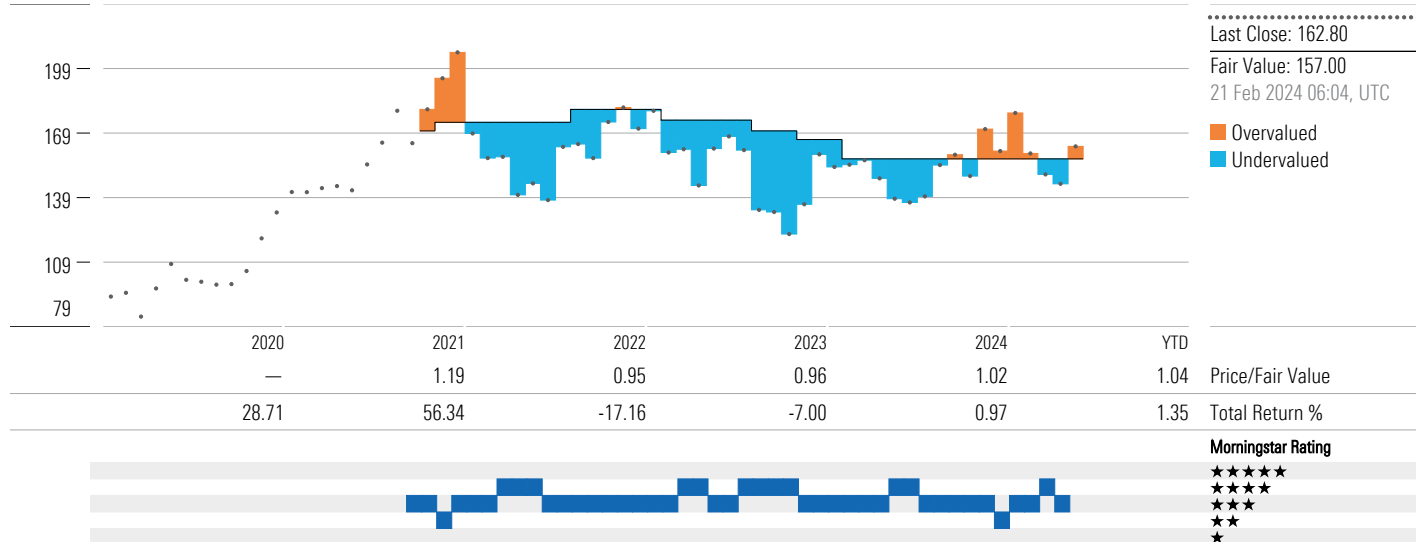


Keysight Technologies Inc KEYS ★★★ 20 May 2025 21:41, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
162.80 USD	157.00 USD	1.04	28.13 USD Bil	Wide	Mid Blend	Medium	Standard	
20 May 2025	21 Feb 2024 06:04, UTC		20 May 2025					7 May 2025 05:00, UTC

Price vs. Fair Value



Total Return % as of 20 May 2025. Last Close as of 20 May 2025. Fair Value as of 21 Feb 2024 06:04. UTC.

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Research Methodology for Valuing Companies

Important Disclosure

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The primary analyst covering this company does not own its stock.

The ESG Risk Rating Assessment is a representation of Sustainalytics' ESG Risk Rating.

Keysight Earnings: Demand Is Trending Positive and Updated Fiscal 2025 Outlook Matches Our Model

Analyst Note William Kerwin, CFA, Senior Equity Analyst, 21 May 2025

Keysight Technologies' April quarter results beat management guidance, highlighted by revenue rising 7% year over year to \$1.31 billion. July quarter guidance calls for modest sequential revenue growth, and management raised its fiscal 2025 revenue growth guidance to 6%, from 5%.

Why it matters: We like the demand for Keysight. After a 9% revenue decline in fiscal 2024, we believe the firm is back to healthy and durable levels of growth. Keysight's orders exceeded revenue in the quarter, which we find a positive indicator to continuing growth.

- ▶ Artificial intelligence continues to drive growth for Keysight's data center and chip-testing businesses, helping to offset softer demand for wireless network and automotive testing. We expect these currently softer markets to rebound to growth in fiscal 2026.
- ▶ Management quantified its gross tariff impact at about \$100 million annually, which equates to close to a 200-basis-point gross margin headwind, but expects to fully mitigate this cost by the end of fiscal 2025. We like minimal China manufacturing exposure for Keysight in this environment.

The bottom line: We are maintaining our \$157 fair value estimate for wide-moat Keysight, and management's revised guidance is more in line with our model. Shares rose 5% after hours on the full-year guidance increase, and remain fairly valued.


- We continue to like Keysight's comprehensive portfolio for communications testing, and appreciate

Keysight Technologies Inc

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Sector	Industry
 Technology	Scientific & Technical Instruments

Business Description

Keysight Technologies is a leader in the field of testing and measurement, helping electronics OEMs and suppliers alike bring products to market to fit industry standards and specifications. Keysight specializes in the communications market, but also supplies into the government, automotive, industrial, and semiconductor manufacturing markets. Keysight's solutions include testing tools, analytical software, and services. The firm's stated objective is to reduce time to market and improve efficiency at its more than 30,000 customers.

its exposure to attractive secular trends like AI.

Coming up: Keysight expects to close on its acquisition of Spirent Communications in the July quarter, which is later than the expectation of the April quarter. We still expect the deal to close and to broaden Keysight's portfolio, particularly in network deployment.

► Keysight also expects its acquisitions of two smaller businesses from Ansys and Synopsys—both helping to add to the firm's chip design software portfolio—to close upon the closing of Synopsys' acquisition of Ansys.

Business Strategy & Outlook William Kerwin, CFA, Senior Equity Analyst, 20 Nov 2024

We think Keysight Technologies is the leader in communications testing and measurement solutions, and offers a vendor-agnostic way to invest in the rapidly growing 5G and high-speed networking markets. In our view, Keysight has the strongest and broadest communications testing capabilities in the market, inclusive of hardware, software, and services. We think a comprehensive portfolio allows Keysight to act as a strategic partner to its customers, enabling new designs and accelerating time to market for network operators, network equipment OEMs, device OEMs, and suppliers.

We believe that Keysight can reduce time to market for customers more than competitors as a result of its end-to-end portfolio of premium offerings. We think Keysight's leadership stems from its large investment in R&D that it focuses on the communications market. We also think hefty organic and inorganic investment has led to Keysight leading the market pivot toward software and credit its unmatched portfolio breadth for its top market share. We also contend that a broad portfolio that layers software and services on top of hardware embeds Keysight into customer workflows and entrenches customers in its ecosystem. A broad, sticky portfolio underpins our wide economic moat rating for the firm.

Keysight should continue to dominate the communications market, especially as its exposure weights more heavily into complex 5G and AI testing, in which it is already demonstrating proficiency. We forecast market share gains for Keysight and think greater complexity in 5G and AI networks will expand its wallet share at customers—both of which would result in continued outperformance of the underlying testing market. We expect the firm to continue shifting customers to subscription billing for its software and services and think it will complement continued organic investment with strategic M&A to further build out its software portfolio. We expect the growing mix of software and services to expand margins. Finally, we forecast Keysight to continue generating impressive cash flow and to send a large proportion of it back to shareholders.

Bulls Say William Kerwin, CFA, Senior Equity Analyst, 20 Nov 2024

- We think Keysight's large research and development budget has created a competitively advantaged

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Competitors

	Keysight Technologies Inc KEYS	Emerson Electric Co EMR	Teradyne Inc TER	Fortive Corp FTV
Economic Moat	Wide	Wide	Wide	Narrow
Currency	USD	USD	USD	USD
Fair Value	157.00 21 Feb 2024 06:04, UTC	111.00 5 Nov 2024 22:19, UTC	115.00 29 Apr 2025 17:26, UTC	87.00 1 May 2025 21:46, UTC
1-Star Price	211.95	172.05	178.25	117.45
5-Star Price	109.90	66.60	69.00	60.90
Assessment	Fairly Valued 20 May 2025	Fairly Valued 20 May 2025	Undervalued 20 May 2025	Undervalued 20 May 2025
Morningstar Rating	★★★ 20 May 2025 21:41, UTC	★★★ 20 May 2025 21:29, UTC	★★★★ 20 May 2025 21:30, UTC	★★★★ 20 May 2025 21:41, UTC
Analyst	William Kerwin, Senior Equity Analyst	Nicholas Lieb, Equity Analyst	William Kerwin, Senior Equity Analyst	Krzysztof Smalec, Equity Analyst
Capital Allocation	Standard	Standard	Standard	Exemplary
Price/Fair Value	1.04	1.06	0.71	0.83
Price/Sales	5.66	3.88	4.58	4.11
Price/Book	5.43	3.49	4.68	2.41
Price/Earning	46.51	20.72	24.27	31.00
Dividend Yield	0.00%	1.76%	0.59%	0.44%
Market Cap	28.13 Bil	66.37 Bil	13.06 Bil	24.45 Bil
52-Week Range	119.72 — 186.20	90.06 — 134.85	65.77 — 163.21	60.39 — 83.32
Investment Style	Mid Blend	Mid Blend	Mid Blend	Mid Blend

portfolio for communications testing that we don't expect other firms would be able to easily replicate.

