Automobile

China's LiDAR Revolution: Cost Breakthroughs, Profit Inflection, Industry Consolidation

MARKET WEIGHT
(Maintained)

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Highlights

- We initiate coverage on Hesai and RoboSense with BUY ratings and target prices of HK$33.00 and HK$50.00 respectively.
- Global LiDAR shipments are expected to grow at a five-year CAGR of 51% from 5m units in 2025 to 40m units in 2030, driven by cost reduction and the burgeoning demand from the ADAS and robotics industries.
- Chinese LiDAR companies slashed LiDAR costs from >US$9,000 to <US$300 via interlinked technological and manufacturing breakthroughs.
- China dominates the global LiDAR industry with a 90% market share; Hesai and RoboSense make up a 60% market share after industry consolidation.
- Hesai and RoboSense are entering an earnings inflection point, driven by sales scaling to critical mass and sustained cost reductions.

Analysis

- **Light detection and ranging (LiDAR) employs laser pulses to generate dense, real-time 3D point-cloud maps with centimetre-level accuracy and reliability regardless of lighting,** making it essential for advanced driver-assistance systems (ADAS), autonomous driving (AD), and robotics.
- **Chinese LiDAR companies have dismantled the traditional high-cost structure of LiDAR via technological and manufacturing breakthroughs,** turning a >US$9,000 component into a sub-US$300 mass-market sensor.
- **Duopoly dominated by Hesai and RoboSense.** China accounts for 80-90% of shipments in the global LiDAR industry. After intense industry consolidation, Hesai Group (Hesai) and RoboSense Technology Co (RoboSense) now command a 60% market share due to their technological leadership.
- **Five-year shipment CAGR of 49% in 2026-30.** Global LiDAR shipments surged from under 0.2m units in 2020 to roughly 5m units in 2025, and are projected to reach 37.3m units by 2030 (49% five-year CAGR), as cost reduction from chip-level integration unlocks mass-market adoption.
- **Dual engines: ADAS and robotics.** ADAS represents more than 80% of demand and is the primary growth engine of the LiDAR industry, while higher-ASP robotics is emerging as a fast-growing, high-margin second curve. Both could see their value grow at a five-year CAGR of over 30% in 2025-30.
- **Foray into physical AI market with new fusion sensor products.** Hesai's Picasso SoC and Kosmo, and RoboSense's Eocene series SoCs and AC-series Active Camera enlarge the addressable market by 10 times.
- **Earnings approaching inflection point.** Hesai turned around in 2025 with a net profit of Rmb436m, with earnings expected to grow at 46% three-year CAGR in 2026-28. For RoboSense, we expect net profit to turn positive at Rmb91m in 2026 and grow at a 173% two-year CAGR in 2027-28.
- **Strong projected earnings growth supports premium valuations.** Hesai and RoboSense trade at just 0.5x 2027F PEG, a discount to Chinese ADAS plays, with respective DCF-derived target prices of HK$33.00 and HK$50.00.

Segmental Rating

Segment	Rating
OEMs	MARKET WEIGHT (Maintained)
Auto parts	MARKET WEIGHT (Maintained)
Battery and battery materials	OVERWEIGHT (Maintained)

Source: UOB Kay Hian

Sector Picks

Company	Ticker	Rec	Share Price (HK$)	Target Price (HK$)
Hesai	2983 HK	BUY	15.77	33.00
RoboSense	2498 HK	BUY	22.56	50.00

Source: Bloomberg, UOB Kay Hian

Figure 1: Peer Comparison

Company	Ticker	Rec	Price 15 Jul 26 (HK$)	Target Price (HK$)	Upside To TP (%)	Last Year End	PE 2025 (x)	PE 2026F (x)	PE 2027F (x)	Yield 2026F (%)	ROE 2026F (%)	Market Cap. (HK$m)	Price/ NAV ps (x)
Hesai	2983 HK	BUY	15.77	33.00	109.3	12/2025	35.0	31.5	19.0	-	5.9	19,825	1.8
RoboSense	2498 HK	BUY	22.56	50.00	121.6	12/2025	Loss	101.9	23.5	-	2.4	10,653	2.4

Source: Bloomberg, UOB Kay Hian

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This report uses the closing prices of 15 Jul 26

Industry Overview

LiDAR is a remote-sensing technology that uses laser pulses to measure distances with exceptional precision. A LiDAR system emits millions of laser pulses per second, calculates the time each pulse takes to reflect off surrounding objects, and generates a dense, real-time three-dimensional point-cloud map of the environment. Unlike cameras, LiDAR performs reliably regardless of lighting conditions and delivers centimetre-level ranging accuracy, making it an indispensable "eye" for machines that require spatial awareness.

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The core applications of LiDAR span multiple sectors, primarily including:

- **Automobile – >80% of demand.** In automotive and AD, LiDAR enables ADAS and Level 3+ (L3+) autonomy by providing 360-degree perception for highway cruising, urban navigation, and collision avoidance.
- **Robotics – 15-20% of demand.** In robotics and industrial automation, it powers warehouse autonomous mobile robots (AMR), last-mile delivery vehicles, mechanical arms, and emerging humanoid platforms through precise 3D mapping and obstacle detection.
- **Others – <1% of demand.** Additional uses include aerial surveying and topographic mapping with drones or aircraft, smart infrastructure for traffic monitoring and perimeter security, environmental monitoring, forestry, archaeology, and defence applications.

China's LiDAR market has emerged as the undisputed global leader in LiDAR technology. China is the world's biggest market for LiDAR, accounting for 80-90% of global shipments. Chinese companies such as Hesai and RoboSense now supply 80-90% of LiDAR units worldwide. This dominance stems from rapid vertical integration, accelerated technological iteration, and the explosive expansion of China's intelligent vehicle market.

Chinese companies such as Hesai and RoboSense supply 80-90% of LiDAR units worldwide.

Industry growth. Global LiDAR shipments surged at a five-year CAGR of >100% from less than 200,000 units in 2020 to about 5m units in 2025, mainly driven by the ADAS sub-segment of the auto parts segment within the automobile sector.

Looking forward, we expect global LiDAR shipments to grow at a 51% five-year CAGR to 40m units in 2030 from 2025, driven by ADAS and robotics. As for dollar value, we anticipate the global LiDAR market growing at a 25% five-year CAGR from 2025-30, based on a 51% shipment CAGR and an average of 10-20% p.a. ASP drop. We expect ADAS and robotics to see their value grow at a five-year CAGR of over 30% from 2025-30, outpacing the industry average.

Figure 2: Global LiDAR Shipments

(m units)	2020	2025	2030F	CAGR 2025-30
ADAS LiDAR	0.01	4.00	30.00	50
Robotics LiDAR	0.11	1.00	10.00	58
Others	0.02	0.05	0.06	4
Total	0.14	5.05	40.06	51

Source: Gasgoo, Yole, UOB Kay Hian

Figure 3: Global LiDAR Market Size

(US$b)	2020	2025	2030F	CAGR 2025-30
ADAS LiDAR	0.12	1.20	4.50	30
Robotics LiDAR	0.38	0.70	4.00	42
Others	1.28	1.30	1.14	(3)
Total	1.77	3.20	9.64	25

Source: Gasgoo, Yole, UOB Kay Hian

GROWTH DRIVERS

Cost reduction driven by technological advancement and economies of scale. The single most powerful driver of LiDAR commercialisation is a steep, multi-generational decline in costs achieved through technological evolution and manufacturing scale. The ASP of ADAS LiDAR slumped by more than 90% from US$9,000 in 2020 to US$300 in 2025, and is expected to halve to US$150 by 2030. The sharp cost reduction is due to architectural simplification, chip-level integration and economies of scale.

The ASP of ADAS LiDAR slumped by more than 90% from US$9,000 in 2020 to US$300 in 2025, and is expected to halve to US$150 in 2030.

- **Architectural simplification.** The industry has progressed through three distinct generations of LiDAR architecture.
  - **First-generation mechanical rotating LiDAR units, dominant before 2020,** relied on spinning 360-degree assemblies with 16-128 channels and commanded prices of US$5,000-50,000 or higher. These systems were bulky, power-intensive, and ill-suited for high-volume automotive integration.
  - **Second-generation semi-solid or hybrid designs, which were mainstream from 2021 to 2023,** replaced full mechanical rotation with one-dimensional rotating mirrors or micro-electromechanical system

First-generation LiDARs cost US$5,000-50,000 or more.

Second-generation LiDARs cost US$500-1,000.

(MEMS) mirrors paired with fixed transceiver arrays. Products such as Hesai's AT128 and RoboSense's M-series brought costs down to US$500-1,000 at volume while maintaining a 200-metre-plus range.

- **The current third-generation, with full solid-state and digital architectures that gained traction from 2024 onwards,** eliminates macroscopic moving parts. Sub-variants include MEMS mirrors for a balanced performance, optical phased arrays for pure electronic beam steering, and digital flash systems built on single-photon avalanche diode (SPAD) receiver arrays, vertical-cavity surface-emitting laser (VCSEL) transmitter arrays, and single-chip System-on-Chips (SoC). RoboSense's E/EM platform and Hesai's fourth-generation application-specific integrated circuits (ASIC) are leading examples. At scale, these units achieve costs of US$100-300 for mid-range models and below US$200 for entry-level short-range variants.

Third-generation LiDARs cost only US$100-300 at scale.

- **Chip-level integration, or chipisation, is the decisive technological breakthrough** that integrates VCSEL transmitter arrays, SPAD receiver arrays, and processing logic into single SoCs. This breakthrough reduces bill-of-materials (BOM) costs by 40-60% and power consumption by 30-50% while improving robustness in challenging weather conditions.
  - **Slashing of component count by 90% through drastic component consolidation.** Traditional LiDARs require hundreds of discrete components – individual lasers, detectors, driver circuits, analogue-to-digital converters (ADC), amplifiers – that have to be assembled piece by piece. Chipisation condenses these functions into a few custom ASIC/SoC, slashing component count by over 90%.
  - **Elimination of costly manual alignment.** In discrete designs, each laser and receiver requires individual optical alignment – a time-consuming, labour-intensive process. Chip-based integration defines critical optical paths via semiconductor lithography, eliminating per-unit calibration and enabling fully-automated production.
  - **Platform-wide tech reuse.** Once core functions are integrated into a few chips, the same chip architecture can spawn multiple LiDAR products across different performance tiers and use cases, achieving core-components reuse rates exceeding 85% and spreading R&D and supply-chain costs over far larger volumes.

  Hesai and RoboSense have mastered in-house SPAD-SoC and VCSEL production. Manufacturing automation exceeding 90% and surging 2025 volumes – over 1.5m units for Hesai and about 0.9m for RoboSense – have driven additional 10-20% cost reductions. The semiconductor learning curve suggests each cumulative doubling of volume reduces unit costs by 15-25%.

Chipisation reduces BOM costs by 40-60% and power consumption by 30-50%.

This combination of architectural simplification, chip-level integration, and scale creates a self-reinforcing flywheel. Technological breakthroughs lower costs, thereby unlocking larger OEM design-ins and robotics adoption, which in turn generates volume and funds further iteration and automation. By late-25, LiDAR had successfully entered models priced as low as Rmb60,000, confirming that the cost curve has decisively crossed the mass-market viability threshold and opened the door to sustained annual volume growth of over 60%.

Growth in ADAS industry. ADAS and L3+ AD constitute the absolute main engine of LiDAR demand. The ADAS portion of total LiDAR demand spiked from less than 10% in 2020 to over 80% in 2025. EV intelligent-driving penetration accelerated sharply worldwide, with about 3m LiDAR-equipped vehicles delivered in 2025 (>200x of 10,000-15,000 units in 2020) at a 3.3% penetration rate. We expect global shipments of LiDAR-equipped vehicles to grow to 15m units by 2030, implying a 38% five-year CAGR and 15% penetration rate. Based on that, we expect global ADAS LiDAR shipments to grow from 4m units in 2025 to 30m units in 2030 (50% five-year CAGR).

Figure 4: Estimation Of Global ADAS LiDAR Market Size

	2020	2025	2030F	CAGR 2025-30
(a) Global light vehicle shipment (m units)	77.7	92.0	100.0	1.7
(b) Penetration rate of ADAS LiDAR (%)	0.02	3.27	15.0	2.3
(c) Global shipment of vehicles equipped with LiDAR (m units)	0.01	3.0	15.0	37.9
(d) Average LiDAR cost per vehicle (US$)	9,000	400	300	(5.5)
(e) Average number of LiDARs per vehicle	1.0	1.3	2.0	8.5
(f) Global ADAS LiDAR shipment (m units)	0.01	4.0	30.0	49.6
(g) ASP of ADAS LIDAR (US$)	9,000	300	150	(12.9)
(h) Global ADAS LiDAR market (US$b)	0.1	1.2	4.5	30.3

Note: (c) = (a) x (b); (d) = (e) x (g); (f) = (c) x (e)
Source: Gasgoo, Yole, UOB Kay Hian

- **Cost reduction.** Due to budget limits, LiDARs were only installed in cars priced above Rmb150,000 in 2025 and earlier. The reduction of LiDAR ASP from Rmb2,000 in 2025 to Rmb1,000 and below facilitates the penetration of LiDAR in mass-market cars (Rmb70,000-150,000).
- **OEMs compete on ADAS.** After EV platforms became commoditised, intelligence emerged as the primary competitive differentiator, prompting virtually all major Chinese OEMs – and an increasing number of global players – to standardise LiDAR across flagship and volume models.
- **Per-vehicle loading has increased from one forward long-range unit in basic L2+ systems to 2-3 units in L3 and L4 platforms.** Regulatory approvals for L3 operations in China and Europe, combined with stricter C-NCAP and Euro NCAP safety requirements, have further accelerated adoption. Advancing ADAS levels requires more comprehensive environmental perception, directly increasing LiDAR count: an L2 vehicle typically uses one forward-facing LiDAR supplemented by two blind-spot LiDARs, while L3/L4 systems scale to 1-2 forward-facing LiDARs and 4-6 blind-spot LiDARs for 360-degree coverage without blind spots.

Figure 5: Estimation Of Global Robot LiDAR Market Size

(US$b)	2020	2025	2030F	CAGR 2025-30
(a) Global shipment of robots equipped with LiDAR (m units)	0.1	0.5	5.0	58.5
(b) Average LiDAR cost per robot (US$)	7,000	1,400	800	(10.6)
(c) Average number of LiDARs per robot	2.0	2.0	2.0	-
(d) Global robotic LiDAR shipment (m units)	0.1	1.0	10.0	58.5
(e) ASP of robotic LiDAR (US$)	3,500	700	400	(10.6)
(f) Global robotic LiDAR market (US$b)	0.4	0.7	4.0	41.7

Note: (b) = (c) x (e); (d) = (a) x (c); (f) = (d) x (e)
Source: Gasgoo, Yole, UOB Kay Hian

Growth in robotics industry. Robotics represents the second major growth curve, contributing about 1m units in worldwide shipments or 16-17% of total LiDAR shipments. We expect global robotics LiDAR shipments to grow tenfold from 1m units in 2025 to 10m units in 2030 (58.5% five-year CAGR). Enabled by continuous cost reduction and embodied-AI development, the downstream demand drivers include: a) humanoid robots, b) robotic lawn mowers, c) robotaxis, d) warehouse AMRs, e) unmanned delivery vehicles, f) autonomous street sweepers, g) driverless mining trucks, and h) autonomous forklifts.

- **Humanoid robot.** Global humanoid robot shipments are expected to jump from 13,000 units in 2025 to 200,000-250,000 units (70-80% five-year CAGR) with each humanoid robot equipped with 1-2 LiDARs (except Tesla Optimus).
- **Robotic lawn mower.** Global shipments of lawn mowers reached 12m units in 2025, of which 1.2m units (10%) were robotic lawn mowers, mostly real-time kinematic (RTK) models that use RTK GPS for precise, wire-free mowing without LiDAR. Since mid-25, Chinese companies like Mammotion have launched autonomous robotic lawn mowers equipped with 1-2 LiDARs, while Ninebot and Roborock have introduced their models at CES 2026. Autonomous robotic lawn mowers offer much better convenience at a price of US$1,000-6,000, and are thus expected to take market share from both traditional lawn mowers and RTK robotic lawn mowers.
- **Robotaxi.** The number of robotaxis worldwide totalled 7,000 as of end-25, and the number is expected to grow 20- to 100-fold to 100,000-500,000 by 2030. Note that on average every robotaxi is equipped with 4-8 LiDARs (except Tesla that uses a vision-based approach).

Robotics LiDAR carries a materially higher ASP – typically US$600–2,000 or more – compared with mass-market ADAS LiDARs priced at US$200-600. This premium reflects stricter requirements for 6-DoF (Degrees of Freedom) motion fusion, higher durability in unstructured environments, and integration with manipulators and domain controllers. Consequently, the rising robotics contribution exerts upward pressure on blended industry ASP and helps offset automotive price compression while delivering superior margins. The combination of higher ASP and faster unit sales growth in robotics therefore supports overall industry profitability even as automotive ASPs stabilise.

Hesai and RoboSense target a US$100b physical AI market through chip-level sensor fusion, 10 times the LiDAR market.

Foray into physical AI market with new fusion sensor products, enlarging addressable market by 10 times. Hesai and RoboSense are converging on a unified "sensor-to-perception-system" strategy tailored for the physical AI era. Hesai's Picasso SPAD-SoC and Kosmo system eliminate the need for a standalone camera by embedding full-colour vision directly into the LiDAR, while RoboSense's Phoenix and Peacock SoCs power the AC-series Active Camera, natively fusing LiDAR, camera, and inertial measurement unit (IMU) at the hardware level. These chip-level fusion innovations provide the high-density, real-time spatial perception foundational to physical AI systems in AD, humanoid robotics, and industrial automation. Both effectively bridge the traditional LiDAR and camera markets, positioning them to capture the global physical AI market which is projected to grow to US$100b by 2030, 10 times the global LiDAR market.

- **Hesai's Picasso SPAD-SoC and Kosmo system** represent a generational leap, achieving chip-level 6D full-colour point clouds with photon detection efficiency exceeding 40%, eliminating the need for a separate camera module by natively fusing spatial and chromatic data. This integration can slash vehicle BOM by up to 30%, effectively allowing Hesai to tap the camera market while lowering ADAS costs to under US$200 per unit.
- **RoboSense's Phoenix and Peacock SoCs, together with the AC-series Active Camera,** pioneer a unique hardware-level spatiotemporal fusion of LiDAR, camera, and IMU, delivering a reported improvement of more than 70% in perception consistency over traditional 3D cameras. This creates a new robotic vision category, blurring the line between sensor and perception system to serve both ADAS and high-growth robotics markets.

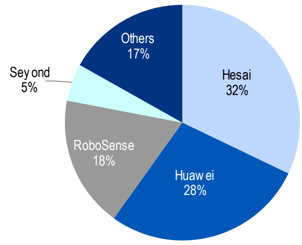
COMPETITIVE DYNAMICS

The global LiDAR industry exhibits extreme market concentration and overwhelming Chinese leadership. The world's top four LiDAR producers are all Chinese companies – Hesai, Huawei Technologies Co (Huawei), RoboSense and Seyond Holdings (Seyond) – which respectively hold approximately 32%/28%/18%/5% shares of the global market. The combined market share of the top four players (CR4) exceeded 80%, leaving other players – DJI Technology Co (DJI) Livox, Luminar Technologies (Luminar), Valeo, Innoviz Technologies (Innoviz), Aeva Technologies (Aeva), and others – with less than 20% combined. Chinese players have cornered about 90% of the market.

- **ADAS LiDAR.** Hesai and Huawei are the top two ADAS LiDAR manufacturers each with a 35% market share, and RoboSense is the third-largest player with a 15% market share. Huawei's position requires nuance. Over 95% of its LiDAR volume serves affiliated brands (Aito, Luxeed, Avatr, etc), with external third-party sales making up less than 5%. Therefore, in the open competitive market, Hesai and RoboSense are unambiguously the two largest players, collectively commanding over 70% of non-captive demand. The remaining market is shared by DJI's Livox, Luminar, Valeo, etc.
- **Robotics LiDAR.** RoboSense alone shipped more than 303,000 robotics LiDARs in 2025, achieving an 11-fold yoy increase and taking the global leadership position in that category (30% market share). As the second-largest player in the category, Hesai shipped more than 239,000 robotic LiDARs in 2025, up 426% yoy and a 24% share of the global market. The two companies jointly captured over half of the global robotics LiDAR market in 2025. The remaining less than half market was shared by DJI's Livox, Shenzhen Leishen Intelligence System Co (Leishen), and Sony Corporation. The robotaxi hardware market is dominated by Hesai and RoboSense. The top five robotaxi players (Didi, Baidu, WeRide, Pony.ai and Waymo, which jointly made up about 97% of the robotaxi fleet as of end-25) all use components from Hesai and RoboSense. Even Waymo has recently pivoted from in-house LiDAR production to Hesai.

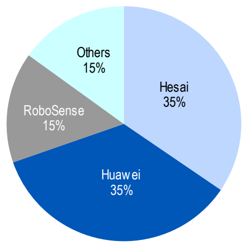
Intense industry consolidation in 2021-25. In 2021, there were over 100 LiDAR startups globally. Following the intense industry consolidation, currently fewer than 10 companies are able to reliably secure orders from customers. Currently 60-70% of market share is concentrated in the hands of the top two players – Hesai and RoboSense. Additionally, diversification into higher-margin robotics LiDARs further reduces the incentive for destructive pricing. Going forward, cost reduction will likely outpace ASP decline, boosting margins.

Figure 6: Market Share of Top Four LiDAR Players (2025)



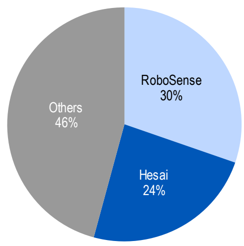
Source: Respective companies, Yole, UOB Kay Hian

Figure 7: Market Share Of Top Four ADAS LiDAR Players (2025)



Source: Respective companies, Yole, UOB Kay Hian

Figure 8: Market Share Of Top Two Robotics LiDAR Players (2025)



Source: Respective companies, Yole, UOB Kay Hian

Chinese companies' global LiDAR dominance rests on four pillars:

- **Unmatched speed of technological iteration delivering chipised solid-state solutions years ahead of Western competitors.** While legacy players stayed with mechanical or early MEMS designs, Chinese innovators leapfrogged to cost-effective semi-solid-state trans-mirror and fully digital architectures. Platformised product matrices, ASIC/SoC integration and co-developed perception algorithms have shortened development cycles dramatically. The result is volume production of high-performance, compact LiDARs that outperform earlier Western equivalents at lower cost – securing dominant global shares in both the ADAS and robotaxi markets.
- **Complete localisation and vertical integration of the supply chain for VCSELs, SPAD wafers, optics, chips and automated assembly.** Leading Chinese firms have eliminated foreign dependencies by mastering proprietary VCSEL arrays, SPAD-SoC chips (AEC-Q100 certified) and precision optics entirely within China. End-to-end domestic control – from wafer fabrication to automated production lines – removes geopolitical risks that still constrain Western suppliers. This full-stack sovereignty enables seamless scaling, rapid customisation for OEMs and complete technology independence in the core semiconductor and optical modules that define modern LiDAR performance.
- **Massive domestic validation fleets powered by national intelligent-vehicle policy support.** China's explosive ADAS rollout, backed by L3 regulatory clearance, subsidies and the New Energy Vehicle Plan, has created the world's largest real-world testing environment. Fleet operators and major OEMs generate millions of kilometres of L4 data annually, accelerating product refinement far beyond fragmented Western trials. This unique combination of policy-driven demand and vast on-road validation has turned China into the world's proving ground, de-risking new designs and compressing time-to-volume for domestic champions.
- **Structurally lower cost bases achieved through scale, labour efficiency, capex amortisation and vertical integration.** Massive domestic demand supports production lines exceeding 2m units annually, spreading fixed costs thinly while learning-curve effects and automation drive down unit economics from thousands of dollars to hundreds. Labour efficiency, chip-level integration (replacing expensive discrete components) and full vertical control eliminate the margin stacking seen abroad. These structural advantages support aggressive pricing that powers penetration into Rmb150,000 vehicles, creating a self-reinforcing flywheel of volume growth and further cost reduction unmatched outside China.

