Who's Who In Silicon Carbide And Gallium Nitride Power Semiconductors

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This document offers a listing of manufacturers of silicon carbide (SiC) and gallium nitride (GaN) discrete power semiconductors, ICs and modules. Descriptions of each company's focus and/or product offerings are provided with an emphasis on device types and voltage ratings using information taken from vendor websites. This list is current as of the date shown below and will be updated periodically. If you know of additional companies that may be appropriate for inclusion in these lists, please contact me.

For more information on SiC & GaN power devices, including product and technology news, conference news, and technical articles discussing the use of these devices in power converter designs, see How2Power.com's section on Silicon Carbide and Gallium Nitride Power Technology.

*As of 11/08/2021**

SiC & GaN Device And Module Manufacturers

- Alpha & Omega Semiconductor
- Apex Microtechnology
- Cambridge GaN Devices
- CISSOID
- Efficient Power Conversion (EPC)
- EPC Space
- Exagan
- GaN Systems
- GaN Power International
- GeneSiC Semiconductor
- Hitachi Power Semiconductor Device
- Infineon Technologies
- Innoscience
- Littelfuse
- Microsemi, A Microchip company
- Mitsubishi Electric
- Navitas Semiconductor
- NexGen Power Systems
- Nexperia
- onsemi
- Panasonic
- Powerex
- Qorvo
- Power Integrations
- Rohm Semiconductor
- Renesas Electronics
- SemiQ
- Solitron Devices
- STMicroelectronics
- Tagore Technology
- Texas Instruments
- Transphorm
- United Silicon Carbide (UnitedSiC, now Qorvo)
- ViSIC Technologies
- Wolfspeed

Alpha & Omega Semiconductor

(Sunnyvale, CA)

Alpha and Omega Semiconductor lists several 1200-V SiC MOSFETs and one 650-V SiC MOSFET.

(Source: http://www.aosmd.com/products/gan/sic).

The company also lists one enhancement-mode 650-V GaN transistor, which was introduced in March 2019 as the initial product in the company's αGAN Technology platform.

(Source: http://www.aosmd.com/products/gan/gan-fets)

Apex Microtechnology

(Tucson, AZ)

In 2020, Apex Microtechnology introduced "a fully integrated three-phase driver designed primarily to drive brushless dc (BLDC) and permanent magnet synchronous motors (PMSMs) or dc-ac inverters. The module uses silicon carbide (SiC) MOSFETs to improve efficiency over other devices in its class."

(Source: http://www.how2power.com/pdf_view.php?url=/newsletters/2007/products/H2PToday2007_products_ApexMicrotech.pdf)

Cambridge GaN Devices

(Cambridge, United Kingdom)

"CGD has been created to explore and develop a number of unique opportunities in power electronics made possible by the team's proprietary application of gallium nitride to the silicon-based semiconductor transistor manufacturing process. With silicon transistors widely acknowledged as having attained maximum efficiency, CGD's power design engineers have developed a range of gallium nitride transistors that are over 100 times faster, lose 5 [to] 10 times less power and are 4 times smaller than existing silicon equivalents."

(Source: https://camgandevices.com/about-us/)

"CGD GaN technology can be applied to almost anything that requires power and operates in the rich 650-V market segment."

(Source: https://camgandevices.com/applications/)

CISSOID

(Mont-Saint-Guibert, Belgium)

CISSOID is a "leader in high-temperature semiconductor solutions, delivering standard products and custom products for power management, power conversion and signal conditioning in extreme temperature and harsh environments. CISSOID provides high reliability products guaranteed from -55°C to +225°C and commonly used outside that range, from cryogenic lows to upper extremes.

(Source: http://www.cissoid.com/company/)

Products include power SiC MOSFETs and diodes, SiC MOSFET and diode power modules, and gate drivers for silicon, SiC and GaN transistors.

(Source: http://www.cissoid.com/high-temperature-electronics/)

Efficient Power Conversion

(El Segundo, CA)

"In June 2009, EPC delivered the first commercial enhancement-mode GaN (eGaN) transistors. These new devices were manufactured in a Taiwanese foundry designed to produce standard silicon integrated circuits creating a mature, efficient, and low cost supply chain, making its GaN transistors extraordinarily reliable and affordable. Today EPC offers more than 100 products that address a $13 billion market."

