



Largan Precision (3008 TT)

The world's leading optical lens supplier getting ready for an iPhone upgrade



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Summary



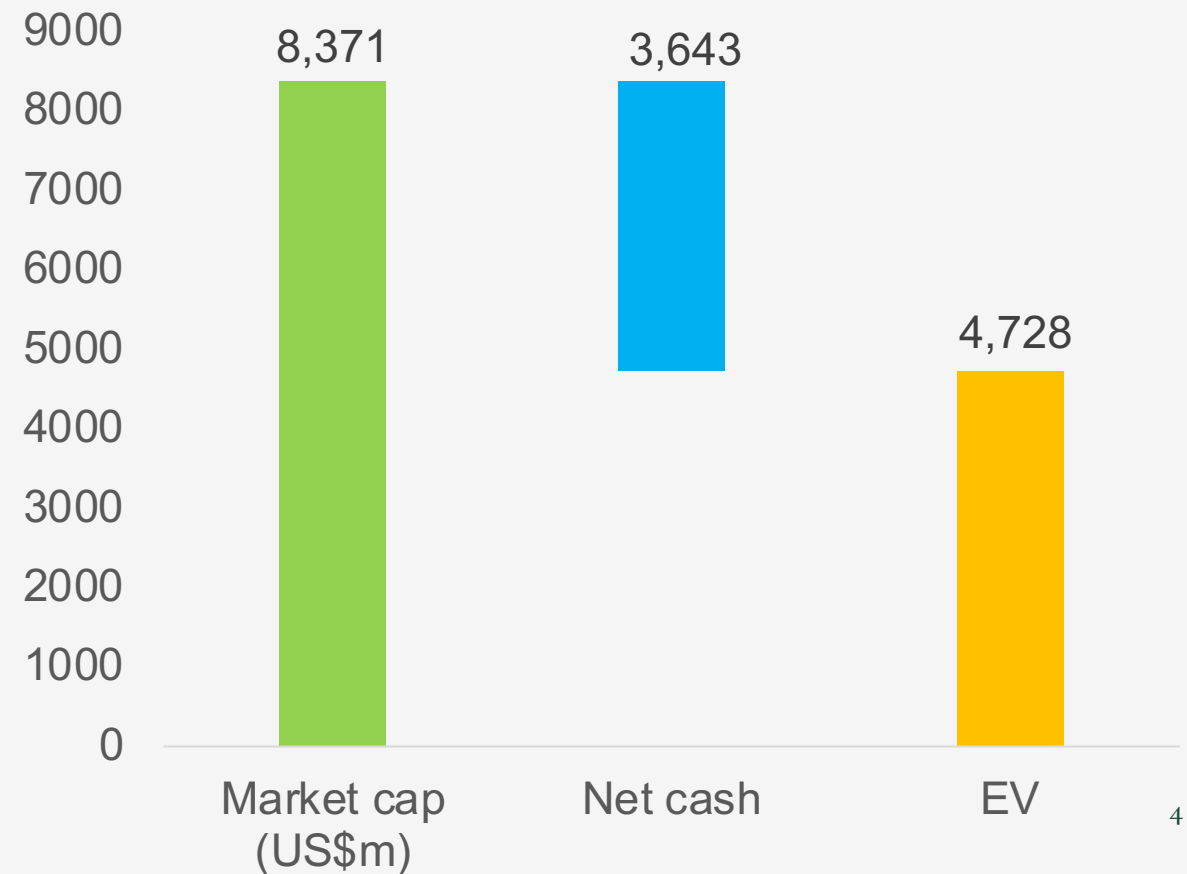
1. Largan Precision is the world's largest producer of lenses for smartphone cameras. It's Apple's preferred supplier for its higher-end iPhone Pro cameras. And every single one of the highest-ranking Android smartphone cameras use Largan as their supplier as well.
2. Camera lenses have long been the most profitable of almost any part of the iPhone supply chain. The reason is that plastic lenses for smartphones require extreme precision, with tolerances $1/500^{\text{th}}$ the diameter of a human hair. Largan is the only company with 90%+ production yields (<10% of output is discarded), whereas competitors remain below 70%. Scale in R&D also helps Largan maintain a technological lead. Largan's management team is well-regarded as well.
3. The smartphone market is mature. Smartphone sales volumes have even dropped during COVID-19 as many stayed at home. But there are two other drivers of the market. Each phone is adding more cameras to improve light intake across different focal lengths. And each camera is adding lens elements for each set, to reduce refraction.
4. Largan has been suffering bad during COVID-19. First, the US banned Huawei from using the Google app store and US components in its smartphones, causing its sales to drop dramatically. Huawei used to be almost 15% of Largan's revenues. Second, Apple diversified away from Largan from 2020. Analysts interpreted this to be a sign of weakness of Largan but in reality it's more about Apple trying to ensure ample supply during COVID-19. But Apple has not been satisfied with its other suppliers.
5. The iPhone camera experiences upgrades every three years. The last upgrade was in 2019. It's likely that the 2023 iPhone 15 Pro will include an 8P lens set with a periscopic lens, technology that only Largan can master and has patents for. The overall smartphone industry is likely to recover somewhat as well.
6. Assuming a certain recovery from the double-assault of the Huawei ban and the loss of Apple business implies a P/E multiple of around 10x vs 2025e. Historically, Largan has traded closer to 18x P/E. In addition, 42% of Largan's market cap is now in net cash.

Capitalisation



- Share price: TWD 1,870*
- Shares outstanding: 133.5 million
- Market cap: US\$8.4 billion
- Net cash: US\$3.6 billion
- Enterprise value: US\$4.7 billion

US\$ million



* TWD = Taiwanese Dollar. TWD/USD = 29.815

Business overview



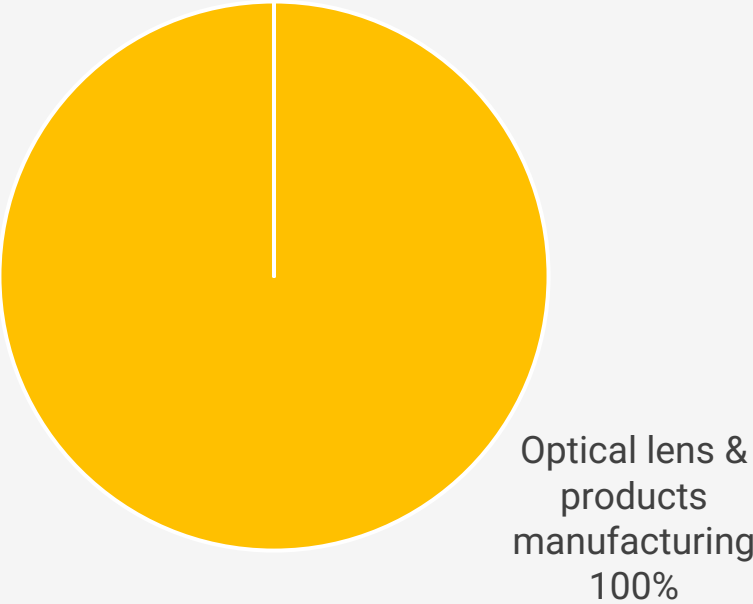
- Largan (大立光) is the world's largest producer of smartphone camera lenses with a pre-pandemic market share of about 30%.
- It specializes in the plastic or hybrid lens sets (plastic / glass) used in smartphones. More than >95% of Largan's revenues are from plastic lenses for the smartphone industry.
- The company has been extraordinarily profitable with strong free cash flow generation and a median historical ROE of about 30%.
- While Largan's competitors are diversified, Largan focuses primarily on the higher-end of the smartphone market, and is the main supplier for Apple's iPhone cameras. It's also a major supplier of smartphone lenses for Samsung, Huawei, Xiaomi, Oppo and Vivo.
- Largan is also involved in the sales of consumer contact lenses, voice coil motors, lenses for sleep monitoring and for automotive-related lenses.



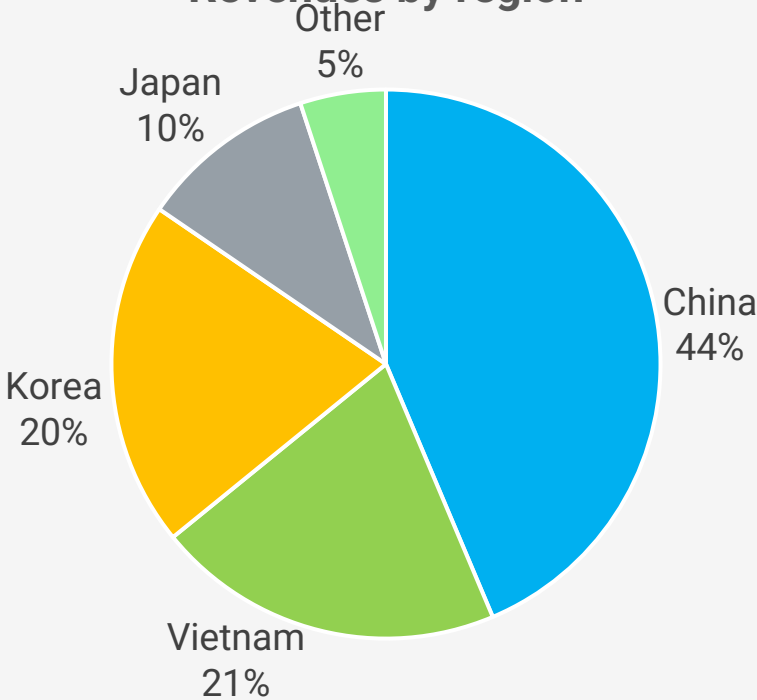
Largan produces optical lenses for smartphone manufacturers with assembly operations in China, Vietnam and Korea



Revenues by segment



Revenues by region

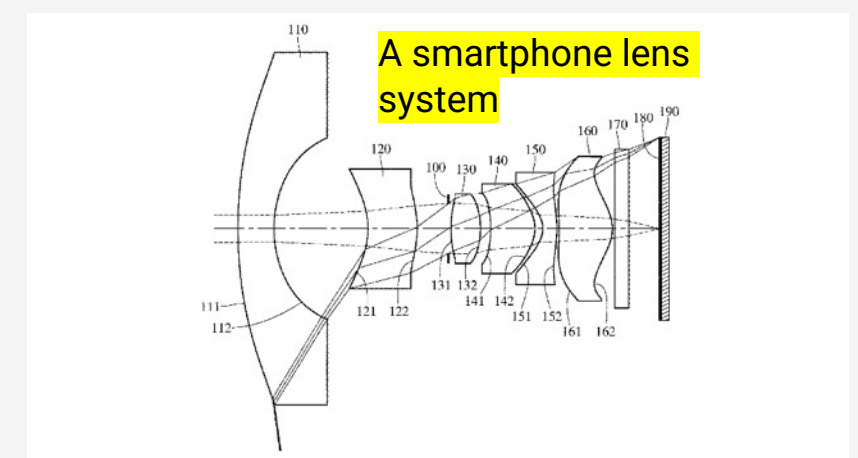
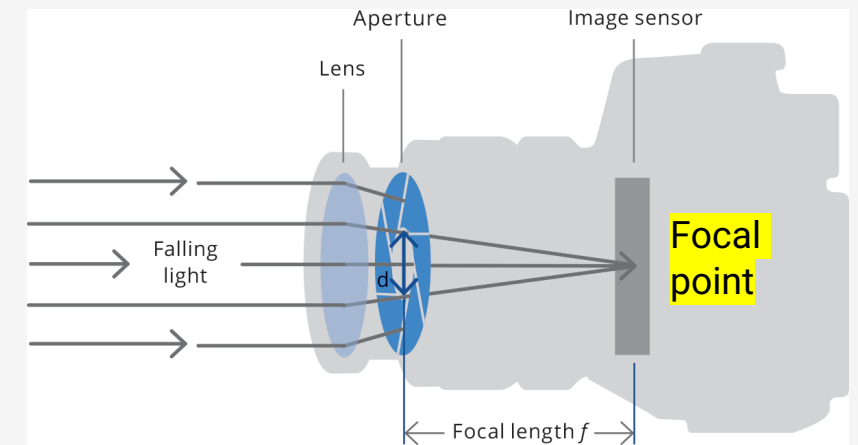