Figure 9: LiDAR Suppliers Of Major Robotaxi Companies

	Forward-facing primary LiDAR	Blind-spotting LiDAR
Didi	RoboSense	RoboSense
Baidu Apollo Go	RoboSense (exclusive)	RoboSense
WeRide	Pivoted from Hesai 128-line to RoboSense EM4	RoboSense E1
Pony.ai	Hesai 128-line / RoboSense EM4	RoboSense E1
Geely Eva Cab	RoboSense EM4	RoboSense
Waymo	Pivoted from in-house production to Hesai	Pivoted from in-house production to Hesai

Source: Respective companies, UOB Kay Hian

Company Outlook

CORPORATE EARNINGS

Hesai and RoboSense at inflection point of turnaround with burgeoning top-line growth and cost reduction outpacing product price erosion. Hesai achieved record GAAP profitability (Rmb436m) in 2025, while RoboSense recorded its first profitable quarter in 4Q25 with GAAP net profit of Rmb106m. Looking ahead, we expect Hesai's net profit to grow to Rmb548m/Rmb908m/Rmb1,358m in 2026/27/28 respectively, implying a 46% three-year CAGR. As for RoboSense, we expect net profit to turn positive at Rmb91m in 2026 and grow to Rmb395m/Rmb678m in 2027/28 respectively, implying a 173% two-year CAGR. The turnaround and exponential earnings growth will be driven by the following:

Hesai and RoboSense achieved profitability in 2025 and 4Q25 respectively.

- **Market share gain via tech leadership, cost leadership and superior product quality.** We expect Hesai's and RoboSense's sales volume to grow at a three-year CAGR of 69%/85% from 1.62m/0.91m units in 2025 to 7.8m/5.8m units in 2028, implying an increase in market share from 32%/18% to 38%/29%. Both companies continue to gain market shares through demonstrated tech leadership, cost leadership, superior product quality, and relentless iteration.
  - **Hesai** will extend its lead by integrating the new Picasso colour SPAD-SoC into its 1D-mirror semi-solid architecture, fusing fourth-generation ASIC precision with true-colour point clouds for superior object recognition and long-range density. This lowers system cost and complexity while meeting stringent AEC-Q100 and ISO 26262 standards, securing mass adoption across diverse OEM and robotaxi fleets.
  - **RoboSense** will capture more share as its Phoenix SoC elevates long-range digital LiDAR with unmatched consistency and low power, while the Peacock SoC drives ultra-compact, weather-resilient corner units. This full-spectrum chip-up approach, backed by AEC-Q100 qualification, cements its robotics-platform strategy and broadens ADAS penetration.
- **Cost reduction supported by economies of scale, chipisation, vertical integration and automated production lines.** Survivor economics clearly favour scale leaders, whose marginal costs now sit comfortably below marginal prices, setting the stage for sustained profitability and further market share gains. Cost reductions from chipisation and scale now consistently outpace price erosion, underpinning gross margin growth. Additionally, gross profit is growing rapidly along with revenue, covering R&D expenses – the biggest fixed-cost item. We expect R&D costs as a percentage of revenue for Hesai and RoboSense to drop from 26-33% in 2025 to 15-20% in 2028.
- **Easing price war after intense industry consolidation.** The 2022-25 price war in China's LiDAR sector, which compressed ASPs by 40-50% p.a. is transitioning to a stable, profitability-focused phase in 2026. We expect the industry-wide annual ASP decline to moderate gradually from 40-50% in 2024-25 to below 20-30% in 2026 and about 10% p.a. in 2027-28, driven by cost reduction and product mix changes (the share of blind-spot LiDARs in the sales mix will rise along with the advancement of ADAS).

Hesai vs RoboSense

Hesai's primary strengths are its unmatched volume scale, customer breadth, and point-cloud leadership. Its main weakness is its heavier reliance on ADAS pricing dynamics. RoboSense's strengths lie in its robotics-platform potential and digital-technology differentiation, though it faces the challenge of closing the overall scale gap with Hesai. Both companies share abundant opportunities in global L3+ expansion, robotics acceleration, and embodied-AI growth.

- **Hesai's founders combine elite US education with Silicon Valley industrial experience, while RoboSense's leadership has strong roots in a top Chinese academic institution.**

Figure 10: LiDAR Suppliers Of Major Chinese Auto OEMs

OEM	Model	Supplier	LiDAR
BYD	YW U7, U8	RoboSense	Digital LiDAR
	Denza Z9GT	RoboSense	Digital LiDAR
	Great Tang	RoboSense	Digital LiDAR
	Seal 07 EV	RoboSense	Digital LiDAR
	Han, Tang, Song, Qin	RoboSense / Hesai	Digital LiDAR / AT-series
	Seagull, Dolphin	RoboSense	Digital LiDAR
	Sealion 05, Sealion 06 EV	RoboSense	Digital LiDAR
	Song Ultra	RoboSense	Digital LiDAR
Geely	Zeekr 9X	RoboSense	Forward LiDAR: EM4 (520-line)
		Fushi Tech	Blind-spotting LiDAR: All-solid-state LiDAR
	Zeekr 8X	RoboSense	Forward LiDAR: EM-series
		Fushi Tech	Blind-spotting LIDAR: All-solid-state LiDAR
	Zeekr 001/007	Hesai	AT series
	Galaxy V900	Hesai	ATX
	Other Galaxy models	Hesai	AT series
	Lotus Eletre, Emeya	Hesai	n.a.
NIO	ET7, ES8 (all-new), ET9	Seyond	1 x Falcon + 2 x Robin W
	ES9	Seyond	1 x Falcon + 2 x Robin W
	ES6, EC6 and other NT2 platform models	Seyond	Falcon
Li Auto	MEGA	Hesai	ATL
	L7 / L8 / L9	Hesai	ATL
	i6 / i8	Hesai	ATL
Xiaomi	New SU7	Hesai	T128
	YU7	Hesai	Full line-up designated for 2026
Leapmotor	C10 / C11 / C16	Hesai	AT128 (Smart Driving Version)
	B10	Hesai	ATX
	A10	Hesai	ATX
	B & C series from 2025	Hesai	ATX
Great Wall Motor	New models (expected delivery 2026)	RoboSense	Digital LiDAR
IM Motor	LS9	RoboSense	EM series (520-line)
	LS8	RoboSense	EM series (520-line)
	L6, LS6	RoboSense	M series (eg M1)
SAIC	Feifan F7	RoboSense	M series
	Feifan R7	Luminar	Iris
FAW-VW	ID. AURA T6, ID ERA 9X	RoboSense	Digital LiDAR
Buick	Zhijing E7	RoboSense	Digital LiDAR

Source: Respective companies, UOB Kay Hian

- **Hesai's** CEO Li Yifan earned a B.S. from Tsinghua University and a PhD in robotics from the University of Illinois, then served as a principal engineer at Western Digital. Co-founder and Chief Scientist Sun Kai holds a Stanford PhD and subsequently conducted postdoctoral research there, while CTO Xiang Shaoqing, another Tsinghua alumnus, earned dual Stanford master's degrees and worked as a hardware integration engineer at Apple.
- **RoboSense** graduated from the Harbin Institute of Technology (HIT). CEO Qiu Chunxin completed his PhD in control science and engineering at HIT and founded the company directly on his doctoral research, pioneering MEMS solid-state LiDAR. His PhD supervisor, Professor Zhu Xiaorui, joined as Co-founder and Chief Scientist, bringing deep academic robotics expertise, and CTO Liu Letian was his PhD peer.

- **Hesai holds a clear lead in scale and profitability, while RoboSense offers greater robotics leverage and a distinctive digital-architecture edge.** In 2025, Hesai shipped 1.62m LiDARs (including 1.38m ADAS LiDARs and 239,000 robotics LiDARs) and captured an estimated 32% global market share, generating Rmb3.03b in revenue and Rmb436m in GAAP net profit. RoboSense shipped about 912,000 units (including 609,000 ADAS LiDARs and 303,000 robotics LiDARs) to form an estimated 18% share, with revenue of Rmb1.94b and 2025 net loss of Rmb146m (4Q25 net profit at Rmb106m).
- **Hesai enjoys broader OEM diversity and stronger overseas exposure, whereas RoboSense harbours deeper robotics-platform ambitions.** Product mix differs meaningfully.
  - **Hesai** derives 85% of sales volume from ADAS LiDAR with 15% from robotics LiDAR. RoboSense's mix is roughly 67% ADAS LiDAR and 33% robotics LiDAR. In 2025, Hesai's LiDAR sales volume more than tripled to 1.62m units, thanks to major design wins from over 10 OEMs (including BYD, Geely, Zeekr, Great Wall Motor, Chery, Changan, Leapmotor, SAIC, etc) amid China's ADAS boom, helping Hesai to take a 35% share of the global ADAS LiDAR market and over 40% share of China's passenger vehicle (PV) OEM standard-fit forward-facing primary LiDAR market.
  - **RoboSense.** RoboSense's total sales volume grew 68% yoy to 912,000 units, but ADAS LiDAR sales volume grew only 17% yoy as it lost major customers – XPeng (which pivoted to the vision-based approach) and Huawei-affiliated brands (which switched to Huawei's LiDARs). RoboSense compensated by securing orders from other auto OEMs (BYD, Geely, Leapmotor, SAIC, FAW, etc) and expanding aggressively into robotics applications, with robotics LiDAR shipment spiking 11x yoy to 303,000 units.
- **Hesai achieves a much higher gross margin than RoboSense primarily due to its dominant >60% share in the premium robotaxi market, which supports higher ASPs.** Its efficient one-dimensional trans-mirror architecture with deep chipisation also enables better cost control than RoboSense's broader, lower-margin mass ADAS focus. Hesai's 4Q25 gross margin reached 41.0%, with EBIT margin at 10.2% and net margin at 15.3%. RoboSense achieved gross margin of 28.5%, with EBIT and net margins turning positive at 17.3%/14.1 respectively in 4Q25. Both companies maintain strongly positive net-cash positions with minimal interest-bearing debts.
- **Technology competition between the two leaders now converges on in-house digital SPAD-SoC platforms.**
  - **Hesai** has unveiled its fifth-generation Picasso SPAD-SoC – the world's first 6D full-color LiDAR chip – natively fusing RGB colour sensing with Time of Flight (ToF) ranging at the pixel level on a single die to output colour point clouds directly, with photon detection efficiency exceeding 40%. Mounted on the ETX series (configurable up to 4,320 lines/4K resolution, 600-metre max range), Picasso redefines perception from grayscale to full-spectrum vision.

Figure 11: High-end LiDAR Products – Hesai vs RoboSense

	Hesai	RoboSense
Top-tier mass-produced forward ADAS LiDAR	AT1440 (1,440 lines, 300 metres @ 10%) Mass production started in 2H25; customers: KargoBot L4 autonomous truck, WeRide Robotaxi GXR	EM4 1080 (1,080 lines, 300 metres @ 10%, 120° x 25°) Mass production started in 2Q25; customers: BYD, Geely, Zeekr, GAC GOVY eVTOL, FAW Hongqi, SAIC Audi, IM Motors, GWM, Didi, WeRide, Baidu Apollo Go, Pony.ai
Next-gen forward ADAS LiDAR	ETX powered by Picasso SPAD-SoC (4,320 lines, 400 metres @ 10%, Max: 600 metres) Mass production will start in 2H26; customers: Li Auto, Mercedes-Benz	EM4 2160 (2,160 lines, 300 metres @ 10%, Max: 600 metres, 120° x 27°) Mass production will start by 3Q26); customers: Geely Eva Cab, etc.

Note: For the comprehensive comparison between Hesai's products and RoboSense's, please refer to the Appendix.
Source: Respective companies, UOB Kay Hian

- **RoboSense** counters with its Eocene digital architecture and twin flagship SoCs: Phoenix, the first automotive-grade chip monolithically integrating 2,160 native lines (over 4 MP resolution, 600-metre range), and Peacock, the industry's first mass-producible 640×480 all-solid-state large-array SPAD-SoC with a 180°×135° ultra-wide field of view (FOV) for blind-spot coverage, robotics, and spatial intelligence.

While both pursue chip-level integration, they diverge in colour strategy: Hesai embeds full-colour capability directly into the SPAD sensor array itself, whereas RoboSense achieves colour fusion via an external colour filter array and has previewed a next-generation RGBD sensor for 2027.

Figure 12: Key Figures – Hesai vs RoboSense

	Hesai	RoboSense
Market share (%)		
LiDAR (2025/26F/27F/28F)	32.1 / 36.9 / 37.9 / 38.5	18.1 / 27.0 / 28.0 / 28.6
- ADAS LiDAR	34.5 / 39.1 / 39.7 / 40.1	15.2 / 22.1 / 22.6 / 23.1
- Robotics LiDAR	23.9 / 29.6 / 31.6 / 32.5	30.3 / 47.3 / 50.2 / 51.2
Sales volume (m units)		
Total (2025/26F/27F/28F)	1.62 / 3.15 / 5.15 / 7.80 (69% 3-yr CAGR)	0.91 / 2.30 / 3.80 / 5.80 (85% 3-yr CAGR)
- ADAS LiDAR	1.38 / 2.65 / 4.30 / 6.50 (68% 3-yr CAGR)	0.61 / 1.50 / 2.45 / 3.75 (83% 3-yr CAGR)
- Robotics LiDAR	0.24 / 0.50 / 0.85 / 1.30 (76% 3-yr CAGR)	0.30 / 0.80 / 1.35 / 2.05 (89% 3-yr CAGR)
ASP (Rmb/unit)		
Blended ASP	1,828 / 1,317 / 1,224 / 1,129	1,991 / 1,477 / 1,293 / 1,169
- ADAS LiDAR	1,287 / 1,000 / 920 / 846	1,816 / 1,350 / 1,230 / 1,150
- Robotics LiDAR	4,953 / 3,000 / 2,760 / 2,539	2,343 / 1,700 / 1,400 / 1,200
Revenue (Rmbm)		
Total (2025/26F/27F/28F)	3,028 / 4,215 / 6,367 / 8,868 (43% 3-yr CAGR)	1,941 / 3,380 / 4,837 / 6,675 (51% 3-yr CAGR)
- ADAS LiDAR	1,778 / 2,650 / 3,956 / 5,502 (46% 3-yr CAGR)	1,106 / 1,890 / 2,817 / 4,025 (54% 3-yr CAGR)
- Robotics LiDAR	1,185 / 1,500 / 2,346 / 3,301 (41% 3-yr CAGR)	710 / 1,360 / 1,890 / 2,520 (53% 3-yr CAGR)
Profitability (%)		
Gross margin (2025/26F/27F/28F)	41.8 / 40.4 / 40.4 / 40.3	26.5 / 29.0 / 30.0 /31.0
EBIT margin (2025/26F/27F/28F)	5.6 / 11.0 / 14.3 / 16.1	(9.5) / 0.4 / 6.4 / 10.5
Earnings (Rmbm)		
Net profit (2025/26F/27F/28F)	436 / 548 / 908 / 1,358 (46% 3-yr CAGR)	(146) / 91 / 395 / 678 (173% 2-yr CAGR)

Source: Respective companies, UOB Kay Hian

Risk Factors

Substitution by 4D millimetre-wave radar remains a theoretical concern. 4D imaging radar has improved significantly and costs only US$50-150 vs LiDAR's US$200-600, prompting some cost-sensitive OEMs to explore radar-camera fusion for basic L2+ or entry-level L3 vehicles. However, LiDAR's superior true-3D point-cloud density, centimetre-level ranging accuracy independent of lighting, and robust static-object detection make full replacement improbable for safety-critical L3+ applications. Industry consensus positions 4D radar as complementary rather than a direct substitute, confining substitution risk largely to ultra-low-cost segments below Rmb150,000.

Tesla's pure-vision strategy has demonstrated viability for certain L2 and L3 use cases. Nevertheless, the overwhelming majority of mainstream OEMs – including Mercedes-Benz, BMW, GM, and virtually all Chinese EV makers – plus global safety regulators, continue to mandate multi-modal redundancy for L3+ to address edge-case failures involving adverse weather, low light conditions, and rare objects. Tesla's China market share remains below 5%, and even Tesla has incorporated radar and explored LiDAR hybrids in its Cybertruck and robotaxi programmes. LiDAR's established role in regulations and safety insurance limits this risk to a narrow set of vision-only purists.

Substitution risk from alternative LiDAR architectures and low-cost radar-fusion systems. Despite the leading positions of Picasso/Kosmo and Eocene in the SPAD-SoC space, several alternative technology paths remain active in the LiDAR market. Optical phased array (OPA) solid-state solutions (by RoboSense and Litratech) are approaching production readiness, while frequency-modulated continuous-wave (FMCW) schemes (by Aeva) enable 4D imaging and have already seen miniaturised product releases; meanwhile, a 4D imaging radar costs only US$50-150, prompting some cost-sensitive OEMs to explore radar-camera fusion as an alternative. Should any of these technologies achieve unexpected breakthroughs in cost or performance, they could exert competitive pressure on the current SPAD-SoC trajectory.

Competitive risk from Huawei's expansion beyond its captive ecosystem. Huawei has already transitioned all captive-brand LiDARs to in-house production. While its 896-line unit trails Hesai's 512-line AT512 and RoboSense's 1,080-line EM4, Huawei commands a combined 35% ADAS LiDAR market share in 2025, on par with Hesai, and enjoys captive scale within the HarmonyOS ecosystem. However, its LiDAR costs are 50-100% above those of Hesai and RoboSense, and it lacks a proprietary SPAD-SoC.

Replacement risk from Western suppliers. If Hesai or RoboSense face sanctions, viable Western alternatives are virtually non-existent. Luminar filed for bankruptcy, Cepton was acquired, and Innoviz targets only approximately US$70m in 2026 revenue – a fraction of Chinese leaders' scale. Ouster shipped only about 7,200 units in 3Q25. With Chinese suppliers commanding around 90% of global LiDAR shipments, no Western company possesses the production capacity or cost structure to replace them at scale in the near term.

Geopolitical risks from US chip-export restrictions and import tariffs on Chinese modules or vehicles could impede Western expansion. However, Hesai and RoboSense have achieved substantial self-sufficiency in core SPAD-SoC, VCSEL, and optics technologies, materially reducing exposure. China's market, still representing over 80% of demand, provides a robust buffer. Market leaders also pursue localisation, third-market partnerships, and tariff-less-sensitive robotaxi/robotics channels. Historical precedents with Huawei and DJI demonstrate adaptation through vertical integration and diversified growth. For scale leaders with strong balance sheets, net impact remains manageable.

Valuation

Hesai and RoboSense are trading at 37.2x and 31.9x 2027F PE respectively, a premium to the average of 19.9x for Chinese auto parts companies. The PE premium of the two companies is due to their expected stronger earnings growth. Hesai's and RoboSense's EPS are expected to grow 50%/66% in 2028 respectively, outpacing Chinese auto parts companies' 15.5%. Taking earnings growth into account, Hesai and RoboSense are trading at only 0.5x and 0.5x 2027F PEG, below the average of 1.4x for Chinese auto parts companies.

As tech companies, Hesai and RoboSense are more comparable to tech peers like Pony.ai, Seyond, Horizon Robotics and Black Sesame. For tech companies, price-to-sales (P/S) ratio is a more meaningful gauge. Hesai and RoboSense are trading at 3.6x and 2.9x 2027F P/S, a discount to the peer average of 7.8x.

Based on 10-year DCF (WACC: 15-16%/terminal growth: 4%), we arrive at a target price of HK$33.00 for Hesai (implying 40x 2027F PE, 0.8x 2027F PEG and 5.7x 2027F P/S) and HK$50.00 for RoboSense (implying 51.2x 2027F PE, 0.8x 2027F PEG and 4.4x 2027F P/S). Based on the WACC and terminal growth assumptions (3-5%), the DCF-derived target prices hover in the range of HK$28-40 for Hesai and HK$42-60 for RoboSense.

Figure 13: DCF Target Price Sensitivity – Hesai

	WACC		
Terminal growth	14%	15%	16%
5%	40	35	31
4%	37	33	30
3%	35	31	28

Source: UOB Kay Hian

Figure 14: DCF Target Price Sensitivity – RoboSense

	WACC		
Terminal growth	15%	16%	17%
5%	60	53	46
4%	56	**50**	44
3%	53	47	42

Source: UOB Kay Hian

Figure 15: Peer Comparison

Company	Ticker	Rec	Price @ 15 Jul 26 (lcy)	Target price (lcy)	Upside to target (%)	Last year end	PE 2025 (x)	PE 2026F (x)	PE 2027F (x)	EPS growth 2028F (%)	PEG 2027F (x)	P/S 2025 (x)	P/S 2026F (x)	P/S 2027F (x)	Yield 2026F (%)	ROE 2026F (%)	Market cap (lcy m)	Price/ NAV ps 2026F (x)
Hesai Group	2983 HK	BUY	15.77	33.00	109.3	12/2025	35.0	31.5	19.0	49.6	0.4	5.7	4.1	2.7	-	5.9	19,825	1.8
RoboSense	2498 HK	BUY	22.56	50.00	121.6	12/2025	Loss	101.9	23.5	71.8	0.3	4.8	2.6	1.8	-	2.4	10,653	2.4
ADAS-related tech companies																		
Pony.ai	PONY US	BUY	6.95	26.10	275.54	12/2025	n.a.	n.a.	n.a.	n.a.	n.a.	33.5	23.0	9.2	-	(13.6)	3,013	14.3
Seyond	2665 HK	N.R.	2.72	n.a.	n.a.	12/2025	n.a.	n.a.	n.a.	n.a.	n.a.	2.6	1.2	1.0	-	(343.8)	3,535	n.a.
Horizon Robotics	9660 HK	N.R.	4.42	n.a.	n.a.	12/2025	n.a.	n.a.	n.a.	n.a.	n.a.	15.0	9.4	5.9	-	(27.8)	64,701	5.7
Black Sesame	2533 HK	N.R.	11.33	n.a.	n.a.	12/2025	n.a.	n.a.	n.a.	n.a.	n.a.	8.1	4.6	3.1	-	(117.0)	7,685	15.0
Average							**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**14.8**	**9.5**	**4.8**	**-**	**(125.6)**		**11.7**
Auto parts companies																		
Huizhou Desay SV	002920 CH	BUY	82.92	168.00	102.6	12/2025	20.2	20.1	17.1	17.4	1.0	1.5	1.3	1.1	1.7	15.1	49,490	2.8
Ningbo Tuopu	601689 CH	BUY	54.50	93.00	70.6	12/2025	33.1	29.3	25.6	10.5	2.4	3.1	2.8	2.5	1.0	8.4	91,888	3.8
Zhejiang Sanhua	002050 CH	BUY	41.50	57.00	37.3	12/2025	43.4	37.0	32.0	15.3	2.1	5.6	5.1	4.5	1.1	14.2	174,633	5.0
Ningbo Joyson	600699 CH	BUY	20.84	43.00	106.3	12/2025	22.0	16.5	14.5	16.3	0.9	0.5	0.5	0.4	1.2	9.9	29,357	1.6
Average							**29.6**	**25.7**	**22.3**	**14.9**	**1.6**	**2.7**	**2.4**	**2.1**	**1.3**	**11.9**		**3.3**

Source: Bloomberg, UOB Kay Hian

Appendix – All About LiDAR

INTRODUCTION

LiDAR is a foundational remote sensing technology that has evolved from a specialised tool into a critical enabling technology for autonomy and precision across multiple industries. Its core operating principle is to emit laser pulses and measure the time each pulse takes to return after reflecting off surrounding objects. This process is performed millions of times per second, generating precise, real-time 3D point cloud maps of the environment. By equipping machines with high-resolution spatial perception unaffected by lighting conditions, LiDAR serves as critical perceptual "eyes," bridging physical reality and digital decision-making.