(Source: https://epc-co.com/epc/AboutEPC.aspx)

EPC's product portfolio spans 15-V to 350-V enhancenment-mode GaN FETs and ICs. The latter include half-bridges and eToF laser driver ICs. The company also offers an extensive list of demo boards for various applications and has published several books on GaN technology, devices and applications. For a quick summary of their products, see the TB001 Technology Brief at https://epc-co.com/epc/Portals/0/epc/documents/articles/EPC_eGaN_FET_Product_Brief.pdf.

EPC Space

(Haverhill, MA)

"EPC Space [formerly Freebird Semiconductor] is a joint venture between Efficient Power Conversion (EPC) and VPT, a HEICO company. EPC is the largest producer of GaN-on-Si power devices and dominates the <400-V market. VPT is a global leader in providing power conversion solutions for use in avionics, military, space, and industrial applications. As a joint venture, EPC Space will be focused on designing and manufacturing radiation hardened (rad hard) GaN-on-silicon transistors and ICs packaged, tested, and qualified for satellite and high-reliability applications."

(Source: https://epc.space/about/)

EPC Space offers rad hard GaN discrete devices from 40 V to 300 V, rad hard GaN die on ceramic adaptor from 40 V to 300 V, rad hard GaN drivers and power stages, and demo boards.

(Source: https://epc.space/, see Products menu)

Exagan

(Grenoble, France)

"Exagan believes that superior GaN device performance and product leadership will be achieved by controlling all critical parameters of its products: material, design, process, packaging and final test as well as mastering the entire GaN production flow.

The company's team of semiconductor experts created the unique G-Stack technology to produce GaN-on-silicon material using an industry-leading, scalable and cost-effective 200-mm platform, leveraging Soitec's material IP and CEA-Leti's extensive device expertise and development infrastructure."

STMicroelectronics owns a majority stake in this company.

(Source: http://www.exagan.com/en/company/vision/)

"Exagan offers high-performance, GaN-based, 650-volt fast-switching power devices for the next generation of electrical converters …" These include the G-FET and G-Drive product series. The latter include embedded gate drivers.

(Source: http://www.exagan.com/en/products/portfolio/)

GaN Systems

(Ottawa, Ontario, Canada)

"GaN Systems is the only company with a product line that encompasses both the 100-V and 650-V product ranges needed to solve critical engineering power design challenges that exceed the capability of legacy silicon technologies in both consumer and industrial uses."

(Source: https://gansystems.com/gan-transistors/faq/#toggle-id-4)

Portfolio page lists three 100-V GaN E-HEMTs and a long list of 650-V GaN E-HEMTs.

(Source: https://gansystems.com/gan-transistors/)

GaN Power International

(Vancouver, British Columbia, Canada)

"GaNPower International is proud to offer discrete GaN power devices, GaN/silicon copackaged IC and all-GaN power ICs. We currently offer qualified devices (in production) as well as limited engineering samples in stock for 650 V and 1200 V with current capability ranges from 8 A to 60 A. The devices and ICs come in several packages including TO-220, TO-252, TO263, DFN and LGA. In addition to GaN devices and IC, we also offer power system solutions with GaNPower patented technologies that take advantage of the high frequency and high efficiency switching characteristics of GaN. All discrete GaNFETs are single-die E-mode devices with threshold voltage about 1.4 V."

(Source: https://iganpower.com/ganhemts/)

GeneSiC

(Dulles, VA)

"GeneSiC is a pioneer and … leader in silicon carbide technology while also invested in high-power silicon technologies. The global leading manufacturers of industrial and defense systems depend on GeneSiC's technology to elevate the performance and efficiency of their products."

SiC products include SiC MOSFETs (750 V to 3300 V), SiC Schottky MPS (650 V to 3300 V), SiC PiN rectifiers (8000 V and 15,000 V), SiC junction transistors (1200 V and 1700 V) and custom products.

(Source: https://www.genesicsemi.com/)

Hitachi Power Semconductor Device

(Tokyo, Japan)

Website indicates that the company "will introduce large-capacity IGBT/SiC modules that contribute to high efficiency for [the] inverter.