Source: Bloomberg

Introduction to the optical lens industry



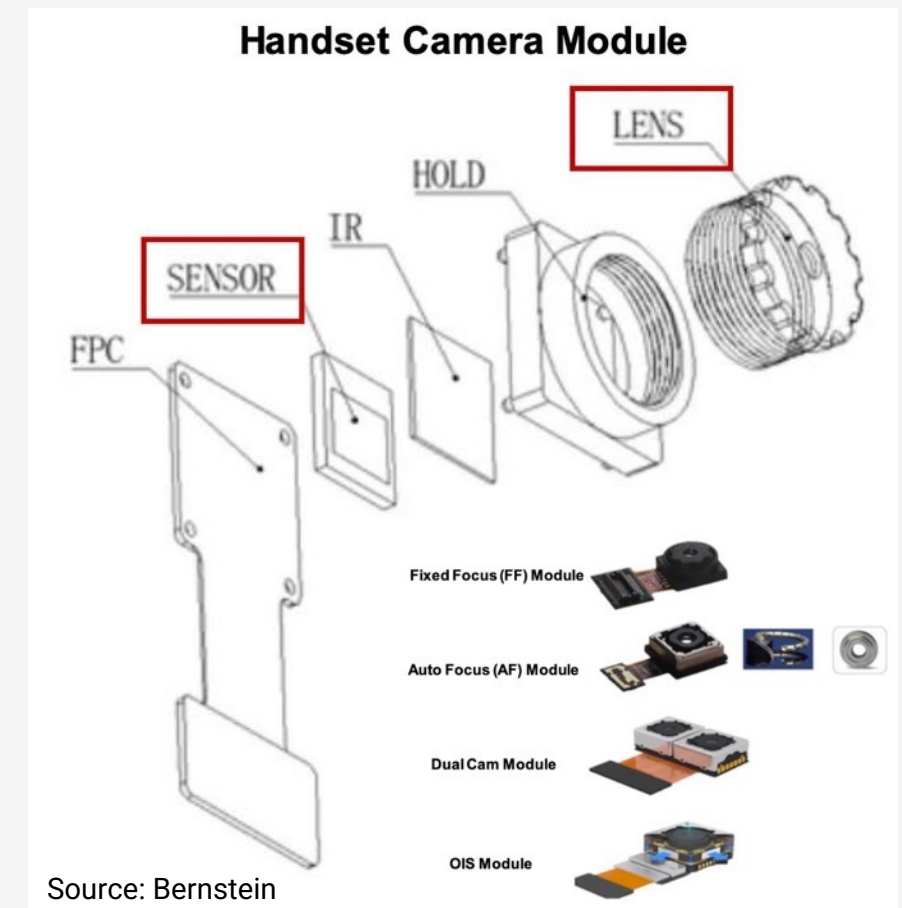
- **Lens:** A lens is a clear transparent object made of glass or plastic that bends light. They are typically used to correct eye problems or to capture light onto a small image sensor. Lenses are generally either convex (thick centre part), concave (thin centre part) or planar (flat).
- **Use cases:** The most important uses cases of lenses are eyewear, microscopes, binoculars, telescopes, projectors and smartphone cameras.
- **Focal length:** Light will pass through the spherical lens and converge into a "focal point" where it can be captured in an image sensor. The distance " f " between the lens and the focal point is called the "focal length". The shorter the focal length, the wider the angle of view becomes, enabling you to capture more of the surroundings.
- **Aperture:** The word "aperture" refers to the opening in a camera that lets light in. A large aperture means that the opening is large, helping to take in a greater amount of light into the camera. In smartphones cameras, apertures are typically fixed.
- **Stacking:** In modern smartphones, 7 or more lenses are stacked on top of each other to enable a maximum of light with a minimum amount of refraction.
- **ISO:** Sensitivity level in the sensor.
- **Shutter speed:** Length of time the shutter opens, impacting light the intake.





The three main parts of smartphone camera systems

1. **Optical lens set:** Optical lenses are used to focus light and funnel it onto the image sensor. Today's optical lens sets typically have 6-9 individual lens elements and are either all plastic or in some cases hybrid (plastic + glass). The plastic lenses are produced through plastic injection molding techniques.
2. **Image sensor:** Sensors are typically using CMOS technology (complementary metal oxide semiconductor). These capture light and convert it into a digital form that can be analysed through logic chips such as CPUs and GPUs.
3. **Camera module:** The camera module is the part that holds the entire system together into one unit. Modules often includes auto-focus features through a voice-coil motor (VCM) systems. They can also include optical image stabilisation features (OIS) that reduce noise from hand vibrations. The modules are connected to flexible printed circuit boards.



Plastic lenses are cheaper and easier to produce with high production yields despite extreme precision



- For many years, the lens industry was dominated by glass lenses produced by Japanese camera brands such as Nikon, Canon and Minolta.
- But with the rise of smartphones, plastic lenses became ubiquitous as they don't add weight, are easier to shape into aspherical shapes and are cost-effective, too.
- The precision and production yields of plastic lenses are also far higher since they don't require heating and cooling, which typically changes the properties of the final glass lens.

Plastic	Glass
Lower index of refraction	Better optical properties, with higher light transmittance
Easier to mold into aspherical shape	Difficult to shape into aspherical lens
Lower resistance to heat once finished	Low production yield due to heating and cooling impacting the shape in the process
Lower cost	About 10x more costly

Today's iPhones are equipped with three cameras on the back (telephoto + wide + ultra-wide) and two on the front (IR + selfie)



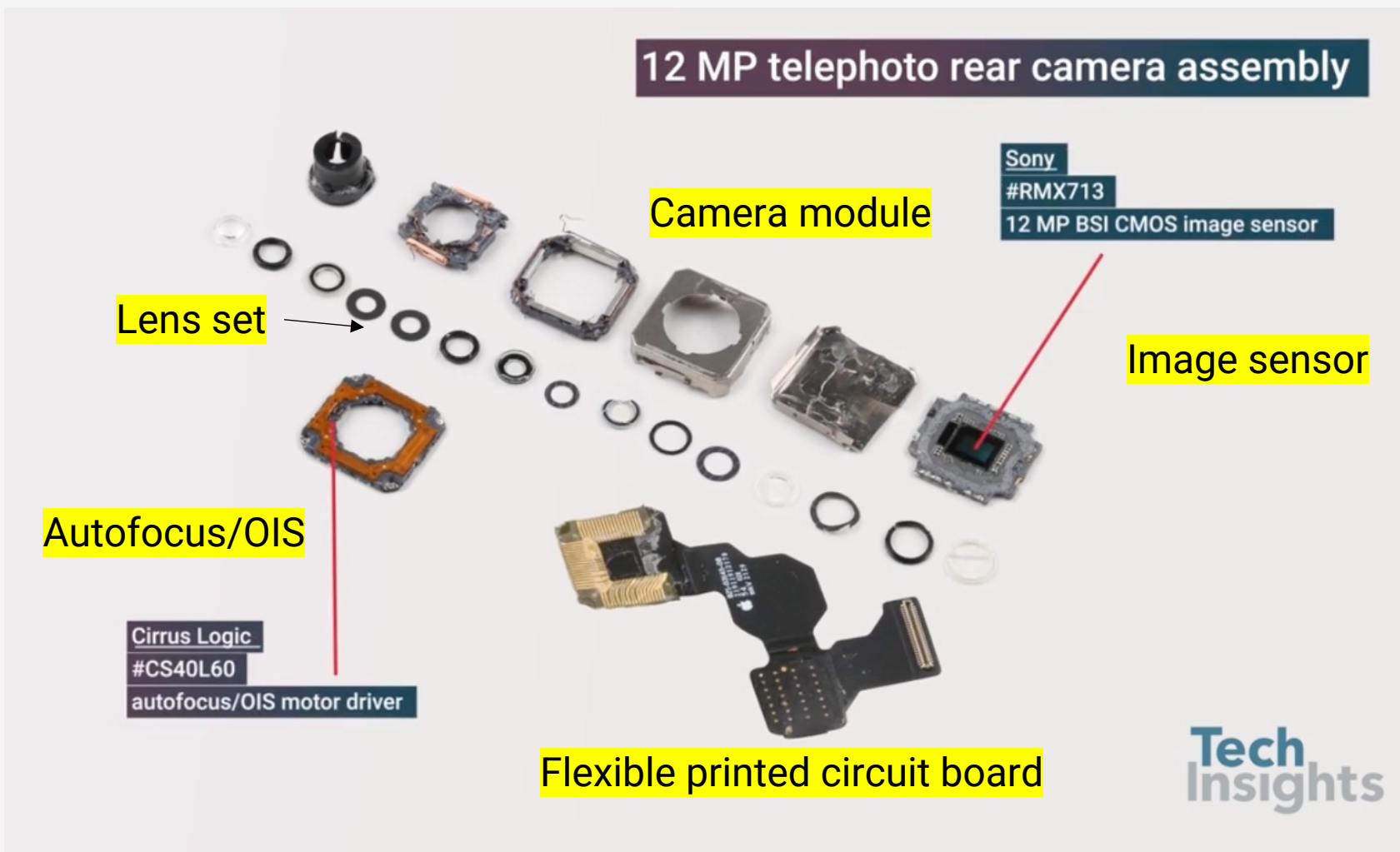
Smartphone cameras can be improved through a greater number of cameras and a greater number of lenses



- The iPhone 13 Pro camera has three rear-facing cameras:
 - An ultra-wide camera
 - A wide angle camera
 - A telephoto camera.
- Since smartphones are small and thin, their cameras need to be small and thin as well. Each individual camera won't be able to take in much of the surroundings. And small cameras will also not be able to zoom into the object you're shooting.
- Smartphone manufacturers solve the size constraint by adding several cameras and then merging the photos from each, a process called "oversampling". Dual and triple cameras can also create "bokeh" effects with a shallow depth of field. Several cameras can also improve night shots, e.g. by having one camera capture a shot using an RGB sensor and another camera using a monochrome sensors, and then merging the two photos together.
- Larger image sensors can improve picture quality, but size again poses a constraint. You can partially solve that problem by increasing the number of lenses in each camera. Extra lenses can also help correct for spherical aberrations (when incoming light rays end up getting focused on different points).
- Using too many optical lenses in each camera increases thickness (a typical camera module is ~4mm). Using too many lenses can also cause refraction problems. The need for miniature component increases the need for extreme precision in the manufacturing process.



The iPhone 13 telephoto camera system laid out on a table



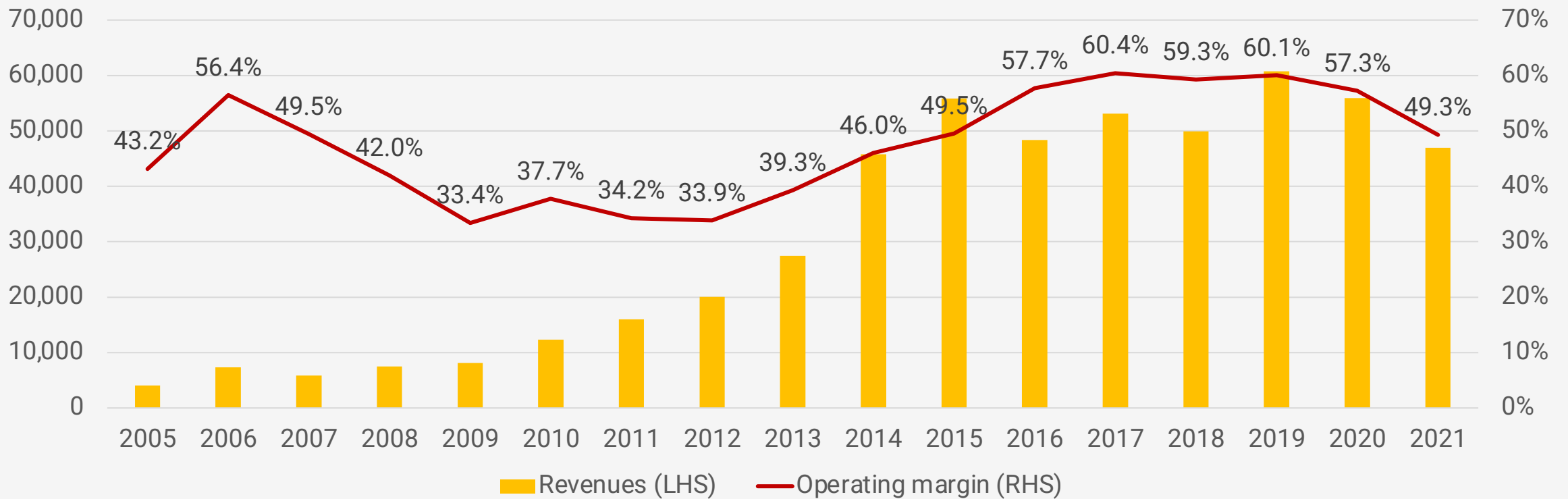
Largan grew as a supplier of plastic lenses for the smartphone industry



