LCD? LED? Plasma? The How-To Geek Guide to HDTV Technology

With image technology progressing faster than ever, High-Def has become the standard, giving TV buyers more options at cheaper prices. But what's different in all these confusing TVs, and what should you know before buying one?

If you're considering buying a television this Holiday season for a loved one (or simply for yourself), it can be a big help to know what to look for. Take a look to find out what sets HD televisions apart, learn some of the confusing jargon associated with them, and see a comparison of four of the types of HDTVs commonly sold today.

HDTV versus Standard Definition

MEET THE AUTHOR

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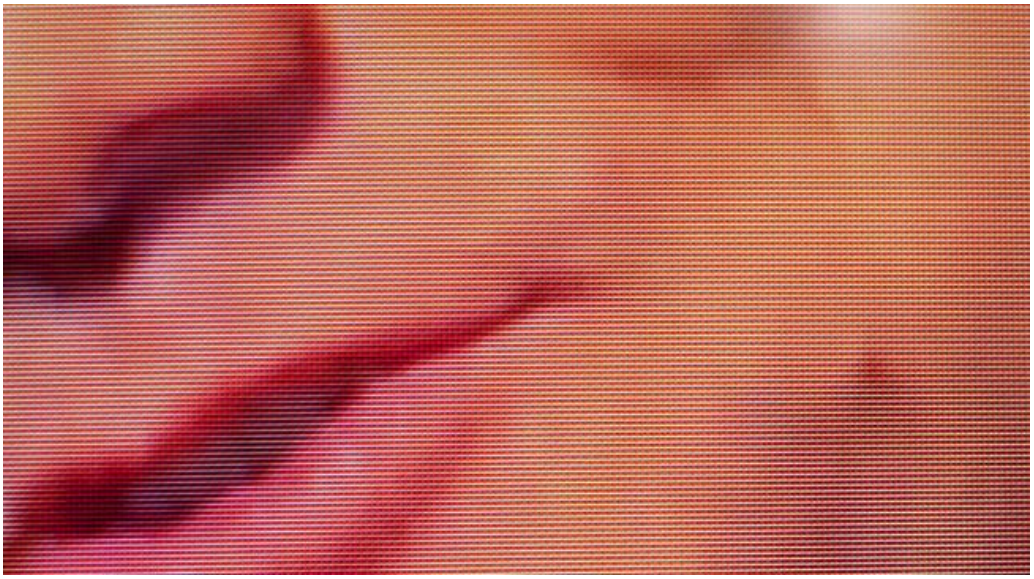

Televisions and monitors create images in the same way, illuminating combinations of *Red, Green, and Blue* to create single picture elements, or pixels. Different types of displays have their unique ways of doing this, but in theory, they're all doing the same thing: creating the illusion of an image with tiny points made from combinations of various amounts of primary colors.

For years, the standard for television and home theater were Low-Def Cathode Ray Tube monitors, which in ordinary household situations would usually have a paltry 640 pixels by 480 pixels. While it was possible to create images full of detail by shooting movies with quality film stock, when it was played on low def televisions, quality could not help but be lost as high-quality film photography is forced into a low-resolution TV medium. While film photography is independent of the confinements of pixel-based video, it was impossible for consumers to view beautiful high-quality movies without purchasing copies of movie reels and setting up old fashioned theater projectors, which are also independent of resolution.

The simple answer was just to create home monitors with more and more pixels, with the modern widescreen definition at 1920 pixels by 1080 pixels. This makes each individual pixel smaller, creating images that look sharper and cleaner. However, HDTVs and computer monitors are more complicated than simply the sum of their pixels.

Important Terms to Know When Buying HDTVs

With each subsequent generation of television, the language and buzzwords surrounding Hi-Def televisions become more and more complex. Here's a rundown of the terms you're likely to hear, and what each of them mean.

Contrast Ratio: A number ratio resembling 1:1 or 10,000:1, which illustrates how much difference there is between the brightest whites and the darkest black colors the screen can display. The higher the ratio, the better the contrast.

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Refresh Rate: How often the display hardware will redraw (or "refresh") the image created on the screen. Videos are made of "frames," which are flashed on screen multiple times per frame because the Refresh Rate is faster than the Frame rate. In other words, you'll watch the same frame multiple times in a single second, because the refresh is so incredibly fast. Refresh rates are measured in Hz, or cycles per second.