(Source: http://www.hitachi-power-semiconductor-device.co.jp/en/products/index.html)

Products under development include 1700-V and 3300-V full SiC MOSFET modules, 3300-V hybrid SiC modules with advanced trench HiGT–sLiPT, SiC Schottky barrier diode and ultra-low recovery loss SiC diode.

(Source: http://www.hitachi-power-semiconductor-device.co.jp/en/products/igbt/sic/index.html)

Infineon Technologies

(Neubiberg, Germany and El Segundo, CA)

"Infineon is offering the broadest product and technology portfolio including silicon, silicon carbide gallium-nitride-based devices. … Our innovative … technology implements high-performance wide-bandgap semiconductor materials and includes Infineon's CoolSiC.… [and] our CoolGaN solutions in both discrete and integrated power stages….EiceDRIVER SiC MOSFET gate driver ICs are well-suited to drive SiC MOSFETs, especially our ultra-fast switching CoolSiC SiC MOSFETs."

(Source: https://www.infineon.com/cms/en/product/power/wide-band-gap-semiconductors-sic-gan/)

CoolSiC products include discrete diodes, hybrids in discretes and modules, and MOSFETs in discretes, IPMs, and modules, ranging from 600 V to 1700 V.

(Source: https://www.infineon.com/cms/en/product/technology/silicon-carbide-sic/)

GaN products include HEMTs (400 V and 600 V) and EiceDRIVER GaN gate driver ICs.

(Source: https://www.infineon.com/cms/en/product/technology/gallium-nitride-gan/)

Innoscience

(Zhuhai, China)

Innoscience's "first phase is located in Zhuhai National Hi-Tech District and has established China's first mass production line of 8-inch GaN-on-Si power device. Innoscience provides a wide range of solutions including 30-V [to] 650-V GaN-on-Si power devices."

(Source: http://www.innoscience.com.cn/En/Index/pageView/catid/35.html)

Products include GaN FETs (40 V and 100 V), GaN half bridge and GaN IC with FET and driver.

(Source: http://www.innoscience.com.cn/En/Index/pageView/catid/23.html)

Littelfuse

(Chicago, IL)

"IXYS: A Littelfuse Technology represents a comprehensive portfolio of advanced power semiconductor technologies, including silicon and wide-bandgap solutions in discrete and module packages."

(Source: https://www.littelfuse.com/products/power-semiconductors.aspx)

SiC products include Schottky diodes (650 V and 1200 V) and MOSFETs (1200 V and 1700 V).

(Source: https://www.littelfuse.com/products/power-semiconductors/silicon-carbide.aspx)

Microchip Microsemi Product Portfolio

(Chandler, AZ)

The company's power discretes and modules include SiC MOSFETs (700 V, 1200 V and 1700 V), SiC Schottky barrier diodes (700 V, 1200 V and 1700 V) in through leads, surface-mount packages and chips, and SiC modules.

(Source: https://www.microsemi.com/product-directory/606-discretes)

Mitsubishi Electric

(Tokyo, Japan)

Products include SiC MOSFETs (1200 V), SiC Schottky barrier diodes (600 V and 1200 V) and hybrid and full-SiC power modules (600 V to 3300 V).

(Source: https://www.mitsubishielectric.com/semiconductors/products/powermod/index.html)

Navitas Semiconductor

(El Segundo, CA)

This company is an "industry leader in GaN with drive, control and protection in a single easy-to-use integrated circuit (IC). Navitas GaNFast ICs are easy-to-use 'digital in, power out' building blocks that enable up to one hundred times faster switching speeds while increasing energy savings by as much as 40%."

(Source: https://navitassemi.com/about-navitas/)

"Using lateral 650-V eMode GaN-on-Si technology, Navitas' proprietary AllGaN process design kit (PDK) was created to enable the monolithic integration of GaN FET and GaN drive, plus logic and protection functions. The die can then be packaged into industry-standard, low-inductance, low-cost, 5 × 6- or 6 × 8-mm QFN packages for off-line ac or 400-V dc-input applications.

