

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By Type (Single Mode, Multi-Mode), By Material (Gallium Arsenide, Indium Phosphide, Others), By Wavelength (Red, Near Infrared, Short Wave Infrared), By Application (Sensing, Data Communication, Industrial Heating & Printing, Others), By End User (Mobile & Consumer, Telecom & Infrastructure, Industrial, Defense & Aerospace, Medical, Automotive & Mobility), By Region, Competition, Opportunities and Forecast, 2019-2029F

<https://marketpublishers.com/r/S7B1E3B57283EN.html>

Date: May 2024

Pages: 80

Price: US\$ 3,500.00 (Single User License)

ID: S7B1E3B57283EN

Abstracts

Saudi Arabia Vertical Cavity Surface Emitting Laser Market was valued at USD 71.10 million in 2023 and is anticipated to project robust growth in the forecast period with a CAGR of 13.47% through 2029. The vertical cavity surface emitting laser (VCSEL) market refers to the global industry centered around the manufacturing, distribution, and utilization of VCSEL technology. VCSELs are a specialized type of semiconductor laser diode that emits light vertically from the surface of a semiconductor chip, in contrast to traditional edge-emitting lasers. This unique design offers advantages such as precise beam control, efficient power consumption, and a wide range of applications.

The VCSEL market encompasses a diverse range of sectors, including data communication, 3D sensing, optical interconnects, automotive LiDAR systems, and more. It plays a pivotal role in emerging technologies and applications, such as high-speed data transmission, facial recognition, augmented reality, and autonomous

vehicles.

In recent years, the VCSEL market has experienced substantial growth due to increased demand for consumer electronics, data centers, and advanced optical sensing solutions. Governments and businesses worldwide are investing heavily in VCSEL technology to keep pace with the rapid evolution of the tech industry. As a result, the VCSEL market is dynamic, innovative, and poised for continuous expansion as it continues to shape the future of various high-tech industries.

Key Market Drivers

Rapid Technological Advancements:

Saudi Arabia's VCSEL market is driven by the rapid technological advancements in the semiconductor industry. VCSELs are crucial components in emerging technologies, such as 3D sensing, data communication, and facial recognition. As technology evolves, the demand for more efficient and cost-effective VCSELs grows. Saudi Arabia has recognized the importance of staying at the forefront of technology, and this has driven significant investments in research and development in the VCSEL sector. These technological advancements have led to the miniaturization of VCSELs, making them more versatile and applicable in various industries.

The proliferation of 5G technology, in particular, has fueled demand for high-performance VCSELs, as they are used in optical transceivers and sensors in 5G base stations. This driver has led to a growing number of local and international VCSEL manufacturers establishing a presence in Saudi Arabia to meet the market's needs.

Increased Demand for Consumer Electronics:

The significant driver of the Saudi Arabian VCSEL market is the increased demand for consumer electronics. VCSELs are widely used in smartphones, tablets, and other gadgets for applications like facial recognition and augmented reality. As the standard of living in the country rises and the population becomes more tech-savvy, the demand for these advanced consumer electronics is on the rise. Saudi Arabia's VCSEL market is benefiting from this trend, with a surge in VCSEL production to meet the local demand.

The Middle East region is a significant market for luxury and premium smartphones, many of which incorporate VCSEL technology for their advanced features. This has

created a lucrative niche for VCSEL manufacturers in the Saudi Arabian market.

Data Centers and Cloud Computing Expansion:

The expansion of data centers and cloud computing facilities in Saudi Arabia is another critical driver for the VCSEL market. VCSELs are used extensively in data centers for high-speed data transmission and optical interconnects. As Saudi Arabia continues to invest in the development of its digital infrastructure, the need for advanced data center solutions has surged.

The growth in cloud computing services and the adoption of hyperscale data centers in the region have fueled the demand for high-speed and energy-efficient VCSELs. Saudi Arabia's strategic location as a global data traffic hub between Europe and Asia positions it as an ideal location for data center growth. This, in turn, drives the demand for VCSELs in the country.

