7400 series Derivative families

7400 series parts were constructed using bipolar transistors, forming what is referred to as transistor-transistor logic or **TTL**. Newer series, more or less compatible in function and logic level with the original parts, use CMOS technology or a combination of the two (BiCMOS). Originally the bipolar circuits provided higher speed but consumed more power than the competing 4000 series of CMOS devices. Bipolar devices are also limited to a fixed power supply voltage, typically 5 V, while CMOS parts often support a range of supply voltages.

Milspec-rated devices for use in extended temperature conditions are available as the 5400 series. Texas Instruments also manufactured radiation-hardened devices with the prefix *RSN*, and the company offered beam-lead bare dies for integration into hybrid circuits with a *BL* prefix designation.

Regular-speed TTL parts were also available for a time in the 6400 series - these had an extended industrial temperature range of -40 ºC to +85 ºC. While companies such as Mullard listed 6400-series compatible parts in 1970 data sheets, by 1973 there was no mention of the 6400 family in the Texas Instruments *TTL Data Book*. Some companies have also offered industrial extended temperature range variants using the regular 7400 series part numbers with a prefix or suffix to indicate the temperature grade.

As integrated circuits in the 7400 series were made in different technologies, usually compatibility was retained with the original TTL logic levels and power supply voltages. An integrated circuit made in CMOS is not a TTL chip, since it uses field-effect transistors (FETs) and not bipolar junction transistors, but similar part numbers are retained to identify similar logic functions and electrical (power and I/O voltage) compatibility in the different subfamilies. Over 40 different logic subfamilies use this standardized part number scheme.

- **Bipolar**
  - **74** - Standard TTL. the original logic family had no letters between the "74" and the part number. 10 ns gate delay, 10 mW dissipation, 4.75-5.25 V, released in 1966.
  - **74L** - Low-power. Larger resistors allowed 1 mW dissipation at the cost of a very slow 33 ns gate delay. Obsolete, replaced by 74LS or CMOS technology. Introduced 1971.

- **74H** - High-speed. 6 ns gate delay but 22 mW power dissipation. Used in 1970s era supercomputers. Still produced but generally superseded by the 74S series. Introduced in 1971.
- **74S** - High-speed Schottky. Implemented with Schottky diode clamps at the inputs to prevent charge storage, this provides faster operation than the 74 and 74H series at the cost of increased power consumption and cost. 3 ns gate delay, 20 mW dissipation, released in 1971.
- **74LS** - Low-power Schottky. Implemented using the same technology as 74S but with reduced power consumption and switching speed. Typical 10 ns gate delay, a remarkable (for the time) 2 mW dissipation, 4.75-5.25 V.
- **74AS** - Advanced Schottky, the next iteration of the 74S series with greater speed and fan-out despite lower power consumption. Implemented using the 74S's technology with "miller killer" circuitry to speed up the low-to-high transition. 1.7 ns gate delay, 8 mW, 4.5-5.5 V.
- **74ALS** - Advanced low-power Schottky. Same technology as 74AS but with the speed/power tradeoff of the 74LS. 4 ns, 1.2 mW, 4.5-5.5 V.
- **74F** - Fast. Fairchild's version of TI's 74AS. 3.4 ns, 6 mW, 4.5-5.5 V. Introduced in 1978.

- **CMOS**
  - **C** - CMOS 4-15 V operation similar to buffered 4000 (4000B) series.
  - **HC** - High-speed CMOS, similar performance to LS, 12 ns. 2.0-6.0 V.
  - **HCT** - High speed, compatible logic levels to bipolar parts.
  - **AC** - Advanced CMOS, performance generally between S and F.
  - **ACQ** - Advanced CMOS with Quiet outputs.
  - **AHC** - Advanced high-speed CMOS, three times as fast as HC, tolerant of 5.5V on input.
  - **ALVC** - Low-voltage - 1.8-3.3 V, time Propagation Delay (TPD) < 3 ns at 3.3 V.
  - **ALVT** - Low-voltage - 2.5-3.3 V, 5 V tolerant inputs, high current â‰¤ 64 mA, TPD < 3 ns at 2.5 V.
  - **AUC** - Low-voltage - 0.8-2.5 V, TPD < 2.5 ns at 1.8 V.
  - **AUP** - Low-voltage - 0.8-3.6 V (3.3 V typically), TPD 15.6/8.2/4.3 ns at 1.2/1.8/3.3V, partial power-down specified (IOFF), inputs protected.
  - **AVC** - Low-voltage - 1.8-3.3 V, TPD < 3.2 ns at 1.8 V, bus hold, IOFF.
  - **FC** - Fast CMOS, performance similar to F.
  - **LCX** - CMOS with 3 V supply and 5 V tolerant inputs.
  - **LV** - Low-voltage CMOS - 2.0-5.5 V supply and 5 V tolerant inputs.
  - **LVC** - Low voltage - 1.65-3.3 V and 5 V tolerant inputs, TPD < 5.5 ns at 3.3 V, TPD < 9 ns at 2.5 V.
  - **LV-A** - 2.5-5 V, 5 V tolerant inputs, TPD < 10 ns at 3.3 V, bus hold,

IOFF, low noise.
    - **LVT** - Low-voltage - 3.3 V supply, 5 V tolerant inputs, high output current < 64 mA, TPD < 3.5 ns at 3.3 V, IOFF, low noise.
    - **LVQ** - Low-voltage - 3.3 V.
    - **LVX** - Low-voltage - 3.3 V with 5 V tolerant inputs.
    - **VHC** - Very-high-speed CMOS - "S" performance in CMOS technology and power.
- **BiCMOS**
    - **BCT** - BiCMOS, TTL-compatible input thresholds, used for buffers.
    - **ABT** - Advanced BiCMOS, TTL-compatible input thresholds, faster than ACT and BCT.

Many parts in the CMOS HC, AC, and FC families are also offered in "T" versions (HCT, ACT, and FCT) which have input thresholds that are compatible with both TTL and 3.3 V CMOS signals. The non-T parts have conventional CMOS input thresholds.

The 74H family is the same basic design as the 7400 family with resistor values reduced. This reduced the typical propagation delay from 9 ns to 6 ns but increased the power consumption. The 74H family provided a number of unique devices for CPU designs in the 1970s. Many designers of military and aerospace equipment used this family over a long period and as they need exact replacements, this family is still produced by Lansdale Semiconductor.

The 74S family, using Schottky circuitry, uses more power than the 74, but is faster. The 74LS family of ICs is a lower-power version of the 74S family, with slightly higher speed but lower power dissipation than the original 74 family; it became the most popular variant once it was widely available.

The 74F family was introduced by Fairchild Semiconductor and adopted by other manufacturers; it is faster than the 74, 74LS and 74S families.

Through the late 1980s and 1990s newer versions of this family were introduced to support the lower operating voltages used in newer CPU devices.