Both 'single' and 'half-bridge' GaN power ICs are available, with a broad range of power and functionality, and adaptable for a wide range of applications…"

(Source: https://navitassemi.com/gan-power-ics/)

NexGen Power Systems

(Santa Clara, CA)

NexGen Power Systems offers "technology solutions utilizing GaN on GaN discrete semiconductor devices, modules, and systems that increase efficiency and reliability of power conversion systems while dramatically reducing their cost, size, and weight.

We have assembled a world-class team of engineers with proven track records in inventing, developing, and commercializing semiconductor technologies. Our internal expertise and competence encompasses GaN epitaxial growth, materials characterization, device design and processing, electrical characterization, reliability testing, and product development.

Our focus is in developing and manufacturing vertical power semiconductor devices built in homoepitaxial GaN layers formed on bulk GaN substrates. We have established licensing and supply agreements with multiple GaN substrate vendors, giving us access to the highest quality and lowest cost bulk GaN substrates.

(Source: https://nexgenpowersystems.com/about/)

Products include 700-V and 1200-V devices.

(Source: https://nexgenpowersystems.com/datasheets/)

Nexperia

(Nijmegen, the Netherlands)

"Offering high power performance and high-frequency switching, the design and structure of our normally-off GaN FET products ensure standard, low-cost gate drivers can be used in your design."

Products include 650-V GaN FETs.

(Source: https://www.nexperia.com/products/gan-fets/#/p=1,s=0,f=,c=,rpp=,fs=0,sc=,so=,es=)

On November 8, 2021, Nexperia announced the addition of 650-V SiC Schottky diodes to its product line.

(Source: Press release at https://www.nexperia.com/about/news-events/press-releases/nexperia-expands-its-wide-bandgap-semiconductor-offering-with-new-family-of-high-performance-silicon-carbide-sic-diodes.html)

onsemi (formerly ON Semiconductor)

(Phoenix, AZ)

"The portfolio of silicon carbide (SiC) diodes from ON Semiconductor include AEC-Q101 qualified and PPAP capable options specifically engineered and qualified for automotive and industry applications….The portfolio of gate drivers from ON Semiconductor includes GaN, IGBT, FET, MOSFET, H-Bridge MOSFET, and SiC MOSFET inverting and non-inverting drivers ideal for switching applications...The portfolio of silicon carbide (SiC) MOSFETs from ON Semiconductor are designed to be fast and rugged. .. [and under GaN gate drivers:] The ideal performance characteristics provided by the portfolio of gate drivers from ON Semiconductor… enable them [to] meet the requirements of specific applications…"

(Source: https://www.onsemi.com/solutions-applications/segments/industrial-cloud-power/computing-peripherals/wide-bandgap-solutions)

Products include SiC diodes (650 V, 1200 V and 1700 V), MOSFETs (650 V, 900 V and 1200 V) and SiC modules (900 V and 1200 V).

(Source: https://www.onsemi.com/products/discrete-power-modules/silicon-carbide-sic)

Panasonic

(Osaka, Japan)

Panasonic previously offered the X-GaN normally off devices. However a page on the Panasonic website indicates that these parts were designated end-of-life Sept. 1, 2020.

(Source: https://industry.panasonic.eu/products/devices/semiconductor-solutions/gan-power-eol-sept-1st-2020)

A notice on another page indicates "The semiconductor business of Panasonic Corporation (hereinafter referred to as the "Company") will be transferred on September 1, 2020 to Nuvoton Technology Corporation (hereinafter referred to as "Nuvoton")."

(Source: https://industrial.panasonic.com/ww/business-transfer-of-semiconductors)

Powerex

(Youngwood, PA)

"Powerex and Mitsubishi continue to expand their product offering with the newest power semiconductor technology, silicon carbide. SiC offers significant advantages over traditional silicon-based devices in power applications requiring low losses, high frequency switching and/or high temperature environments. This product line includes cutting edge SiC MOSFET modules as well as hybrid Si/SiC (Si IGBT/SiC SBD) modules."

Modules offer 1200-V and 1700-V ratings.

