

CES 2019: A Great And Possibly Growing Forum For Power Developments

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With its thousands of exhibits, demo suites and meeting rooms, CES 2019 provided insights into developments and trends in many areas of electronics including power electronics. All of the products being showcased need power supplies in some form. In some cases, such as autonomous vehicles, power electronics is an enabling technology since most of these cutting edge products are electric vehicles. This year Kevin and I toured a few of the exhibition halls at CES and met with representatives of power semiconductor companies in their suites. We not only saw a wide array of end products that are driving demands for high-performance or application-specific power solutions, we also saw many power converter reference designs and product examples using advanced power ICs, power semiconductors, and power modules.

Semiconductor Companies Were Out In Force

Semiconductor companies were everywhere this year and mainly followed one of two strategies. Most had a hospitality meeting room or hotel suite where they invited customers, partners and press to meet and view their demos in private. Texas Instruments, Infineon, Rohm Semiconductors, STMicroelectronics, Maxim, ON Semiconductor, EPC and Nexperia did this. Others seemed to have "graduated" to having floor space in the exhibition halls. Companies such as Qualcomm, Intel, ADI-LTC, Navitas, Microchip, NXP, Mitsubishi Electric and others went this route. In many cases, these exhibitors were showing complete original design manufacturer (ODM) like systems available for customers to private label or license. In other instances, they displayed product examples by specific customers that were using their chips.



Autonomous vehicle concepts from Kia and Mercedes-Benz.

The semiconductor companies at CES focused their exhibits on reference designs, partnerships including 3rd party relationships, and the concept of building ecologies. Drilling down, subjects such as built-in cybersecurity and autonomous driving were top of mind. Statista's "Connected Car Report 2019" projects that 100,000 level 4 or 5 autonomous cars will be built and deployed in 2019—although this is small piece of the overall automotive market, the segment is growing rapidly. (More on autonomous vehicles at CES in a bit.)

Whether they were showing their wares in the main exhibit halls or in the private meeting rooms or suites, the semiconductor companies featured a wide range of application demos using their components. Some of these application were the same one featured in the exhibits of the various OEMs. But what the semiconductor demos help illustrate is that all systems shown at CES need power and power electronics, whether a small device powered by energy harvesting, high-power traction drives, or even higher power, grid-tied alternative energy systems—or products operating at power levels anywhere between those extremes.

One takeaway from the power semiconductor demos is that wide bandgap technology is displacing swaths of the traditional MOSFET market. Telecom specs are 60 V to 72 V tops for safety extra low voltage (SELV) applications, so GaN is displacing MOSFETS in that market. According to EPC, GaN devices are at cost parity

with MOSFETS and 20 V is the crossover point. So below 20-V operation, there's little added value to using GaN.

Autonomous Vehicles, Radar/LiDAR And More Sensing

The North Hall of the Las Vegas Convention Center featured exhibits by car companies, their suppliers and other transportation-related exhibits. Despite the plethora of cars, there was little mention of driving with most exhibitors referring to "mobility" in their slogans—no doubt a nod to the anticipated changing nature of the automotive experience. With all the major car companies represented, autonomous vehicles (which are also EVs) were front and center in these exhibits.

Cars were not the only autonomous vehicles on display. An autonomous cart for farm work by Honda and a huge hybrid helicopter/plane by Bell Nexus demonstrated that the self-driving trend is creeping into different areas. As might be expected with car-centric exhibits, many of the products on display and the booths holding them were quite large. But an exhibit by Numarine took big to a whole new level by displaying a 78-foot smart (but not autonomous) luxury yacht called Adonis. It was so large, it easily obscured the tractor trailer parked behind it.



Hybrid helicopter-plane from Bell Nexus and smart yacht from Numarine.

Many of the autonomous cars on display were rather exotic looking thanks not only to their unusual shapes, but also their elaborate exterior lights and displays, some of which are intended to communicate with pedestrians or drivers of other vehicles. These elaborate lighting, signaling and display schemes suggest even more opportunities for LED drivers.

However, it wasn't so much the new vehicle lighting concepts that caught my (David's) eye as much as the exhibits featuring radar and LiDAR products. These are enablers for autonomous vehicles as well as other products. In the case of LiDAR, this is considered an early adopter of GaN devices such as those produced by EPC. That company has been showing LiDAR product examples using its part for several years. But the appearance of radar product examples in the TI and Infineon demo suites seemed new.

TI showcased its radar module in a 3D positioning application of fall detection. It also can be used in building or factory automation. Infineon featured a display by its customer, Blumio, showing how radar could be used for measuring a patient's blood pressure, breathing and other vital signs, noninvasively. Blumio's co-founder, Oliver Shay, very enthusiastically discussed the benefits of this technology.

