

Vehicle Electrification and Energy Management Technologies are Moving Forward

Contributed by Louis Burgyan, Technical Adviser, LTEC Corporation

Despite the recent sluggish growth forecast of 3.1% for the global economy by the IMF, research and development activity in the field of vehicle electrification and energy management is moving ahead at full speed. This is also reflected in the unusually large number of technical analysis requests received by LTEC Corporation from the automotive industry. During the period of April to September in 2015, LTEC completed over 100 in-depth analysis reports, the majority of them dealing with advanced automotive electronics related EVs (Electric Vehicles,) HEVs (Hybrid Electric Vehicles), and PHEVs (Plug-in HEVs).

No doubt, this furry of activity is fueled by maturing wide bandgap semiconductor technologies, preparations for high volume production of batteries for EVs and energy storage applications for rooftop solar panels, and CO₂ regulations and other government incentives promoting green technologies. In addition, visionary concepts focusing on Smart Grid Technologies begin to view the fast growing deployed battery capacity for vehicle electrification and photovoltaic energy storage as a potentially useful component for increasing surge capacity and reducing peak energy demand. For the first time ever, the automotive industry is engaged in researching some of the new concepts of grid stabilization, demand response, and distribution optimization in order to determine how the substantial and growing deployed battery capacity could be utilized to minimize grid overload and provide distributed energy storage capacity.

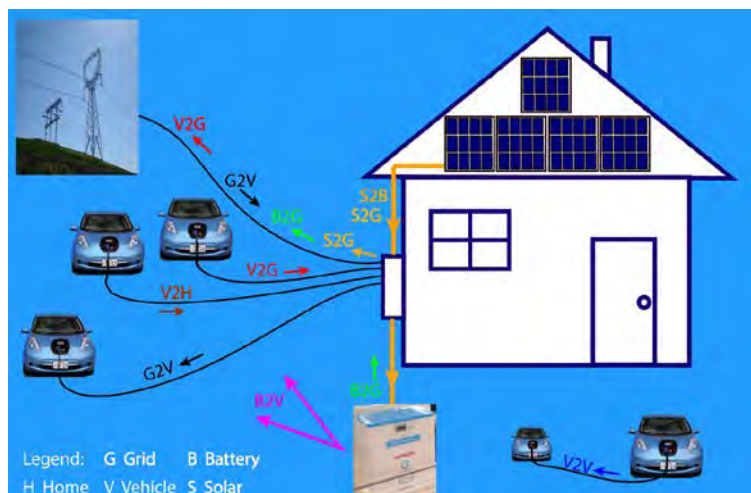


Figure 1. Illustration of a Bidirectional Energy Management system at the home

Researchers at Nissan, Toyota, BMW, Tesla Motors, and others are actively engaged in studying various aspects of EV battery –smart grid integration, a potential solution that may someday become an essential component for grid stabilization. For some of these concepts to work, bidirectional energy management systems have to be developed. It is also necessary to create financial incentives for the consumer to secure willingness to participate and carry the burden of some costs and inconvenience, something not to be taken for granted. Nevertheless, research and development is moving forward, and LTEC Corporation’s IP Analysis Services help its customers to understand and learn about leading edge vehicle electrification technologies as they appear on the market and assist them in creating and protecting their intellectual property.

Wide bandgap semiconductor devices are essential elements of vehicle electrification, advanced grid-connected renewable energy systems, and smart grid based energy management solutions.

ROHM (SiC)		CREE (SiC)		ST Micronics (SiC)		GaN System	
Product name	Function	Product name	Function	Product name	Function	Product name	Function
SCS110AG	SBD	C3D10060G	SBD	STPSC806D	SBD	CS66508P-E03-TY	Switch
SCS106AG		C3D01060A		STPSC1206		GS61008P	
SCS108AG		C3D02060A		STPSC2006CW			
SCS112AG		C3D03060A		STPSC406			
SCS110AG		CMF10120		STPSC606			
SCS120KES		CMF20120	STPSC1006D				
SCS105KG		Transistor	C2M0080120	SCT30N120	Transistor		
SCS110KG							
SCS120AE2							
SCH2080KE		Transistor					

Table 1. Some of the recent SiC and GaN analysis reports available from LTEC Corporation

Table 1 lists some of LTEC Corporation’s latest technology analysis reports of SiC and GaN semiconductor devices. A number of other system-level analysis reports are also available. Figure 2 shows images from a new technical analysis report of the Suzuki Alto battery management system designed for high fuel efficiency light motor vehicle applications. Suzuki’s 660cm³ vehicle engine achieves 75.2 mile/gallon fuel efficiency with help from the S-ENCHARGE® battery assisted system. Figure 3 shows the front page of one of the recent SiC device analysis reports by LTEC.