Automotive LiDAR Systems:

The Saudi Arabian VCSEL market is also benefiting from the increasing integration of VCSELs in automotive LiDAR (Light Detection and Ranging) systems. As the automotive industry shifts towards autonomous vehicles and advanced driver-assistance systems (ADAS), the demand for LiDAR technology is on the rise.

VCSELs play a crucial role in LiDAR systems, as they provide the necessary laser source for accurate distance measurement. The Saudi Arabian government's push for technological innovation and its focus on smart and sustainable transportation solutions have created a favorable environment for the growth of VCSEL applications in the automotive sector.

Medical and Healthcare Applications:

VCSELs are increasingly being utilized in medical and healthcare applications, including optical coherence tomography (OCT) for ophthalmology and various diagnostic and therapeutic applications. Saudi Arabia's commitment to enhancing its healthcare infrastructure has led to a growing demand for advanced medical technologies.

VCSELs offer precise and non-invasive solutions for medical imaging and diagnostics, making them a valuable tool in the healthcare sector. The Saudi VCSEL market has, therefore, experienced a boost due to the integration of these lasers into medical

devices and instruments used in hospitals and clinics.

Defense and Security Applications:

The defense and security sector in Saudi Arabia has also contributed to the growth of the VCSEL market. VCSELs are used in military and security applications, including target designators, range finders, and secure communication systems. With a focus on maintaining national security and protecting critical infrastructure, the Saudi Arabian government has driven investments in defense technology.

VCSELs are an essential component in advanced defense systems, and this has led to a steady demand for high-performance VCSELs in the country. Moreover, VCSELs offer advantages such as low power consumption and enhanced reliability, making them suitable for military and security applications.

Government Policies are Likely to Enhance the Market in the Upcoming Years.

Vision 2030 and Technology Diversification:

Saudi Arabia's Vision 2030 is a transformative blueprint that outlines the country's goals for diversifying its economy beyond oil and embracing technology and innovation. As part of this vision, the Saudi government has implemented several policies to foster technology development and attract investment in sectors like semiconductor manufacturing and photonics, both of which are highly relevant to VCSEL production.

Under Vision 2030, the government has established the National Industrial Development and Logistics Program (NIDLP), which prioritizes the development of advanced technologies and the localization of strategic industries. This initiative aims to reduce the reliance on imports, encouraging domestic production of VCSELs and other high-tech components.

Vision 2030 has introduced policies to strengthen intellectual property rights and enhance research and development (R&D) infrastructure. The Saudi government has established partnerships with international technology companies and invested in local R&D centers, which benefit VCSEL manufacturers by providing access to advanced research facilities and fostering innovation.

Investment in Semiconductor Manufacturing:

The Saudi Arabian government recognizes the significance of semiconductor manufacturing for technology development and has introduced policies to stimulate investment in this sector. The growth of the semiconductor industry directly impacts the VCSEL market, as these lasers are integral components in semiconductor devices.

The government has offered incentives and subsidies to attract foreign semiconductor manufacturers, aiming to establish a robust semiconductor ecosystem within the country. This includes building advanced manufacturing facilities and providing financial support for semiconductor-related research and development projects.

These policies not only encourage semiconductor manufacturers to set up operations in Saudi Arabia but also indirectly benefit the VCSEL market by creating a local demand for these laser components.

Education and Workforce Development:

To support the growth of high-tech industries like VCSEL manufacturing, the Saudi government has put in place policies to enhance education and workforce development. These policies focus on improving science, technology, engineering, and mathematics (STEM) education at all levels, from primary schools to higher education institutions.

The government has also created scholarship programs to send Saudi students abroad to pursue degrees in fields relevant to the semiconductor and photonics industries. Upon returning, these students contribute to the local talent pool, increasing the availability of skilled professionals for VCSEL manufacturers.

These initiatives aim to bridge the skills gap, ensure the availability of a knowledgeable workforce, and facilitate technology transfer to the Saudi labor market, which is vital for the success of the VCSEL industry in the country.