- Keysight holds a majority share of the 5G testing market, which we think will elicit strong top-line growth and expand profitability over the next five years.
- We expect Keysight to convert over 100% of net income into free cash flow, and predict it to generate over \$1 billion in free cash flow annually over our forecast.

Bears Say William Kerwin, CFA, Senior Equity Analyst, 20 Nov 2024

- We think Keysight faces an uphill battle to disrupt an automotive testing market which we think is more fragmented and competitive.
- In our view, Keysight's reliance on M&A to build out its portfolio creates risk of stagnating growth if its target pipeline dries up, or of destroying value if it overpays for bolt-ons.
- Keysight's transition to a recurring revenue model for its software and services is still nascent, and we think the firm has a long way to go to increase the stickiness of its solutions.

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Economic Moat William Kerwin, CFA, Senior Equity Analyst, 21 Feb 2024

In our view, Keysight Technologies possesses a wide economic moat owing to intangible assets in the design of test and measurement equipment and software and switching costs for its portfolio of solutions. We think Keysight is a leader in testing and measurement, helping OEMs and all tiers of suppliers accelerate time to market for new products in the communications, aerospace and defense, automotive, industrial, and semiconductor markets. We don't expect any competitor to encroach on Keysight's leadership—especially in communications—and expect the firm to earn economic profits over the next 20 years as a result of its comprehensive portfolio that layers software and services over hardware.

Testing equipment is used by OEMs and suppliers during research and development and manufacturing to fine tune chips and devices to exact specifications. For example, Keysight manufactures millimeter wave transceivers and radio frequency emulators to test an RF chipset's ability to transceive signals amid a variety of interference environments and signal strengths. Oscilloscopes can analyze the amplitude and frequency of a 5G signal in testing out a base station's effectiveness. Similarly, Ethernet channel testing solutions enable suppliers to test the effectiveness of optical transceivers in data transfer and connectivity in a data center, connected car, or other application.

We believe Keysight is the leading player in the communications testing market, in part from being the only player to service the entire communications ecosystem. Keysight's portfolio addresses all layers of the communications stack, from the physical layer all the way through to the application software layer. We think having the most comprehensive communications testing portfolio in the marketplace makes Keysight a more efficient solution and gives it a leg up in acquiring new customers. Testing is an integral part of the development process, with engineers iterating designs in simulation software, testing different prototypes, and then implementing quality control in manufacturing. Each step introduces new variables to account for, and using multiple testing vendors across development can require calibrating equipment together and ensuring measurement differences aren't resulting from different equipment. By using Keysight tools and software at each step, engineers can remove variability between each step, saving critical development time and accelerating time to market. Keysight takes this one step further with its PathWave platform, which aggregates software analysis from each step of the development process into one place, reducing variability and iterations and simplifying the process for engineers. In one case study, NTT Docomo credits using a comprehensive Keysight solution for shortening development time for its 5G deployment at the Tokyo Olympics by at least 20% and going to market a full year faster than the competition. With a portfolio addressing all facets of communications and including software, Keysight stands out among its testing peers as a strategic partner. Rather than selling into a specific portion of a customer's development, Keysight can offer a complete strategy for reducing time to market that features its tools and software.

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We think unmatched portfolio breadth and leading capabilities have led to Keysight holding one of the top market shares overall in testing and measurement, a leading position in communications, and a dominant share of the 5G testing market. Management estimates that Keysight holds 25% of the overall testing and measurement market and estimates that 75% of 5G designs globally— between base stations and devices —have been developed using Keysight solutions.

We posit that Keysight’s advantage in communications testing and measurement stems from hefty investment in research and development and vertically integrated production. While some of its peers invest similar proportions of sales into R&D, Keysight exceeds all of them in size, so its total R&D investment in a given year nearly doubles that of the nearest competitor. We think large R&D investment has allowed Keysight to invest aggressively in software and be first to market with a platform like PathWave. Moreover, Keysight gains efficiency from partial vertical integration, with about 50% of manufacturing taking place in-house. The firm operates its own fab in Santa Rosa, California, which it co-locates with its R&D staff. This allows the firm to quickly take designs into production and troubleshoot, rather than waiting on a foundry partner with myriad other customers to serve. We think this improves R&D efficiency and allows Keysight to maintain its high organic investment while staying profitable. Among its peer group, Keysight is the only one in the top three of both R&D as a percentage of sales and operating margin. In our view, the ability to invest twice as much as competitors while maintaining top-tier operating profits gives us confidence in Keysight’s ability to maintain its innovation lead over the next 20 years.

We also think Keysight’s moat is bolstered by switching costs, stemming from an end-to-end solution set combining hardware, software, and services. Keysight’s solutions service the entire design cycle, from design and simulation all the way through to volume manufacturing and operation. We view Keysight as a one-stop-shop for customers and think this leads to switching costs as entire workflows get designed around Keysight’s solutions. Keysight’s comprehensive portfolio not only improves efficiency at customers but makes ripping its solutions out even harder—a customer would likely have to source from multiple suppliers if it chose to leave Keysight. For example, Keysight is the only testing player to supply electronic design automation (EDA) software for chips, which is typically a stand-alone market. Switching away from Keysight would likely require sourcing from multiple new testing suppliers and a new EDA supplier, too.

We also think that Keysight’s focus on selling into research and development versus manufacturing leads to stickier customer relationships. R&D relationships tend to be quite close — sales usually involve one engineer at a time. In our view, individual engineers exhibit stronger personal preference and stickiness than a company as a whole—once an engineer adopts Keysight into their workflow (and so long as it satisfies their needs), we think they’d be loath to learn an entirely new solution. Furthermore, selling early in development to R&D makes Keysight more likely to win manufacturing placements later

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in development. Manufacturing testing (quality control) is typically dual-sourced, but if a given supplier is used in R&D, it's likely to be used predominantly in manufacturing, further reducing variability between measurements. A second testing supplier would then be used as a check, ending in roughly a 70%/30% split for Keysight and the competitor, respectively.

We think Keysight entrenches customers even further by layering software on top of its solutions. It is our view that layering software on top of enterprise hardware creates an overall stickier combined solution that engrains itself deeper in customer workflows. Although all oscilloscopes, signal analyzers, and other testing hardware run on embedded software, Keysight has been pivoting to proprietary analytical software to optimize testing and measurement with its hardware. Keysight's applications save engineers time by automatically analyzing massive quantities of data—an oscilloscope can make 256 billion measurements per second—and Keysight's customers can aggregate all their data and subsequent analysis in its PathWave platform. Moreover, Keysight's applications are modifiable. A Keysight application engineer will help customize a program to fit an engineer's specific requirements at installation. We think an integral software approach with customization embeds Keysight's tools into customer workflows and makes cobbling together a replacement difficult. Customers would have to replace more than physical tools, and adapt entire workflows to new software—or face the prospect of not finding similar functionality from a new vendor.

Finally, we think the inclusion of services into customer contracts further augments Keysight's stickiness. We think services both elongate the average duration of contracts and further embed customers in the Keysight ecosystem. Keysight has 68 regional services centers globally and locates them near hubs of customers. Keysight's services vary in intensity. At a base level, Keysight customers utilize repair and calibration services annually or biannually—equipment needs to be calibrated for accurate measurements, similar to tuning a guitar or violin. Additionally, Keysight application engineers can work with customers to offer troubleshooting, usage guidance, and tweaking of software. For large customers, application engineers will even work on-site at a customer, integrating into the design team. In our view, services allow a customer to use their solutions for longer and create a stickier overall solution as software and workflows become customized to having Keysight as an on-demand partner. We think deep partnership and services has led to long customer relationships—sometimes lasting decades.

We think Keysight's sticky portfolio has led to a strong base of high-margin recurring revenue that we think will enable it to continue earning excess returns on invested capital. According to management, adding services to a contract can double the gross margin of a deal—and come at little additional cost to the firm. We credit growing software and services sales for helping to expand gross margins since Keysight's spinoff in 2014. Software and services now make up more than one third of Keysight's top line, and we expect this number to expand. In 5G applications, which we expect to become a significant portion of sales, software alone can make up 40% of a contract. Additionally, over two thirds of

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Keysight's engineers are now focused on software, and many of the firm's recent acquisitions have been software-centric—exhibiting a companywide pivot toward software. In our view, strong recurring revenue gives us confidence in Keysight's ability to retain customers in its ecosystem and in turn earn economic profits over a 20-year horizon.