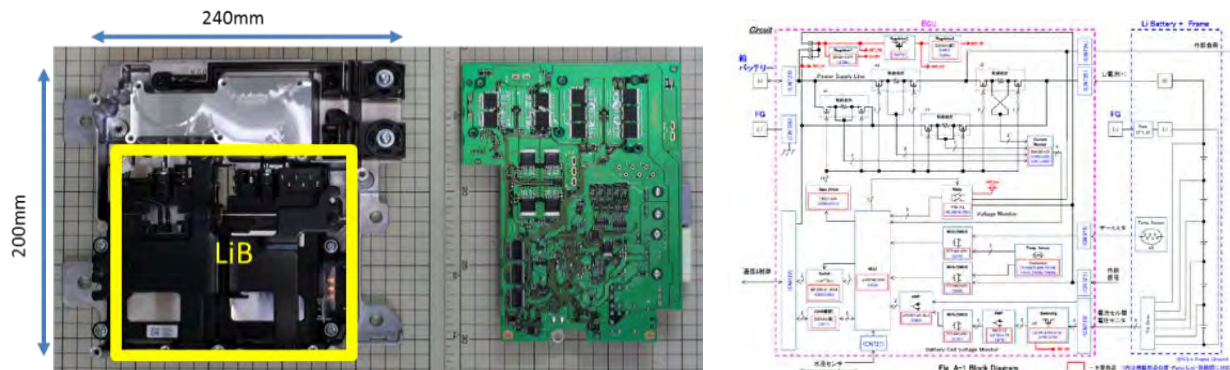


Figure 2. Battery management system to enhance fuel efficiency



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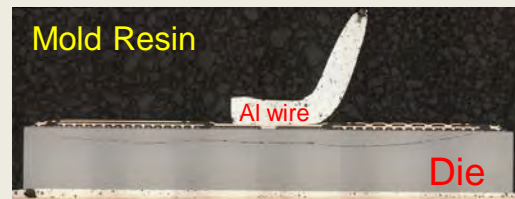
DETAILED STRUCTURE ANALYSIS REPORT OF PANASONIC PGA26C09 DV GaN POWER SEMICONDUCTOR DEVICE

Package

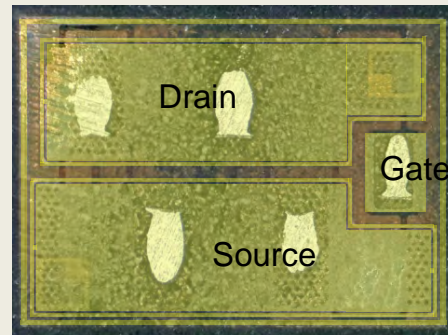


TO-220 Package

Overall cross-section.



GaN Die



- This 89 page report reveals construction details of the **Panasonic PGA26C09DV** GaN power semiconductor device including **two-layer Cu interconnect, Al bond wire over active area, on-chip integrated Gate ESD protection, and unique recessed/regrowth AlGaN channel barrier structure.**
- The report includes package details, layout analysis, die analysis by delayering, cross sections (SEM, TEM), and materials analysis (EDX).

Please contact LTEC Corporation

Contact info@ltecusa.com for more information.



LTEC Corporation US Representative Office
No.203 2880 Zanker Road San Jose, CA 95034

Phone: (408)432-7247

www.ltecusa.com Contact: info@ltecusa.com

Figure 3. One of several recent analysis reports on wide bandgap semiconductor devices

LTEC Corporation's technical analysis reports cover a wide range of engineering topics:

- PCB analysis of various automotive products
 - Structure analysis, circuit extraction, electrical tests and simulations
- DCDC convertor for EV, PV, PHV
- Motor inverter controller for EV, PV, PHV
- Battery control ECU for EV, PV, PHV
- Battery charge control ECU
- LED Head light
- Camera module for automotive application
- Sensor module
- Instrument panel
- Devices for automotive application
- Multi cells Battery voltage measurement IC
- DCDC converter IC
- LED controller IC
- CMOS image sensor
- ...and many more

Useful links

<http://energy.gov/eere/vehicles/vehicle-technologies-office-batteries>
<http://www.technologyreview.com/news/538541/nissan-gm-give-ev-batteries-a-second-life/>
<http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&ved=0CDEQFjAFahUKEwiv2YHbwdHIAhVQy2MKHfNEDYQ&url=http%3A%2F%2Ftechxplore.com%2Fpdf347526819.pdf&usg=AFQjCNEECMpDQDTUqisxzQ8EJipNzaymZQ>
<http://www.pdma.com/technical-forums/energy-efficiency/presentations>
<http://electronicdesign.com/print/power/lithium-battery-technology-drivers>

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LTEC Corporation
Corporate Head Office
4-42-8 Higashi-Arioka, Itami
Hyogo, 664-0845 JAPAN

US Representative Office
2880 Zanker Road, Suite 203
San Jose CA 95134
(408) 432-7247

info@lteccusa.com

US Sales Office
Fides Sales
2310 Homestead Road, C1 #500
Los Altos, CA 94024
1 (408) 673-0073
sales@fidessales.com
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