The LiDAR field is characterised by diverse technological approaches and application-specific solutions, and can generally be categorised along two axes: scanning technology and application domain.

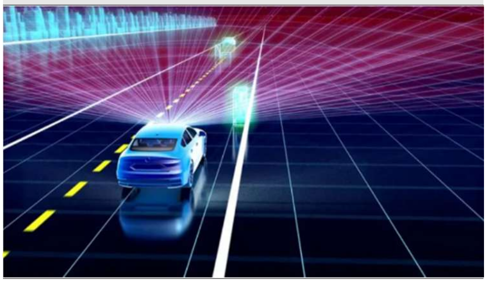
Classification by scanning technology and type. The mechanism by which a LiDAR sensor scans the environment determines its capabilities, costs, and suitability for different use cases.

- **Mechanical rotating LiDAR** is the first-generation technology, once widely used in AD research. It employs a rotating assembly of laser emitters and receivers, providing a 360-degree horizontal FOV. While offering excellent coverage, its moving parts can pose challenges in terms of durability, size, and integration for mass-market automotive applications.
- **Solid-state LiDAR.** This new generation of technology has no or minimal macroscopic moving parts, making it crucial for automotive integration. It can be subdivided into:
  - **MEMS-based LiDAR.** It uses MEMS mirrors to steer the laser beam and offers a good balance of performance, reliability, and cost-reduction potential.
  - **OPA LiDAR.** It electronically steers laser beams by manipulating the phase of light waves. It represents a purely solid-state solution with the potential to achieve very compact and robust designs.
  - **Flash LiDAR.** It illuminates the entire scene with a single broad laser "flash," much like a camera. It excels at short-range, high-speed detection but typically has a more limited detection range than scanning types.

Classification by application domain. Requirements for detection range, resolution, FOV, and cost have driven significant specialisation in the industry.

- **ADAS.** The largest and most dynamic market segment. In this domain, LiDAR is categorised by its in-vehicle roles:
  - **Forward-Looking Long-Range LiDAR**. Typically, 1-1 units, mounted on the roof or front grille, are used for high-speed highway perception (detection range >200 metres).
  - **Short-range/side LiDAR or blind-spot LiDAR.** Usually solid-state, it is integrated into the corners or sides of a vehicle for urban driving, intersection traffic detection, and blind-spot monitoring.
- **Robotics and industrial automation.** These LiDARs encompass AMRs in warehouses, last-mile delivery robots, and robotic arms. They prioritise cost-effectiveness, precision at medium ranges, and reliability in controlled environments.
- **Aerial and topographic surveying.** These LiDARs are used on UAVs, aircraft, and ground-based stations for mapping, forestry, urban planning, and archaeology. These systems typically emphasise extremely high precision, long detection range, and integration with GPS/IMU systems.

Operation Of ADAS LIDAR



Source: Mobility Engineering Tech

- **Smart infrastructure and security.** Fixed LiDAR sensors are deployed for traffic monitoring, perimeter security, and crowd analytics in smart cities, providing wide-area, continuous surveillance.

CORE COMPONENTS OF LIDARS AND THEIR MANUFACTURERS

The BOM cost of a LiDAR system primarily comprises the: a) transmitter module, b) receiver module, c) scanning module, d) mainboard, and e) structural components. In addition, LiDAR possesses a higher-level optical module – the architectural design of the entire optical system – whose core task is to build a precise, stable, and efficient optical platform, ensuring the three light paths of transmission, scanning, and reception can be precisely coupled, separated, and work in coordination.

Among all the constituents, the laser source, detector, analogue chips, and field-programmable gate array (FPGA) carry the highest proportion of value, collectively accounting for about 60% or more of the BOM cost. They also represent the upstream segments with the highest technological barriers and form the foundation underpinning the development of the entire LiDAR industry.

Transmitter module. Its core function is to generate and shape laser beams and covers the laser source, laser driver IC, and optical elements such as collimating lenses and diffusers.

- **Laser sources** are classified by emission method into edge-emitting lasers (EEL, light exits from the chip's edge, offering high single-emitter power, but complex and costly to manufacture) and VCSEL (light emits from the top surface, enabling cheap, highly integrated arrays). The automobile industry is converging on VCSEL with a 905 nm wavelength as the mainstream choice, adopted by leading LiDAR makers such as Hesai (ATX, AT128 series), RoboSense (EM4), and Huawei (D3P, D3 series).

  A conventional single-junction VCSEL suffers from limited power density due to material physics and the laser-induced damage threshold. Multi-junction VCSELs overcome this bottleneck by vertically stacking multiple active regions connected via tunnel junctions, substantially boosting power and efficiency. Key players mastering this technology include upstream chip suppliers Lumentum, Coherent, ams-Osram, and Trumpf, as well as vertically-integrated LiDAR system companies Hesai and RoboSense. Lumentum, Coherent, and ams-Osram collectively hold an estimated 60-70% of the global VCSEL chip market; Chinese manufacturers Vertilite and Everbright Photonics are catching up with a cost advantage of about 30% for mass-produced 905 nm automotive-grade VCSELs.

- **Laser driver integrated circuits (IC)** precisely control laser diode current, modulation, and stability to ensure high-accuracy ranging. The market is led by Analog Devices (~15–20 %), Texas Instruments, Renesas, Silergy, ON Semiconductor, and STMicroelectronics, with the top five holding a combined share of roughly 40-50 %. Chinese firms remain in catch-up mode, with foreign suppliers holding approximately 70 % of the high-end market, but domestic LiDAR companies are progressively integrating driver functionality into proprietary chip platforms to reduce import dependence.

Scanning module. This module steers the beam to cover the FOV. Three primary routes exist:

- **Rotating mirror** (mature, mechanically rugged, used in Hesai AT128, Valeo SCALA, Seyond Falcon) employs a continuously rotating prism driven by precision motors and bearings, offering a long range (>200 m) and uniform point clouds, but with inherent mechanical wear limits. The core precision motor market is a specialised niche led by Nidec, MinebeaMitsumi, and Maxon, with Chinese suppliers Moons' Industries and DINGS' Intelligent Technology gaining market share.

- **MEMS** (a millimetre-scale silicon micro-mirror vibrating at high frequency, semi-solid-state, used in RoboSense M1 and Huawei's mid-range LiDAR) enables chip-level scanning with high integration and cost-reduction potential, but faces a fundamental trade-off between aperture size and detection range. The global MEMS micro-mirror market is highly concentrated, with Mirrorcle Technologies, Analog Devices, Texas Instruments, Hamamatsu, and Bosch as leading players; Chinese firms Zhiwei Sensing, Yitoa Intelligent Control, Opus, and Suzhou Xijing Technology are developing rapidly.
- **OPA** (all-solid-state, purely electronic beam steering with no moving parts) represents the ultimate chip-scale future direction but currently faces side-lobe, fabrication, and range challenges, and has yet to reach mass production (eg LitraTech).

Receiver module. This module detects and converts weak return signals, comprising detectors, amplifier circuits, receiving lens assembly, and optical filters.

- **Detectors** fall into three types: Avalanche Photodiode (APD, multiplies signal internally, essential for 1550 nm systems), Silicon Photomultiplier (SiPM, an analogue array of single-photon-sensitive microcells, cost-effective for mainstream ADAS up to about 200 lines, holding approximately 69% of volume in 2024), and SPAD (a digital single-photon detector array enabling high resolution, forecast to approach a 50% market share by 2035). The high-end detector market is virtually monopolised by Sony, Hamamatsu, onsemi, and First Sensor. Chinese challengers such as Fortsense and Adaps Photonics are delivering cost-competitive SPAD arrays; for example, Adaps' 128-channel chip reportedly costs about 40 % less than imports and has been deployed in NIO ET7. Leading LiDAR system makers are also progressing toward in-house SPAD-SoC development.
- **Analogue front-end/readout circuits (AFE/ROIC)** handle low-noise amplification, filtering, and digitisation at the receiver end, often integrated with detectors. The segment is concentrated among ADI, Texas Instruments, Sony, STMicroelectronics, ON Semiconductor, and NXP, with a top-five share of 40-50%. Chinese LiDAR firms are building proprietary AFE platforms to reduce foreign reliance.

A control and processing module performs system control, signal processing, and point-cloud generation, using analogue chips, ADCs, and main control chips such as FPGAs (flexible configurable logic, power-hungry at scale) and ASICs (custom-designed for low cost and power). The industry is transitioning from general-purpose FPGA-based architectures toward highly-integrated digital SoCs. AMD (Xilinx) and Intel (Altera) dominate the FPGA segment with a combined global share of approximately 80%; key LiDAR-processing chip players also include Lattice Semiconductor, Microchip, Achronix, and Efinix. Chinese LiDAR manufacturers – once heavily dependent on imported Xilinx FPGAs – have achieved rapid breakthroughs through vertical integration and proprietary ASIC/SoC development. Hesai has iterated its in-house chip platform to V4.0 and is the only LiDAR company to self-develop all seven core components, having deployed roughly 100m of its own chips by end-24; RoboSense and Huawei likewise integrate self-designed processing SoCs. This "de-FPGAisation" has contributed to Chinese LiDAR suppliers capturing over 90% of domestic vehicle installations.

Optical components (lenses, filters, windows) are dominated by Asian manufacturers, with Sunny Optical holding a 25-30 % share and the top three accounting for 40-50 %. These components provide beam shaping, narrowband filtering, and environmental protection.

Components Of LiDAR And Structure Of Upstream Segments

Module	Sub-component / Item	Key Technologies / Types	Global Leading Players	Chinese Players & Progress	Market Position / Notes	CR3 / CR5
Transmitter	Laser Source	EEL (edge-emitting) vs VCSEL (surface-emitting); 905 nm multi-junction VCSEL becoming automotive mainstream	Lumentum, Coherent, ams-Osram, Trumpf (chip suppliers); Hesai, RoboSense (vertically integrated)	Vertilite, Everbright Photonics catching up with around 30% cost advantage for automotive-grade 905 nm VCSELs	Lumentum, Coherent, ams-Osram hold 60-70% of global VCSEL market	CR3: 60-70%
	Laser Driver IC	Precision current control, modulation, stability for ranging	ADI (15-20%), TI, Renesas, Silergy, ON Semi, STMicro	Domestic LiDAR firms progressively integrating driver functionality into proprietary chip platforms	Foreign suppliers still hold around 70% of high-end driver market	CR5: 40-50%
Scanning	Rotating Mirror	Mature, mechanically rugged, >200-metre range, uniform point cloud (Hesai AT128, Seyond Falcon)	Nidec, MinebeaMitsumi, Maxon (precision motors)	Moon's Industries, DINGS' Intelligent Tech gaining share; Topband claims around 30% share in vehicle LiDAR rotating mirror motor segment by end-25	Mechanical wear limits remain	n.a.
	MEMS	Millimetre-scale silicon micro-mirror, semi-solid-state (RoboSense M1, Huawei mid-range)	Mirrorcle Tech, ADI, TI, Hamamatsu, Bosch	Zhiwei Sensing, Yitoa Intelligent Control, Opus, Suzhou Xijing Tech	Highly concentrated market; trade-off between aperture size and range	n.a.
	OPA	All-solid-state, purely electronic beam steering, no moving parts	Pre-commercial	LitraTech	Ultimate chip-scale direction, not yet mass-produced	n.a.
Receiver	Detector	APD (essential for 1550 nm), SiPM (cost-effective, around 69% volume in 2024), SPAD (digital, forecast about 50% share by 2035)	Sony, Hamamatsu, ON Semi, NXP	Fortsense, Adaps Photonics (128-ch SPAD around 40% cheaper than imports, adopted in NIO ET7); system makers developing in-house SPAD-SoCs	SiPM dominates volume today; SPAD adoption rising rapidly	n.a.
	AFE / ROIC	Low-noise amplification, filtering, digitisation at receiver; often integrated with detector	ADI, TI, Sony, STMicro, ON Semi, NXP	LiDAR companies building proprietary AFE platforms to reduce foreign reliance	Closely tied to detector tech	CR5: 40-50%
Control & Processing	FPGA → ASIC / SoC	Main control and point-cloud generation; transition from power-hungry FPGAs to low-cost, low-power ASICs and SoCs	AMD (Xilinx) + Intel (Altera) around 80% FPGA share; Lattice, Microchip, Achronix, Efinix	Hesai (in-house chip platform V4.0, all 7 core components, about 100m chips shipped by end-24), RoboSense, Huawei (self-designed processing SoCs)	"De-FPGAisation" helped Chinese LiDAR suppliers capture >90% of domestic vehicle installations	CR2: ~80% CR3: ~80%
Optical Components	Lens, Filter, Window	Beam shaping, narrowband filtering, environmental protection	Asian dominance; Sunny Optical (25-30% share)	Domestic supply chain included in Asian dominance	High-volume, relatively mature segment	CR3: 40-50%

Source: UOB Kay Hian

TECHNOLOGICAL PATHS

The complete technical framework of LiDAR spans multiple key segments, including transmission, scanning, reception, signal processing, and ranging, with each segment having a series of either parallelly developed or mutually substitutable technology pathways. Below is a summary matrix of the mainstream technology pathways for each segment.

For ADAS LiDAR, the most dominant mass-production combination today is **VCSEL + 905 nm + Rotating Mirror + SiPM/SPAD**, balancing cost-performance, reliability, and chip-scale integration. Purely solid-state approaches like OPA remain pre-commercial.

The history of LiDAR's technological evolution is a chronicle of steady advancement from "mechanical motion" towards "solid-state" and "chip-based" architectures. The overarching goal is to reduce cost to a level that permits large-scale series-production fitment while satisfying automotive-grade reliability. The mainstream solution for primary automotive LiDAR is now unmistakably defined: the combination of VCSEL + 905 nm + rotating mirror + SiPM/SPAD has become the dominant technological direction, thanks to its superior cost-performance ratio, automotive-grade reliability, and a high degree of chip-based integration. The technology roadmap is converging gradually. Purely solid-state approaches (such as OPA) remain some distance away from large-scale commercial deployment.

LiDAR Tech Path Matrix

Tech Segment	Main Tech Routes	Core Mechanism	Advantages	Limitations
Transmitter (Wavelength)	905 nm (silicon-based)	Uses near-infrared laser, detectable by silicon PDs/APDs	Low-cost detectors; mature ecosystem	Lower eye safety; shorter effective range at same power
	1,550 nm (InGaAs-based)	Uses longer wavelength, absorbed by the eye's cornea/vitreous	High eye safety; allows for higher output power	InGaAs detectors expensive; higher system cost
Transmitter (Laser type)	EEL (Edge-Emitting Laser)	Laser emits from cleaved facet; high power density	High peak power; long proven in LiDAR	Complex assembly; lower wafer-level testing yield
	VCSEL (Vertical-Cavity Surface-Emitting)	Laser emits vertically from surface; easy 2D array integration	Scalable to array; cheap wafer-level manufacturing	Lower peak power per emitter (mitigated by arrays)
	Fibre laser	Uses doped optical fibre as gain medium; typically 1,550 nm	Very high power; excellent beam quality	High cost; larger size; complex thermal management
Scanner	Mechanical Rotary (full assembly rotation)	Motor rotates entire transmitter + receiver module	360° horizontal FOV; very mature tech	Large size; limited MTBF (<1,000h); difficult to assemble
	Rotating Mirror (Mechanical, fixed transceiver)	Motor rotates a mirror only; laser and detector remain stationary	Lower inertia than full rotation; more compact; good MTBF	Still has moving parts; limited mirror size/angle
	MEMS (Micro-Electro-Mechanical Systems)	Micro-mirror electrostatically/ electromagnetically swings to steer beam	Small size; low cost potential; solid-state hybrid	Limited mirror aperture; angle vs size trade-off; sensitive to changes in temperature
	OPA (Optical Phased Array)	Array of optical antennas with electronically controlled phase shifters	Truly solid-state; no moving parts; fast random steering	Immature manufacturing; high optical loss; sidelobe interference
	Flash (Flood Illumination)	Single board pulse illuminates entire scene; no scanning	No moving parts; simplest structure; best for short range	Very limited range (signal power spreads over FOV); sensitive to ambient light
Receiver	PIN Photodiode	Basic p-i-n junction; zero internal gain	Simple; fast; very low cost	No gain; poor weak-signal detection
	APD (Avalanche Photodiode)	Operates in linear mode; high reverse bias creates multiplication gain	Mature; good sensitivity; linear output	Limited gains (<100); cannot detect single photons
	SPAD (Single-Photon Avalanche Diode)	Operates in Geiger mode; single photon triggers avalanche	Single-photon sensitivity; digital output	Needs quenching circuit; dark count and cross talk issues
	SiPM (Silicon Photomultiplier)	Array of SPAD cells connected in parallel; analogue sum output	High gain; single-photon resolution; robust	Neighbouring cells interfere, causing false signals; delayed noise pulses occur; biasing requires precise high voltage
Signal Processing & Ranging Components	Pulse ToF (Time of Flight)	Measures round-trip time of short laser pulse	Simple, direct, well-understood; works at long range	Dependent on peak power; pulse pile-up affects multi-echo accuracy
	FMCW (Frequency-Modulated Continuous Wave)	Uses chirped frequency; measures beat note and Doppler shift	Excellent interference immunity; measures velocity (4D); lower peak power	Complex optical front-end; high processing requirement; expensive
	Phase-based (AMCW)	Amplitude-modulated continuous wave; measures phase shift	Very high precision (mm-level)	Range ambiguity; limited practical distance (<100 metres)
	Full Waveform Processing	Digitally records entire return pulse shape	Extracts multiple echoes; better target classification	Huge data rate; high storage/computation cost

Source: UOB Kay Hian

Short to medium term (2023-28): Semi-solid-state (rotating mirror/MEMS) coexists with mechanical and pure solid-state LiDAR, but remains the absolute volume mainstream.

- **Reasons for success.** These solutions strike the best balance between performance, reliability, and cost. They discard the bulky moving structure of mechanical rotation while circumventing the fundamental shortcomings in ranging distance or technological maturity that currently beset pure solid-state routes.
- **Divergence within routes:**
  - **Rotating-mirror route (exemplified by Hesai AT128).** With a simpler, more robust scanning structure and a larger optical aperture, this route excels in detection range, signal-to-noise ratio, and automotive reliability certification. It has been swiftly adopted by high-end models that prioritise performance (eg the entire Li Auto range). MEMS micro-mirrors have shown limitations in point-cloud uniformity and achievable deflection angle, and have thus been largely overtaken in the long-range primary LiDAR market, with the rotating-mirror solution becoming the mainstream choice for long-range radar due to its superior reliability and more regular point-cloud patterns.
  - **MEMS route (exemplified by RoboSense M1).** Through extreme chip-based design and integration, this route offers greater potential for miniaturisation, cost reduction, and consistent mass production, making it better suited to meet the stringent cost-control demands of automakers and thereby achieving broader customer coverage (eg BYD, Geely).
- **Conclusion.** Over the next 3-5 years, rotating-mirror and MEMS will coexist and each will continue to be refined, with neither route completely supplanting the other. Automakers will choose according to model positioning (performance-first vs cost-first). Hesai (rotating mirror) and RoboSense (MEMS), as the leaders of these two routes, have already established significant first-mover advantages and scale-driven barriers.

Long-term outlook (2028 and beyond): Pure solid-state (Flash/OPA) is the ultimate direction, but the road is long

- **Flash route.** Currently positioned principally as a short-range blind-spot-filling radar (side, rear), its challenge lies in overcoming physical constraints to achieve longer detection distances within safe laser power limits. Should a breakthrough occur, it would become a disruptive solution. Hesai's FT120 has already established an early footprint in this area.
- **OPA route.** Although it represents the theoretical "holy grail", the fundamental physics and engineering challenges it faces – such as optical side-lobe interference, fabrication complexity, and high power consumption – are unlikely to be resolved in the short term. Mass production is at least 8-10 years away.
- **Integration trend.** Future high-level AD vehicles are likely to adopt a hybrid architecture of "one forward-facing high-performance rotating-mirror/MEMS primary radar + two to four lateral/rear pure solid-state Flash corner radars", achieving an optimal blend of performance and cost.
- **Cost reduction.** Chip-based and integration technologies are the key to lowering cost, with the potential to drive the price of LiDAR down to the thousand-renminbi range, a revolutionary leap. This will not only accelerate adoption in mass-market vehicles but, critically, will successfully broaden the application scenario from autonomous cars alone to diverse fields such as humanoid robots and intelligent industry, opening a "second growth chapter" grounded in scale and ecosystem.

Industry chain bottlenecks and core cost drivers

The key to LiDAR cost reduction lies in "chip-based design" – replacing the assembly of discrete components with semiconductor processes. This replaces traditional discrete components (individual lasers, detectors, driver circuits, amplifiers, ADCs, processors, etc) with application-specific circuits fabricated using semiconductor technology (ASIC/SoC + custom optoelectronic integration). This can reduce BOM cost by 50-80 %, shrink volume by 30-50 %, and lower power consumption by over 40 %, while simultaneously improving reliability, consistency, and iteration speed.

The core initiative resides in the in-house development or deep-customisation capability of VCSEL (transmitter-end laser arrays) and SPAD (receiver-end single-photon avalanche diodes). The central logic is: whoever possesses stronger in-house or deep-customisation capability in chips – particularly VCSEL and SPAD – will seize the initiative in future cost control and performance optimisation. Whoever masters array design, driver integration, signal-processing fusion, and related patents can simultaneously drive down cost and push up performance under high-volume manufacturing conditions.

As of May 26, Hesai and RoboSense were the only two Chinese top-tier players globally to have achieved mass production of a "full-chain chip-based design". Both have broken through the deep customisation of VCSEL and SPAD and achieved million-unit-level deliveries under automotive-grade (AEC-Q100) certification. Both claim to be "the only one" in certain dimensions, but in reality they form a complementary, competitive duo: Hesai leans towards "all seven core components + patent barriers + manufacturing scale", while RoboSense leans towards "digital architecture + SPAD-SoC integration + rapid multi-scenario deployment".

In conclusion, both have firmly grasped the initiative in chip-based design, and the depth of their in-house/custom VCSEL and SPAD capabilities has already far surpassed that of traditional international players (Velodyne, Luminar, etc., which still remain heavily reliant on external suppliers). Over the next 2-3 years, whoever takes the lead in production yield, patent litigation response, and new tracks such as robotics and exports will further cement dual dominance in cost and performance. Hesai increasingly resembles an "all-round champion in technology and manufacturing" while RoboSense resembles a "pioneer in digital innovation and scenario explosion". The reduction of Chinese LiDAR costs and the enhancement of Chinese competitiveness globally are already heavily tied to the success or failure of these two companies' chip-based strategies.

What exactly is LiDAR "Chip-based Design"?