Fair Value and Profit Drivers William Kerwin, CFA, Senior Equity Analyst, 20 Nov 2024

Our fair value estimate for Keysight Technologies is \$157 per share, which implies a fiscal 2025 adjusted price/ earnings ratio of 23 times and a fiscal 2025 enterprise value/sales ratio of 5 times.

After a 9% revenue decline in fiscal 2024, driven by postpandemic customer digestion and weaker end-market demand, we expect Keysight to return to top-line growth in fiscal 2025. We forecast more modest growth in fiscal 2025 before a more meaningful rebound in fiscal 2026. Long-term, we see mid-single-digit growth for Keysight. We anticipate the commercial communications market to continue driving results as Keysight's largest. Keysight acts as an integral partner to OEMs and suppliers for 5G network buildouts as well as data center investments, which we think will maintain medium-term demand. We also think the firm will slowly take share in the budding automotive market and expect this to continue being the fastest grower out of its electronic industrial segment. We forecast 6% growth for the commercial communications market at midcycle, 4% growth for the aerospace, defense, and government market, and high-single-digit growth for the electronic industrial segment at midcycle.

We expect a mix tilting toward software and services to expand non-GAAP gross margins from 65% in fiscal 2024 up to 66% in fiscal 2029. We also think gross margins will see a boost from a greater mix of 5G networks, as these deals can feature up to 40% software content. We also think operating margin will expand as the firm exerts operating leverage during recovering demand. We forecast R&D expenses to stay elevated but think the firm will benefit from scale on the SG&A line. All in, we predict non-GAAP operating margins to expand from a below-normal 26% in fiscal 2024 to 30% in fiscal 2029.

Risk and Uncertainty William Kerwin, CFA, Senior Equity Analyst, 22 Feb 2023

We assign Keysight Technologies a Medium Morningstar Uncertainty Rating. The firm is heavily exposed to the communications market, and we think any downturn or slowdown in this market would have an outsize effect on Keysight's results. Additionally, much of our forecast for the firm's top-line growth and profitability rests upon 5G network buildouts, and slower-than-expected adoption could hamper Keysight's growth and profitability. We also think Keysight faces risk from its mix shift toward software. We view Keysight as the leader among its peers in the transition but think the pivot offers an opportunity for a competitor to disrupt the market. If Keysight fails to maintain its leadership in software, its competitive position could weaken. In our view, Keysight's active M&A strategy poses another risk. We forecast a steady stream of tuck-in acquisitions for the company helping to pad growth and profitability. If the firm fails to make the right deals, or overpays for targets, it could hamper growth

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and destroy value. If Keysight’s inorganic strategy slows altogether, it could risk losing key additions to competitors and its competitive advantage could grow slimmer. Finally, we foresee minimal environmental, social, and governance, or ESG, risk for Keysight. The firm’s greatest material ESG issue (MEI) in our view is the risk of losing human capital to competitors, but we don’t see evidence of this happening and think a strong variable compensation program helps keep talent motivated to remain at the firm.

Capital Allocation William Kerwin, CFA, Senior Equity Analyst, 20 Nov 2024

We rate Keysight Technologies’ Capital Allocation as Standard, based on our assessment of a sound balance sheet, fair investments, and appropriate shareholder distributions. Keysight’s stated capital allocation priorities, in order, are organic investment, strategic mergers and acquisitions, and share repurchases. We think Keysight’s balance sheet is in sound position, with a net cash-neutral position and long-dated debt maturities. We also think Keysight’s investment strategy is fair. We approve of the firm’s focus on organic investment, specifically in research and development, which we think has allowed it to carve out a wide economic moat. We also think that Keysight’s M&A strategy has given it access into high-growth future markets, and has helped it to transition to a more integrated software approach. Finally, we think Keysight’s shareholder distributions are appropriate. The firm targets sending 50% of its free cash flow back to shareholders in the form of repurchases and has achieved this over the past five years. We also credit the firm for focusing on investment first, while using its heady free cash flow to send leftover cash to shareholders.

Analyst Notes Archive

Keysight: Booth at CES 2025 Builds Our Confidence in Long-Term Position for Automotive Testing

William Kerwin, CFA, Senior Equity Analyst, 9 Jan 2025

We visited Keysight Technologies' booth at CES 2025. Keysight exhibited several solutions for automotive testing, including for electric vehicles, charging infrastructure, and connected cars. Keysight's exhibits spanned research and development as well as manufacturing testing. Why it matters: Keysight's CES 2025 exhibits affirmed our belief that the firm is very well positioned for automotive testing. This adheres to our long-term thesis on the firm. We believe Keysight possesses the most comprehensive solution set for automotive testing and stands to benefit from increasing electronic content and greater connectivity in cars. We see many of Keysight's solutions as best-of-breed, including its ability to test both electronic hardware and software content in cars as well as radar testing and simulation for vehicle development. The bottom line: We maintain our \$157 fair value estimate for wide-moat Keysight and view the stock as fairly valued. Keysight's expansive portfolio is a key tenet of our wide moat rating. We like Keysight's strong mix toward research and development testing, which we see as stickier and a more reliable revenue stream. Long view: Rising adoption of advanced technologies in vehicles (like autonomy, higher voltage drivetrains, and connectivity) should

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directly translate to good revenue growth for Keysight's automotive business over the next five to 10 years. Keysight cited that the share of electronics as a part of a car's bill of materials has expanded to an average of 30% today, from 15% in the past. We believe this figure can rise toward 50% over the long term. We like that Keysight is positioned to capitalize on future trends in vehicles, including vehicle-to-grid charging, vehicle-to-vehicle connectivity for autonomous driving, and expanding charging infrastructure footprints.

Keysight Earnings: We Like the Growth Outlook for Fiscal 2025 and See Shares as Fairly Valued

William Kerwin, CFA, Senior Equity Analyst, 20 Nov 2024

We retain our \$157 per share fair value estimate for wide-moat Keysight Technologies with our long-term thesis intact after good October-quarter results. Keysight's revenue declined in fiscal 2024 behind weaker end-market demand, but we expect a return to mid-single-digit growth in fiscal 2025 and beyond. Management's growth outlook for fiscal 2025 was a little light compared with our model, but we view a return to growth positively nonetheless. We expect demand to remain mixed across Keysight's end markets in 2025, with strength in wired data center connectivity offset by softer demand for wireless telecom spending and electric vehicle investment. Keysight looks fairly valued to us. Shares rose nearly 10% in after-hours trading on guidance that beat FactSet consensus, but was more in line with our own model. October-quarter revenue declined 2% year over year but rose 6% sequentially to \$1.29 billion, reflecting the green shoots of a recovery from weaker end-market demand for Keysight. Commercial communications continues to benefit from data center and artificial intelligence investment, generating growth despite weaker orders from wireless customers. Keysight's wired communications orders rose more than 10% in fiscal 2024, which bodes well for future growth, in our view. Demand remained weaker in the electronic industrial segment, where Keysight has exposure to electric vehicles, which have seen softer adoption in 2024. We think all of the firm's end markets can grow in fiscal 2025, but we believe communications revenue will outperform industrial revenue. Keysight's January-quarter revenue guidance met our model, and management added guidance for 5% revenue growth and 10% earnings growth in fiscal 2025. We were pleased to get positive fiscal 2025 guidance, even if it was a shade weaker than our expectations. We believe Keysight can see a gradual recovery in its weaker end markets over the next year, and should be set up for slightly stronger growth in fiscal 2026.

Keysight Earnings: Market Is Coming Around to Our Recovery Thesis and Shares Are Fairly Valued

William Kerwin, CFA, Senior Equity Analyst, 20 Aug 2024

We maintain our \$157 fair value estimate for shares of wide-moat Keysight Technologies with our medium-term recovery thesis intact. Keysight's fiscal third quarter results and fiscal fourth quarter guidance beat our model, and we see both indicating the green shoots of a demand recovery. Keysight has seen weak results in fiscal 2024 stemming from slower orders from communications and industrial customers. We see this downturn as short-term and market-driven. We continue to like the firm's

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position for long-term growth as the best-of-breed provider of communications testing equipment, which also underpins our wide moat rating. Shares jumped 10% after hours on positive results and guidance, coming right up to our fair value estimate. July quarter sales of \$1.22 billion were flat sequentially and down 12% year over year. We see results positively and believe the company is set for a return to sequential growth, despite the year-over-year decline that shows the ongoing weak demand in fiscal 2024. Specifically, Keysight's orders rose both year over year and sequentially, which we believe is a positive leading indicator to future revenue growth. In fiscal 2024, wired communications testing sales serving data center customers and artificial intelligence buildouts have helped offset weaker wireless and industrial testing demand. We expect wired data center strength to continue and for demand to gradually come back for the wireless side of the business over the next year. October quarter guidance was positive and above our model. At the midpoint, sales of \$1.26 billion imply 3% sequential growth. Positive guidance gives us confidence in our longer-term recovery thesis for the firm. We model near-term sequential revenue growth, with a return to high-single-digit revenue growth in fiscal 2025 and fiscal 2026. We expect growth in the next couple of quarters to be driven by the communications testing side of the business, with industrial demand picking back up in fiscal 2025.

