

IC part numbers can sometimes be confusing, so here is some hopefully helpful information.

Most synthesizers from the 1980's were designed using a combination of 4000 series CMOS chips, which can operate at 15 volts, and 74LS series chips, which can only operate at 5 volts. 4000 series chips can have a part number such as:

HF4051 (Japanese part)
CD4051 (National, TI, etc)
MC14051 (Motorola)

These parts are equivalent and interchangeable.

Many of the 4000 series chips have a B after the part number. This stands for "buffered", as the original (RCA) parts were not buffered and had limited drive, so buffers were added at the outputs to increase the drive current, and the B was added. Most new parts are buffered types. Parts with "UB" after the part number are "unbuffered". These have lower output drive current, and tend to be used mostly in special applications, such as oscillator circuits. In general, older non-B chips can be replaced with newer buffered B parts, unless the schematic or parts list specifies an unbuffered part.

The 7400 series was one of the first "families" of logic chips. These chips were designed using what was called "transistor-transistor logic", and are often called TTL chips as a result. The idea was to have chips with different functions which could all work together. These parts were widely used in the early 1970s. A number of other logic families were derived from the 7400 series. For instance a Quad (four gates) AND chip could be:

7408 original series
74L08 lower power, but slower than 7408
74LS08 lower power and similar speed to 7408
74ALS08 lower power than 7408, faster than 74LS08
74S08 faster than all above chips, but uses more power
74AS08 even faster than 74S08
74F08 another fast variant

These are all bi-polar (not CMOS) IC's which were designed to operate at 5V. Of the above families, the one you will see most in synthesizers from the 1980's and early 90's is the 74LS family, as it offers good speed at reasonable power consumption. Older units from the 1970's may have 7400 series chips in them, which are not as easy to get these days. Special circuits that run at faster speeds may use 74S or 74AS parts. Note that even though the part numbers are similar, chips in different families have different characteristics, and were chosen for them. If you replace a 74S08 with a 74LS08 chip, the circuit may seem to work, but if the unit heats up, it may become flaky or stop working. It's always best to replace a chip with one with the same exact part number unless you are sure of what you are doing.

Since designers were familiar with the 7400 series of chips and their functions, IC makers decided to make CMOS versions with the same function and pin layout. Here are

some CMOS equivalents of the 7408 AND gate:

74C08 This is actually made with the same process as a 4000 series chip, so it can operate at 15 volts, but is much slower than a 74LS08 for example. This chip should only be used if the schematic or parts list specifies it.

74HC08 The "H" stands for high-speed. The 74HC chips are 5V parts, but they are much faster than 4000 series parts and could be used instead of older logic families to save power. But designers had to use them carefully, as the characteristics are different from 74LS chips. A 74HC chip should NOT be used to replace a 74LS chip except in unusual cases, as almost all of the 74LS series chips are still available and the characteristics are different.

74HCT08 This is a high-speed CMOS part, but the input logic thresholds were designed to allow it to work in a circuit with 7400 or 74LS chips. The acceptable voltage levels for 0 and 1 values are different between TTL and CMOS chips, which makes mixing them tricky. The 74HCT family is a 5V CMOS one, but with input levels more like a TTL (7400 or 74LS) type of chip. These chips are not common, but if you need to replace one, you need to use a 74HCT part, not a 74HC part.

Watch out for chips like these:

74HC4051 This is a 5V part, even though it has the same function as the CD4051 chip. You cannot operate this part at 12 volts!

74HC4066 is another example of this merging of part numbers between two families. This is NOT a replacement for a CD4066 or MC14066. It's a 5V part with lower "on" resistance than the CD4066, so it is a useful part, but not for replacing CD4066's.