Before chip-based design, traditional LiDAR used a discrete-component design. It could be imagined as a bulky desktop computer, requiring hundreds of independent components – lasers, receivers, control circuits and the likes – to be precisely assembled piece by piece, much like building blocks. This approach not only resulted in a large product size (the early "flowerpot" form factor) but also made assembly extremely difficult and kept costs stubbornly high.

Chip-based design, by contrast, uses semiconductor processes to integrate the numerous, functionally dispersed electronic components (such as laser driver circuits, signal amplification and acquisition circuits, digital processing circuits) onto a few specially designed, fingernail-sized chips (ASICs).

This is far more complex than "porting" and "compaction"; it is a deep fusion of functions. Taking an industry-leading fourth-generation chip as an example, it adopts a SPAD-SoC architecture that integrates the receiving-end array, signal processing unit, and even a dual-core CPU and a dedicated waveform processing core, achieving a unified sensing, storage, and computing architecture. The contrasting architecture is summarised below:

Estimation Of Global Robot LiDAR Market Size

Dimension	Traditional discrete-component LiDAR	Chip-based LiDAR
Design philosophy	Function stacking, physical piecing together	System-defined, single-chip integration
Core composition	Hundreds of discrete devices, multiple PCBAs	A few core ASIC chips (eg SoC)
Physical characteristics	Bulky size (eg "flowerpot"), heavy	Compact (like a business card holder), lightweight

Source: UOB Kay Hian

Why does the chip-based design enable dramatic cost reduction?

Chip-based design is the core driving force behind LiDAR's price reduction from tens of thousands of dollars to below US$200. Its logic operates on three levels:

- **Source reduction of BOM and component count.** Chip-based design condenses functions that originally required hundreds of individual components into just a few chips. For instance, through in-house chip development and optimised circuit design, the number of components in a LiDAR unit has been drastically reduced; some technologies have managed to cut the component count by over 90%. This source-level streamlining directly lowers the costs of material procurement and inventory management.
- **Dramatically simplified production and alignment.** The greatest cost pain point of discrete-component LiDAR lies in the production phase, where every laser and receiver needed individual optical alignment – a time-consuming, labour-intensive process heavily dependent on skilled operators. After chip-based integration, the critical optical paths are precisely defined by semiconductor lithography processes, eliminating the need for per-unit calibration. This greatly simplifies the production flow and paves the way for fully automated production lines. Automated manufacturing not only runs faster (Hesai's line can produce one unit every 45 seconds) but also achieves higher yield and consistency, thereby amortising the unit manufacturing cost.
- **Technology reuse under a platform strategy.** Chip-based design is the foundation for a product platform strategy. Once core functions are integrated onto a few chips, the same chip architecture can spawn LiDAR products with different performance levels and use cases (eg Hesai's forward-looking long-range AT series and the blind-spot-filling FT series LiDARs). This "common chip origin, scenario-adapted" model enables an exceptionally high reuse rate of core components (Hesai claims a core-component reuse rate exceeding 85%), significantly spreading R&D and supply-chain management costs and avoiding the reinvention of the wheel.

OTHER ADVANTAGES OF CHIP-BASED DESIGN

Beyond dramatically reducing costs, chip-based design brings multi-dimensional performance improvements:

- **Performance leap.** Chip-based integration makes it possible to pack hundreds or even thousands of laser channels into an extremely small space, achieving ultra-high line counts and resolution (eg 1,440 lines). Simultaneously, a proprietary waveform decoding engine (IPE) can filter out over 99.9% of environmental noise in real time at the chip level, markedly improving detection capability in adverse weather conditions such as rain, fog, and strong glare.
- **Enhanced reliability and consistency.** Solder joints and connectors in discrete designs are all potential failure points. Chip-based design greatly reduces these physical connections. Moreover, the chips are designed and manufactured to rigorous automotive standards (such as AEC-Q100 certification), making LiDAR more resistant to vibration and thermal cycling, while fundamentally guaranteeing product consistency and reliability.

- **Extreme miniaturisation and low power consumption.** The most visible change brought about by integration is a drastic reduction in volume and weight. LiDAR has evolved from a roof-mounted "flowerpot" into a svelte module that can be embedded behind the windscreen. At the same time, chip-based design has significantly lowered power consumption (some data indicate a reduction of over 60% compared with traditional mechanical LiDARs) – a critical advantage for range-sensitive EVs and robots.
- **Enabling new application scenarios.** Miniaturised, low-cost, low-power, and highly reliable chip-based LiDAR extends its application horizon from high-end vehicles to much broader fields, such as unmanned delivery vehicles and robotic vacuum cleaners, where cost and compactness are paramount.

Drawbacks and challenges of chip-based design. Despite these enormous advantages, the path towards chip-based design is not without obstacles and faces significant challenges:

- **Extremely high technical and capital thresholds.** Developing a LiDAR-specific ASIC is a hugely complex system-engineering task, requiring a top-flight team proficient in optics, analogue circuits, digital circuits, and chip design. It demands massive capital investment and a long development cycle. For start-ups, this is an asset-heavy route that is hard to sustain.
- **Zero tolerance for tape-out failure.** The cost of a chip tape-out (trial production) is extraordinarily high, often reaching tens of millions of renminbi, and any design error is extremely costly to rectify. This means chip-based design allows very little room for error and imposes stringent requirements on product definition and design capability.
- **Amortisation of initial R&D expenditure.** Although chip-based design ultimately slashes the per-unit cost of LiDAR, the enormous upfront R&D investment needs to be amortised over large-scale mass production. Until a certain shipment volume is reached, the economic benefits of the chip-based route are not apparent.
- **Supply-chain dependency risk.** Even though domestic manufacturers have made breakthroughs in chip design, high-end chip manufacturing still relies on a handful of globally-leading semiconductor foundries. Under the influence of geopolitical factors, this constitutes a potential supply-chain security risk.

In summary, LiDAR chip-based design is a disruptive technological innovation. By leveraging the economies of scale of the semiconductor industry, it elegantly resolves the traditional LiDAR "impossible triangle" of high performance, high cost, and large size. Though the path is fraught with challenges, it is widely acknowledged by the industry as the essential route to mass production and widespread adoption.

Comparison Between Hesai And Robosense In Tech Path

	Hesai (2983 HK/HSAI US)	RoboSense (2498 HK)
Customers and Markets	**Broad and deep:** Strong ties to Li Auto with diversification to BYD, Xiaomi, Changan, Geely, SAIC, and global OEMs (eg, a major European OEM). Dominant in global Robotaxi (61% market share, incl. Baidu, Didi). Strong in robotics (delivery, cleaning).	**Broad and fast-growing:** Extensive clientele across 32 automakers/Tier 1s (including BYD, GAC, Geely, Great Wall). Major global presence with 12 international/JV brands. Robotaxis (>90% of players, including Didi) and robotics (3,400+ clients, strong in delivery, lawn mowers) are key growth areas.
Product Positioning	**Ultimate performance and high-end + mass-market:** Known for setting the "performance ceiling" (highest resolution, long range). Balances this with platformisation for cost efficiency. Targets both premium and mass-market segments.	**High value and aggressive cost reduction:** Focuses on "radical cost reduction" through a digital architecture. Aggressively targets mid-range to low-end market penetration (eg MX series <$200) while offering high-performance options (EM4).
Typical Products	**AT series (ADAS):** AT128 (mass-produced), ATX (Gen4), AT512 (512 channels, 400m range) **Pandar/OT series (Robotaxi):** OT128 (chip-based) **FT series (Solid-State Blind Spot):** FT120, FTX **JT series (Robotics):** JT16, JT128	**M series (ADAS):** M1 (mass-produced), M2, M3 **EM platform (Digital):** EM4 (500+ channels), EMX, E1 (full solid-state) **Robotics:** E1R, Airy, Fairy, Helios **Active camera (AC series):** AC1, AC2 (robot vision)
Chipisation Strategy	**Full-stack In-house (Deepest):** "100% in-house development of 7 core components." Self-developed VCSEL, SPAD, SoC (RISC-V FMC500). V4.0 chip uses 3D stacking + addressable photon isolation. Focuses on integrating all seven core components.	Complete digital architecture (Thorough): "All-in digital architecture". World's first to integrate a SPAD array + processing into a single SPAD-SoC chip. Replaces FPGA. Focuses on full-link digitisation (transmission, reception, processing).
Scanning Architecture	Rotating mirror as the primary approach, supplemented by solid-state: Primarily 1D rotating mirror (eg, AT128) for high reliability and performance. Developing flash full solid-state for blind spot detection (FT series).	Started with MEMS, now on digital platforms: Started with MEMS (M1). Now transitioning to digital platforms (EM) which blend digital control with scanning, and full solid-state (E1) for short range.
Wavelength/Ranging Principle	905nm ToF: Standard for ADAS. Utilises high-power customized VCSEL arrays.	940nm ToF: Uses 940nm digital VCSEL with ToF. The EM4 pushes performance boundaries (600m range).
Transmitter (VCSEL) Technology	High-power customised arrays: Industry pioneer in using VCSEL for long-range applications. Photon Vector Technology (PVT) for higher efficiency. Multi-junction VCSEL arrays.	2D Addressable VCSEL: World's only mass-produced 2D addressable VCSEL chip (940nm). Enables electronic scanning and high-density arrays.
Receiver (SPAD) Technology	SPAD-SoC Pursuer: Early adopter of SPAD (acquisition of Fastree3D). V4.0 uses 3D stacked SPAD arrays. Focuses on sensitivity and noise reduction.	SPAD-SoC Leader: Global first to integrate a SPAD-SoC for long-range primary LiDAR. Uses 3D stacking. The "Huiyan big model" is integrated for on-chip processing and noise filtering.
Strengths	**Most comprehensive tech + strongest manufacturing:** "Technical and manufacturing all-rounder". Full-stack in-house R&D (7 core components). #1 in global LiDAR patents. Strong manufacturing scale (Hangzhou and Shanghai factories). Proven high-end performance in robotaxis.	**Digital pioneer + ecosystem-first:** "Digital innovation and scenario-explosion pioneer". World's first to mass-produce digital LiDAR with a SPAD-SoC. Rapid iteration. Strong cost structure (MX series). Dual-engine strategy (auto + robotics) paying off with a clear vision for a "Robotics Technology Platform".
Weaknesses	**High transition investment:** Early focus on SiPM; transitioning to all-digital SPAD requires sustained investment. High R&D expenses due to full-stack approach. Slightly slower penetration in ultra-low-cost vehicle segments.	**Premium segment catch-up:** High-end perception slightly lags behind Hesai's (despite strong EM4 specs), historical MEMS reliability is under scrutiny, and its patent portfolio is thinner.

Source: Respective companies, UOB Kay Hian

UNDERSTANDING LIDAR PERFORMANCE METRICS

Selecting a LiDAR sensor is not a single-variable decision. Its performance is defined by a set of interdependent specifications that directly impact the safety envelope, object classification capability, and system cost of an autonomous vehicle or robot. For institutional investors, understanding these metrics is essential to evaluate a company's technology roadmap and its fit for different automation levels. Below, we define the core specifications and explain why they matter.

- **Range (maximum detection range).** The maximum distance at which a LiDAR can reliably detect a target with a specified reflectivity. It is usually quoted with a probability of detection (eg 90%) and a target type (eg a diffuse Lambertian reflector at 10% reflectivity). Long range buys time. For highway driving at 120 km/h (75 mph), a vehicle needs 150-200 metres of sensing distance to safely detect a stationary object, plan a manoeuvre, and stop or swerve.

- **Reflectivity context.** A 10% reflectivity target simulates a pedestrian wearing dark clothing or a worn asphalt surface – a relatively low-reflectance but safety-critical object. A number like “200 m @ 10%” is much more stringent and meaningful than “300 m @ 90%” (a highly reflective retro-reflector). National Institute of Standards and Technology (NIST)-traceable calibration (eg “10% NIST”) adds metrological rigour, ensuring that range figures are comparable across manufacturers. A longer detection range at low reflectivity directly translates to a higher operational design domain (ODD) and a larger safety margin – a critical differentiator for L3/L4 highway-pilot systems.
- **Number of lines (laser channels).** There are a number of discrete laser/detector pairs in a sensor. Each “line” generates a ring of points in the vertical direction. A higher line count yields a denser vertical sampling of the scene. Think of lines as the vertical resolution of a radar image. A 16-line LiDAR might only return a few points on a distant pedestrian, making shape classification difficult. A 128-line LiDAR can reconstruct the same pedestrian with dozens of points, enabling reliable distinction between a person and a pole. Higher line counts are essential for small-object detection at long range. However, beyond a certain point (200–300 lines for forward-looking ADAS), the incremental benefit diminishes, and the cost, data volume, and processing load become more significant concerns. The number of lines is therefore a practical proxy for sensor generation and object-classification confidence.
- **Field of view (FOV).** The angular extent of the sensor’s coverage is expressed in degrees for horizontal (H) and vertical (V) axes. For example, a forward-looking LiDAR might have 120° H × 25° V; a blind-spot sensor might cover 120° H × 90° V. FOV determines where a sensor sees. A wide horizontal FOV is crucial at intersections, for cut-ins, and for detecting crossing objects from the side. Vertical FOV must cover the road surface close to the vehicle (to detect small debris or curbs) as well as overhead signs and bridges. Forward-facing sensors trade vertical FOV for range (concentrating energy where it matters at highway speeds), while near-field blind-spot sensors require a very wide vertical FOV to cover the ground right next to the vehicle. FOV also dictates the number of sensors needed for 360-degree coverage – a direct BOM consideration.
- **Resolution (angular resolution).** The smallest angular separation between two adjacent laser beams is typically quoted in degrees for both horizontal and vertical axes. A lower number means finer discrimination (eg, 0.05° is better than 0.2°). Resolution governs the ability to separate and identify objects at a distance. At 200 metres, a 0.1° horizontal resolution maps to points spaced about 35 cm apart – enough to recognise a vehicle but insufficient to detect a 15 cm piece of debris on the road. A 0.05° resolution halves that gap, dramatically improving small-object detection and shape fidelity. Many modern LiDARs offer a “region of interest” (ROI) with dynamically increased resolution in a narrow zone (eg, the road ahead), preserving high angular sampling where it is most safety-critical while keeping overall data rates manageable.
- **Point rate (points per second).** The total number of 3D points a sensor generates per second is often quoted for a single return (first echo). It is the product of the number of lines, the scan rate (frame rate), and the horizontal resolution. Point rate is the raw “data firehose” metric. A higher point rate yields a denser point cloud, enabling more accurate object detection, tracking, and classification. It also allows for higher frame rates (eg, 20 Hz vs 10 Hz), which reduces latency and improves the system’s ability to track fast-moving objects. However, a high point rate demands more onboard processing power, higher data bandwidth, and more thermal management – all of which affect system cost and integration complexity. Investors should view point rate alongside resolution and range to gauge the balance a sensor strikes between richness of perception and practical compute burden.

ADDITIONAL KEY METRICS

- **Frame rate (Hz).** This looks at the number of complete scans per second. A higher frame rate reduces perception latency, critical for high-speed highway scenarios.
- **Power consumption (W)** directly affects thermal design and a vehicle's electric range. A power-efficient sensor simplifies integration and lowers heat-dissipation requirements.
- **Dimensions and weight.** Both dictate packaging options (grille, roof, behind windshield) and are especially critical for robotics platforms where payload and space are at a premium.
- **Wavelength (typically 905 nm or 1550 nm).** 905 nm benefits from a mature, low-cost silicon ecosystem; 1,550 nm can achieve higher eye-safe power limits and better performance in fog/rain, but historically at a higher cost. Most mass-adoption ADAS LiDARs use 905 nm.
- **Technology type (Mechanical, MEMS, flash, hybrid solid-state).** This defines the beam-steering approach and, consequently, reliability, cost, and scalability. Solid-state designs (no macroscopic moving parts) are generally favoured for automotive-grade durability and cost reduction over vehicle lifetime.

No single metric defines a LiDAR's market suitability. A winning product balances these specifications against cost, reliability, and automotive qualification. When comparing sensors across companies, investors should look for: a) a clear target scenario (long-range highway vs urban blind-spot vs robotics); b) performance specifications quoted at a low, standard reflectivity (10% NIST); and c) a technology platform that can scale down the cost curve while maintaining a safety-relevant point-cloud density. The shift from "more lines" to "smarter point clouds" – with configurable ROI, in-house SoCs, and tight software integration – increasingly separates commodity sensors from platforms that enable true L3/L4 autonomy.

LiDAR Products Of Hesai, Robosense And Huawei

Series Name	Model Name	Type	Technology	Chips/SoCs	Max Range / Reflectivity	Number of Lines	FOV (H x V)	Resolution (H x V)	Point Rate (pts/s)	Price	Application Scenario
Hesai											
AT Series	AT128	Forward ADAS LiDAR	Hybrid solid-state (1D Rotating Mirror)	Proprietary ASICs	200 metres @10%	128	120° x 25.4°	Up to 0.1° x 0.2°	1.53m (Single Return)	Rmb900-1,000	L2/L3 ADAS, Highway Pilot, Urban Navigation
	ATX		Hybrid solid-state	FMC500 RISC-V based	230 metres @ 10%	116-256	120° x 20°	Up to 0.08° x 0.05°	1.536m-3.84m	Rmb1,000-1,500	L2+ ADAS in mass production vehicles
	AT512		Hybrid Solid-State	4th-gen proprietary chip	300 metres @ 10% (Max: 400 metres)	512	120° x 25.6°	2400 x 512 (Global)	12.3m (Single Return)	Rmb2,000-2,500	L2/L3 ADAS, Highly Automated Driving (L3+)
	AT1440		Hybrid Solid-State	4th-gen proprietary chip	300 metres @ 10%	1440	n.a.	0.02° (Angular)	>34m	>Rmb5,000	Ultra-High-Definition, Image-Level Perception for L3/L4 ADAS
ET Series	ET25	Forward ADAS LiDAR (behind windshield)	Hybrid Solid-State	Proprietary ASICs	250 metres @ 10% (without windshield)	n.a. (Based on AT Platform)	120° x 25°	Up to 0.05° x 0.05°	>3m	n.a.	L2/L3 ADAS, In-Cabin Installation
	ETX	Forward ADAS LiDAR	6D Full-Colour Hybrid Solid-State	Picasso SPAD-SoC	400 metres @ 10% (Max: 600 metres)	1,080 / 2,160 / 4,320	n.a.	0.05° to 0.1° x 0.05° to 0.1°	n.a.	>Rmb5,000	L3/L4 ADAS
FT Series	FT120	Blind-spotting ADAS LiDAR	Fully Solid-State (Flash)	Proprietary ASICs	100 metres (Max)	n.a. (Flash-based)	100° x 75°	160 x 120 (Global)	192k (Single Return)	~Rmb450	Near-Range Blind Spot Coverage, L2/L3 ADAS
	FTX	Blind-spotting ADAS LiDAR	Fully Solid-State	n.a.	30 metres @ 10%	n.a. (Flash-based)	180° x 140°	n.a.	492k	<Rmb800	Next-Gen Blind-spotting Detection for L3/L4 ADAS and Robots
JT Series	JT16	Robotics LiDAR	360° Mechanical Spinning	n.a.	30 metres @ 10% (Max: 100 metres)	16	360° x 40°	0.6° x 2.67°	48k	Rmb900	Robotic Lawn Mowers, AGVs, AMRs
	JT128	Robotics LiDAR	360° Mechanical Spinning	Proprietary tech	n.a.	128	360° x 187°	n.a.	n.a.	Rmb1,000-2,000	Robotics Applications
XT Series	XT32	Robotics LiDAR	360° Mechanical Spinning	Proprietary ASICs	120 metres (Max)	32	360° x 31°	0.18° x 1°	640k (Single Return)	Similar to Pandar Series'	Intelligent Logistics, Unmanned Minibuses, AGVs

Series Name	Model Name	Type	Technology	Chips/SoCs	Max Range / Reflectivity	Number of Lines	FOV (H x V)	Resolution (H x V)	Point Rate (pts/s)	Price	Application Scenario
Pandar Series	Pandar 128	Robotics LiDAR (also for AD)	360° Mechanical Spinning	n.a.	200 metres @ 10%	128	360° x 40° (Configurable)	Up to 0.1° x 0.125°	>3.4m (Single Return)	Rmb30,000-50,000	Robotaxis, Autonomous Trucks, Smart City Infrastructure
OT Series	OT128	Robotics LiDAR	360° Mechanical Spinning	n.a.	200 metres @ 10% (Max 230 metres)	128	360° x 40° (-25° to + 15°)	0.1° to 1.72° (Configurable) x 0.1°/0.2°/0.4° (Configurable)	3.456m (Single Return, Max)	Higher than Pandar	Autonomous Vehicles, L4 ADAS, Industrial Applications
RoboSense											
M Platform	M1	Forward ADAS LiDAR	MEMS Solid-State	n.a.	150 metres @ 10%; 200 metres (Max)	126	120° x 25°	Avg: 0.2° x 0.2°	750k (Single Return)	Rmb2,000	L2/L3 ADAS, L5 Driverless Automated Driving
	M2	Forward ADAS LiDAR	MEMS Solid-State	2D Scanning Chip (AEC-Q100 Certified)	200 metres @ 10%; 250 metres (Max)	n.a. (Point Rate-based)	n.a.	Avg: 0.1° x 0.1°	1.575m (Single Return)	Rmb1,600	L3+ ADAS, Seamless Upgrade from M1
	MX	Forward ADAS LiDAR	MEMS Solid-State	In-house SoC M-Core	200 metres (Max)	126 (ROI equivalent: 251)	120° x 25°	Best: 0.1° x 0.1°	n.a.	Rmb1,000-1,500	Cost-effective L2/L3, Mass Adoption
EM Platform	EM4	Forward ADAS LiDAR	Digital LiDAR	SPAD-SoC, 940nm VCSEL	300 metres @ 10%; 600 metres (Max)	1,080 (configurable: 520-2,160	120° x 27°	Up to 0.05° x 0.025°	25.92m (Single Return)	>Rmb5,000	High-level ADAS, L4 Robotaxi
	EMX	Forward ADAS LiDAR	Digital LiDAR	SPAD-SoC, VCSEL	300 metres (Max)	192	120° x 25° (Max: 140° H)	0.08° x 0.1° (Global)	2.88m	Rmb1,500-2,000	High-level ADAS, L3 ADAS
R Platform	Airy	Robotics LiDAR	Digital LiDAR (Hemispherical)	VCSEL, SPAD-SoC	30 metres @ 10% 120m (Diameter Coverage)	192 / 96	360° x 90° (Hemispherical)	n.a.	1.72m (192-beam)	~Rmb4,000	Robotics: AGVs, AMRs, Quadrupedal Robots, Service Robots
	Airy Lite	Robotics LiDAR	Digital LiDAR	VCSEL, SPAD-SoC	40 metres @ 10%; 60 metres (Max)	24 (channels)	360° x 45°	0.6° x 1.96°	144k (Single Return)	Rmb4,700	Robotics: AMRs, AGVs, Delivery Robots, Cleaning Robots, Quadrupeds
	Fairy	Robotics LiDAR	Digital LiDAR	VCSEL, SPAD-SoC	150 metres (Max)	96 / 48	360° x 32°	0.25° x 0.33°	1.37m (96-beam)	>Rmb10,000	Robotics: Handheld Mapping, Drones, Mobile Robots
E Platform	E1	Blind-spot ADAS LiDAR	Fully Solid-State (Flash)	SPAD-SoC, 2D VCSEL	30 metres @ 10%; 120 metres (Max)	n.a. (Flash-based)	120° x 90°	n.a.	n.a.	Rmb900-1,000	Blind Spot Coverage, L2/L3 ADAS
Helios Series	Helios 16	Robotics LiDAR	360° Mechanical Spinning	n.a.	90 metres @ 10%; 150 metres (Max)	16	360° x 30°	0.2°/0.4° x 2°	288k (Single Return)	US$2,000-3,000	Robots, Intelligent Vehicle, V2X
Helios Series	Helios 32	Robotics LiDAR	360° Mechanical Spinning	n.a.	80 metres @ 10%; 150 metres (Max)	32	360° x 70°	Up to 0.2°/0.4° x Up to 1.33°	576k (Single Return)	Higher than Helios 16	Robots, Autonomous Vehicles, V2R, Mapping
Bpearl	RS-Bpearl	Robotics LiDAR (Blind-spot)	360° Mechanical Spinning	n.a.	30 metres @ 10%	32	360° x 90°	n.a.	n.a.	Rmb4,800	Short-Range Blind-spot Detection for Unmanned Logistics, Robotaxis, Drones
Ruby Series	Ruby Plus	Robotics LiDAR	360° Mechanical Spinning	n.a.	240 metres @ 10%; 250 metres (Max)	128	360° x 40°	Up to 0.1° x 0.1°	2.304m (Single, Balanced)	Rmb135,000	Robotaxis, Robotruck, Autonomous Street Sweeper/Logistic Vehicle
Huawei											
Qiankun	96-line	Forward ADAS LiDAR	360° Mechanical Spinning	Lattice FPGA	200 metres (Max)	96	120° x 25°	n.a.	n.a.	<Rmb8,000	L2/L3 ADAS, Urban and Highway Scenarios
	D3 (192-line)	Forward ADAS LiDAR	Hybrid Solid-State (1D Rotating Mirror)	VCSEL, SPAD-SoC (Sony IMX459, TI TDA4AL, Lattice FPGA	180 metres @ 10% 250 metres (Max)	192	120° x 20°	0.25° x 0.1°	~1.84m	Rmb7,000-8,000	L2/L3 ADAS, Aito M7 Ultra, Avatr
	896-line (Dual Optical Path)	Forward ADAS LiDAR	Hybrid Solid-State (Dual Optical Path Architecture)	n.a.	n.a.	896	120° (H, Wide-Angle)	n.a.	n.a.	>Rmb6,000	Image-Grade Perception, L2/L3 ADAS, Aito M9, Zunjie S800
n.a.	SL210	Blind-spot ADAS LiDAR	Fully Solid-State (Flash)	n.a.	8 metres @ 10%	n.a. (Flash-based)	120° x 90°	0.5° x 0.375°	n.a.	Rmb450	Parking Assistance, Near-Range Object Detection

