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ON Semiconductor®

Energy Efficient Innovations

Automotive Solutions

Comprehensive solutions for advanced automotive subsystems from ON Semiconductor.

www.onsemi.com

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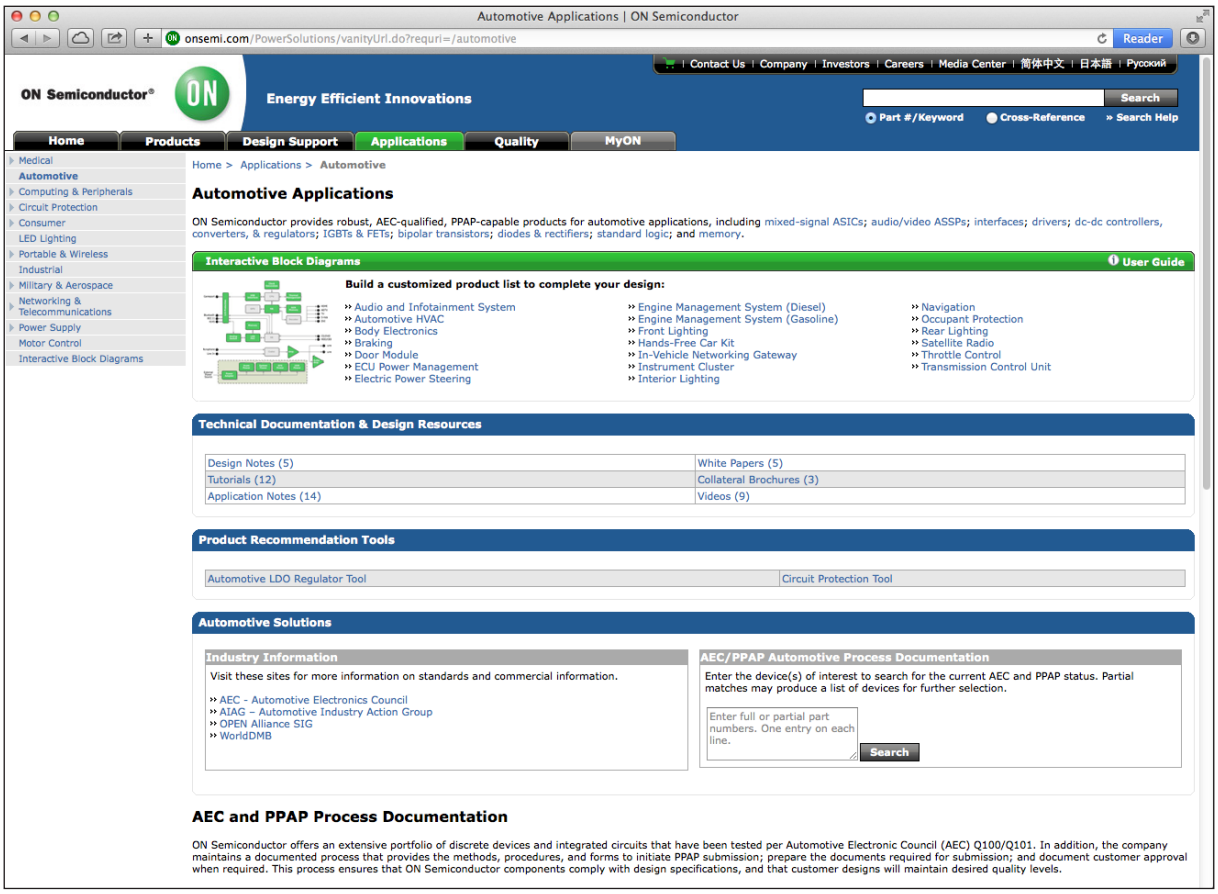


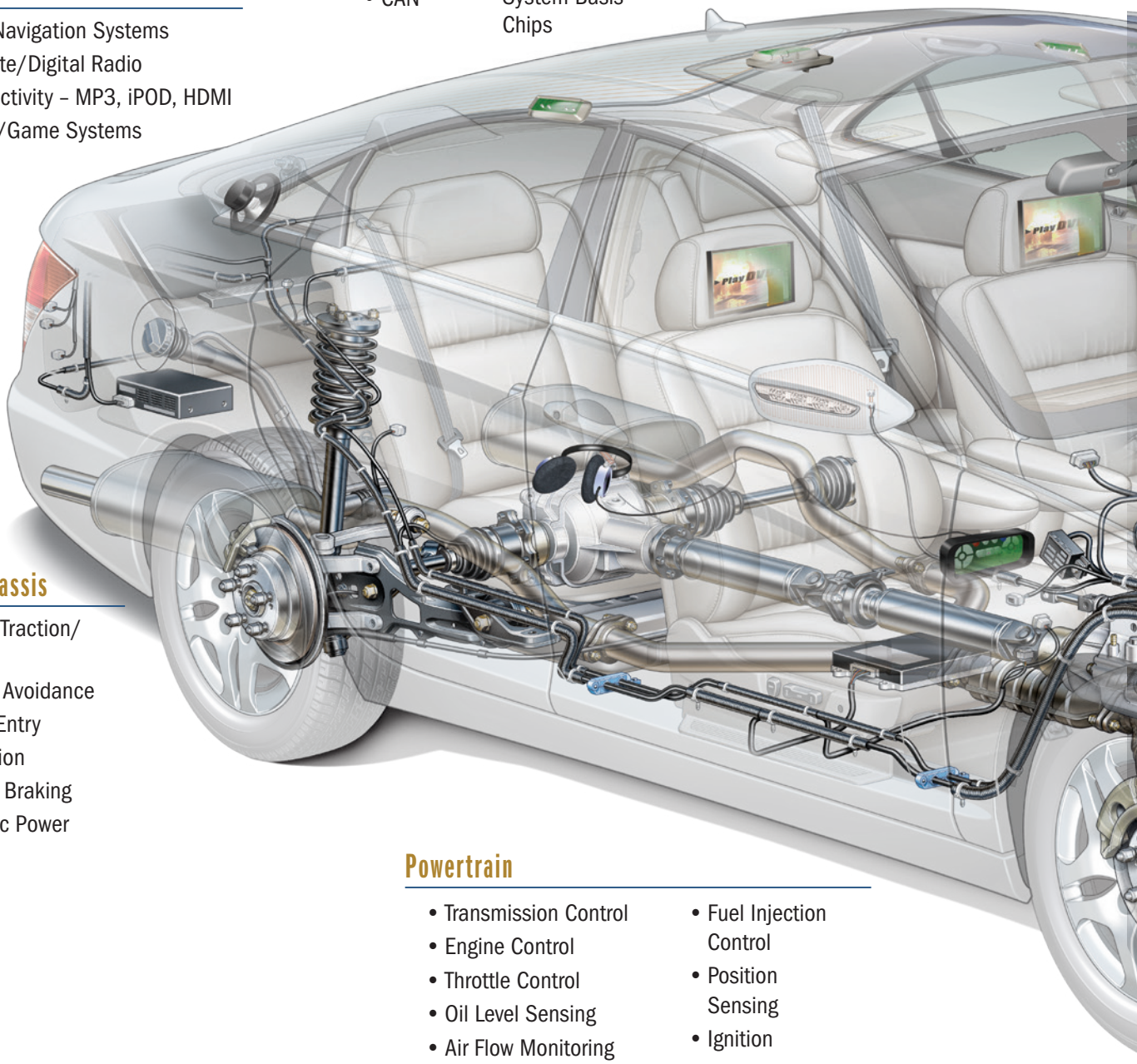
EXPERTISE

In-Vehicle Networking

- FlexRay™
- LIN
- CAN
- PSI5
- SENT
- System Basis Chips

Audio & Infotainment

- GPS/Navigation Systems
- Satellite/Digital Radio
- Connectivity – MP3, iPOD, HDMI
- Movie/Game Systems



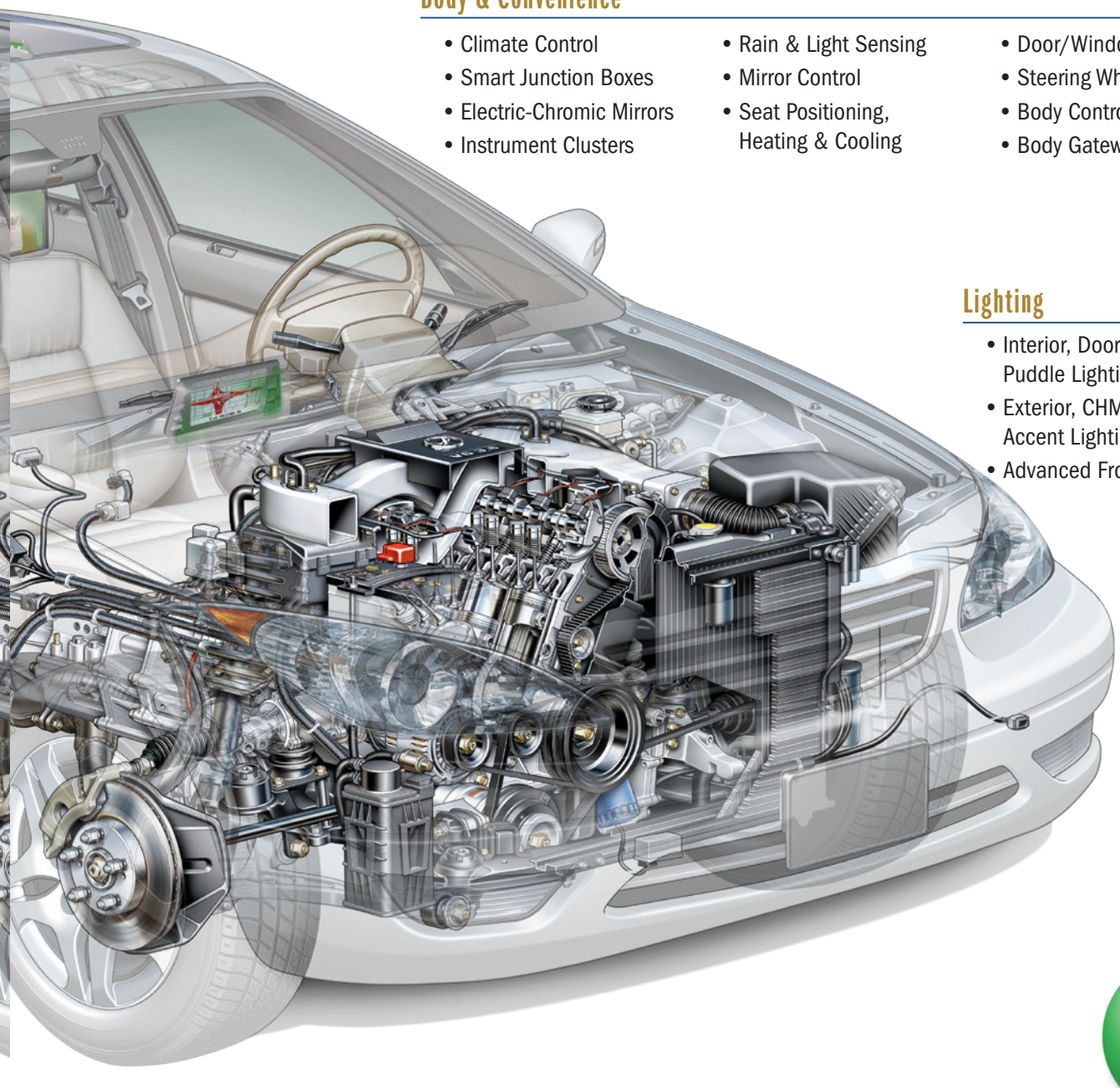
Safety & Chassis

- Braking/Traction/ Stability
- Collision Avoidance
- Keyless Entry
- Suspension
- Dynamic Braking
- Electronic Power Steering

Powertrain

- Transmission Control
- Engine Control
- Throttle Control
- Oil Level Sensing
- Air Flow Monitoring
- Valve Control
- Fuel Injection Control
- Position Sensing
- Ignition
- Alternators

ON Semiconductor enables energy efficient automotive solutions that reduce emissions, improve fuel economy, and enhance lighting, safety, connectivity, and infotainment power delivery systems. The company provides a broad array of power management, protection, processing, signal conditioning and control products that deliver solutions focused on powertrain, dynamic braking, lighting, climate control, door zone, collision warning, IVN, and infotainment applications.



Body & Convenience

- Climate Control
- Smart Junction Boxes
- Electric-Chromic Mirrors
- Instrument Clusters
- Rain & Light Sensing
- Mirror Control
- Seat Positioning, Heating & Cooling
- Door/Window Control
- Steering Wheel Sensors
- Body Control Units
- Body Gateway

Lighting

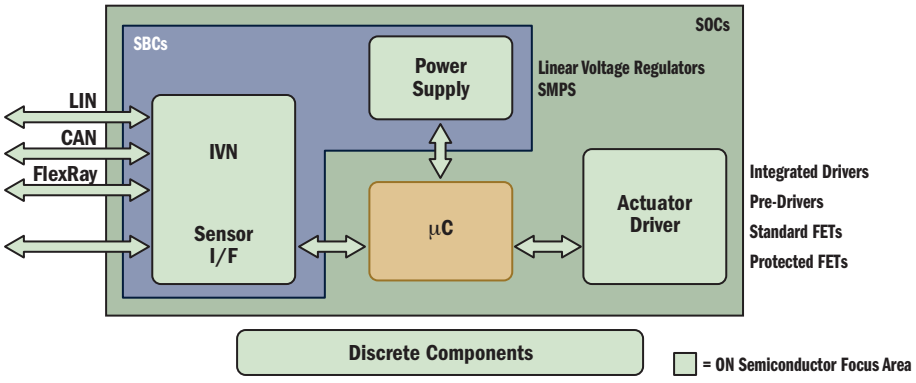
- Interior, Door, Dome, and Puddle Lighting
- Exterior, CHMSLs, RCLs, Accent Lighting
- Advanced Front Lighting

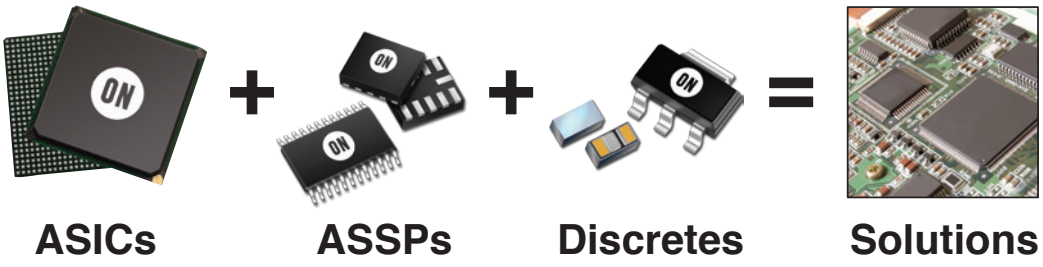
EXPERTISE

Automotive Solutions

Automotive powertrain and body electronics solutions from ON Semiconductor provide an optimized architecture, matched to customer requirements. The company provides multiple options, based on technology and application:

- Application Specific Integrated Circuits (ASIC)
- Application Specific Standard Products (ASSP)
- Standard integrated circuits
- Discrete components
- Analog
- Mixed-signal
- SBCs and SoCs





Automotive Excellence

Automotive Expertise

ON Semiconductor provides energy efficient silicon solutions to the global automotive industry. The company has developed a wide range of automotive components, by applying advanced technology and extensive R&D expertise, in the fields of high-voltage interfacing, smart power management, in-vehicle networking, system level integration, and sensor interfaces.

In-house expertise includes:

- ASIC, ASSP, standard IC, and discrete capability
- Mixed-signal technologies
- High-voltage processes
- Directly owned and operated fabrication facilities
- Class A clean rooms
- High temperature wafer testing
- Burn-in capability

Solutions Engineering Centers

ON Semiconductor operates Solution Engineering Centers in Munich, Germany; Shanghai, China; and Tokyo, Japan. These SECs, located in automotive industry centers, provide local customer support, including application knowledge and system integration skills. Together with local technical field teams and product specialists, the automotive SECs provide the following services:

- Local technical support
- Reference designs and demonstration boards
- Global application architecture consultation
- Optimization of system costs and performances
- Design integration support (ON Semiconductor devices into customer applications)
- Component specification and customer/application test specifications

Global Supply Chain Operations

Advanced Capability

ON Semiconductor invests in EDI, VMI, and other logistics agreements.

Global Locations

Worldwide, ON Semiconductor employs approximately 21,000 people. Headquartered in Phoenix, Arizona, U.S.A., the company owns and operates multiple development centers and manufacturing facilities located in the U.S.A., Europe, and Asia.

Global Supply Chain

ON Semiconductor operates a flexible, reliable, responsive supply chain that supports complex manufacturing networks and dynamic global market conditions. This includes multiple manufacturing and logistics sites located near our customers to ensure supply continuity.

Automotive Long-Term Availability Statement

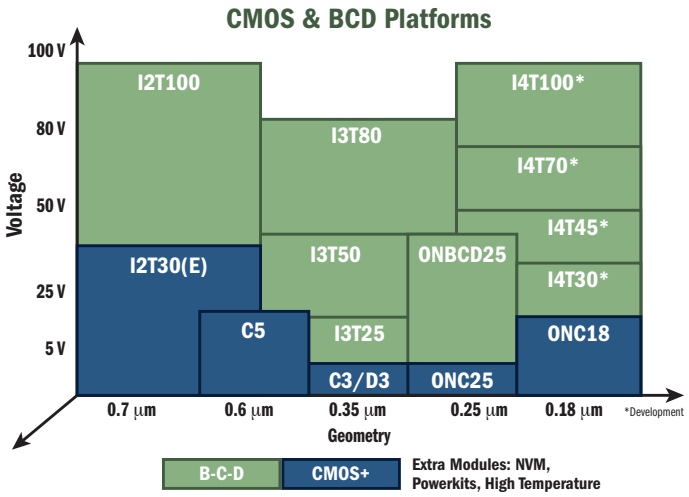
ON Semiconductor is 100% committed to the long-term supply of products in concert with the automotive industry's supply benchmark requirement. The company works with customers to meet their specific supply requirements. ON Semiconductor will make all commercially reasonable efforts to provide automotive customers with advance notice of phase-outs and provide compatible product renewals, when technically feasible and within certain cost constraints, to help ensure long-term supply considerations and requirements are fully achieved.

EXPERTISE

Automotive Technology

Proven Automotive Technical Capabilities

ON Semiconductor has developed a set of dedicated, high-voltage automotive power technologies. With parasitic signals running through automobiles, 80 V spikes can occur and must be accounted for by the design team. Modules and components need to be able to sustain such peaks and remain functional. ON Semiconductor technology enables complex, high-voltage system-on-chip (SoC) solutions that meet requirements for maximum voltage and digital gate integration.



Electro Magnetic Compatibility

In-Vehicle-Networking (IVN) applications require extended immunity against ESD pulses and EMI. Growing vehicle electronic content makes this even more important, and automobile manufacturers set performance standards accordingly. ON Semiconductor offers best-in-class devices using I3T50/I3T80 technologies, which provide advanced capabilities. Robust designs are achieved, for example, by deep trench isolation, which reduces the interference between the different cell structures on the chip.

ON Semiconductor offers a range of technologies that allow up to 100 V supply, and enables component integration – including embedded microprocessor cores.

ON Semiconductor technologies serve as the basis for automotive ASIC and application specific standard product (ASSP) solutions for powertrain (including high temperature applications with ambient temperatures ≥150°C), safety, body, dashboard, in-vehicle-networking (IVN), sensors, and actuator applications.

High Temperature Capability

ON Semiconductor offers a broad portfolio of products that operate in extended temperature ranges, up to 150°C. The company has also launched an initiative to extend high temperature capabilities to 200°C. This initiative includes enhancements to:

- Packaging and Bonding
- High Temperature Testing
- Component Test Vehicles
- Product Test Vehicles
- CAD Tools
- Libraries
- Spice Device Models

Extended high temperature capabilities may be applied to ASICs and ASSPs.

Automotive Quality

Automotive Grade Quality and Control Processes

For over 40 years, ON Semiconductor has been developing and delivering robust, high-performance solutions that allow designers to meet the demanding environmental and performance requirements of automotive applications.

> **Quality Policy**: "*We will exceed Customer Expectations with our Superior Products and Services.*"
>
> **Quality Statement**: "*Every ON employee is personally responsible for ensuring the highest Quality in the products and services delivered to internal and external customers. Continuous improvement in the Quality of our processes, products and service is fundamental to the achievement of customer satisfaction.*"

For certification documents, visit the Quality page on our Web site.

ON Semiconductor Quality Processes

- Registered to ISO 9001:2000
- Registered to ISO/TS 16949:2002, with all fabrication and assembly sites certified
- Quality System and Business Operating System are synonymous, and documented in Technical Specification (TS) 16949:2002.
- Corrective Action Program designed to eliminate root causes of non-conformances
- Controlled documentation procedures

Production Part Approval Process (PPAP)

Our documented process provides the methods, procedures, and forms to initiate PPAP submission; prepare the documents required for submission; and document customer approval when required. This process ensures that ON Semiconductor components comply with design specifications, and that customer designs will maintain desired quality levels.

Zero-Defect Program

Focused Parts "Non-Zero" devices (bottoms-up approach)

- Problem solving methodology
- Adequate Failure Analysis facilities
- Incident ownership

Prevent Recurrence Systemic Improvement (top-down approach)

- Process characterization, control plan, and Failure Mode Effect Analysis
- Maverick lot initiative
- Quarterly detailed Horizon Reports

ON Semiconductor's commitment to the automotive market extends beyond the delivery of great products, to ensuring that our manufacturing and quality processes meet the industry's need for reliability and robustness. The demanding standards of the automotive industry drive the company's design, manufacturing, and delivery processes. ON Semiconductor delivered over 42 billion parts in 2013, with a defect rate of less than 225 parts-per-billion.

Change Management Processes

ON Semiconductor proactively manages product changes to ensure Safe Customer Passage and Flawless Execution.

- Transfers handled in accordance with ON Semiconductor's TS-16949 certified Quality System
- Automotive Reliability Testing performed per Automotive Electronic Council (AEC) Q100/Q101
- Use of detailed Process/Parameter Matching Checklist
- Use of detailed changes process flow, with various checkpoints during and after the change implementation
- Use of program management methodology
- Customers notified through Product Change Notifications, and advance 'Horizon Reports'

EXPERTISE

Functional Safety Management: Development According to ISO 26262

Functional Safety at ON Semiconductor

ON Semiconductor has a long and successful history of mixed signal integrated circuit developments targeting safety critical applications. Following the release of the ISO 26262 standard in November 2011, ON Semiconductor created a dedicated Functional Safety team and implemented a dedicated design flow to support the development of devices targeting safety critical applications according to this new standard. This initiative has proven to be successful, as today the company has experience with the development of mixed-signal integrated circuits targeting applications with safety goals up to ASIL D.

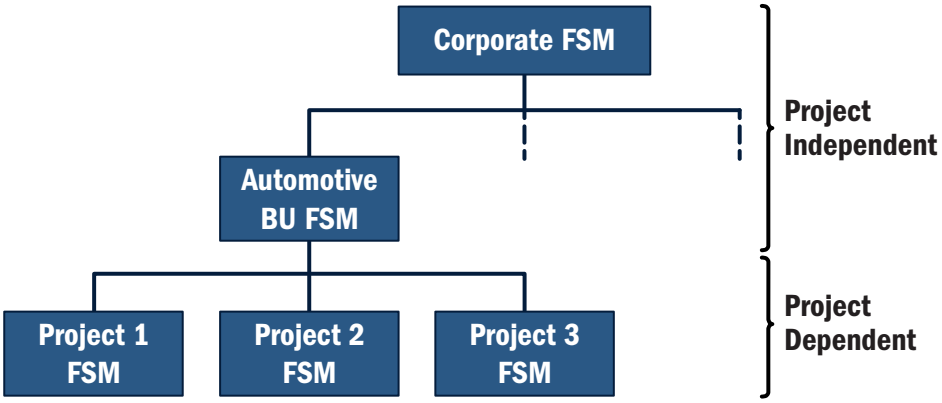
ON Semiconductor is highly involved in the Functional Safety community, especially in ISO 26262. The company is a member of the ISO 26262 work group (TC22/SC3/WG16), as well as part of the new ISO 26262 related semiconductor sub-work group that is clarifying the standard for semiconductor developments.

Creation of Dedicated and Independent Team

The purpose of the project independent team is to create a safety culture in the company and to guarantee an independent and critical look on the way functional safety will be guaranteed during the development of the devices. This independent team, driven partly by the quality department and partly by product development, has responsibility to guide the project Functional Safety Managers as well as the development teams assigned to the different developments, and provide the tools needed to follow the flow as described by the ISO 26262 standard.

Enhancing Experience

Through the ongoing developments and the dedicated Functional Safety Structure, ON Semiconductor is attaining even more significant experience, and is ready to support customers for automotive Functional Safety related projects.



Dedicated and Independent Team

Control, Communication, and Power for Body HVAC

The HVAC system includes several subsystems

Vehicle heating & ventilation systems

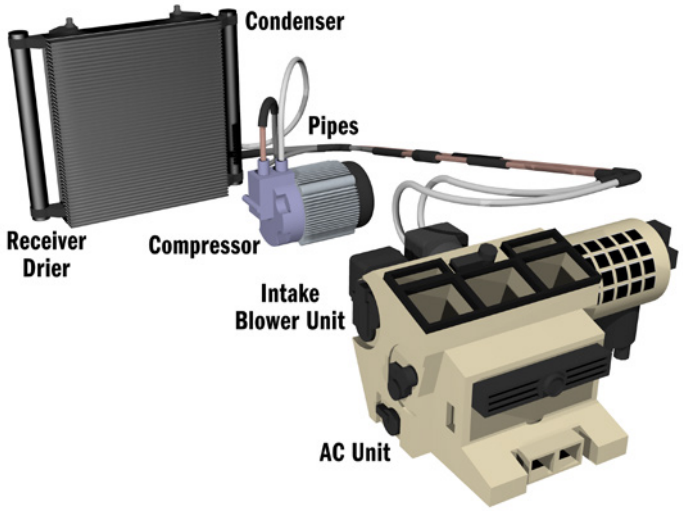
To improve passenger comfort and safety, fresh air is drawn from outside ducts and directed to the passenger compartment. Incoming air can be heated by passing over a small heating core connected to the engine's cooling system.

Air conditioning refrigerant

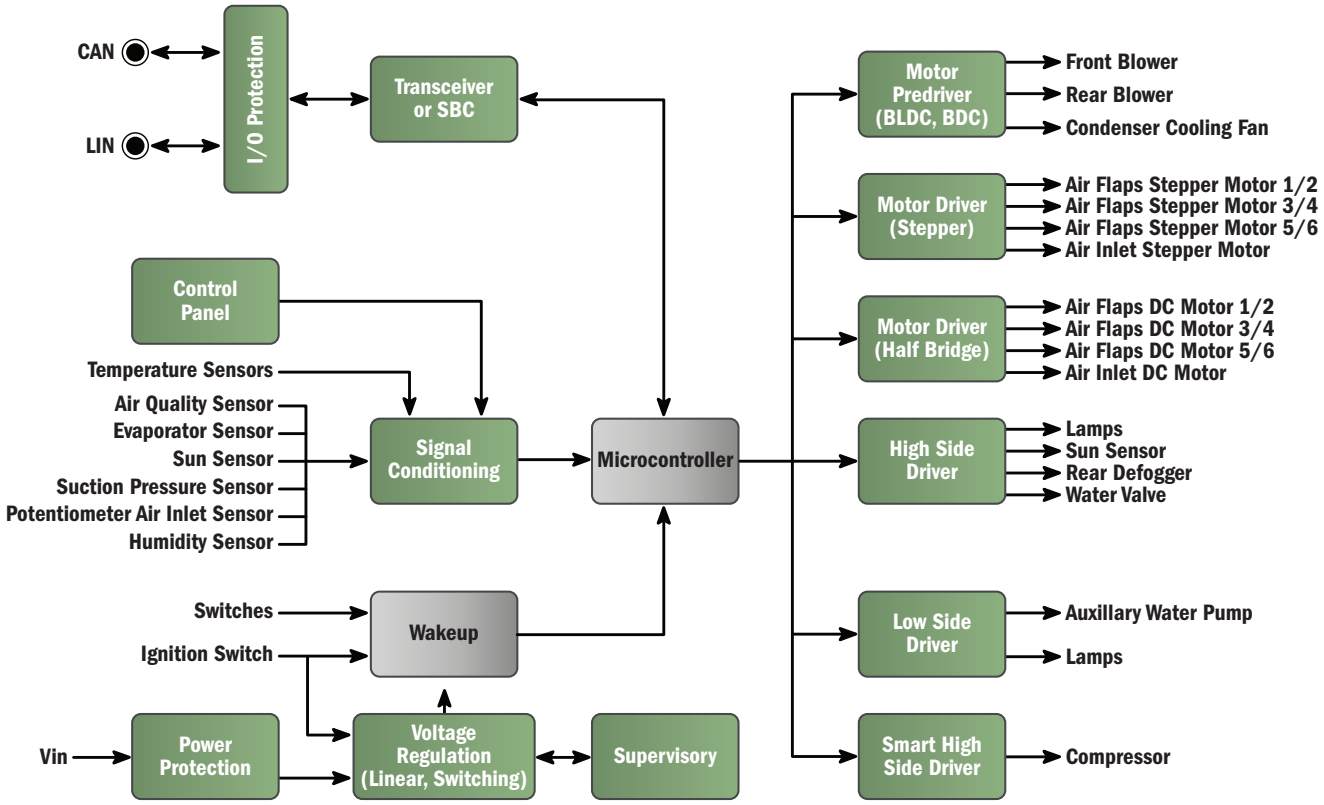
The refrigerant removes heat from the vehicle interior and transfers it to the outside air in a continuous cycle of vaporization and condensation. Reducing the temperature of the air also reduces its humidity. Cold air will not hold as much water vapor as warm air.

Control head

ECU (Electronic Control Unit) with user interface.



Interior Air Conditioning Unit



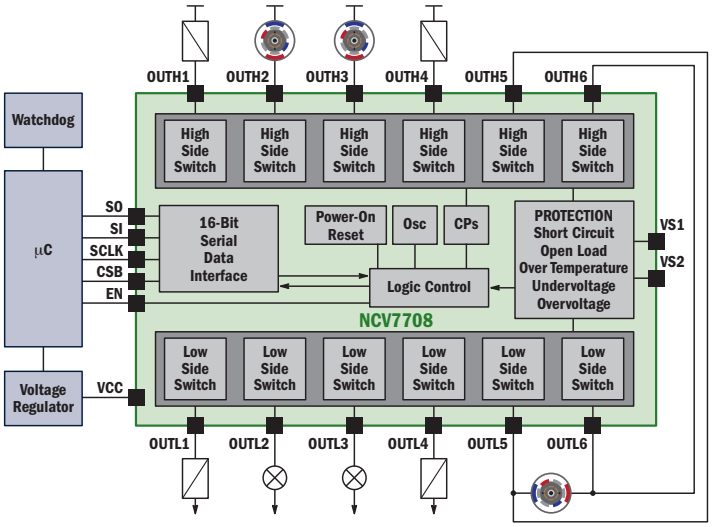
DC Motor Drivers for Body HVAC

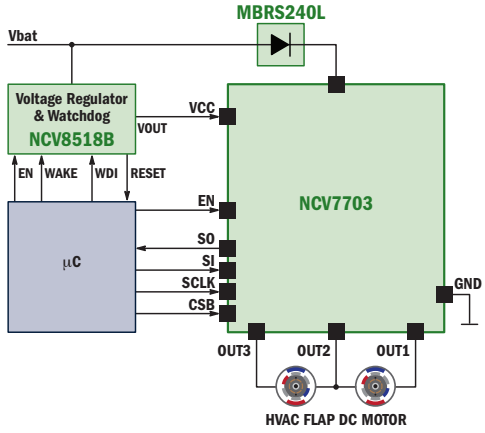
The most popular flap actuators are simple DC motors with position signal feedback to the microcontroller. To control a DC motor in forward and reverse direction, two high-side and two low-side power stages are necessary, in full-bridge configuration. Typically, these drivers integrate required features such as overvoltage, overload, and over temperature protection. In addition, the SPI interface provides diagnostics to the microcontroller.

Integrated pulse count technology combined with an extra signal conditioning block replaces the discrete position potentiometer. In pulse count applications, the circuit detects the DC motor commutation pulses and creates a pulse for every detected commutation pulse. These pulses are generally fed back to a microcontroller for position sensing and control. ON Semiconductor has custom ASICs for these types of circuits, in production today.