Keysight Earnings: Softer Demand Continues, and We Maintain Our Long-Term Thesis William Kerwin, CFA, Senior Equity Analyst, 21 May 2024

We maintain our \$157 fair value estimate for shares of wide-moat Keysight Technologies as we believe our long-term thesis is intact after the firm reported fiscal second-quarter results. Keysight continues to see weaker demand across its served markets, led by commercial communications. We expect soft results through the fiscal year and a multiyear rebound across fiscal 2025 and 2026. Fiscal second-quarter results were slightly above our expectations, while fiscal third-quarter guidance was modestly below our model. Overall, our view on Keysight's longer-term opportunity is unchanged. We continue to see the firm as well-positioned with a comprehensive communications testing portfolio and good adjacent opportunities in cars and semiconductors. We see shares as fairly valued. April-quarter sales declined 13% year over year and 3% sequentially to \$1.22 billion, above the top end of management guidance. Every reported end-market declined double digits year over year. Communications customers generally spend less after surging investment in prior years, specifically in wireless networks. Keysight's chip market exposure has also been soft, with lower manufacturing and testing utilization rates directly relating to weaker revenue. On the bright side, orders were better than revenue, which we see as a leading indicator of future growth. Non-GAAP operating margin came down in line with lower sales, declining over 600 basis points year over year to 24%. July-quarter guidance lightly missed our model, but Keysight maintained its full-year guide. At the midpoint, sales of \$1.19 billion imply a 2% sequential decline from the April quarter. Keysight's guidance for \$4.9 billion in revenue for fiscal 2024 implies mid-single-digit sequential growth in the October quarter, which we see positively. We expect soft demand to weigh on results through 2024 but for orders to pick up and generate growth in fiscal 2025.

Keysight Technologies Inc KEYS ★★★ 20 May 2025 21:41, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
162.80 USD 20 May 2025	157.00 USD 21 Feb 2024 06:04, UTC	1.04	28.13 USD Bil 20 May 2025	Wide	Mid Blend	Medium	Standard	 7 May 2025 05:00, UTC

Keysight Earnings: We Trim Our Short-Term Forecast and Valuation and See Shares Fairly Valued

William Kerwin, CFA, Senior Equity Analyst, 21 Feb 2024

We trim our fair value estimate for shares of wide-moat Keysight Technologies to \$157 per share, from \$166, to reflect a softer short-term environment than we'd previously modeled. Keysight's results came in above the top end of management guidance, but fiscal second-quarter guidance just missed our model, and management's outlook for the fiscal second half was below our forecast. Keysight continues to face softer customer spending, particularly in its wireless communications and industrial markets. We still like the firm's relatively stronger demand in aerospace, defense, and government customers, and it's seeing some upside in data center spending from artificial intelligence, or AI. We continue to expect stronger long-term results from Keysight and appreciate its moaty, comprehensive portfolio for communications testing. Shares slid commensurate to our fair value trim after the results were reported, and we see the stock as fairly valued. January-quarter sales declined 9% year over year and 4% sequentially to \$1.26 billion. Keysight's weaker results have been broad-based, but we see the most acute weakness in commercial communications, which dropped 14% year over year. We believe sales declines are arising from customers pushing out investments that we expect to accrue to revenue in later quarters. April-quarter guidance was modestly below our model, but management's outlook for the fiscal second half was further below our expectations. April-quarter sales guidance of \$1.2 billion at the midpoint would be a 5% sequential decline. Keysight continues to see a stronger second half to the fiscal year, but only modestly. We'd been expecting a better recovery in the short term. We continue to expect orders to return to growth in the back half of fiscal 2024, enabling growth in fiscal 2025. Our expectations for Keysight's overall demand recovery have now been pushed out by a few quarters.

Keysight Earnings: We Expect Ongoing Softness Ahead but Continue to See Long-Term Upside

William Kerwin, CFA, Senior Equity Analyst, 21 Nov 2023

We modestly trim our fair value estimate for shares of wide-moat Keysight Technologies to \$166, from \$170, to reflect lowered expectations for fiscal 2024. We reiterate our confidence in Keysight for the long term, and its ability to rebound from current soft end-market demand. In the fiscal fourth quarter, Keysight saw a continuation of the weak spending environment for telecom customers that has hamstrung orders across fiscal 2023. The firm is now encountering additional weakness out of its consumer and semiconductor end markets, particularly in China, which leads us to taper our short-term forecasts. We now expect a low-single-digit sales decline in fiscal 2024, driven entirely by weaker end markets. We continue to forecast an inflection back to healthy growth for the firm in fiscal 2025 and forecast longer-term growth driven by wireless network, broadband, and data center buildouts and supplemented by artificial intelligence. We believe Keysight will gain share in communications testing with unmatched portfolio breadth and depth, which also underpins its wide moat rating. We see shares as undervalued. October quarter sales dropped 9% year over year and 5% sequentially to \$1.31 billion, at

Keysight Technologies Inc

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20 May 2025 21:41, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
162.80 USD	157.00 USD	1.04	28.13 USD Bil	Wide	Mid Blend	Medium	Standard	
20 May 2025	21 Feb 2024 06:04, UTC		20 May 2025					7 May 2025 05:00, UTC

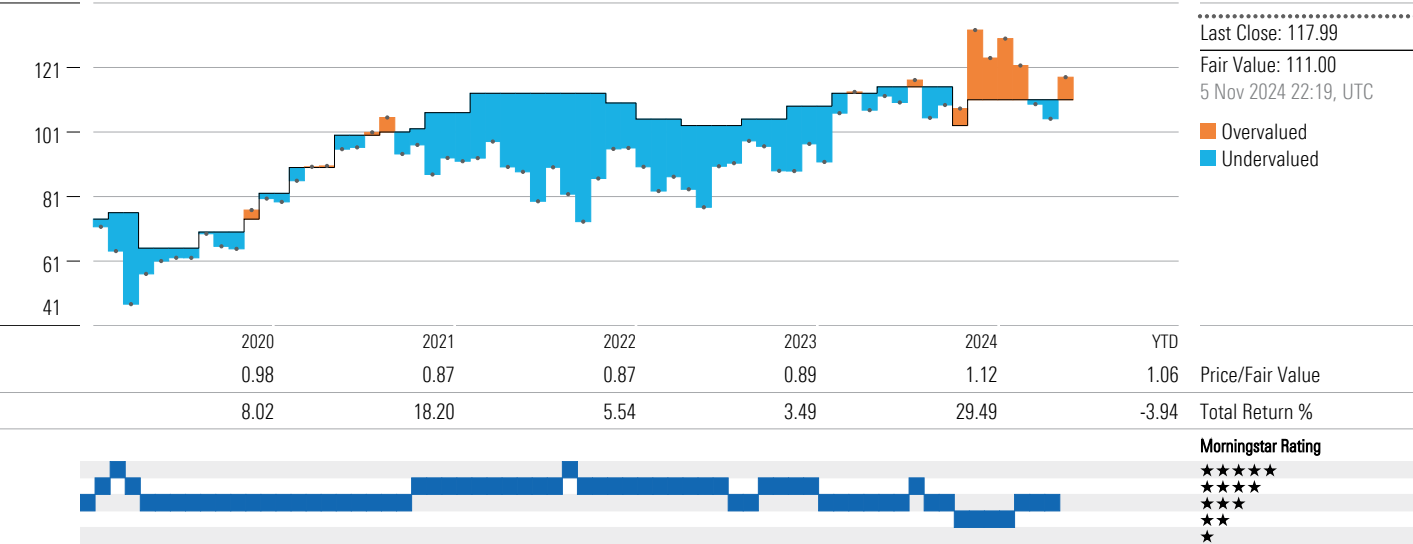
the high end of management guidance. Commercial communications continued its decline dropping 17% year over year and 7% sequentially. This end market declined 7% in fiscal 2023 for Keysight, led largely by weaker spending at data center and wireless customers that we see as broad-based and not specific to Keysight. This was the first quarter of weakness for the electronic and industrial segment, or EISG, which dipped 7% year over year. EISG had served as an offset to communications weakness over fiscal 2023 with midteens growth in the past three quarters, but is seeing weaker spending in China, where Keysight has consumer and semiconductor manufacturing exposure. ■■

