Project
Motor Controller

Application
Commercial Vehicle Electronics

Customer Need

An 8HP 3-Phase Motor is used to drive an air compressor for a large hybrid vehicle breaking system. A motor controller is required to control motor speed with a 300VDC to 420VDC input bus. The product must meet automotive requirements for reliability and ruggedness.

AVID's Solution

Challenges for this project included high instantaneous switching currents, critical timing for phase switching, thermal protection, and addressing the parasitic parameters of the switching devices and other system components. Excessive noise must be eliminated as it causes errant operation and ultimately component failures. Three half bridge drivers commutate at 200 KHz. A high side PWM switches at 20 KHz to control speed. The design is partitioned into two boards; a low voltage digital control board and a high voltage driver board. The LV board comprises a DSP for system control, DC/DC supply, inputs for motor speed, pressure and temperature, and outputs for the PWM drive and valve control. The HV board contains three half bridge IGBT low side drivers and FET high side drivers. Low voltage power isolation is needed for the FET drive and sensor circuits. Thermistor temperature sensing and protection was included for each phase. The layout required hand-crafted planning to accommodate the ~20A currents, isolation requirements, and tight loops to minimize system noise and emissions.

Value Added or Technologies Applied

- Review and Re-Design of Customer Circuitry to Address Problems with Operation, Noise, and Component Failures
- Parallel Paths for Different System Architectures to Determine Optimum Implementation
- Prototyping and Bench Testing of Critical Sections of Each
- Hand-Crafted Layout and Board Partitioning Optimization
- Final Design Implementation, PCB Layout, Prototype, and Bench Testing
- Engineering Build of 20+ Units for Customer Validation and Field Testing
- AVID Support of the Customer Testing, Validation, Field Trials, Production Readiness

Project
Passive Keyless Entry System

Application
Vehicle Electronics

Customer Need

A Tier1 automotive company desired a fully functional, production-ready design of a passive keyless entry and ignition system to offer to major automotive OEMs. The system uses low frequency immobilizer technology leveraging RFID techniques. System components include base station, key fob, and highly directional antennas. A system prototype integrated into an actual vehicle for presentation purposes is included in the development program.

AVID's Solution

Using technology and components which are targeted for RKE and RFID, AVID designed the base station and key fob boards. HF was used for traditional push button operation, whereas LF was used to achieve the passive hands-free mode. Multiple antennas are required to accurately detect the position of the fob; inside or outside the vehicle. This allows starting when inside the passenger compartment, but inhibited when outside. Additionally, a locked door will remain locked when the fob is inside, but unlocks when in close proximity outside. Custom omni-directional antennas to facilitate LF and HF wavelengths were designed to fit in side view mirrors, door handles, and in the passenger compartment. A custom electro-mechanical latch was designed to address combo electro-mechanical and straight mechanical opening and locking. Rolling code algorithms were implemented for security. The fob required special attention to power management to achieve long battery life. Critical factors considered for the design include automotive environmental and EMC requirements, cost, reliability, safety, and adaptability to different vehicles.

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Project
Passive Keyless Entry System

Application
Vehicle Electronics

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Value Added or Technologies Applied

- Product Specification
- System Architecture and Design (Hardware, Firmware, Mechanical, RF)
- Prototype and Validation
- Multiple Demonstration System Integrations (Vehicle Cut-Away, Full Vehicle, Motorcycle, Bench Top Demo System)
- Project Management of Several Third Party Contributors of System Components
- Manufacturing Engineering Support, Production Test Procedure
- Customer Support for OEM Presentations and SAE Show Support for Demo Platforms and Booth Duty.

Project
Keyless Ignition Electronics

Application
Vehicle Key Fob

Customer Need

A mechanically-oriented customer needs electronic design assistance for a keyless fob ignition system. The system incorporates off-the-shelf immobilizer technology but requires electronics for position detection of the fob for the different states of ignition power normally addressed by a key switch. In this case the fob is inserted into a movable trolley to achieve the equivalent of accessory, on, start, and off. A push to start feature is required along with dimmable panel lighting, and interface to other vehicle electronics. Compliance with the automotive MIZRA documentation standard was required.