Dual Hex High/Low-Side Driver

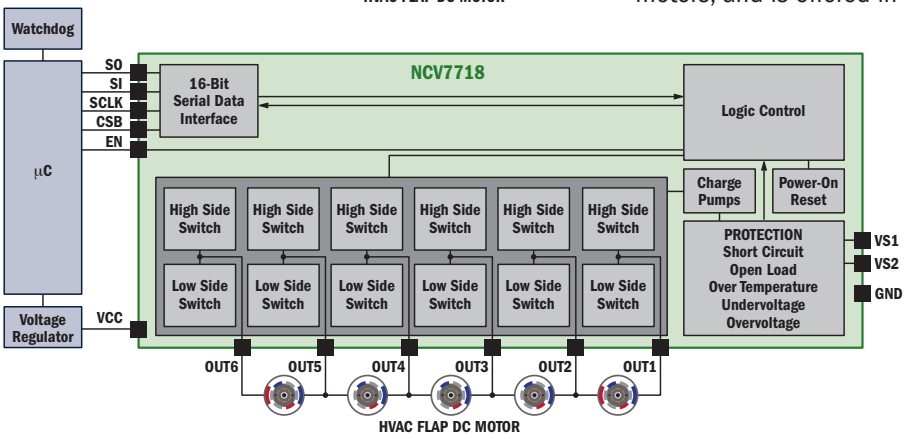
The NCV7708 is a flexible, single sided high/low-side driver. The six high and low-side channels are specifically designed for motor control configurations, like half or full bridges. NCV7708 will control five DC motors via a 16-bit SPI interface. The device can also control relays or LEDs.





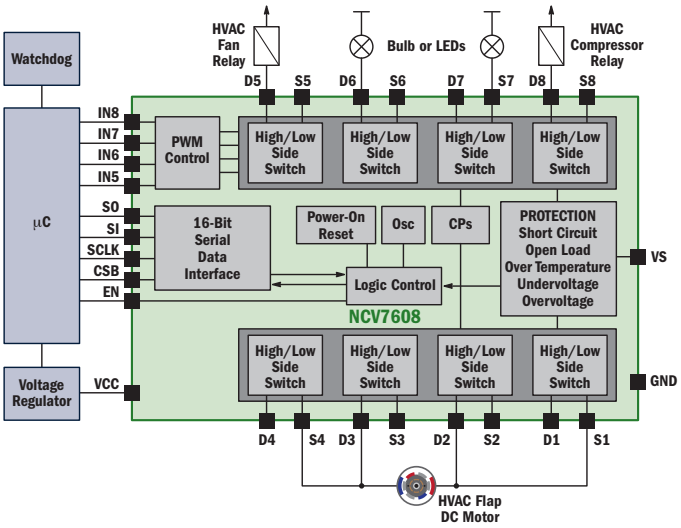
Half-Bridge Drivers

NCV7703 triple half-bridge driver controls two DC Motors. The power stages are internally connected as half-bridges, which allows a pin-count reduction to the SOIC-14 package. NCV7718 hex half-bridge driver controls up to 5 DC motors, and is offered in the SSOP-24 package.

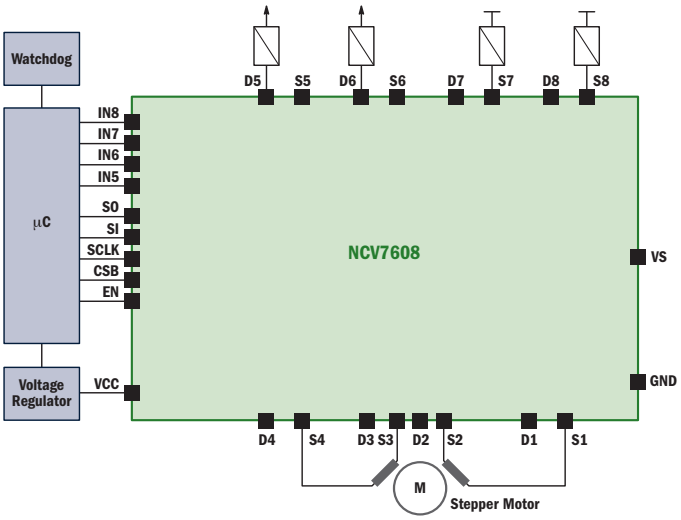


Configurable Motor, Relay, and LED Driver for Body HVAC

The NCV7608 drives different types of motors and various loads, such as bulbs, LEDs, and relays. The eight integrated output drivers are configurable in any combination of high-side, low-side, or half-bridge. This enables connection to DC, unipolar, or bipolar stepper motors. In addition, four channels include external PWM control capability. NCV7608 includes a special diagnostic current disable bit to prevent LED-glowing, as well as standard diagnostic features.

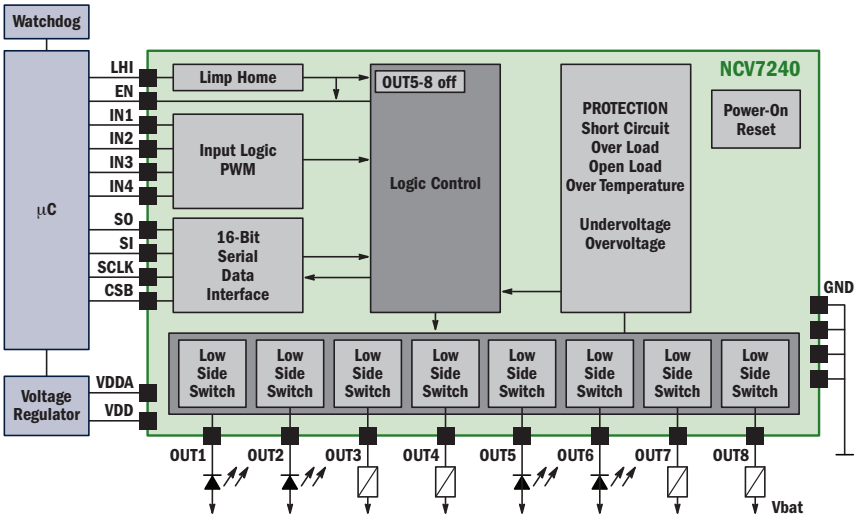


Highest Flexibility with NCV7608



NCV7608 Supports Unipolar and Bipolar Stepper Motor Control

The NCV7240 automotive eight channel low-side driver provides drive capability up to 600 mA per channel. Output control via SPI port offers convenient reporting of faults. Additionally, parallel control of the outputs is addressable (in pairs) via the INx pins. A dedicated limp-home mode pin (LHI) enables OUT1-OUT4 while disabling OUT5-OUT8. The NCV7240 is able to drive loads like LEDs, relays, or unipolar stepper motors.

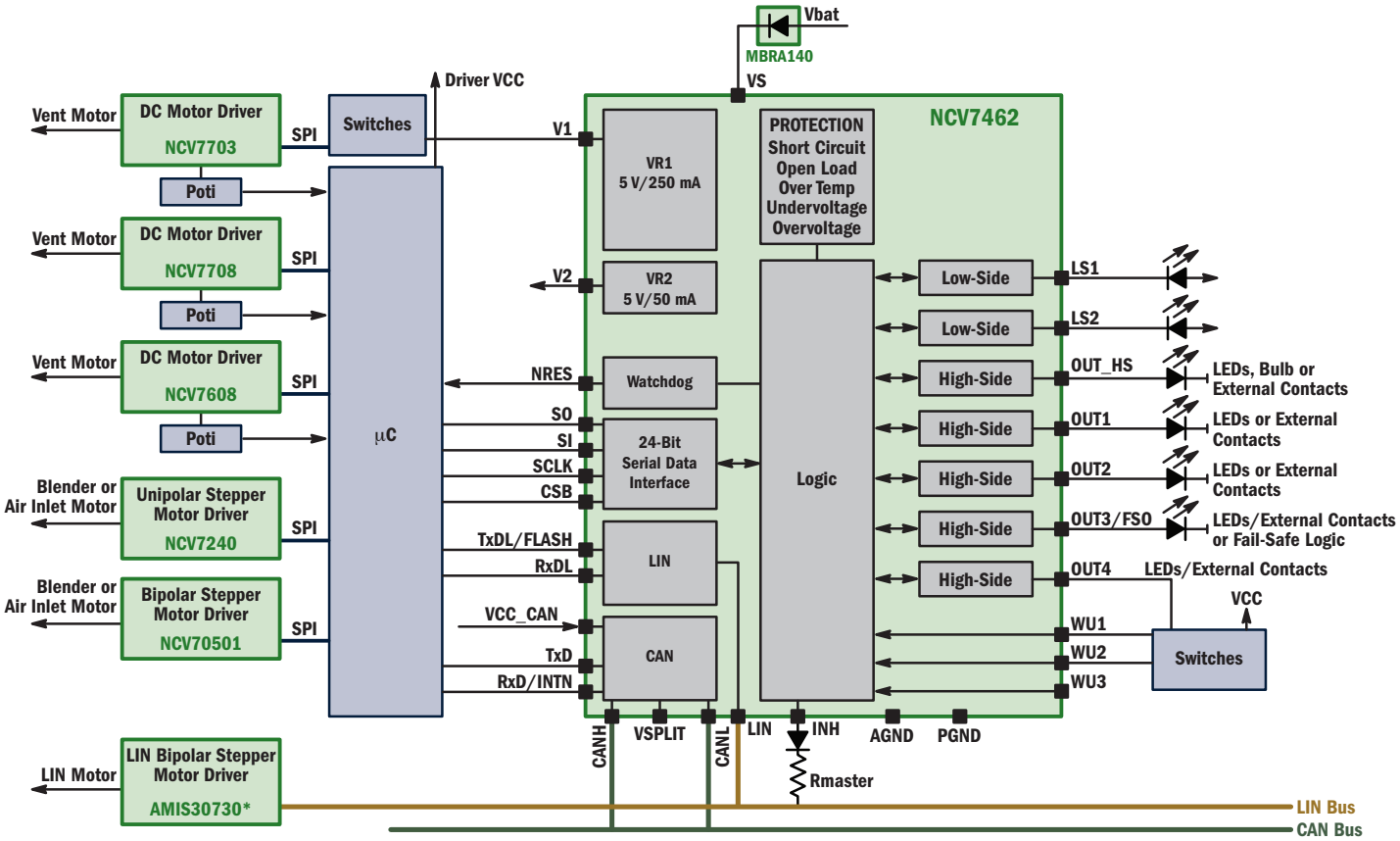


Air Flap Actuator Driver Topologies for HVAC

Climate control systems may operate with different system topologies - driven by the different regional and OEM requirements.

Actuator Types

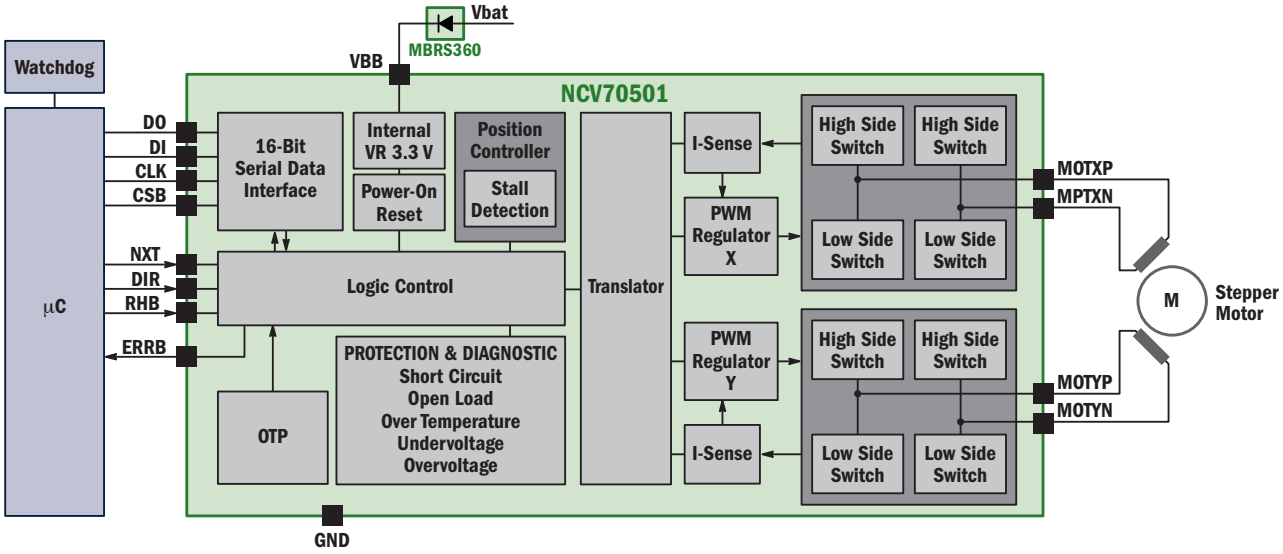
- Direct controlled actuators
  - DC motors (with and without position feedback)
  - Unipolar stepper motors
  - Bipolar stepper motors
- Bus connected mechatronic actuators
  - LIN bipolar stepper motors



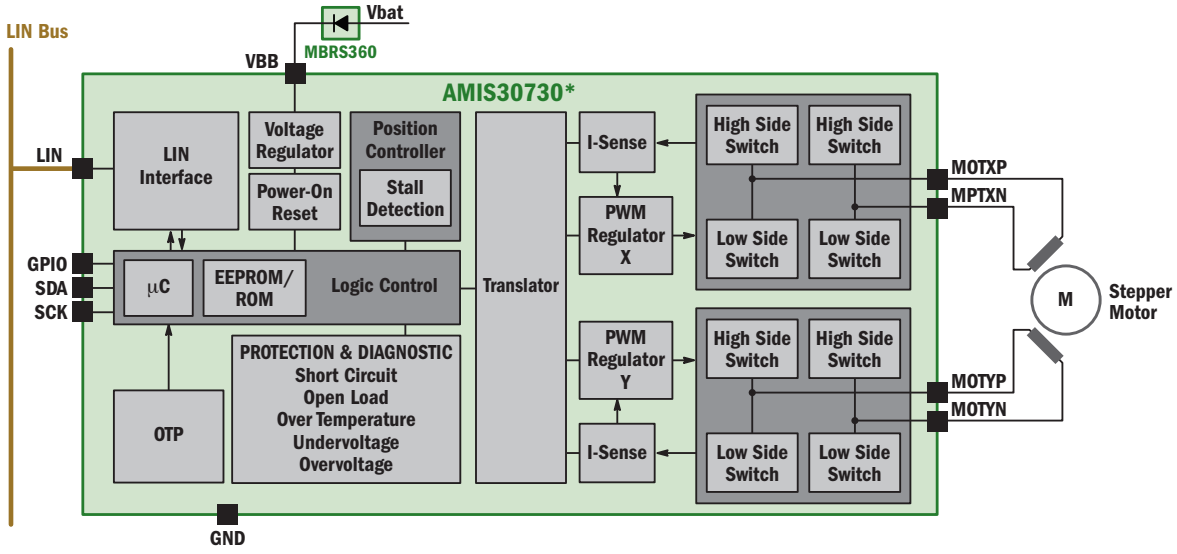
* Customer specific embedded software

Bipolar Stepper Motor Drivers for HVAC

In climate control systems unipolar and bipolar stepper actuators are used. For unipolar solutions the control electronic is more simple compared to bipolar ones. Instead of four low-side switches for unipolar motors, the bipolar requires two full-bridges.



Air-inlet flaps require low acoustic noise because the actuator operates in a continuous manner. Low acoustic noise can be achieved by using stepper motors, such as the NCV70501 micro−stepping stepper motor driver for bipolar stepper motors. NCV70501 controls the current through the windings of the bipolar stepper motor, contains a current−translation table and takes the next micro−step depending on the clock signal on the “NXT” input pin and the status of the “DIR” (=direction) register or input pin. An external microcontroller can work in interrupt mode, so there is no need to monitor the status registers continuously.



* Customer specific embedded software

AMIS-30730 is a single-chip platform for intelligent stepper motor drivers with embedded microcontroller and LIN interfaces. The device may be customized with embedded software for dedicated mechatronic solutions connected remotely with a LIN master.

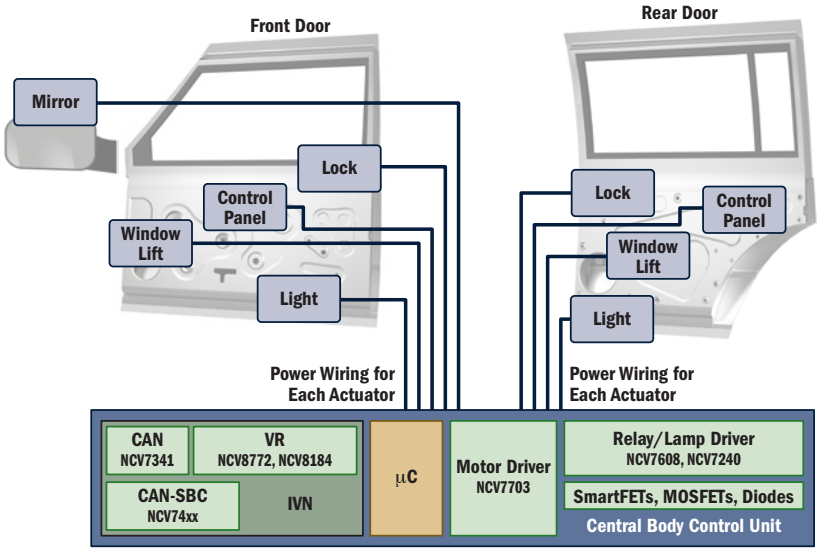
Door Electronics Systems

Door electronics are prevalent in modern vehicles, with most automobiles containing electronic window lifts and central locks. Additional safety features, like pinch protection and child-proof locks, increase the electronic content in door modules. Additional available features include side mirror positioning, folding, and defrosting; and for high-end models, electrochromic mirror control, that darkens the mirror depending on the brightness of the irradiated beam of oncoming traffic. Some lamp applications, like flashers in the mirror or some LEDs for interior lights, are also being adopted.

There are different door electronic topologies available:

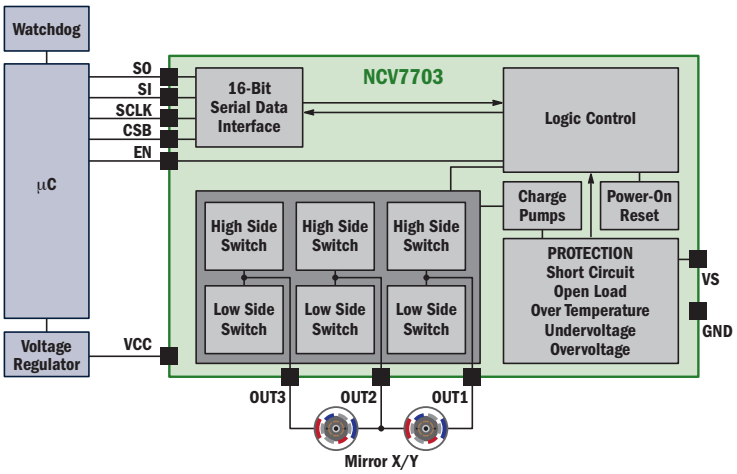
- Centralized door electronics
- De-centralized door electronics
- Mixed door electronics

Centralized Door Electronics System



The most common topology is centralized electronics, where the electronics system is implemented in the Body Control Unit (BCU). ON Semiconductor offers:

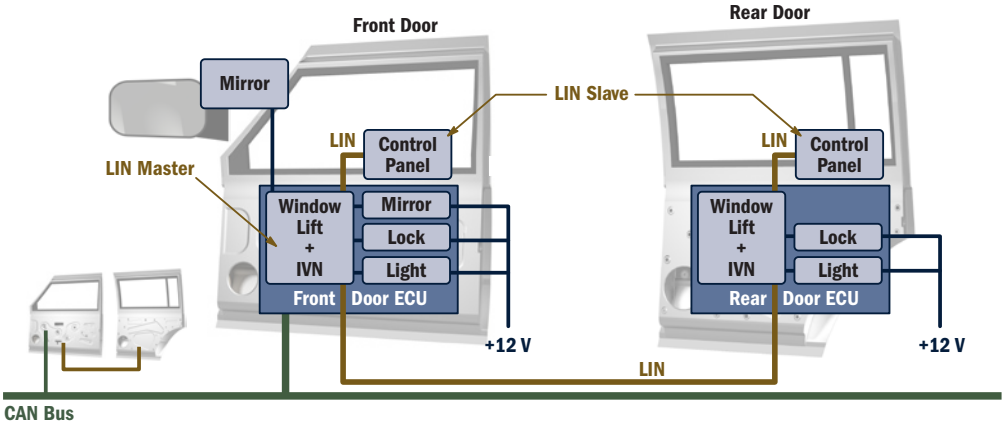
- In-Vehicle-Networking – CAN transceivers, LIN transceivers, system-basis-chips
- Voltage regulators
- Load drivers for motors, lamps, and relay controls
- Logic functions
- Discrete components - diodes, transistors, protection devices



For mirror positioning, two motors adjust the glass along x and y axes. The NCV7703 features three integrated half-bridge drivers. The output stages are controlled by a 16-bit SPI interface. Complete diagnostic information is provided to the microcontroller through the SPI.

Door Electronics Systems

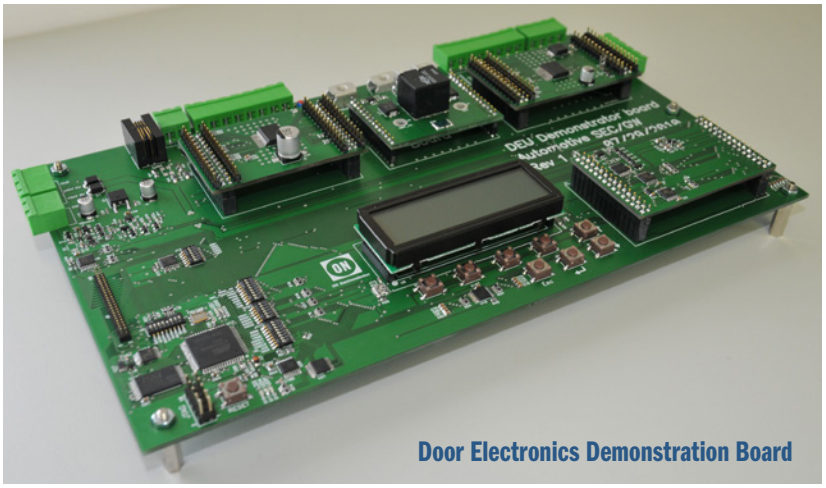
De-Centralized Door Electronics System



As the electronics content becomes more complex, the large amount of wires drives designs toward a de-centralized topology. The de-centralized door modules communicate over a CAN or LIN bus system.

Benefits of de-centralized door module topologies:

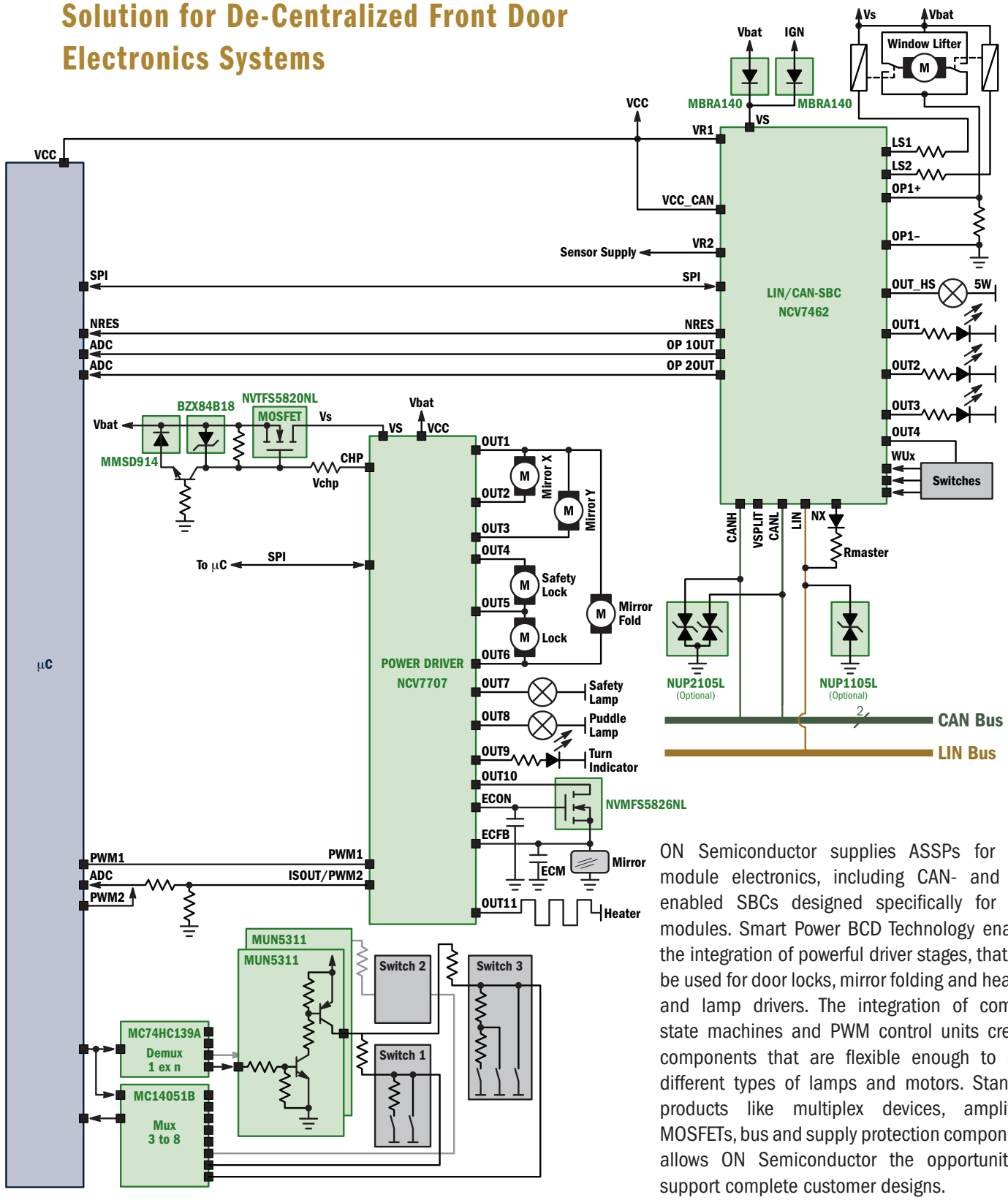
- Reduced use of wiring harness
- Reduced weight and power consumption positively impact fuel consumption
- Enables modular architectures through use of sub-modules



Door Electronics Demonstration Board

BODY

Solution for De-Centralized Front Door Electronics Systems

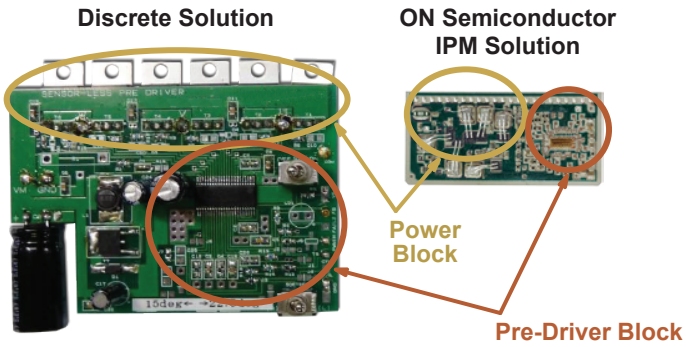


ON Semiconductor supplies ASSPs for door module electronics, including CAN- and LIN-enabled SBCs designed specifically for door modules. Smart Power BCD Technology enables the integration of powerful driver stages, that may be used for door locks, mirror folding and heating, and lamp drivers. The integration of complex state machines and PWM control units creates components that are flexible enough to drive different types of lamps and motors. Standard products like multiplex devices, amplifiers, MOSFETs, bus and supply protection components, allows ON Semiconductor the opportunity to support complete customer designs.

Automotive Intelligent Power Modules and Power Modules

ON Semiconductor provides standard and customized automotive power modules to drive 3-phase motors for a variety of applications, and for voltages ranging from 12 V to 20 V and currents from 10 A to 180 A. ON Semiconductor modules provide modular solutions that fulfill the need to reduce fuel consumption and emissions via the electrification of belt driven system components.

Automotive Intelligent Power Modules and Power Modules from ON Semiconductor are automotive qualified and are specifically designed, manufactured, and tested to operate in a harsh automotive environment, and meet or exceed the industry's toughest reliability and quality requirements.



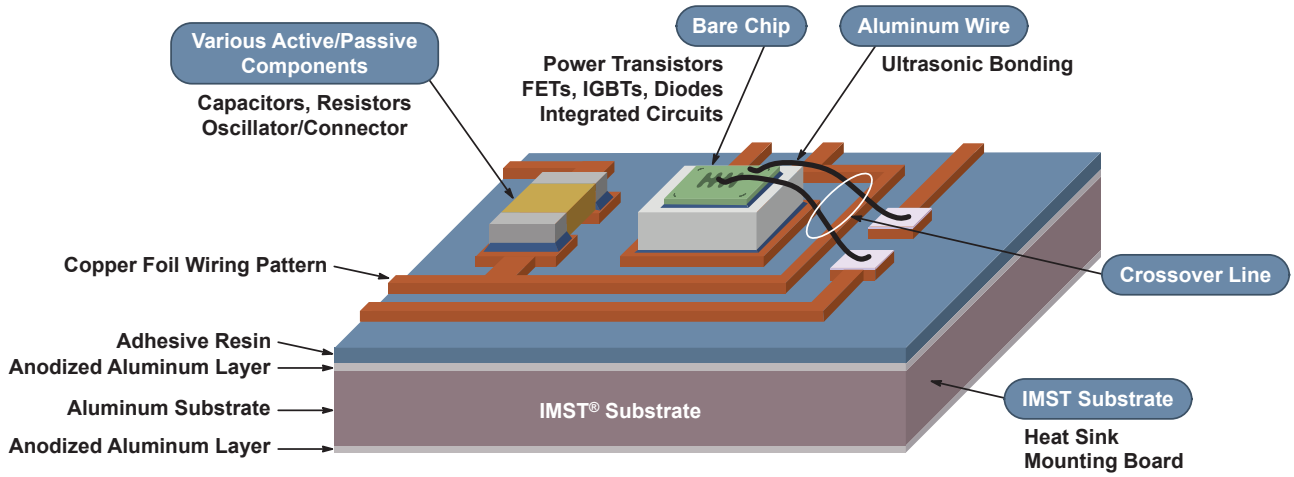
Intelligent Power Module Comparison to a Discrete Solution

Automotive Intelligent Power Modules and Power Modules from ON Semiconductor enable integrated solutions that deliver higher reliability in a smaller, lighter package. Additionally, these products can be mounted directly to motor housings, replacing the need for a heatsink.

For Intelligent Power Modules solutions in current ranges from 10 A to 50 A continuous, ON Semiconductor's Insulated Metal Substrate Technology (IMST®) enables power output circuits, control circuits, and their peripheral circuits to be mounted on the same substrate.

IMST forms electronic circuits on plates of aluminum with high thermal conductivity delivering excellent thermal performance, enhanced noise suppression, and high efficiently. For more information, reference ON Semiconductor White Paper TND6031/D.

For current ranges between 50 A and 200 A, a Direct Bonded Copper (DBC) type substrate is used.

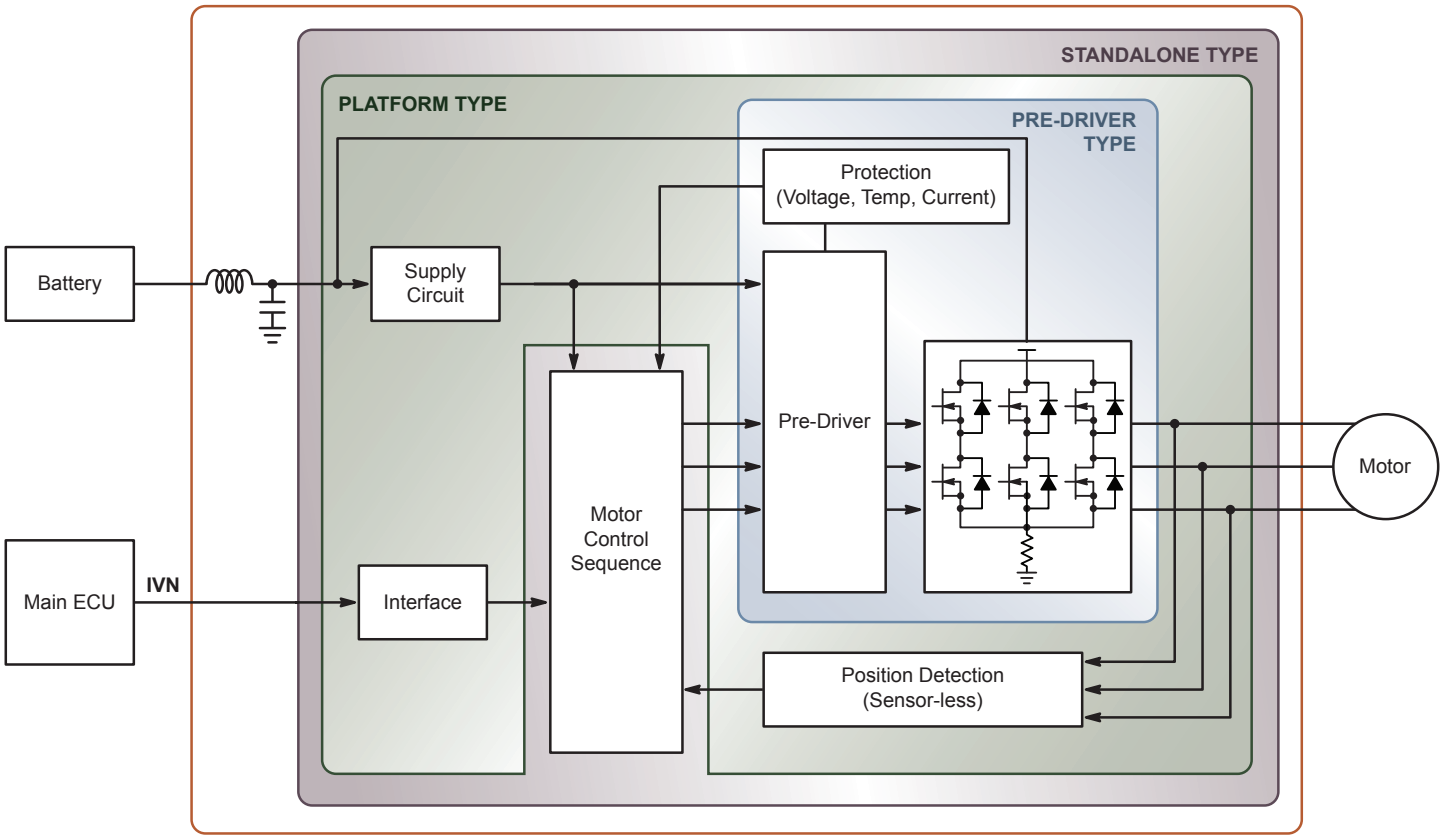


Insulated Metal Substrate Technology

Typical Applications

- HVAC Blower Fans
- Electrical Water Pumps
- Electrical Oil Pumps
- Engine Cooling Fans
- Electrical Fuel Pumps
- Electrical Power Steering

ON Semiconductor provides different types of Intelligent Power Modules based on customer requirements, including standalone solutions that enable PCB-less solutions, to pre-driver types that include a pre-driver, power stage, and protection circuits.