(Sources: https://www.pwrx.com/summary/SiC-Modules.aspx?c=55)

Power Integrations

(San Jose, CA)

"PowiGaN is Power Integrations' internally developed gallium nitride (GaN) technology. PowiGaN switches replace the traditional silicon transistors on the primary side of PI's highly integrated offline flyback switcher ICs, reducing switching losses…"

(Source: https://www.power.com/company/our-innovations/powigan-technology)

PI's new SiC MOSFET gate driver…delivers the highest peak-output gate current available without an external boost stage.

(Source: https://www.power.com/company/our-innovations)

Renesas Electronics

(Tokyo, Japan)

"[Renesas'] portfolio includes fast recovery diodes and silicon carbide (SiC) Schottky barrier diodes."

However, no part numbers are listed.

(Source: https://www.renesas.com/cn/en/products/power-and-discrete/power-diodes.html)

Portfolio includes GaN FETs including rad hard versions with 40-V to 200-V ratings plus GaN FET drivers including rad tolerant and rad hard versions.

(Source: https://www.renesas.com/cn/en/search?keywords=GaN)

ROHM Semiconductor

(Kyoto, Japan and Santa Clara, CA)

"ROHM's broad portfolio includes SiC Schottky barrier diodes (SBDs), SiC MOSFETs, full SiC power modules (integrating SiC SBDs and MOSFETs), and high heat-resistance power modules."

Their SiC portfolio offers the following device ratings: SiC Schottky barrier diodes (650 V and 1200V), SiC MOSFETs (650 V, 1200 V and 1700 V), SiC power modules (1200 to 1700 V), SiC Schottky barrier diodes bare die (650 V, 1200 V and 1700 V) and SiC MOSFET bare die (650 V and 1200V).

(Source: https://www.rohm.com/products/sic-power-devices)

SemiQ (formerly Global Power Technologies)

(Lake Forest, CA)

Previously known as Global Power Technologies, "SemiQ designs, develops and manufactures silicon carbide (SiC) power semiconductors as well as 150-mm SiC epitaxial wafers. SiC diodes and MOSFETs are available in both discrete and module form factors as well as bare die and wafer form…The company is uniquely positioned with a fully redundant SiC supply chain."

Portfolio includes the following devices and ratings: SiC Schottky diodes, discretes, bare die, and modules (650 V, 1200 V and 1700 V) and a SiC MOSFET (1200 V).

(Source: https://semiq.com/en-us/)

Solitron Devices

(West Palm Beach, FL)

"Solitron Devices [manufactures] power semiconductors and integrated power solutions for systems that demand the ultimate in performance and reliability. Solitron is … leading the way in development of next generation multi-chip power assemblies. Combining advanced technologies such as SiC and GaN along with innovative packaging materials and techniques, Solitron's technology is at the forefront of power density, weight and efficiency."

(Source: https://solitrondevices.com/)

Products include the following devices and ratings: SiC diodes (650 V to 1700 V), SiC MOSFETs (650V, 900 V and 1200 V) and SiC power modules (650 V and 1200 V).

(Source: https://solitrondevices.com/silicon-carbide-products/silicon-carbide-mosfets/ and others under Silicon Carbide Products menu.)

STMicroelectronics

(Geneva, Switzerland)

"Due to the improved thermal design of ST's power electronics systems, our silicon-carbide (SiC) MOSFETs ensure good robustness thanks to the industry's highest temperature rating of 200°C and voltage ranging from 650 to 1700 V. As well as, our gallium nitride on silicon substrate (GaN/Si) transistors allow highest efficiency and highest power density thanks to outstanding specific dynamic on-state resistance and small capacitances ranging to 100 and 650 V."

(Source: https://www.st.com/en/power-transistors.html)

Tagore Technology

(Arlington Heights, Illinois, U.S.A. and Kolkata, India)

Tagore Technology was founded…to pioneer gallium nitride-on-silicon (GaN-on-Si) semiconductor technology for radio frequency (RF) and power management applications. Our advanced proprietary technologies and devices significantly reduce complexity, size, weight and power consumption of system solutions at an aggressive price point—delivering dramatically improved power conversion figure of merit compared to silicon solutions.

We are a fabless semiconductor company with design centers in Arlington Heights, Illinois, U.S.A. and Kolkata, India. Our R&D team is dedicated to developing disruptive solutions leveraging wide bandgap technologies that help address RF and power design challenges for our customers and accelerate time-to-market for a wide range of applications… We partner with leading semiconductor foundries and assembly houses to deliver products that offer premium quality and proven high reliability.