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Keysight Technologies Inc KEYS ★★★ 20 May 2025 21:41, UTC

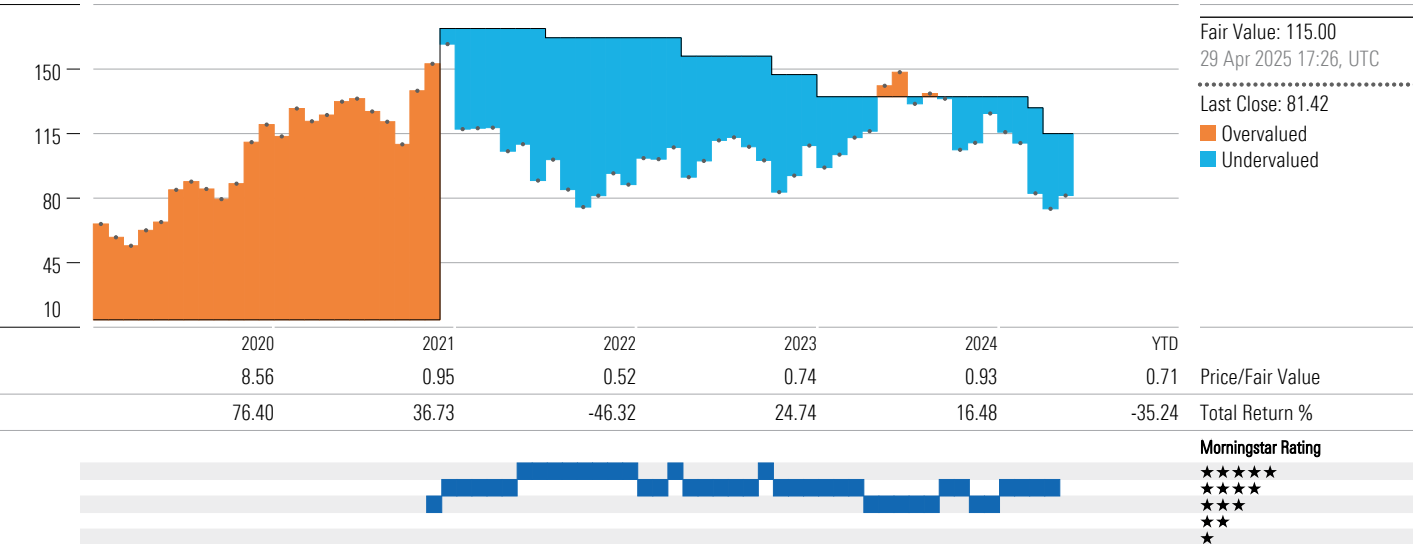
Competitors Price vs. Fair Value

Emerson Electric Co EMR



Total Return % as of 20 May 2025. Last Close as of 20 May 2025. Fair Value as of 5 Nov 2024 22:19, UTC.

Teradyne Inc TER



Total Return % as of 20 May 2025. Last Close as of 20 May 2025. Fair Value as of 29 Apr 2025 17:26, UTC.

Keysight Technologies Inc

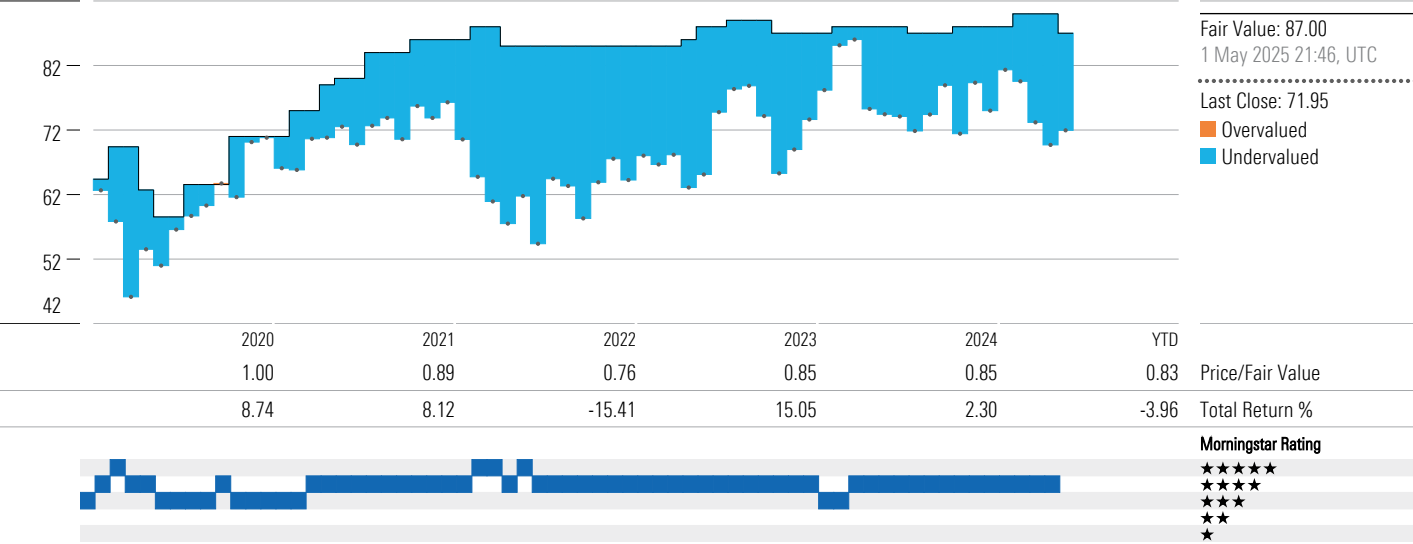
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20 May 2025 21:41, UTC

Competitors Price vs. Fair Value

Fortive Corp



Total Return % as of 20 May 2025. Last Close as of 20 May 2025. Fair Value as of 1 May 2025 21:46, UTC.

Keysight Technologies Inc KEYS ★★★

20 May 2025 21:41, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
162.80 USD 20 May 2025	157.00 USD 21 Feb 2024 06:04, UTC	1.04	28.13 USD Bil 20 May 2025	Wide	Mid Blend	Medium	Standard	 7 May 2025 05:00, UTC

Morningstar Valuation Model Summary

Financials as of 25 Feb 2025

Fiscal Year, ends 31 Oct	Actual			Forecast				
	2022	2023	2024	2025	2026	2027	2028	2029
Revenue (USD Mil)	5,420	5,464	4,979	5,265	5,649	6,063	6,399	6,755
Operating Income (USD Mil)	1,326	1,343	819	826	1,070	1,298	1,453	1,609
EBITDA (USD Mil)	1,557	1,570	1,103	1,103	1,344	1,570	1,730	1,887
Adjusted EBITDA (USD Mil)	1,809	1,861	1,548	1,590	1,826	2,063	2,236	2,409
Net Income (USD Mil)	1,124	1,057	614	734	942	1,158	1,291	1,423
Adjusted Net Income (USD Mil)	1,388	1,488	1,096	1,215	1,413	1,640	1,785	1,934
Free Cash Flow To The Firm (USD Mil)	860	887	-121	-586	818	897	999	1,117
Weighted Average Diluted Shares Outstanding (Mil)	182	179	175	172	169	166	162	159
Earnings Per Share (Diluted) (USD)	6.18	5.91	3.51	4.26	5.56	6.99	7.95	8.95
Adjusted Earnings Per Share (Diluted) (USD)	7.63	8.31	6.26	7.06	8.35	9.89	11.00	12.17
Dividends Per Share (USD)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Margins & Returns as of 25 Feb 2025

	3 Year Avg	Actual			Forecast					5 Year Avg
		2022	2023	2024	2025	2026	2027	2028	2029	
Operating Margin %	22.1	24.5	24.6	16.5	15.7	19.0	21.4	22.7	23.8	20.8
EBITDA Margin %	—	28.7	28.7	22.2	21.0	23.8	25.9	27.0	27.9	—
Adjusted EBITDA Margin %	—	33.4	34.1	31.1	30.2	32.3	34.0	34.9	35.7	33.4
Net Margin %	17.4	20.7	19.3	12.3	13.9	16.7	19.1	20.2	21.1	18.2
Adjusted Net Margin %	25.0	25.6	27.2	22.0	23.1	25.0	27.1	27.9	28.6	26.3
Free Cash Flow To The Firm Margin %	9.9	15.9	16.2	-2.4	-11.1	14.5	14.8	15.6	16.5	10.1

