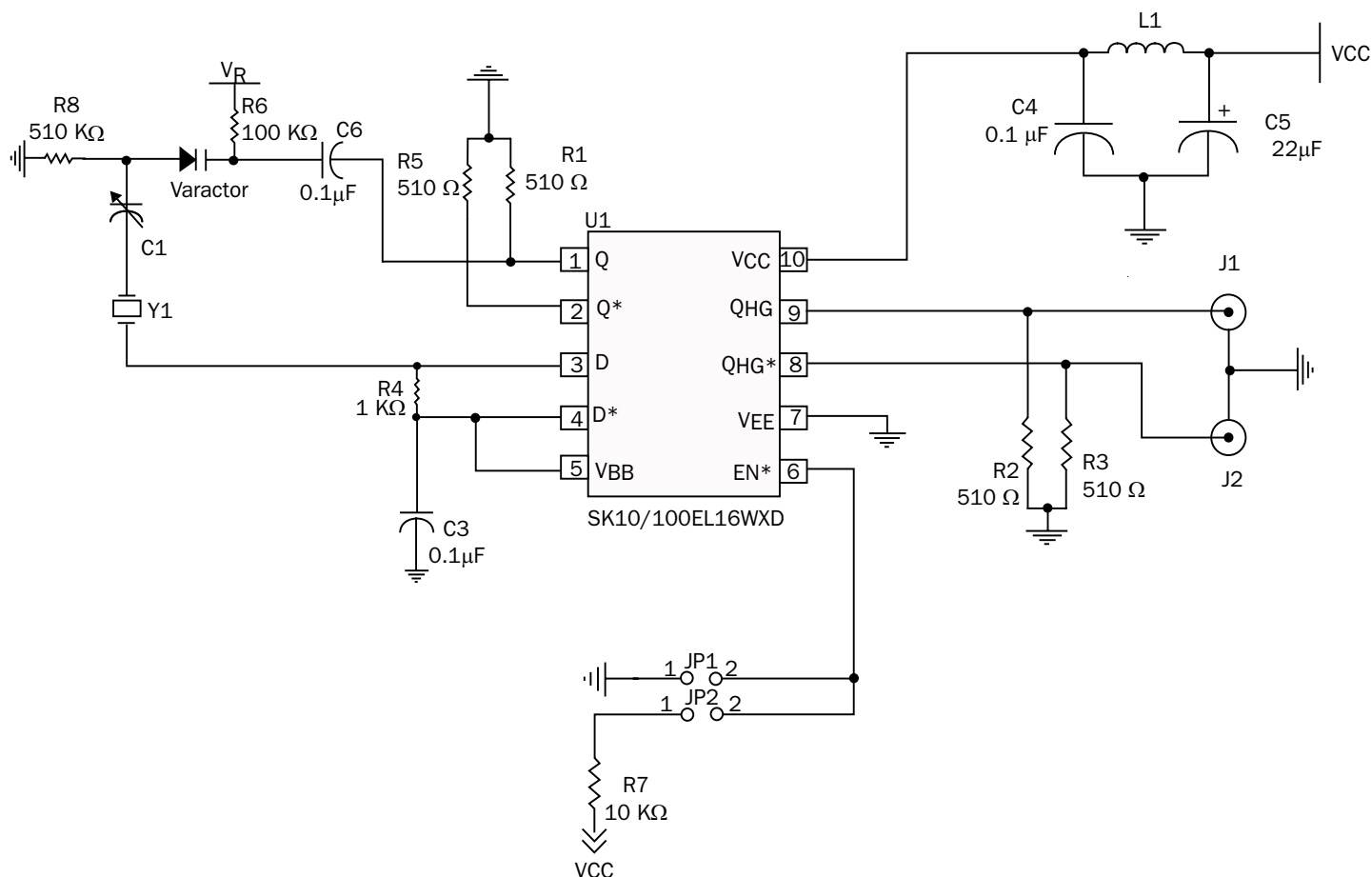


Figure 4: Voltage Controlled Crystal Oscillator

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