# [A 15" (Inch) TFT-LCD](http://en.wikipedia.org/wiki/Image:TFT_LCD_display_Samsung_SyncMaster_510N.jpg)TFT LCD

**TFT-LCD** (**Thin Film Transistor Liquid Crystal Display**) is a variant of [liquid crystal display](http://en.wikipedia.org/wiki/Liquid_crystal_display) (LCD) which uses [thin film transistor](http://en.wikipedia.org/wiki/Thin_film_transistor) (TFT) technology to improve image quality. TFT LCD is one type of [active matrix](http://en.wikipedia.org/wiki/Active-matrix_liquid_crystal_display) LCD, though it is usually synonymous with LCD. It is used in [televisions](http://en.wikipedia.org/wiki/Television), [flat panel displays](http://en.wikipedia.org/wiki/Flat_panel_display) and [projectors](http://en.wikipedia.org/wiki/Projector)

A 15" ([Inch](http://en.wikipedia.org/wiki/Inch)) TFT-LCD

## Construction

Normal liquid crystal displays like those found in calculators have direct driven image elements – a [voltage](http://en.wikipedia.org/wiki/Voltage) can be applied across one segment without interfering with other segments of the display. This is impractical for a large [display](http://en.wikipedia.org/wiki/Display) with a large number of picture elements ([pixels](http://en.wikipedia.org/wiki/Pixel)), since it would require millions of connections - top and bottom connections for each one of the three colors ([red](http://en.wikipedia.org/wiki/Red), [green](http://en.wikipedia.org/wiki/Green) and [blue](http://en.wikipedia.org/wiki/Blue)) of every pixel. To avoid this issue, the pixels are addressed in rows and columns which reduce the connection count from millions to thousands. If all the pixels in one row are driven with a positive [voltage](http://en.wikipedia.org/wiki/Voltage) and all the pixels in one column are driven with a negative voltage, then the pixel at the intersection has the largest applied voltage and is switched. The problem with this solution is that all the pixels in the same column see a fraction of the applied voltage as do all the pixels in the same row, so although they are not switched completely, they do tend to darken. The solution to the problem is to supply each pixel with its own [transistor](http://en.wikipedia.org/wiki/Transistor) switch which allows each pixel to be individually controlled. The low leakage current of the transistor also means that the voltage applied to the pixel does not leak away between refreshes to the display image. Each pixel is a small capacitor with a transparent [ITO](http://en.wikipedia.org/wiki/Indium_tin_oxide) layer at the front, a transparent layer at the back, and a layer of [insulating](http://en.wikipedia.org/wiki/Electrical_insulation) liquid crystal between.

The circuit layout of a TFT-LCD is very similar to the one used in a [DRAM](http://en.wikipedia.org/wiki/Dynamic_random_access_memory) memory. However, rather than building the transistors out of [silicon](http://en.wikipedia.org/wiki/Silicon) which has been formed into a [crystalline](http://en.wikipedia.org/wiki/Crystal) wafer, they are fabricated from a [thin film](http://en.wikipedia.org/wiki/Thin_film) of silicon deposited on a [glass](http://en.wikipedia.org/wiki/Glass) panel. Transistors take up only a small fraction of the area of each pixel, and the silicon film is etched away in the remaining areas, allowing light to pass through.

The silicon layer for TFT-LCD s is typically deposited using the [PECVD](http://en.wikipedia.org/wiki/PECVD) process from a [saline](http://en.wikipedia.org/wiki/Silane) gas precursor to produce an [amorphous](http://en.wikipedia.org/wiki/Amorphous) silicon film. [Polycrystalline silicon](http://en.wikipedia.org/wiki/Polycrystalline_silicon) is also used in some displays where higher performance is needed from the TFTs, typically in very high resolution displays or ones where performing some data processing on the display itself is desirable. Both amorphous and polycrystalline silicon TFTs have very poor performance compared with transistors fabricated from single-crystal silicon.

**Types**

## There are four types of TFT-LCD s that we describe one of them:

1. TN + film

2. IPS

3. MVA

4. PVA

### TN + film

The 'TN ([Twisted nematic](http://en.wikipedia.org/wiki/Twisted_nematic)) + film' display is the most common consumer display type, due to its low production cost and wide development. The pixel response time on modern TN panels is sufficiently fast to most users to avoid the shadow-trail and ghosting artifacts that were a cause for complaint in the past. This fast response time has been a heavy marketed aspect of TN displays, although in most cases this number does not reflect performance across the entire range of possible color transitions. Traditional response times were quoted as an ISO standard black > white transition and did not reflect the speed of transitions across grey tones (a much more common transition for liquid crystals to make in practice). Modern use of RTC (Response Time Compensation – Overdrive) technologies has allowed manufacturers to significantly reduce grey to grey (G2G) transitions, while the ISO response time remains practically unchanged. Response times are now quoted in G2G figures, with 4ms and 2ms now being commonplace for TN Film based models. This marketing strategy, combined with the relatively lower cost of production for TN panels, has led to the dominance of TN in the consumer market.

## Safety

The liquid [crystals](http://en.wikipedia.org/wiki/Crystal) inside the display are [poisonous](http://en.wikipedia.org/wiki/Poison). It must not be ingested, touch your skin or clothes. If spills due cracked display occur wash off immediately with soap and water. [[3]](http://en.wikipedia.org/wiki/TFT_LCD#_note-1)

## References

1. [**^**](http://en.wikipedia.org/wiki/TFT_LCD#_ref-matuszczyk_0) Marek Matuszczyk, [Liquid crystals in displays](http://www.mc2.chalmers.se/pl/lc/engelska/applications/Displays.html). Chalmers University Sweden, ca. 2000.
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3. [**^**](http://en.wikipedia.org/wiki/TFT_LCD#_ref-1) [Liquid crystal display module model: MTF-T057AMSLN-V1](http://www.microtipsusa.com/product_pdfs/Color%20TFT/MTF-T057AMSLN-V1_REV-B.pdf). 070925 microtipsusa. com