Source: UOB Kay Hian

Stock Picks

Hesai Group (2983 HK)

Global LiDAR Leader Poised For Explosive ADAS And Robotics Growth

	BUY
Share Price	HK$15.77
Target Price	HK$33.00
Upside	109.3%

Analyst(s)

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Highlights

- Hesai is a global LiDAR leader in ADAS (>30% market share) and robotics (>60% market share). Its chipised design (SoC/ASIC), platformisation and >90% automation rate ensure industry-leading cost and performance.
- New product launches represent a core growth driver for Hesai, particularly through its high-value long-range models.
- Hesai is upgrading from spatial perception to spatial intelligence with the 6D full-colour SPAD-SoC Picasso and spatial AI hardware Kosmo.
- Hesai has secured exclusive deals with BYD, Leapmotor, Great Wall Motor, XPeng, and robotaxi leaders (Baidu Apollo, Pony.ai).
- We expect net profit to grow at a three-year CAGR of 46% from 2025-28.
- Initiate coverage on Hesai with a BUY rating and target price of HK$33.00.

Analysis

- **World's top LiDAR supplier.** Hesai Group (Hesai), a global light detection and ranging (LiDAR) leader, holds a >30% market share in advanced driver-assistance system (ADAS) LiDAR and >60% of robotaxis. Its chipised design and platformisation ensure industry-leading cost and performance.
- **Cost leadership via self-developed System-on-Chips (SoC) and application-specific integrated circuits (ASIC), platformisation and over 90% automation (one unit/45s).** ASP and unit cost will fall 10-15% p.a. on scale-up in 2026-28, driving sales growth while underpinning gross margin.
- **New product launches are a core growth driver,** particularly through Hesai's high-value long-range models (AT1440, ETX). The shift in the sales mix toward high-value long-range models also underpins margin growth.
- **Hesai is upgrading from spatial perception to spatial intelligence,** powered by its 6D full-colour SPAD-SoC Picasso and spatial AI hardware Kosmo. This fundamentally redefines Hesai's investment thesis.
- **Customer momentum is the clearest near-term catalyst.** Key customers include BYD, Geely, Changan, Leapmotor, Baidu Apollo, Pony.ai, etc.
- **Sharp earnings inflection.** The company turned around in 2025 with a net profit of Rmb436m, as revenue had grown to a critical mass covering fixed costs. We expect net profit to grow at a 46% three-year CAGR in 2026-28.
- **Initiate coverage with a BUY rating and target price of HK$33.00,** based on 10-year DCF. Our target price implies 40x 2027F PE.

Key Financials

Year to 31 Dec (Rmbm)	2024	2025	2026F	2027F	2028F
Net turnover	2,077	3,028	4,215	6,367	8,868
EBITDA	(73)	293	609	1,104	1,637
Operating profit	(205)	169	465	913	1,424
Net profit (rep./act.)	(102)	436	548	908	1,358
Net profit (adj.)	14	551	548	908	1,358
EPS (Fen)	(9.9)	39.2	43.6	72.2	108.0
PE (x)	n.a.	35.0	31.5	19.0	12.7
P/B (x)	3.7	1.9	1.8	1.7	1.5
EV/EBITDA (x)	n.a.	55.7	26.8	14.8	10.0
Dividend yield (%)	-	-	-	-	-
Net margin (%)	(4.9)	14.4	13.0	14.3	15.3
Net debt/(cash) to equity (%)	(65.8)	(45.0)	(45.6)	(45.2)	(46.6)
Interest cover (x)	n.a.	(1.5)	(3.2)	(5.9)	(8.2)
ROE (%)	(2.6)	6.8	5.9	9.1	12.2
Consensus net profit	-	-	578	921	1,281
UOBKH/Consensus (x)	-	-	0.95	0.99	1.06

Source: Hesai, Bloomberg, UOB Kay Hian

Stock Data

GICS sector	Consumer Discretionary
Bloomberg ticker:	2983 HK
Shares issued (m):	1,257.1
Market cap (HK$m):	19,825.1
Market cap (US$m):	2,558.1
3-mth avg daily t'over (US$m):	24.7

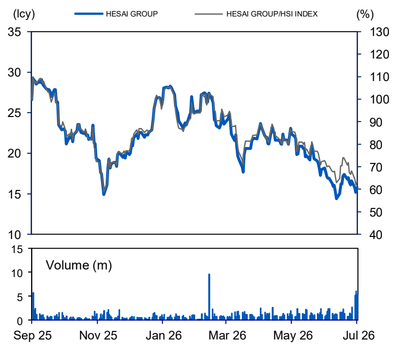
Price Performance (%)

52-week high/low				HK$30.50/ HK$14.26
1mth	3mth	6mth	1yr	YTD
(13.2)	(31.4)	(40.7)	n.a.	(29.1)

Major Shareholders	%
Sun Kai	5.87
Xiang Shaoqing	5.66
Li Yifan	5.65

Balance Sheet Metrics	
FY26 NAV/Share (HK$)	8.70
FY26 Net Debt/Share (HK$)	3.97

Price Chart



Source: Bloomberg

Company Description

Hesai Group develops, manufactures and sells LiDARs for automobiles, robotaxis and robots.

Investment Highlights

As the global number one LiDAR supplier, Hesai has over 30% ADAS share and over 60% robotaxi share, enabled by its chip-based cost advantage.

- **Hesai Group (2983 HK/HSAI US) stands as the global number one LiDAR supplier in passenger-car ADAS, underpinned by unmatched technology depth and manufacturing scale.** With 2025 shipments of 1.62m units (+223% yoy), Hesai already holds a more than 30% share of the global ADAS passenger-car LiDAR market, over 40% share of China's passenger car OEM forward-facing primary LiDAR market, and over 60% of level 4 (L4) robotaxis. Its differentiated edge lies in chipised architecture – fourth-generation self-developed SoC and ASIC – combined with platformised product families (AT, QT, XT, JT, OT series) and over 90% automated production lines, delivering superior point-cloud density, zero blind spots (PandarXT), and the industry's lowest bill of materials (BOM) cost trajectory.

Chip-driven low BOM and automated production deliver industry-leading costs, protecting 41% gross margin.

- **Structural cost leadership.** Chip integration reduces discrete components by more than 50%; automated lines (Hangzhou Hertz + Shanghai Maxwell) achieve one-unit-per-45-second takt time with over 90% automation rate and full manufacturing execution system (MES) traceability. Hesai had an ASP of Rmb1,828 (~US$260) and an average unit COGS of Rmb1,088 (~US$166) in 2025, well below the industry average of more than US$350 and US$250 respectively. Looking ahead, we expect Hesai's ASP and unit COGS to drop 10-15% p.a. in 2026-28 with scale and tech advances, underpinning sales growth and a steady gross margin of around 40%.

High-performance long-range LiDARs and proprietary 6D SPAD-SoC Picasso lift ASPs and sustain margins above 40%, driving growth.

- **A transformative product cycle built on proprietary SoC.** Hesai is now launching a new generation of products based on its own custom-designed chips, which deliver a major leap in both sensing performance and cost efficiency. The upgraded ATX series, Picasso SPAD-SoC, and ETX series together represent the most powerful LiDAR platform in the industry and provide clear visibility on multi-year design win conversion.
  - **The upgraded ATX series**, which began mass production ramp-up in Apr 26, integrates the in-house Fermi C500 processing chip and advanced photon isolation technology, boosting range and resolution in a compact form factor. It has secured over 4m units in orders from leading global OEMs, making it the highest-volume LiDAR programme and paving the way for substantial revenue growth over the coming 2-3 years.
  - **The AT1440** represents the industry's highest-line-count LiDAR. It delivers 1,440 lines, a 300-metre range at 10% reflectivity, and over 34 million points per second via Hesai's fourth-generation chip platform. Its 0.02° angular resolution creates point clouds over 30 times more detailed than mainstream solutions, enabling precise detection of small objects in complex scenarios valued by level 4 (L4) ADAS customers.
  - **The Picasso SPAD-SoC** is the world's first 6D full-colour single-photon avalanche diode (SPAD) based LiDAR SoC. It natively fuses XYZ geometry with RGB colour on a single chip, capturing intensity, velocity, and full-colour data alongside spatial information for true 4K perception. This eliminates discrete components, simplifies architecture, and drives steep unit cost reductions at scale.
  - **The ETX series** is the first to use the Picasso SoC. Set for mass production in 2H26, it generates up to 4,320 lines of full-colour 4K point clouds with a 600-metre range. It provides unprecedented environmental detail for L3/L4 ADAS, embedding intelligence directly in silicon to enhance safety-critical detection and premium segment pricing power.
- **Transition from spatial perception to spatial intelligence via Picasso and Kosmo spatial AI hardware platform fundamentally strengthens Hesai's thesis.** Moving beyond the US$10b ADAS LiDAR market into the US$100b physical AI arena by 2030 expands the addressable market 10-fold, propelling Hesai into key infrastructure for the physical AI economy.

Figure 1: Hesai Upgraded ATX

Source: Hesai

Figure 2: Hesai AT1440

Source: Hesai

Figure 3: Hesai ETX

Source: Hesai

Figure 4: Hesai Picasso SPAD-SoC

Source: Hesai

Figure 5: Hesai Kosmo Spatial AI Hardware

Source: Hesai

- **LiDARs with Picasso can replace cameras.** The SoC natively captures full-colour point clouds without external fusion, consolidating sensors, simplifying vehicle architecture, and cutting system costs. Miniaturisation may eventually enable embedding in mobile handsets for 3D full-colour consumer perception.
- **The Kosmo platform captures, records, and processes high-fidelity 3D worlds, extending its reach into the consumer and robotics markets.** It serves as a foundational tool for training physical AI models in robotics. Creative applications include immersive 3D rendering for advertising, accelerated content creation for games and film, and spatial capture in consumer devices. Hesai pursues a phased strategy starting with B2B enterprise customers in automotive, robotics, advertising, and entertainment before B2C expansion. Priced at Rmb80,000-100,000 today, Kosmo is expected to see material price declines with volume growth, unlocking mass adoption.

Design wins across top OEMs, robotaxi leaders, and robotics firms drive Hesai's visible multi-year revenue ramp-up.

- **Customer momentum provides the clearest near-term catalyst.** Hesai has design wins from all top 10 Chinese OEMs and serves as the primary LiDAR partner for NVIDIA's DRIVE Hyperion 10 platform. It secured strategic wins in 2024-25 across mass-market vehicles, robotaxis, and logistics, driving visible multi-year revenue growth.
  - **Mass-market OEMs.** BYD's Han and Tang models feature Hesai LiDARs, with the Seal and Atto series to follow for L2+/L3 in the Rmb150,000-200,000 segment. Leapmotor's B10 uses ATX, Great Wall WEY Mocha and Changan Deepal use AT128, and Geely Zeekr has selected Hesai for its upcoming models.
  - **Robotic lawn mowers.** In Mar 26, Hesai won an exclusive 10m-unit JT-series order for Dreame and MOVA mowers – the largest in LiDAR history. The lightweight 200g JT series offers 360° views for precise outdoor obstacle avoidance. With Dreame mowers ranking No.1 globally, this provides a high-growth stream as the market heads toward US$4b by 2028, reducing passenger-vehicle cyclicality.
  - **Robotaxis.** Baidu Apollo's sixth-generation fleet uses four AT128 units per vehicle. Pony.ai, WeRide, and Dubai deployments further expand adoption.
  - **Robotics and logistics.** Hesai supplies to Meituan, JD, Embotech, Neolix, and others. Warehouse automation and Kodiak autonomous trucks add volume. The Dreame order signals strong consumer traction.

Hesai will see a sharp earnings inflection as volume scale and operating leverage drive a three-year CAGR of 46% in net profit.

- **Sharp earnings inflection.** Hesai turned around in 2025 with a GAAP net profit of Rmb436m, as revenue had grown to a critical mass covering fixed costs, especially R&D expenses. Looking ahead, we expect net profit to grow at a three-year CAGR of 46% to Rmb548m/Rmb908m/Rmb1,358m in 2026/27/28 respectively. This growth is underpinned by projected sales volumes of 3.15m/5.15m/7.8m units over the same period—a 69% three-year CAGR from our 2025 baseline—partially offset by expected ASP declines of 28%, 7%, and 8% respectively. Crucially, margins will expand as fixed costs are spread across a much larger revenue base. For example, we project R&D/revenue to drop from 26.3% in 2025 to 19.0% in 2028, while SG&A/revenue falls from 15.9% to 7.5% over the same timeframe.

Valuation

Initiate coverage with DCF-derived target price of HK$33.00. Our 10-year DCF model is based on 15% WACC and 4% terminal growth rate. Our target price of HK$33.00 implies 40x 2027F PE, 0.8x 2027F PEG and 5.7x 2027F P/S. Based on the various assumptions for WACC (14-16%) and terminal growth (3-5%), the DCF-derived target price ranges from HK$28.00 to HK$40.00.

Figure 6: DCF Target Price Sensitivity

	WACC		
Terminal growth	14%	15%	16%
5%	40	35	31
4%	37	33	30
3%	35	31	28

Source: UOB Kay Hian

Figure 7: 10-Year DCF Model

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F	2029F	2030F	2031F	2032F	2033F	3034F	2035F	Terminal value
OCF	117	811	726	1,183	2,259	3,197	4,192	5,358	6,393	7,636	9,125	
Capex + R&D expenditure	(309)	(500)	(360)	(400)	(800)	(800)	(600)	(560)	(600)	(640)	(680)	
FCF	(192)	311	366	783	1,459	2,397	3,592	4,798	5,793	6,996	8,445	79,845
Discount factor	1.00	0.87	0.76	0.66	0.57	0.50	0.43	0.38	0.33	0.28	0.25	
Discounted cash flow		271	277	515	834	1,192	1,553	1,804	1,894	1,989	2,088	
Sum of discounted cash flow	12,414											
Discounted terminal value	19,737											
Net cash / (Debt)	4,028											
Fair Value	36,179											
Share outstanding (m)	1,257											
Fair value per share (HK$)	33.0											
Implied 2027F PE (x)	39.8											
Implied 2027F PEG (x)	0.8											
Implied 2027 P/S (x)	5.7											
WACC (%)	15.0											
Terminal growth rate (%)	4.0											

Source: Hesai, UOB Kay Hian

Business And Earnings Outlook

Hesai's growth will be driven by the following structural tailwinds:

- Accelerating ADAS penetration in China and global OEMs
- Robotaxi commercialisation (Baidu, Pony.ai, Dubai fleets)
- Robotics/logistics demand (Meituan, JD, factory automation)
- Proprietary cost-reduction roadmap (ASICs + automation)
- New products (the upgraded ATX, AT1440, ETX, next-generation solid-state)
- Customer diversification, and overseas expansion (Europe, Middle East)

REVENUE

Going forward, we expect revenue to grow at a three-year CAGR of 43% from Rmb3,028m in 2025 to Rmb4,215m/Rmb6,367m/Rmb8,868m in 2026/27/28 respectively, based on: a) a three-year CAGR of 69% in sales volume, and b) ASP decline of 28%/7%/8%.

- **Sales volume (69% three-year CAGR in 2026-28).** Based on order backlog, Hesai guides for 3.0m-3.5m units in sales volume (up 85-116% yoy) for 2026, including 2.5m-3.0m units of ADAS LiDARs (up 81-117% yoy) and 500,000 units of robotics LiDARs (up 109% yoy). We estimate Hesai's 2026-28 sales volume at 3.15m/5.15m/7.80m units (69% three-year CAGR).
  - **ADAS LiDAR (85% of sales volume and 60% of revenue in 2025).** Hesai targets 2.5m-3.0m units in ADAS LiDAR sales volume (up 81-117% yoy) for 2026, including 2.3m-2.7m units of forward LiDARs and 200,000-300,000 units of blind-spot LiDARs. We estimate Hesai's 2026/27/28 ADAS LiDAR sales volume at 2.65m/4.30m/6.50m units respectively (68% three-year CAGR from 2025's 1.38m-unit base), implying a global market share of 39-40% (up from 34.5% in 2025), on the back of confirmed multi-model wins from BYD, Geely, Leapmotor, Great Wall Motor, Changan, Mercedes-Benz.
  - **Robotics LiDAR (15% of sales volume and 40% of revenue in 2025).** Hesai guides for 500,000 units in robotics LiDAR sales volume (+109% yoy) for 2026, including 450,000 units for autonomous robotic lawn mowers and 50,000 units for robotaxis. We expect sales volume to grow at a three-year CAGR of 76% to 0.50m/0.85m/1.30m units in 2026/27/28 respectively, based on strong orders from robotic lawn mower manufacturers, robotaxi fleets (Baidu Apollo exclusive, Pony.ai, WeRide), Meituan and JD for industrial automated guided vehicles (AGV), and overseas logistics players (Dubai, Europe), as well as JT/XT series adoption in low-speed autonomy.
- **ASP.** We expect blended ASP to decline 28%/7%/8% in 2026/27/28 respectively, driven by cost reduction, as a result of economies of scale, platform standardisation, and a change in product mix (the share of blind-spot LiDARs will rise along with the advancement of ADAS).

GROSS MARGIN

We assume a steady blended gross margin at 40% in 2026/27/28 (vs 41.8% in 2025), with the cost reductions from the fourth-generation ASIC integration and 90%+ automation (one unit/45s) offsetting ASP pressure. The 1ppt yoy drop in blended gross margin in 2026 is based on an increase in the share of ADAS LiDARs (gross margin at 35-45%) vs robotics LiDARs (gross margin at 50-60%) in revenue mix. This is in line with management's long-term gross margin target of over 40%.

Figure 8: Revenue Estimates and Assumptions

	25	26F	27F	28F	CAGR 26-28
Global LiDAR shipment (m units)					
Automotive LiDAR	4.0	6.8	10.8	16.2	59.4
Robotics LiDAR	1.0	1.7	2.7	4.0	58.8
Others	0.1	0.1	0.1	0.1	4.0
Total	**5.1**	**8.5**	**13.6**	**20.3**	**58.9**
Hesai's market share (%)					
ADAS LiDAR	*34.5*	*39.1*	*39.7*	*40.1*	*1.9*
Robotics LiDAR	*23.9*	*29.6*	*31.6*	*32.5*	*2.8*
Overall	***32.1***	***36.9***	***37.9***	***38.5***	*2.1*
Hesai's sales volume ('000 units)					
ADAS LiDAR	1,381	2,650	4,300	6,500	67.6
Robotics LiDAR	239	500	850	1,300	75.8
Total	**1,620**	**3,150**	**5,150**	**7,800**	68.8
Hesai's ASP (Rmb)					
ADAS LiDAR	1,287	1,000	920	846	(13.0)
Robotics LiDAR	4,953	3,000	2,760	2,539	(20.0)
Overall ASP	**1,828**	**1,317**	**1,224**	**1,129**	(14.9)
Product revenue	2,983	4,170	6,322	8,823	43.5
- LiDAR products	2,963	4,150	6,302	8,803	43.8
- ADAS LiDAR	1,778	2,650	3,956	5,502	45.7
- Robotics LiDAR	1,185	1,500	2,346	3,301	40.7
- Other revenues	20	20	20	20	-
Service revenue	45	45	45	45	0.2
Revenue	**3,028**	**4,215**	**6,367**	**8,868**	43.1

Source: Hesai, UOB Kay Hian

OPERATING EXPENSES

- **R&D expenses – the biggest cost item.** R&D expenditure peaked at Rmb856m in 2024 for next-generation solid-state and overseas certification, and dropped 7% yoy to Rmb797m in 2025. Looking ahead, we estimate R&D expenses at Rmb969m/Rmb1,337m/Rmb1,685m in 2026/27/28 (23%/21%/ 19% of revenue) respectively, driven by R&D for the applications of Picasso SPAD-SoC and Kosmo. Revenue will likely far outpace R&D expenses in 2026-28 with the ASIC platform maturing and volume ramping up, dragging down R&D expense-to-revenue ratio.
- **SG&A expenses.** We project SG&A expenses at Rmb470m/Rmb522m/ Rmb665m in 2026/27/28 (11.2%/8.2%/7.5% of revenue) respectively, based on sales & marketing leverage from existing blue-chip relationships, and general and administrative expense efficiencies from Enterprise Resource Planning (ERP) and MES, and global footprint optimisation.

EARNINGS

Net profit turned positive to Rmb436m in 2025, as Hesai achieved critical mass with sales volume of 1.62m units (+223% yoy). Looking ahead, we forecast net profit at Rmb548m/Rmb908m/Rmb1,358m respectively in 2026/27/28 (46% three-year CAGR), based on 43% revenue CAGR, steady gross margin, operating leverage (EBIT margin at 11%/14.3%/16.1%), interest income on >Rmb4b in net cash, and minimal tax (China incentives).

