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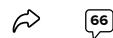


# LED LCD vs. OLED: TV display technologies compared

LED LCD is the dominant TV display technology by far, especially now that plasma is dead. Its only potential competitor is OLED, found on few high-end TVs made exclusively by LG. Here's a look at the pros and cons of each.



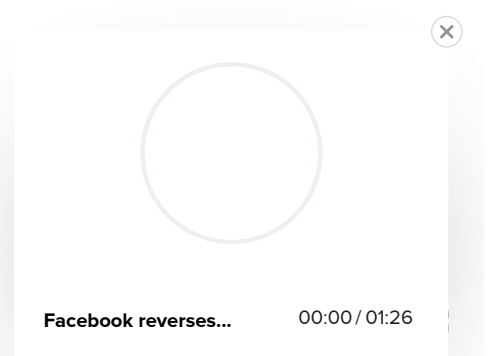
Geoffrey Morrison April 12, 2017 12:14 p.m. PT



For the last decade or so, TV buyers were forced to answer the question "LCD or plasma?" with their hard-earned dollars. Now plasma has been removed from consideration.

Pretty much every sold today TV is based on good old LCD (liquid crystal display) technology, whether manufacturers choose to call them LED TVs, SUHD TVs, Super UHD TVs or something even more futuristic-sounding like Quantum Dot LED TVs (QLED).

The exception is OLED. Televisions based on Organic Light Emitting Diode display technology are fundamentally different from LCD TVs. The



most basic difference is that each pixel provides its own illumination, while all of the pixels in an LCD TV are illuminated by an LED backlight. That difference leads to all kinds of picture quality effects, some of which favor LCD, but most of which benefit OLED.

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The first OLED TVs started shipping in 2013. For now they're only made by [LG Display](#) (although [Sony is starting to sell LG-made OLED TVs too](#)) and they're more expensive than most like-sized LCDs. They also happen to have the [best picture quality CNET has ever tested](#).

OLED may be the picture-quality king, but LCD isn't going down without a fight, introducing all sorts of new technology that could keep the contest close for years to come.

So which one is better? Read on for their strengths and weaknesses. In general we'll be comparing OLED to the best (read: most expensive) LCD has to offer, mainly because there's no such thing as a cheap OLED TV. And when a particular advantage is likely to change in the future, we've made a note.

If you're curious how LCDs work, check out [LED LCD backlights explained](#) and [LED local dimming explained](#). If you're curious about OLED, check out [What is OLED?](#).

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## Light output (brightness)

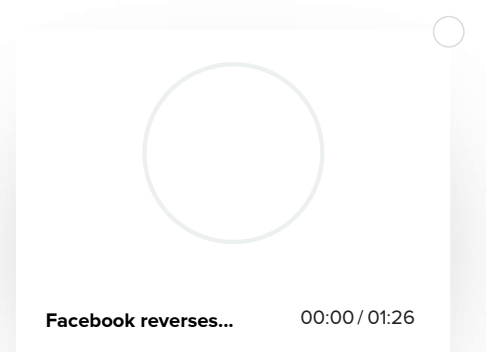
### Winner: LCD

### Loser: OLED

Take this category with a grain of salt. Both TV types are very bright and can look good in even a sunny room, let alone more moderate indoor lighting situations or the dark rooms that make TV images look their best. When it comes down to it, no modern TV could ever be considered "dim."

LCD gets the nod here specifically because the whole screen can be brighter, a function of its [backlight](#). OLED can't do a full screen with as much brightness. Full-screen brightness isn't very important in the real world however, so this category is a relatively hollow victory for LCD.

Light output also plays a big part in High Dynamic Range (HDR), which we'll discuss a little later.



## Black level

**Winner: OLED**

**Loser: LCD**

At the other side of light output is black level, or how dark the TV can get. OLED wins here because of its ability to turn off individual pixels completely. It can produce truly perfect black.

