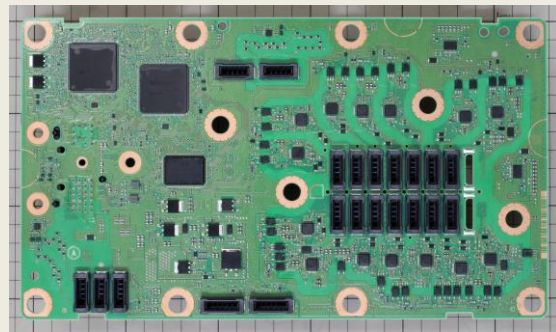


## TOYOTA PRIUS ZVW51 MOTOR-INVERTER CIRCUIT ANALYSIS REPORT

**June, 2016.** This ninety-five page document is one of six reports, each analyzing various segments of the ZVW51 system. This report is focusing on the control board and its detailed circuits analysis. PCB structural details with various dimensions, component list, block diagram, detailed circuit schematic diagram, transformer inductance measurement, noise countermeasures and thermal analysis results are included in this report.



**Prius ZVW51 front inverter**



**Control board**

The PCB within this Motor Inverter, produced by DENSO, is the control board for the power module (Power Card). The main functions of the control board are motor drive control, regenerative motor control, and bi-directional DC-DC converter control. The system has the following key features:

1. Control is performed by fourteen gate driver ASICs and one control ASIC, all made by Denso, and two MCUs fabricated by Renesas. The ASICs are key enablers to reduce PCB size.
2. The control algorithm is straightforward, few external components are required.
3. The resolver interface circuit is also included in the control board.

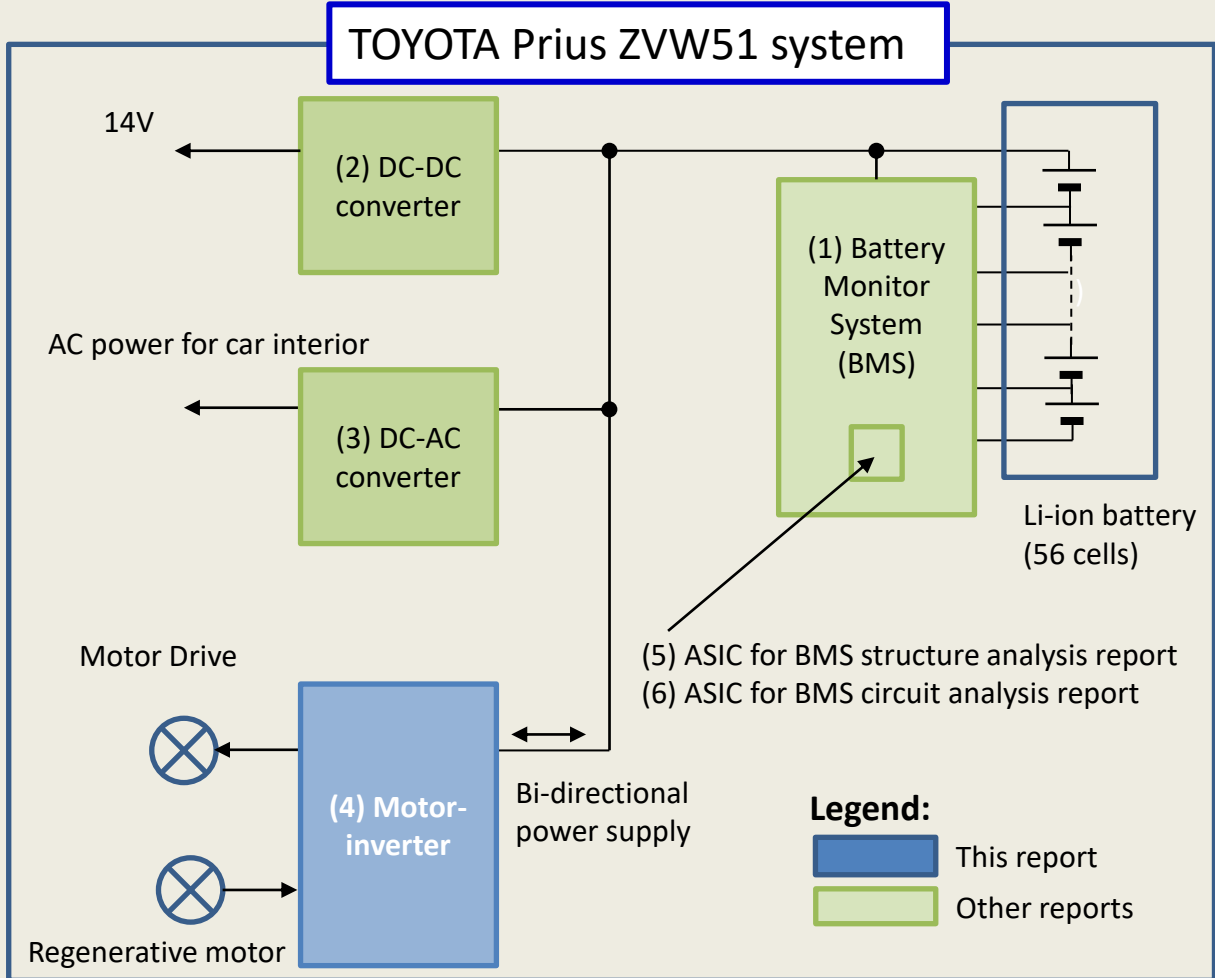
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15G-0008-1

The block diagram of the Toyota Prius ZVW51 system, and the corresponding LTEC analysis reports are listed below:



### Family of LTEC analysis reports related to the ZVW51 system

### Report No.

- |   |            |
|---|------------|
| 1. BMS PCB circuit analysis report analysis report          | 15G-0006-1 |
| 2. DC-DC converter PCB circuit analysis report              | 15G-0007-1 |
| 3. DC-AC converter PCB circuit analysis report              | 16G-0001-1 |
| 4. Motor-inverter PCB circuit analysis report (this report) | 15G-0008-1 |
| 5. ASIC for BMS structure analysis report                   | 15G-0013-1 |
| 5. ASIC for BMS circuit analysis report                     | 15G-0005-1 |

15G-0008-1

Examination of the control board, the subject of this report, leads to our conclusion that the dual heat management path and the extensive use of ASICs in this PCB, along with other features, enabled significant size reduction and cost savings.

In reference to Page 2, all six constituent elements of the ZVW51 system, analyzed and reported on by LTEC, reflect that overall, the Toyota Prius ZVW51 system represents an exceptionally well thought-out compact, highly cost-effective design.

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