FINANCIAL POSITIONS AND CASH FLOWS

- **Net cash balance.** Hesai had Rmb4,755m in cash & deposits and Rmb727m in debts (Rmb448m short-term debts, Rmb279m long-term debts) as of end-25, implying a net cash balance of Rmb4,028m. We forecast net cash balance increasing to Rmb4,339m/Rmb4,705m/Rmb5,488m by the end of 2026/27/28 respectively, as free cash flow will likely turn positive from 2026.
- **Cash flows.** We project operating cash flow at Rmb811m/Rmb726m/ Rmb1,183m in 2026/27/28 respectively (116% three-year CAGR), driven by earnings growth and drawdown of inventories and receivables. Capex will likely spike to Rmb500m in 2026 and pull back to Rmb360m/Rmb400m in 2027/28 respectively, as production capacity is expected to double from 2m units in 2025 to 4m units in 2026 and grow gradually to 9m units in 2028. As such, we expect free cash flow to turn positive to Rmb311m in 2026 and grow to Rmb783m in 2028. Hesai's cash-rich, debt-light position provides full flexibility for capacity expansion (9m units by 2028), R&D, and potential overseas M&A while maintaining a fortress balance sheet.

Risk Factors

Hesai sees high customer concentration with exclusivity risks and robotaxi policy dependence, as well as…

Customer concentration and order-execution risks, amplified by exclusivity and co-development dependencies. Hesai's top five customers (including BYD, Baidu, Pony.ai) accounted for >60% of its 2025 revenue. Hesai has exclusivity arrangements with BYD for more than 10 models scheduled for mass production, and serves as the main LiDAR supplier for next-generation fleets from Baidu Apollo Go and Pony.ai. Any loss of exclusivity (eg if BYD shifts more aggressively to its own LiDAR or a second source) could reduce volume forecasts by 15-20%. Additionally, robotaxi commercialisation in China and overseas remains policy-dependent; a slowdown in Baidu's Apollo Go roll-out or Pony.ai's expansion directly impacts Hesai's L4 backlog. Hesai expands its customer base, uses volume-based exclusivity clauses, diversifies L4 platforms and non-robotaxi applications, and maintains flexible manufacturing lines to mitigate concentration and policy risks.

…ASIC yield risks, DoD listing stigma, and data-localisation hardware adaptations.

Technology, regulatory and geopolitical risks. Hesai's next-generation solid-state LiDAR relies on custom ASICs; yield or qualification delays could postpone mass production by 6-12 months. To mitigate this, Hesai collaborates with multiple foundries, runs parallel qualifications, uses redundant designs, and makes pre-production risk buys. Failure to certify future ASICs to meet evolving safety standards could damage its reputation; Hesai embeds safety requirements early and operates an IATF 16949 closed-loop quality system. Its placement on the US Department of Defense (DoD) Section 1260H list creates stigma, reputational harm, and delisting risk. Hesai counters this by legally challenging the listing, diversifying its OEM customer base outside the US, and maintaining a Hong Kong secondary listing. For overseas data-localisation rules, it develops modular, software-configurable hardware and forms local data-processing partnerships.

TSMC dependency and cost spikes are mitigated by dual sourcing and buffer inventory.

Supply-chain and foundry risks. Hesai relies on specialised foundries (eg TSMC) for ASICs and on GaAs vertical-cavity surface-emitting laser (VCSEL). A 10% raw-material cost spike could pressure gross margins by 1-2 ppt. Mitigations include long-term supply agreements with price caps, dual sourcing, optical design optimisation, and strategic buffer inventory. More critically, disrupted access to TSMC could delay ASIC supply for 2-4 months. Hesai addresses this by qualifying a secondary non-US foundry for legacy nodes, investing in design-for-manufacturing toolkits for faster porting, maintaining a six-month wafer bank for vulnerable ASICs, and developing in-house post-processing capabilities.

Shareholder litigation risk from DoD disclosure is managed with robust controls.

Legal and securities litigation risks. Hesai has faced a shareholder lawsuit (Wong vs Hesai) over alleged omissions regarding its DoD listing status. Although dismissed, future changes in that status could trigger additional securities litigation, incurring legal costs and management distraction. Hesai mitigates this with robust disclosure controls and a cross-functional committee that monitors DoD developments and updates filings promptly. It also holds Directors and Officer (D&O) liability insurance for securities claims, has expanded its risk-factor disclosures, and retains specialised securities counsel on retainer under a litigation contingency protocol to minimise response time and expenses.

Profit & Loss

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F
Net turnover	**3,028**	**4,215**	**6,367**	**8,868**
EBITDA	293	609	1,104	1,637
Deprec. & amort.	(124)	(144)	(191)	(213)
EBIT	**169**	**465**	**913**	**1,424**
Total other non-operating incomes	187	-	-	-
Associate contributions	(0)	-	-	-
Net interest income/(expense)	111	144	155	174
Pre-tax profit	**467**	**609**	**1,068**	**1,598**
Tax	(31)	(61)	(160)	(240)
Minorities	-	-	-	-
Net profit	**436**	**548**	**908**	**1,358**
Net profit (adj.)	551	548	908	1,358

Balance Sheet

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F
Fixed assets	1,099	1,455	1,624	1,811
Other LT assets	2,849	2,849	2,849	2,849
Cash/ST investment	1,663	1,975	2,340	3,123
Other current assets	5,307	5,325	6,188	7,019
Total assets	**11,261**	**11,932**	**13,371**	**15,220**
ST debt	448	448	448	448
Other current liabilities	729	825	1,144	1,450
LT debt	279	279	279	279
Other LT liabilities	43	43	43	43
Shareholders' equity	8,959	9,507	10,415	11,773
Minority interest	-	-	-	-
Total liabilities & equity	**11,261**	**11,932**	**13,371**	**15,220**

Cash Flow

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F
Operating	**117**	**811**	**726**	**1,183**
Pre-tax profit	467	609	1,068	1,598
Tax	(31)	(61)	(160)	(240)
Deprec. & amort.	124	144	191	213
Associates	0	-	-	-
Working capital changes	-	-	-	-
Non-cash items	-	-	-	-
Other operating cashflows	(443)	119	(373)	(389)
Investing	**(5,554)**	**(500)**	**(360)**	**(400)**
Capex (growth)	(309)	(500)	(360)	(400)
Investments	(2,705)	-	-	-
Others	(2,540)	-	-	-
Financing	**4,346**	**-**	**-**	**-**
Dividend payments	-	-	-	-
Proceeds from borrowings	460	120	120	120
Loan repayment	(347)	(120)	(120)	(120)
Others/interest paid	4,234	-	-	-
Net cash inflow (outflow)	**(1,091)**	**311**	**366**	**783**
Beginning cash & cash equivalent	2,843	1,668	1,979	2,344
Changes due to forex impact	(84)	-	-	-
Ending cash & cash equivalent	**1,668**	**1,979**	**2,344**	**3,127**

Key Metrics

Year to 31 Dec (%)	2025	2026F	2027F	2028F
Profitability				
EBITDA margin	9.7	14.5	17.3	18.5
Pre-tax margin	15.4	14.4	16.8	18.0
Net margin	14.4	13.0	14.3	15.3
ROA	5.1	4.7	7.2	9.5
ROE	6.8	5.9	9.1	12.2
Growth				
Turnover	45.8	39.2	51.1	39.3
EBITDA	n.a.	108.2	81.3	48.2
Pre-tax profit	n.a.	30.5	75.5	49.6
Net profit	n.a.	25.7	65.7	49.6
Net profit (adj.)	n.a.	(0.4)	65.7	49.6
EPS	n.a.	11.3	65.7	49.6
Leverage				
Debt to total capital	6.5	6.1	5.4	4.8
Debt to equity	8.1	7.6	7.0	6.2
Net debt/(cash) to equity	(45.0)	(45.6)	(45.2)	(46.6)
Interest cover (x)	(1.5)	(3.2)	(5.9)	(8.2)

Appendix – Company Overview

COMPANY BACKGROUND

Hesai was founded in 2012 in Silicon Valley as HS Instruments by three Tsinghua/Stanford alumni: Dr Li Yifan (Western Digital chief engineer), Dr Sun Kai (Stanford research associate), and Mr Xiang Shaoqing (Apple iPhone hardware engineer). They returned to Shanghai in 2014 and initially developed laser gas sensors before pivoting to LiDARs in 2016 (first 32-line ADAS LiDAR).

Key Milestones

Year	Milestone
2017	First 40-line Pandar40; A-round funding
2019	Pandar64; C-round US$173M (Bosch, Lightspeed)
2020	Pandar128 flagship; PandaSet open dataset
2021-23	Chipised platform launch; Nasdaq IPO (HSAI)
2024	501,900 units shipped; non-GAAP profit turned positive
2025	Capacity exceeded 2m units; 1.6m units shipped; new ATX/QT128 volume ramp-up; GAAP profit turned positive; HKEX dual listing

Source: UOB Kay Hian

PRODUCTS

- **A comprehensive product portfolio spanning mechanical spinning, semi-solid-state, and solid-state LiDARs.** Hesai's product evolution began with mechanical spinning LiDARs and has progressively expanded into a full matrix covering ADAS, autonomous driving, and robotics applications. These established products – many of which are already in mass production and deployed across tens of thousands of vehicles – provide the foundation for Hesai's revenue base and technological credibility, while the newer chipised platforms (ATX, AT1440, Picasso, ETX) represent the next growth frontier.
  - **Pandar series – the mechanical LiDAR lineage that built Hesai's reputation in autonomous driving.** In 2017, Hesai launched the Pandar40, China's first mass-produced 32-line LiDAR. This was followed by the Pandar40P in Dec 18, the world's first LiDAR with full anti-interference capability. The Pandar64, a 64-line long-range mechanical LiDAR, further extended detection performance for L4 applications. In Oct 20, Hesai introduced the PandarXT, a 32-line 360° mechanical spinning LiDAR based on a self-developed chip, offering a 120-metre range at 20% reflectivity, a 31° vertical field of view, and over 90% detection probability for 10% reflectivity objects at 80-metre under 100k Lux sunlight. Compared with conventional 16-line LiDARs, the PandarXT doubles both vertical resolution and point frequency while maintaining low power consumption (10W) and a compact form factor. The Pandar128, a 128-line high-performance LiDAR, delivers over 3.45 million points per second (single return) with image-grade resolution and became the world's first LiDAR to achieve ISO 26262 ASIL-B functional safety certification.
  - **AT128 – the milestone semi-solid-state LiDAR that unlocked ADAS mass-market adoption.** Launched in 2021, the AT128 integrated 128 independent laser channels into a chipised architecture, achieving a 1200×128 global resolution, 200-metre range at 10% reflectivity, and over 1.53 million points per second. It secured more than 1.5m units in design-win orders from top automakers shortly after launch and has since entered large-scale production, powering models from Li Auto, Xiaomi, Lotus, and others. The AT128 also received ISO 26262 functional safety certification, cementing its role as the workhorse for L2+/L3 passenger vehicles.

- **FT series, ET series, and OT series – addressing short-range blind spots, ultra-thin packaging, and 360° perception.** The FT120 is Hesai's first pure solid-state blind-spot LiDAR with no moving parts, featuring a 100°×75° ultra-wide field of view for close-range obstacle detection. The ET25 is an ultra-thin long-range LiDAR designed for windshield-mounted integration, measuring only 25mm in height; it achieves a 250-metre range without windshield attenuation and delivers over 3 million points per second, making it ideal for sleek vehicle designs. The OT128, launched in Sep 24, is a 360° mechanical LiDAR flagship that shares the same mature chip architecture as the AT128, offering 3.456 million points per second and a maximum detection range of 230 metres. Uniquely, the OT128 is the world's only mechanical LiDAR that employs ASIC-based solutions in both its transmitter and receiver systems, and it has been widely deployed in L4 robotaxi fleets including Baidu Apollo, Pony.ai, Motional, and WeRide.

- **A transformative product cycle built on proprietary SoC.** Hesai has entered a decisive new product cycle that leverages custom silicon to deliver a step-change in perception capability and cost efficiency. The upgraded ATX series, the Picasso SPAD-SoC, and the ETX series together represent the most powerful LiDAR platform in the industry and provide clear visibility on multi-year design win conversion.
  - **The upgraded ATX series,** which has been ramping up mass production since Apr 26, integrates the in-house Fermi C500 processing chip and advanced photon isolation technology. This refresh boosts range and resolution while maintaining ATX's compact form factor. Critically, the ATX has already secured over 4m units in orders from leading global OEMs, establishing it as the highest-volume LiDAR programme on the market and providing a direct pathway for material revenue growth over the coming 2-3 years.
  - **The AT1440 – the industry's highest-line-count LiDAR.** Setting a new benchmark for automotive-grade ultra-high-definition perception, the AT1440 delivers an industry-leading 1,440 lines, a 300-metre range at 10% reflectivity, and over 34 million points per second, powered by Hesai's fourth-generation proprietary chip platform. Its 0.02° angular resolution produces image-level point clouds that are over 30 times more detailed than mainstream automotive LiDARs, enabling precise capture of small objects in complex scenarios – a capability particularly valued by L4 ADAS customers.
  - **The Picasso SPAD-SoC.** At the heart of Hesai's long-range platform lies Picasso, the world's first 6D full-colour SPAD-based LiDAR SoC that natively fuses XYZ geometry with RGB colour on a single chip. By combining a high-density SPAD array with on-chip processing, Picasso captures intensity, velocity, and full-colour information alongside spatial data, delivering true 4K perception. This breakthrough eliminates discrete components, dramatically simplifying the sensor architecture and enabling a steep reduction in unit cost as volumes scale.
  - **The ETX series – the first sensor to harness the Picasso SoC.** Scheduled for mass production in 2H26, the ETX generates up to 4,320 lines of full-colour 4K point clouds and delivers 4K ultra-HD perception with a maximum detection range of 600 metres, offering an unprecedented level of environmental detail for L3 and L4 ADAS. By embedding intelligence and colour discrimination directly into the silicon, ETX not only raises the ceiling on safety-critical object detection but also reinforces Hesai's pricing power in the premium LiDAR segment.

- **Transition from spatial perception to spatial intelligence with 6D full-colour SPAD-SoC Picasso and spatial AI hardware Kosmo.** The transition from spatial perception to spatial intelligence is fundamentally redefining Hesai's investment thesis, anchored by two groundbreaking platforms: the 6D full-colour SPAD-SoC Picasso and the spatial AI hardware Kosmo. By moving beyond its legacy ADAS LiDAR business – a global market estimated at US$10b in 2030 – into the expansive physical AI arena, projected at US$100b in the same year, this dual-platform transition enlarges the company's addressable market by 10-fold, transforming Hesai from a component supplier into an essential infrastructure provider for the physical AI economy.
  - **LiDARs equipped with Picasso can replace cameras.** The strategic significance of Picasso extends well beyond next-generation ADAS LiDARs. Because the chip natively captures full-colour point clouds without requiring external camera fusion, LiDARs equipped with Picasso can progressively replace traditional cameras in vehicles, consolidating multiple sensor functions into a single, high-performance unit and simplifying vehicle architecture while reducing system cost. Looking further ahead, the miniaturisation trajectory of SPAD-SoC technology opens up the possibility of embedding Picasso-class sensors into mobile handsets, enabling consumer devices to perceive and interact with the physical world in three dimensions and full colour.
  - **The Kosmo spatial AI hardware platform captures, records, and processes high-fidelity 3D worlds, extending Hesai's reach from ADAS LiDARs into the consumer and robotics markets.** Kosmo serves as a foundational tool for training physical AI models in robotics, where accurate spatial data is essential for teaching machines to navigate and manipulate real-world environments. Beyond industrial applications, Kosmo addresses creative and commercial use cases: advertising agencies can render luxury goods and automobiles in immersive three dimensions for next-generation marketing campaigns, video game studios and film producers can accelerate content creation with real-world spatial assets, and consumer electronics manufacturers can integrate spatial capture into devices for enhanced end-user experiences.

    Hesai is executing a phased go-to-market strategy for Kosmo, initially targeting enterprise customers (B2B) across automotive, robotics, advertising, and entertainment verticals before expanding to individual customers (B2C) as volume scales and price points decline. Currently priced at Rmb80,000-100,000, Kosmo is positioned as a professional-grade tool; management anticipates that as production volumes ramp up and component costs fall, pricing will decline materially, unlocking mass-market adoption.

LiDAR Products

Series Name	Model Name	Type	Technology	Chips/ SoCs	Max Range/ Reflectivity	Number of Lines	FOV (H x V)	Resolution (H x V)	Point Rate (pts/s)	Price	Application Scenario
AT Series	AT128	Forward ADAS LiDAR	Hybrid solid-state (1D Rotating Mirror)	Proprietary ASICs	200 metres @10%	128	120° x 25.4°	Up to 0.1° x 0.2°	1.53m (Single Return)	Rmb900-1,000	L2/L3 ADAS, Highway Pilot, Urban Navigation
	ATX		Hybrid solid-state	FMC500 RISC-V based	230 metres @ 10%	116-256	120° x 20°	Up to 0.08° x 0.05°	1.536m-3.84m	Rmb1,000-1,500	L2+ ADAS in mass production vehicles
	AT512		Hybrid Solid-State	4th-gen proprietary chip	300 metres @ 10% (Max: 400 metres)	512	120° x 25.6°	2400 x 512 (Global)	12.3m (Single Return)	Rmb2,000-2,500	L2/L3 ADAS, Highly Automated Driving (L3+)
	AT1440		Hybrid Solid-State	4th-gen proprietary chip	300 metres @ 10%	1440	n.a.	0.02° (Angular)	>34m	>Rmb5,000	Ultra-High-Definition, Image-Level Perception for L3/L4 ADAS
ET Series	ET25	Forward ADAS LiDAR (behind windshield)	Hybrid Solid-State	Proprietary ASICs	250 metres @ 10% (without windshield)	n.a. (Based on AT Platform)	120° x 25°	Up to 0.05° x 0.05°	>3m	n.a.	L2/L3 ADAS, In-Cabin Installation
	ETX	Forward ADAS LiDAR	6D Full-Colour Hybrid Solid-Stte	Picasso SPAD-SoC	400 metres @ 10% (Max: 600 metres)	1,080 / 2,160 / 4,320	n.a.	0.05° to 0.1° x 0.05° to 0.1°	n.a.	>Rmb5,000	L3/L4 ADAS
FT Series	FT120	Blind-spotting ADAS LiDAR	Fully Solid-State (Flash)	Proprietary ASICs	100 metres (Max)	n.a. (Flash-based)	100° x 75°	160 x 120 (Global)	192k (Single Return)	~Rmb450	Near-Range Blind Spot Coverage, L2/L3 ADAS
	FTX	Blind-spotting ADAS LiDAR	Fully Solid-State	n.a.	30 metres @ 10%	n.a. (Flash-based)	180° x 140°	n.a.	492k	<Rmb800	Next-Gen Blind-spotting Detection for L3/L4 ADAS and Robots
JT Series	JT16	Robotics LiDAR	360° Mechanical Spinning	n.a.	30 metres @ 10% (Max: 100 metres)	16	360° x 40°	0.6° x 2.67°	48k	Rmb900	Robotic Lawn Mowers, AGVs, AMRs
	JT128	Robotics LiDAR	360° Mechanical Spinning	Proprietary tech	n.a.	128	360° x 187°	n.a.	n.a.	Rmb1,000-2,000	Robotics Applications
XT Series	XT32	Robotics LiDAR	360° Mechanical Spinning	Proprietary ASICs	120 metres (Max)	32	360° x 31°	0.18° x 1°	640k (Single Return)	Similar to Pandar Series'	Intelligent Logistics, Unmanned Minibuses, AGVs
Pandar Series	Pandar 128	Robotics LiDAR (also for autonomous driving)	360° Mechanical Spinning	n.a.	200 metres @ 10%	128	360° x 40° (Configurable)	Up to 0.1° x 0.125°	>3.4m (Single Return)	Rmb30,000-50,000	Robotaxis, Autonomous Trucks, Smart City Infrastructure
OT Series	OT128	Robotics LiDAR	360° Mechanical Spinning	n.a.	200 metres @ 10% (Max 230 metres)	128	360° x 40° (-25° to + 15°)	0.1° to 1.72° (Configurable) x 0.1°/0.2°/0.4° (Configurable)	3.456m (Single Return, Max)	Higher than Pandar	Autonomous Vehicles, L4 ADAS, Industrial Applications

Source: UOB Kay Hian

CUSTOMERS

- **Customer momentum is the clearest near-term catalyst.** Hesai has already locked in design wins from all top 10 Chinese OEMs, and has also been selected as the primary LiDAR partner for NVIDIA's DRIVE Hyperion 10 platform, positioning its products as the default sensor for a broad ecosystem of global automakers. In 2024-25, the company secured strategic and exclusive wins across mass-market passenger vehicles, robotaxi fleets, and logistics automation. These contracted volumes translate into highly visible, multi-year revenue growth.

- **Mass-market OEMs.** BYD's Han and Tang models now feature Hesai LiDARs, with the Seal and Atto series expected to follow, targeting L2+/L3 penetration into the Rmb150,000-200,000 segment; Leapmotor's B10 compact SUV adopts the ATX, while Great Wall Motor's WEY Mocha and Changan's Deepal line-up embed AT128 sensors, and Geely's Zeekr brand has designated Hesai for use in its upcoming models.
- **Robotic lawn mowers.** Hesai's landmark partnership with Dreame Technology marks a strategic inflection point going into consumer robotics. In Mar 26, Hesai secured a record-breaking order to supply 10m JT-series LiDAR units exclusively for robotic lawn mowers under the Dreame and MOVA brands – the largest single order in LiDAR history. Dreame's LiDAR-equipped mowers already rank No. 1 globally by sales, underscoring the commercial traction of this partnership. The JT series, weighing only 200g and offering a true 360° omnidirectional field of view, is purpose-built for outdoor consumer robotics, enabling precise obstacle avoidance in complex garden environments. This contract serves as a powerful reference design that substantially lowers the barrier for other garden equipment manufacturers to follow. As the global robotic lawn mower market expands – projected to reach US$4b by 2028 – this partnership provides Hesai with a durable, high-growth revenue stream that diversifies its top-line away from passenger-vehicle cyclicality and strengthens its competitive moat in adjacent autonomous systems.
- **Robotaxis.** Baidu Apollo's sixth-generation fleet deploys Hesai's four AT128 units per vehicle for 360° coverage, supporting a scale-up to tens of thousands of vehicles. Pony.ai and WeRide have integrated Hesai into their growing commercial operations across multiple Chinese cities, and Hesai has delivered over 1,000 units for robotaxi deployment in Dubai.
- **Robotics and logistics.** Hesai supplies Meituan delivery robots, JD logistics vans, and Embotech BMW plant tractors. Neolix RoboVans (300+ cities, 17 countries) use ATX and FTX sensors, while Meituan Keeta drones adopt FTX. Warehouse automation via Thoro.ai, Cratus, and Gausium adds scale. A 10m-unit Dreame lawn-mower order signals consumer momentum. Kodiak Robotics uses Hesai for autonomous trucks.

PRODUCTION BASES

Hesai operates two state-of-the-art production bases that form the backbone of its scalable manufacturing operations.

- **The Hangzhou Hertz Manufacturing Centre** houses fully-automated LiDAR production lines with a 100% automation rate in core processes, enabling an output of one unit every 45 seconds while ensuring consistent quality and cost efficiency.
- **The Shanghai Maxwell Smart Manufacturing Centre** supports high-volume lines tailored for both automotive ADAS and robotics applications, serving as an advanced hub for new product design, testing, and calibration.
- **New plant in Thailand.** Hesai has an industrial land parcel of around 25,600 sqm in Thailand. The company is advancing plans for a new plant there, with production lines expected to commence mass production by early-27.

Together, the facilities in China delivered a combined production capacity exceeding 2m units in 2025, and the company targets to double production capacity to 4m units in 2026.