Intelligent Power Module Types for BLDC motor drives between 10 A and 50 A

Motor Driver Module

Device	Description	V_B Max	I_{out} Max	R_S	Pre-Driver	MOSFET	Current Limit	Thermal Shutdown	UVLO	DIAG Function	Package(s)
STK984-090A-E	3-Phase BLDC Motor Driver	40 V	20 A	3 mΩ	●	●	●	●	●	●	SIP-23

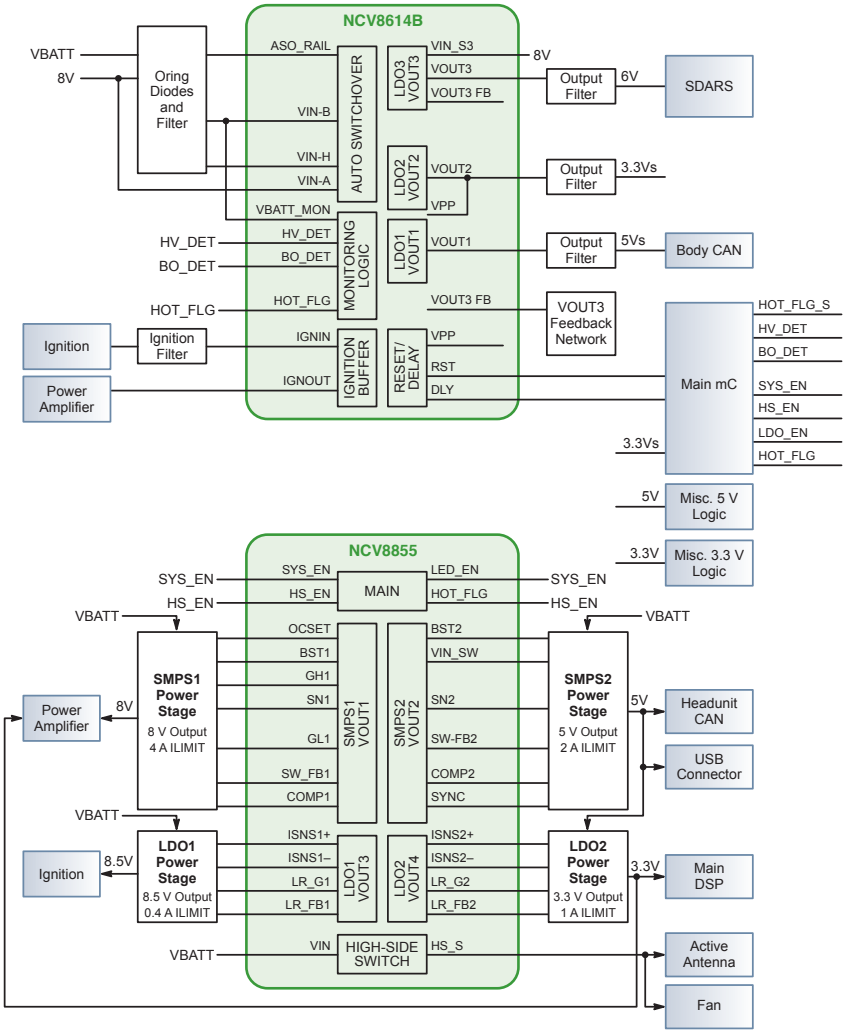
Automotive Intelligent Power Modules and Power Modules are typically semi-custom or full custom products.

Dual Power Management Units

The NCV8614B and NCV8855 power management units are optimized for power supplies - integrating LDOs, SMPSs, high side switches, buffers, and I/Os – delivering solution cost and size reductions. The NCV8614B and NCV8855 can be used in combination to form a complete automotive radio or instrument cluster power solution.

The NCV8614B multiple output linear regulator with Automatic Switchover (ASO) input voltage selector is specifically designed to address automotive radio systems and instrument cluster power supply requirements. The NCV8614B supplies power to various “always on” loads such as the CAN transceivers and microcontrollers (core, memory and I/O). The ASO circuit selects between three different input voltage sources to reduce power dissipation.

There are possible different output voltages, currents and feature configurations customized for particular applications.



The NCV8855 multiple output controller/ regulator includes an integrated high-side load switch. The NCV8855 includes a switchmode power supply (SMPS) buck controller, a 2 A SMPS buck regulator and two low dropout (LDO) linear regulator controllers. The NCV8855 supplies power to various loads, such as a tuner, CD logic, audio processor and CD/tape control within a car radio. The high-side switch can be used for a CD/tape mechanism or switching an electrically-powered antenna or display unit. In an instrument cluster application, the NCV8855 can be used to power graphics display, flash memory and CAN transceivers. In addition, the high-side switch can be used to limit power to a TFT display during a battery overvoltage condition.

Current Sense LDOs for Active Antennas

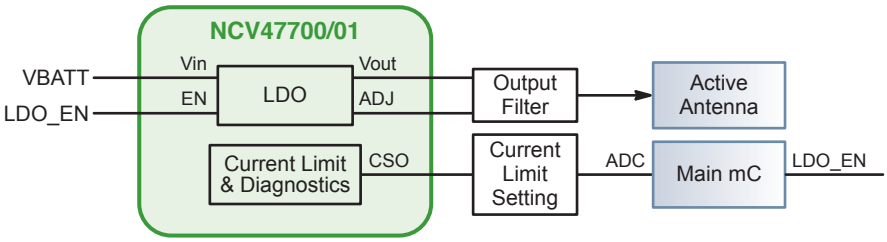
Current sense LDO linear voltage regulators provide precise current limiting, which can be adjusted for particular application requirements. These devices provide diagnostic information to control MCUs, either as analog or digital outputs, enabling the MCU implement required steps (e.g., switch off the LDO with overloaded or unloaded output). Both current sense and diagnostic features are particularly useful for off-the-module loads, when it is necessary to know the status of an external load and take appropriate actions. Current sense LDOs also provides reverse battery, reverse bias, short-to-battery, short-to-ground, and thermal shutdown protection features.

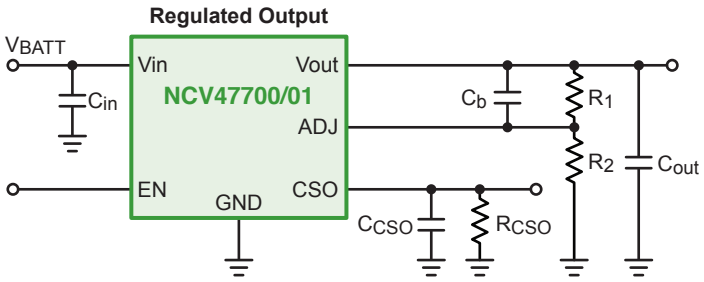
The NCV47700 (6% V_{out} accuracy) and NCV47701 (3% V_{out} accuracy) are 350 mA output current integrated low dropout regulators with adjustable output voltage and integrated current sense feature providing diagnosis and system protection functionality. The current limit of the device is adjustable by a resistor connected to CSO pin. The current flowing out of CSO pin is proportional to the output current.

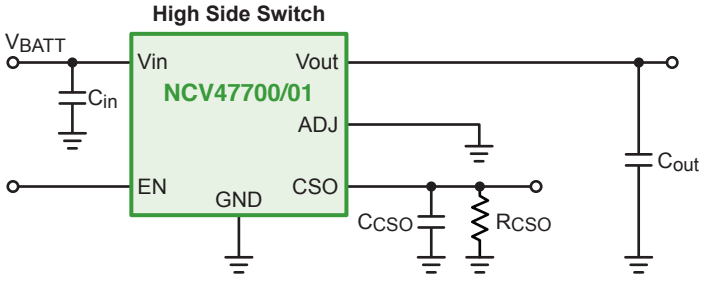
Current mirroring guaranteed precision is ±10% (I_{out}/I_{CSO}) @ I_{out} = 10 mA to 350 mA, providing precise information about Iout value to control system by means of voltage drop across the RCSO resistor.

The NCV47700/01 can be configured as an adjustable output voltage regulator, providing required voltage at preset level or high side switch, providing output voltage close to supply voltage thanks to low dropout feature.

NCV47700/01 active antenna solutions with current sense and diagnostic features provide significant BOM and PCB space reductions, compared to commonly used discrete solutions.







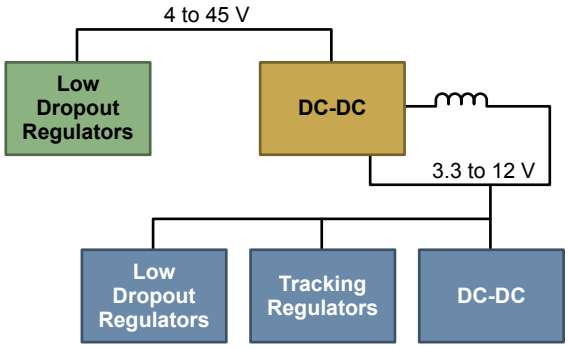
POWER MANAGEMENT

Buck SMPS for Post Regulation

For distributed power systems containing a DC to DC converter and several post-regulation power supplies.

Features

- Efficient DC-DC power delivery
- Very low quiescent current from CMOS technology
- Low cost LDOs



Medium Voltage MOSFETs for SMPS

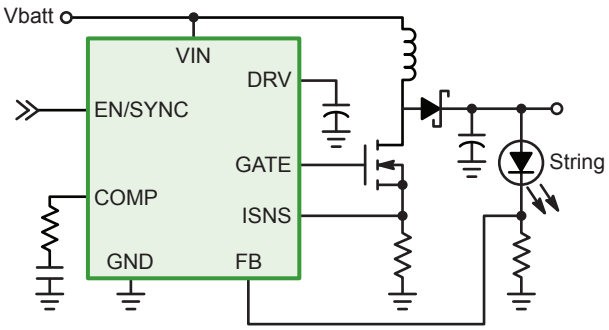
SMPS Device	Topology	Power (W)	MOSFET Device	B_{VDSS} Min (V)	$R_{DS(on)}$ Max (mΩ)	Package
NCV8871	LED	4	NVF3055L108	60	120	SOT-223
	SEPIC	7	NVD5863NL	60	7.1	DPAK
		24	NVD5865NL	60	18	DPAK
			NVTFS5826NL	60	24	µ8 FL
	Flyback		NVD5414N	60	37	DPAK
	Boost	11	NVD6824NL	100	23	DPAK
		3 (55 V)	NVD5807N	40	31	DPAK
		160	NVD5802N (x 2)	40	4.4	DPAK
NCV898031	SEPIC	7	NVMFS5844NL	60	12	SO-8 FL
			NVTFS5826NL	60	24	µ8 FL
NCV8852	Buck	10	NVTFS5116PL	-60	52	µ8 FL
NCV8855	Multi-Output	10	NVTFS5826NL	60	24	µ8 FL
			NVD5865NL	60	18	DPAK

Boost/Flyback/SEPIC SMPS Controllers

The highly flexible NCV8871, NCV8873, and NCV898031 controllers provide compact, easy to use, cost effective lighting solutions for boost, flyback, and SEPIC topologies. The devices operate over a wide input battery voltage range (3.2 V to 45 V), and feature a low shutdown current of under 10 μA.

The NCV8871 and NCV8873 devices have factory programmable switching frequencies from 170 kHz to 1 MHz. The NCV8873 feedback voltage is set to 0.2 V in order to better fit applications where constant current regulation is desired, such as LED drivers. The NCV898031 has a set switching frequency of 2 MHz, which permits the use of smaller filter components for a lower cost system solution.

These devices provide integrated current limit, thermal shutdown, and under-voltage lockout, and are rated from -40°C to 150°C junction temperature.



NCV8871xx Backlighting PWM Deep Dimming Application – Minimal External Components

Additional performance combinations available with rapid prototyping. Factory programmable features:

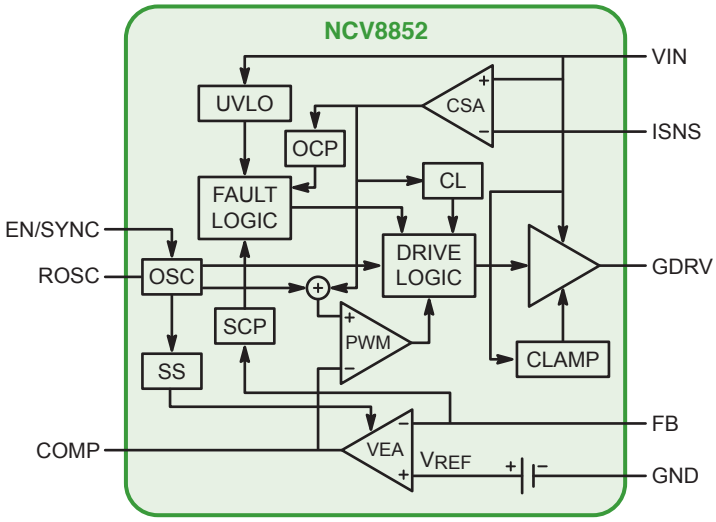
- Fsw: 170 kHz to 1 MHz
- Minimum on-time
- Max duty cycle
- Slope compensation
- Current limit
- Gate drive voltage
- Gate drive strength

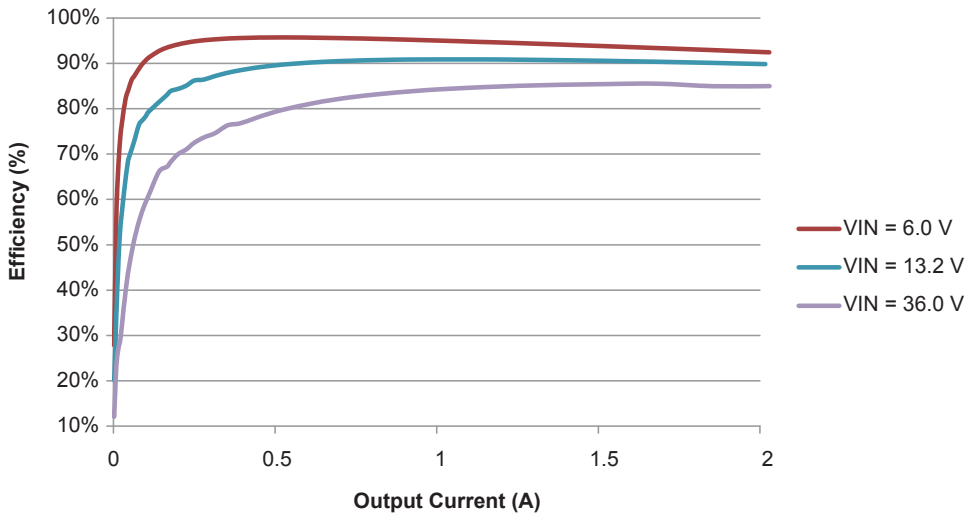
Low Dropout Buck SMPS for System Supply

NCV8852 adjustable-output non-synchronous buck controller drives an external P-channel MOSFET. The device uses peak current mode control with internal slope compensation, and incorporates an internal regulator that supplies charge to the gate driver.

NCV8852 Features

- Ultra low Iq sleep mode
- Adjustable output with 800 mV ±2% reference voltage
- Wide input of 3.1 to 44 V
- Programmable switching frequency
- Internal Soft-Start
- Undervoltage lockout
- External frequency synchronization
- 100% max duty cycle
- Programmable cycle-by-cycle current limit
- Hiccup overcurrent protection
- Hiccup short circuit protection





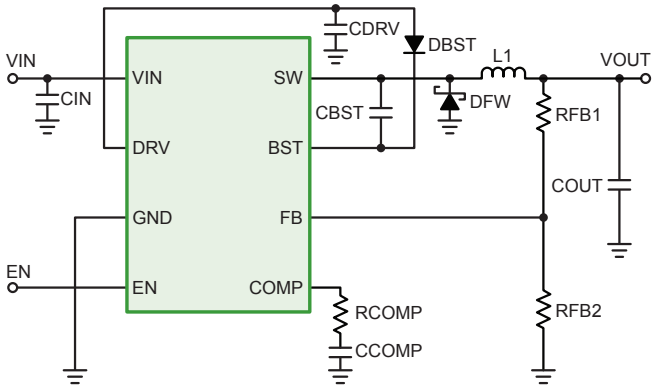
POWER MANAGEMENT

Battery Connected Buck SMPS for Primary Power Conversion

The 2 MHz NCV890xxx portfolio removes the need for EMI countermeasures and reduces the number of required external components in automotive power supplies. The devices achieve output as low as 3.3 V from an 18 V input, without pulse skipping. A wide range of output currents and features is available.

Features

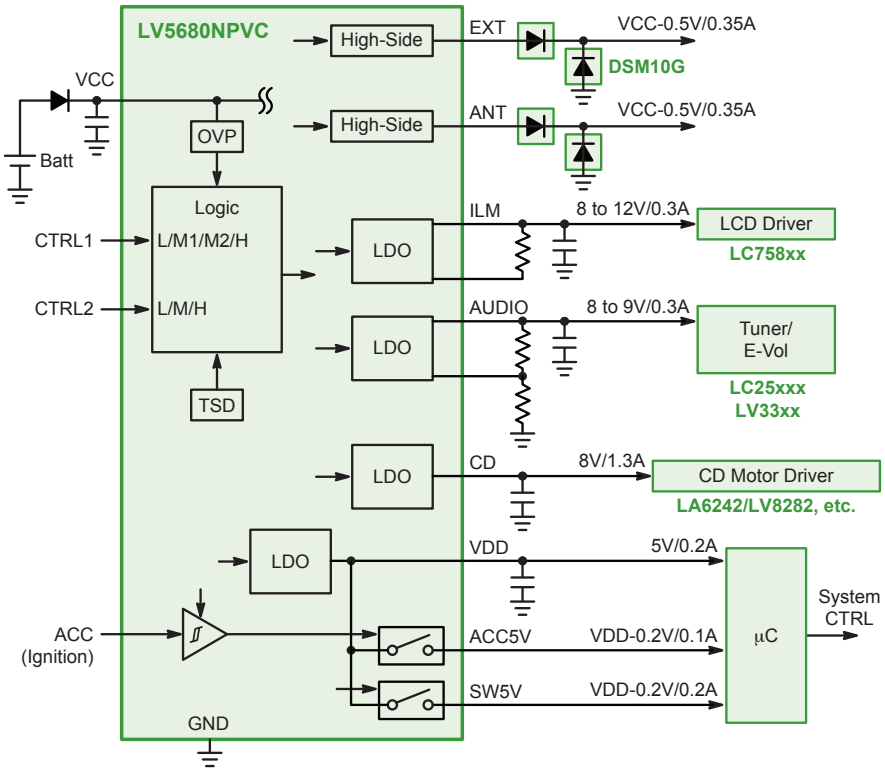
- Peak current limit: 1.2 A, 2 A, 3 A versions
- Load dump capability: 40 V and 45 V versions
- Synchronization input: use an external clock or synchronization output in order to override internal switching frequency
- Synchronization output: Allows the synchronization of another power supply or other device
- Power Good: Open drain output; high when output voltage is above power good threshold
- Reset: Open drain output; high when output voltage is above reset threshold, and has a programmable delay
- Spread spectrum: Internally generated spread spectrum, with both the modulation frequency and modulation depth externally programmable
- Standard features: Under-voltage lock-out, frequency fold back, peak current limit, thermal shut down, and low Iq sleep mode



Device	Peak Current Limit (A)	Sync	Load Dump (V)	Package(s)
NCV890100	1.2	No	40	DFN-8, SOIC-8 EP
NCV890130	1.2	No	45	DFN-8
NCV890101	1.2	Yes	40	DFN-10
NCV890131	1.2	Yes	45	DFN-10
NCV890201	2.0	Yes	40	DFN-10
NCV890231	2.0	Yes	45	DFN-10

Multiple Voltage Regulators for Audio Subsystems

The LV5680NPVC multiple power supply for audio systems incorporates four LDOs and two high-side switches. Integrated accessory detector and high-side switch from VDD reduces system parts count.



LV5680NPVC Features

- 4 Regulators, 2 V_{CC} high-side switches, 2 V_{DD} high-side switches
  All output stage P-channel LDMOS
- Maximum surge peak voltage 50 V
- Over-current, over-voltage, and over-heat protection
- Development system
- Low thermal resistance HZIP-15J (θ_{jc} = 2°C/W)

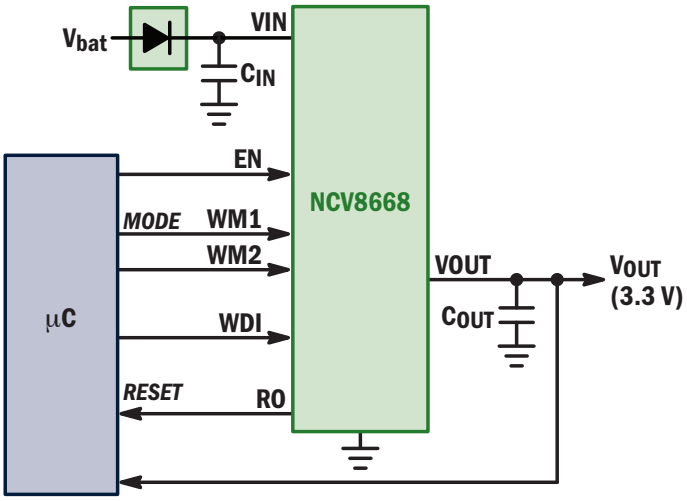
Multiple Output Power Supplies

Device	Operating Voltage (V)	I_{stby} Max (µA)	Vstby	REG1	REG2	REG3	REG4	REG5	REG6	High Side (mA)	Package(s)
LV5680NPVC	10 - 16	800	5.0 V, 200 mA	8 V, 1.3 A	8-9 V (Adj), 300 mA	8-12 V (Adj), 300 mA	–	–	–	350, 300	HZIP-15J
LV5681P	10 - 16	800	5.7 V, 200 mA	7 V, 1.3 A	8-9 V (Adj), 300 mA	8-12 V (Adj), 300 mA	–	–	–	350, 300	HZIP-15J
LV56801P	10 - 16	800	3.3 V, 200 mA	8 V, 1.3 A	8-9 V (Adj), 300 mA	8-12 V (Adj), 300 mA	–	–	–	350, 300	HZIP-15J
LV5682P	10 - 32	800	5.0 V, 200 mA	8 V, 1.3 A	8-9 V (Adj), 300 mA	8-12 V (Adj), 300 mA	–	–	–	350, 300	HZIP-25
LV5683P	10 - 16	100	3.3/5.0 V, 300 mA	5/8 V, 1.1 A	8.5 V, 300 mA	–	3.3 V, 500 mA	–	–	–	HZIP-15
LV56831P	10 - 16	100	3.3/5.0 V, 300 mA	–	8.5 V, 400 mA	12 V, 500 mA	3.3/5.0 V, 500 mA	–	–	–	HZIP-15
LV5684PVD	10 - 16	100	3.3 V, 350 mA	5/8 V, 1.3 A	5-9 V (Adj), 250 mA	5-12 V (Adj), 300 mA	3.3 V, 450 mA	–	–	350, 300	HZIP-15
LV5686PVC	10 - 16	100	5.0 V, 300 mA	–	9.0 V, 500 mA	9.85 V, 300 mA	–	–	–	300 x 2, 350 x 1, 500 x 3	HZIP-15
LV5692P	10 - 16	100	3.3 V, 300 mA	8 V, 1.3 A	8.4 V, 500 mA	8.4 V, 500 mA	3.3 V, 300 mA	–	Ext FET Driver	500	HZIP-15J
LV5693P	10 - 16	100	5.7 V, 300 mA	8 V, 1.3 A	8.4 V, 500 mA	8.4 V, 500 mA	3.3 V, 300 mA	–	Ext FET Driver	500	HZIP-15J
LV5694P	10 - 16	100	3.3/5.0 V, 300 mA	7.6/8.1 V, 1.3 A	8.45 V, 800 mA	9.0 V, 500 mA	–	5 V, 500 mA	–	500, 350	HZIP-15J
LV5695P	10 - 16	100	3.3/5.0 V, 300 mA	8 V, 1.3 A	8.45 V, 800 mA	8.5 V, 500 mA	–	5 V, 500 mA	–	500, 350	HZIP-15J
LV5696P	10 - 16	100	3.3/5.0 V, 200 mA	8 V, 1.0 A	8.5 V, 300 mA	3-8 V (Adj), 200 mA	3.3 V, 800 mA	5 V, 500 mA	–	200	HZIP-15J

Watchdog and Tracking LDOs for Power Supplies

Watchdog LDOs

Watchdog LDOs from ON Semiconductor deliver 150 to 250 mA load current, and provide supervision of an external single sided or window watchdog, for mircocontroller-based automotive applications. The portfolio provides integrated protection features, such as peak transients, current limit, thermal shutdown, and in most cases allows -40°C to 150°C operating junction temperature.

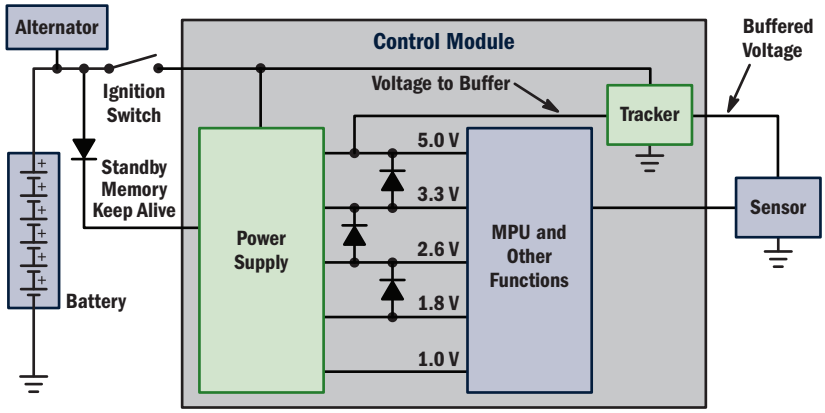


The NCV8518B 250 mA LDO voltage regulator incorporates a watchdog feature which continuously monitors the WDI input from the microprocessor in order to determine the output state.

The NCV8668 and NCV8768 are 150 mA LDO regulators that feature low typical Iq of 38 µA and 31 µA respectively during sleep mode, and include window watchdog functionality.

Tracking LDOs

Engine controllers must provide fully regulated, buffered power supply rails to power external sensors. Also known as tracking regulators, these devices must be fully protected from external faults, such as short to GND, short to battery, and reverse battery; and should still provide regulated output with very close tracking of the reference voltage. ON Semiconductor offers a wide range of single and dual tracking regulators – including CS8182, CS8183, CS8361, CS8363, NCV8184 - with various output current and package options for automotive engine controller applications.