- **1987:** Scott Lin (林耀英) founded Largan in Taichung, Taiwan in 1987. The company was set up to manufacture lenses and viewfinders for scanners & cameras. Prior to that, he was an engineer for German auto parts supplier Robert Bosch.
- **1991:** After getting advice from his friend John Huang at Premier Technology, Scott Lin decided to shift Largan's focus to plastic aspherical lenses, which are small, thin, light and in some cases sharper than glass spherical lenses. That set Largan up to benefit from the coming digital camera and later smartphone boom.
- **1995:** Largan set up its first factory in China (Dongguan) to increase productivity and reduce cost
- **1996:** The first development of hybrid (soft + hard) lens for scanners and bar codes
- **1997:** Start of production of hybrid lenses for scanners and later digital cameras
- **2001:** Merger with Largan Optronic, a related company also owned by Scott Lin
- **2002:** IPO on the Taiwan Stock Exchange
- **2002:** First entry into the mobile phone camera market with a VGA lens
- **Early 20002s:** Largan lost digital camera patents to Japanese companies
- **2003:** Largan set up a new factory in China (Suzhou) to increase productivity and reduce cost
- **2009:** New headquarters in the Taichung Precision Machinery R&D Park
- **2010:** Scott Lin's son Lin En-Ping, a pediatrician, became CEO after having worked for the company for four years since 2006
- **2016:** Apple decided to shift VCM assembly from Largan to downstream companies



Largan's historical growth and margins have been impressive

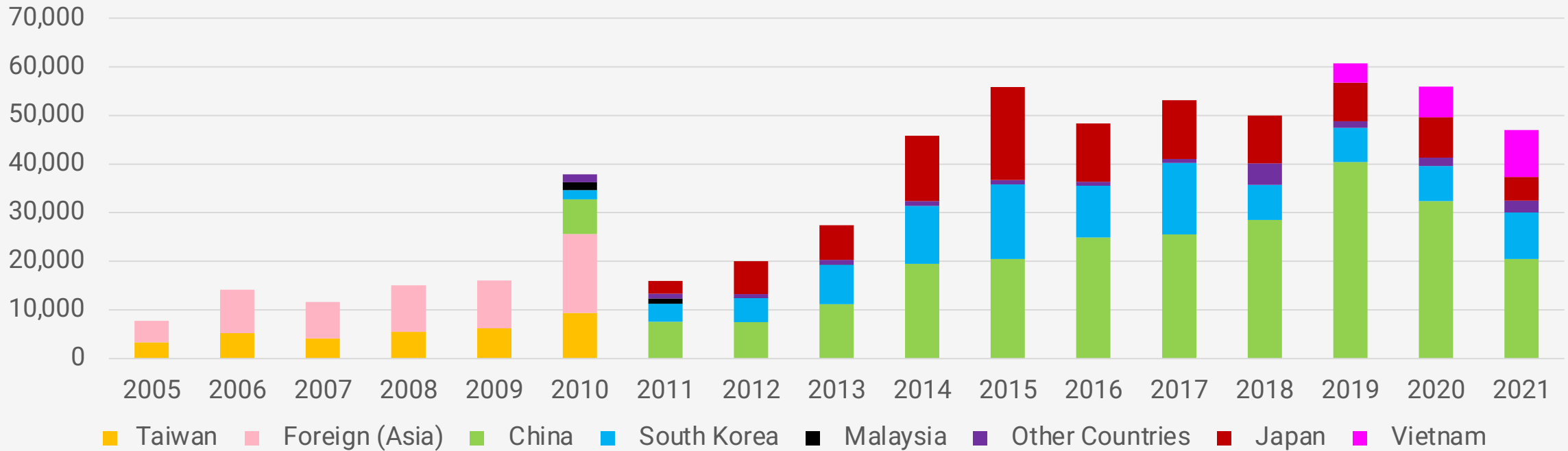


Source: TIKR

Largan's has diversified exposure across Samsung (Korea, Vietnam), Apple (China), and Japan (potentially Sony)



Largan geographical split



Source: TIKR



Today's Largan is run by the founder's son

- Founder Scott Lin resigned from the day-to-day management of Largan in 2010. He's still alive but has stepped down from the board as well.
- The founder's first son Lin En-Chou (林恩舟) took over the role as Chairman in 2013 while the younger son Lin En-Ping (林恩平, a.k.a. Adam Lin) became CEO at the same time. Today Lin En-Ping is both Chairman and CEO of Largan.
- Lin En-Ping known to be aggressive, suing Samsung Electronics for patent infringement and investing heavily in 2014 in the world's biggest lens factory. Prior to joining Largan in 2006, he was a pediatrician.

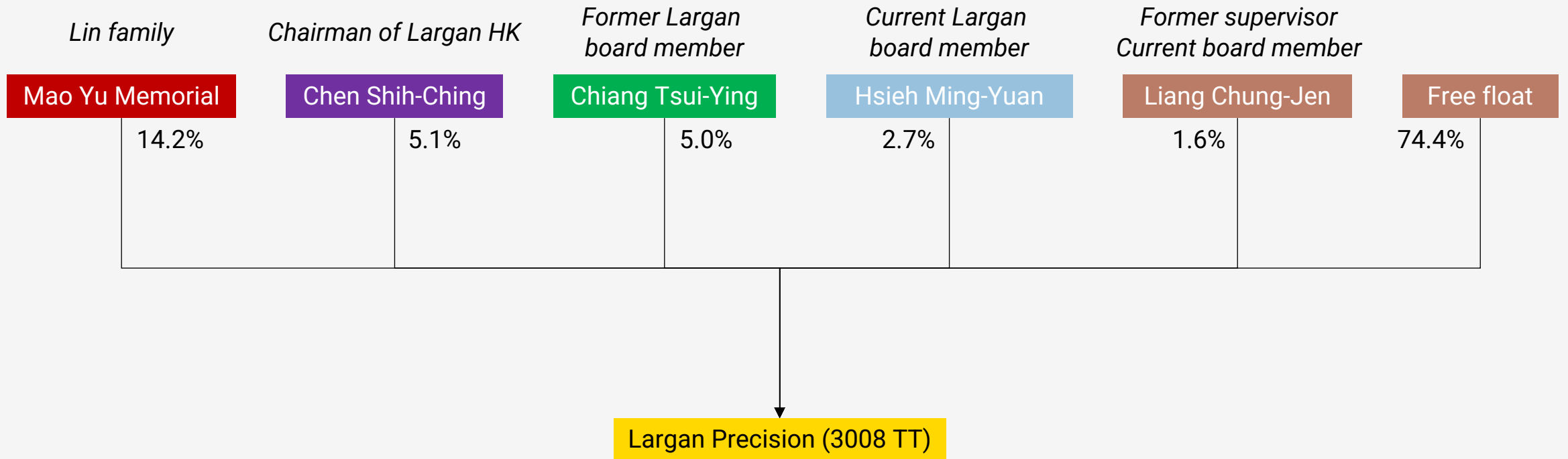


Scott Lin, founder



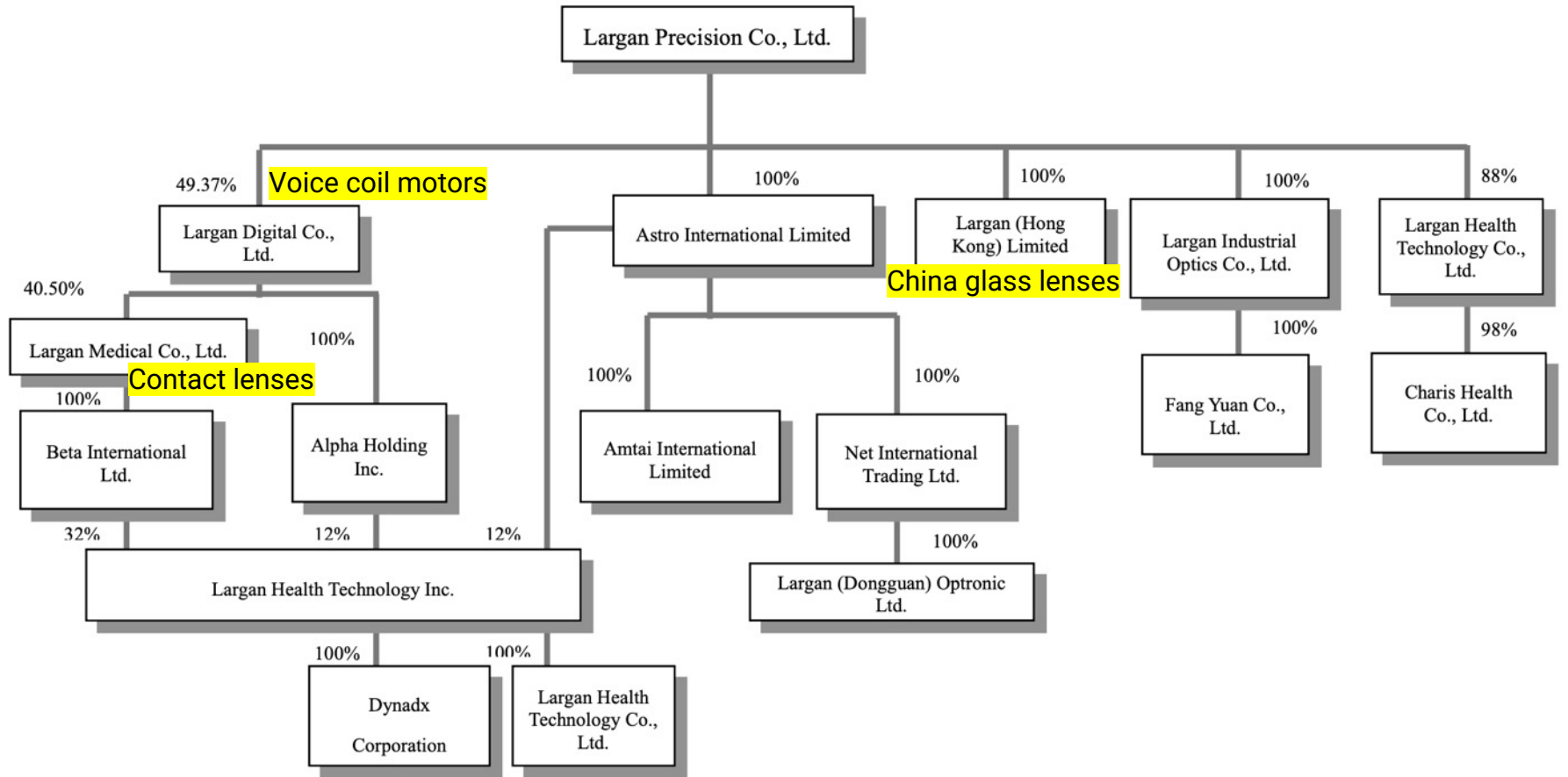
Son Lin En-Ping, CEO

Largan is owned by the Lin family and senior engineers who may or may not have retired





Largan's organisation chart is relatively clean



Largan's has 9 production sites in Taichung, Taiwan as well as two in mainland China. The Dongguan factory is used for glass lens production.



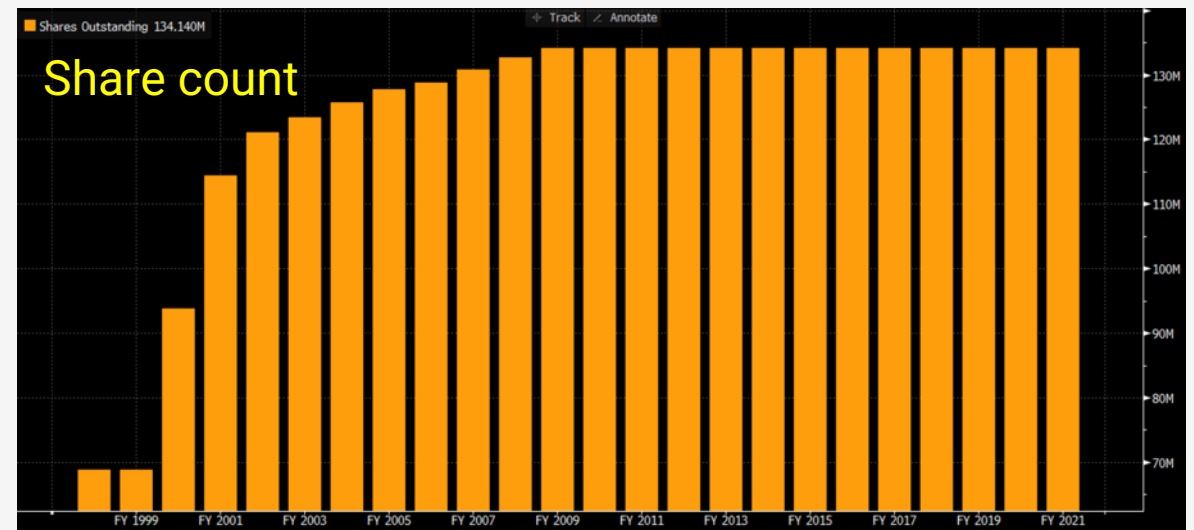
Capital allocation and corporate governance



- Largan's share count has been flat for many years. The 2021 stock buyback was modest at only 1.3 million shares out of 134 million total.
- The only M&A that has taken place since the IPO is the 15.2% acquisition of a minority stake in Ability Opto-Electronics for USD 21 million. It was announced in 2021 and is reported as still-pending. But in any case, it doesn't move the needle.
- Largan's dividend pay-out ratio has risen modestly to 51%. But it could certainly pay out a lot more, given that net cash represents 42% of market cap.
- Instead, Largan's net cash balance has been building up, from 68% of revenues in 2011 to 225% of revenues in 2021.