The higher the refresh rate, the better your picture will be, affecting the way fast-moving images appear, reducing blurring and improving clarity. Plasma displays usually have a much higher refresh rate, with the typical screen having a 600hz refresh rate, but LCD or LED TVs have been catching up with 60, 120, 240, or even some 480hz refresh rates available.

Pixel Response Time: Similar to refresh rate, Pixel response time is the number of milliseconds the individual pixels take to react to a refreshed image. While Refresh rate deals with the time it takes the hardware to refresh the image, response time refers to how quickly the individual pixels change color from white to black or red or green. The lower the time, the better. Better response times will also create less blurry pictures for fast moving images.

CRT: Acronym for Cathode Ray Tube, the oldest commercial model of televisions and computer monitors. Cathode Ray Tubes are not preferred by modern consumers, despite excellent picture quality, because they necessarily huge, bulky, and heavy.

LCD: An acronym for Liquid Crystal Display, an extremely common model of display, found in laptops and TVs, as well as displays on alarm clocks and microwaves. LCD is a very energy efficient way of creating color displays compared to CRT.

LED: Stands for Light Emitting Diode, a simple circuit that emits light. LED is the newer addition to the HDTV bestiary, and is the new, hip product to push on consumers.

Plasma: Plasmas use the same technology that the Fluorescent lights over your head use to light televisions. Plasma screens were the Rolls Royce of television screens for years, with LED displays only recently being pushed into the forefront.

Rear Projection: Also called **RPTV**, rear projection TVs are effectively projectors casting high-resolution images on the back of large screens, similar to movie theater projectors, except contained in a television unit.

Composite: The yellow video cable that connects old-fashioned analog signal into televisions. Composite connections are only low-resolution, and are not ideal for HDTVs.

Component: A cable connection splitting video into three signals, allowing for HD signal.

HDMI: The standard for digital input, HDMI is a digital connection for devices to televisions, capable of output of high-def video and audio.

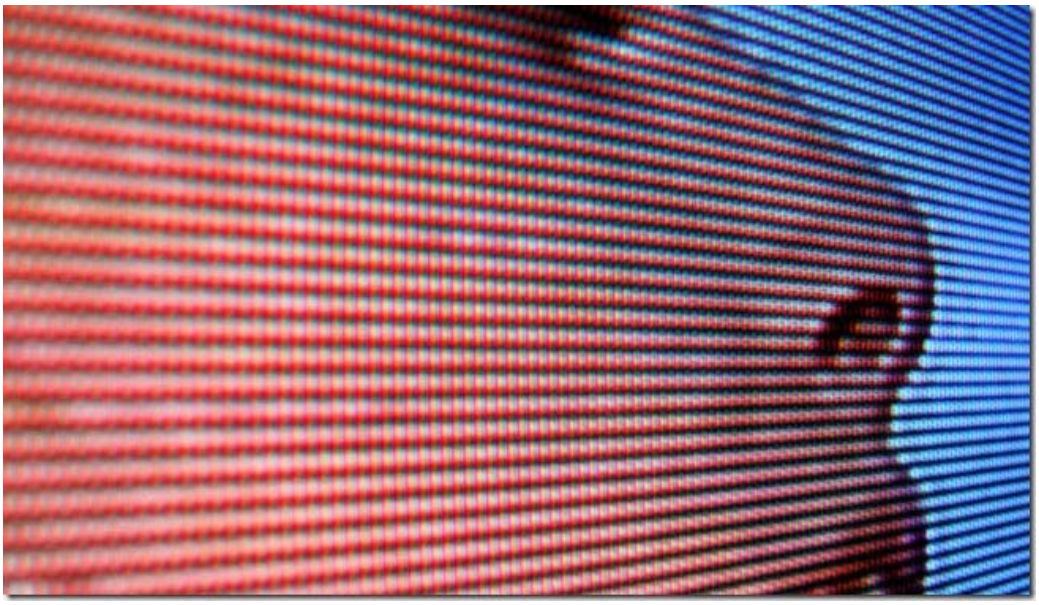
DVI: The PC input counterpart for HDMI, How-To Geek has already explained the differences between HDMI and DVI.