(Source: http://www.tagoretech.com/page.php?page-id=32)

Products include 650-V GaN FETs.

(Source: http://www.tagoretech.com/page.php?page-id=9)

Texas Instruments

(Dallas, Texas)

"Our family of gallium nitride (GaN) FETs with integrated gate drivers and GaN power devices offer the most efficient GaN solution with lifetime reliability and cost advantages."

GaN products include 600-V and 650-V GaN FETs with integrated driver and protection, a half-bridge power stage and reference designs.

(Source: http://www.ti.com/power-management/gallium-nitride/overview.html)

Transphorm

(Goleta, CA)

"Transphorm is a global semiconductor company…Transphorm deploys its unique vertically-integrated business approach that leverages the industry's most experienced GaN engineering team at every development stage: design, fabrication, device and application support."

(Source: https://www.transphormusa.com/en/company/)

Products include 650-V GaN FETs.

(Source: https://www.transphormusa.com/en/products/)

Toyoda Gosei

(Kiyosu, Japan)

"Toyoda Gosei has developed a vertical GaN power semiconductor device with high current operation of 100 A on a single chip… The company's latest development, which has doubled the electric current capacity from the previous 50 A to 100 A on a single chip, is the introduction of a new current distribution layer that lowers electric resistance by expanding the flow of electricity on the drift layer. …Toyoda Gosei will continue improving the reliability and other qualities of the devices for their early commercialization in collaboration with manufacturers in the field of power electronics."

(Source: May 23, 2019 press release at https://www.toyoda-gosei.com/news/detail/?id=228)

United Silicon Carbide (UnitedSiC, now Qorvo)

(Monmouth Junction, NJ)

This SiC specialist's website says, "powerful combination enables best-in-class intelligent SiC power solutions".

(Source: https://unitedsic.com/)

Products include SiC Merged-PiN-Schottky (MPS) diodes (650 V, 1200 V and 1700 V), SiC JFETs (650, 900 V, 1200 V and 1700 V) and SiC FETs (cascode-configured JFETs, 650 V, 750 V, 1200 V and 1700V).

(Source: https://unitedsic.com/ and see Products menu.)

On November 3, 2021, Qorvo announced its acquisition of UnitedSiC.

ViSIC Technologies

(Nes Ziona, Israel)

"VisIC Technologies was founded …with the goal of advancing gallium nitride (GaN) technology into mainstream usage…Based on the foundations of the fundamental science the development team arrived at an optimized design of one of the most reliable, high voltage, high current (650-V, 100-A) transistor designs. The design was neither based upon enhancement-mode GaN with its inherent gate limitations nor the restrictive performance of cascode depletion-mode GaN. The D3GaN era arrived with the novel Depletion-mode Direct Drive GaN technology emerging as an eminently suitable technology meeting the demand of highly reliable and extremely robust product…VisIC Technologies works with Taiwan Semiconductor Manufacturing Company (TSMC) as a foundry source for the proprietary D3GaN process."

(Source: https://visic-tech.com/about/)

Products include 650-V GaN-based transistors, eval boards and reference designs.

(Source: https://visic-tech.com/gan-based-products/)

Wolfspeed

(Durham, NC)

"Wolfspeed's founders were the first to successfully commercialize silicon carbide, and for more than 30 years have focused on designing and supplying the industry's highest-performing silicon carbide and GaN-on-silicon-carbide materials and devices for high-power applications."

(Source: https://www.wolfspeed.com/company/about/)

Power products include discrete SiC MOSFETs (650 V, 900 V, 1000 V, 1200 V and 1700 V), bare die SiC MOSFETs (650 V, 900 V, 1200 V and 1700 V), discrete and bare die SiC Schottky diodes (600 V, 650 V and 1200 V), SiC power modules (1200 V), gate driver boards, reference designs and evaluation kits.

Source: https://www.wolfspeed.com/ and see Products menu.)

Reference

For perspective on how this field has changed, see the 2019 edition of "Who's Who In Silicon Carbide And Gallium Nitride Power Semiconductors".