Regulatory Framework for Emerging Technologies:

Saudi Arabia recognizes that emerging technologies like VCSELs require a supportive regulatory environment to thrive. The government has established a comprehensive regulatory framework that addresses issues related to intellectual property rights, export controls, safety standards, and environmental regulations in the high-tech sector.

These regulations are designed to provide clarity and predictability for businesses operating in the VCSEL market. They ensure that companies can operate within a secure and well-defined legal framework, which is essential for attracting investment and encouraging innovation in the sector.

Local Content and Localization Initiatives:

The Saudi government has introduced localization initiatives aimed at increasing the domestic production of high-tech components, including VCSELs. These initiatives require companies operating in Saudi Arabia to source a certain percentage of their components locally.

To encourage compliance, the government has offered incentives, tax breaks, and support for technology transfer and research collaboration between international and local firms. These policies not only boost VCSEL production but also create a supportive environment for technology companies to set up manufacturing facilities and research centers within the country.

Customs and Trade Policies:

The Saudi Arabian government has implemented customs and trade policies that impact the import and export of high-tech components, including VCSELs. These policies are designed to promote the development of a self-reliant technology sector and reduce the country's dependence on foreign imports.

To achieve these goals, the government has adjusted customs duties and import tariffs to incentivize the local production of technology components. Additionally, it has facilitated trade agreements and partnerships with countries known for their expertise in the semiconductor and photonics industries, enabling the efficient flow of technology-related goods and services.

Key Market Challenges

Technological Dependence and Innovation Gap

The Saudi Arabian VCSEL market, while experiencing growth, faces a significant challenge in terms of technological dependence and an innovation gap. This issue is multifaceted and pertains to several key aspects of the industry's development.

Saudi Arabia's semiconductor and photonics industries, of which VCSELs are a crucial part, heavily rely on advanced technologies and know-how that are often imported from established technology hubs in countries like the United States, Europe, and Asia. While the government has been actively working to diversify the economy and promote technology transfer, there is still a significant dependence on external expertise and intellectual property.

The primary consequences of this dependence is an innovation gap. While the country is investing in research and development (R&D) and educational initiatives, it takes time to build a homegrown ecosystem of innovation and expertise that can rival global leaders in the field. Innovations in VCSEL technology, which drive competitiveness and market growth, often originate in these well-established technology regions.

The challenge lies in the time and resources needed to close this innovation gap. The country is making strides in creating partnerships with international tech companies and sending students abroad for advanced education in relevant fields. However, these efforts may take years to yield results in the form of truly innovative VCSEL products and applications.

While the Saudi government is actively encouraging local production and technology localization, there are still obstacles related to the adoption of innovative technologies within the country's industries. Local manufacturers may be cautious about adopting new VCSEL technologies due to concerns about compatibility, reliability, and the higher costs associated with cutting-edge innovations.

Addressing this challenge requires a multi-faceted approach. Saudi Arabia needs to continue its investment in R&D, education, and technology partnerships while simultaneously incentivizing local industries to adopt and adapt innovative VCSEL technologies. Collaboration between academia, research institutions, and the private sector is essential for overcoming these technological challenges and establishing a more self-reliant VCSEL ecosystem.

Global Market Competition and Scalability

The major challenge faced by the Saudi Arabia VCSEL market is the intense global market competition and the need for scalability. While Saudi Arabia is making strides to establish itself as a player in the high-tech sector, it faces strong competition from established VCSEL manufacturers in countries with well-established technology

industries.

VCSELs are integral components in a range of cutting-edge applications, from 3D sensing in consumer electronics to LiDAR in autonomous vehicles and data communication in data centers. The global demand for these technologies is substantial, and competition among manufacturers is fierce. Established industry leaders in countries like the United States, China, and Japan have significant advantages in terms of experience, resources, and established supply chains.