Liquid Crystal Display (LCD) Televisions

Liquid Crystal Displays, or LCD, were the first type of monitor to provide the smaller profile, allowing for thinner displays that provide good picture quality. While they do not have the depth of color range or high contrast ratios of CRT monitors, modern LCD TVs have a good range of color that can light up even bright rooms.

Liquid Crystals do not emit any light, and have to be backlit in order to produce bright colors. (If you've ever owned a first generation Gameboy Advance, you'll understand what a non-backlit LCD screen looks like.) When an HDTV is classified as an LCD television, it usually means that it is backlit with CCFLs, or Cold Cathode Fluorescent Lamps.

Light Emitting Diode (LED) Televisions



While LED televisions are what is currently being pushed on consumers, they are not quite the breakthrough that the commercials would lead consumers to believe. LED televisions are actually LCD televisions that are lit with Light Emitting Diodes as opposed to the standard CCFLs, discussed in the LCD section, above. They do offer certain advantages, but as they are the new tech offered to consumers, they are pricier than older models, and do not necessarily have the best picture because they are newer.

CCFL-style LCD televisions and Plasma televisions use more energy than LED lights, which are extremely energy efficient producers of extraordinarily bright light. For this reason, LEDs are offered as the "Eco-conscious" alternative to Plasma and traditional LCD. They are also free of harmful chemicals like mercury.

There are two styles of LED televisions. One is called "edge-lit", with lights set around the television frame; the other is "full-array," with lights set behind the screen in a grid pattern. Edge-lit models reflect light into the center of the monitor, and are the thinnest, lightest models available. Since they have fewer lights inside, edge-lit LED models are cheaper compared to full-array models. Full-arrays, however, have the best contrast ratios in LED technology.

LED does not quite live up to the contrast ratios and colors Plasma displays can create, although they do have excellent image quality and contrast ratios no standard LCD screen can hold a candle to.

Plasma Televisions

When electric currents (electrons) are passed through positively-charged gasses (protons and neutron nucleuses) inside bulbs. This soup of electrical current and ions is called “Plasma,” and emits light (photons) at different wavelengths (colors). So what does this mean for your television?

Plasma screen televisions produce some of the best image quality consumers are likely to find. Their model is well suited for larger screens, and provides some of the best contrast ratios and colors available. Plasmas are also small profile, thin monitors, capable of being hung on walls like LCD or LED televisions. Pixel response is also a key benefit to plasma televisions; their images are rendered quickly, countering image blurring effects of fast-moving images on screen, providing clear pictures. In addition to all of this. Plasma televisions also have the widest angle viewing image, with quality constant from direct, in-front viewing to side angles, delivering a better picture to a larger crowd.

While they can provide some of the best images, Plasmas are the biggest energy hogs of modern flatscreen HDTVs. While many are Energy Star compliant, LEDs consume less power and contain fewer harmful chemicals. Eco-conscious and ethical gadget buyers may wish to consider this when buying a television. Plasmas are also more vulnerable to burned-in images than LCD/LED flatscreens if users are not as careful as they should be.

Rear Projection Televisions (RPTVs)

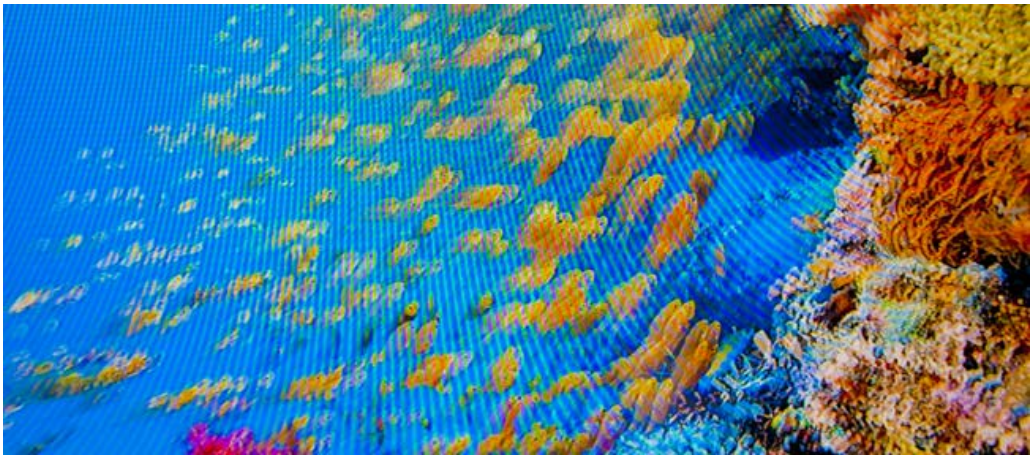
The forgotten ancestor to theater televisions, RPTVs still have a lot to offer consumers. Since they are lit from the back by projectors, their contrast ratio is somewhat more limited, and their images look best in dark rooms. They are also thicker and deeper than any modern HDTV, which is usually a flatscreen to be mounted on the wall. While many modern projection televisions are thinner than older models, many consumers see this as a limitation, as space and viewing distance may be an important buying factor.