The better LCDs have local dimming, where parts of the screen can dim independently of others. This isn't quite as good as per-pixel control because the black areas still aren't absolutely black, but it's better than nothing. The best LCDs have full-array local dimming, which provides even finer control over the contrast of what's onscreen -- but even they can suffer from "blooming," where a bright area spoils the black of an adjacent dark area.

Check out [LED LCD backlights explained](#) and [LED local dimming explained](#) for more info.



An OLED TV has perfect black levels and bright whites, for an infinite contrast ratio.

Sarah  
Tew/CNET

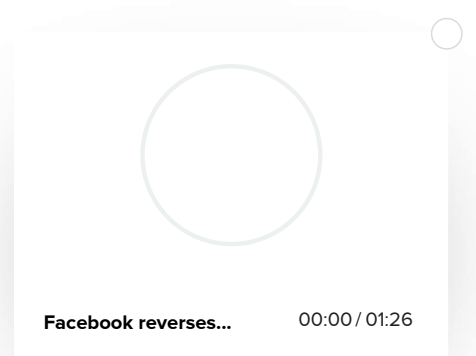
## Contrast ratio

**Winner: OLED**

**Loser: LCD**

Here's where it comes together. Contrast ratio is the difference between the brightest and the darkest a TV can be. OLED is the winner here because it can get extremely bright, plus it can produce absolute black with no blooming. It has the best contrast ratio of any modern display.

Contrast ratio is the most important aspect of picture quality. A high contrast-ratio display will look more realistic than one with a lower contrast ratio.



For more info, check out [the basics of contrast ratio](#) and [why it's important to understand contrast ratio](#).

## Resolution

### Winner: Tie

This one's easy. Both OLED and LCD are widely available in Ultra HD 4K form. There are also plenty of 1080p LCDs. Some older OLEDs are 1080p, but new models are all 4K.

## Refresh rate and motion blur

Winner: Tie (with exceptions)

Refresh rate is important in reducing motion blur, or the blurring of anything on screen that moves (including the whole image if the camera pans). Sadly, the current version of OLED has motion blur, just like LCD.

OLEDs, and all current 4K TVs, have a 120Hz refresh rate. Cheaper LCDs are 60Hz, while some 1080p LCDs are available at up to 240Hz (though these are extremely rare). This is despite the marketing numbers claiming much higher refresh rates.

OLEDs and many LCD use [black-frame insertion](#), which is a way to improve motion resolution without resorting to the (usually) dreaded [Soap Opera Effect](#).

Learn [what refresh rate means](#) and [if your TV really is 120Hz](#).



High-end LCDs like the Sony XBR-65X930D can get brighter than OLED TVs, which is especially important for HDR. Sarah Tew/CNET

## High Dynamic Range (HDR)

Winner: Tie

The New York Times

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High Dynamic Range (HDR) is one latest technologies that can significantly improve picture quality. It's an expansion of contrast ratio, an improvement in brightness, and more.

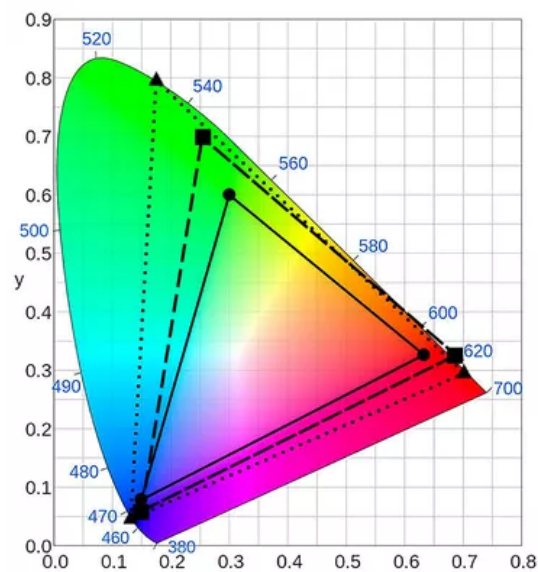
There are both OLED and LCD models that are HDR-compatible. The best HDR LCDs can produce brighter highlights than OLED, but OLED still has a better overall contrast ratio (dynamic range, if you will) thanks to its better black level. Which is to say, done well, both are good. You need HDR content though.