EffectiveAction Type	Ticker / ID	Summary
1) 10/26/21 Stock Buyback	3008 TT	Open Market for Common; 1.342M Shares
2) 03/09/21 Acquisition	3008 TT	Target: Ability Opto-Electronics Technology Co Ltd, Sought: 15.20%
3) 03/11/02 Equity Offering	3008 TT	INTL Equity Offering: IPO

Source: Bloomberg

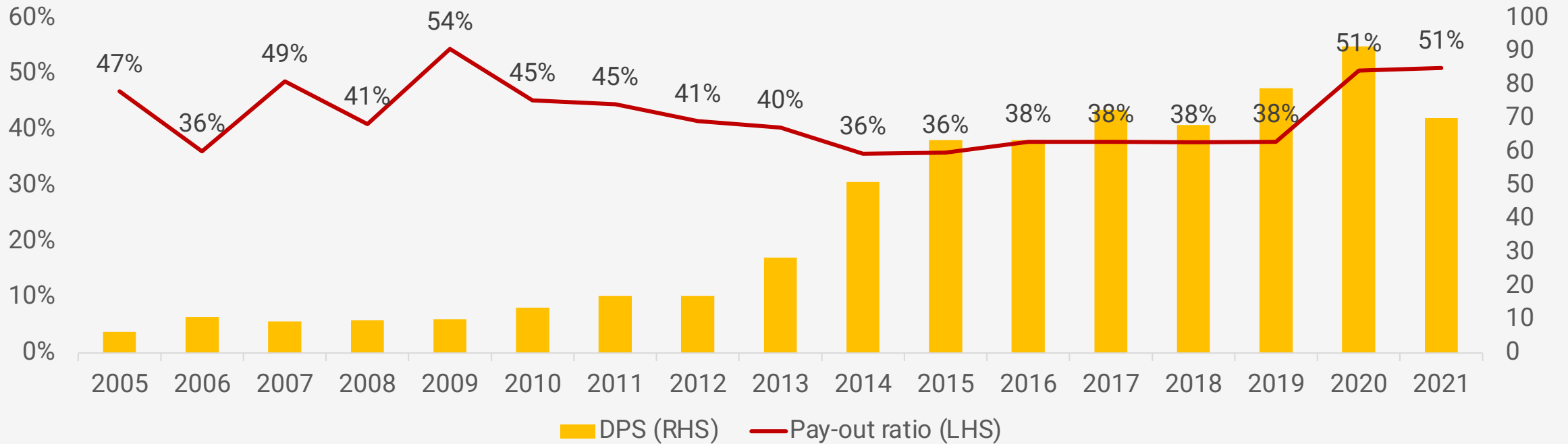


Source: Bloomberg

Largan has historically paid out about 40% of earnings as dividends



Largan dividend per share / pay-out ratio



Source: TIKR



Largan's competitive advantages

- Cheap and important product:** Largan's pricing power might be related to the fact that optical lenses are relatively inexpensive (<\$2 even for the highest end lens sets) compared to the impact they have on smartphone camera quality.
- Superior execution:** Largan's production yield has long been about 90% compared to 70% at its competitors – enabling much higher profitability. Largan achieved this efficiency and production yield by developing its own mold and manufacturing equipment. Sunny Optical and Genius use normal plastic injection molding machines from the likes of FANUC.
- Economies of scale:** Largan has for many years dominated the smartphone camera lens industry, with a 30%+ global market share. Historically, it supplied 90%+ of iPhone lenses and 95%+ of lenses sold to premium phones made by Huawei, Oppo and Vivo. Large scale enables Largan to spend more on R&D and remain at the top technologically.
- Cutting edge portfolio of products:** Cutting edge lens production is about attaining tolerances <0.1 micrometers with little to no margin of error (a human hair has a diameter of 50 micrometers). The smallest details such as floor vibrations or temperature can cause flaws in injection-molded lenses. Largan is the only company in the world able to produce 9P lens sets, and is the only company supplying periscope lenses. Sunny Optical remains behind technologically, as does Genius. According to engineers quoted by Nikkei, Largan continues to remain at least a generation ahead of its competitors.
- Patents:** Largan has over 2,700 patents. Since 2013, Largan has launched several patent battles against Genius, Ability, Samsung and others. Above 5P lenses, competitors have difficulties escaping Largan's patents, paralyzing their development.

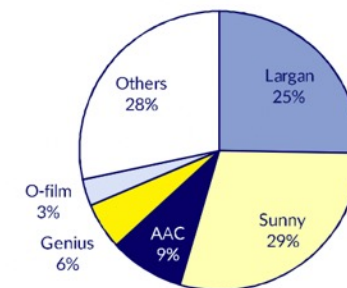
Largan leads by a generation

Technology roadmap by vendor

	1H15	2H15	1H16	2H16	1H17	2H17	1H18	2H18	1H19	2H19	1H20	2H20
Largan	6P				7P				8P			
Sunny					6P				7P			
Genius					6P				7P			

Source: CLST

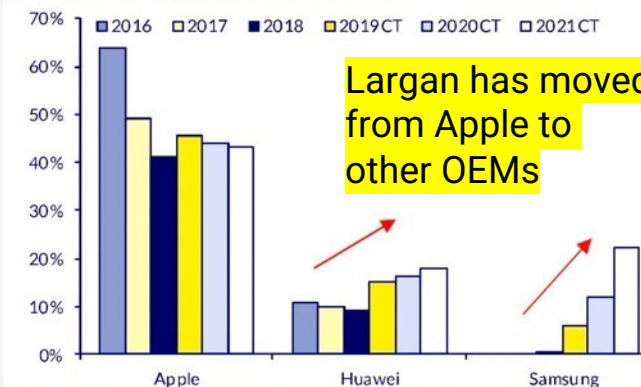
Lens market share in 2020



During COVID-19, Sunny took a greater market share by selling to Chinese OEMs

Source: CLST

Largan's penetration in major customers

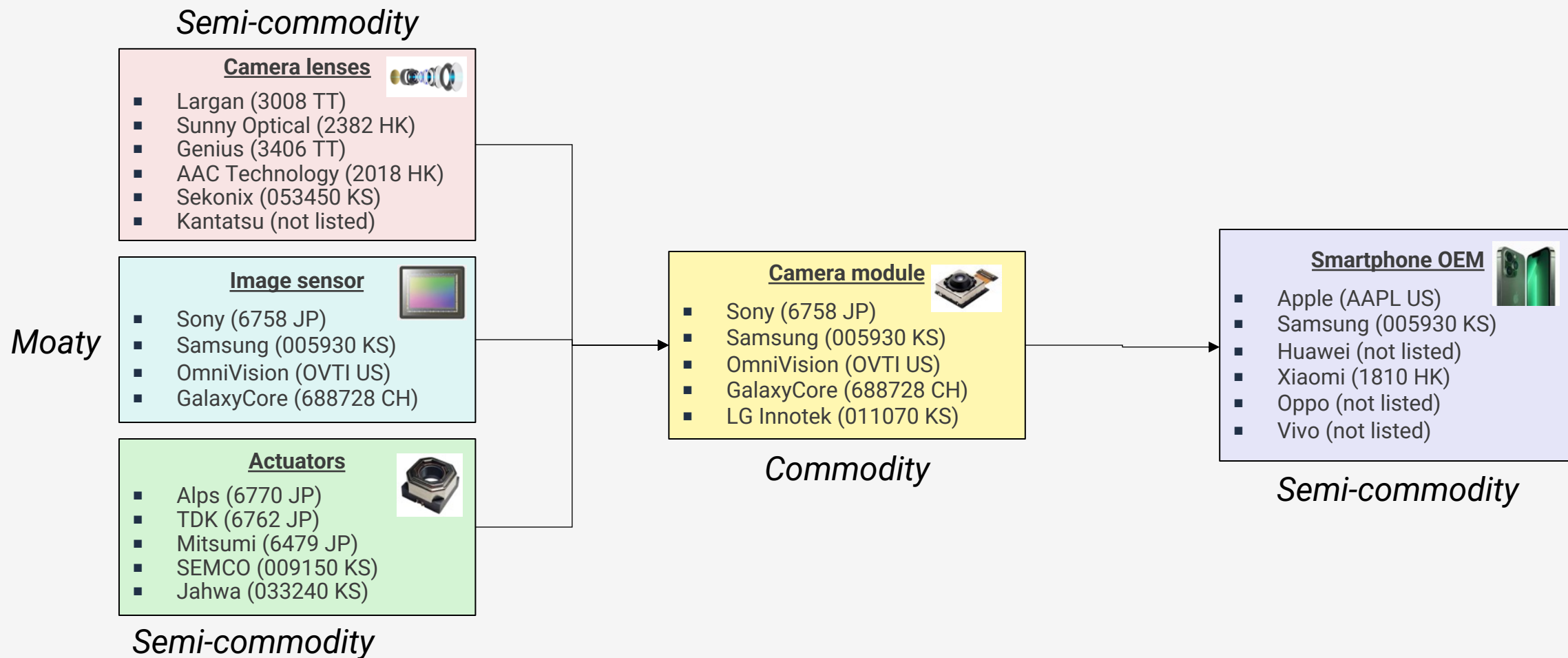


Largan has moved from Apple to other OEMs

Source: CLST



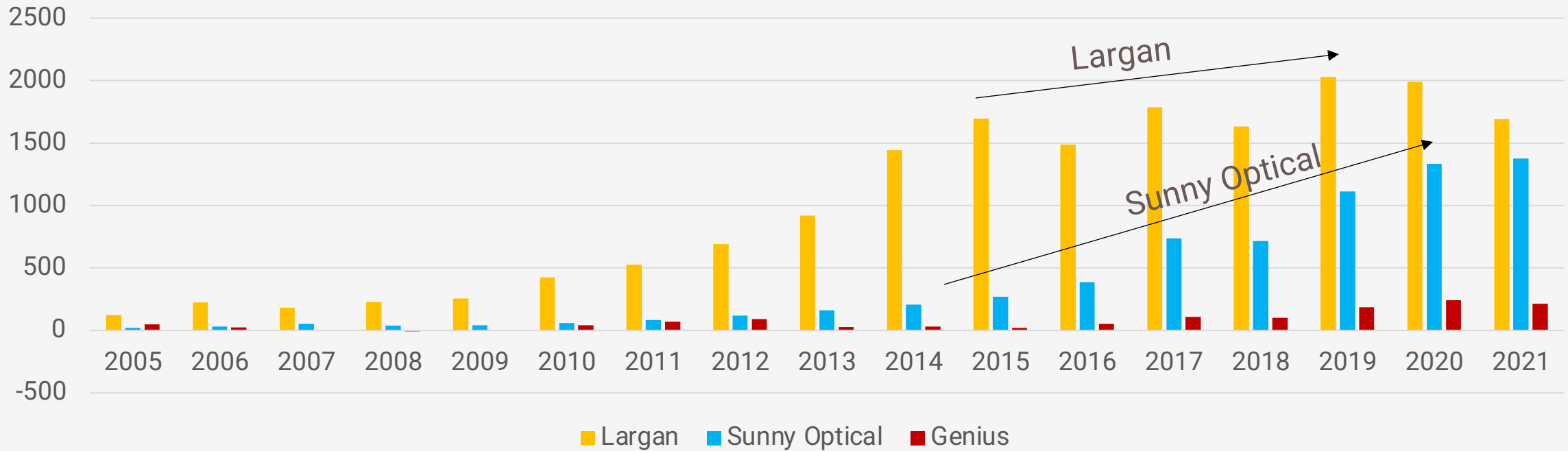
The smartphone camera supply chain



Sunny Optical has taken market share from Largan on the lower end... Genius remains much smaller



Gross profit





The best camera phones all seem to use Largan lenses

DXO Mark top smartphones by camera scores

- The Honor Magic4 Ultimate has an 8P main camera lens, with an ultra-wide camera that has a dual free-form lens. I'm almost certain these come from Largan.
- Huawei P50 Pro, Xiaomi Mi 11 Ultra and Huawei Mate 40 Pro+ all use periscopic lenses. These must have come from Largan as well.
- iPhone 13 Pro / Pro Max also come primarily from Largan.