You’ll find that RPTVs are surprisingly lightweight, because they are almost entirely empty space. Moving an RPTV is a simple task, while some dense flatscreens may actually be

heavier by comparison.

Because the images are projected, the cost of huge screens is similar to the cost of smaller units, with excellent picture quality and reasonably price on units as large as 82 inches. By comparison, Plasma or LED screens of that size would be so outrageously expensive, most stores would not care to carry them. Despite their shortcomings, RPTVs can deliver an excellent HD experience to the budget-conscious home theater.

3D-Capable Televisions



Capitalizing on the current 3D movie trend, many HDTVs are including 3D-Capable hardware in their monitors. 3D Televisions and hardware are complex, confusing, and potentially very expensive. Stay tuned to How-To Geek for a complete rundown on 3D HDTVs, and what you'll need to get 3D in your home theater.

Many readers will find that this guide doesn't offer any clear-cut answers as to "which HDTV is better?" There is no objective answer, as each buyer will have unique needs. Video game players might enjoy the fast refresh and bright colors of LEDs, and sports and movie buffs may like the better contrast ratio and better colors available in Plasma TVs. Others still may want to recreate the theater-like experience with an enormous Rear-projection TV in a large dark room. Spend some time thinking about your own situation, and this guide can help you make a more informed decision for your own needs.

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Source: Howstuffworks.com; FirstGlimpse , July 2009 Issue.

Edit: Some helpful readers have pointed out that I had flipped around a key feature of edge-lit versus full-array televisions. After looking back at my source, I found that its wording was confusing, and had to switch the one key fact about edge-lit and full-array televisions because I had read it wrong.

This article was originally written on 12/6/10

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InDiSent

December 5, 2010 11:37 pm

Shouldn't this ("CCFL-style LED televisions and Plasma televisions use more energy than LED lights") read :
CCFL-style LCD televisions and Plasma televisions use more energy than LED lights?

The Geek

December 5, 2010 11:41 pm

Thanks for spotting that typo… will fix it right away.

Duckbrain

December 6, 2010 12:21 am

I think "Plasma screens televisions" should read "Plasma screen televisions".

Thank you for this guide. I have been trying to help my dad with some of this stuff, but I did not know enough about it. This is great because it outlines how to choose what type of TV you need for your uses. I also like that you provided some definitions for those terms that they use for TVs. Keep up the great work.

Will Zegeer

December 6, 2010 12:24 am

I've always heard that Plasma's life span is shorter than the others. Is that true?

=)

Jedijax

December 6, 2010 12:36 am

Impressive article. Not too "techie", and yet thorough enough for me to understand and explain to most people Geek, you are a life-saver!

Antrikshy

December 6, 2010 12:47 am

As many readers may ask, plasmas do have a shorter life span because of the technology they use. Also, if you leave an image paused on out for days, the colours might get 'stuck' on them. Moreover they are big energy hoggers. That is why very few companies are still producing them.

Béranger

December 6, 2010 1:05 am

I hoped you will address a major issue, but you didn't.

The term LCD is abusive. The correct term is TFT or TFT LCD.

LCD is that 80ish monochrome (gray-greenish) display with no backlight that is still used in some watches. There is no silicon in them.

What people abusively call today LCD is actually Thin-Film Transistor TFT (TFT-LCD), with an active semiconductor matrix. A hugely different technology and a tremendous improvement.

And LED is actually AMOLED (Active-matrix organic light-emitting diode), right? Not like the LEDs you can have on front panels and in some torches…

cg

December 6, 2010 1:40 am

Great article. This sentence is a bit confusing though

"LED does not quite live up to the contrast ratios and colors Plasma displays can create, although they do have excellent image quality and contrast ratios no other display can compare to."