Learn more about the differences between HDR for photography and HDR for TVs.

## Expanded Color Gamut

Winner: Tie

Wide Color Gamut, or WCG, is related to HDR, though you can technically have one without the other. It's an expansion of the colors possible on "standard" TVs. Think richer, deeper and more vibrant colors.



The smallest triangle (circles at corners) is what your current HDTV can do. The next largest (squares) is P3 color. The largest (triangle edges) is Rec 2020.

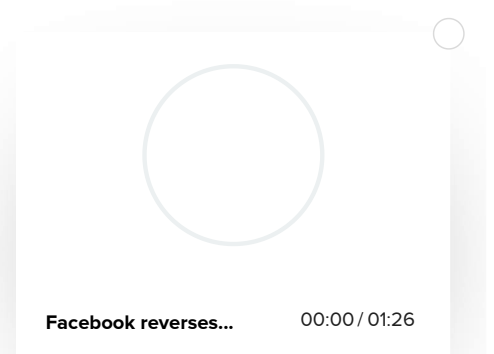
Geoffrey Morrison/CNET (triangles); Sakurambo (base chart)

Certain LCDs and most new OLED models are capable of WCG. In LCDs it's largely thanks to Quantum Dots.

Read more about how TVs make color, how they will make color, and how Wide Color Gamut works.

## Viewing angle

Winner: OLED



## Loser: LCD

One of the main downsides of LCD TVs is a change in picture quality if you sit away from dead center (as in, off to the sides). How much this matters to you certainly depends on your seating arrangement, but also on how much you love your loved ones.

A few LCDs use in-plane switching (IPS) panels, which have better off-axis picture quality than other kinds of LCDs, but don't look as good as other LCDs straight on (primarily due to a lower contrast ratio). If you're sitting off to the side, curved screens may let you see the far side of the screen better but views of the closer side are going to remain as bad (or worse).

OLED doesn't have the off-axis issue LCDs have; its image looks basically the same, even from extreme angles.

## Uniformity

### Winner: OLED

### Loser: LCD

Uniformity refers to the consistency of brightness across the screen. Most edge-lit LED LCDs are pretty terrible with this, "leaking" light from their edges.

OLED is much better. Unlike plasma, however, it isn't perfect, with some early models having parts of the screen look slightly dimmer. We're anxious to check out the forthcoming flat OLED TVs because the curve might be responsible for some of OLED's uniformity issues.

## Energy consumption

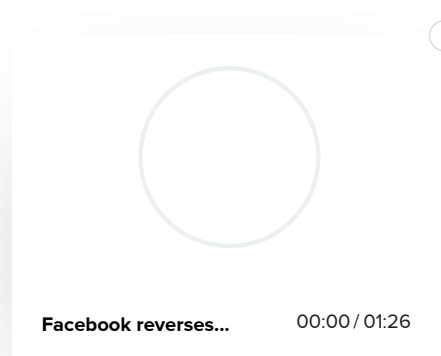
### Winner: LED LCD

### Runner-up: OLED

OLED's energy consumption is directly related to screen brightness. The brighter the screen, the more power it draws. It even varies with content. A dark movie will require less power than a hockey game or ski competition.

The energy consumption of LCD only varies depending on the backlight setting. The lower the backlight, the lower the power consumption. A basic LED LCD with its backlight set low will draw less power than OLED.

The only way to make OLED more energy-efficient is to reduce its brightness, but since that reduces its contrast ratio as well, it's not ideal. So we'll give this category to LCD, even though it's fairly close and neither uses much power. Depending on size, settings, and how much you watch it (of course) it's around \$20 to \$30 a year to run a modern TV.



Here's [what you need to know about TV power consumption](#) for more info.

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## Lifespan

### Winner: Tie -- sort of

LG says its new OLED TVs have a lifespan of 100,000 hours to half brightness, a figure that's similar to LED LCDs.