Rank	Device	Launch Price	Launch Date	CAMERA	SELFIE	AUDIO	DISPLAY	BATTERY
1.	Honor Magic4 Ultimate	\$1211	Mar 2022	146	-	-	95	-
2.	Huawei P50 Pro	\$907	Jul 2021	144	106	68	93	79
3.	Xiaomi Mi 11 Ultra	\$1200	Mar 2021	143	94	71	87	69
4.	Huawei Mate 40 Pro+	\$1363	Oct 2020	139	-	-	-	-
5.	Apple iPhone 13 Pro	\$999	Sep 2021	137	99	75	98	76
=	Apple iPhone 13 Pro Max	\$1099	Sep 2021	137	99	75	99	89
7.	Huawei Mate 40 Pro	\$1199	Oct 2020	136	104	-	-	-
8.	Google Pixel 6 Pro	\$899	Oct 2021	135	102	71	90	49
=	Vivo X70 Pro+	\$833	Sep 2021	135	-	66	91	-
10.	Asus Smartphone for Snapdrag...	\$1499	Jul 2021	133	-	77	-	-

Largan has a clear technological lead but Apple's efforts to diversify have hurt them in recent years



"Smartphone lenses are the iPhone component with the highest profit margin, as well as being the most difficult to produce, long making it an iconic product for Taiwanese manufacturers."

- Journalist at CommonWealth Magazine

"I've never met the founders, or anyone else from Largan. I've learned about the company from the CEOs of other large Apple and Android suppliers my bank works with. They uniformly sing Largan's praises. "Though I try, I can't find a single weak point, except maybe that the founders should probably be retired and working on their golf game"

- HK-based competitor

"Apple has been unable to nurture a second Largan. If there is a second Largan in the future, prices will be slashed and today's shared prosperity will no longer exist,"

- Industry insider

"[Apple's] smartphone CPU/GPU capacity is so powerful that they can lower their demands on hardware components"

- Anonymous optics maker executive

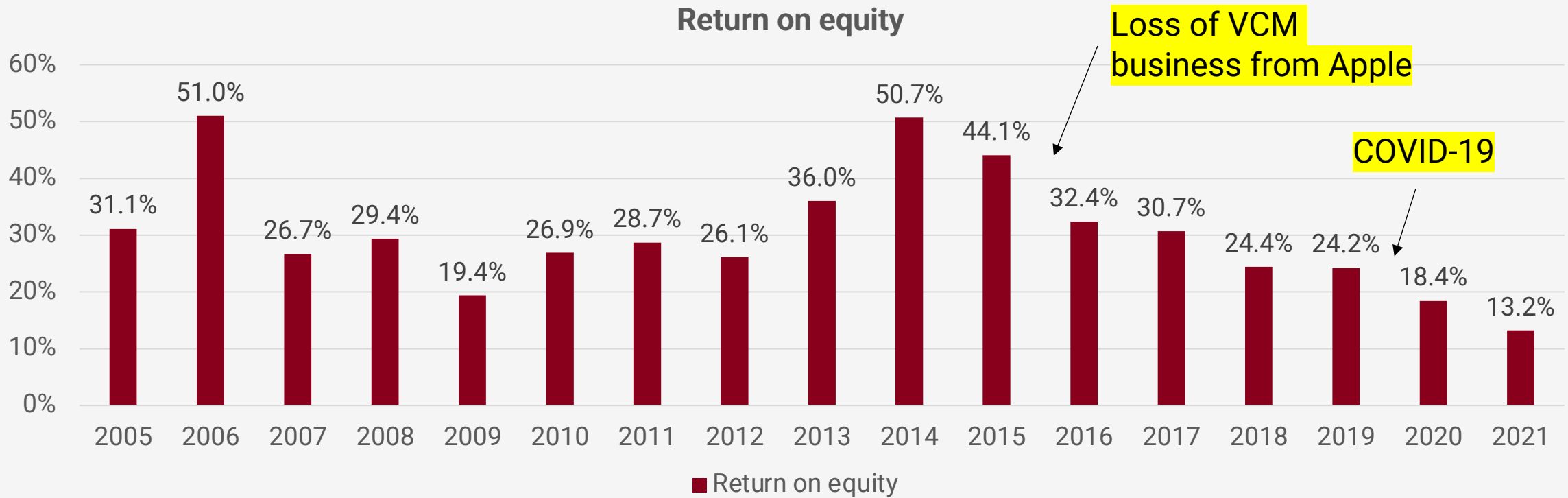
"In recent years Apple has had the capacity to apply deep learning technology to facial recognition and backgrounds, and make minute lighting adjustments to significantly improve imaging results"

- Professor Winston Hsu at NTU

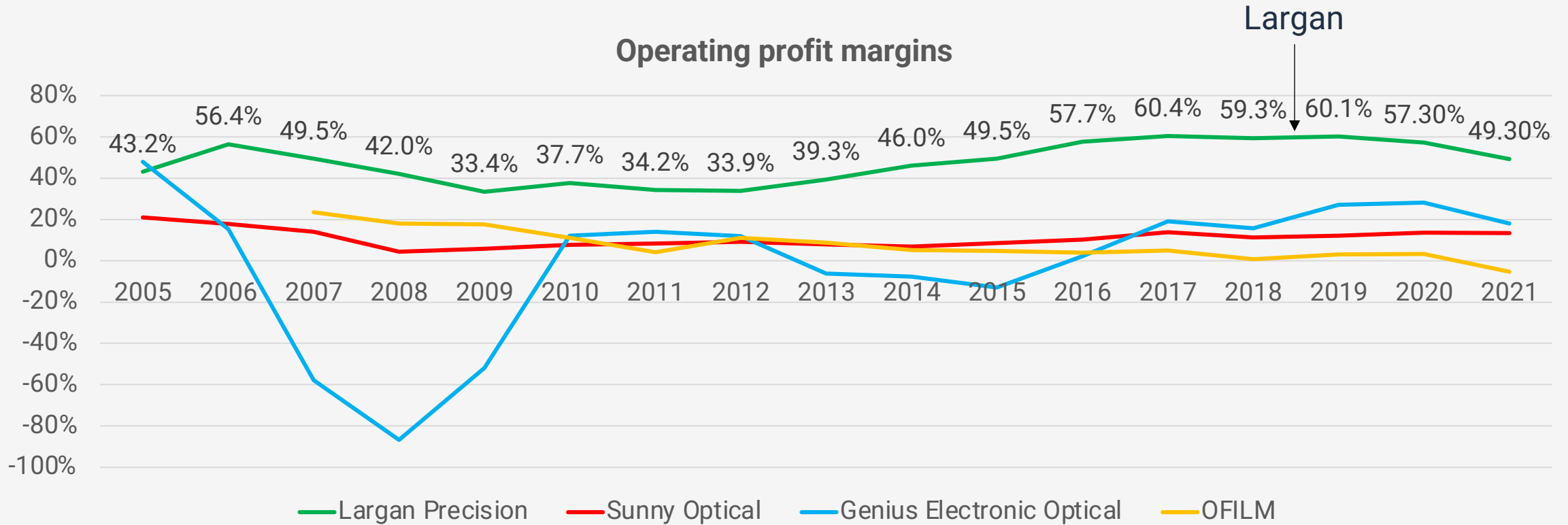
"Intellectual property remains weakly protected [in China]. Mainland Chinese companies have less incentive to do as Largan did and plow years of effort and investment into a new technology with an uncertain path to market."

- Peter Fuhrman, investment banker

Largan's return on equity has come down over time and is now close to its cost of capital

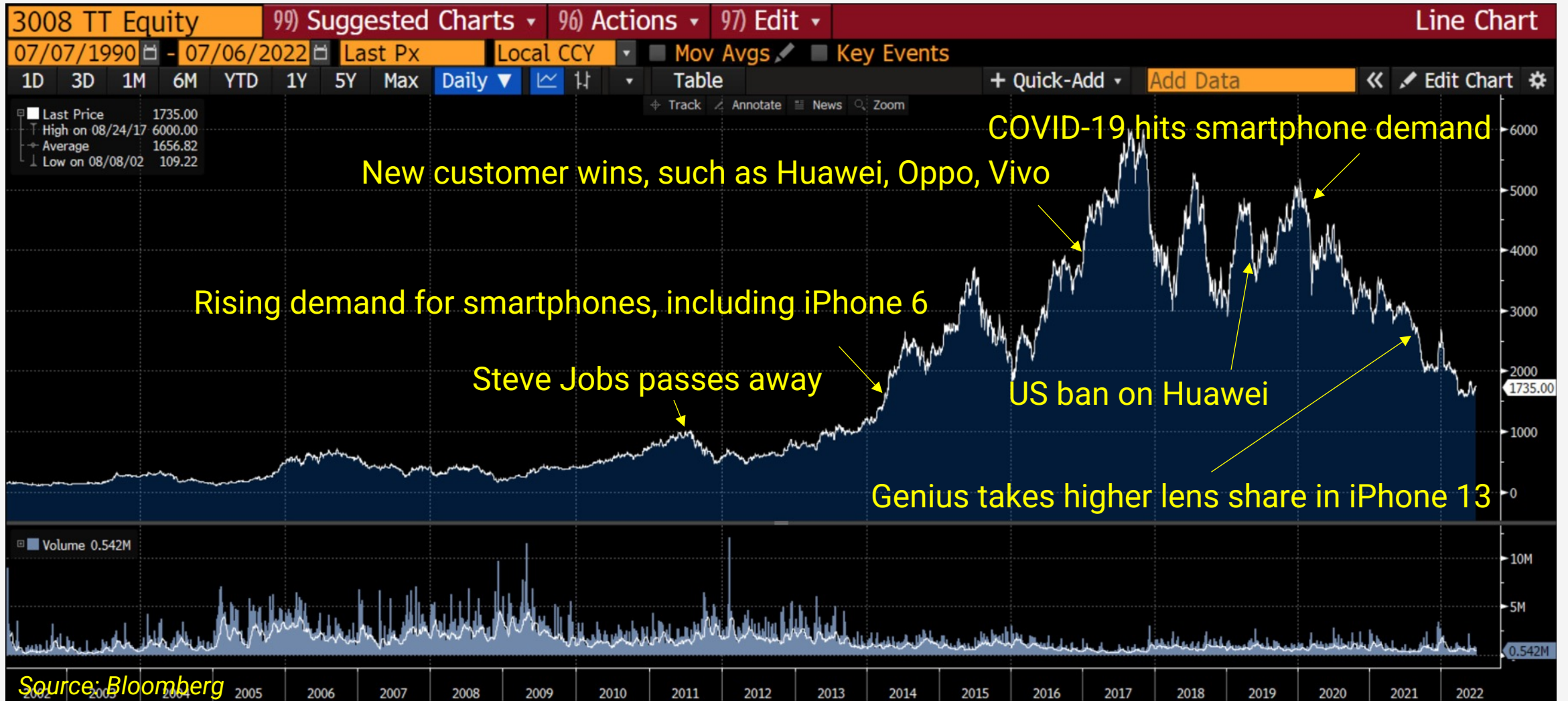


Largan's margins are by far the highest in the industry, driven by its large exposure to optical lenses and superior production yield