Buffering Voltage to Send it Outside of a Module to a Sensor

Wide Selection of Automotive Qualified Linear Regulators

Linear Voltage Regulators

Device	Output Current	Output Voltage (V)	Dropout (Max)	Sleepmode Current (Max)	Quiescent Current (Max) @ Low Load (Load)	Tolerance (%)	Enable	Package(s)
NCV553	80 mA	5	0.8 V	–	6 µA (1 mA)	±3		SC-82
CS8101	100 mA	5	0.6 V	50 µA	140 µA (100 µA)	±2	✔	SOIC-8, SOIC-20W
NCV317L	100 mA	Adj	1.9 V (Typ)	–	–	±4		SOIC-8, TO-92
NCV2931A	100 mA	Adj, 5	0.6 V	1 mA	1 mA (10 mA)	±3.8	✔	SOIC-8, SOT-223, DPAK-3
NCV2951A	100 mA	Adj, 3.3, 5	0.45 V	–	120 µA (100 µA)	±1.5	✔	SOIC-8
NCV4949A	100 mA	5	0.5 V	–	260 µA (300 µA)	±2		SOIC-8, SOIC-8 EP, SOIC-20W
NCV612	100 mA	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.1, 3.3, 5	0.3 V	1 µA	90 µA (1 mA)	±3	✔	SC-70
NCV662	100 mA	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5	0.3 V	1 µA	6 µA (1 mA)	±4	✔	SC-82
NCV663	100 mA	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5	0.3 V	–	6 µA (1 mA)	±4		SC-82
NCV78LxxA	100 mA	5, 8, 12, 15, 24	1.7 V (Typ)	–	–	±4		SOIC-8, TO-92
NCV551	150 mA	1.4, 1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.1, 3.2, 3.3, 5	0.22 V	1 µA	8 µA (1 mA)	±3	✔	TSOP-5
NCV4264-2	150 mA	3.3, 5	0.5 V	–	70 µA (100 µA)	±2		SOT-223
NCV4266	150 mA	5	0.5 V	10 µA	200 µA (1 mA)	±2	✔	SOT-223
NCV4269A	150 mA	5	0.5 V	–	250 µA (1 mA)	±2		SOIC-8, SOIC-8 EP, SOIC-14, SOIC-20W
NCV4279A	150 mA	5	0.5 V	–	250 µA (1 mA)	±2		SOIC-8, SOIC-14
NCV4299	150 mA	3.3, 5	0.5 V	1 µA	105 µA (1 mA)	±2	✔	SOIC-8, SOIC-14
NCV4299A	150 mA	3.3, 5	0.5 V	1 µA	95 µA (100 µA)	±2	✔	SOIC-14
NCV571	150 mA	0.8, 0.9, 1.0, 1.2	0.45 V	1 µA	8 µA (150 mA)	±4	✔	TSOP-5, DFN-6
NCV8501	150 mA	Adj, 2.5, 3.3, 5, 8, 10	0.6 V	30 µA	75 µA (100 µA)	±2	✔	SOIC-8, SOIC-16 EP
NCV8502	150 mA	Adj, 2.5, 3.3, 5, 8, 10	0.6 V	–	75 µA (100 µA)	±2		SOIC-8, SOIC-16 EP
NCV8560	150 mA	Adj., 1.3, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.5, 5	0.125 V	1 µA	180 µA (150 mA)	±2	✔	DFN-6, TSOP-5
NCV8660B	150 mA	3.3, 5	0.6 V	–	40 µA (150 mA)	±2		DPAK-5, SOIC-8
NCV8664	150 mA	3.3, 5	0.6 V	–	30 µA (100 µA)	±2		SOIC-8, SOT-223, DPAK-3
NCV8665	150 mA	5	0.6 V	–	40 µA (100 µA)	±2		D2PAK-5, SOIC-8
NCV8667	150 mA	5	0.6 V	1 µA	50 µA (150 mA)	±2	✔	SOIC-8, SOIC-14
NCV8668	150 mA	3.3, 5	0.6 V	1 µA	44 µA (100 µA)	±2	✔	SOIC-8, SOIC-8 EP, SOIC-14
NCV8669	150 mA	5	0.6 V	–	50 µA (150 mA)	±2		SOIC-14
NCV8768	150 mA	5	0.6 V	1 µA	36 µA (100 µA)	±1.5, ±2	✔	SOIC-14
NCV8769	150 mA	5	0.6 V	–	33 µA (150 mA)	±2		SOIC-14
NCV8570B	200 mA	1.8, 2.5, 2.8, 3.0, 3.3	0.155 V	1 µA	75 µA (1 mA)	±2	✔	DFN-6, TSOP-5
NCV8702	200mA	1.8, 2.8, 3.0, 3.3	0.14V	1 µA	60 µA (1 mA)	±2	✔	DFN-6, TSOP-5
NCV8508B	250 mA	3.3, 5	0.9 V	–	150 µA (150 mA)	±3		SOIC-8 EP, D2PAK-7
NCV8518B	250 mA	5	0.75 V	1 µA	150 µA (150 mA)	±2	✔	SOIC-8 EP, SOIC-16 EP
NCV8703	300mA	1.8, 2.8, 3.0, 3.3	0.18V	1 µA	60 µA (1 mA)	±2	✔	DFN-6, TSOP-5
NCV33275	300 mA	3.3, 5	0.5 V	–	200 µA (0 mA)	±2		SOT-223
NCV33375	300 mA	1.8	0.5 V	4 µA	200 µA (0 mA)	±2	✔	SOT-223
NCV47700	350 mA	Adj	0.5 V	10 µA	230 µA (1 mA)	±6	✔	SOIC-8 EP
NCV47701	350 mA	Adj	0.5 V	10 µA	230 µA (1 mA)	±3	✔	SOIC-8 EP
NCV8674	350 mA	5	0.6 V	–	38 µA (100 µA)	±2		D2PAK-3
NCV8675	350 mA	3.3, 5	0.6 V	–	50 µA (100 µA)	±2, ±2.5		DPAK-5, D2PAK-5
NCV8770	350 mA	5	0.875 V	–	28 µA (350 mA)	±1.5, ±2		D2PAK-5
NCV8772	350 mA	3.3, 5	0.875 V	1 µA	30 µA (350 mA)	±1.5	✔	D2PAK-7, D2PAK-5, DPAK-5
NCV8503	400 mA	Adj, 2.5, 3.3, 5	0.6 V	1 µA	350 µA (100 µA)	±2	✔	SOIC-16 EP
NCV8504	400 mA	Adj, 2.5, 3.3, 5	0.6 V	–	150 µA (100 µA)	±2		SOIC-16 EP
NCV8505	400 mA	Adj, 2.5, 3.3, 5	0.6 V	1 µA	350 µA (100 µA)	±2	✔	D2PAK-7
NCV8506	400 mA	Adj, 2.5, 3.3, 5	0.6 V	–	150 µA (100 µA)	±2		D2PAK-7
NCV4274A	400 mA	2.5, 3.3, 5, 8.5	0.5 V	–	250 µA (1 mA)	±2		SOT-223, DPAK-3, D2PAK-3
NCV4276B	400 mA	Adj, 3.3, 5	0.5 V	10 µA	220 µA (1 mA)	±2	✔	DPAK-4, D2PAK-5
NCV4275A	450 mA	3.3, 5	0.5 V	–	200 µA (1 mA)	±2		DPAK-5, D2PAK-5
NCV317M	500 mA	Adj	2.2 V (Typ)	–	–	±4		DPAK-3
NCV5500	500 mA	Adj, 1.5, 3.3, 5	0.7 V	50 µA	500 µA (100 µA)	±4.9	✔	SOIC-8, DPAK-5
NCV5501	500 mA	1.5, 3.3, 5	0.7 V	–	500 µA (100 µA)	±4.9		DPAK-3
NCV78Mxx	500 mA	5, 8, 12, 15	**	–	**	±4		DPAK-3, TO-220
NCV78MxxA	500 mA	5	**	–	**	±4		DPAK-3
NCV8141	500 mA	5	1.5 V	50 µA	**	±3	✔	D2PAK-7
NCV8535	500 mA	Adj, 1.5, 1.8, 2.5, 2.8, 2.85, 3.0, 3.3, 5	0.34 V	1 µA	190 µA (100 µA)	±1.5	✔	DFN-10
NCV8537	500 mA	Adj, 1.8, 2.5, 3.3, 5.0	0.34 V	1 µA	190 µA (100 µA)	±1.5	✔	DFN-10
CS8126	750 mA	5	0.6 V	–	–	±3		D2PAK-7
NCV33269	800 mA	Adj, 3.3, 5, 12	1.35 V	–	–	±2		DPAK-3
NCV78xxA	1 A	5, 12	**	–	–	±4		D2PAK-3, TO-220
NCV78xx	1 A	5, 8, 12, 15	**	–	–	5%		DPAK-3, D2PAK-3, TO-220
NCV5661	1 A	Adj, 1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3	1.3 V	300 µA	–	±2	✔	DPAK-5, DFN-6
NCV1117	1 A	Adj, 1.5, 1.8, 2, 2.5, 3.3, 5, 12	1.2 V	–	–	±2		DPAK-3, SOT-223
NCV317	1.5 A	Adj	2.25 V (Typ)	–	–	±4		D2PAK-3, TO-220
NCV565	1.5 A	Adj	1.3 V	–	–	±3		D2PAK-5
NCV59152	1.5 A	Adj, 1.8, 2.5, 2.8, 3.0, 3.3, 5.0	0.5 V	5 µA	–	±1.5	✔	DFN-8, D2PAK-3, D2PAK-5
NCV5662	2 A	Adj, 1.5	1.3 V	300 µA	–	±2	✔	D2PAK-5
NCV59302	3 A	Adj, 1.8, 2.5, 2.8, 3.0, 3.3, 5.0	0.5 V	5 µA	–	±2	✔	D2PAK-5
NCV5663	3 A	Adj, 1.5	1.3 V	300 µA	–	±2	✔	D2PAK-5

** See data sheet for details.

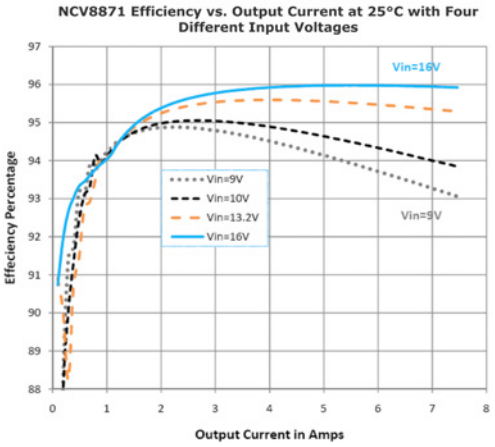
Switch Mode Power Supplies (SMPS)

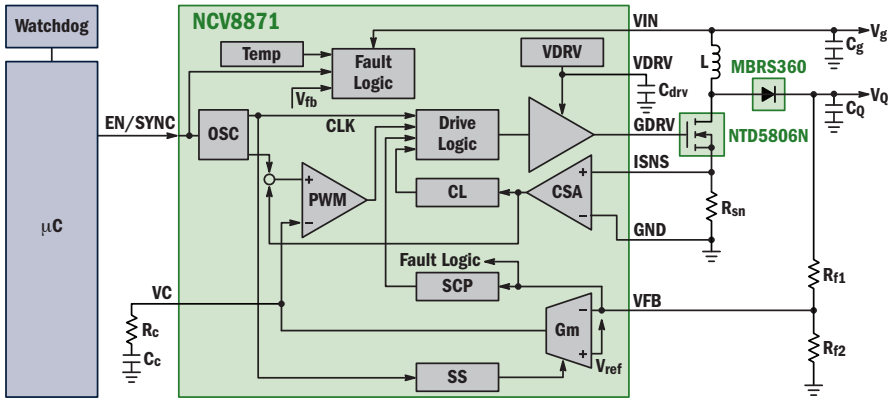
Boost SMPS
- Standard Regulators
- Standard Controllers

Buck SMPS
- Standard Regulators
- Low Iq Regulators
- Multi-Megahertz Regulators
- Standard Controllers
- Low Iq Controllers

Boost SMPS

The NCV8871 adjustable output, non-synchronous boost controller drives an external N-channel MOSFET. The device uses peak current mode control with internal slope compensation. NCV8871 incorporates an internal regulator that supplies charge to the gate driver. Designed for powertrain, start-stop, and display applications, NCV8871 can be configured as a SEPIC converter to regulate the car battery voltage, that can vary from 4.5-18 V to a regulated output of 6 V in an engine ECU. It can also be configured as a boost converter to boost the battery voltage from 4.5-18 V to an output voltage of 55-65 V, to power the injectors of direct gasoline injection systems.

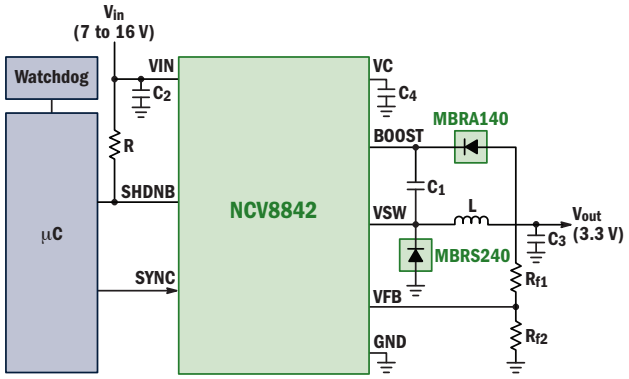




Buck SMPS

ON Semiconductor is developing high efficiency, high frequency switch mode power supplies, that can withstand automotive load transients up to 40 V. The high switching frequencies enable the devices to provide the entire buck solution in a very small foot print, by meeting the stringent EMC/EMI performance required in powertrain applications. The SMPS buck regulator portfolio has expanded for multi-megahertz operation, including the NCV890100, that operates up to 2 MHz, with 1.2 A output current capability.

The NCV8842 and NCV8843 buck regulators operate at a fixed frequency of 170/340 kHz. The devices employ the V2 control architecture to provide excellent transient response and overall regulation, and simple loop compensation. The NCV8842 accommodates input voltages from 4-40 V and contains synchronization circuitry. The delivery of 1.5 A from this compact buck solution is enabled through the integration of an NPN device. NCV8842 and NCV8843 are well suited for applications require medium to high currents with low output voltage, such as microprocessor core voltage power of 1.3-1.5 V in an ECU.

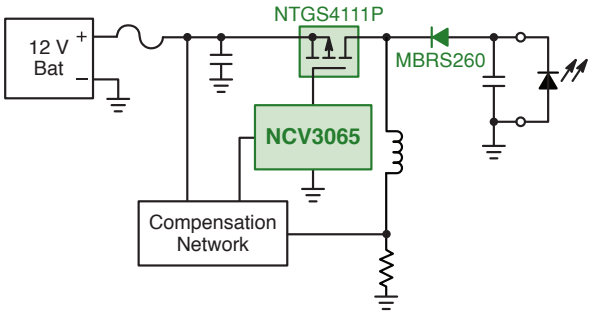


POWER MANAGEMENT

Switching Regulators and Controllers

Features

- >2 MHz Switching Frequency
- External Synchronization
- PowerGood & ENABLE
- Wide input voltage range
- Low quiescent current



Switching Regulators

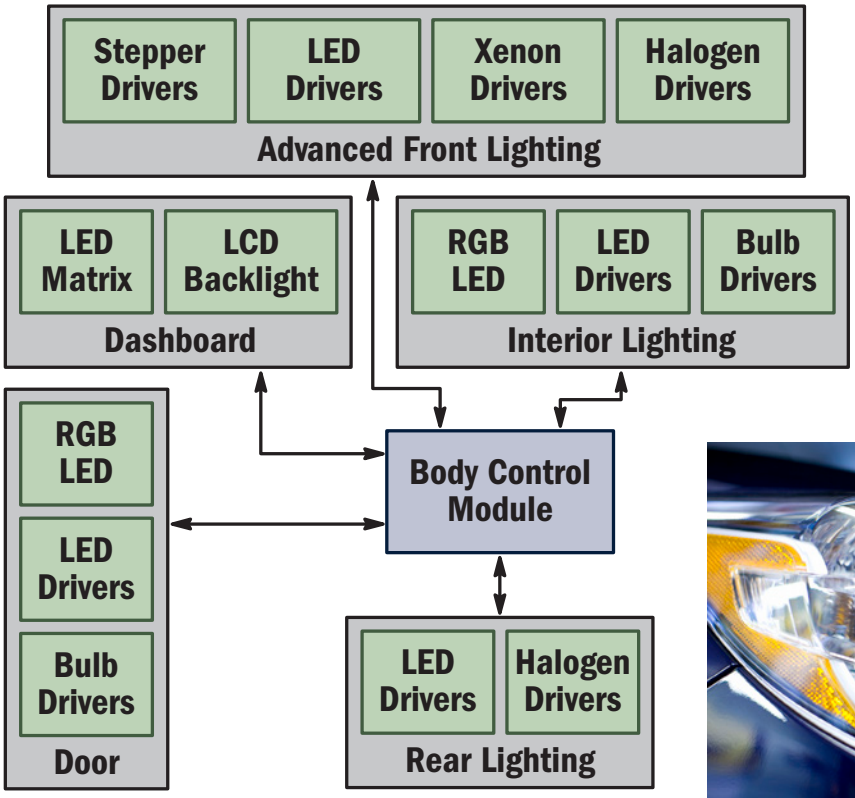
Device	I_{OUT} (A)	f_{SW} (kHz)	V_{in} Min (V)	V_{in} Max (V)	Comments	Package
NCV2574	0.5	52	4.75	40	Internal compensation	SOIC-16W
NCV2575	1.0	52	4.75	40	Internal compensation	D2PAK
NCV890100	1.2	2000	4.5	40	–	DFN-8
NCV890101	1.2	2000	4.5	40	–	DFN-10
NCV8842	1.5	Up to 200	4	40	V^2	SOIC-8, SOIC-16W, DFN-18
NCV8843	1.5	Up to 700	4	40	V^2	SOIC-8, SOIC-16W, DFN-18
NCV3063	1.5	Up to 250	3	40	High f_{SW} for optimized size & efficiency	DFN-8, SOIC-8, PDIP-8
NCV3064	1.5	Up to 250	3	40	High f_{SW} for optimized size & efficiency; Enable	DFN-8, SOIC-8, PDIP-8
NCV3065	1.5	Up to 250	3	40	LED driver	DFN-8, SOIC-8, PDIP-8
NCV3066	1.5	Up to 250	3	40	LED driver with ENABLE	DFN-8, SOIC-8, PDIP-8
NCV33063	1.5	100	3	40	Buck, Boost SEPIC	SOIC-8
NCV51411	1.5	260	4.5	40	V^2, SYNC	DFN-18, SOIC-16W, SOIC-8
NCV5171	1.5	260	2.7	30	Boost, Flyback, SEPIC	SOIC-8
NCV5173	1.5	560	2.7	30	Boost, Flyback, SEPIC	SOIC-8
NCV3163	3.4	Up to 300	2.5	40	High f_{SW} for optimized size & efficiency	DFN-18, SOIC-16W
NCV33163	3.4	Up to 150	2.5	60	High input voltage	SOIC-16W, PDIP-16

Switching Controllers

Device	V_{OUT} Min (V)	f_{SW} (kHz)	V_{in} Min (V)	V_{in} Max (V)	Comments	Package
NCV494	Down to 5.0	Up to 200	7	40	Single-ended or push-pull	SOIC-16
NCV8851B	Down to 0.8	275	4.5	40	<1 µA quiescent current	SOIC-16W

Automotive Lighting Systems

ON Semiconductor offers standard products and custom devices for automotive lighting applications. The company leads the market for Xenon driver ASICs and developed the defacto standard stepper driver for headlight levelling and swiveling.



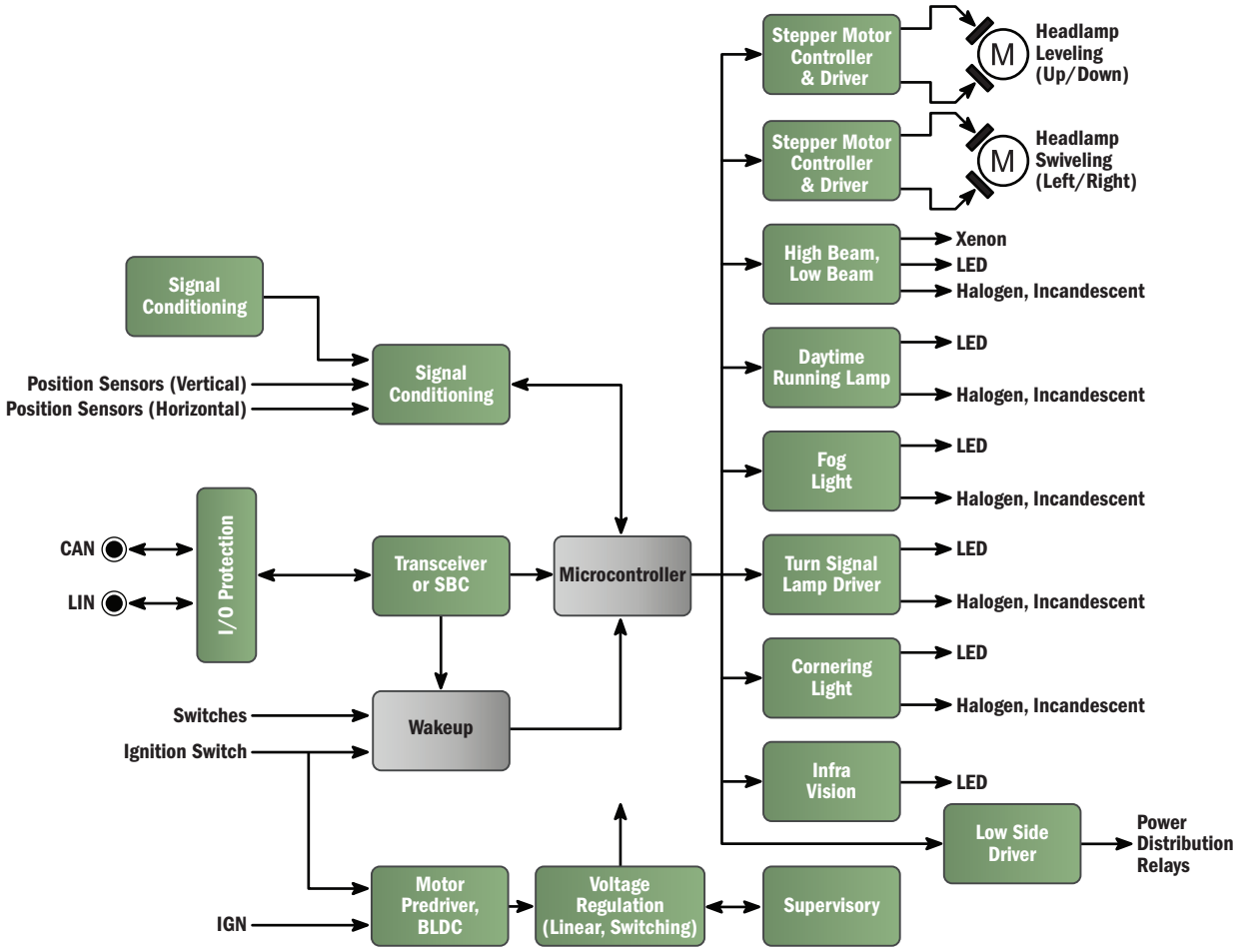
Front Lighting

The majority of automobiles on the road today are equipped with halogen lights for the high-beam (HB) and low-beam (LB) functions - the main front lighting functions. Halogen LB typically consumes 55 W, and provides ~1,000 lumen. HID technology - introduced over ten years ago - consumes 35 W, and provides ~3,500 lumen. Because of the high intensity and risk of glare to approaching traffic, some countries require automatic leveling of the LB, plus a high pressure cleaning device. Over time, HID lights will integrate the HB function into bi-xenon solutions.

While halogen technology continues to be viable for front lighting, automotive designs increasingly use LED lighting. LED lighting offers enhanced styling options, enables 'instant-on' lighting, and allows brightness control from 0% to 100% power.

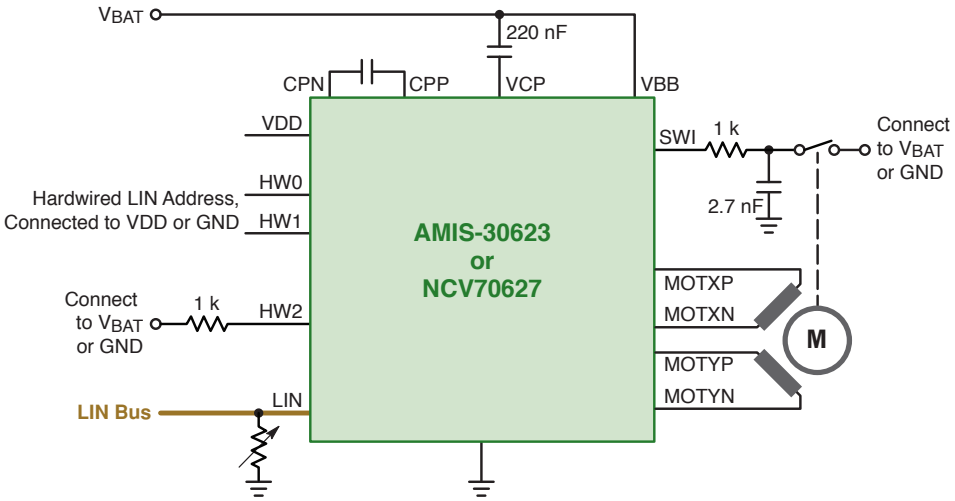
Another important aspect for automotive front lighting is beam swiveling for Advanced Frontlighting Systems (AFS), to optimize the visibility in curves, and Adaptive Driving Beam (ADB), to adapt the beam to real-time situations. Stepper motors provide the primary controls for AFS and ADB.

ON Semiconductor offers a full range of products, from generic bulb driver solutions to stepper drivers, LED drivers, and Xenon drivers, that are specifically designed for front lighting.

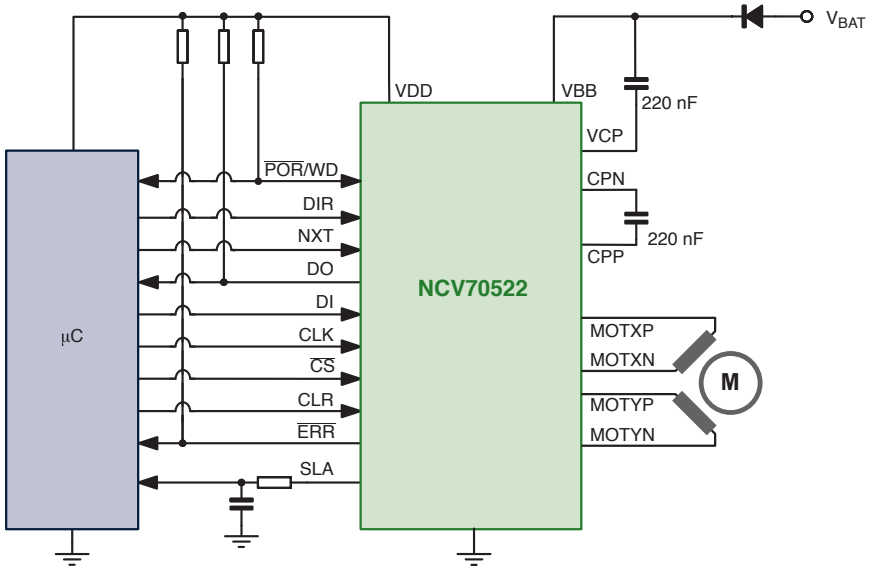


Leveling and Swiveling for Front Lighting

The AMIS-30623 single-chip micro-stepping motor driver, with integrated controller and LIN interface, enables the design of dedicated mechatronic solutions connected remotely with a LIN master.The device receives positioning instructions through the bus and subsequently drives the motor coils to the desired position, using configurable parameters for current, speed, acceleration, and deceleration. AMIS-30623 also detects motor stalling.

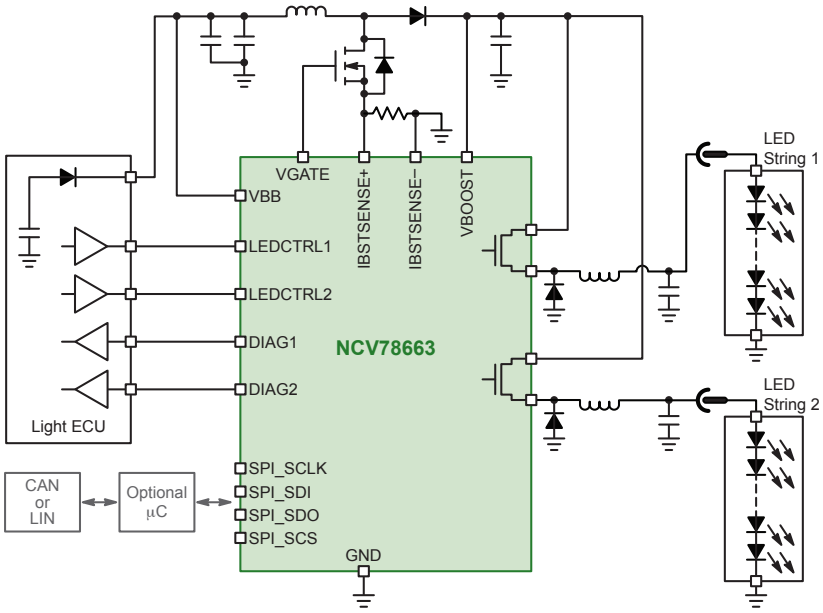


NCV70521 and NCV70522 are single-chip micro-stepping motor drivers with current translation table and SPI interface. NCV70522 also includes an embedded 5 V regulator and a watchdog reset. The devices act as peripheral drivers, receiving 'Next Micro-Step' commands from a microcontroller, and synchronizing the motor coil-current with the desired speed. The integrated SPI bus allows parameter setting and diagnostics feedback.



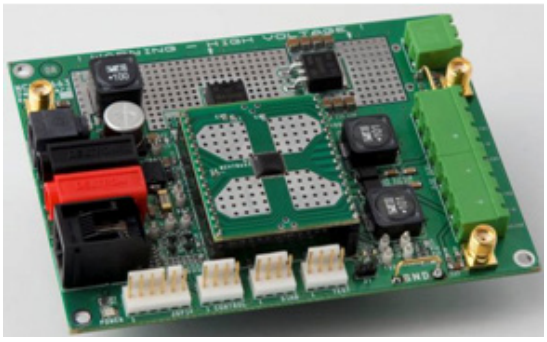
Power Ballast and Dual LED Driver for Advanced LED Front Lighting Systems

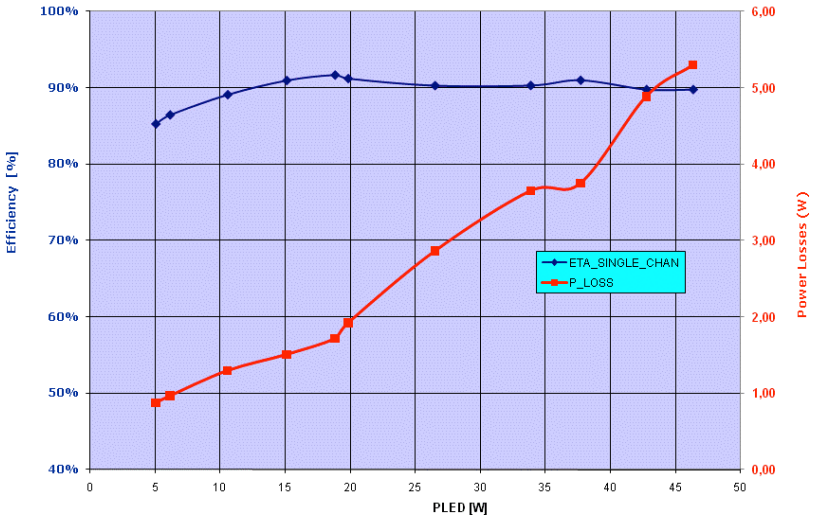
The NCV78663 single-chip, intelligent LED driver for front lighting enables single-module control of high beams, low beams, daytime running lights, position lights, cornering lights, turn indicators, and fog lights. With integrated digital dimming, SPI programmable settings, and build-in diagnostics, the NCV78663 offers an integrated, energy efficient solution for comprehensive front lighting control.



Features

- System integrated solution with few external components.
- Buck-boost topology
- LED current regulator
  - Constant average current
  - Efficient integrated buck switches (high-side)
  - Current up to 2 A
  - Extended diagnostics: detection of open circuit or failing driver, short, over-current protection, single LED failures
  - Thermal protection
- System customization by SPI interface and/or OTP-settings
  - Multiple system configurations with one device
  - Fewer module versions for OEM
- Better EMC behavior, without extra filtering
  - Low EMC from battery
  - Low EMC to LED string
- High overall efficiency (>90%)
- Evaluation kit available





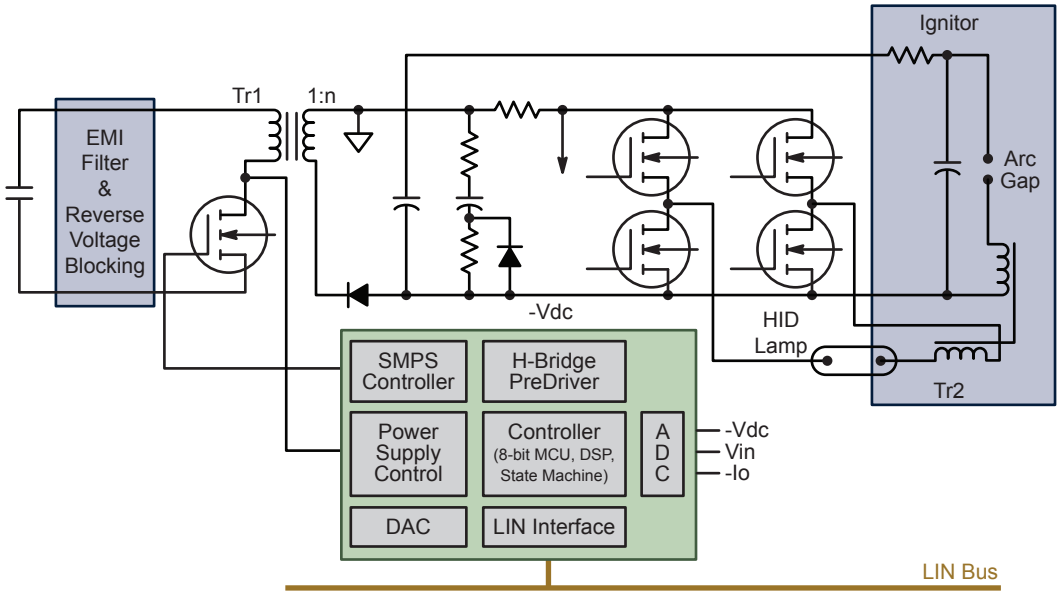
LIGHTING

Fully Featured ASICs for HID Front Lighting

The introduction of high intensity discharge (HID) lamps (or Xenon) has enhanced front lighting systems. Compared to traditional halogen lamps, HID delivers improved color rendering, lower power consumption, longer life time, and higher light output. To support the advanced functionality, HID headlamps require highly efficient ballast and sophisticated control circuitry.

ON Semiconductor HID lamp control system features:

- Full analog solution
- Mixed analog/digital solution with 8-bit µC or dedicated state machine
- Integrated DC/DC controller
- Exhaustive diagnostic functions (OV, UV, temperature sensor, life time counter)
- Various communication interfaces (LIN, SPI)
- Supports 35 W (D1/D2/D3/D4) and 25 W (D5) lamps



Linear Current Regulator and Controller for Automotive LED Rear Combination Lamps

Features – NCV7680

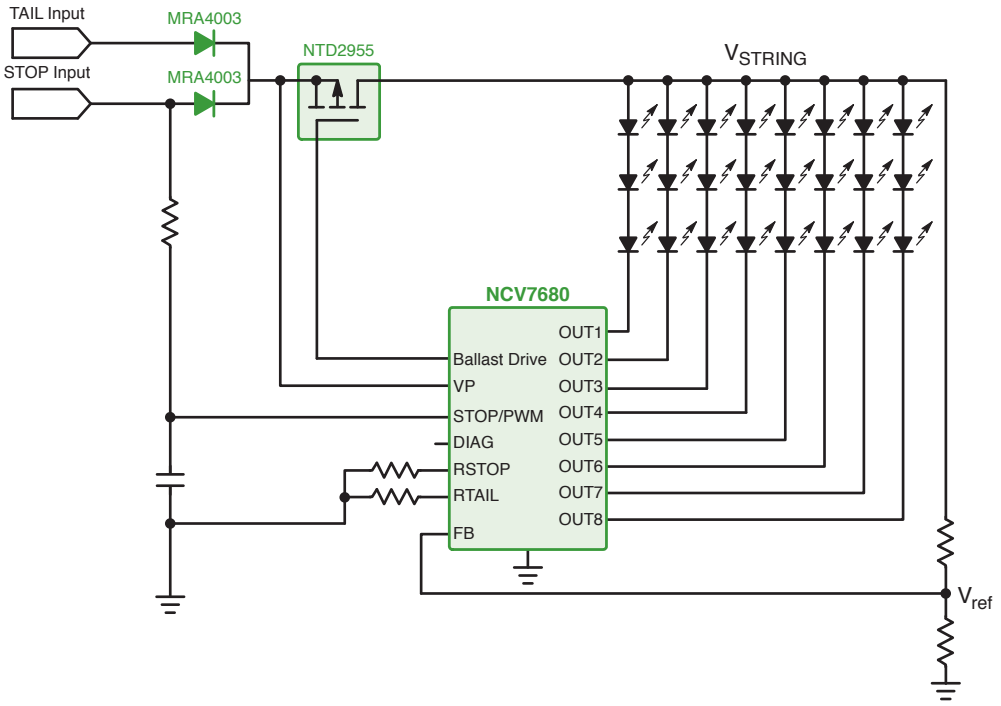
- Constant current outputs for LED string drive
- Open LED string diagnostic with open−drain output
- Slew rate control eliminates EMI concerns
- On−chip 1 kHz tail PWM dimming
- Over-voltage and over-temperature set back power limitation

Automotive battery systems have wide variations in line supply voltage. Low dropout is a key attribute for providing consistent LED light output at low line voltage.