This competition presents a challenge for the Saudi Arabian VCSEL market, as local manufacturers may find it challenging to break into a market dominated by established players. Scalability is another concern, as global VCSEL demand requires manufacturers to produce VCSELs in high volumes to meet market needs and remain competitive.

One of the hurdles is the need for a well-developed supply chain, which encompasses the sourcing of raw materials, efficient manufacturing processes, and reliable distribution networks. While Saudi Arabia is making investments in semiconductor manufacturing and technology transfer, it may take time to develop the required infrastructure for large-scale VCSEL production.

Global market dynamics and economic fluctuations can pose challenges. Changes in demand, tariffs, trade disputes, or shifts in technology trends can impact the VCSEL market's growth and profitability, making it essential for Saudi Arabian manufacturers to remain agile and adaptable.

To overcome these challenges, Saudi Arabia must focus on two key areas. First, it should promote international partnerships and collaborations to access global supply chains and gain valuable insights from established VCSEL manufacturers. These partnerships can facilitate knowledge transfer and help the country's VCSEL industry remain competitive on a global scale.

Saudi Arabia should continue its investments in semiconductor manufacturing and infrastructure development to ensure that local VCSEL manufacturers can meet the scalability demands of the global market. Government incentives and support for technology companies looking to set up operations within the country can play a crucial role in overcoming these challenges.

The Saudi Arabian VCSEL market faces challenges related to technological

dependence and an innovation gap, as well as intense global market competition and the need for scalability. Overcoming these challenges requires a strategic and multifaceted approach that includes investments in R&D, education, technology partnerships, and the development of a robust supply chain to ensure the competitiveness and growth of the local VCSEL industry.

Key Market Trends

Increased Adoption of VCSEL Technology in Emerging Applications

In the Saudi Arabia Vertical Cavity Surface Emitting Laser (VCSEL) market, a notable trend is the escalating adoption of VCSEL technology across various emerging applications. Traditionally known for their use in optical communication applications, VCSELs are increasingly finding their way into diverse sectors such as consumer electronics, automotive, healthcare, and industrial applications.

Significant driver behind this trend is the continuous advancement in VCSEL technology, leading to improved performance, efficiency, and cost-effectiveness. Manufacturers are investing in research and development efforts to enhance the capabilities of VCSELs, making them suitable for a broader range of applications. For instance, the development of high-power VCSELs has facilitated their utilization in automotive LiDAR systems, enabling autonomous driving functionalities.

The growing demand for VCSELs in facial recognition technology, gesture recognition systems, and 3D sensing applications in smartphones and tablets is contributing to market expansion. These applications require compact, reliable, and energy-efficient laser sources, making VCSELs an ideal choice. Additionally, the increasing adoption of VCSEL-based sensors in healthcare for non-invasive monitoring and diagnostics further propels market growth.

Government initiatives and investments aimed at fostering technological innovation and promoting local manufacturing capabilities are bolstering the Saudi Arabian VCSEL market. With a focus on diversifying the economy and reducing dependence on oil revenue, the Saudi government is supporting initiatives that encourage the development and adoption of advanced technologies such as VCSELs.

The increasing adoption of VCSEL technology across emerging applications is a prominent trend in the Saudi Arabian market. As VCSELs continue to evolve and offer enhanced performance characteristics, their utilization is expected to expand

further, driving market growth and diversification.