Do LEDs have better contrast ratio than plasma or not?

Gouthaman Karunakaran

December 6, 2010 1:58 am

That was an eye-opener. Like you mentioned in the article LEDs are hyped in the commercial. But, I still can't understand why they are so pricey!

Ivan

December 6, 2010 4:15 am

2007 58″ Panasonic Plasma – 720 Watts
2010 63″ Samsung Series 8 Plasma – 500 Watts

pitman

December 6, 2010 4:21 am

This article came at a perfect time because they started promoting LEDs here and I was wondering what the fuss was all about, also people usually come to me for electronic advice (since I'm a tech-guy) and now I can tell them what is all the LED rage.

sam0t

December 6, 2010 5:14 am

Is the following statement really correct, it is in conflict with information I read on another site.

"

Edge-lit models reflect light into the center of the monitor, and need a larger profile to have enough room to do this. Since they have fewer lights inside, edge-lit LED models are cheaper compared to full-array models. Full-arrays, however, have the best contrast ratios in LED technology, and are the thinnest, lightest models available.
"

http://www.ledtele.co.uk/whatisledtv.html

According to the site linked above, the edge-lit LED models are thinner than full-array ones. Maybe there has been advancements in the field and the link I posted is not valid anymore, but which one is more correct today?

Fabian

December 6, 2010 5:16 am

Are you sure that the “Full-array” LED’s are really the “thinnest and lightest models”? Afaik the edge-led’s are thinner because they can utilize flat light guiding structures to distribute the light from the edge to the center whilst full-arrays have to have the room for the led array matrix behind the screen making them thicker.

Geoff

December 6, 2010 5:56 am

“effecting the way” should be “affecting the way”

Eric Z Goodnight

December 6, 2010 6:32 am

Thanks for spotting those typos. In particular, I kept typing LED when I meant LCD, or even CRT when I meant LCD.

@Fabian, @sam0t: I’ve checked my source and what you’re pointing out is correct–the source was simply worded poorly, and I was misinformed by what I thought it said. I’ll change it immediately.

Hatryst

December 6, 2010 7:07 am

Another very informative article !
And this proves that there’s no room for CRT TVs now

Bobro

December 6, 2010 7:53 am

nice artical…

if we can get some info on OLED screens too that would be cool (also are these the ones that can be just a display on a clear material that can then be rolled up whilst the image is still being displayed (there is a vid on YouTube of this, it is cool!!)

Bob Bowen

December 6, 2010 12:09 pm

I’m still “in the dark.” What is the best desktop monitor for the home user, LCD or LED, Plasma being too too power-hungry? Good, article, though, because now I understand what these terms mean. The answer seems to be LED? But is it? Thanks.

GaGator

December 6, 2010 12:21 pm

Thanks for timely and helpful article. I am in the process of replacing my older 4:3 ratio SONY desktop HDTV and now

know exactly what I need.

Daniel

December 6, 2010 12:26 pm

@Béranger: no, it's not AMOLED. The LEDs used in 'LED' televisions are much more like the ones found in the torches. AMOLED screens will be the next hype in this market, but today they're yet too expensive.

Daniel

December 6, 2010 12:30 pm

Béranger: no, it's not AMOLED. The LEDs used in 'LED' televisions are much more like the ones found in the torches. AMOLED screens will be the next hype in this market, but today they're yet too expensive.

mrphil

December 6, 2010 1:27 pm

OLED TV's are already in the marketplace and have been for a couple of years.. albeit they are mostly portable size, but they are Televsisions and so deserve a place in this article regardless of their ridiculous price tag. This article is a great reference for newbies.. please update to include OLED

Colin

December 6, 2010 2:06 pm

A very interesting and informative article. It seems manufacturers are fudging over their claims again! When I read about the new LED models being launched I assumed (stupidly) that they would ALL be the 'full array' type that would switch off the back-light in areas of black in the picture to create truer blacks and massively increasing the contrast ratio. So, it seems we are being sold LED models as the next big thing when the majority are simply edge lit and replacing the CCFL's? Not so 'cool' after all :0(
I too would like to hear about emerging technologies such as OLED and UHDTV?

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