Growth & Ratios as of 25 Feb 2025

	3 Year CAGR	Actual			Forecast					2029 5 Year CAGR
		2022	2023	2024	2025	2026	2027	2028	2029	
Revenue Growth %	0.3	9.7	0.8	-8.9	5.8	7.3	7.3	5.6	5.6	6.3
Operating Income Growth %	-8.3	24.7	1.3	-39.0	0.9	29.5	21.3	12.0	10.7	14.5
EBITDA Growth %	-5.2	13.4	0.8	-29.8	0.0	21.8	16.9	10.2	9.0	11.6
Adjusted EBITDA Growth %	-2.5	8.4	2.9	-16.8	2.7	14.9	13.0	8.4	7.7	9.3
Earnings Per Share Growth %	-9.8	29.2	-4.4	-40.6	21.5	30.5	25.6	13.8	12.6	20.6
Adjusted Earnings Per Share Growth %	-9.8	22.5	9.0	-24.7	12.7	18.3	18.5	11.2	10.7	20.6

Valuation as of 25 Feb 2025

	Actual			Forecast				
	2022	2023	2024	2025	2026	2027	2028	2029
Price/Earning	22.8	14.7	23.8	23.1	19.5	16.5	14.8	13.4
Price/Sales	5.7	3.9	5.2	5.3	5.0	4.6	4.4	4.2
Price/Book	7.6	4.7	5.1	5.1	4.7	4.3	3.9	3.5
Price/Cash Flow	—	—	—	—	—	—	—	—
EV/EBITDA	17.3	11.2	16.9	17.7	15.4	13.6	12.6	11.7
EV/EBIT	23.6	15.5	31.9	34.0	26.2	21.6	19.3	17.5
Dividend Yield %	—	—	—	—	—	—	—	—
Dividend Payout %	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Free Cash Flow Yield %	—	—	—	—	—	—	—	—

Operating Performance / Profitability as of 25 Feb 2025

Fiscal Year, ends 31 Oct	Actual			Forecast				
	2022	2023	2024	2025	2026	2027	2028	2029
ROA %	13.9	12.2	6.6	7.1	8.8	10.9	11.4	12.2
ROE %	27.0	22.7	12.0	13.3	16.2	18.4	18.9	19.1
ROIC %	17.3	16.1	9.4	8.7	9.7	11.3	12.1	12.7

Keysight Technologies Inc **KEYS** ★★★

20 May 2025 21:41, UTC

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Financial Leverage (Reporting Currency)	Actual			Forecast				
	2022	2023	2024	2025	2026	2027	2028	2029
Fiscal Year, ends 31 Oct								
Debt/Capital %	6.1	8.6	7.3	7.4	6.9	4.6	4.4	2.9
Assets/Equity	1.9	1.9	1.8	1.9	1.8	1.7	1.7	1.6
Net Debt/EBITDA	0.0	-0.3	0.2	0.8	0.5	0.3	0.1	-0.1
Total Debt/EBITDA	1.1	1.1	1.3	1.4	1.3	0.8	0.7	0.5
EBITDA/ Net Interest Expense	36.9	1,861.0	-48.4	-93.5	-102.7	-45.8	-49.7	-53.5

Forecast Revisions as of 25 Feb 2025			2025		2026		2027	
Prior data as of 20 Nov 2024			Current	Prior	Current	Prior	Current	Prior
Fair Value Estimate Change (Trading Currency)			157.00	156.89	—	—	—	—
Revenue (USD Mil)			5,265	4,979	5,649	5,262	6,063	5,646
Operating Income (USD Mil)			826	819	1,070	903	1,298	1,125
EBITDA (USD Mil)			1,590	1,548	1,826	1,575	2,063	1,772
Net Income (USD Mil)			1,215	1,096	1,413	1,183	1,640	1,349
Earnings Per Share (Diluted) (USD)			4.26	3.51	5.56	4.78	6.99	5.96
Adjusted Earnings Per Share (Diluted) (USD)			7.06	6.26	8.35	6.87	9.89	7.97
Dividends Per Share (USD)			0.00	0.00	0.00	0.00	0.00	0.00

Key Valuation Drivers as of 25 Feb 2025

Cost of Equity %	9.0
Pre-Tax Cost of Debt %	5.5
Weighted Average Cost of Capital %	8.7
Long-Run Tax Rate %	15.0
Stage II EBI Growth Rate %	10.0
Stage II Investment Rate %	40.0
Perpetuity Year	20

Additional estimates and scenarios available for download at <https://pitchbook.com/>.

Discounted Cash Flow Valuation as of 25 Feb 2025

	USD Mil
Present Value Stage I	1,975
Present Value Stage II	9,598
Present Value Stage III	14,577
Total Firm Value	26,149
Cash and Equivalents	1,796
Debt	1,790
Other Adjustments	0
Equity Value	26,155
Projected Diluted Shares	171
Fair Value per Share (USD)	157.00

Keysight Technologies Inc

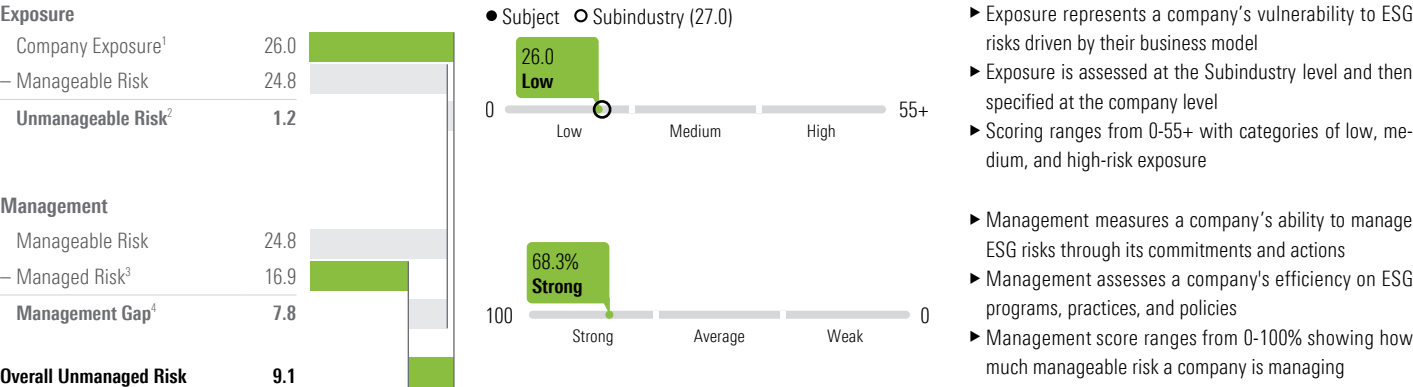
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20 May 2025 21:41, UTC

Last Price	Fair Value Estimate	Price/FVE	Market Cap	Economic Moat™	Equity Style Box	Uncertainty	Capital Allocation	ESG Risk Rating Assessment¹
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20 May 2025	21 Feb 2024 06:04, UTC		20 May 2025					7 May 2025 05:00, UTC

ESG Risk Rating Breakdown



ESG Risk Rating



ESG Risk Ratings measure the degree to which a company’s value is impacted by environmental, social, and governance risks, by evaluating the company’s ability to manage the ESG risks it faces.

1. A company’s Exposure to material ESG issues 2. Unmanageable Risk refers to risks that are inherent to a particular business model that cannot be managed by programs or initiatives 3. Managed Risk = Manageable Risk multiplied by a Management score of 68.3% 4. Management Gap assesses risks that are not managed, but are considered manageable 5. ESG Risk Rating Assessment = Overall Unmanaged Risk = Management Gap plus Unmanageable Risk

ESG Risk Rating Assessment⁵



Peer Analysis 07 May 2025

Company Name	Exposure		Management		ESG Risk Rating	
Keysight Technologies Inc	26.0 Low	0 —●— 55+	68.3 Strong	100 —●— 0	9.1 Negligible	0 —●— 40+
Emerson Electric Co	46.7 Medium	0 —●— 55+	53.4 Strong	100 —●— 0	22.8 Medium	0 —●— 40+
Intuit Inc	30.2 Low	0 —●— 55+	59.5 Strong	100 —●— 0	13.4 Low	0 —●— 40+
Teradyne Inc	32.1 Low	0 —●— 55+	52.9 Strong	100 —●— 0	16.1 Low	0 —●— 40+
Fortive Corp	55.7 High	0 —●— 55+	49.9 Average	100 —●— 0	30.6 High	0 —●— 40+