OLED is a newer technology, but we haven't seen widespread issues with the technology so far.

If you're the type of person who can't stop worrying about the longevity of their TV, then I guess LCD is your only option. Though keep in mind, there's no guarantee about those either, as any glance at Amazon or Internet forums will tell you.

Generally though, flat panels are very reliable.

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## Burn-in

### Winner: Too early to tell

All TVs can "[burn in](#)," or develop what's called "image persistence," where a ghost of an image remains on screen. It's really hard to do this with most LCDs. It's slightly easier with OLED. However, watching something else for a few minutes should fix the issue. In neither case is it as sticky as it tended to be on some older plasma TVs.

Regardless, don't leave a static image on screen all night.



Sony's 100-inch Z9D series LCD TV unveiled by company execs. Lexy Savvides/CNET

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## Screen size



## Winner: LCD

## Loser: OLED

LCD TVs are available in a vast array of sizes, from less than 20 inches to more than 100 inches. OLED TVs only come in three sizes today: 55 inches, 65 inches and 77 inches. And the current price of a 77-inch OLED TV is around 20 grand.

In other words, if you want a TV smaller than 55 inches or larger than 65, LCD is your only option.

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## Price

### Winner: LCD

### Loser: OLED

You can get 50-inch LCDs for around \$500. It's going to be a long time before OLEDs are that price.

That said, OLED will get cheaper. LG has dropped the price of OLED sharply several times already.

It's also worth considering that the top-of-the-line LCDs are often similar in price to OLED.

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## And the picture-quality winner is... OLED


LCD dominates the market because it's cheap to manufacture and delivers good enough picture quality for just about everybody. But according to reviews at CNET and elsewhere, OLED wins for overall picture quality, largely due to the incredible contrast ratio.

LCDs continue to improve, though, and many models offer excellent picture quality for far less money than OLED, especially in larger sizes.

Which is to say, there are a lot of great TVs out there.

*Got a question for Geoff? First, check out [all the other articles he's written](#) on topics like [why all HDMI cables are the same](#), [TV resolutions explained](#), [LED LCD vs. OLED](#), and more. Still have a question? Tweet at him [@TechWriterGeoff](#) then check out his [travel photography on Instagram](#). He also thinks you should check out his bestselling [sci-fi novel](#) and its [sequel](#).*

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# First stimulus vote Friday? What that means for when your check could come

The timeline for a new payment arrival is fast approaching. But tax season and your priority group with the IRS could affect whether you'd get your check first or last. Here's what we know.



Jessica Dolcourt Feb. 24, 2021 8:00 a.m. PT



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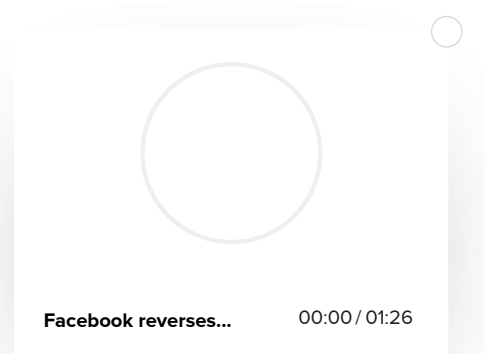


You could be weeks away from receiving a new stimulus check. Here's everything we know right now.

Sarah Tew/CNET

The first major vote on the \$1.9 trillion COVID-19 relief package is set for Friday, House Majority Leader Steny Hoyer tweeted, a move that will help cement the timeline for a third stimulus check, as well as funding for vaccine distribution, \$400 in weekly federal unemployment insurance and more. Like these other benefits, Democrats' maneuver to fast-track the bill is only one factor in mapping out when your \$1,400 stimulus check would arrive.

For example, tax season 2020 could affect the third check's delivery, and so could the payment group you're in (more below). In addition,



some groups of people, like [SSDI and SSI recipients](#), could receive their funds a different way. And if there's a problem with your check at all, you could wait months. (By the way, here's how [the three stimulus checks compare](#).)