AVID's Solution

A low cost microcontroller was implemented to perform sensing of limit switches which were triggered by the trolley position. Dedicated outputs were controlled based on a closely controlled state machine based on normal operation requirements but constrained by safety and fail safe considerations. PWM was used for backlight dimming of the panel lighting provided by LEDs. Multiple LEDs and light pipes were used for a consistent brightness. All software documentation was created to comply with the MIZRA spec. Special care was paid to the board design to meet stringent automotive requirements for power and EMC.

Value Added or Technologies Applied

- Hardware and Firmware Architecture
- Hardware and Firmware Design and Documentation Compliant with Automotive Standard
- Prototype and Validation
- Engineering Build for Customer Testing and Field Tests
- Qualification Test Support
- Manufacturing Support

AVID TECHNOLOGIES, INC.

Engineering Samples – Automotive Market

Project
Wireless Sensor Acquisition System

Application
Engine Monitoring

Customer Need

Our customer received a government contract to develop a wireless sensor system to be used to monitor and record various engine parameters such as battery voltage, engine oil level and viscosity, antifreeze temperature, vibration monitoring, and so on. To eliminate wiring, the sensors were to be battery powered and include a low cost wireless interface. The base station is powered from the vehicle battery and includes sufficient storage of sensor data history, its own I/O, and a Bluetooth interface which provides for downloading vehicle data wirelessly at the maintenance facility.

AVID's Solution

AVID was asked to design a prototype model of the system first. Once proven and approved by the government, a Phase 2 would follow for actual packaging of the sensors. The system was designed around a custom 915MHz RF link. Each sensor was addressable and reported data when requested by the base. The sensor design included analog inputs capable of voltage or current inputs, software programmable gain stage, and 12 bit A/D. A factory calibration process allowed the use of embedded reference and other non-precision components. The base station included similar inputs as well as the memory for data storage. An off-the-shelf Bluetooth module was selected for the model to shorten development time and cost. Several boards were made which were actually put into vehicle to complete the proof of concept.

Value Added or Technologies Applied

- System Architecture, Sensor Electronics and Base Station Hardware and Firmware Architecture
- Hardware Design of the Base Station and Sensor Board
- Firmware Design of the Sensor Board, Firmware Driver Design and Test Code for the Base Station
- PCB Layout of Both Boards
- Prototype and Validation
- Engineering Builds for Proof of Concept Systems
- EMC Test Support

Project
Multi-Output Power Supply

Application
Vehicle Electronics

Customer Need

Existing customer's product was in full production. Customer requested analysis for cost reduction targeted at 30%. Base requirement for as good or better performance, and form, fit, and functional replacement. The application was a power converter used to create various supply voltages as required by an instrument cluster with stepper motors, vacuum florescent display, backlighting, and other indicator devices. The supply produces five regulated DC and a single AC voltage from the 12V vehicle bus.

AVID's Solution

AVID re-evaluated the entire design architecture and implemented a Sepic topology with tightly regulated primary outputs and secondary outputs which follow the primary regulation. All parts were carefully evaluated to determine absolute requirements and if suitable lower cost replacements could be used. Efficiency was greatly improved allowing the elimination of a large heat sink saving board space and cost. Part count was reduced by one-third with similar BOM cost savings. Regulation, ripple, step response were improved. The new design was prototyped and validated against stringent automotive standards for EMC emissions and immunity. The design surpassed the cost savings goal, as well as out performed the existing design in several areas. AVID supported the production release and pilot builds.

Value Added or Technologies Applied

- Existing Design Evaluation, New Design Architecture
- Hardware and Packaging Design
- Prototype and Validation
- EMC Testing, Design Tweaks as Required
- DV, PV Support as Requested From Our Customer
- Ongoing Production Support as Requested