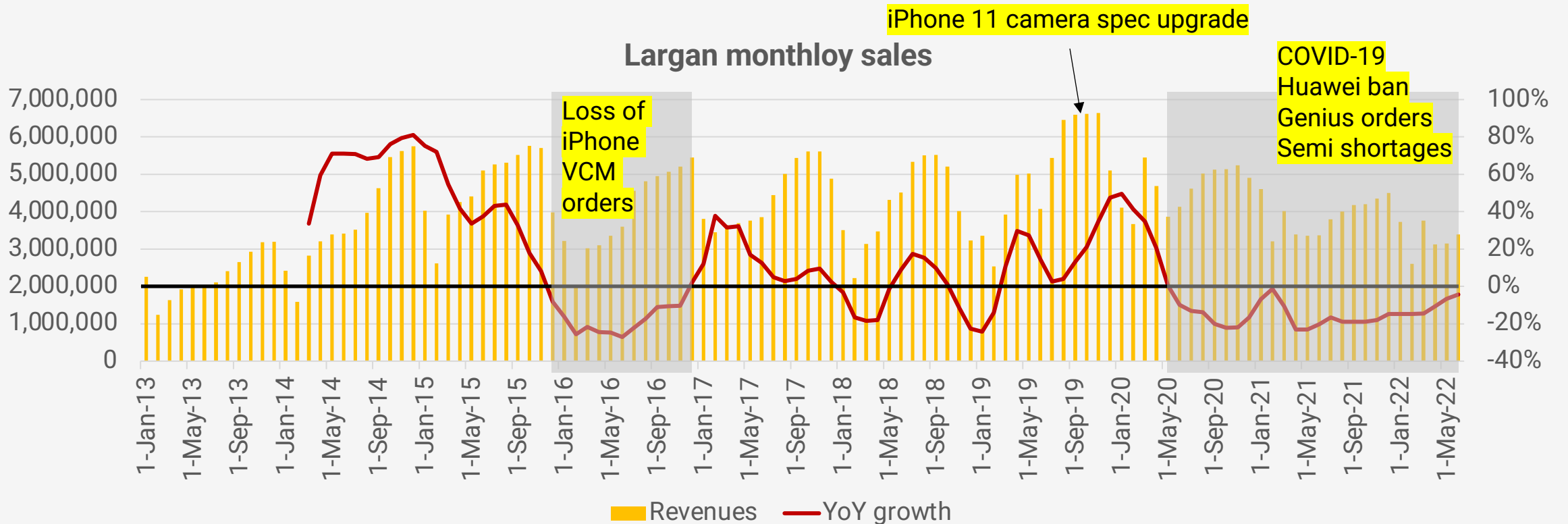


Source: TIKR

Largan's share price has severely underperformed



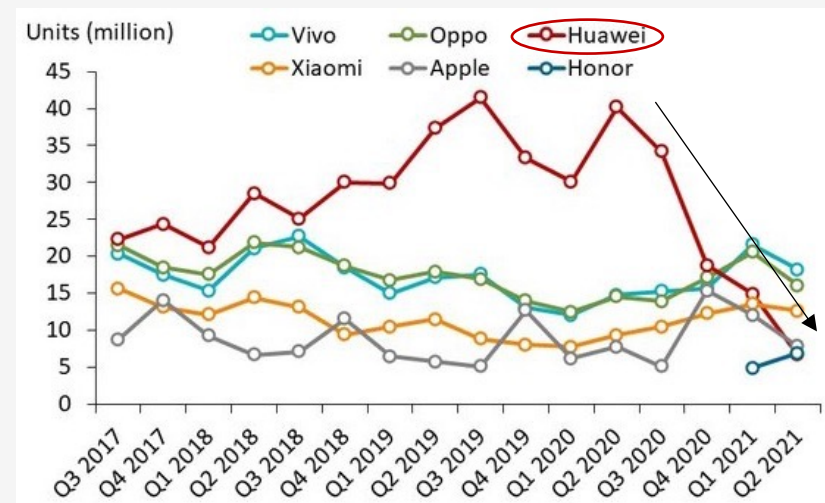
Monthly sales have dropped since early 2020 due to COVID-19, US sanctions on Huawei and Apple market share loss to Genius





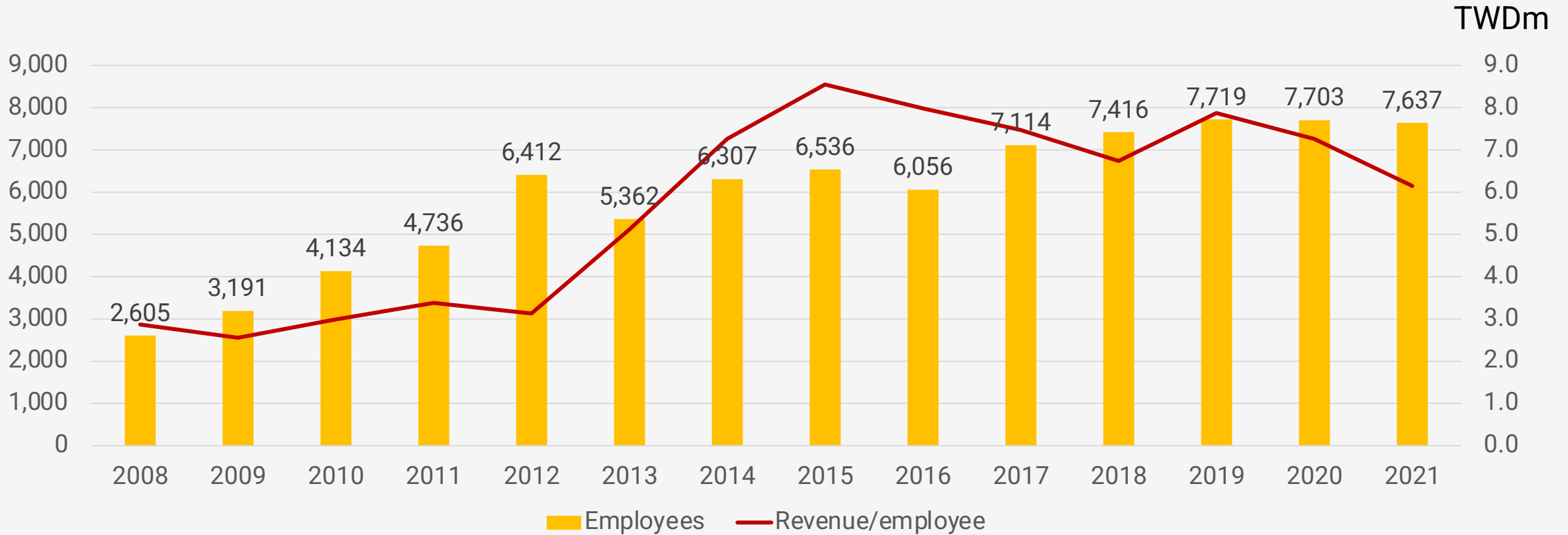
What's caused the recent slump

- **The Huawei ban:** Huawei was hit by US sanctions in 2020, limiting its ability to use components made by US companies. Huawei phones also lost access to the Google Play app store. Largan had roughly 10-20% of its revenues from Huawei and most of those revenues disappeared from 3Q2020 onwards.
- **Apple diversification:** Apple has diversified the lens supply chain away from Largan, first in 2016 and then during COVID-19. Since the outbreak of the pandemic, Apple added on Genius Electronic Optical, most likely to reduce the risk of COVID-19 related supply chain disruptions.
- **COVID-19:** There's no doubt that the smartphone industry has been hit by the pandemic. Demand is down single digit percentages vs the 2019 baseline. The shortage of semiconductor chips has also made it difficult for smartphone OEMs to develop and launch new products. CEO Lin En-Ping's said in a recent earnings call that: *"The semiconductor shortage is a serious issue that is affecting our company"*
- **5G content cost hike:** There was a spec downgrade in many smartphone manufacturers phones in 2020 due to significant cost increases related to 5G-related semi content, which reduced the room for camera upgrades. That narrative is plausible but hard to confirm.
- **New Face ID design:** Apple also introduced a change to their Face ID design, causing the lens content to deteriorate with the iPhone 13 in 2021.



Source: CounterPoint Research

Largan's employee count has flat-lined but no cost-cutting yet

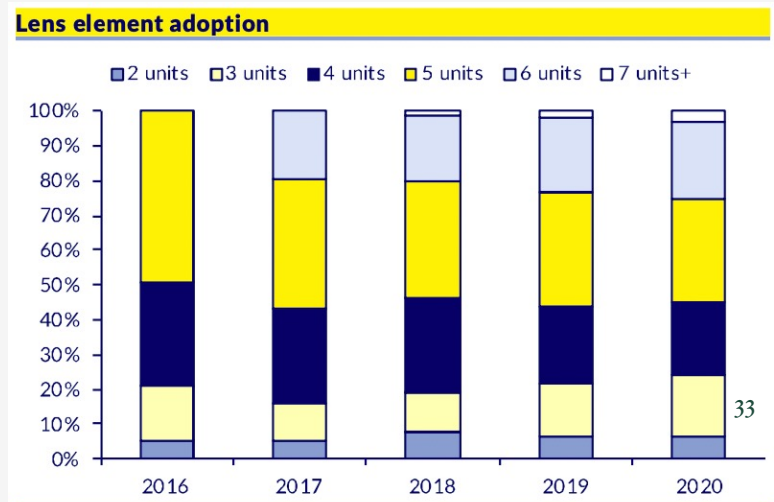
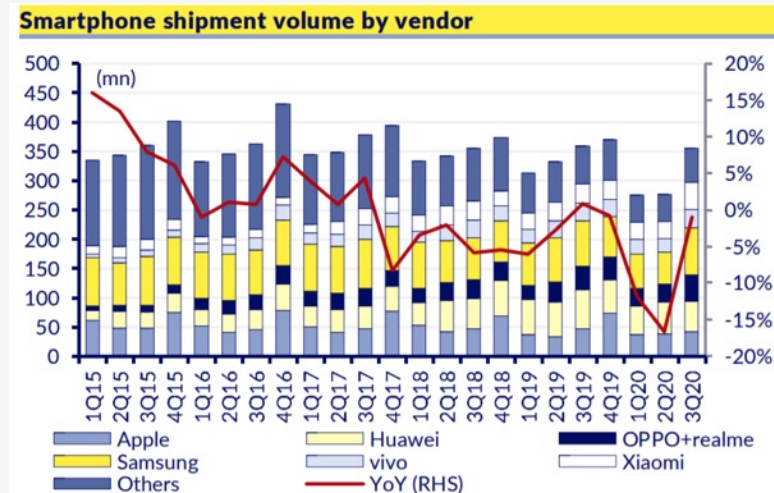


Source: Bloomberg



Long-term industry trends

- The smartphone industry is mature, with volumes declining 2-3% per year. But sales values have kept increasing thanks to higher average selling prices. So the replacement cycle is lengthening, but customers are buying higher-quality phones whenever they do upgrade.
- Smartphone cameras are improving every year. In June 2022, Sony Semiconductor's CEO said that smartphone-equipped cameras will surpass DSLR cameras as soon as 2024.
- The number of cameras per smartphone has gradually gone up as well. The average number of cameras per smartphone was about 2x in 2017 and closer to 3x today.
- And within each camera, each lens set has a greater number of lens elements – from about 4-5 in 2016 closer to 5-6 today.
- In recent years, camera software capabilities have become as important as software in achieving high-quality smartphone photos. For example, iPhone and Google Pixel smartphones routinely outperform Sony smartphones, despite the latter's superior camera hardware.
- Smartphone cameras are also moving beyond just taking photos to sensing functions such as face recognition, fingerprint sensors, AR applications that need depth maps. Those functionalities require cameras.



Source: CLST

What will change for Largan?



1. **Recovery from COVID-19:** China's smartphone sales has been weak in 2022 due to the country's COVID-19 related lockdowns. Chinese brands make up roughly 15-20% of Largan's revenues. Largan says that "outlook is pessimistic overall" and that "nobody is sure about the timing of recovery", but Largan is notoriously conservative.
2. **Supply chain constraints easing:** A shortage of semiconductor chips during COVID-19 halted smartphone development and raised costs for smartphone OEMs. Many therefore delayed optical component upgrades. Also, the demand for smartphones during COVID-19 was low as individuals stayed at home, using their computers instead. But even though semiconductor chip shortages are easing, China's lockdowns further complicate production.
3. **The 2023 iPhones upgrade cycle:** Apple tends to upgrade the iPhone camera roughly every three years. The last major upgrade was in 2019. And the next upgrade is likely to come in 2023, finally upgrading from 7P lenses to 8P. Largan is the only supplier able to produce 8P lens sets so far. Though it is true that Apple's delay in its optical lens spec upgrade left room for competition to enter.
4. **Market share loss to Genius / Sunny Optical:** After Genius became an Apple lens supplier, Sunny Optical became a supplier for iPhone 13 as well as, taking a ~3% order share. But Japan's Kentatsu was removed from the lens supplier list in iPhone 13.
5. **Future product releases** include: 1) Periscope lenses 2) Under-screen lenses 3) Dual free-form lenses, to correct distortion at the edge of images 4) Integrated VCM + lens product
6. **Factory expansions:** Largan currently has 9 manufacturing sites in Taichung. It has selected three available land plots for further development, but due to COVID-19, development has been delayed until 2023 at the earliest.
7. **Renewed commitment to auto:** After giving up on the auto lens business, Largan revived its commitment to the sector in 2021. It has now established a new subsidiary called Largan Industrial Optics Co that focuses on auto-related lenses, initially for Tesla.

The last time the iPhone had a major camera upgrade was in 2019. The 2022 upgrade will be small with selfie camera from 5P to 6P.