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We'll go over the latest information about the [third stimulus check](#) priority payment groups and potential delivery timelines. For more details, here's how the ["targeted" third check](#) could change the fine print, and [every way you could get more money, less money or no new check at all](#). This story was recently updated.

## Will the IRS deliver stimulus checks in waves? That's likely

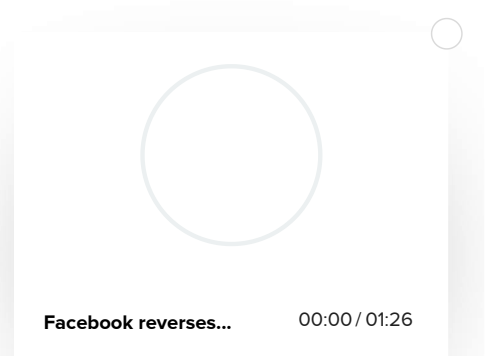
The IRS organized the first two stimulus checks according to payment groups, with [direct deposit](#) recipients the first in line, followed by people receiving [physical checks](#) and then [EIP cards](#). Using the timeline from the second payment, we can take an educated guess as to when the IRS could start sending the first checks for each group.

We also know that Democrats, who hold the majority in Congress, have a goalpost of March 14 to pass the [\\$1.9 trillion stimulus bill](#) -- this is the date [federal unemployment insurance for \\$300 a week expires](#). We also factor in what happens if the timeline slips a week. For example, if the bill passes the House and the Senate makes substantial changes, it would go back to the House for a vote.

Complicating matters, the [IRS is also dealing with tax returns](#) at the same -- more on that below. Keep in mind, it could take weeks for the IRS to process every group's funds, so consider the possible dates below as just a starting point. We refresh this timeline as the situation evolves.

#### WHEN COULD THE NEXT STIMULUS CHECK POSSIBLY ARRIVE?

Stimulus check passes Congress	Friday, March 12	Monday, March 22
Stimulus bill signed into law	Sunday, March 14	Tuesday, March 23
First direct deposit check sent	Week of March 22	Week of March 29
First paper checks sent	Week of March 29	Week of April 5
First EIP cards sent	Week of April 5	Week of April 12
IRS deadline to finish sending checks	Dec. 31, 2021	Dec. 31, 2021

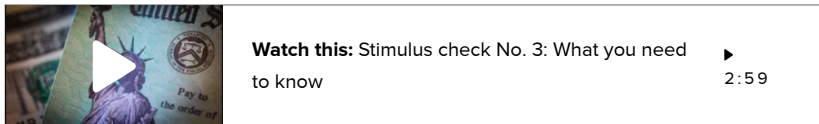


## Would you be in the same payment group as last time? Why that could change

When you get your stimulus money would likely depend on how you get it. That was largely true with the first two checks (there are always some exceptions) and is expected to play out similarly the third time around.

[Direct-deposit recipients](#) typically get their stimulus money faster, as evidenced by how the government handled the first two rounds of payments in March and December. But both times there were issues involving [deposits going to temporary accounts](#) that were rejected by banks.

The IRS told CNET in January that some people who received a physical check or [EIP card](#) the first time may get paid by the other method the second time around. And, anecdotally, we've heard of people who received direct deposit payments the first time finally getting an EIP card in the mail -- and not an electronic bank transfer -- weeks after the IRS tool said the payment was issued.



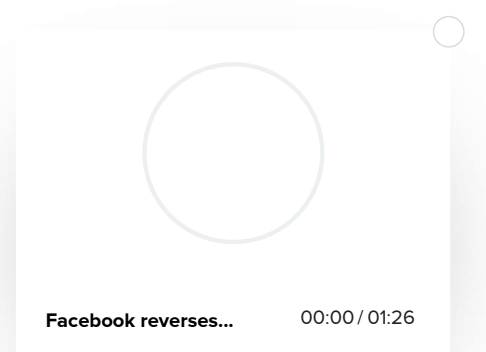
While you won't have the final say in how you get your payment, we recommend signing up for [direct deposit with the IRS](#) when you submit your [2020 tax return](#), if you [ordinarily file taxes](#). If you already have an account, make sure your details are correct. We also suggest you try to [file your taxes quickly](#). While you can [file an extension to submit your taxes later](#) (you'd still have to pay taxes owed now,) whether that will help or hurt you may get a little complicated.