The NCV7680 consists of eight linear programmable constant current sources. System design with the NCV7680 allows for two brightness levels, one for stop and one for tail illumination. Optional PWM control - the preferred method for dimming LEDs - can also be implemented. The PWM generator's fixed frequency provides flicker−free illumination. Optional external ballast FET allows for power distribution on designs requiring high currents.

To support the common RCL configuration of LED strings, the NCV7680 provides eight matched outputs for individual string drive, with current set by a single resistor. Individual string drive ensures equal current distribution between the strings.

The NCV7680 can function as a standalone device or in conjunction with additional support circuitry for more complex systems. When operating in combination with a boost controller, additional LEDs may be connected to a string.



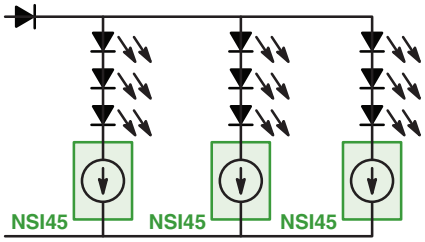
Application Diagram with External FET Ballast Transistor

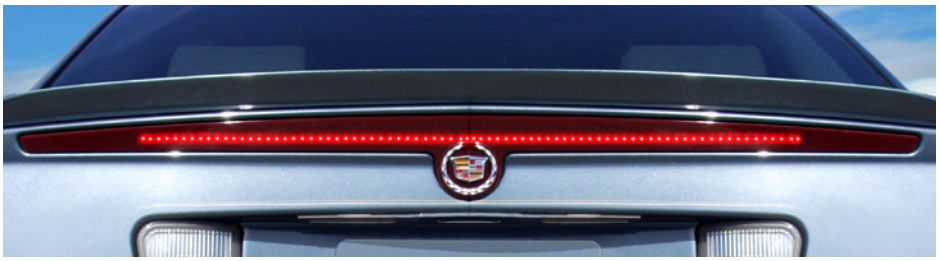
Constant Current Regulators for Center High Mount Stop Lamp

The NSI45 two-terminal linear constant current regulators are simple, economical, and robust devices that provide an effective solution for regulating current in cost-sensitive LED applications. The devices require no external components, allowing them to be implemented as high or low–side regulators. These devices regulate output current over a wide range of input voltage, and are designed with a negative temperature coefficient to protect LEDs from thermal runaway at extreme voltage and operating temperature.

NSI Series Features

- Regulated current provides constant brightness over wide voltage range
- Negative temperature coefficient protects LEDs in high ambient conditions
- 45 V maximum operating voltage withstands battery load dump





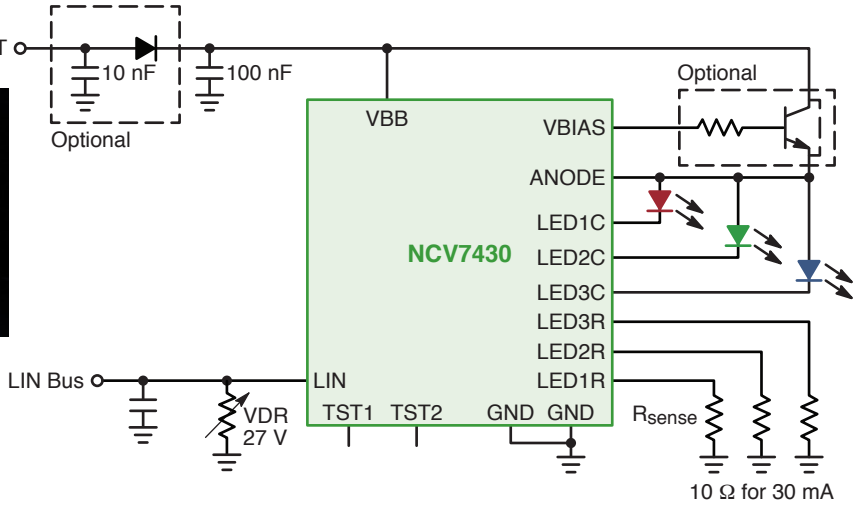
Automotive LIN RGB LED Driver for Interior Lighting

The LIN Bus (Local Interconnect Network) is an inexpensive serial communications protocol, which is used within current automotive network architectures. It is a relatively slow communication system intended to monitor sensor devices or actuators in today's cars.

The NCV7430, LIN RGB LED Driver, combines a LIN transceiver together with a RGB LED driver and memory. It is a single-chip RGB driver intended to monitor for dedicated multicolor LED applications in Automotive interior lighting. It contains a LIN interface (slave) for parametric programming of LED color and intensity. The device receives instructions through the LIN bus and subsequently drives the LEDs independently.

The NCV7430 acts as a slave on the LIN bus and the master can request specific status information (parameter values and error flags). The LIN address of the NCV7430 can be programmed in the internal memory of the device.

The NCV7430 is fully compatible with automotive requirements.



Features — NCV7430

RGB LED Driver
- 3 independent LED current regulators
- LED currents programmable with external resistors
- Power dissipation option with external ballast transistor
- LED temperature compensation with external sense circuit
- Modulation control for 3 LEDs (with calibration)

LIN Interface
- LIN physical layer according to LIN 2.1/SAE J2602
- OTP-programmable device node number and group address
- Diagnostics and status information about LEDs
- Supports auto-addressing

Protection and Diagnostics Over-Current Detection
- Short circuit detection to GND and VBB
- Open LED detection
- High temperature warning and shutdown
- Retry mode on error detection

Power Saving
- Sleep mode supply current 20 μA
- Compliant with 14 V automotive systems

EMI Compatibility
- LIN Bus integrated slope control
- EMC reduced LED modulation mode

Constant Current Regulators for Interior Lighting

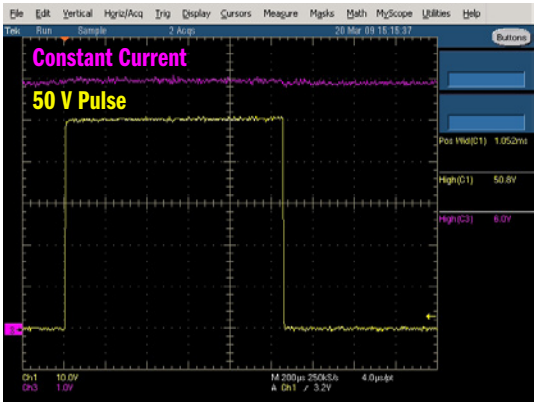
The two-terminal linear constant current regulators (CCRs) are simple, economical, and robust devices that provide an effective solution for regulating current in cost-sensitive LED applications. The devices require no external components, allowing them to be implemented as high or low–side regulators. These devices regulate output current over a wide range of input voltage, and are designed with a negative temperature coefficient to protect LEDs from thermal runaway at extreme voltage and operating temperature.

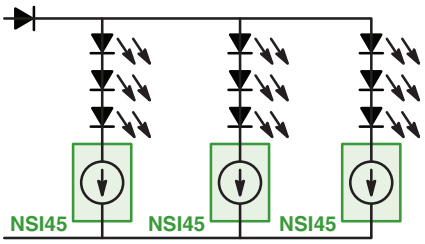
Features

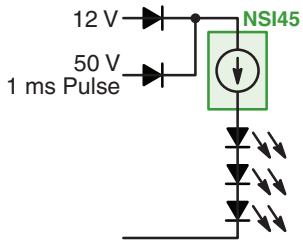
- Regulated current provides constant brightness over wide voltage range
- Negative temperature coefficient protects LEDs in high ambient conditions
- Available with multiple maximum operating voltages (45 V, 50 V, and 120 V) to withstand battery load dump

Resources

- Sample Kit: CCR2KIT/S







Device	Max Anode-to-Cathode Voltage (V_{AK}) (V)	Voltage Overhead ($V_{in} - V_{LEDs}$) (V)	Constant Current I_{reg} (@ V_{ak} = 7.5 V) (mA)	Current Tolerance Over Voltage	Max Junction Temperature (°C)	Packages
NSI45xxx	45	1.8	Fixed: 15, 20, 25, 30	±15%, ±10%	150	SOD-123, SOT-223
NSI50xxx	50	2.0	Fixed: 10, 350	±10%	175	SMC, DPAK
NSIC20xx	120	1.8	Fixed: 20, 30, 50	±15%	175	SMB
NSI45xxxJ	45	1.8	Adjustable 20 to 40 35 to 70 60 to 100 90 to 160 150 to 350	±15%	150	SOT-223, DPAK

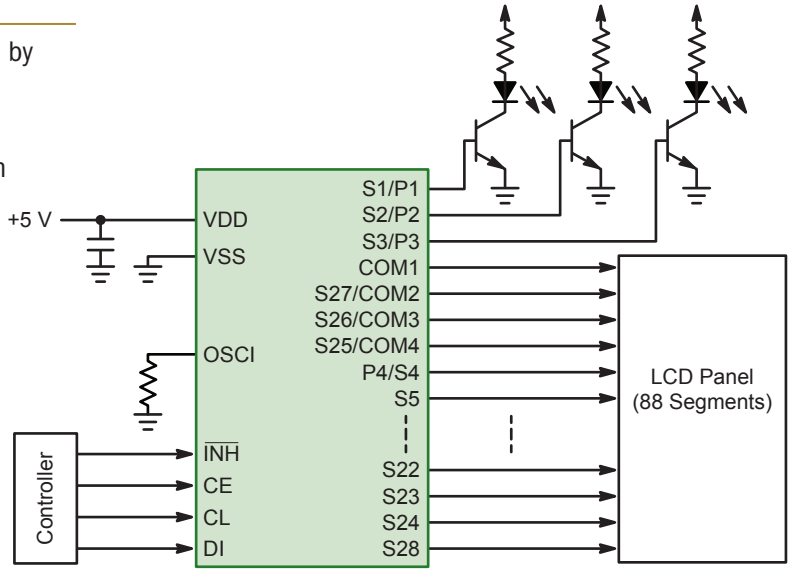
NOTE: xxx in the device number represents the current level.

LIGHTING

LCD Drivers for Information Display Panels

Features

- LCD driver (common drive and segment drive) controlled by external microprocessor
- Serial data input supports CCB format communication
- Many additional functions around the display application
  - Key input function
  - LED driver output port
  - General purpose output port
  - PWM output function for brightness adjustment of the backlight
  - LCD display contrast adjustment
- Wide operating temperature (T_A = -40 to +85/+105 °C)



LC75843 Application Diagram, 1/4 Duty, 3-Channel PWM

Device	Segments*			V_{DD} (V)	Interface Voltage (V)	V_{LCD} (V)	Output Ports	PWM Channels	Package(s)
	Static, 1/2 Duty	1/3 Duty, 1/4 Duty							
LC75843	24 to 28, 46 to 54	66 to 78, 84 to 100		4.0 - 6.3	3.3 or 5.0	V_{DD}	4	3	TSSOP-36
	1/3 Duty	1/4 Duty							
LC75897	363 to 387	480 to 512		2.7 - 6.0	V_{DD}	2.7 - 6.0	8	3	SQFP-144
LC75809	231 to 267	304 to 352		4.5 - 6.3	3.3 or 5.0	V_{DD}	12	6	TQFP-100
LC75879	183 to 207	240 to 272		4.5 - 6.3	3.3 or 5.0	V_{DD}	8	3	TQFP-80J
LC75829	147 to 159	192 to 208		4.5 - 6.0	3.3 or 5.0	V_{DD}	4	–	QIP-64E, SQFP-64
LC75839	147 to 159	192 to 208		4.5 - 6.0	3.3 or 5.0	V_{DD}	4	3	SQFP-64
LC450029	159	208		4.5 - 6.0	V_{DD}	V_{DD}	–	–	Chip w/ Au Bumps
LC75806	198 to 231	260 to 304		4.5 - 6.0	3.3 or 5.0	V_{DD}	9	–	TQFP-100
LC75886	150 to 171	196 to 224		4.5 - 6.0	3.3 or 5.0	V_{DD}	5	–	SQFP-80
	1/8 Duty	1/9 Duty	1/10 Duty						
LC75818	Dot matrix (5 x 7) x 16 + 80	Dot matrix (5 x 8) x 16 + 80	Dot matrix (5 x 9) x 16 + 80	2.7 - 3.6	3.3 or 5.0	4.5 - 10.0	4	–	TQFP-120
LC75812	Dot matrix (5 x 7) x 13 + 65	Dot matrix (5 x 8) x 12 + 64	–	2.7 - 3.6	3.3 or 5.0	4.5 - 10.0	3	3	TQFP-100
	Static, 1/2 Duty	1/3 Duty, 1/4 Duty	LED Driver						
LC75805	38, 74	108, 140	48 Channels	4.5 - 5.5	V_{DD}	V_{DD}	–	7	QIP-100E

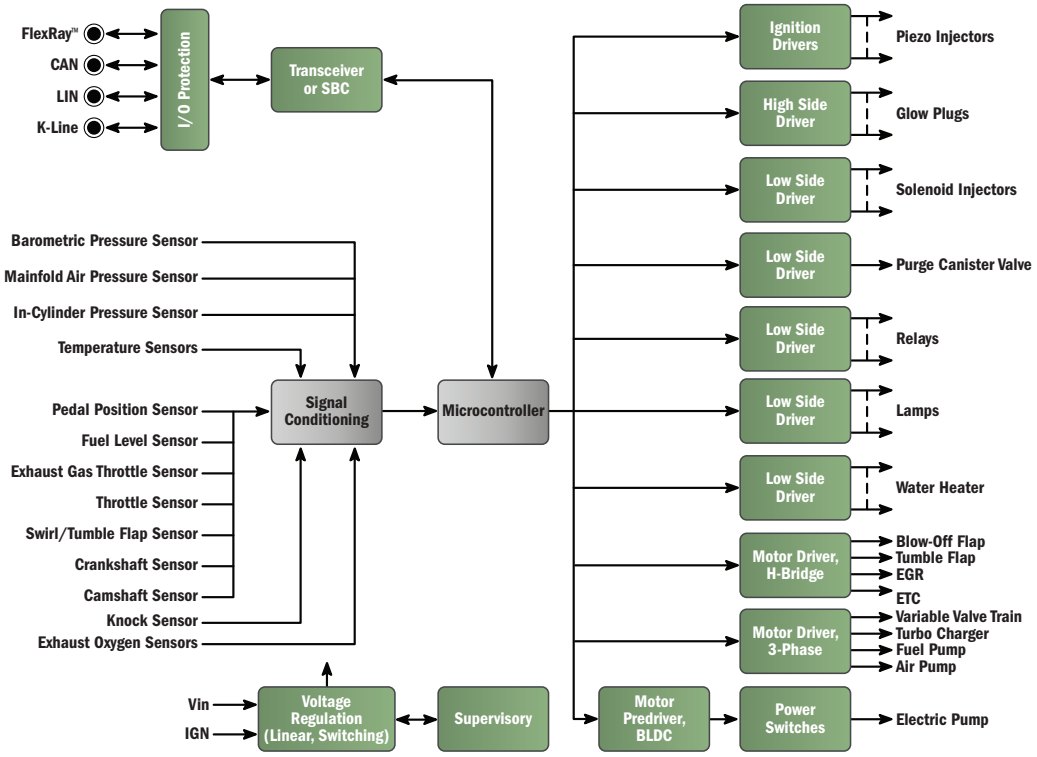
* Number of segments depends on 'common v segment' configuration.

Engine Management Systems

Approximately 80% of engines in the world are gasoline engines. Gasoline engines are starting to incorporate direct injection and turbo charging, to improve the efficiency of the simple and cost-effective engine. Gasoline engines will continue to be the predominant power source world wide; however, diesel engines have achieved ~40% penetration in Europe and have additional potential in North America.

Automotive electronics contributes to the drive for efficiency through control, sensing and actuation of the engine. Critical components, such as injectors and valves, are carefully controlled to reach the maximum efficiency. To improve control, pressure in the combustion chamber is measured and processed in real time, in order to reduce fuel consumption of the gasoline engine by 30%.

ON Semiconductor has developed numerous custom solutions and standard products for gasoline, bi/flexfuel, and diesel engines. The company's expertise covers the full spectrum of applications, ranging from air and fuel supply over ignition control, to exhaust after-treatment subsystems.



Diesel Engine Management System

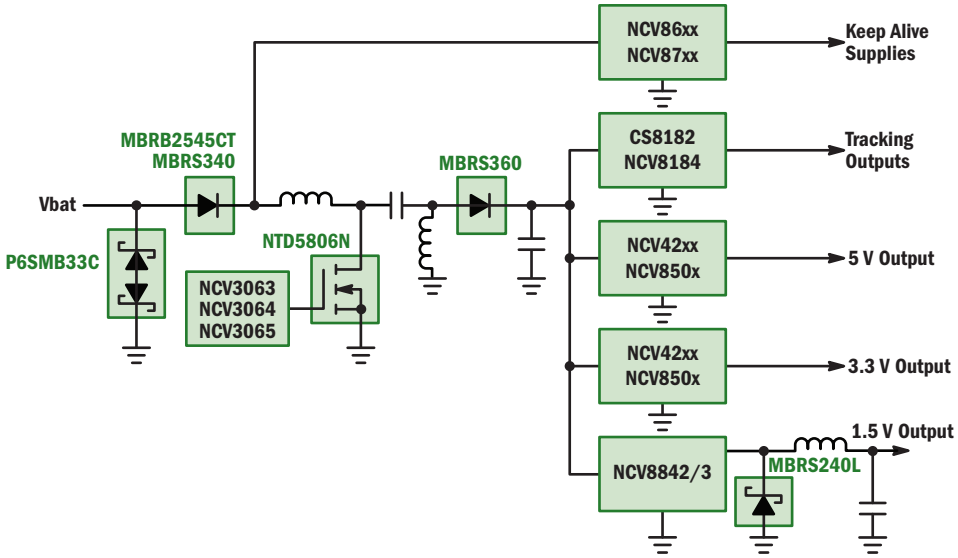
Product Portfolio

- Inductive angular sensor interfaces
- Pressure sensor interfaces
- Knock- and wheel-speed detection circuits
- Oil-, urea- and air-flow interfaces
- In-vehicle networking components
- Actuator drivers and pre-drivers for throttle and flaps, solenoid- and piezo-fuel injection systems, spark ignition, fans, pumps, and hydraulic controls

Power Management Rails for Powertrain

Increasing demand for lower emissions, higher fuel economy, higher efficiency engines, and higher performance vehicles drive the need for precise control of ignition, fuel systems, and exhaust control. In order to efficiently perform all these functions, the latest generation of engine controllers need high-end 32-bit multi-core processors. These high-end microprocessors require efficient and reliable power management subsystems.

The power management subsystem must be able to handle various battery transients, such as load dump, double battery, reverse battery, and other inductive and capacity coupled transients. The subsystem typically provides regulated 5 V, 3.3 V, 1.0-1.5 V, and other tracking outputs, to power microcontrollers, sensors, memories, and other peripheral devices in the ECU.



ON Semiconductor offers a wide selection of highly efficient power supply solutions that can handle harsh powertrain battery transients. The portfolio includes multi-topology controllers, such as NCV8871 and NCV3063, to provide regulated voltage greater than 5 V with a battery operating voltage between 4 V to 18 V; as well as buck regulators and controllers, like NCV8851 and NCV8842, to supply the high current, low voltage microcontroller cores.

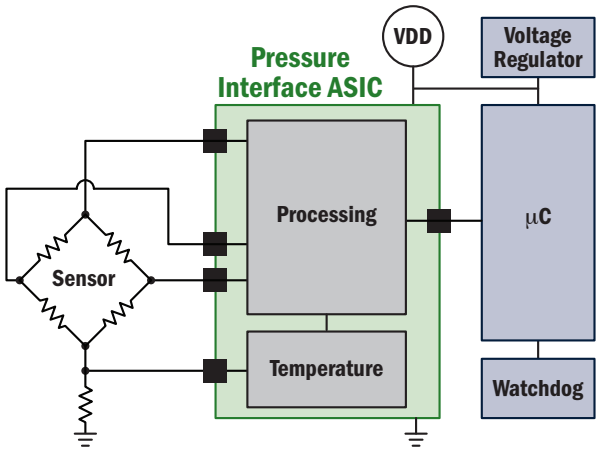
To support 'keep alive' 5 V and 3.3 V voltage rails in an ECU, ON Semiconductor offers a wide selection of low Iq and standard linear voltage regulators. In addition, fully protected tracking regulators - such as NCV8184, CS8182, and CS8183 – that can power external sensors, complete the portfolio.

Along with the linear regulators and switch mode power supplies, ON Semiconductors also offers power MOSFETS for SEPIC and BUCK applications, as well as low Vf rectifiers and TVS diodes for reverse battery and load dump applications.

ASICs for Powertrain

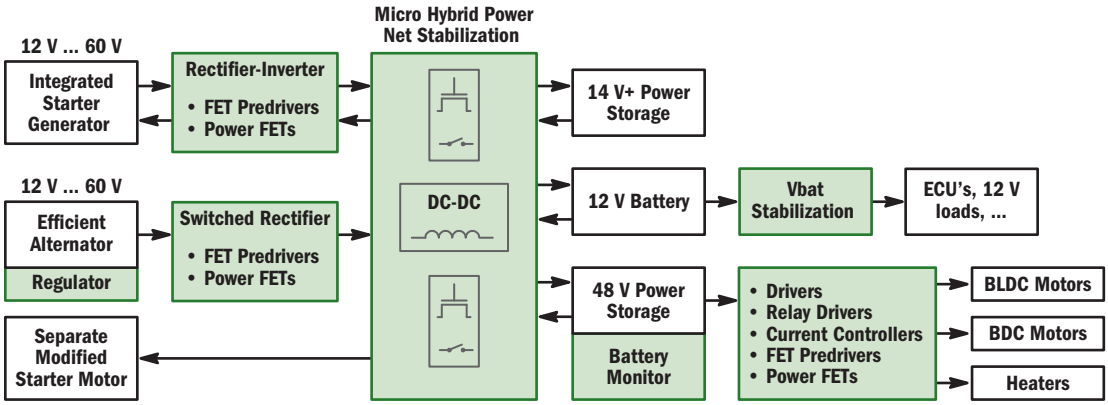
Cylinder Pressure Sensing

Monitoring and measuring pressure is an integral part of engine management. Pressure sensors keep track of conditions within the manifold (MAP and TMAP), monitor diesel particle filters, and control the high pressures involved in both diesel and gasoline direct injection. In-cylinder pressure sensing (ICPS) enables even more accurate combustion control, to allow further reduction in NOx and CO2 emissions, for cleaner diesels and other advanced internal combustion engines of the future.



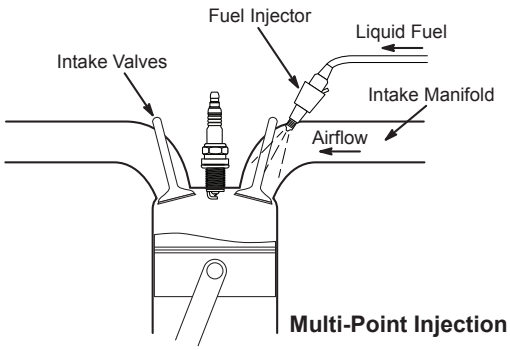
Micro-Hybrid

Micro-Hybrids are start-stop vehicles with additional features to reduce CO2 emissions: the internal combustion engine is switched-off while the vehicle is still moving; regenerative brake energy can be captured in a dedicated power-storage system; and electricity generation is avoided during acceleration. An efficient alternator or an Integrated Starter Generator (ISG) replaces the standard alternator while dedicated integrated circuits control the power net stability. Some of the 12 V high power loads (such as electric power steering and window defrosters) and some belt-driven ancillary loads (such as water pump, compressor, fan) can be replaced by electric drives from a 48 V battery. ON Semiconductor offers robust technologies, key intellectual property, and production proven solutions that address the harsh environments in these emerging applications.

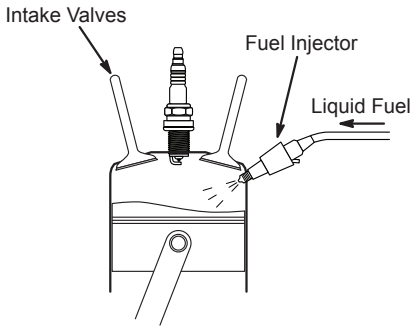


Injection Systems

Fuel injection systems carefully meter the amount and timing of fuel to each cylinder. Fully integrated multi-point (MPI) gasoline engine management systems remain by far the most popular solution. However, the gasoline direct injection (GDI) system has the strongest growth rate.



Multi-Point Injection



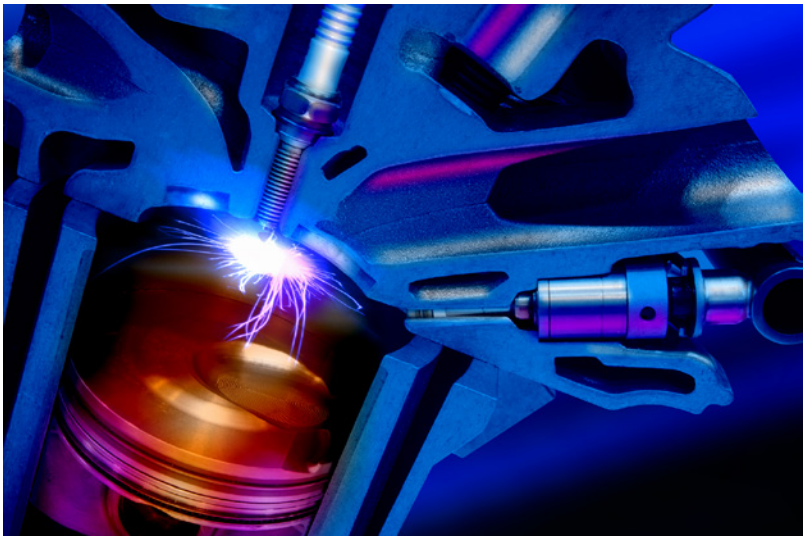
Direct Injection

Multi-point Indirect Injection

Gasoline engines are typically equipped with indirect injection systems. They may be single point (SPI) where the fuel is injected in the throttle housing; or multi point (MPI) where each cylinder has its own injector in the inlet manifold.

Direct Injection

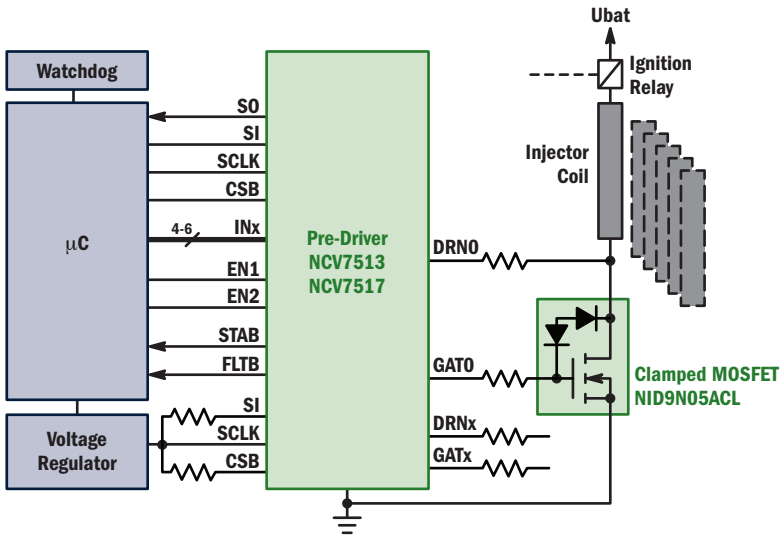
Many diesel engines feature direct injection (DI) technology. The injector nozzle is placed inside the combustion chamber itself. The gasoline direct injection engine (GDI) utilizes this system as well, since it gives a better volumetric efficiency as only air is drawn in through the induction system, increasing the amount of air induced and minimizing fuel losses. The injector also features several spray modes, so the fuel is better distributed and a powerful air-fuel mixture is created. The injector actuator is implemented as a solenoid or a piezo based solution. With piezo technology, fuel can be more precisely dosed when injected into an engine's combustion chamber, considerably reducing fuel consumption and exhaust emissions.

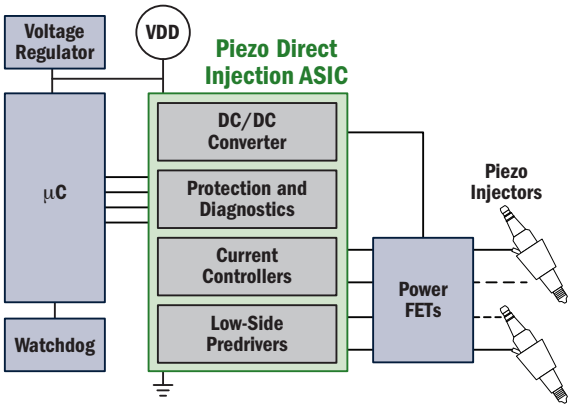


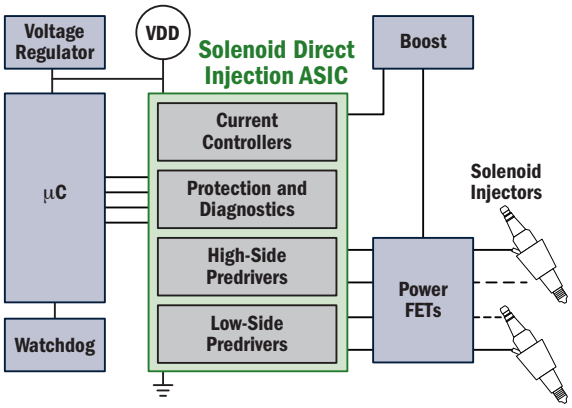
Solutions for Injection Systems

Multi-Point Indirect Injection

The FLEXMOS™ family from ON Semiconductor offers application specific scalability through the choice of external MOSFETs. The low-side pre-drivers NCV7513, NCV7517, and NCV7518, are programmable six channel products for driving logic-level MOSFETs. The devices are controllable by a combination of serial SPI and parallel inputs. They feature programmable fault management modes and allow power-limiting PWM operation with programmable refresh time. Each channel independently monitors its external MOSFET's drain voltage for fault conditions. Shorted load fault detection thresholds are fully programmable. Fault information for each channel is encoded by fault type and is available through SPI communication.







Direct Injection

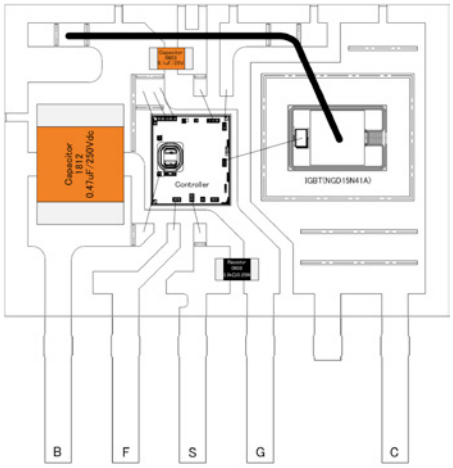
Engine management systems - in particular, injection functions - are subject to extensive qualification cycles, due to the harsh operating conditions of wide temperature and voltage ranges, and switching of inductive and capacitive loads. ON Semiconductor has developed multiple drivers for injection systems, using proprietary design techniques, combined with high-voltage manufacturing processes.