Dual rear-facing cameras

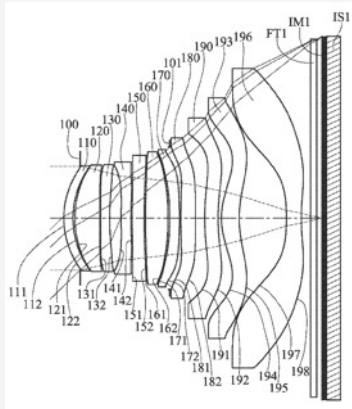
Triple rear-facing cameras

	iPhone 6S	iPhone 7+	iPhone X	iPhone Xs	iPhone 11 Pro	iPhone 12 Pro	iPhone 13 Pro	iPhone 14 Pro
Release date	Sep 2015	Sep 2016	Sep 2017	Sep 2018	Sep 2019	Sep 2020	Sep 2021	Sep 2022
Front	5MP, f/2.2, 31mm	7MP, f/2.2, 32mm	7MP, f/2.2, 32mm	7MP, f/2.2, 32mm	12MP, f/2.0, 32mm	12MP	12MP, f/2.2, 23mm	12MP, f/2.2
Back	12MP, f/2.2, 29mm	12MP, f/1.8, 28mm	12MP, f/1.8, 28mm	12MP, f/1.8, 28mm	12MP, f/1.8, 26mm	12MP, f/1.6, 26mm	12MP, f/1.5, 26mm	48MP, f/1.5, 19mm
		12MP, f/2.8, 56mm	12MP, f/2.8, 57mm	12MP, f/2.4, 52mm	12MP, f/2.0, 52mm	12MP, f/2.0, 52mm	12MP, f/2.8, 77mm	12MP, f/2.8, 77mm
					12MP, f/2.4, 120mm	12MP, f/2.4, 120mm	12MP, f/1.8, 120mm	12MP, f/1.8, 120mm
# of lenses for the wide angle	5P	6P	6P	6P	6P	7P	7P	7P

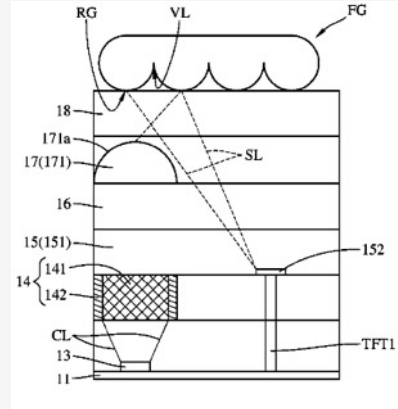
Largan's recent patents include 8-11P lenses, hybrid lenses, fingerprint sensors, actuators, periscope modules, automatic tilt modules with sensors



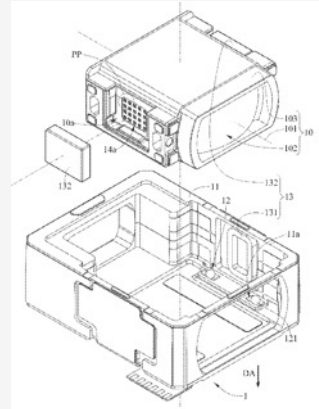
11P lens set



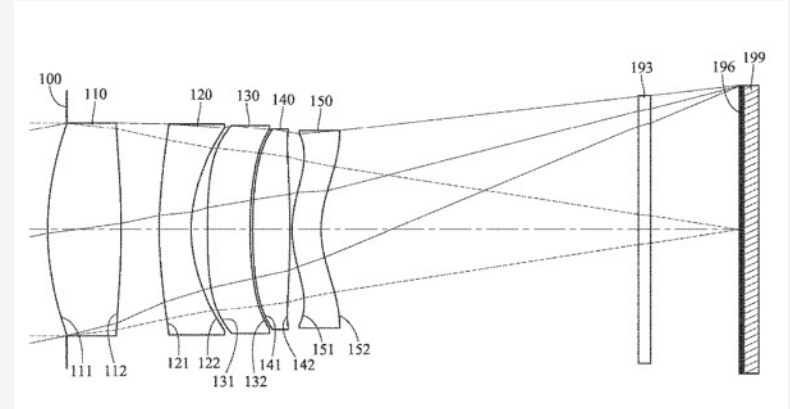
Fingerprint sensor



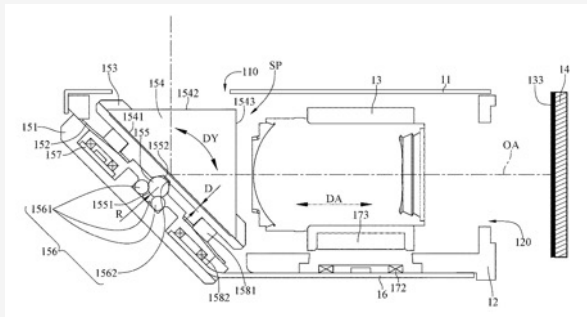
Actuator



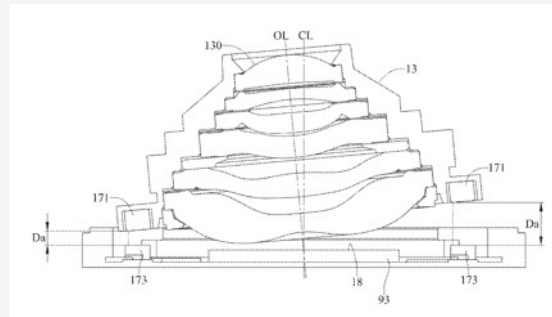
Dual image sensor systems



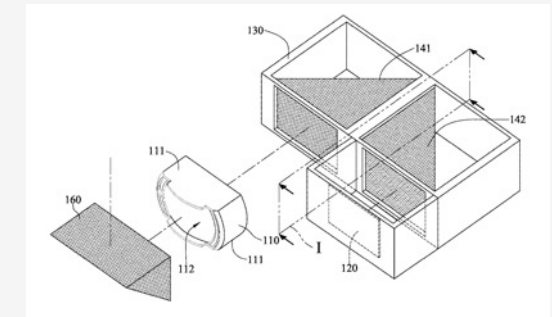
Periscope reflection module



Module with automatic tilt



Module with light folding



Source: US Patent and Trademark Office

iPhone 14 will probably upgrade its front-facing selfie camera... but a rear-facing quad-camera set-up will have to wait until iPhone 15 Pro in Sep 2023



- Analyst Ming-Chi Kuo predicts that the front-facing camera module for the iPhone 14 Pro will shift from fixed focus to autofocus through the use of a voice coil motor (VCM).
- In addition, the lens set will be upgraded from 5P to 6P.
- It's like to have a larger f/1.9 aperture.
- It will be produced by:
 - Lenses: Largan and Genius
 - Sensors: Sony
 - Focus system: Alps and Luxshare
- But Ming-Chi Kuo predicts that "Genius will be "the main supplier for the front-facing 6P lens, and the ASP is about 20% higher than 5P".
- The iPhone 14 Pro will be released in September 2022
- Source: <https://www.imore.com/iphone-14-could-be-big-upgrade-front-facing-camera-selfie-fans>

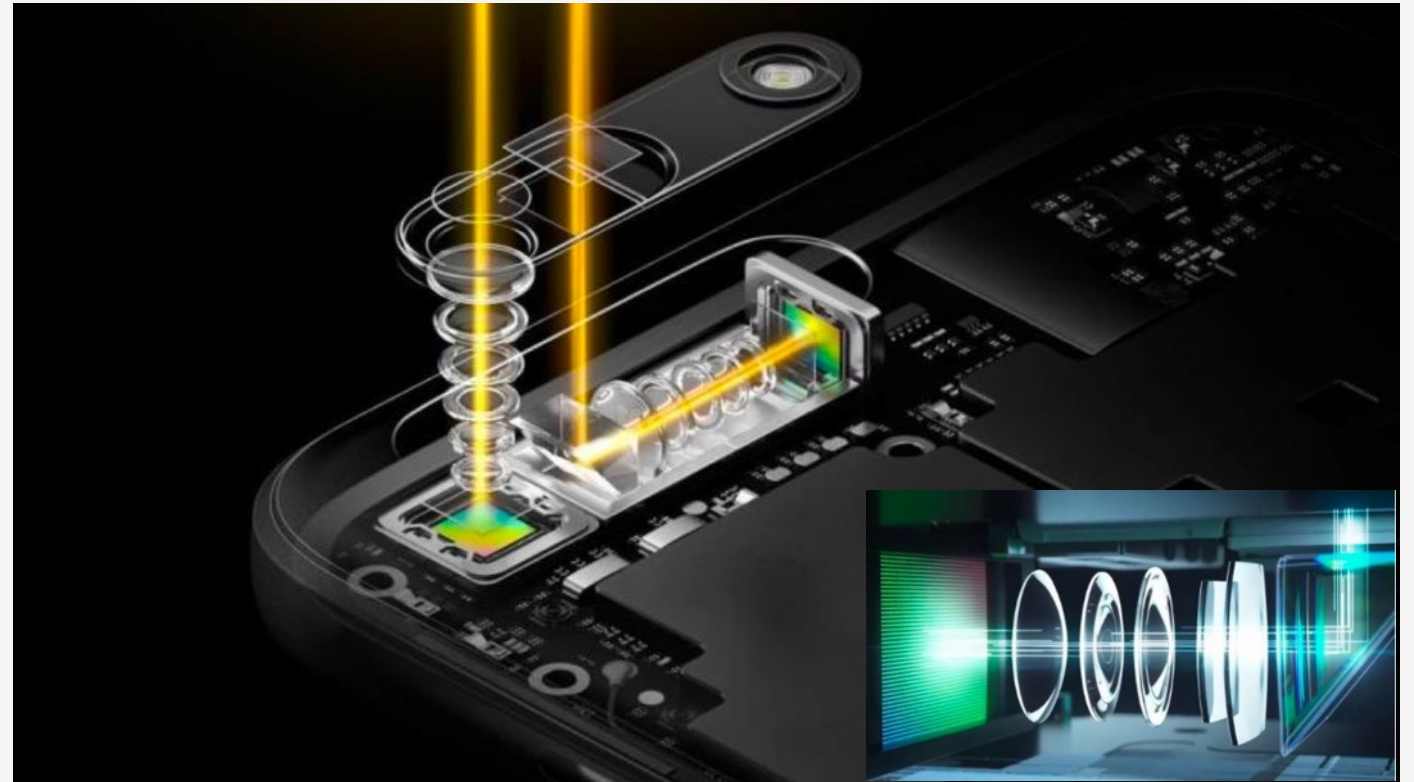


An iPhone 14 Pro render. Source: Jon Prosser

Periscope lenses could well be implemented for iPhone 15 Pro in 2023



- Periscope lenses are laid out horizontally rather than vertically along the smartphone body.
- The benefit of periscope lenses is that they let in a greater amount of light and allows for greater refraction as well.
- We're already starting to see the use of periscope lenses for high-end Android smartphone cameras. The first shipment to Huawei started in 2019.
- The next question is when Apple will adopt this new technology. Some rumours suggest that Apple is looking to adopt a periscopic lens in the iPhone 15 Pro.
- When Apple finally does so, Largan will be a great position to dominate this new category, ahead of Sunny Optical and Genius.