R&D CENTRES

Hesai's R&D centres are strategically positioned across three global innovation hubs to accelerate breakthroughs in LiDAR technology.

- **Shanghai** serves as the primary centre, housing the majority of core research teams focused on optical systems, perception algorithms, and product platformisation.
- **Silicon Valley.** This facility drives advanced ASIC architecture and chip-level integration, capitalising on its proximity to world-class semiconductor talent and enabling the company's pioneering four-generation ASIC roadmap.
- **Stuttgart.** The European centre in Stuttgart ensures alignment with stringent automotive standards, supporting customised solutions for international OEMs and regulatory compliance.

WORK FORCE

As of 2025, Hesai's total workforce comprised 1,142 employees. R&D personnel numbered 602 (52.7% of the total), while the production and supply chain accounted for 187 (16.4%), sales for 115 (10.1%), management for 61 (5.3%), and other functions for 177 (15.5%). Notably, 61.8% of Hesai's engineers held master's or PhD degrees, and its R&D headcount consistently represents approximately 53% of the overall workforce. This deep technical talent pool underpins Hesai's industry-leading innovation edge.

MAJOR SHAREHOLDERS

The top five shareholders of Hesai are Dr Sun Ke, Mr Xiang Shaoqing, Dr Li Yifan, Fidelity Management & Research (FMR), and Xiaomi Corp, who hold 5.87%/5.76%/5.65%/4.50%/3.20% stakes in the company respectively. The three founders and senior executives jointly hold a 17.28% stake and 68.73% voting rights, ensuring steady management and their sustained commitment to the company.

Shareholding Structure

	Shareholding (shares)	Stake (%)	Voting Rights (%)
Dr Sun Kai	9,228,622	5.87	23.48
Mr Xiang Shaoqing	9,055,634	5.76	22.66
Dr Li Yifan	8,879,636	5.65	22.59
FMR	7,072,431	4.50	1.70
Xiaomi Corp	5,032,680	3.20	1.21
Others	117,873,208	75.01	28.36
Total	157,142,211	100.00	100.00

Source: Hesai

Key Management Profile

Name	Age	Title	Year of joining the Company	Education and Professional Background	Responsibilities
Dr Li Yifan	39	Chairman, CEO, Co-founder	2014	- BS in Mechanical Engineering, Tsinghua (2009) - PhD in Robotics, University of Illinois (2013) - Former Principal Engineer at Western Digital in Silicon Valley, specialising in high-speed, high precision motion control	Overall strategy and execution
Dr Sun Kai	40	Chief Scientist, Co-founder	2014	- BS in Thermal & Power Engineering, Shanghai Jiao Tong University (2007) - PhD in Mechanical Engineering (with a minor in Electrical Engineering), Stanford University (2013) - Postdoctoral scholar and subsequent appointee at Stanford University, researching molecular sensing systems	R&D, supply chain, intellectual property
Mr Xiang Shaoqing	40	CTO, Co-founder	2014	- BS in Precision Instruments, Tsinghua University (2007) - Double MS in Mechanical Engineering and Electrical Engineering, Stanford University (2011) - Former Hardware System Integration Engineer at Apple Inc	Product development, manufacturing, IT security
Ms Yang Cailian	34	Vice President Operations, Executive Director, Joint Company Secretary	2014	- BS in Business English, Yancheng Teachers University - The first employee of the company	Administrative operations, major projects
Mr Fan Peng	43	CFO	2024	- BS in Accounting and MBA, Tsinghua University - CFO of Seyond Holdings - Vice President of Hailiang Education Group Inc - Chief Strategy Officer of Aesthetic Medical	Finance reporting, investor relations

Source: Hesai

RoboSense Technology Co (2498 HK)

AI Robotics Platform At A Profit Inflection Point

Highlights

- RoboSense has evolved from a pure LiDAR hardware supplier into an AI-driven robotics tech platform with full-stack capabilities.
- The company has solidified its technology and cost leadership in digital LiDARs through full-stack self-developed SPAD-SoC and 2D VCSEL chips.
- A turnaround is expected in 2026 with a two-year net profit CAGR of 180% in 2026-28, driven by a strong order backlog from both the ADAS and robotics segments and cost reduction.
- Initiate coverage with a BUY rating and target price of HK$50.00.

Analysis

- **RoboSense Technology Co (RoboSense) has evolved from a pure LiDAR hardware supplier into an AI-driven robotics tech platform with full-stack capabilities,** holding roughly 18% market share and being one of only two Chinese players mass producing digital light detection and ranging (LiDAR) at scale.
- **The company has solidified its technology and cost leadership in digital LiDARs through full-stack self-developed single-photon avalanche diode (SPAD) System-on-Chips (SoC) and 2D vertical-cavity surface-emitting laser (VCSEL) chips,** both AEC-Q qualified in 2025, enabling the industry's only mass-producible digital matrix (EM4, EMX, E1, E1R).
- **RoboSense's AC-series active cameras and new RGBD fusion sensors drive its physical-AI pivot, expanding the addressable market 10 times to over US$100b.**
- **Strong order backlog.** RoboSense has over 9m units in its order backlog, including 56 car models for 13 Chinese OEMs, 23 overseas/JV models, robotaxi leaders, and robotic lawn mower companies.
- **Net profit is expected to turn positive to Rmb91m in 2026 and grow at a two-year CAGR of 173% to Rmb395m/Rmb678m in 2027/28 respectively,** on an 83% three-year sales volume CAGR, an average 16% p.a. ASP drop, and margin improvement on the back of operating leverage.
- **Initiate coverage with a DCF-derived target price of HK$50.00.** Our 10-year DCF model is based on 16% WACC and 4% terminal growth rate. Our target price implies 52x 2027F PE, 0.7x 2027F PEG and 4.0x 2027F P/S.

Key Financials

Year to 31 Dec (Rmbm)	2024	2025	2026F	2027F	2028F
Net turnover	1,649	1,941	3,515	5,034	6,903
EBITDA	(451)	(85)	113	430	845
Operating profit	(584)	(184)	14	322	725
Net profit (rep./act.)	(482)	(146)	91	395	678
Net profit (adj.)	(396)	(54)	91	395	678
EPS (Fen)	(111.0)	(31.6)	19.3	83.6	143.7
PE (x)	n.a.	n.a.	101.9	23.5	13.7
P/B (x)	3.0	2.4	2.4	2.2	1.9
EV/EBITDA (x)	n.a.	n.a.	67.3	17.7	9.0
Dividend yield (%)	-	-	-	-	-
Net margin (%)	(29.2)	(7.5)	2.6	7.8	9.8
Net debt/(cash) to equity (%)	(86.6)	(56.5)	(50.8)	(44.5)	(40.5)
ROE (%)	n.a.	n.a.	(0.2)	(4.4)	(9.9)
Consensus net profit	n.a.	(4.3)	2.4	9.7	14.7
UOBKH/Consensus (x)	-	-	60	317	595

Source: RoboSense, Bloomberg, UOB Kay Hian

	BUY
Share Price	HK$22.56
Target Price	HK$50.00
Upside	121.6%

Analyst(s)
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Stock Data

GICS Sector	Consumer discretionary
Bloomberg ticker	2498 HK
Shares issued (m)	472.2
Market cap (HK$m)	10,652.8
Market cap (US$m)	1,374.6
3-mth avg daily t'over (US$m)	24.4

Price Performance (%)

52-week high/low				HK$46.50/HK$20.32
1mth	3mth	6mth	1yr	YTD
(19.7)	(38.4)	(41.4)	(30.6)	(38.4)

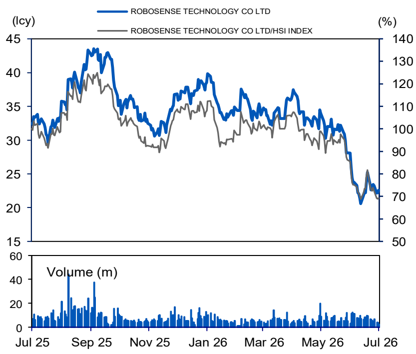
Major Shareholders

	%
Qiu Chunxin	10.19
Zhu Xiaorui	6.11

Balance Sheet Metrics

FY26 NAV/Share (HK$)	9.45
FY26 Net Debt/Share (HK$)	4.80

Price Chart



Source: Bloomberg

Company Description

RoboSense Technology Co develops and manufactures ADAS LiDARs, robotics LiDARs, and robotic parts and components.

Investment Highlights

- **RoboSense is an AI-driven robotics technology platform company supplying industry-leading LiDAR hardware, perception solutions, and components for advanced driver-assistance system (ADAS), robotaxis/ robotrucks, and robotics.** Its full-stack capabilities span self-developed SPAD-SoC chips, 2D VCSEL arrays, micro-electromechanical system (MEMS) scanners, and AI perception software (HyperVision). Holding a roughly 18% LiDAR market share globally, it is one of only two Chinese players mass producing digital LiDARs at scale.

The company's full-stack AI robotics platform has an 18% share of the LiDAR market, making it one of only two digital LiDAR mass-producers.

- **Technology and cost leadership through full-stack self-developed SPAD-SoC and 2D VCSEL chips,** both AEC-Q qualified in 2025. This architecture reduces bill of materials (BOM) cost by over 30% vs field-programmable gate array (FPGA) peers, improves point-cloud quality in rain and fog via bottom-layer signal processing, and scales along a Moore's Law trajectory. That enables RoboSense to offer one of the only two mass-producible digital LiDAR product matrixes (EM4, EMX, E1, E1R).
  - **EM4** delivers a 300-metre detection range at 10% reflectivity, a 600-metre maximum range, and 1,080 laser lines – among the best available. These breakthroughs have driven explosive design wins – 144 models across 32 OEMs/Tier 1s (including >90% of global robotaxi/robotruck leaders such as Didi and Pony.ai) and 56 models from 13 Chinese OEMs on the EM platform alone.

  Going forward, RoboSense will launch two SPAD-SoCs based on its Eocene digital architecture – Phoenix and Peacock.
  - **The "Phoenix" chipset, the industry's first automotive-grade monolithic SPAD-SoC,** delivers a native 2,160-beam output on a single chip, producing an ultra-high-resolution point cloud of 2,160 × 1,900 – equivalent to a 4-megapixel camera – with a 600-metre detection range. The Phoenix chipset is scalable from 240 to 2,160 lines, its 4-megapixel configuration having already secured design-win contracts with top global automakers for 2026 mass production.
  - **The "Peacock" all-solid-state ultra-large-array SPAD-SoC** propels robotics into image-grade 3D perception with high-density VGA (640 × 480) resolution and an expansive 180° × 135° field of view, millimetre-level precision and a minimum detection distance under 5cm. It provides the dense, structure-rich depth images essential for robotic interaction; mass production is slated for 3Q26.

Self-developed chips deliver more than 30% BOM cost reduction, 144 design wins, and a dominant share of robotaxis.

Figure 1: RoboSense EM4

Source: RoboSense

- **Proprietary SPAD-SoC and RGBD fusion sensor platform: A foray into physical AI enlarging addressable market by 10 times to over US$100b.** RoboSense's investment case is being reshaped by a shift from spatial perception to spatial intelligence – underpinned by its proprietary Eocene SPAD-SoC architecture.
  - **AC-series active cameras fuse high-resolution imaging with onboard AI processing,** delivering superior object detection for next-generation ADAS and AD. Their seamless integration with LiDAR systems creates a comprehensive perception stack, accelerating OEM adoption. With design wins across major automakers and a scalable, cost-optimised architecture, the AC-series positions RoboSense for capturing explosive growth in the smart vehicle sensor market. The Active Camera 2 (AC2) launched in 2025 is the industry's first direct time-of-flight + red green blue (RGB) + IMU fusion sensor, which can replace forward-facing perception cameras in vehicles and red, green, blue, depth (RGB-D) cameras in robots. AC2 and the Papert 2.0 dexterous hand enable RoboSense to offer eye-hand coordination systems for robots.
  - **A new RGBD fusion sensor planned for end-27** will combine this high-density spatial data with colour information, enabling colour-enriched

RoboSense's investment case is reshaped by a shift from spatial perception to spatial intelligence, supported by Eocene.

3D perception. It is a future sensor based on the newly-announced Peacock SPAD-SoC chipset.

This SPAD-SoC and RGBD trajectory positions RoboSense for capturing demand across the physical AI value chain – from high-resolution spatial data acquisition to fused perception – enlarging its addressable market by 10 times to over US$100b by 2030. That opportunity is already materialising, with robotics emerging as a high-margin second growth engine.

- **Accelerating sales momentum underpinned by strong order backlog.** RoboSense holds over 9m units in its final ADAS order backlog. We expect its total LiDAR sales volume to grow at a three-year CAGR of 85% from 912,000 units in 2025 to 2.3m/3.8m/5.8m units in 2026/27/28 respectively, of which 64-65% will be ADAS LiDARs and 35-36% robotics LiDARs
  - **ADAS segment.** The order backlog and ADAS adoption momentum are accelerating, with 56 start-of-production (SOP) or ramping models for 13 top-tier OEMs, 23 overseas/JV models, and 144 cumulative design wins. Recent wins include two major new EV companies and global SUV/pickup leaders, plus multi-hundred-thousand-unit overseas orders from SAIC Audi, FAW Toyota, and European/Japanese JVs.
  - **Robotics LiDAR segment.** The segment is building a similarly powerful backlog, with over 30 SOP or ramping autonomous mobility platforms, 18 overseas projects, and 68 cumulative design wins across robotaxi, delivery robots and industrial automation. Recent wins include multi-thousand-unit orders from top-tier robotaxi operators and logistics leaders.
    - **Robotaxis.** RoboSense leads in customer adoption among robotaxi companies, with its solid-state LiDAR solutions used by over 90% of robotaxi industry leaders like Didi and Pony.ai. It has a near-monopoly in the level 4 (L4) blind-spot LiDAR market with its E1 product, achieving a market share of close to 100%.
    - **Robotic lawn mowers.** RoboSense was ranked no.1 globally for its 2025 3D LiDAR sales volume in robotic lawn mowers, with deep partnerships across Mammotion (anchored by a 1.2m-unit, three-year order – the segment's largest ever), Segway Navimow, and Roborock. In 2025, RoboSense's robotics LiDAR shipments exceeded 303,000 units, growing over 11 times yoy, and by 1Q26, its robotics revenue surpassed automotive revenue, contributing over half of total revenue. These contracted volumes provide a durable, high-growth revenue stream diversifying the top-line beyond passenger-vehicle cyclicality.
    - **Humanoids.** RoboSense partners nearly 50 top-tier humanoid and quadruped robotics players, including Unitree, Agibot, Galbot, ENGINEAI, and Dobot, and was ranked no.1 in global humanoid robot LiDAR sales in 2025. Key milestones include the delivery of its 1 millionth LiDAR unit (E1R) to Humanoid Robot (Shanghai) Co for integration into the full-size humanoid robot "Qinglong". RoboSense also supports Youibot's industrial humanoid robot "Xifeng" with its Airy digital LiDAR, and Pudu Robotics' humanoid robot "PUDU D7" with two Airy units.

We project 56 SOP'd models, 144 design wins, and a three-year CAGR of 85% in ADAS volume through 2028.

- **Earnings to turn positive in 2026 and grow at two-year CAGR of 173% in 2027-28.** We forecast revenue growing at a three-year CAGR of 53% from Rmb1,941m in 2025 to Rmb3,515m/Rmb5,034m/Rmb6,603m in 2026/27/28 respectively, driven by: a) an 85% sales-volume CAGR (total LiDAR units from 0.91m in 2025 to 5.8m in 2028) on ADAS ramp-ups and robotics penetration, b) an ASP decline of around 16% annually (still supportive of 15-20% automotive share gains), and c) net margin turning around from -7.5% in 2025 to +2.6%/+7.8%/+9.8% in 2026/27/28 as fixed-cost dilution and gross-margin expansion kick in. We expect net profit to turn positive to Rmb91m in 2026 and grow at a two-year CAGR of 173% to Rmb395m/Rmb678m by 2027/28 respectively.

The turnaround will be driven by a three-year CAGR of 53% and margin expansion due to cost reduction and economies of scale.

Valuation

- **Initiate coverage with a DCF-derived target price of HK$50.00.** Our 10-year DCF model is based on 16% WACC and 4% terminal growth rate. Our target price of HK$50.00 implies 52x 2027F PE, 0.7x 2027F PEG and 4.0x 2027F P/S. Based on the various assumptions (WACC: 15-17%, terminal growth: 3-5%), the fair value range is HK$42-60.

Figure 2: DCF Target Price Sensitivity

	WACC		
Terminal growth	**15%**	**16%**	**17%**
5%	60	53	46
4%	56	**50**	44
3%	53	47	42

Source: UOB Kay Hian

Figure 3: 10-Year DCF Model

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F	2029F	2030F	2031F	2032F	2033F	3034F	2035F	Terminal value
OCF	(582)	(36)	73	294	954	1,648	2,265	3,103	4,230	5,738	7,751	
Capex + R&D expenditure	(86)	(120)	(130)	(180)	(578)	(622)	(576)	(719)	(900)	(1,129)	(1,418)	
FCF	(667)	(156)	(57)	114	376	1,025	1,690	2,384	3,329	4,609	6,333	54,884
Discount factor	1.00	0.86	0.74	0.64	0.55	0.48	0.41	0.35	0.31	0.26	0.23	
Discounted cash flow		(135)	(42)	73	208	488	693	844	1,015	1,212	1,436	
Sum of discounted cash flow	5,792											
Discounted terminal value	12,441											
Net cash / (Debt)	2,140											
Fair Value	20,374											
Share outstanding (m)	472											
Fair value per share (HK$)	50.0											
Implied 2027F PE (x)	51.6											
Implied 2027F PEG (x)	0.7											
Implied 2027F P/S (x)	4.0											
WACC (%)	16.0											
Terminal growth rate (%)	4.0											

Source: RoboSense, UOB Kay Hian

Business And Earnings Outlook

RoboSense's growth is underpinned by four structural drivers: a) digital LiDAR cost reduction via full-chip self-development, b) new high-performance products (EM4/EMX long-range digital, E1R robot-optimised, AC2), c) expanding customer base across 13 Chinese + 12 overseas/JV OEMs plus over 90% robotaxi coverage, and d) robotics platform diversification that opens a second multi-billion-renminbi addressable market. These factors combine to deliver sustained volume growth, ASP resilience, and margin expansion even as growth in the broader auto market normalises.

Four growth drivers – self-developed chips, new products, customer additions, robotics – help propel volume, ASP, and margin growth.

REVENUE

Revenue growth moderated from 111% in 2023 to 18% in 2025, due to a slowdown in ADAS LiDAR sales volume growth.

We expect revenue to grow at a three-year CAGR of 53% in 2026-28, driven by SOP ramps on more than 56 car models and robotics projects.

Going forward, we expect revenue to grow at a three-year CAGR of 53% from Rmb1,941m in 2025 to Rmb3,515m/Rmb5,034m/Rmb6,903m in 2026/27/28 respectively, based on: a) 2.3m/3.8m units of sales volume (85% three-year CAGR), and b) 16% ASP decline p.a. on average. This compares with the company's 2026 sales volume guidance of 2.3m-2.8m units, including 1.5m-1.8m units of ADAS LiDARs and 0.5m-0.8m units of robotics LiDARs.

- **ADAS LiDAR (~60% of revenue).** We expect sales revenue from ADAS LiDARs to increase from Rmb1,106m in 2025 to Rmb2,025m/Rmb3,014m/Rmb4,313m in 2026/27/28 respectively, implying a 57% three-year CAGR.
  - **Three-year sales volume CAGR of 85%.** RoboSense's sales volume of ADAS LiDARs grew only 17% yoy to 609,000 units in 2025, underperforming the industry. This was because RoboSense lost major customers in 2025 – XPeng (as it pivoted to the vision-based approach) and Huawei-affiliated brands (as they switched to Huawei LiDARs). These customers jointly contributed over 60% of RoboSense's ADAS sales volume in 2024. Looking ahead, the company guides for 1.5m-1.8m units in ADAS LiDAR sales volume for 2026. Sales volume is projected at 1.5m/2.45m/3.75m units in 2026/27/28 respectively (three-year CAGR of 83% from the 2025 base), driven by SOP ramps on over 56 models already won (including BYD, Geely, Zeekr, Great Wall Motor, Leapmotor, SAIC, FAW).
  - **ASP is forecast to fall by an average of 14% p.a. (Rmb1,350/Rmb1,230/Rmb1,150 in 2026/27/28 respectively)** as economies of scale and chip cost-down offset feature upgrades, and the share of blind-spot LiDARs will rise along with the advancement of ADAS.
- **Robotics LiDAR and others (~40% of revenue).** We anticipate sales revenue from robotics LIDAR growing at a three-year CAGR of 51% from Rmb710m in 2025 to Rmb1,360m/Rmb1,890m/Rmb2,460m in 2026/27/28 respectively.
  - **Three-year CAGR of 89%.** The company guides for 0.8m-1.0m in sales volume of robotics LiDARs, including 600,000 units of autonomous robotic lawn mowers and 200,000-400,000 units of robotaxis and other robots. We estimate sales volume at 0.80m/1.35m/2.05m units in 2026/27/28 respectively (three-year CAGR of 89% from the 2025 base), fuelled by buoyant demand from robotic lawn mower manufacturers, robotaxi and humanoid/service-robot companies, as well as demand for new E1R/Airy products.
  - **ASP is expected to decline an average of 20% p.a. to Rmb1,700/Rmb1,400/Rmb1,200 in 2026/27/28 respectively.**

Figure 4: Revenue Estimates and Assumptions

	25	26F	27F	28F	CAGR 26-28
Global LiDAR shipment (m units)					
Automoitve LiDAR	4.0	6.8	10.8	16.2	59.4
Robotics LiDAR	1.0	1.7	2.7	4.0	58.8
Others	0.1	0.1	0.1	0.1	4.0
Total	**5.1**	**8.5**	**13.6**	**20.3**	**58.9**
RoboSense's market share (%)					
ADAS LiDAR	*15.2*	*22.1*	*22.6*	*23.1*	
Robotics LiDAR	*30.3*	*47.3*	*50.2*	*51.2*	
Overall	***18.1***	***27.0***	***28.0***	***28.6***	
RoboSense's sales volume ('000 units)					
ADAS LiDAR	609	1,500	2,450	3,750	83.3
Robotics LiDAR	303	800	1,350	2,050	89.1
Total	**912**	**2,300**	**3,800**	**5,800**	**85.3**
RoboSense's ASP (Rmb)					
ADAS LiDAR	1,816	1,350	1,230	1,150	(14.1)
Robotics LiDAR	2,343	1,700	1,400	1,200	(20.0)
Overall ASP	**1,991**	**1,472**	**1,290**	**1,168**	**(16.3)**
Product revenue	1,816	3,385	4,904	6,773	55.1
- ADAS LiDAR	1,106	2,025	3,014	4,313	57.4
- Robotics LiDAR	710	1,360	1,890	2,460	51.3
Solutions	78	80	80	80	1.0
Services & others	48	50	50	50	1.6
Revenue	**1,941**	**3,515**	**5,034**	**6,903**	**52.6**

Source: RoboSense, UOB Kay Hian

GROSS MARGIN

Gross margin more than tripled from 8.4% in 2023 to 26.5% in 2025 due to improved economies of scale. 1Q26 gross margin dipped 1.8ppt yoy to 21.7% as a result of higher overheads incurred in manufacturing new EMX LiDAR products in the initial mass production stage.

Gross margin is poised to reach 31% by 2028, driven by chip integration, automation, and an improved robotics mix.