Segmental Insights

Type Insights

The Single Mode segment emerged as the dominating segment in 2023. Single-mode VCSELs are well-suited for data center applications due to their ability to transmit data over longer distances with low dispersion and low attenuation. With the growth of data centers and cloud computing in Saudi Arabia, there may be a higher demand for single-mode VCSELs to support high-speed and long-distance optical communication. Single-mode VCSELs are capable of high-speed data transmission, making them essential for applications where fast and reliable data transfer is critical. This includes applications like fiber optics and optical interconnects, which are integral to modern data centers and telecommunications infrastructure. Single-mode VCSELs are preferred for long-range sensing applications, such as LiDAR (Light Detection and Ranging) systems in autonomous vehicles. With the growing interest in smart transportation and autonomous driving technology in Saudi Arabia, the demand for single-mode VCSELs for LiDAR systems might be on the rise. Single-mode VCSELs play a significant role in long-distance telecommunications, supporting high-capacity data transmission over optical fiber networks. The expansion of telecommunications infrastructure in Saudi Arabia could drive the demand for single-mode VCSELs. Single-mode VCSELs are used in various industrial and medical applications that require precision and long-range performance. This includes applications like laser-based machining and medical diagnostics, which might be on the rise in the Saudi Arabian market. Global technological trends and standards can influence the preference for single-mode VCSELs. These lasers are widely adopted in international technology standards, making them a common choice for global technology manufacturers.

Regional Insights

Norther & Central Region

The Norther & Central Region held the largest market share in 2023. The dominance of the Northern and Central Regions in the Saudi Arabia Vertical Cavity Surface Emitting Laser (VCSEL) market can be attributed to the concentration of high-tech industries and research institutions in these areas. These regions serve as hubs for innovation, technological development, and collaboration, creating a conducive ecosystem for the growth of the VCSEL market.

In cities like Riyadh and Jeddah, which are located in the Central and Northern Regions, respectively, there is a significant presence of leading technology companies, research centers, and academic institutions specializing in photonics, semiconductor manufacturing, and telecommunications. These entities actively engage in research, development, and commercialization of VCSEL technology and its applications across various sectors.

Government initiatives aimed at promoting innovation and technology-driven economic diversification contribute to the growth of the VCSEL market in these regions. The Saudi Vision 2030, which outlines the Kingdom's strategic goals for economic transformation, emphasizes the importance of investing in high-tech industries and fostering innovation ecosystems. As a result, there is increased funding and support for research and development activities related to advanced technologies like VCSELs.

The presence of established industrial zones and technology parks in the Northern and Central Regions provides infrastructure and logistical support for VCSEL manufacturing and distribution. These zones attract both domestic and international companies involved in semiconductor fabrication, optical components manufacturing, and electronics assembly, thereby facilitating the supply chain for VCSEL products.

The proximity of the Northern and Central Regions to key markets in the Middle East and North Africa (MENA) region enhances their strategic importance in the VCSEL market. Companies operating in these regions can leverage their geographic location and access transportation networks for efficient distribution of VCSEL products to neighboring countries with growing demand for high-tech solutions.

The dominance of the Northern and Central Regions in the Saudi Arabian VCSEL market can be attributed to factors such as the concentration of high-tech industries and research institutions, government support for innovation, and favorable infrastructure. These regions serve as vibrant ecosystems for VCSEL technology development and commercialization, driving market growth and leadership.

Key Market Players

Broadcom Inc.

Infineon Technologies AG

Lumentum Operations LLC

ams-OSRAM AG

TRUMPF Inc.

Toyoda Gosei Co., Ltd.

Vertilas GmbH

Coherent Corporation

HLJ Technology Co., Ltd.

Teledyne FLIR LLC

Report Scope:

In this report, the Saudi Arabia Vertical Cavity Surface Emitting Laser Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By Type:

Single Mode

Multi-Mode

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By Material:

Gallium Arsenide

Indium Phosphide

Others

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By Wavelength:

Red

Near Infrared

Short Wave Infrared

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By Application:

Sensing

Data Communication

Industrial Heating & Printing

Others

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By End User:

Mobile & Consumer

Telecom & Infrastructure

Industrial

Defense & Aerospace

Medical

Automotive & Mobility

Saudi Arabia Vertical Cavity Surface Emitting Laser Market, By Region:

Northern & Central Region

Western Region

Eastern Region

Southern Region

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Saudi Arabia Vertical Cavity Surface Emitting Laser Market.

Available Customizations:

Saudi Arabia Vertical Cavity Surface Emitting Laser Market report with the given market data, TechSci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

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Detailed analysis and profiling of additional market players (up to five).

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