Crystal specifications and applications

Philips video decoders and encoders require crystals that meet specific parameters. Specifying the frequency alone will not guarantee proper operation.

Operational failures that could be a related to crystal dysfunction are:
1. Inability to achieve line lock (horizontal lock).
2. Inability to achieve chroma lock.
3. Slow lock acquisition.

The oscillators of the Philips decoders and encoders were originally designed for third overtone crystals which are applied using the example in Figure 1A. There are two load capacitors to match the C_{load} parameter of the crystal and a LC trap to prevent the crystal from operating in the fundamental mode. The drawback of these crystals is that it is difficult to obtain devices in low profile or surface mount because the third overtone AT cut precludes the smaller packages.

Tests were performed to determine if fundamental mode crystals would perform well without excessive loading of the oscillator. The C_{load} parameter of fundamental crystals was 18pF instead of the 8pF for the third overtone, therefore increased load capacitance was required. The LC trap is not required, see Figure 1B.

When specifying these fundamental crystals, it is important that the resonance resistance be kept low (80 ohms or less) to allow the oscillator to start.

The THIRD OVERTONE specifications are:

Nominal Frequency:	26.800000MHz (square pixel decoders) 24.576000MHz (CCIR decoders) 27.000000MHz (CCIR encoders) 24.545445MHz (square pixel encoders–NTSC) 29.500000MHz (square pixel encoders–Pal)
Load capacitance C_{load}:	8pF
Adjustment tolerance:	±40ppm
Resonance resistance:	50Ω (square pixel) 60Ω (CCIR)
Drive level dependency:	80Ω
Motional capacitance C_1:	1.1fF (square pixel) 1.0fF (CCIR)
Parallel capacitance C_0:	3.5pF (square pixel) 3.3pF (CCIR)
Temperature range:	0 to 70° Celsius
Frequency stability:	±20ppm

The FUNDAMENTAL mode specifications are:

Nominal Frequency:	26.800000MHz (square pixel decoders) 24.576000MHz (CCIR decoders) 27.000000MHz (CCIR encoders)
Load capacitance C_{load}:	18pF (standard)
Adjustment tolerance:	±30ppm (B option)
Resonance resistance:	80Ω
Drive level:	2mWatts max.
Motional capacitance C_1:	4fF to 35fF
Parallel capacitance C_0:	7pF
Temperature range:	0 to 70° Celsius
Frequency stability:	±50ppm (B option)

The Philips part numbers for these crystals are:

9922 520 30004 for 26.800000MHz These are third overtone crystals
9922 520 30009 for 24.576000MHz

These are available from the Philips Components Passive Group, phone: (803) 772–2500

Crystal specifications and applications

Crystals are also available from MMD–Mills Marketing and Distribution:

MMC–001–24.576 000MHz These are third overtone
MMC–002–24.545445 MHz
MMC–003–26.800000 MHz
MMC–004–27.000000 MHz
MMC–005–29.500000 MHz

MMD also carries fundamental mode crystals:

B20BA1–24.576MHz These are low–profile through–hole
B20BA1–26.800MHz
B20BA1–27.000MHz

D20BA1–24.576MHz These are low–profile surface mount
D20BA1–26.800MHz
D20BA1–27.000MHz

MMD can be reached at (714) 444–1402, Fax:(714) 444–1149. The contacts are Rodney Mills and Matt LaVine.

Crystals are also available from Ecliptek. Their part numbers are:

ECX–2194–26.800MHz These are third overtone
ECX–2097–24.576MHz

Ecliptek can be reached at (714) 433–1200 ext. 250, the contact is Mark Stoner.

There is a procedure that may be used to determine if a crystal is properly loaded and running at the correct frequency:

For the decoders :

1. Program the decoder for normal operation (no video input is needed).
2. Set the horizontal phase lock loop bit, HPLL to a logical 1 (normal operation has this bit set to 0). This puts the decoder in a free–running mode, in the center of the lock range.
3. Measure the frequency of the LLC clock output pin, not the crystal itself, this frequency should be:

   27.000000 MHz for CCIR decoders set for either NTSC or Pal (or Secam)
   24.545445 Mhz for square pixel decoders set for NTSC
   or
   29.500000 MHz for square pixel decoders set for Pal or Secam

For the encoders:

1. Set the CDIR pin to a logical 0. This sets the LLC pin as an output. Program the encoder to the MASTER sync mode. Measure the frequencies as you would for the corresponding decoders above.
2. Conversely, if you do not have an accurate frequency counter but do have an accurate source of video (or H/Comp. sync) you can use this signal as a reference. Connect one probe of a dual–trace scope to your reference (this could also be demodulated broadcast video from a tuner, a very accurate source) and connect the other probe to any output of the decoder or encoder that contains horizontal information. For the decoders this could be either the HREF or HS output, for the encoders this could be RCV2 (set as an output) or RCM2 or look at the composite or luminance outputs.
3. Compare the rate at which one trace takes to drift one horizontal interval with respect to the other. A 1 second interval corresponds to a 60ppm difference, a 4 second interval corresponds to a 15ppm accuracy. Anything less than 2 seconds should be considered out of spec.

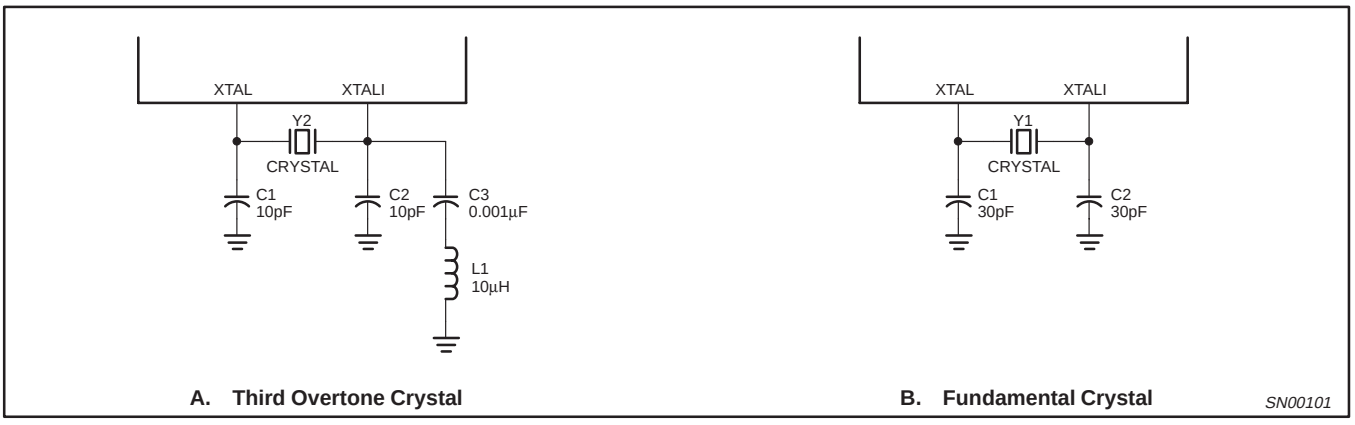

Figure 1. Crystal Application Example