The company expects gross margin to improve going forward, with a three-year target of 35%, based on the deliveries of new car models and robots from 2H26, cost optimisation of self-developed chips, and improving capacity utilisation. We anticipate RoboSense's capacity utilisation increasing from 46% in 2025 to 77%/95%/97% in 2026/27/28 respectively.

We forecast gross margin rising from 26.5% in 2025 to 29.0%/30.0%/31.0% in 2026/27/28 respectively, driven by continued unit-cost reduction (COGS/unit down 14-18% p.a.) from chip vertical integration and 95% automation at the Mars base, plus a favourable shift in product mix toward higher-margin robotics solutions.

OPERATING EXPENSES

R&D expenses are projected at Rmb773m/Rmb956m/Rmb1,187m (22%/19%/17% of revenue) in 2026/27/28 respectively; absolute spend is forecast to rise in 2026-28 on EM-platform and robotics platform investments but decline as a percentage of revenue as the business scales and key chip developments are completed.

R&D spend rises but R&D and SG&A margins decline as a percentage of revenue due to operating leverage.

SG&A expenses are modelled at Rmb344m/Rmb393m/Rmb449m (9.8%/7.8%/6.5% of revenue for 2026/27/28), benefitting from operating leverage and efficiency gains in global sales infrastructure.

EARNINGS

Net profit turned positive to Rmb104m in 4Q25, as sales volume scaled up to 459,600 units (+183% yoy/+148% qoq), and returned negative at Rmb63m in 1Q26, as sales volume dropped seasonally to 330,300 units (+204% yoy/-28% qoq). Gross margin fell temporarily due to higher start-up costs for the launch of the aforementioned new EMX LiDAR products.
We expect net profit to turn positive to Rmb91m in 2026, and then surge to Rmb395m/Rmb678m in 2027/28 respectively (173% two-year CAGR). The swing is driven by gross profit leverage, sharply lower finance costs after the IPO, and positive operating leverage once fixed R&D costs are absorbed.

We expect net profit to turn positive in 2026 before surging at a two-year CAGR of 173% to Rmb678m by 2028.

FINANCIAL POSITIONS AND CASH FLOWS

Cash and deposits stood at Rmb2,619m with Rmb479m interest-bearing debts at end-25, giving net cash of Rmb2.14b. We forecast net cash remaining at about Rmb2b in 2026-28, despite capex for the robotics lines. We expect operating cash flow to turn positive to Rmb73m in 2027 and grow to Rmb294m in 2028. We anticipate free cash flow turning positive to Rmb114m in 2028.

Net cash is set to come in at around Rmb2b, operating cash flow should turn positive in 2027, and free cash flow will likely turn positive in 2028.

Risk Factors

- **Customer concentration and order execution risk.** Top-five customers accounted for 74.6% of RoboSense's 2024 revenue, including XPeng and Huawei-affiliated auto brands. Since 2025, XPeng and the Huawei-affiliated auto brands have ceased procuring LiDARs from RoboSense, as the former pivoted from the multi-sensor fusion approach to the vision-based approach, and the latter switched to Huawei LiDARs. However, RoboSense's ADAS LiDAR sales volume still grew 17% yoy, driven by a strong order volume from BYD, Geely, and overseas OEMs like Toyota and Lucid. The revenue contribution from the top-five customers fell to 38.2% in 2025, though it was still high. Any delay in model launches (regulatory approval, supply-chain issues) or loss of exclusivity could drag near-term volume forecasts. RoboSense diversifies its customer base and uses volume-based agreements, modular E/M platforms, and safety stock for high-volume programmes to mitigate concentration and launch delay risks.

RoboSense mitigates high customer concentration risks by diversifying its customer base to include BYD, Geely, Toyota and Lucid.

- **Technology and regulatory risks – RoboSense's specific MEMS execution and validation timeline.** RoboSense relies primarily on MEMS-based solid-state LiDARs (eg the E Platform and M Platform), whereas Hesai Group uses hybrid solid-state (translation + MEMS) with a different reliability profile. RoboSense's next-generation solid-state products (eg E1R, MX) face a compressed certification window – failing ISO 26262 ASIL-B/D or IEC 60825 eye-safety for any key variant could trigger customer recalls or design-outs. Moreover, RoboSense has a concentrated overseas pipeline (Toyota, Lucid, European OEMs); any delay in meeting GDPR or UN R155 cybersecurity standards for these specific programmes would jeopardise its 2026-27 global revenue targets. RoboSense embeds compliance early, uses pre-certified MEMS IP, runs parallel safety certifications, maintains a TÜV-linked safety team, and tests prototypes with Toyota/Lucid to close cybersecurity gaps.

MEMS validation risks are managed via early compliance and pre-certified IP.

- **Macro and raw-material headwinds – tied to RoboSense's single-source dependencies and modest buffer inventory.** Unlike its larger peers, RoboSense sources certain laser diodes and MEMS mirrors from a limited set of suppliers (eg Lumentum, Mirrorcle). A 10% raw-material cost spike would erode its already-thin gross margin by 1-2 ppt, given its lower absolute margin base (~26%). RoboSense counters raw-material headwinds by dual-sourcing critical laser diodes and MEMS mirrors from secondary suppliers in Japan and China. It also negotiates long-term supply agreements with annual price reviews and volume-based rebates. Design-for-manufacturing improvements lower component counts, while a three- to four-month strategic buffer inventory and automated assembly lines reduce labour costs, protecting gross margins despite raw-material volatility.

Single-source dependencies are countered by dual-sourcing and buffer inventory.

Profit & Loss

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F
Net turnover	**1,941**	**3,515**	**5,034**	**6,903**
EBITDA	(85)	113	430	845
Deprec. & amort.	(67)	(74)	(85)	(100)
EBIT	**(184)**	**14**	**322**	**725**
Total other non-operating incomes	-	-	-	-
Associate contributions	(13)	-	-	-
Net interest income/(expense)	89	77	73	73
Pre-tax profit	**(126)**	**91**	**395**	**798**
Tax	(19)	-	-	(120)
Minorities	(1)	-	-	-
Net profit	**(146)**	**91**	**395**	**678**
Net profit (adj.)	(54)	91	395	678

Balance Sheet

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F
Fixed assets	293	338	383	463
Other LT assets	72	62	52	43
Cash/ST investment	2,098	1,932	1,865	1,969
Other current assets	2,540	3,110	3,809	4,590
Total assets	**5,266**	**5,700**	**6,364**	**7,319**
ST debt	290	290	290	290
Other current liabilities	884	1,227	1,497	1,774
LT debt	157	157	157	157
Other LT liabilities	36	36	36	36
Shareholders' equity	36	36	36	36
Minority interest	17	17	17	17
Total liabilities & equity	**5,266**	**5,700**	**6,364**	**7,319**

Cash Flow

Year to 31 Dec (Rmbm)	2025	2026F	2027F	2028F
Operating	**(582)**	**(36)**	**73**	**294**
Pre-tax profit	(126)	91	395	798
Tax	(19)	-	-	(120)
Deprec. & amort.	67	74	85	100
Associates	13	-	-	-
Working capital changes	-	-	-	-
Non-cash items	(517)	(202)	(407)	(484)
Other operating cashflows	-	-	-	-
Investing	**(1,256)**	**(130)**	**(140)**	**(190)**
Capex (growth)	(86)	(120)	(130)	(180)
Investments	6	-	-	-
Others	(1,176)	(10)	(10)	(10)
Financing	**1,155**	**-**	**-**	**-**
Dividend payments	-	-	-	-
Proceeds from borrowings	748	136	136	136
Loan repayment	(450)	(136)	(136)	(136)
Others/interest paid	857	-	-	-
Net cash inflow (outflow)	**(682)**	**(166)**	**(67)**	**104**
Beginning cash & cash equivalent	2,836	2,098	1,932	1,865
Changes due to forex impact	(56)	-	-	-
Ending cash & cash equivalent	**2,098**	**1,932**	**1,865**	**1,969**

Key Metrics

Year to 31 Dec (%)	2025	2026F	2027F	2028F
Profitability				
EBITDA margin	(4.4)	3.2	8.5	12.2
Pre-tax margin	(6.5)	2.6	7.8	11.6
Net margin	(7.5)	2.6	7.8	9.8
ROA	(3.1)	1.7	6.5	9.9
ROE	(4.3)	2.4	9.7	14.7
Growth				
Turnover	17.7	81.1	43.2	37.1
EBITDA	n.a.	n.a.	280.2	96.5
Pre-tax profit	n.a.	n.a.	334.2	102.2
Net profit	n.a.	n.a.	334.2	71.8
Net profit (adj.)	n.a.	n.a.	334.2	71.8
EPS	n.a.	n.a.	334.2	71.8
Leverage				
Debt to total capital	9.1	8.5	7.6	6.6
Debt to equity	12.6	12.5	11.3	9.8
Net debt/(cash) to equity	(56.5)	(50.8)	(44.5)	(40.5)
Interest cover (x)	n.a.	(0.2)	(4.4)	(9.9)

Appendix – Company Overview

COMPANY BACKGROUND

Dr Qiu Chunxin (PhD Control Science, Harbin Institute of Technology) founded RoboSense in Aug 14 following his research on outdoor robotics perception. He recruited his PhD supervisor Dr Zhu Xiaorui (chief scientist) and peer Mr Liu Letian (CTO).

The company started with mechanical LiDAR for robotics (RS-LiDAR-16/32), pivoted to automotive with the world's first mass-produced car-grade MEMS LiDAR (M1) in 2019-20, achieved first overseas SOP in 2020, listed on HKEX in Jan 24 (2498 HK), and launched its digital SPAD-SoC platform in 2024-25. Key milestones include 1 millionth LiDAR delivery (Feb 25), EM4/EMX digital long-range launches, and robotics platform expansion (AC2, Papert 2.0).

PRODUCTS

- **Initial and mainstream LiDAR product evolution.** RoboSense's product journey spans from early mechanical spinning LiDARs to MEMS-based semi-solid-state M-series, and now to the fully digital E-platform powered by proprietary SPAD-SoC and VCSEL chips.
  - **Early-generation mechanical LiDARs** (eg, RS-LiDAR-16/32) established the company's foothold in autonomous driving with 16-32 laser channels and a 100-metre to 150-metre detection range, but were constrained by moving parts, high unit costs, and assembly complexity, serving primarily as proof-of-concept sensors for early ADAS and robotaxi trials.
  - **The M-series (M1, M2)** became the mainstream ADAS LiDAR for 2020-24, employing MEMS mirror scanning to achieve automotive-grade durability, a compact wedge-shaped form factor, and 150-metre to 200-metre range at 10% reflectivity. With design wins across multiple global OEMs for L2+/L3 production vehicles, the M-series bridged the gap between prototype validation and high-volume mass production.
  - **E1 (ADAS blind-spot LiDAR) and E1R (humanoid-robot LiDAR)** share the same solid-state chip-based E-platform with ultra-wide field of view (FoV). E1 cuts ground blind zones to under 15 centimetres, removing near-field risks. E1R offers 30 metres at 10% reflectivity and 260,000 pts/s for precise obstacle avoidance and navigation. Together, they extend RoboSense's digital LiDAR leadership from cars to robotics.
- **The future mainstream will be defined by the Phoenix and Peacock SPAD-SoCs,** extending the digital platform to ultra-high-resolution (4-megapixel equivalent for Phoenix) and all-solid-state wide-FOV (180°×135° for Peacock), proving that RoboSense's product evolution – from mechanical to MEMS to fully digital – consistently pushes the boundaries of performance, cost, and scalability for both automotive and robotics applications.
  - **EM4** offers a detection range of 300 metres at 10% reflectivity, a maximum range of 600 metres, and 1,080 laser lines, one of the best in the industry. These breakthroughs have driven explosive design wins – 144 models across 32 OEMs/Tier-1 suppliers (including more than 90% of global robotaxi/robotruck leaders such as Didi and Pony.ai) and 56 models of 13 Chinese OEMs on the EM platform alone.

Going forward, RoboSense will launch two SPAD-SoCs based on its Eocene digital architecture – Phoenix and Peacock.

- **The Phoenix chipset is the industry's first automotive-grade monolithic SPAD-SoC.** It delivers a native 2,160-beam output on a single chip, producing an ultra-high-resolution point cloud of 2,160 × 1,900 – equivalent to a 4-megapixel camera – with a 600-metre detection range. Scalable from 240 to 2,160 lines, its 4-megapixel configuration has secured design wins from top global automakers for mass production in 2026.
- **The Peacock all-solid-state ultra-large-array SPAD-SoC** propels robotics into image-grade 3D perception with high-density VGA (640 × 480) resolution and an expansive 180° × 135° FOV, millimetre-level precision and a minimum detection distance under 5 centimetres. This provides the dense, structure-rich depth images essential for robotic interaction; mass production is slated for 3Q26.

• **RoboSense's proprietary SPAD-SoC and RGBD fusion sensor platform: A foray into physical AI enlarging addressable market by 10 times to over US$100b.** RoboSense's investment thesis is being reshaped by a fundamental evolution from spatial perception to spatial intelligence. This is underpinned by its proprietary Eocene SPAD-SoC architecture that sets a new benchmark for image-grade 3D perception and anchors its physical-AI ambitions.

- **RoboSense's AC-series active cameras fuse high-resolution imaging with onboard AI processing,** delivering superior object detection for next-generation ADAS. Their seamless integration with LiDAR systems creates a comprehensive perception stack, accelerating OEM adoption. With design wins across major automakers and a scalable, cost-optimised architecture, the AC-series positions RoboSense for capturing explosive growth in the smart vehicle sensor market. The Active Camera 2 (AC2) launched in 2025 is the industry's first direct time-of-flight + RGB + IMU fusion sensor, which can replace forward-facing perception cameras in vehicles and RGB-D cameras in robots. AC2 and the Papert 2.0 dexterous hand enable RoboSense to offer eye-hand coordination systems for robots.
- **A new RGB-D fusion sensor planned for end-27** will combine this high-density spatial data with colour information, enabling colour-enriched 3D perception. It is a future sensor based on the newly-announced Peacock SPAD-SoC chipset.

This SPAD-SoC and RGBD trajectory positions RoboSense for capturing demand across the physical-AI value chain – from high-resolution spatial data acquisition to fused perception – enlarging its addressable market by 10 times to over US$100b by 2030. Already, that physical-AI opportunity is materialising in robotics, which has emerged as a high-margin second growth engine.

LiDAR Products

Series Name	Model Name	Type	Technology	Chips/ SoCs	Max Range/ Reflectivity	Number of Lines	FOV (H x V)	Resolution (H x V)	Point Rate (pts/s)	Price	Application Scenario
M Platform	M1	Forward ADAS LiDAR	MEMS Solid-State	n.a.	150 metres @ 10%; 200m (Max)	125	120° x 25°	Avg: 0.2° x 0.2°	750k (Single Return)	Rmb2,000	L2/L3 ADAS, L5 Driverless Autonomous Driving
	M2	Forward ADAS LiDAR	MEMS Solid-State	2D Scanning Chip (AEC-Q100 Certified)	200 metres @ 10%; 250m (Max)	n.a. (Point Rate-based)	n.a.	Avg: 0.1° x 0.1°	1.575m (Single Return)	Rmb1,600	L3+ ADAS, Seamless Upgrade from M1
	MX	Forward ADAS LiDAR	MEMS Solid-State	In-house SoC M-Core	200 metres (Max)	126 (ROI equivalent: 251)	120° x 25°	Best: 0.1° x 0.1°	n.a.	Rmb1,000-1,500	Cost-effective L2/L3, Mass Adoption
EM Platform	EM4	Forward ADAS LiDAR	Digital LiDAR	SPAD-SoC, 940nm VCSEL	300 metres @ 10%; 600m (Max)	1080 (configurable: 520-2160	120° x 27°	Up to 0.05° x 0.025°	25.92m (Single Return)	>Rmb5,000	High-level ADAS, L4 Robotaxi
	EMX	Forward ADAS LiDAR	Digital LiDAR	SPAD-SoC, VCSEL	300 metres (Max)	192	120° x 25° (Max: 140° H)	0.08° x 0.1° (Global)	2.88m	Rmb1,500-2,000	High-level ADAS, L3 ADAS
R Platform	Airy	Robotics LiDAR	Digital LiDAR (Hemispherical)	VCSEL, SPAD-SoC	30 metres @ 10% 120m (Diameter Coverage)	192 / 96	360° x 90° (Hemispherical)	n.a.	1.72m (192-beam)	c. Rmb4,000	Robotics: AGVs, AMRs, Quadrupedal Robots, Service Robots
	Airy Lite	Robotics LiDAR	Digital LiDAR	VCSEL, SPAD-SoC	40 metres @ 10%; 60 metres (Max)	24 (channels)	360° x 45°	0.6° x 1.96°	144k (Single Return)	Rmb4,700	Robotics: AMRs, AGVs, delivery robots, cleaning robots, quadrupeds
	Fairy	Robotics LiDAR	Digital LiDAR	VCSEL, SPAD-SoC	150 metres (Max)	96 / 48	360° x 32°	0.25° x 0.33°	1.37m (96-beam)	>Rmb10,000	Robotics: Handheld Mapping, Drones, Mobile Robots
E Platform	E1	Blind-spot ADAS LiDAR	Fully Solid-State (Flash)	SPAD-SoC, 2D VCSEL	30 metres @ 10%; 120m (Max)	n.a. (Flash-based)	120° x 90°	n.a.	n.a.	Rmb900-1,000	Blind Spot Coverage, L2/L3 ADAS
Helios Series	Helios 16	Robotics LiDAR	360° Mechanical Spinning	n.a.	90 metres @ 10%; 150m (Max)	16	360° x 30°	0.2°/0.4° x 2°	288k (Single Return)	US$2,000-3,000	Robots, Intelligent Vehicle, V2X
Helios Series	Helios 32	Robotics LiDAR	360° Mechanical Spinning	n.a.	80 metres @ 10%; 150m (Max)	32	360° x 70°	Up to 0.2°/0.4° x Up to 1.33°	576k (Single Return)	Higher than Helios 16	Robots, Autonomous Vehicles, V2R, Mapping
Bpearl	RS-Bpearl	Robotics LiDAR (Blind-spot)	360° Mechanical Spinning	n.a.	30 metres @ 10%	32	360° x 90°	n.a.	n.a.	Rmb4,800	Short-Range Blind-spot Detection for Unmanned Logistics, Robotaxis, Drones
Ruby Series	Ruby Plus	Robotics LiDAR	360° Mechanical Spinning	n.a.	240 metres @ 10%; 250 metres (Max)	128	360° x 40°	Up to 0.1° x 0.1°	2.304m (Single, Balanced)	Rmb135,000	Robotaxis, Robotruck, Autonomous Street Sweeper/Logics Vehicle

Source: UOB Kay Hian

CUSTOMERS

- **The company's ADAS LiDAR customers are auto OEMs, while robotics LiDAR customers include robotaxi companies, robotic lawn mower manufacturers, and humanoid robot producers.**
  - **ADAS segment.** RoboSense's order backlog and ADAS adoption momentum are accelerating dramatically, with 56 SOP or ramping models for 13 top-tier OEMs, 23 overseas/JV models, and 144 cumulative design wins. Recent wins include two major new-power and global SUV/pickup leaders, plus multi-hundred-thousand-unit overseas orders from SAIC Audi, FAW Toyota, and European/Japanese JVs.
  - **Robotics LiDAR segment.** The segment is building a similarly powerful backlog, with over 30 SOP'd or ramping autonomous mobility platforms, 18 overseas projects, and cumulative 68 design wins across robotaxi, delivery robots and industrial automation. Recent robotics wins include multi-thousand-unit orders from top-tier robotaxi operators and logistics leaders, reinforcing demand visibility.
    - **Robotaxis.** RoboSense is the leader in customer adoption among robotaxi companies, with its solid-state LiDAR solutions adopted by over 90% of robotaxi industry leaders like Didi and Pony.ai. It also has a near-monopoly in the niche L4 blind-spot LiDAR market with its E1 product, achieving a market share close to 100%.
    - **Robotic lawn mowers.** RoboSense has extended its robotics leadership to the consumer domain, ranking no.1 globally for 2025 3D LiDAR sales volume in robotic lawn mowers. It has established deep partnerships with global leaders such as Mammotion, Segway Navimow, and Roborock. The partnership with Mammotion was anchored by a 1.2m-unit order spanning three years – the single largest order in the history of the robotic lawn mower segment.
    - In 2025, RoboSense's robotics LiDAR shipments exceeded 303,000 units, growing over 11 times yoy, and by 1Q26, its robotics revenue surpassed automotive revenue for the first time, accounting for more than 50% of total revenue. These contracted volumes provide a durable, high-growth revenue stream that diversifies the top-line beyond passenger-vehicle cyclicality.
    - **Humanoid robot companies.** RoboSense partners nearly 50 top-tier humanoid and quadruped robotics players, including Unitree, Agibot, Galbot, ENGINEAI, and Dobot, and ranked no.1 in global humanoid robot LiDAR sales in 2025. Key milestones include the delivery of its 1 millionth LiDAR unit (E1R) to Humanoid Robot (Shanghai) Co for integration into the full-size humanoid robot Qinglong. RoboSense also supports Youibot's industrial humanoid robot Xifeng with its Airy digital LiDAR, and Pudu Robotics' humanoid robot PUDU D7 with two Airy units.

PRODUCTION BASES

The company's Mars Intelligent Manufacturing Base (Shenzhen area) boasts around 48,000 m² and a 95% automation rate. It supports LiDAR + robotics production, and its capacity is scaled for over 1m units p.a.

R&D CENTRES

- Domestic: Shenzhen (headquarters & core algorithm/chip), Shanghai, Suzhou (all fully operational).
- Overseas: Stuttgart (Germany), Detroit & Silicon Valley (USA) – sales/support, no manufacturing.

EMPLOYEES

- Employee numbers: Around 1,626 employees as of Dec 25; vast majority in Mainland China.
- Breakdown (approximate from disclosures): R&D about 60%, manufacturing/quality around 25%, sales/marketing/admin approximately 15%. Most hold bachelor's or higher degrees.

MAJOR SHAREHOLDERS

The largest shareholder of RoboSense is TMF Group Holding B.V., the holding company held by the founders and key management of the company, Dr Qiu Chunxin, Dr Zhu Xiaorui and Mr Liu Letian.

- TMF Group Holding B.V. – 21.04%
  - Dr Qiu Chunxin – 10.19%
  - Dr Zhu Xiaorui – 6.11%
  - Other founder Employee Stock Ownership Plan (ESOP) vehicles (Dr Qiu Chunxin and Mr Liu Letian) – 3.74%
  - Additional management incentive trusts (key executives) – 0.96%
- Alibaba Group Holding – 4.85%
- Beijing Cainiao Network Technology – 4.73%
- Huaxing Growth Capital – 4.03%
- China Renaissance Partners – 3.93%

Key Management Profile

Name	Age	Title	Year of joining the company	Education and professional background	Responsibilities
Dr Qiu Chunxin	41	Executive Chairman, Chief Scientist, Co-founder	2014	- PhD in Control Science and Engineering, Harbin Institute of Technology - Founded RoboSense in 2014 based on his PhD research insights. - Led the company's technical vision from its inception, pioneering work in MEMS solid-state LiDAR	Overall strategy, LiDAR R&D, chip technology
Mr Qiu Chunchao	36	CEO, Executive Director	2018		Day-to-day operations, sales, execution
Mr Liu Letian	37	Co-founder, CTO, Executive Director	2014	- PhD, Harbin Institute of Technology; he was a PhD peer of Qiu Chunxin	As CTO, he has been responsible for leading the technical development and engineering of RoboSense's LiDAR products

Source: RoboSense

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