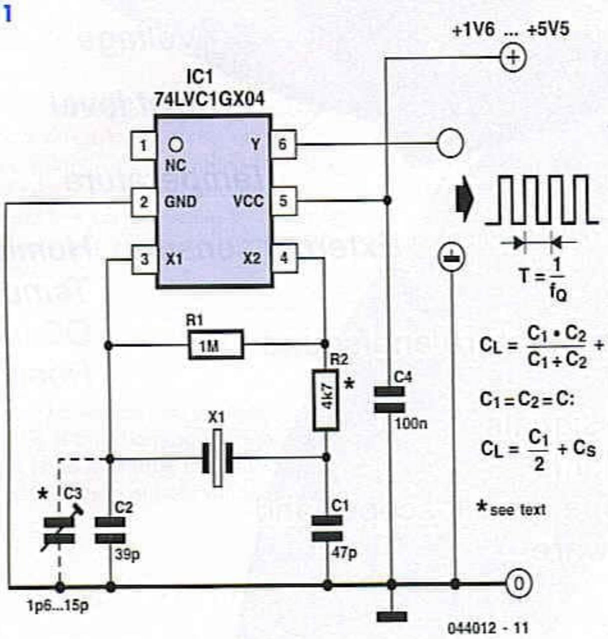
1



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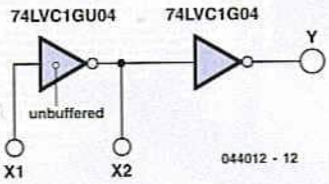

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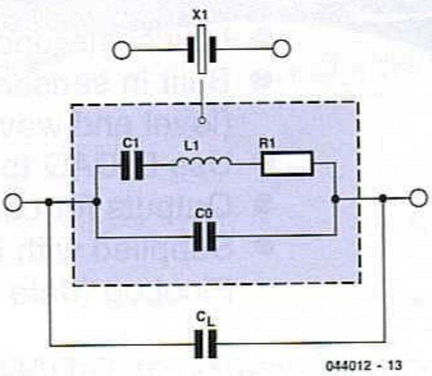

Combi-gate Oscillator IC

Many of you will know that a digital oscillator built from unbuffered inverters in a 74xx04U IC has to be followed by a 'normal' gate. Both functions are now available from a single IC produced by Philips.

A quartz crystal oscillator built around an unbuffered logic gate type 74HC04U traditionally employs a high feedback resistance to be effectively turned into a high-gain linear amplifier (**Figure 1**). The frequency-determining quartz crystal is also inserted in the feedback path, its resonance characteristics forcing the circuit to oscillate at the crystal frequency. This works very well but unfortunately there are also a few disadvantages: not only are five of the six gates in the HC04U package left unused, but you will also need one unbuffered gate to make the signal truly digital-compatible because the output signal of the linear oscillator stage looks more like a sinewave.
The above combination of an unbuffered and a buffered gate is now available in a single IC package type 74LVC1GX04 from Philips (**Figure 2**). The new IC may be used for oscillator circuits operating at up to 50 MHz and runs happily off supply voltages between 1.65 V and 5.5 V. Its output is capable of 24 mA drive (at V_{cc}= 3.3 V). The first inverter in the new IC is unbuffered and the second one, buffered to ensure the non-digital oscillator signal is properly shaped to meet TTL specifications in regard of swing and absolute high/low levels.

The 74LVC1GX04 requires only a quartz crystal and a small number of external parts. Resistor R1 is the feedback resistance to which the crystal is connected in parallel. Resistor R2 and capacitor C1 together act as voltage divider to keep the quartz crystal dissipation within limits. The dissipation spec may be found in the quartz crystal datasheets, or obtained from the manufacturer. If necessary, the value of R2 may be adapted to your requirements. In **Figure 3**, capacitors C1 and c2 together with the load capacitance C_s form the load on the quartz crystal. The manufacturer will typically indicate that due to the crystal cutting and grinding method, the nominal crystal frequency is reached at a load capacitance of about 30 pF. Because C_L is in parallel with the crystal, a mode called 'parallel resonance' is required. Here, the crystal 'sees' as its load two series connected capacitors, C1 and C2, not forgetting the circuit stray capacitance C_s, which is essentially formed by the gate input (X1, X2 in Figure 1). In practice, C_s equates to about 5 pF.

$$C_L = [(C1\ C2) / (C1 + C2)] + C_s$$

$$C1 = C2 = C$$

$$C_L = C / 2 + C_s$$

With C_L = 30 pF and C1 = C2 =C the latter takes a theoretical value of 50 pF, or 47 pF from the components drawer. C2 may have a trimmer connected in parallel if exact frequency adjustment is required. The value of C2 is then decreased by an amount equal to half the trimmer's full capacitance.

C1 decouples the supply voltage and has to be fitted as close as possible to the 74LVC IC. If necessary, noise suppression may be enhanced by adding a small series resistor or a choke in the supply line.

(044012-1)

Web pointer
www.philipslogic.com/products/lvc/pdf/74lvc1gx04.pdf