Radar and LiDAR are very specific examples of a larger, long term semiconductor industry trend in developing sensing solutions.



ChargePoint's EV charging stations. Level 3 dc charger is shown on left.

Other semiconductor company demos featured various types of image sensors (TI), MEMS accelerometers (and other sensor types) to measure motor vibrations for predictive maintenance (STMicroelectronics) or sensing motor kickback (Rohm Semiconductor) or contactless current sensing (also Rohm). Many of the sensor products may have impact on the way power is managed.



Mitsubishi Electric showed on-board chargers and inverters featuring its power semiconductors.

The emphasis on EVs in the North Hall, also extended to exhibits featuring charging stations such as the one by Charge Point. EV charging was also prominent in the demo suites of STMicroelectronics, Rohm, ON Semiconductor and TI, which either showcased their components in Level 1, 2, or 3 charging stations or used in on-board EV chargers. Some of these featured silicon carbide (SiC) Schottkys and MOSFETs.

Some of these chip makers also showed traction inverters for EV applications. Back in the North Hall, Mitsubishi Electric showed inverters and motors for mild hybrid (48 V) and higher-voltage vehicle systems. The ones on display featured silicon IGBTs, but the company also has developed inverters using SiC MOSFETs.

As they did last year, EPC and Navitas helped to give GaN devices their due at CES. EPC's demo suite featured numerous product examples including multiple LiDAR and wireless power products, as well as more exotic ones like auto-lacing sneakers (practical for pro-

basketball players). Meanwhile Navitas took its participation to a new level this year by exhibiting in one of the South Halls. Their display cases showed various product examples including several ac adapters/chargers, a gaming laptop and e-mobility products (drones, for example).

This year's attention to wide bandgap devices continues and builds on the demos of these devices at CES in previous years, offering further evidence that both SiC and GaN are making strides commercially. Yet, the semiconductor displays and demos were by no means limited to wide bandgap devices.

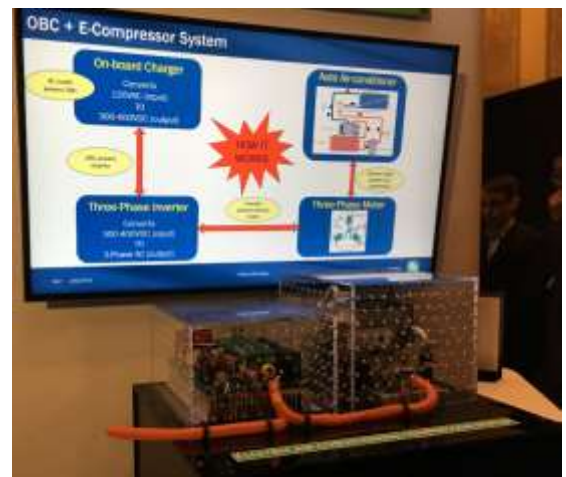
There were plenty of silicon power ICs, discrettes and modules for power servers (solutions for 48 V to CPU voltage, STMicroelectronics), enhancements to motion control chipsets (Infineon's iMotion), ICs and IGBT power modules for PV systems with battery storage (ON), wireless power ICs (Rohm), and buck converters and controllers for automotive subsystems (Maxim), just to name a few. In keeping with the broad scope of CES, a number of the product demos fell into the category of industrial IoT.

Batteries Were There Too

A number of battery suppliers were among the CES exhibitors, and while they tended to be overshadowed by other products, there was one that stood out. ProLogium's solid-state Lithium ceramic batteries are similar to conventional Li-ion batteries except with no electrolyte or separator. These batteries are said to be safer, more easily cooled and higher in energy density (by a factor of two) at the pack level. The individual cells consist of flat, metallic looking sheets that can be easily stacked to achieve the desired battery voltage and connected in parallel to reach the required current output.

While these batteries have numerous possible applications, their usefulness for EVs had the company showing their technology in the EV-centric North Hall. Even more notable, ProLogium's BiPolar+ 3D Solid-State EV Battery Pack was recognized with a CES 2019 Innovation Award.

This article has barely scratched the surface of power-related developments showcased at CES 2019. With the vast number of exhibitors and limited time, there was much more to see and experience at this show than we could take in. We encourage you to read more coverage of CES 2019 in the general press and the electronics industry press. Better yet, make plans to attend CES 2020 so you can quickly come up to speed on the countless products and technology shaping power requirements now and in the future.



ON Semiconductor's on-board charger demo.