Appendix

Historical Morningstar Rating

Keysight Technologies Inc KEYS 20 May 2025 21:41, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	★★★	★★★★	★★★	★★★	★★
Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
★★★	★★★	★★★	★★★	★★★	★★★★	★★★★	★★★	★★★	★★★	★★★	★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★★	★★★★	★★★★	★★★★	★★★★	★★★	★★★	★★★★	★★★★	★★★	★★★	★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
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Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
★★	★★★	★★★	—	—	—	—	—	—	—	—	—
Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
—	—	—	—	—	—	—	—	—	—	—	—

Emerson Electric Co EMR 20 May 2025 21:29, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	★★★	★★★	★★★	★★	★★
Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
★★	★★	★★★	★★★	★★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★★★	★★★★	★★★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
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Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★★	★★★★★	★★★★	★★★

Teradyne Inc TER 20 May 2025 21:30, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	★★★★	★★★★	★★★★	★★★★	★★★
Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
★★★	★★★★	★★★★	★★★	★★★	★★★	★★★	★★★	★★★★	★★★★	★★★★	★★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★★★	★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★	★★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
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Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
★★★	—	—	—	—	—	—	—	—	—	—	—
Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
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Fortive Corp FTV 20 May 2025 21:41, UTC

Dec 2025	Nov 2025	Oct 2025	Sep 2025	Aug 2025	Jul 2025	Jun 2025	May 2025	Apr 2025	Mar 2025	Feb 2025	Jan 2025
—	—	—	—	—	—	—	★★★★	★★★★	★★★★	★★★★	★★★★
Dec 2024	Nov 2024	Oct 2024	Sep 2024	Aug 2024	Jul 2024	Jun 2024	May 2024	Apr 2024	Mar 2024	Feb 2024	Jan 2024
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★	★★★	★★★★
Dec 2023	Nov 2023	Oct 2023	Sep 2023	Aug 2023	Jul 2023	Jun 2023	May 2023	Apr 2023	Mar 2023	Feb 2023	Jan 2023
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Dec 2022	Nov 2022	Oct 2022	Sep 2022	Aug 2022	Jul 2022	Jun 2022	May 2022	Apr 2022	Mar 2022	Feb 2022	Jan 2022
★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★★	★★★★★	★★★★	★★★★
Dec 2021	Nov 2021	Oct 2021	Sep 2021	Aug 2021	Jul 2021	Jun 2021	May 2021	Apr 2021	Mar 2021	Feb 2021	Jan 2021
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Dec 2020	Nov 2020	Oct 2020	Sep 2020	Aug 2020	Jul 2020	Jun 2020	May 2020	Apr 2020	Mar 2020	Feb 2020	Jan 2020
★★★	★★★	★★★★	★★★	★★★	★★★	★★★	★★★★	★★★★	★★★★★	★★★★	★★★

Research Methodology for Valuing Companies

Overview

At the heart of our valuation system is a detailed projection of a company's future cash flows, resulting from our analysts' research. Analysts create custom industry and company assumptions to feed income statement, balance sheet, and capital investment assumptions into our globally standardized, proprietary discounted cash flow, or DCF, modeling templates. We use scenario analysis, in-depth competitive advantage analysis, and a variety of other analytical tools to augment this process. Moreover, we think analyzing valuation through discounted cash flows presents a better lens for viewing cyclical companies, high-growth firms, businesses with finite lives (e.g., mines), or companies expected to generate negative earnings over the next few years. That said, we don't dismiss multiples altogether but rather use them as supporting cross-checks for our DCF-based fair value estimates. We also acknowledge that DCF models offer their own challenges (including a potential proliferation of estimated inputs and the possibility that the method may miss short-term market-price movements), but we believe these negatives are mitigated by deep analysis and our long-term approach.

Morningstar's equity research group ("we," "our") believes that a company's intrinsic worth results from the future cash flows it can generate. The Morningstar Rating for stocks identifies stocks trading at a discount or premium to their intrinsic worth—or fair value estimate, in Morningstar terminology. Five-star stocks sell for the biggest risk adjusted discount to their fair values, whereas 1-star stocks trade at premiums to their intrinsic worth.

Four key components drive the Morningstar rating: (1) our assessment of the firm's economic moat, (2) our estimate of the stock's fair value, (3) our uncertainty around that fair value estimate and (4) the current market price. This process ultimately culminates in our singlepoint star rating.

1. Economic Moat

The concept of an economic moat plays a vital role not only in our qualitative assessment of a firm's long-term investment potential, but also in the actual calculation of our fair value estimates. An economic moat is a structural feature that allows a firm to sustain excess profits over a long period of time. We define economic profits as re-

turns on invested capital (or ROIC) over and above our estimate of a firm's cost of capital, or weighted average cost of capital (or WACC). Without a moat, profits are more susceptible to competition. We have identified five sources of economic moats: intangible assets, switching costs, network effect, cost advantage, and efficient scale.

Companies with a narrow moat are those we believe are more likely than not to achieve normalized excess returns for at least the next 10 years. Wide-moat companies are those in which we have very high confidence that excess returns will remain for 10 years, with excess returns more likely than not to remain for at least 20 years. The longer a firm generates economic profits, the higher its intrinsic value. We believe low-quality, no-moat companies will see their normalized returns gravitate toward the firm's cost of capital more quickly than companies with moats.

When considering a company's moat, we also assess whether there is a substantial threat of value destruction, stemming from risks related to ESG, industry disruption, financial health, or other idiosyncratic issues. In this context, a risk is considered potentially value destructive if its occurrence would eliminate a firm's economic profit on a cumulative or midcycle basis. If we deem the probability of occurrence sufficiently high, we would not characterize the company as possessing an economic moat.

2. Estimated Fair Value

Combining our analysts' financial forecasts with the firm's economic moat helps us assess how long returns on invested capital are likely to exceed the firm's cost of capital. Returns of firms with a wide economic moat rating are assumed to fade to the perpetuity period over a longer period of time than the returns of narrow-moat firms, and both will fade slower than no-moat firms, increasing our estimate of their intrinsic value.

Our model is divided into three distinct stages:

Stage I: Explicit Forecast

In this stage, which can last five to 10 years, analysts make full financial statement forecasts, including items such as revenue, profit margins, tax rates, changes in workingcapital accounts, and capital spending. Based on these projections, we calculate earnings before interest, after taxes (EBIT) and the net new investment (NNI) to de-

rive our annual free cash flow forecast.

Stage II: Fade

The second stage of our model is the period it will take the company's return on new invested capital—the return on capital of the next dollar invested ("RONIC")—to decline (or rise) to its cost of capital. During the Stage II period, we use a formula to approximate cash flows in lieu of explicitly modeling the income statement, balance sheet, and cash flow statement as we do in Stage I. The length of the second stage depends on the strength of the company's economic moat. We forecast this period to last anywhere from one year (for companies with no economic moat) to 10–15 years or more (for wide-moat companies). During this period, cash flows are forecast using four assumptions: an average growth rate for EBIT over the period, a normalized investment rate, average return on new invested capital (RONIC), and the number of years until perpetuity, when excess returns cease. The investment rate and return on new invested capital decline until a perpetuity value is calculated. In the case of firms that do not earn their cost of capital, we assume marginal ROICs rise to the firm's cost of capital (usually attributable to less reinvestment), and we may truncate the second stage.

Stage III: Perpetuity

Once a company's marginal ROIC hits its cost of capital, we calculate a continuing value, using a standard perpetuity formula. At perpetuity, we assume that any growth or decline or investment in the business neither creates nor destroys value and that any new investment provides a return in line with estimated WACC.

Because a dollar earned today is worth more than a dollar earned tomorrow, we discount our projections of cash flows in stages I, II, and III to arrive at a total present value of expected future cash flows. Because we are modeling free cash flow to the firm—representing cash available to provide a return to all capital providers—we discount future cash flows using the WACC, which is a weighted average of the costs of equity, debt, and preferred stock (and any other funding sources), using expected future proportionate long-term, market-value weights.

3. Uncertainty Around That Fair Value Estimate

Morningstar's Uncertainty Rating is designed to capture the range of potential outcomes for a company's intrinsic value. This rating is used to assign the margin of safety required before investing, which in turn explicitly drives our stock star rating system. The Uncertainty Rating is aimed at identifying the confidence we should have in assigning a fair value estimate for a given stock.

Our Uncertainty Rating is meant to take into account anything that can increase the potential dispersion of future outcomes for the intrinsic value of a company, and any-

Morningstar Equity Research Star Rating Methodology



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thing that can affect our ability to accurately predict these outcomes. The rating begins with a suggested rating produced by a quantitative process based on the trailing 12-month standard deviation of daily stock returns. An analyst overlay is then applied, with analysts using the suggested rating, historical rating data, and their own knowledge of the company to inform them as they make the final Uncertainty Rating decision. Ultimately, the rating decision rests with the analyst. Analysts take into account many characteristics when making their final decision, including cyclical factors, operational and financial factors such as leverage, company-specific events, ESG risks, and anything else that might increase the potential dispersion of future outcomes and our ability to estimate those outcomes.