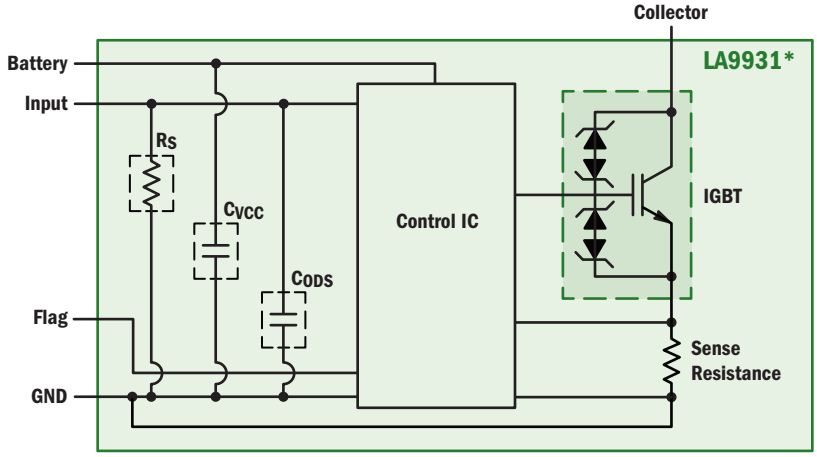
Ignition Systems

LA9931 Igniter Module*

Features

- Complete solution for coil-on-plug applications
- Integrates control circuit, IGBT, passives
- 400 V clamp voltage; 12 A IGBT collector current
- 250 mJ IGBT collector-emitter avalanche energy
- ESD, EMC, ISO pulse: ISO7637-2
- SIP-5J package





* Pending 2H14

Ignition IGBTs

Features

- Cover All Standard Ignition System Requirements
- V Clamp 350 - 450 V
- SCIS 200 -500 mJ
- $V_{ce(on)}$ 1.0 - 2.1 V
- High Pulse Current Capability
- ESD Protection

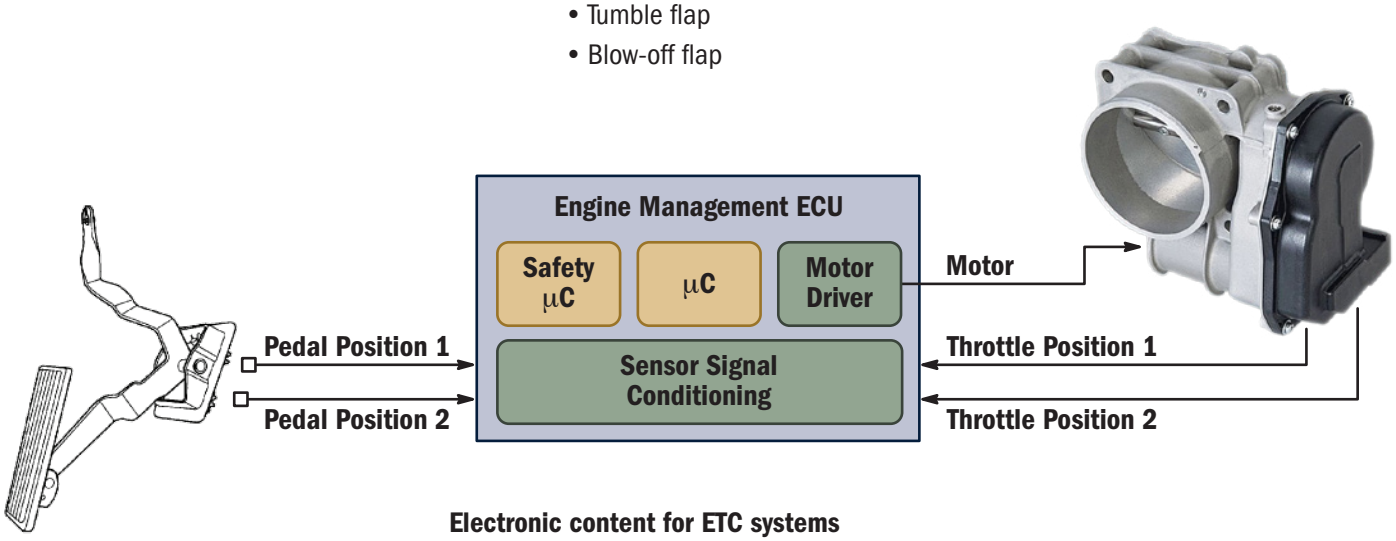
IGBTs

Device	Clamp Voltage	Current	$V_{ce(on)}$ @ I_C = 10 A; V_{GE} = 4.5 V; T_j = 25°C	Package(s)
NGB8245N	450 V	20 A	1.3 V	D2PAK
NGD18N45CLB	450 V	18 A	2.3 V	DPAK
NGB15N41ACL	410 V	15 A	2.1 V	D2PAK
NGD15N41ACL	410 V	15 A	2.1 V	DPAK
NGB18N40ACLB	400 V	18 A	2.0 V	D2PAK
NGD18N40ACLB	400 V	18 A	2.0 V	DPAK
NGB8202AN	400 V	20 A	1.3 V	D2PAK
NGD8201AN	400 V	20 A	1.3 V	DPAK
NGB8204AN	400 V	18 A	2.0 V	D2PAK
NGB8207BN	365 V	20 A	1.5 V	D2PAK
NGB8207ABN	365 V	20 A	1.75 V	D2PAK
NGD8205AN	350 V	20 A	1.3 V	DPAK
NGB8206AN	350 V	20 A	1.3 V	D2PAK

Flap Control

To reduce fuel consumption and meet the strict requirements for the different regulations in the automotive industry - e.g., Euro-4 (2005), Euro-5 (2009), and Euro-6 (2014) - modern engine management systems must optimize the engine's efficiency, and reduce emissions of soot, NOx (Nitrogen Oxide), HC (Hydrocarbon), and CO (Carbon Monoxide). Therefore, the engine control unit needs to control the combustion process in an extremely precise manner. Flap control systems include several air and exhaust gas flaps:

- Electronic throttle
- Exhaust recirculation flap
- Tumble flap
- Blow-off flap

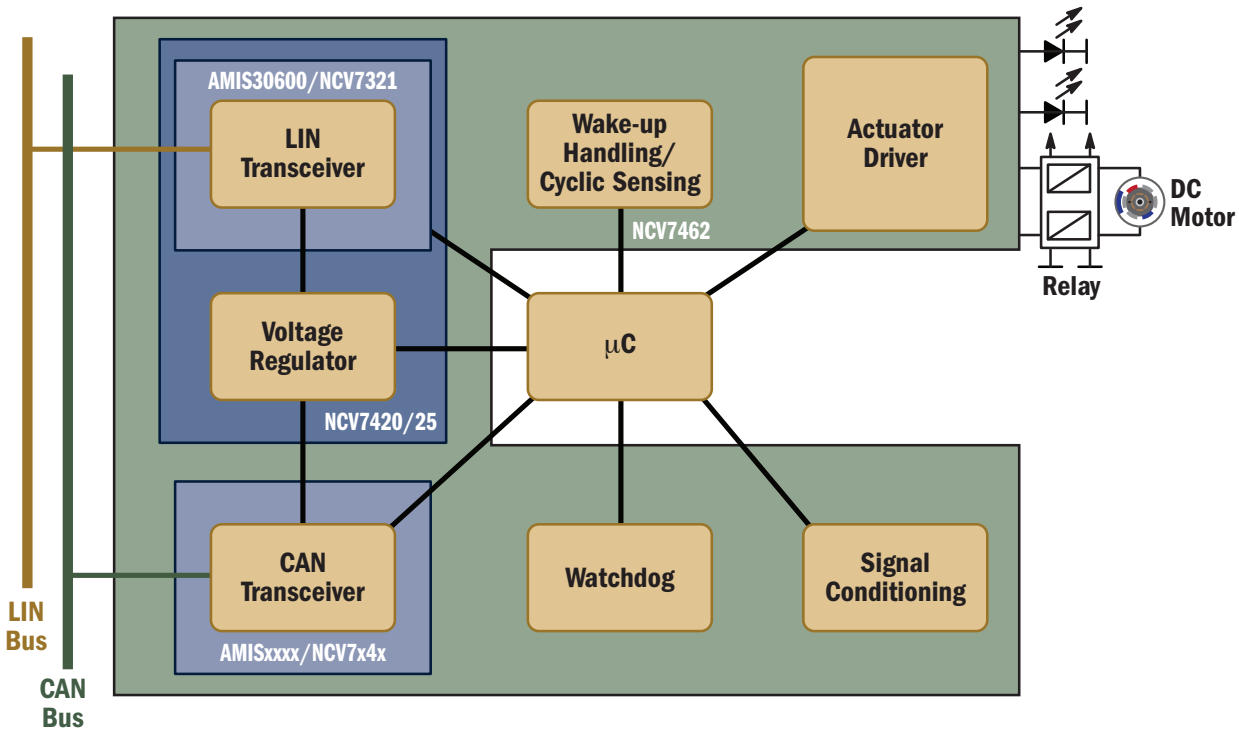


Electronic content for ETC systems

- Pedal position sensor (inductive or Hall effect)
- Throttle position sensor (potentiometer, inductive, or Hall effect)
- DC motor control

In-Vehicle Networking Solutions

Automobile manufacturers today design decentralized, distributed systems, connected through industry interface standards. ON Semiconductor offers an innovative in-vehicle networking portfolio, including LIN, CAN, and FlexRay™ transceivers – AEC and TS16949 qualified. The company also offers System Basis Chips that integrate transceivers with other circuits, including voltage regulators, drivers, and supervisory functions.



Typical System Partitioning with LIN and CAN Bus Connections

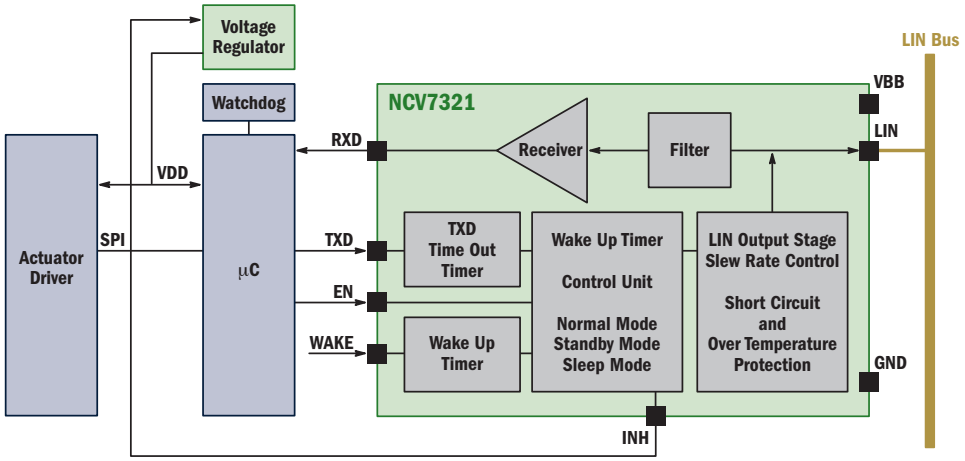
Standalone LIN Transceivers

The LIN bus communicates low rate (up to 20 kBaud) data from control devices - such as door locks, mirrors, car seats, and sunroofs – for non-time-critical functions. The LIN bus protocol uses only a single wire in each node, minimizing wiring costs. Each node includes a slave MCU state-machine that recognizes and translates the instructions specific to that function. ON Semiconductor offers products for both US (SAE J2602-2) and European (LIN Physical Layer Specification Rev. 2.x) standards.

LOCAL INTERCONNECT NETWORK

NCV7321 Features

- Compliant to OEM requirements
- Outstanding EMC performance
- System ESD levels >12 kV
- Combines high voltage analog and digital functionality
- Transmission rate 1-20 kBaud



Standalone LIN Transceiver NCV7321

LIN Transceivers

Device	Description	Bus Speed (Baud)	ISO 9141	LIN 2.0/2.1/2.2	J2602	Sleep Mode Current Typ (µA)	ESD Protection IEC 61000-4-2 (LIN pin)	Package(s)
AMIS-30600	LIN Transceiver	20 k	♦	♦	♦	55	6 kV	SOIC-8
NCV7321	LIN Transceiver	20 k	♦	♦	♦	10	>12 kV	SOIC-8
NCV7424	Quad LIN Transceiver	20 k	♦	♦	♦	30	>12 kV	TSSOP-16
NCV7420	LIN Transceiver with Voltage Regulator (50 mA, 3.3 or 5.0 V)	20 k	♦	♦	♦	20	>12 kV	SOIC-14
NCV7428	LIN Transceiver with Voltage Regulator (70 mA, 3.3 or 5.0 V)	20 k	♦	♦	♦	12	>14 kV	SOIC-8
NCV7425	LIN Transceiver with Voltage Regulator (150 mA, 3.3 or 5.0 V)	20 k	♦	♦	♦	20	>12 kV	SOIC-16W EP

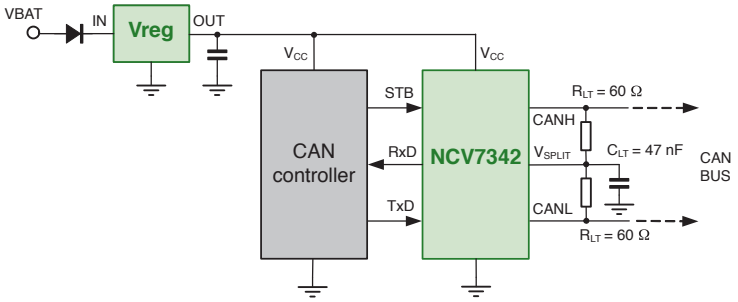
Standalone CAN Transceivers

The latest generation CAN transceivers exhibit industry-leading performance on electromagnetic capabilities (ESD and EMI). These devices are designed in ON Semiconductor's proven, innovative I3T technology, that delivers highly robust, high quality components with failure rates measured in parts-per-*billion*.

GIFT/ICT

Features

- Portfolio includes transceivers specifically designed for:
  - Low Speed Fault Tolerant
  - High Speed
  - Low Power
  - Single Wire
- Conformance tested by external test house (ISO11898)
- System ESD protection according to IEC 61000-4-2
- Highly robust against EM fields (low Electro Magnetic Susceptibility – EMS)



NCV7342 Standalone CAN Transceiver

CAN Transceivers

Device	Description	Standard	Sleepmode Current Max (μA)	Bus Speed Max	ESD Protection IEC 61000-4-2 (CAN pins)	Package(s)
NCV7349	High Speed, Low Power CAN Transceiver**	ISO11898-5	15	1 Mbps	>12 kV	SOIC-8
NCV7342	High Speed, Low Power CAN Transceiver	ISO11898-5	15	1 Mbps	>12 kV	SOIC-8
NCV7340	High Speed, Low Power CAN Transceiver	ISO11898-5	15	1 Mbps	>12 kV	SOIC-8
AMIS-42665	High Speed, Low Power CAN Transceiver	ISO11898-5	15	1 Mbps	4 kV (HBM)	SOIC-8
NCV7341	High Speed, Low Power CAN Transceiver	ISO11898-5	35	1 Mbps	8 kV	SOIC-14
NCV7441	Dual High Speed, Low Power CAN Transceiver	ISO11898-5	30	1 Mbps	8 kV	SOIC-14
AMIS-42700	Dual High Speed CAN Transceiver	ISO11898-2	N/A*	1 Mbps	4 kV	SOIC-20
NCV7351	High Speed CAN Transceiver	ISO11898-2	N/A*	1 Mbps	>12 kV	SOIC-8
AMIS-30660	High Speed CAN Transceiver	ISO11898-2	N/A*	1 Mbps	4 kV	SOIC-8
AMIS-30663	High Speed CAN Transceiver	ISO11898-2	N/A*	1 Mbps	4 kV	SOIC-8
AMIS-41682	Low Speed Fault Tolerant CAN Transceiver	ISO11898-3	60	250 kpbs	6 kV (HBM)	SOIC-14
AMIS-41683	Low Speed Fault Tolerant CAN Transceiver	ISO11898-3	60	250 kpbs	6 kV (HBM)	SOIC-14
NCV7356	Single Wire CAN Transceiver	J2411	60	40 kpbs	4 kV (HBM)	SOIC-14

* Sleepmode not featured/implemented. **SW-CAN – Not defined in ISO.

System Basis Chips

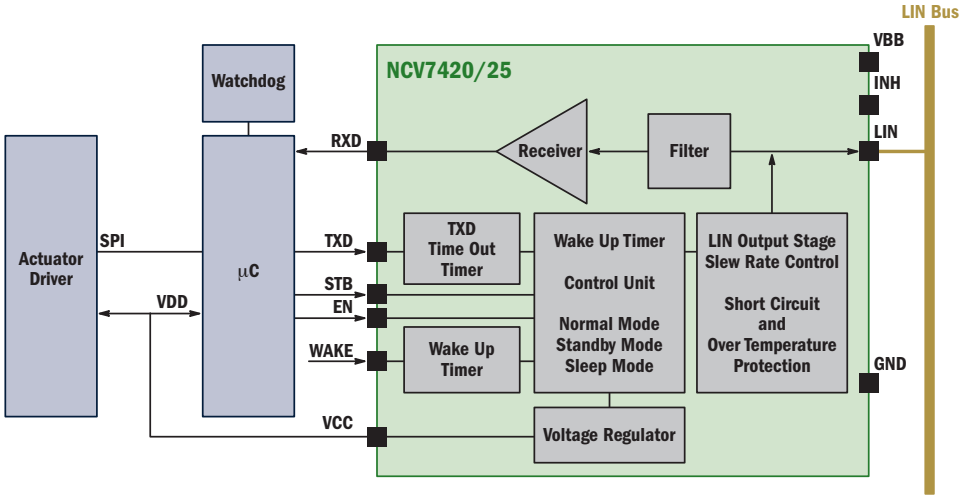
Integration of key system components, like LIN, CAN, and voltage regulators, within ECUs delivers:

- Improved system reliability
- Reduced power consumption
- Use of less board space
- Cost-optimized solutions

ON Semiconductor's IP, combined with years of experience designing integrated custom circuits, has led to successful development of a System Basis Chip portfolio.

NCV7420/5 Features

- Based on NCV7321
- Ideal solution for low BOM slave nodes
- 3.3 V and 5 V versions
- NCV7420 includes 50 mA voltage regulator
- NCV7425 includes 150 mA voltage regulator



NCV7420/25 LIN-SBC: LIN +50/150 mA LDO (5 or 3.3 V)

System Basis Chips

Device	ISO11898-2/-5 Transceivers	LIN 2.x Transceivers	Output Current (mA)	Package
NCV7420	–	1	50	SOIC-14
NCV7428	–	1	70	SOIC-8
NCV7430	–	1	100	SOIC-14
NCV7425	–	1	150	SOIC-16W EP
NCV7462	1	1	250	SSOP-36 EP
NCV7471	1	2	500	SSOP-36 EP

FlexRay™ Transceivers

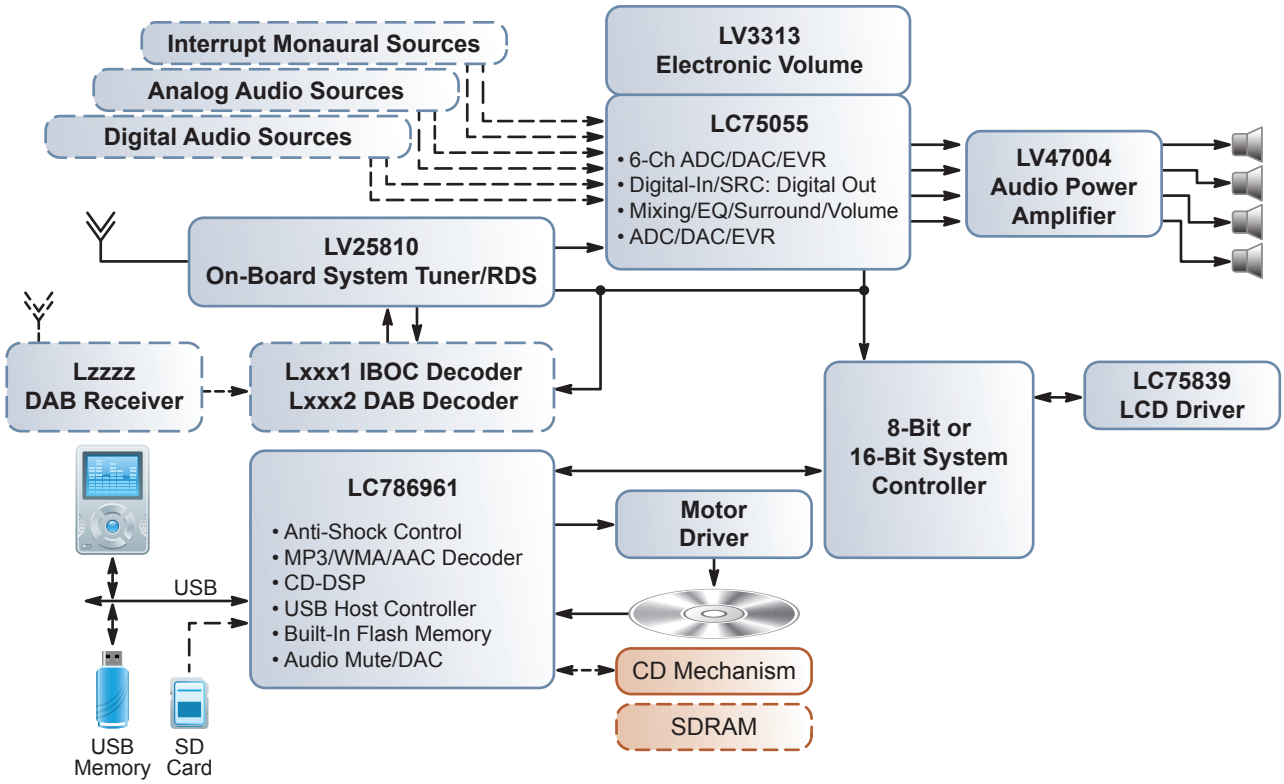
Features

- Compliant to FlexRay v3.0.1 physical layer
- Excellent EMC and ESD performance

FlexRay Transceivers

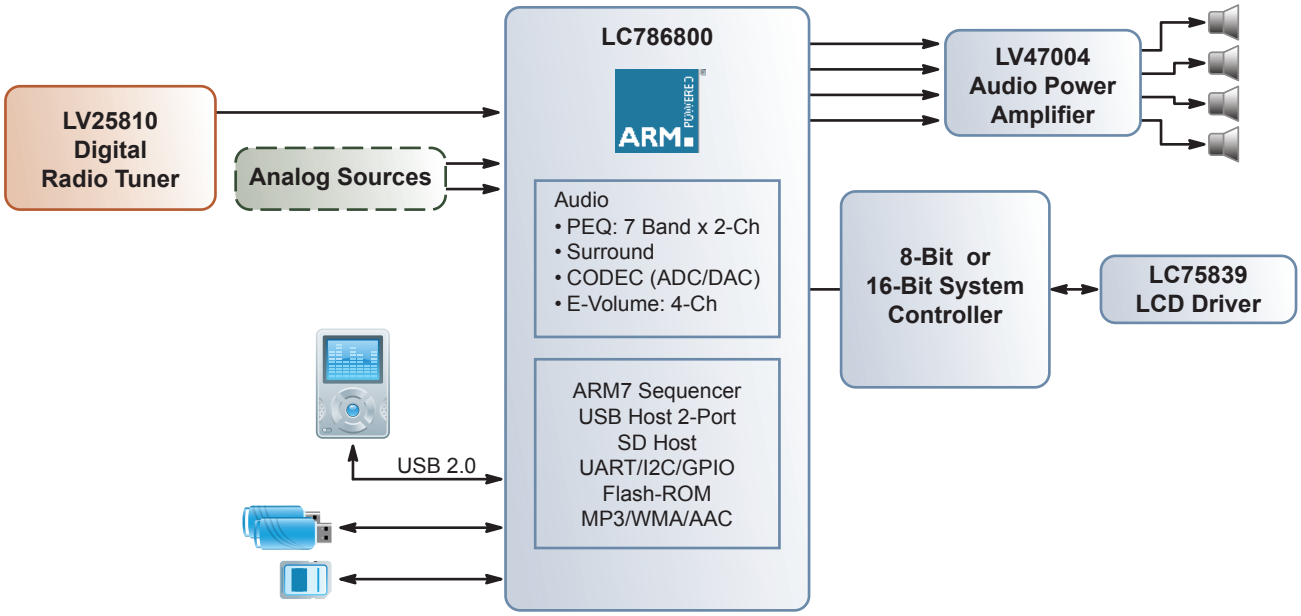
Device	Description	Data Rate	ESD Protection IEC 61000-4-2 (BP, BM pin)	Package
NCV7381	Clamp 30	10 Mb/s	10 kV	SSOP-16
NCV7383	Clamp 15	10 Mb/s	10 kV	TSSOP-14

Audio System Solution



AUDIO

Digital Media Receiver (mechaless) Audio System Solution



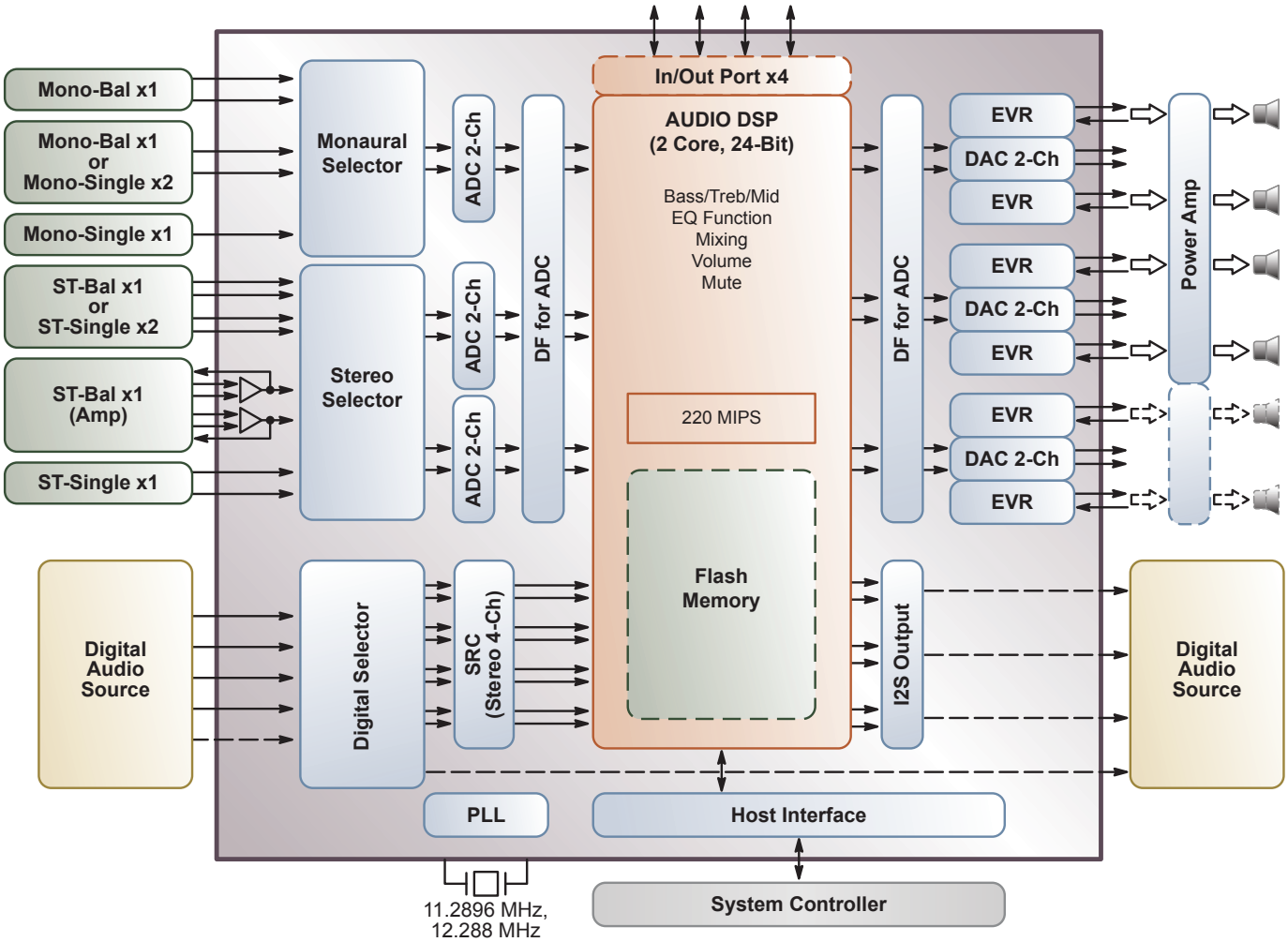
Integrated Audio DSP, A/D, D/A, and Volume Control

LC75055 Features

- Factory programmed Flash memory; reprogrammable with LC75055 debugger tool
- 220 MIPS
- 24x24 → 56-bit ACC; 6 ADC / 6 DAC
- 5 I2S input; 3 I2S output
- 4 hardware SRC
- I2C or SPI
- QIP-100E package

Optional Sound Libraries

- Dolby Pro Logic II
- Dolby DAEP
- SRS CS Surround
- SANYO S3S
- Digital Power Station
- Dedekind



LC75055 System Diagram

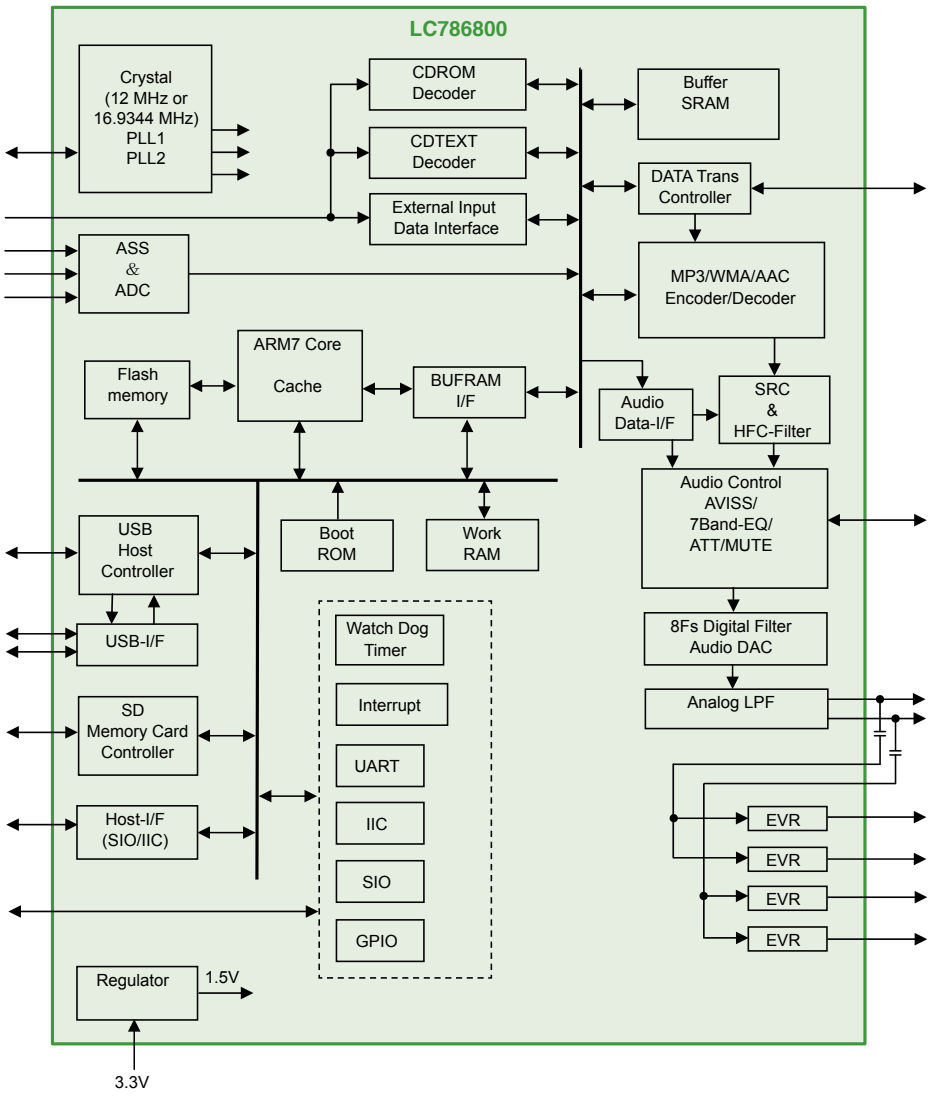
AUDIO

Compressed Audio DSP

The LC786800 provides audio signal processing, compressed audio encode/decode processing, USB host processing, SD memory card host processing, and electronic volume control.