The other payment groups loosely defined (by us) include Social Security beneficiaries who received payments a different way the first time if they're part of the [SSI or SSDI programs](#), and people with more complex scenarios that could lead to potential [issues or holdups receiving their money](#). People in different [child support situations](#) are one example we've seen, as are [people who are incarcerated](#) and people with [complex citizenship scenarios](#).

## The IRS will likely have a deadline for sending out third payments

The Jan. 15 deadline for the second stimulus check approved in December was written into the text of the bill without explanation. Anyone who didn't receive all or part of their second payment must claim it as part of the IRS' [Recovery Rebate Credit on their tax return](#) to get the funds owed -- even if they have [non-filer status and aren't typically required to file taxes](#).

The [latest proposal](#) (PDF) would give the IRS a Dec. 31, 2021 cutoff to complete sending out the third stimulus checks.



How you get your second stimulus check could influence how soon your payment arrives.

Sarah Tew/CNET

### Tax season adds a new dimension to stimulus checks

Since a [third stimulus check](#) is likely to drop in the [middle of tax season](#) (taxes are [due April 15](#)), the IRS may have to [calculate your total](#) based on the most recent tax filing it has. That would be your [2020 taxes if you file early](#), or 2019 taxes if the check is ready before your tax return is. This could also [disqualify some people from getting a third stimulus payment](#). (Learn more about some of the [stimulus check exceptions and catches here](#).)

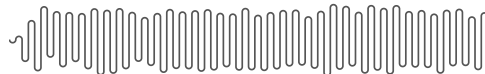
If you're owed money, you [might have to wait a year to claim it](#), until you file your 2021 taxes in 2022, according to the [latest proposal](#) (PDF) under consideration. Filing for a [tax extension could also change your timeline](#) in a way that could be different if the [IRS were to extend the tax due date](#) itself.

By mid-March, tens of millions of Americans may have already received their tax refunds, which could make it tricky for the IRS to straighten out problems or redact refunds after issuing.



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### What can you do to get your check faster?

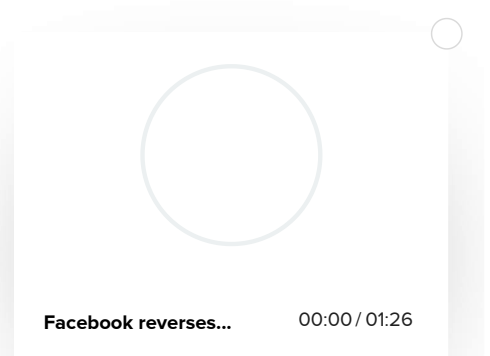
There may be [a few things you can do to help speed up receipt of a third payment](#), assuming the stimulus bill is approved. For example, signing up for [direct deposit](#) with your 2020 tax return would put you in the priority category for a third stimulus payment.

If you've [moved recently, tell the IRS and USPS](#). Here are our other suggestions for how people can make it more likely they'll [get their checks faster](#). Note that there could be some [changes to qualifications](#) that may not apply to a possible third stimulus check.

The first two stimulus checks were nominally sorted by different payment groups, and one had a clear advantage over the others.

Sarah Tew/CNET

### Are you in these groups? More stimulus check details to know




Stimulus checks aren't necessarily a one-size-fits-all situation. Here are our guides for:

- [Older adults, people who are retired and veterans](#)
- [People who receive SSI or SSDI](#)
- [Other tax non-filers](#)
- [Families with mixed-status citizenship](#)
- [Households with dependents, or people trying to understand if they'd receive their own check](#)
- [Families with child support situations](#)

Here's [everything you need to know about stimulus checks](#), including what to do if you ran into problems with [either of the first two payments](#).

First published on May 8, 2020 at 4:00 a.m. PT.

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