Our recommended margin of safety—the discount to fair value demanded before we'd recommend buying or selling the stock—widens as our uncertainty of the estimated value of the equity increases. The more uncertain we are about the potential dispersion of outcomes, the greater the discount we require relative to our estimate of the value of the firm before we would recommend the purchase of the shares. In addition, the Uncertainty Rating provides guidance in portfolio construction based on risk tolerance.

Our Uncertainty Ratings are: Low, Medium, High, Very High, and Extreme.

Margin of Safety		
Qualitative Analysis	★★★★★ Rating	★ Rating
Uncertainty Ratings		
Low	20% Discount	25% Premium
Medium	30% Discount	35% Premium
High	40% Discount	55% Premium
Very High	50% Discount	75% Premium
Extreme	75% Discount	300% Premium

Our uncertainty rating is based on the interquartile range, or the middle 50% of potential outcomes, covering the 25th percentile–75th percentile. This means that when a stock hits 5 stars, we expect there is a 75% chance that the intrinsic value of that stock lies above the current market price. Similarly, when a stock hits 1 star, we expect there is a 75% chance that the intrinsic value of that stock lies below the current market price.

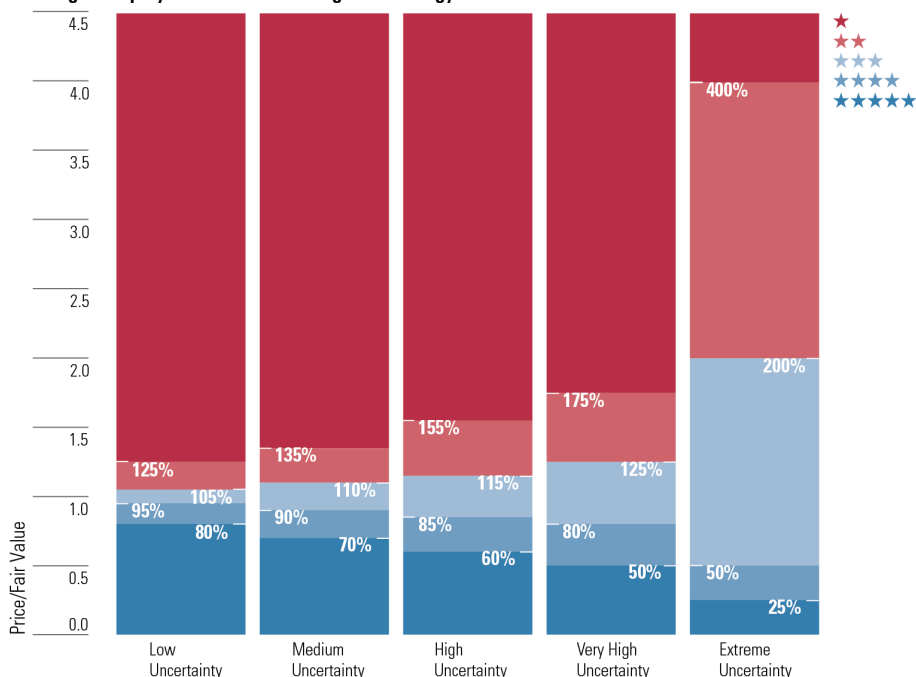
4. Market Price

The market prices used in this analysis and noted in the report come from exchange on which the stock is listed which we believe is a reliable source.

For more details about our methodology, please go to <https://shareholders.morningstar.com>

Morningstar Star Rating for Stocks

Morningstar Equity Research Star Rating Methodology



Once we determine the fair value estimate of a stock, we compare it with the stock's current market price on a daily basis, and the star rating is automatically re-calculated at the market close on every day the market on which the stock is listed is open. Our analysts keep close tabs on the companies they follow, and, based on thorough and ongoing analysis, raise or lower their fair value estimates as warranted.

Please note, there is no predefined distribution of stars. That is, the percentage of stocks that earn 5 stars can fluctuate daily, so the star ratings, in the aggregate, can serve as a gauge of the broader market's valuation. When there are many 5-star stocks, the stock market as a whole is more undervalued, in our opinion, than when very few companies garner our highest rating.

We expect that if our base-case assumptions are true the market price will converge on our fair value estimate over time generally within three years (although it is impossible to predict the exact time frame in which market prices may adjust).

Our star ratings are guideposts to a broad audience and individuals must consider their own specific investment goals, risk tolerance, tax situation, time horizon, income needs, and complete investment portfolio, among other factors.

The Morningstar Star Ratings for stocks are defined below:

★★★★★ We believe appreciation beyond a fair risk ad-

justed return is highly likely over a multiyear time frame. Scenario analysis developed by our analysts indicates that the current market price represents an excessively pessimistic outlook, limiting downside risk and maximizing upside potential.

★★★★ We believe appreciation beyond a fair risk-adjusted return is likely.

★★★ Indicates our belief that investors are likely to receive a fair risk-adjusted return (approximately cost of equity).

★★ We believe investors are likely to receive a less than fair risk-adjusted return.

★ Indicates a high probability of undesirable risk-adjusted returns from the current market price over a multiyear time frame, based on our analysis. Scenario analysis by our analysts indicates that the market is pricing in an excessively optimistic outlook, limiting upside potential and leaving the investor exposed to Capital loss.

Other Definitions

Last Price: Price of the stock as of the close of the market of the last trading day before date of the report.

Capital Allocation Rating: Our Capital Allocation (or Stewardship) Rating represents our assessment of the quality of management's capital allocation, with particular emphasis on the firm's balance sheet, investments, and shareholder distributions. Analysts consider compan-

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ies' investment strategy and valuation, balance sheet management, and dividend and share buyback policies. Corporate governance factors are only considered if they are likely to materially impact shareholder value, though either the balance sheet, investment, or shareholder distributions. Analysts assign one of three ratings: "Exemplary", "Standard", or "Poor". Analysts judge Capital Allocation from an equity holder's perspective. Ratings are determined on a forward looking and absolute basis. The Standard rating is most common as most managers will exhibit neither exceptionally strong nor poor capital allocation.

Capital Allocation (or Stewardship) analysis published prior to Dec. 9, 2020, was determined using a different process. Beyond investment strategy, financial leverage, and dividend and share buyback policies, analysts also considered execution, compensation, related party transactions, and accounting practices in the rating.

Capital Allocation Rating: Our Capital Allocation (or Stewardship) Rating represents our assessment of the quality of management's capital allocation, with particular emphasis on the firm's balance sheet, investments, and shareholder distributions. Analysts consider companies' investment strategy and valuation, balance sheet management, and dividend and share buyback policies. Corporate governance factors are only considered if they are likely to materially impact shareholder value, though either the balance sheet, investment, or shareholder distributions. Analysts assign one of three ratings: "Exemplary", "Standard", or "Poor". Analysts judge Capital Allocation from an equity holder's perspective. Ratings are determined on a forward looking and absolute basis. The Standard rating is most common as most managers will exhibit neither exceptionally strong nor poor capital allocation.

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Sustainalytics ESG Risk Rating Assessment: The ESG Risk Rating Assessment is provided by Sustainalytics; a Morningstar company.

Sustainalytics' ESG Risk Ratings measure the degree to which company's economic value at risk is driven by environment, social and governance (ESG) factors.

Sustainalytics analyzes over 1,300 data points to assess a company's exposure to and management of ESG risks. In other words, ESG Risk Ratings measures a company's unmanaged ESG Risks represented as a quantitative score. Unmanaged Risk is measured on an open-ended scale

starting at zero (no risk) with lower scores representing less unmanaged risk and, for 95% of cases, the unmanaged ESG Risk score is below 50.

Based on their quantitative scores, companies are grouped into one of five Risk Categories (negligible, low, medium, high, severe). These risk categories are absolute, meaning that a 'high risk' assessment reflects a comparable degree of unmanaged ESG risk across all subindustries covered.

The ESG Risk Rating Assessment is a visual representation of Sustainalytics ESG Risk Categories on a 1 to 5 scale. Companies with Negligible Risk = 5 Globes, Low Risk = 4, Medium Risk = 3 Globes, High Risk = 2 Globes, Severe Risk = 1 Globe. For more information, please visit sustainalytics.com/esg-ratings/

Ratings should not be used as the sole basis in evaluating a company or security. Ratings involve unknown risks and uncertainties which may cause our expectations not to occur or to differ significantly from what was expected and should not be considered an offer or solicitation to buy or sell a security.

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