LC786800 Features

- USB 2.0 host function (12 Mbps), SD memory card host function
- MP3, WMA, AAC decoder processing and normal speed MP3 encoder processing
- ARM7TDMI-S™ internal CPU core
- Three stereo channels of analog input and four channels of electronic volume output (LF,LR,RF,RR)
- SIO or IIC for communication with external main controller
- QIP-100E package

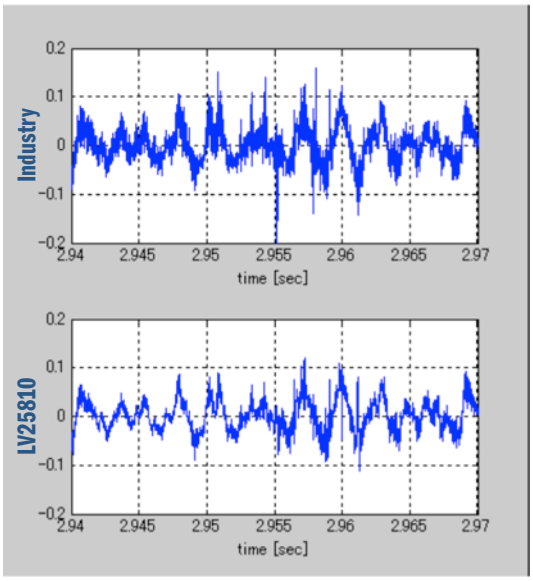


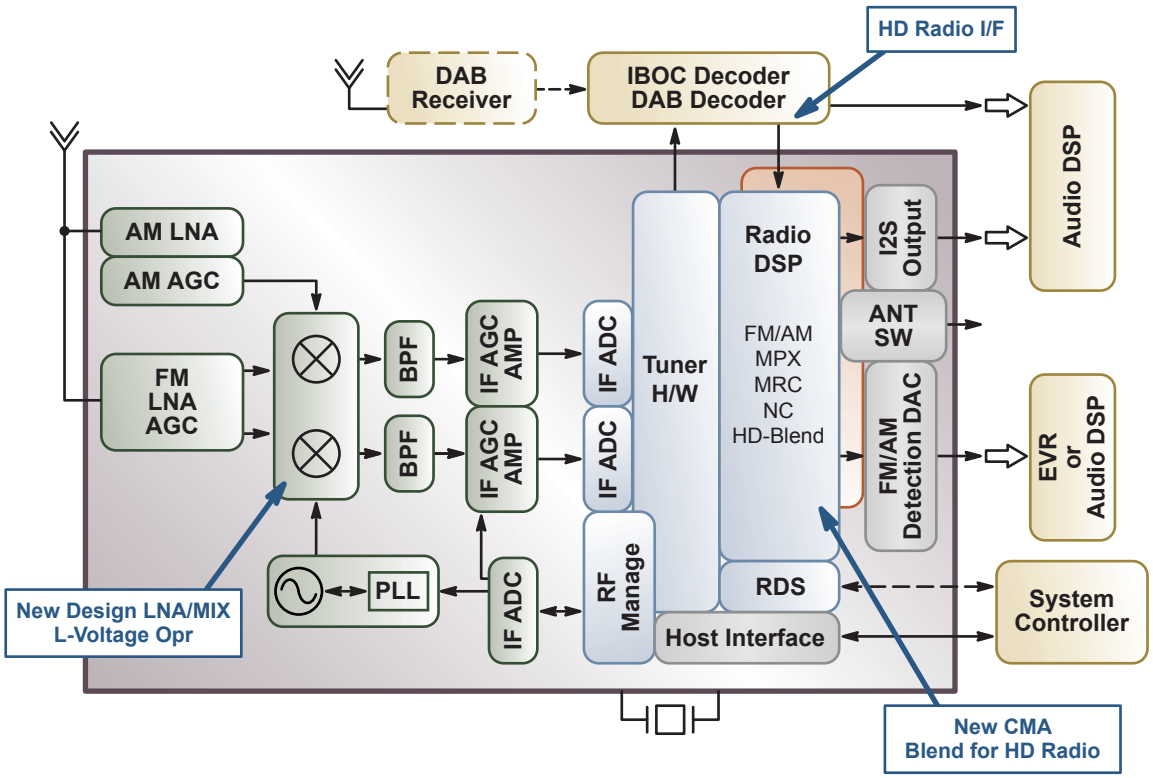
LC786800 System Diagram

DSP Radio Tuner System

LV25810 Features

- Enhanced multi-path noise rejection
- I2C interface
- Standard AM/FM global tuner [AM (LW, MW, SW), FM (JAPAN, US, EU, E-EU, WB)]
- LOW-IF (AM = 59.75 kHz, FM = 300 kHz)
- HD radio ready (I2S I/O port for external HD Radio decoder)





LV25810 Block Diagram

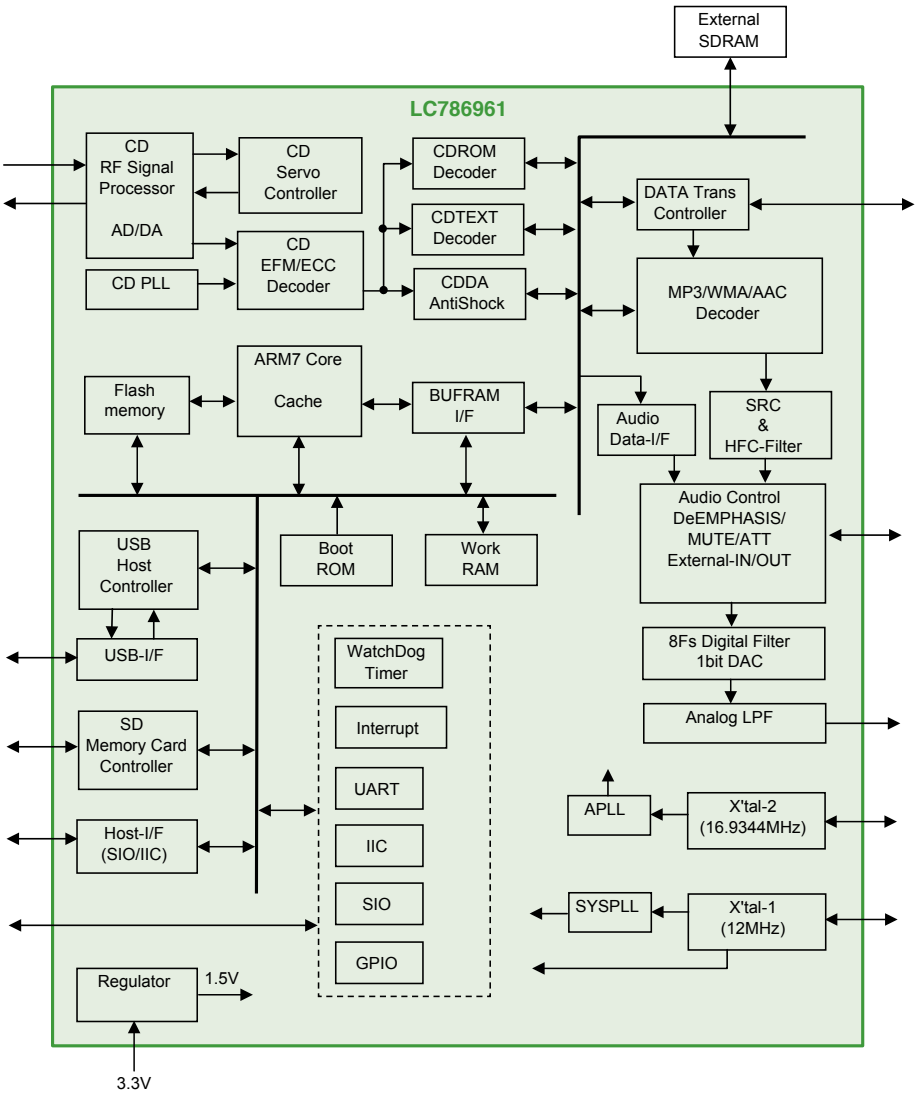
AUDIO

Compact Disc Controller

The LC786961 provides CD servo control, CD signal processing, compressed audio decode processing, audio signal processing, USB host processing, and SD memory card host processing for compact disc systems.

LC786961 Features

- RF signal processing for CD-DA/R/RW, servo control, EFM signal processing, and anti-shock processing
- MP3, WMA, and AAC decoder processing
- Sampling rate convertor, high frequency compensation filter, and other audio signal processing
- USB 2.0 host function (12 Mbps), SD memory card host function
- ARM7TDMI-S™ internal CPU core
- Flash memory for program and data storage
- SIO or IIC for communication with external main controller

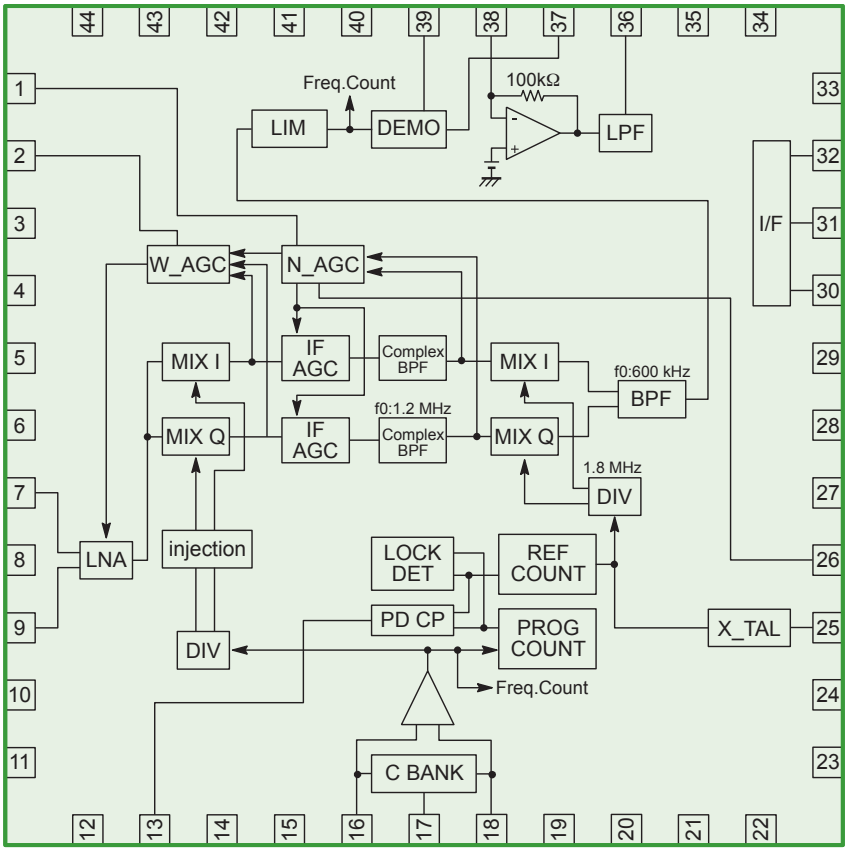


LC786961 Block Diagram

FM Multiple Tuner

LC01707 Features

- Integrated FM-FE, IF, IF-Filter, PLL, FM-DEMO, LPF
- Integrated image reduction complex BPF
- Integrated narrow band IF AGC and wide/narrow band RF AGC
- DLL detection for FM
- I2C interface
- VQFN-44K package



LC01707 Block Diagram

AUDIO

Decoder of DARC Standard for Car Navigation System

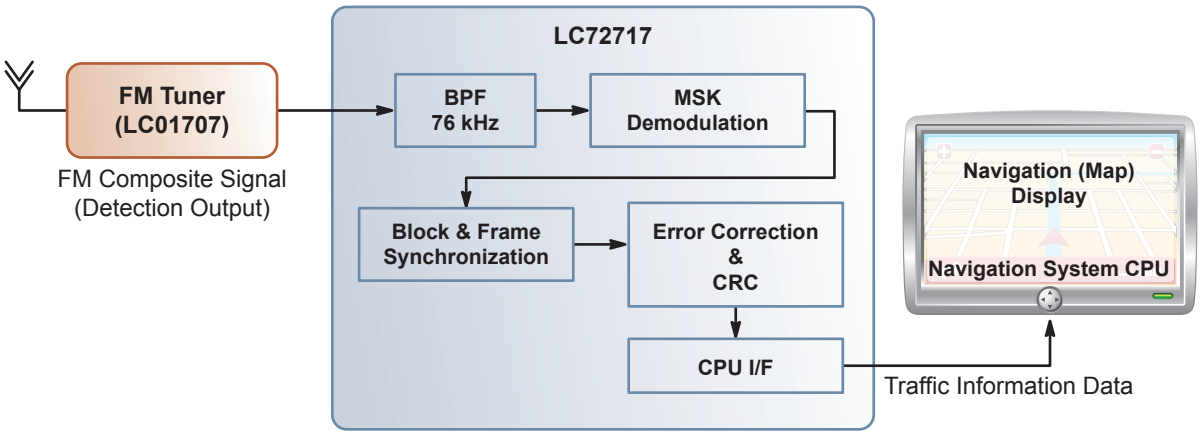
The LC72717 is a data demodulation and decoder for receiving FM multiplex broadcasts for mobile reception in the DARC format. LC72717 includes an on-chip band pass filter for extracting the DARC signal from the FM composite signal. The device also supports ITU-R recommended FM multiplex frame structures (methods A, A', B, and C) and enables design of a compact, multifunction DARC reception system.

LC72717 Features

- Integrates all DARC relevant functions
- Fully adjustable

Applications

- RTIC in China, Thailand and South East Asia
- DARC in Europe



LC72717 Block Diagram

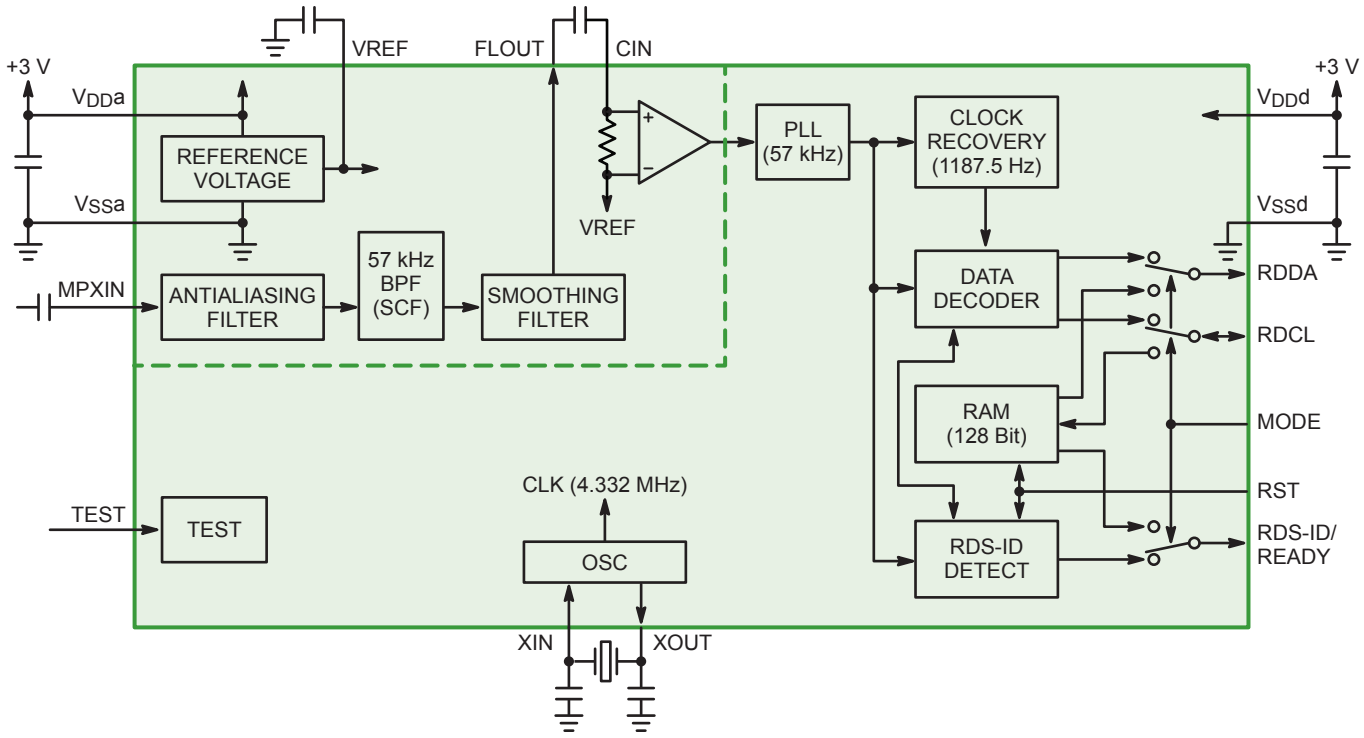
Device	Function	Application	V_{DD} (V)	Packages
LC72717	DARC Decoder	RTIC (China)	2.7 to 3.6	SQFP-64

* VCIS Center license required.

Demodulator for RDS and RBDS Standards

LC72725 Features

- RDS demodulation, 57 kHz carrier and data clock regeneration, bi-phase decode, differential decode
- RDS-ID detect signal with reset
- Switched capacitor bandpass filter
- 128-bit on-chip data buffer
- Standby control

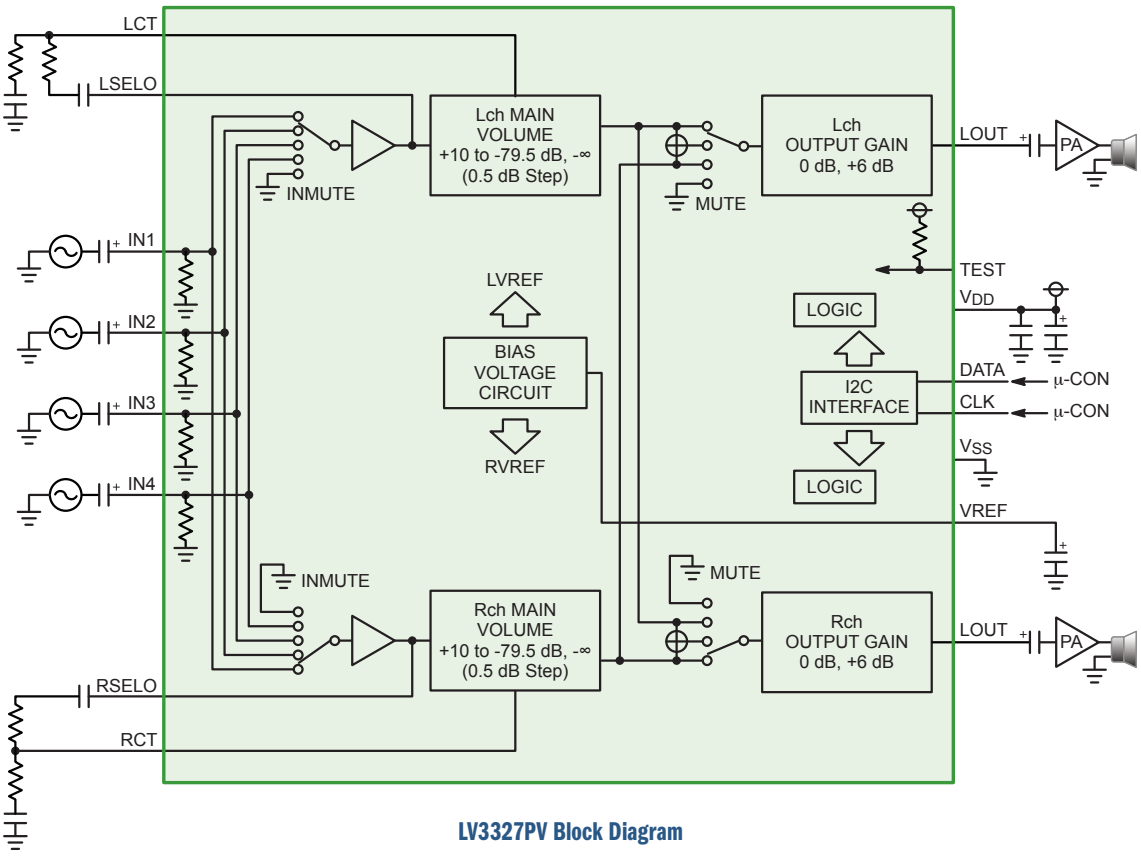


LC72725 Block Diagram

Electronic Volume Control for Audio Systems

Features

- Zero-cross switching
- Soft mute
- Serial data control



LV3327PV Block Diagram

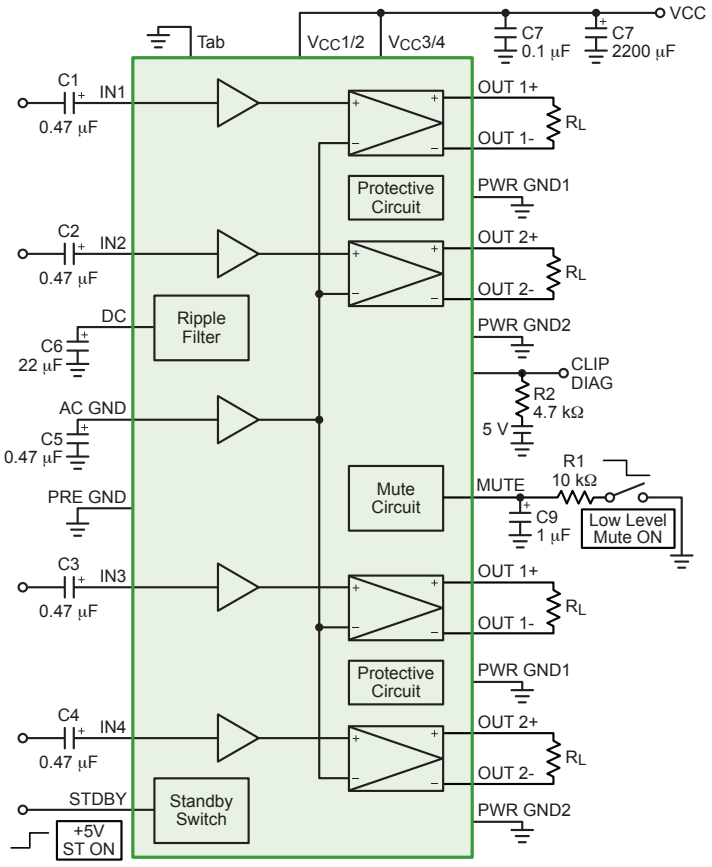
Device	No of Inputs	Equalizer Bands	THD Typ (%)	Volume Control	Features	Package(s)
LV3313PM	4	2	0.01	+10 to –79 dB (1 dB Steps)	Loudness Control, Fader, Mute	QIP-44
LV3319PM	5 or 6	3	0.01	+10 to –79 dB (1 dB Steps)	Loudness Control, Fader, Mute	QIP-44
LV3327PV	4	–	0.01	+10 to –79.5 dB (0.5 dB Steps)	Loudness Control, Mixing	SSOP-16

Class AB Amplifiers for Audio Systems

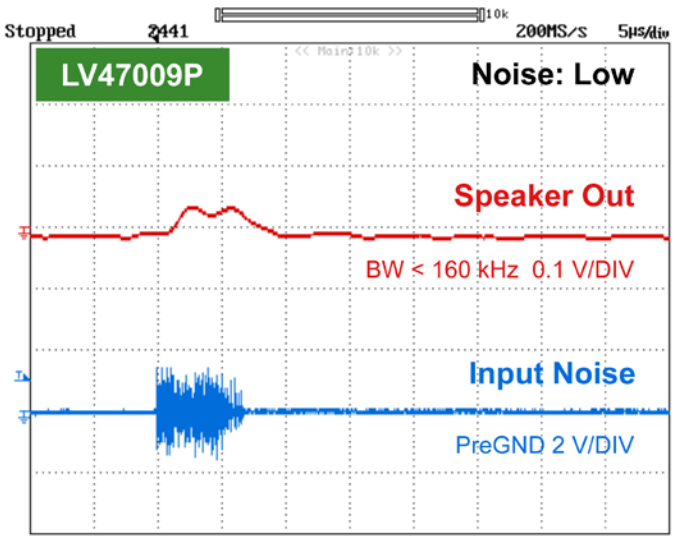
Features

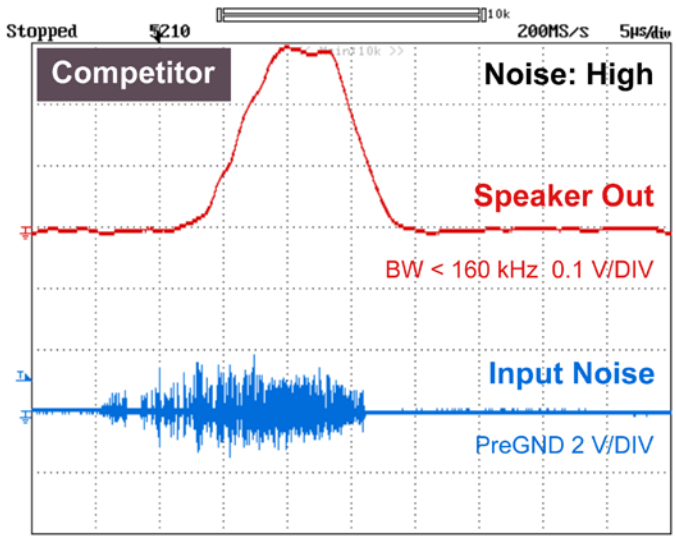
- Complementary high-side P-channel and low-side N-channel DMOW for output stage
- Standby switch
- Mute function
- Integrated protection
- Integrated self-diagnosis

Device	No of Channels	Output Power (W)	Voltage Gain (dB)	Output Type	THD (%)	Package(s)
LV47004	4	41	26	BTL	0.03	HZIP-25
LV47009	4	41	26	BTL	0.03	HZIP-25
LV47011	4	50	26	BTL	0.03	HZIP-25
LV47022	4	48	26	BTL	0.02	HZIP-25



LV47004P Block Diagram





AUDIO

Protection for USB 2.0

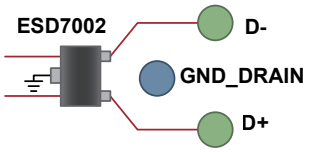
One High Speed Pair, V_{CC}, Low Capacitance ESD Protection

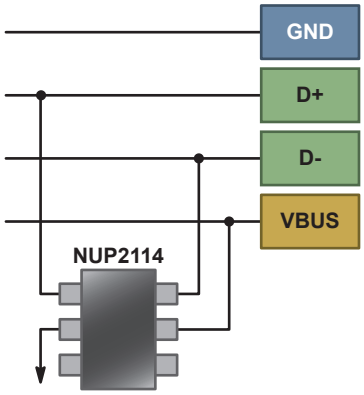
Key Requirement

- Cap < 1.5 pF

Features

- 0.5 - 0.8 pF
- 4 low speed + 1 VBUS integrated – can protect up to 2 USB ports
- Industry leading low clamping voltage
- LVDS compatible





Device	V_{BR} Min (V)	Lines	Capacitance (pF)	Package	Size (mm)
NUP2114	5.5	2	1.0	TSOP-6, SOT-553	3.0 x 2.75, 1.6 x 1.2
ESD7L5.0	5.4	2	0.5	SOT-723	1.2 x 1.2
ESD9L5.0	5.4	1	0.5	SOD-923	1.0 x 0.6
ESD7002	16.5	2	0.2	SC-70	2.1 x 2.1

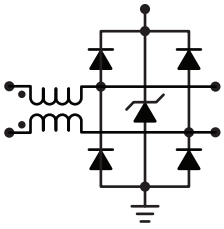
One High Speed Pair, V_{CC}, Common Mode Filter + ESD Protection

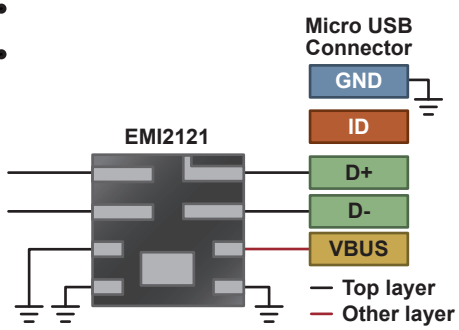
Key Requirement

- Cap < 1.5 pF
- Common Mode Filtering

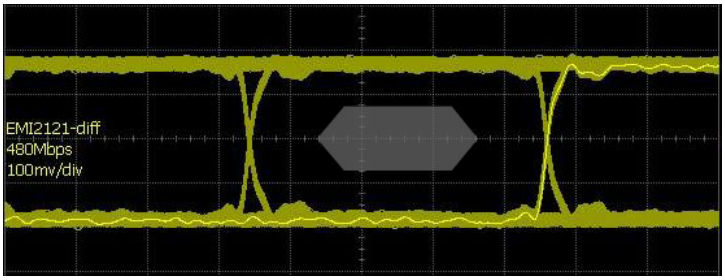
Features

- 0.5 - 0.8 pF
- Integrated EMI suppression with ESD protection
- Industry leading low clamping voltage

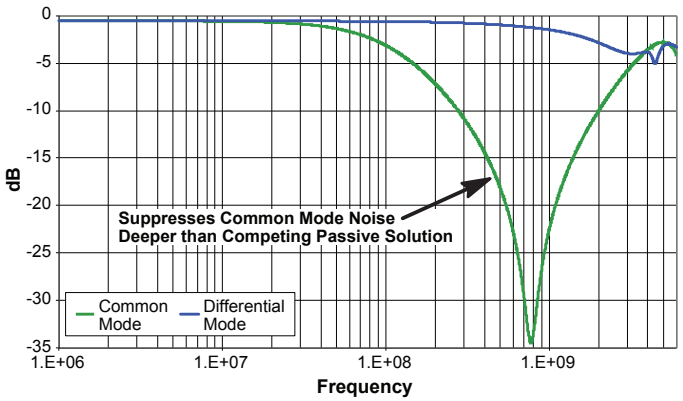




Device	Pairs	Capacitance @ 2.5 V (pF)	CM Attenuation @ 800 MHz (-dB)	DM Bandwidth F3dB (GHz)	Package	Size (mm)
EMI2121	1	0.9	-25	2.5	WDFN-8	2.2 x 2.0 x 0.75
EMI2124	1	0.9	-25	2.5	WDFN-8	2.2 x 2.0 x 0.75



USB 2.0 @ 480 Mb/s



Protection for USB 3.0

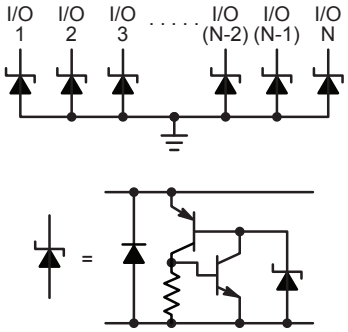
Two SuperSpeed Pairs, One High Speed Pair, V_{CC}, Low Capacitance ESD Protection

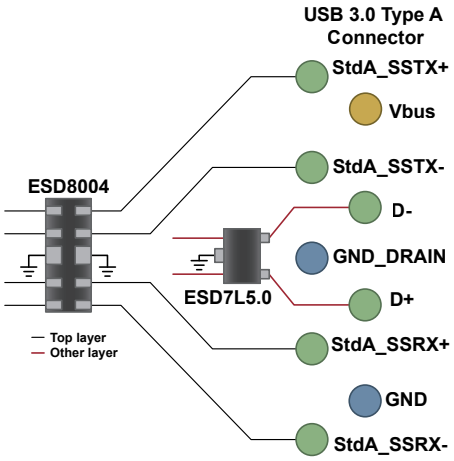
Key Requirement

- Cap < 0.5 pF

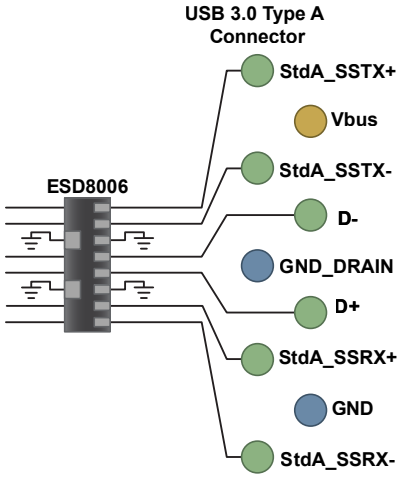
Features

- 0.30 pF or less
- Flow through routing
- Industry leading low clamping voltage versus competitors





ESD8004 – 0.32 pF, 2 Layer Routing
(ESD8004; ESD7L5.0 for D+, D- Lines)



ESD8006 – 0.25 pF, 1 Layer Routing

Device	Lines	Capacitance (pF)	Package	Size (mm)
ESD8006	6	0.25	UDFN-8	3.3 x 1.0
ESD8004	4	0.32	UDFN-10	2.5 x 1.0
ESD7L	2	0.5	SOT-723	1.2 x 1.2

Protection for Antenna and Digital I/O

Single Line High Speed I/O

Part Device	Polarity	V_{rwm} Max (V)	V_{br} Min (V)	R_{dyn} Typ (Ω)	C Max (pF)	ESD Contact (kV)	Package
ESD7351	Uni-Directional	3.3	5	0.35	0.6	20	SOD-x23
ESD7451	Bi-Directional	3.3	5	0.55	0.35	25	SOD-882
ESD7371	Uni-Directional	5.3	7	0.45	0.7	20	SOD-x23
ESD7471	Bi-Directional	5.3	7	0.8	0.35	20	SOD-882
ESD8351	Uni-Directional	3.3	5.5	0.62	0.5	15	SOD-x23
ESD8451	Bi-Directional	3.3	5.5	0.84	0.3	15	SOD-882
ESD7361*	Uni-Directional	16	16.5	0.74	0.55	15	SOD-x23
ESD7461*	Bi-Directional	16	16.5	1.05	0.55	20	SOD-882
ESD7421	Bi-Directional	10.0/16.0	10.5/16.5	0.95	0.6	12	SOD-882

* Pending 2H14.