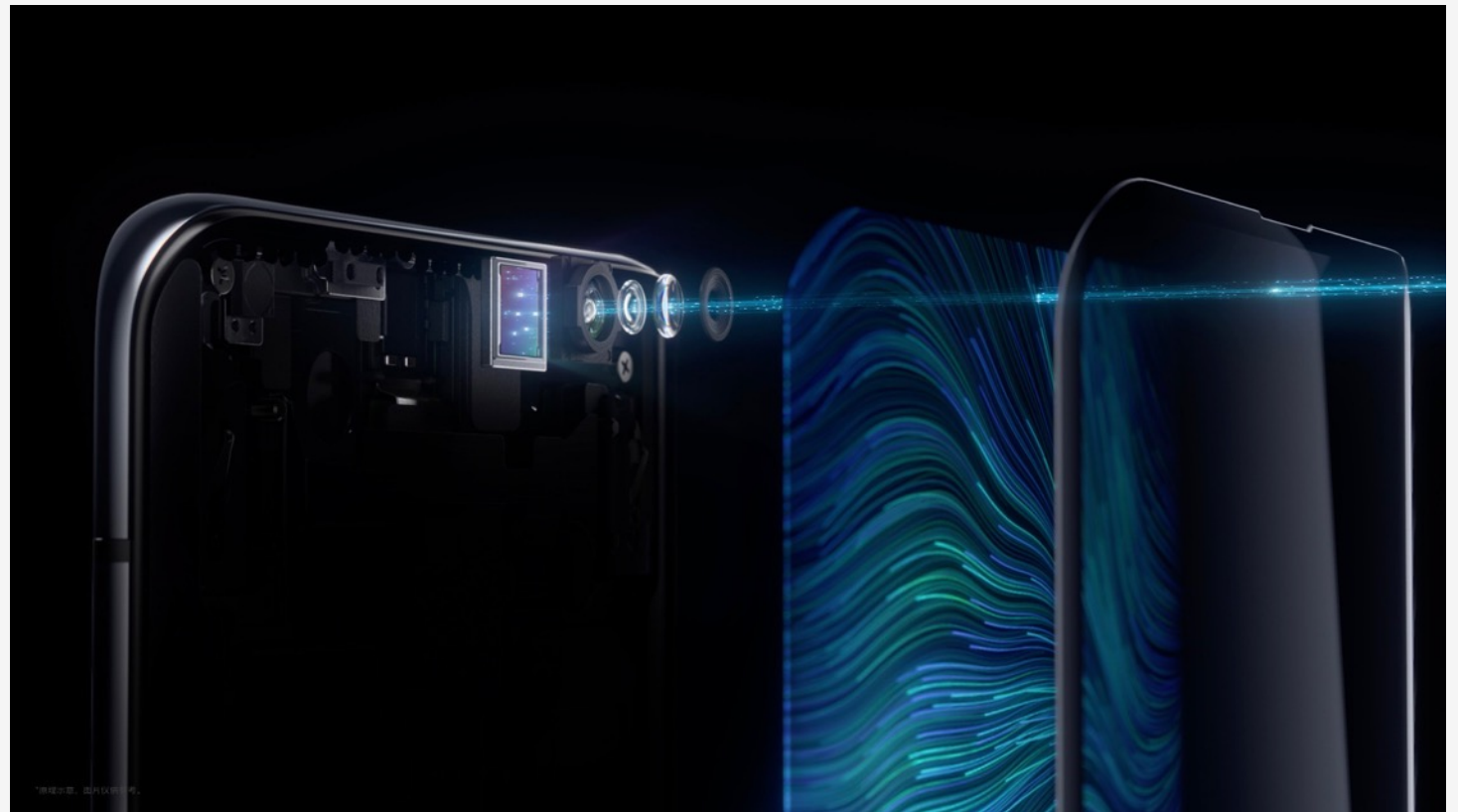


A periscope lens render

Under-screen cameras are far too immature for mass production



- ZTE came out with a under-screen camera phone in 2021 but the reviews were poor
- The camera takes in light from the outside world through semi-transparent display pixels
- Under-screen cameras experience light loss of 30-50% which causes the image quality to deteriorate. Software alone cannot solve the problem and better hardware solutions are needed before under-screen cameras can become mainstream.
- If under-screen cameras ever become a reality for mainstream smartphones, the technology is probably a few years away, at the very least.
- MKBHD review of ZTE's under-screen camera model on [YouTube](#):
- Largan has allegedly provided design solutions for under-screen cameras to a key customer (presumably Apple) and is awaiting instructions. I wouldn't hold my breath given the technological challenges.



An under-screen camera render

Sell-side analysts are bearish, given low spec upgrades for iPhone 14 Pro and sluggish smartphone demand



- 2023 earnings estimates have come down significantly from about TWD 240/share to 134
- Sell-side analysts are generally bearish but concede that 2023 could offer an improvement in the company's fundamentals:
 - *"No near-term catalysts due to sluggish overall/high-end smartphone demand"*
 - *"Limited lens spec upgrades for the 2H22 new iPhone"*
 - *"We suspect downside risk on our GM forecast, given strong NTD"*
 - *"Local news reported that Largan will enter into camera module to serve as a one-stop shopping solution. We disagree. The camera module business model is very different from Largan's lens expertise. Camera module GM of 10-15% is also much lower than Largan's current GM of ~60%"*
 - *"Periscope lens adoption in 2H23... will be [a] mid-term catalyst"*



Largan trades at the right P/E multiple on forward estimates of TWD 134/share. But way below if you take cash into account.



(2023e)	Ticker	Country	Mkt cap (US\$m)	EV/Sales	EV/EBIT	P/E	Div yield
Largan Precision	3008 TT	Taiwan	7,737	2.51x	5.6x	12.7x	3.8%
Sunny Optical	2382 HK	China	15,515	2.09x	14.5x	16.3x	1.1%
Genius Electronic Optical	3406 TT	Taiwan	1,408	2.01x	10.1x	12.8x	2.8%
OFILM	002456 CH	China	3,032	1.29x	81.6x	n.a.	0.0%
TSMC	2330 TT	Taiwan	381,912	4.50x	10.4x	12.0x	2.9%
WIN Semiconductor	3105 TT	Taiwan	2,344	3.00x	12.6x	12.3x	5.0%
Mediatek	2454 TT	Taiwan	32,686	1.27x	5.6x	7.5x	12.6%
Hon Hai Precision	2317 TT	Taiwan	46,918	0.21x	7.1x	8.4x	6.0%
Advantech	2395 TT	Taiwan	576	3.29x	17.9x	22.7x	3.1%
AAC Technology	2018 HK	China	2,556	0.97x	14.2x	11.5x	1.9%
Q Technology	1478 HK	China	765	0.23x	4.1x	5.0x	1.9%
GoerTek	002241 CH	China	16,497	0.88x	13.9x	15.3x	1.0%
Luxshare Precision	002475 CH	China	32,735	1.00x	16.1x	16.7x	0.6%
Zhejiang Crystal-Optech	002273 CH	China	2,447	2.38x	17.3x	22.4x	1.7%
Average			41,492	1.78x	17.3x	13.6x	3.1%
Median			3,032	1.29x	13.9x	12.5x	1.9%

Largan has historically traded around 18x P/E and 14x EV/EBIT



Source: Bloomberg

Largan's share price has underperformed those of Sunny Optical and Genius Electronic Optical



A full recovery to 2019 levels would require the Huawei business to be replaced. It might take time. I don't expect major loss from Apple.



Largan (3008 TT)	2018	2019	2020	2021	2022	2023	2024	2025	2026
Revenue	<u>49,952</u>	<u>60,745</u>	<u>55,944</u>	<u>46,962</u>	<u>47,902</u>	<u>51,734</u>	<u>53,286</u>	<u>54,884</u>	<u>56,531</u>
Cost of revenue	-15,595	-18,824	-18,477	-18,814	-18,203	-18,107	-18,650	-19,210	-19,786
Gross profit	<u>34,358</u>	<u>41,921</u>	<u>37,468</u>	<u>28,149</u>	<u>29,699</u>	<u>33,627</u>	<u>34,636</u>	<u>35,675</u>	<u>36,745</u>
Research and development	-3,258	-3,764	-3,794	-3,602	-3,257	-3,363	-3,304	-3,403	-3,505
Sales, General and administrative	-1,481	-1,677	-1,646	-1,400	-1,437	-1,552	-1,599	-1,647	-1,696
Operating income	<u>29,618</u>	<u>36,480</u>	<u>32,028</u>	<u>23,147</u>	<u>25,005</u>	<u>28,712</u>	<u>29,733</u>	<u>30,625</u>	<u>31,544</u>
Other income (expense)	1,584	80	-338	-122	982	982	982	982	982
Income before taxes	<u>31,202</u>	<u>36,560</u>	<u>31,689</u>	<u>23,026</u>	<u>25,986</u>	<u>29,694</u>	<u>30,715</u>	<u>31,607</u>	<u>32,526</u>
Provision for income taxes	-6,826	-8,316	-7,160	-4,355	-5,197	-5,939	-6,143	-6,321	-6,505
Net income from continuing operations	<u>24,376</u>	<u>28,244</u>	<u>24,530</u>	<u>18,670</u>	<u>20,789</u>	<u>23,755</u>	<u>24,572</u>	<u>25,286</u>	<u>26,021</u>
Diluted	135	135	135	133	133	133	133	133	133
EPS	181	209	182	140	156	178	184	189	195
GPM	68.8%	69.0%	67.0%	59.9%	62.0%	65.0%	65.0%	65.0%	65.0%
OPM	59.3%	60.1%	57.2%	49.3%	52.2%	55.5%	55.8%	55.8%	55.8%
NPM	48.8%	46.5%	43.8%	39.8%	43.4%	45.9%	46.1%	46.1%	46.0%
P/E	<u>10.2x</u>	<u>8.8x</u>	<u>10.2x</u>	<u>13.4x</u>	<u>12.0x</u>	<u>10.5x</u>	<u>10.2x</u>	<u>9.9x</u>	<u>9.6x</u>
EV/EBIT	<u>4.8x</u>	<u>3.9x</u>	<u>4.4x</u>	<u>6.1x</u>	<u>5.6x</u>	<u>4.9x</u>	<u>4.7x</u>	<u>4.6x</u>	<u>4.5x</u>
Div yield	<u>3.6%</u>	<u>4.2%</u>	<u>4.9%</u>	<u>3.8%</u>	<u>4.2%</u>	<u>4.8%</u>	<u>4.9%</u>	<u>5.1%</u>	<u>5.2%</u>

Largan's enterprise value is now close to pre-iPhone levels



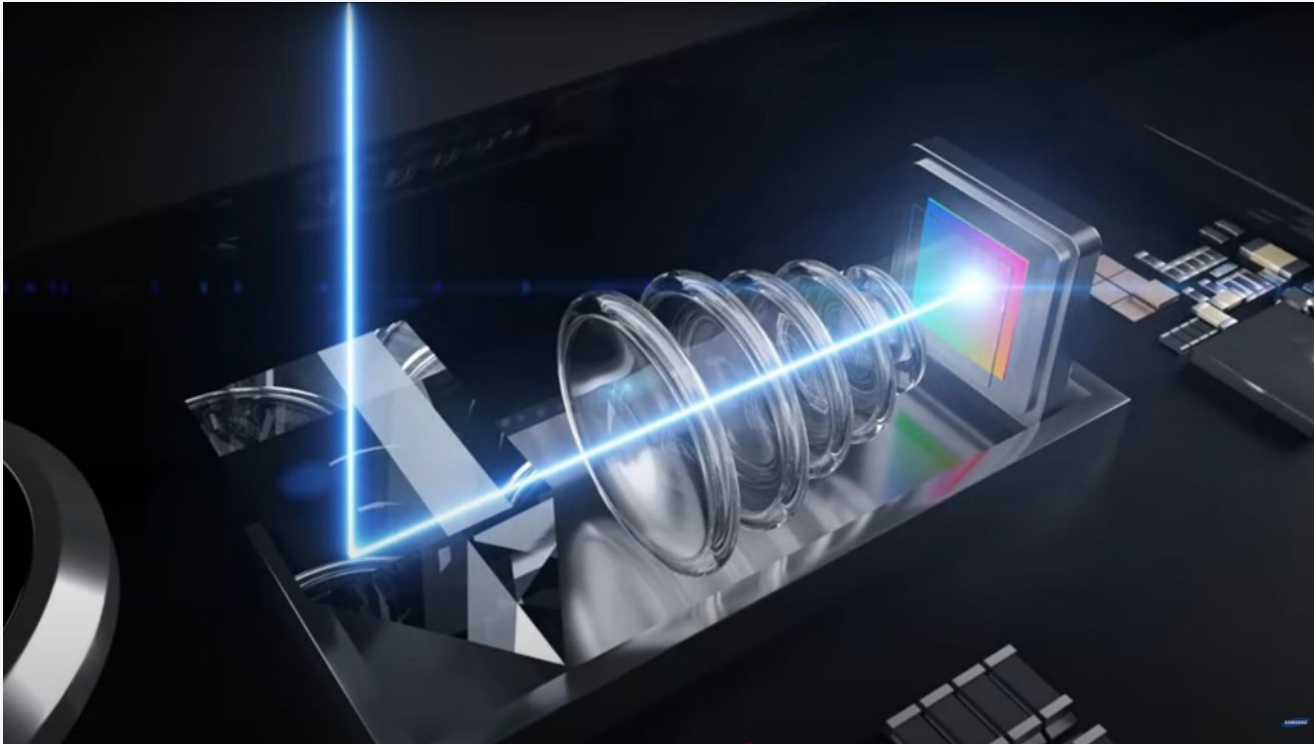


Potential downside risks

- **Customer concentration:** Apple represents 50-55% of Largan's revenues. Apple is known to be a company that hates relying on single suppliers. That said, Largan only has a 50% share in iPhone lens orders at this point, so market share losses may be in the rearview mirror.
- **Competitive pressures:** In the past, it's been impossible for Apple to find another supplier to match Largan's price, volume and quality. Apple allegedly became disappointed with Genius after its [Apple's 2020 quality issues](#). While Sunny Optical took 3% share from iPhone orders, they replaced Japanese supplier Kantatsu. Sunny Optical broke into the Apple supply chain with the iPhone 13, supplying the 7P wide angle lens for the lower-end version. Lin En-Ping said that Apple "*didn't want to be handcuffed to Largan*". But Apple had to make compromises on lens volume and optical quality to achieve supply chain diversification. Out of Apple's top 200 major suppliers, the number of Chinese companies just recently increased to 51 – more than Taiwan's 48 suppliers, for the first time ever.



Catalysts



- The launch of iPhone 15 Pro in September 2023, as it may introduce 8P / periscopic lens sets and quad-camera set-ups
- Smartphone market recovery from COVID-19
- Semiconductor shortages easing, speeding up development of new smartphone models