Protection for HDMI

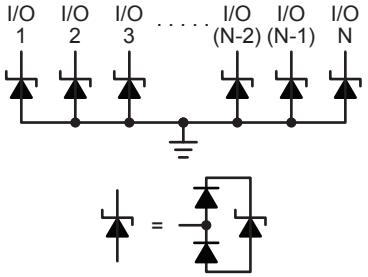
Four High Speed Pairs, Up to Six Additional Interface Lines, Low Capacitance ESD

Key Requirement

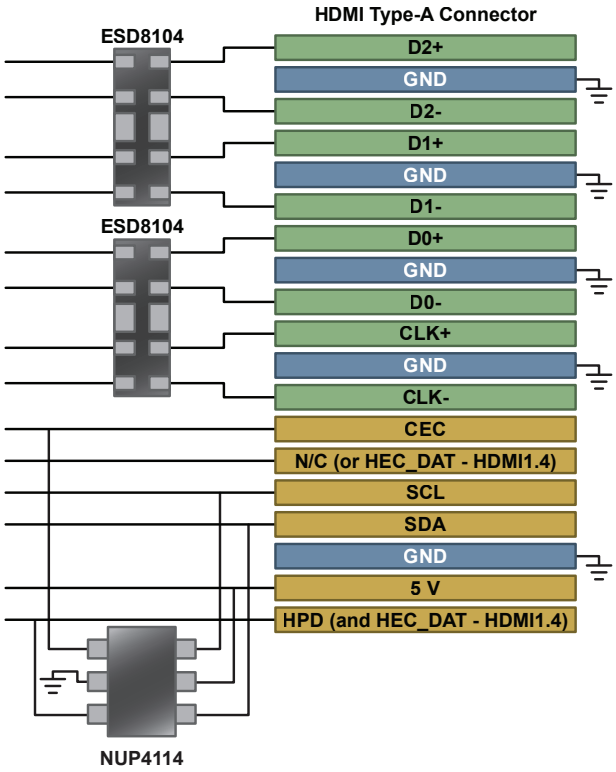
- Cap < 0.5 pF

Features

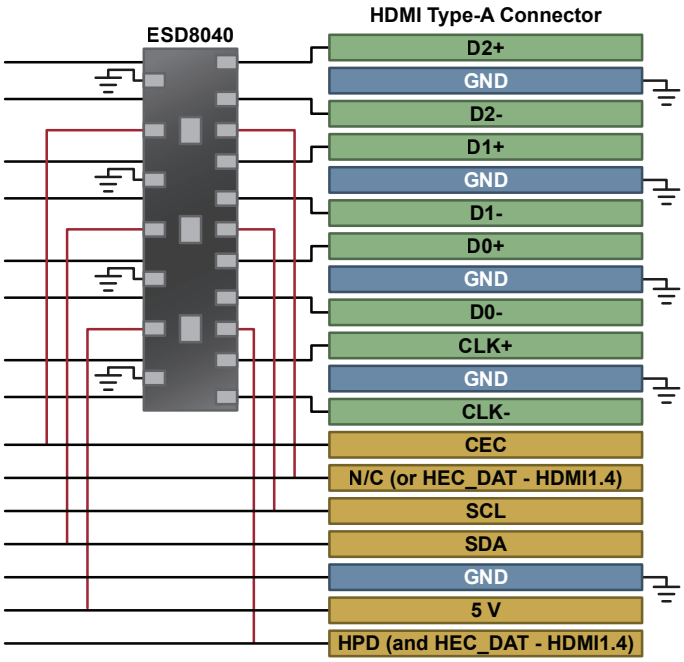
- 0.3 pF ESD protection
- Flow through routing in high speed lines
- Industry leading low clamping voltage



Device	Lines	Capacitance (pF)	Package	Size (mm)
ESD8104	4	0.3	UDFN-10	2.5 x 1.0
ESD8040	14	0.3	UDFN-18	5.5 x 1.5

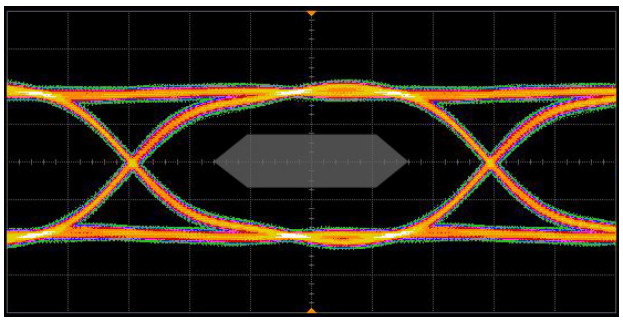


ESD8104

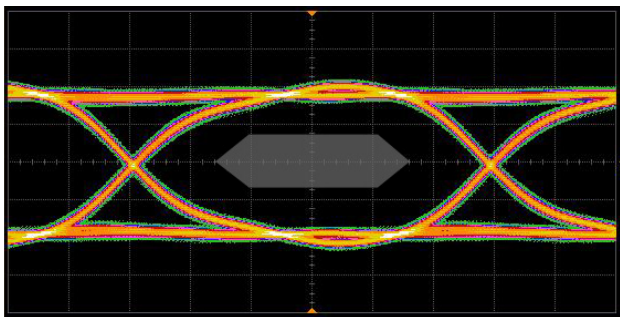


- MediaGuard fully integrated solution
- Includes ethernet protection (HDMI1.4)
- Backdrive current protection

ESD8040



Without ESD



With ESD

HDMI 1.3 & 1.4 = 3.4 Gb/s

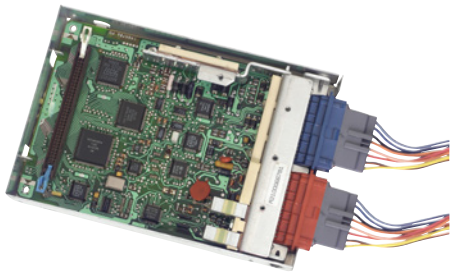
PROTECTION

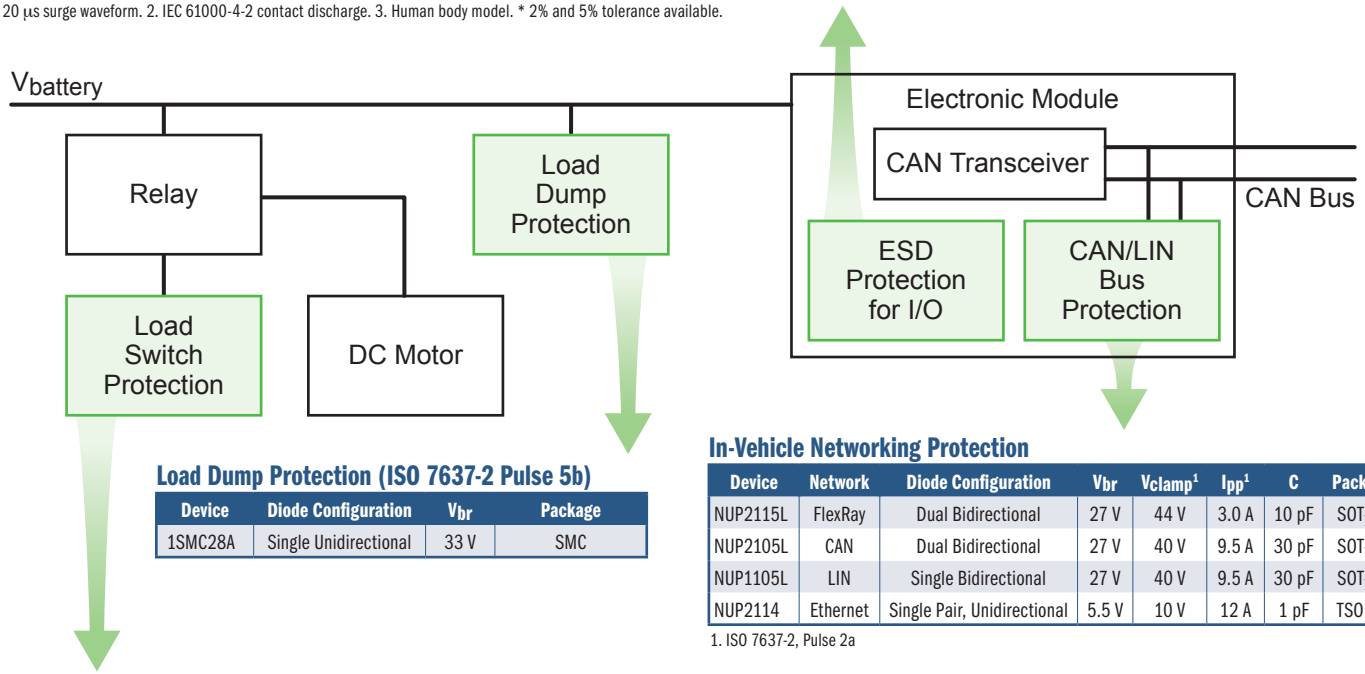
Enhance Reliability of Electronic Modules with Transient Voltage Protection Devices

I/O & Sensor Protection

Device	Diode Configuration	V_{br} Range	P_{pk}[1]	ESD Rating	C	Package
MM5Z Series	Single Unidirectional	4.0 to 15 V	175 W	> 30 kV[2]	<150 pF	SOD-523
MM3Z Series	Single Unidirectional	2.4 to 75 V	–	> 16 kV[3]	<300 pF	SOD-323
MMSZ Series	Single Unidirectional	1.8 to 110 V	–	> 16 kV[3]	<300 pF	SOD-123
MMSZ E Series	Energy Rated Single	1.8 to 110 V	225 W	> 16 kV[3]	<300 pF	SOD-123
MMBZ Series	Single Unidirectional	2.4 to 91 V	–	> 16 kV[3]	<300 pF	SOT-23
MMBZ E Series	Energy Rated Single	2.4 to 91 V	225 W	> 16 kV[3]	<300 pF	SOT-23
MMBZ A Series	Dual Common Anode	5.6 to 33 V	–	> 16 kV[3]	<300 pF	SOT-23
BZX84 Series*	Single Unidirectional	2.4 to 75 V	–	> 16 kV[3]	<450 pF	SOT-23
BZX84 E Series	Energy Rated Single	2.4 to 75 V	225 W	> 16 kV[3]	<450 pF	SOT-23
NZ9F Series*	Single Unidirectional	2.4 to 24 V	–	> 16 kV[3]	<210 pF	SOD-923

1. 8 x 20 μs surge waveform. 2. IEC 61000-4-2 contact discharge. 3. Human body model. * 2% and 5% tolerance available.





Load Dump Protection (ISO 7637-2 Pulse 5b)

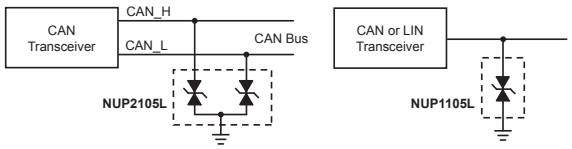
Device	Diode Configuration	V_{br}	Package
1SMC28A	Single Unidirectional	33 V	SMC

In-Vehicle Networking Protection

Device	Network	Diode Configuration	V_{br}	V_{clamp}[1]	I_{pp}[1]	C	Package
NUP2115L	FlexRay	Dual Bidirectional	27 V	44 V	3.0 A	10 pF	SOT-23
NUP2105L	CAN	Dual Bidirectional	27 V	40 V	9.5 A	30 pF	SOT-23
NUP1105L	LIN	Single Bidirectional	27 V	40 V	9.5 A	30 pF	SOT-23
NUP2114	Ethernet	Single Pair, Unidirectional	5.5 V	10 V	12 A	1 pF	TSOP-6

1. ISO 7637-2, Pulse 2a

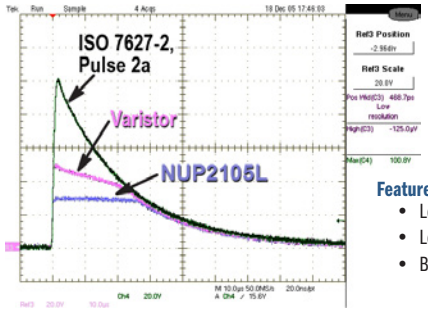
CAN and LIN protection devices improve the noise immunity and reliability of vehicular networks by suppressing overvoltage transients from conducted and radiated EMI and ESD.



Load Switch Protection

Device	Diode Configuration	V_{br}[1]	V_{clamp}[2]	I_{pp}[2]	Package
1SMA28A	Single Unidirectional	33 V	45 V	9 A	SMA
1SMA28CA	Single Bidirectional	33 V	45 V	9 A	SMA
1SMB28A	Single Unidirectional	33 V	45 V	13 A	SMB
1SMB28CA	Single Bidirectional	33 V	45 V	13 A	SMB
1SMC28A	Single Unidirectional	33 V	45 V	33 A	SMC

1. 10 x 1000 s surge waveform. 2. V_{br} available from 6.8 to 90 V in 10% increments.



Features

- Low Clamping Voltage
- Low Capacitance
- Bidirectional Clamping

PROTECTION

Micro-Stepping Motor Drivers for Enhanced Positioning Resolution

Features

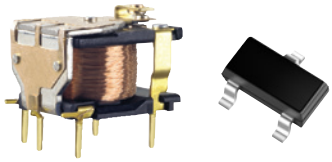
- Micro-stepping technology
- Embedded sensorless step-loss and stall detection
- Configurable for different motor types
- On-chip positioner – AMIS-30623
- On-chip current translation table – NCV70522

Stepping Motor Drivers

Device	Interface	Integrated Linear Regulator	Sensorless Stall Detection	Peak Transient (V)	Peak Current (mA)	Package
AMIS-30621	LIN	✔		40	800	SOIC-20, NQFP-32
AMIS-30622	I^2C	✔		40	800	SOIC-20
AMIS-30623	LIN	✔	✔	40	800	SOIC-20, NQFP-32
NCV70522	SPI	✔	✔	40	1600	NQFP-32, SSOP-36 EP*

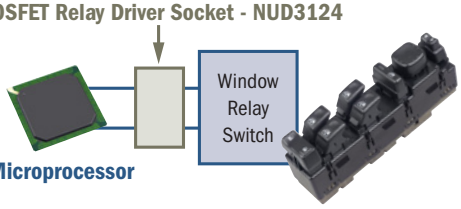
Integrated, Reliable Drive Circuits for Motors and Electro-Mechanical Relays

Most relays mounted to a PCB require a relay driver circuit!



24 V Relay Driver Socket

MOSFET Relay Driver Socket - NUD3124



Features

- Integrates diodes, resistors and capacitors into one circuit
- Delivers additional current to the relay coil and protects against ESD
- Meets IEC61000-4-4 Electrical Fast Transient (EFT) test standards

Relay Drivers

Device	Configuration	Circuit Type *	Voltage (V)	Current (mA)	Package(s)
SZNUD3124	Single	MOSFET	24	150	SOT-23
SZNUD3124D	Dual	MOSFET	24	150	SC-74
SZNUD3160	Single	MOSFET	60	150	SOT-23
SZNUD3160D	Dual	MOSFET	60	150	SC-74

*** MOSFET: the driver circuit consists of a MOSFET combined with resistors and diodes.**

Smart Drivers & Bridges

In automotive systems, there are many different kind of actuators, including relays, bulbs, LEDs, motors, and other resistive and inductive loads. The variety of motor applications in modern vehicles is huge and is growing dramatically due to the increased demand for more efficiency. Comfort electronics – such as electrical window lifts, central door locks, and climate control systems – continue to increase automotive electronic content. The easiest to implement, DC brush motors are the most common electric motors used today. To reduce noise and to increase reliability, stepper motors are becoming more popular in position control applications, e.g. HVAC flaps.

ON Semiconductor provides drivers with integrated power stages; in addition, the company offers pre-drivers that control external MOSFETs in applications where the high load current makes MOSFET integration impractical.

Product types in portfolio:

- Pre-Driver
  - Multi-channel pre-driver
  - Motor control pre-driver
- Multi-channel integrated driver
  - Multiple single-ended high-side and low-side driver
  - Configurable high-side and low-side driver
  - Half-bridge driver
  - High current integrated H-bridge driver
  - Stepper motor driver

Drivers

	Device	Description	SPI	Direct Control	Load Current	I_{lim} Min	V_S Op	V_S Max	Rdson Max @ 25°C (HS/LS)	Package
Half-Bridge	NCV7702B	Configurable Dual H-Bridge	–	✔	–	1 A	7-16 V	60 V	–	SOIC-24
	NCV7710	H-Bridge	24-Bit		3 A	6 A	5.5-28 V	40 V	Typ 150 mΩ, Max 180 mΩ	SSOP-36 EP
Multi-Channel HS/LS	NCV7703B	Triple HS/LS Half-Bridge	16-bit		1 A	1 A	5.5-40 V	40 V	Typ 0.8 Ω, Max 0.95 Ω	SOIC-14
	NCV7707	Front Door-Module Driver, 3x Dual Half-Bridge, 5x HS, 1x LS	24-bit		–	HB: 0.75 A / 3 A / 6 A HS: 0.3 A / 2.5 A / 6 A LS: 0.75 A	5.5-28 V	40 V	HB: 1.8 Ω / 0.36 Ω / 0.18 Ω HS: 1.6 Ω / 0.36 Ω / 0.12 Ω LS: 1.8 Ω	SSOP-36 EP
	NCV7708B	Hex HS/LS Driver	16-bit		1 A	1 A	5.5-40 V	40 V	Max 1.3 Ω / 1.2 Ω	SOIC-28W
	NCV7718	Hex Half-Bridge	16-Bit		0.5 A	0.8 A	4.5-40 V	40 V	Max 2.25 Ω	SSOP-24
	NCV7608	Configurable HS/LS Driver	16-bit	✔	0.35 mA	0.8 A	3-28 V	40 V	Max 2.8 Ω	SOIC-28W
	NCV7240	8x LS Driver	16-Bit	Limp Home Feature	–	0.6 A	5.5 V (V_{DD}/V_{DDA})	5.5 V (V_{DD}/V_{DDA})	Max 3 Ω	SSOP-24

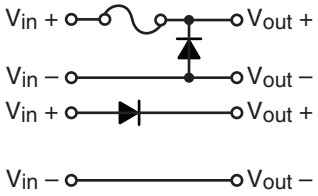
Pre-Drivers

Device	Description	SPI	Direct Control	Load Current	3.3 V / 5 V	V_S Max	Diagnostics		Package
							OL/UL	SC	
NCV7513B	Hex LS Pre-Driver	16-bit	✔	external MOSFET	✔	40 V (drain)	✔	✔	LQFP-32
NCV7517B	Hex LS Pre-Driver	16-bit	✔	external MOSFET	✔	40 V (drain)	✔	✔	LQFP-32
NCV33152	High Speed Dual PreDrvier	–	✔	external MOSFET	–	20 V (V_{DD})	–	–	SOIC-8

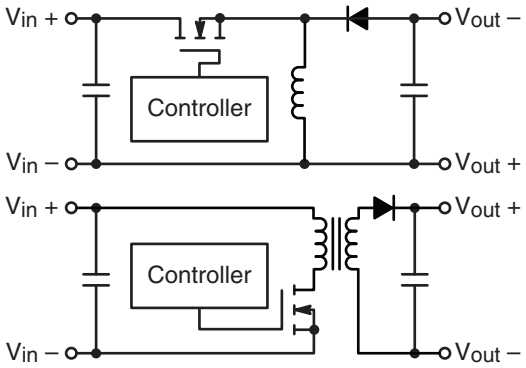
New Rectifier Packaging Solutions for Automotive

Features

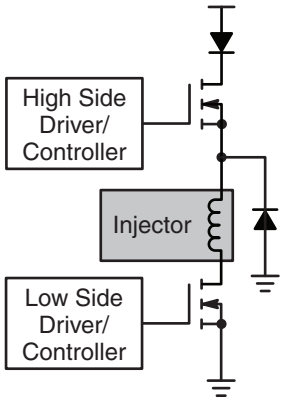
- Low forward voltage drop for improved efficiency
- High forward surge current capabilities
- Fast switching Schottky rectifiers can operate at high frequencies
- Small SOD-123FL, SMA, SMB, SMC and DPAK options to reduce board area
- Capable of use as freewheeling diodes, output rectifiers, energy recirculation diodes, and for polarity protection



Polarity Protection



Freewheeling and Output Rectification



Engine Control and Energy Recirculation Diodes

Polarity Protection Rectifiers

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVBS360	60	3	SMC
SBRD8360	60	3	DPAK
NRVBD660CT	60	6	DPAK
SBRD81045	45	10	DPAK
SBRB1045	45	10	D2PAK
NRVBB1645	45	16	D2PAK
NRVBB2060CT	60	20	D2PAK
SBRB2545CT	45	30	D2PAK
NRVBB30H60CT	60	30	D2PAK
NTSB30100CT	100	30	D2PAK
NTSB30U100CT	100	30	D2PAK
NRVBB4030	30	40	D2PAK
NTSB40120CT	120	40	D2PAK
NTSB60100CT	100	60	D2PAK

Freewheeling and Output Rectification Rectifiers

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVB140SF	40	1	SOD-123FL
NRVB140ESF	40	1	SOD-123FL
NRVBA140	40	1	SMA
SBRS8140	40	1	SMB
NRVB1H60SF	60	1	SOD-123FL
NRVBA160	60	1	SMA
MBRAF1100	100	1	SMA Flat
SURHS8160	600	1	SMB
NRVBAF1540	40	1.5	SMA Flat
NRVBS2040L	40	2	SMB
NRVBS240L	40	2	SMB
NRVTSM260	60	2	Powermite
NRVB2H60SF	60	2	SOD-123FL
NRVBAF260	60	2	SMA Flat
NRVBS260	60	2	SMB
MBRAF2H100	100	2	SMA Flat
NRVBA340	40	3	SMA
SBRS8340	40	3	SMC
SBRD8340	40	3	DPAK
NRVBAF360	60	3	SMA Flat
NRVBAF3200	200	3	SMA Flat
MBRAF440	40	4	SMA Flat
NRVBS540	40	5	SMC
SURHD8560	600	5	DPAK
NRVBD640CT	40	6	DPAK
SBRB1545CT	45	15	D2PAK
NRVBB3030CTL	30	30	D2PAK

SO-8 Flat Lead Rectifiers

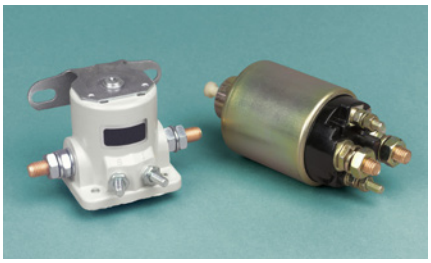
Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVB440MFS	40	4	SO-8FL
NRVB460MFS	60	4	SO-8FL
NRVB540MFS	40	5	SO-8FL
NRVB560MFS	60	5	SO-8FL
NRVB5100MFS	100	5	SO-8FL
NRVB5H100MFS	100	5	SO-8FL
NRVB860MFS	60	8	SO-8FL
NRVB8H100MFS	100	8	SO-8FL
NRVB1045MFS	45	10	SO-8FL
NRVB10100MFS	100	10	SO-8FL
NRVTS10100EMFS	100	10	SO-8FL
NRVTS10120EMFS	120	10	SO-8FL
NRVB1240MFS	40	12	SO-8FL
NTS12100EMFS	100	12	SO-8FL
NRVTS12120EMFS	120	12	SO-8FL
NRVB2045MFS	45	20	SO-8FL
NRVB2045EMFS	45	20	SO-8FL
NRVB30H100MFS	100	30	SO-8FL
MBR5H100MFS	100	5	SO-8FL

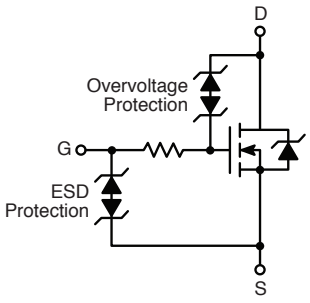
Energy Recirculation Rectifiers

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVB1H100SF	100	1	SOD-123FL
NRVBA1H100	100	1	SMA
SBRS81100	100	1	SMB
SURA8110	100	1	SMA
SURS8110	100	1	SMB
SURA8120	200	1	SMA
SURS8120	200	1	SMB
NRVB2H100SF	100	2	SOD-123FL
NRVBA2H100	100	2	SMA
NBRS2H100	100	2	SMB
SURA8210	100	2	SMA
SURS8210	100	2	SMB
NRVHPM220	200	2	Powermite
NRVHP220SF	200	2	SOD-123FL
SURA8220	200	2	SMA
SURS8220	200	2	SMB
NRVBS3100	100	3	SMC
NRVBS3200	200	3	SMB
NRVBS3201	200	3	SMC
SURS8320	200	3	SMC
NRVBS4201	200	4	SMC
NBRD5H100	100	5	DPAK

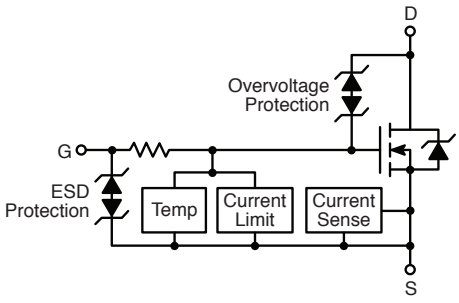
Integrated Circuit Elements with Self-Protected MOSFET Solutions

ON Semiconductor supplies self-protected MOSFETs that may include current limiting, temperature limiting, ESD protection, or a current mirror. The portfolio of smart MOSFETs integrates analog circuit elements for protection and diagnostics within power MOSFETs.

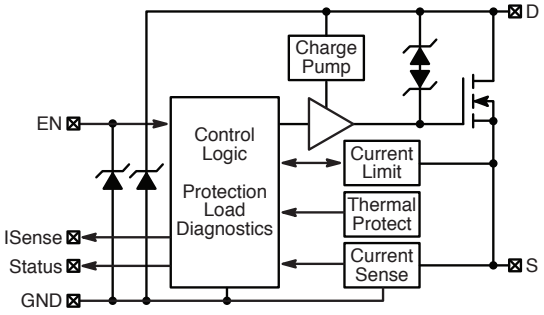




Clamping MOSFET



Low-Side Protected MOSFET



High-Side Protected MOSFET

Clamp FET Features (E-FET)

- Gate-to-Source protection
- Over-voltage protection
- Internal series Gate resistance
- Clamp voltage range 40-50 V

Protected Low-Side Switch

- Short circuit protection
- Current limit
- Thermal shut-down with restart
- ESD protection
- Overvoltage clamped protection

Protected High-Side Switch

- Charge pump
- Short circuit protection
- Current limit
- Temperature limit and shut-down
- ESD protection
- Overvoltage clamped protection
- Diagnostic output
- Loss of ground detection
- Open and underload detection
- Over and undervoltage detection

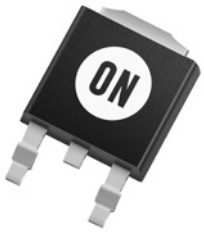
Self-Protected MOSFETs

Device	Description	Channels	Package(s)
LOW SIDE			
NCV8401A	Low Side Protected MOSFET, 23 mΩ	1	DPAK
NCV8402A	Low Side Protected MOSFET, 165 mΩ	1	SOT-223
NCV8402AD	Dual Low Side Protected MOSFET, 165 mΩ	2	SOIC-8
NCV8403A	Low Side Protected MOSFET, 60 mΩ	1	SOT-223, DPAK
NCV8405A	Low Side Protected MOSFET, 100 mΩ	1	SOT-223, DPAK
NCV8406A	Low Side Protected MOSFET, 210 mΩ	1	SOT-223, DPAK
NCV8408	Low Side Protected MOSFET, 65 mΩ	1	SOT-223
NCV8440A	Clamped MOSFET, 95 mΩ	1	SOT-223
NIMD6001A	Dual N-Channel MOSFET w/Diagnostic Output 130 mΩ	2	SOIC-8
HIGH SIDE			
NCV8450A	High Side Protected MOSFET, 1 Ω	1	SOT-223
NCV8452	High Side Protected MOSFET, 200 mΩ	1	SOT-223
NCV8460A	High Side Protected MOSFET w\Digital Diagnostics, 60 mΩ	1	SOIC-8
NCV8461	High Side Protected MOSFET w\Digital Diagnostics, 350 mΩ	1	SOIC-8

Wide Selection of Standard Power MOSFETs

Features

- Low $R_{DS(ON)}$ with Trench technology
- Low Q_G
- High current capability
- 30-100 V rated
- D2PAK, DPAK, SO-8 FL, µ8 FL
- AEC-Q101 qualified
- PPAP capable



N-Channel MOSFETs

Device	Configuration	$V_{(BR)DSS}$ Min (V)	$R_{DS(on)}$ Max (mΩ)	Q_G Typ (nC)	I_D Max (A)	Package
NVMFS4C05N	Single N	30	3.4	30	116	SO-8FL
NVTFS4C05N	Single N	30	3.6	31	102	µ8FL
NVTFS4C06N	Single N	30	4.2	26	71	µ8FL
NVTFS4824N	Single N	30	4.7	29	46	µ8FL
NVTFS4C08N	Single N	30	5.9	18.2	55	µ8FL
NVMFS4841N	Single N	30	7	25.4	89	SO-8FL
NVTFS4C10N	Single N	30	7.4	19.2	47	µ8FL
NVTFS4C13N	Single N	30	9.4	15.2	40	µ8FL
NVTFS4823N	Single N	30	10.5	12	30	µ8FL
NVTFS4C25N	Single N	30	17	10.3	22.1	µ8FL
NVLJD4007NZ	Dual N	30	7000	0.75	0.245	WDFN-6
NVMFS5C404NL	Single N	40	0.75	181	352	SO-8FL
NVMFS5C410NL	Single N	40	0.9	143	315	SO-8FL
NVMFS5830NL	Single N	40	2.3	113	185	SO-8FL
NVMFS5C442NL	Single N	40	2.8	43	126	SO-8FL
NVD5890N	Single N	40	3.7	74	123	DPAK
NVD5890NL	Single N	40	3.7	74	123	DPAK
NVMFS5832NL	Single N	40	4.2	51	120	SO-8FL
NVTFS5811NL	Single N	40	6.7	30	40	µ8FL
NVMFD5852NL	Dual N	40	6.9	36	40	SO-8FL Dual
NVMFS5833N	Single N	40	7.5	32.5	86	SO-8FL
NVMFS5834NL	Single N	40	9.3	24	75	SO-8FL
NVDD5894NL	Dual N	40	10	41	64	DPAK-5
NVMFD5853N	Dual N	40	10	24	53	SO-8FL Dual
NVMFD5853NL	Dual N	40	10	23	34	SO-8FL Dual
NVMFS5C604NL	Single N	60	1.2	120	287	SO-8FL
NVMFS5C612NL	Single N	60	1.5	91	235	SO-8FL
NVMFS5C646NL	Single N	60	4.7	33.7	94	SO-8FL
NVD5863NL	Single N	60	7.1	70	82	DPAK
NVTFS5820NL	Single N	60	11.5	28	29	µ8FL
NVMFS5844NL	Single N	60	12	30	61	SO-8FL
NVMFD5873NL	Dual N	60	13	30.5	58	SO-8FL Dual
NVMFS5885NL	Single N	60	15	21	39	SO-8FL
NVD5865NL	Single N	60	16	29	38	DPAK
NVD5484NL	Single N	60	17	48	54	DPAK
NVTFS5826NL	Single N	60	24	16	20	µ8FL
NVMFS5826NL	Single N	60	24	17	26	SO-8FL
NVMFD5483NL	Dual N	60	36	23.4	24	SO-8FL Dual
NVMFD5877NL	Dual N	60	39	11	17	SO-8FL Dual
NVD5867NL	Single N	60	39	15	22	DPAK
NVMFD5485NL	Dual N	60	44	20	20	SO-8FL Dual
NVD5490NL	Single N	60	64	14	17	DPAK
NVMFD5489NL	Dual N	60	65	12.4	12	SO-8FL Dual
NTDV3055L104	Single N	60	104	7.4	12	DPAK
NVF3055L108	Single N	60	120	7.6	3	SOT-223
NVD6820NL	Single N	90	17	67	50	DPAK
NVD6828NL	Single N	90	20	61	41	DPAK
NVD6824NL	Single N	100	20	66	41	DPAK
NVD6416ANL	Single N	100	74	25	19	DPAK

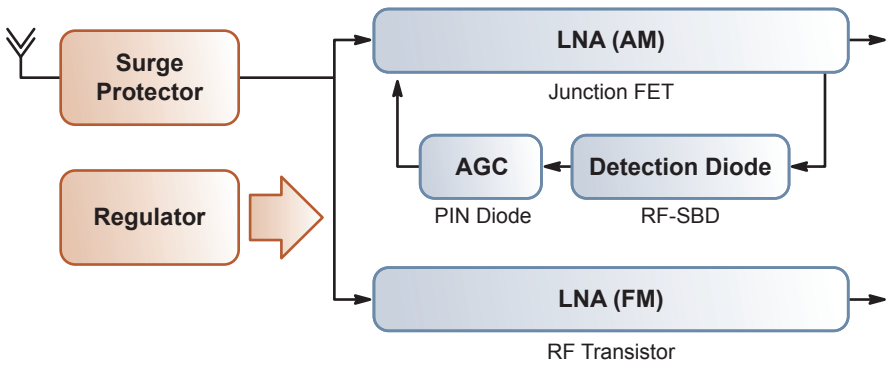
Wide Selection of Standard Power MOSFETs

P-Channel MOSFETs

Device	Configuration	$V_{(BR)DSS}$ Min (V)	$R_{DS(on)}$ Max (mΩ)	Q_G Typ (nC)	I_D Max (A)	Package
ATP104*	Single P	30	8.4	76	75	ATPAK
ATP103*	Single P	30	13	47	55	ATPAK
ATP101*	Single P	30	30	18.5	25	ATPAK
MCH3333A*	Single P	30	215	2.8	2	SOT-323
ATP108*	Single P	40	10.4	80	70	ATPAK
ATP107*	Single P	40	17	47	50	ATPAK
ATP106*	Single P	40	25	29	30	ATPAK
ATP304*	Single P	60	6.5	250	100	ATPAK
ATP302*	Single P	60	13	115	70	ATPAK
ATP114*	Single P	60	16	92	55	ATPAK
NVD5117PL	Single P	60	16	85	61	DPAK
ATP113*	Single P	60	29.5	55	35	ATPAK
ATP112*	Single P	60	43	33.5	25	ATPAK
NVTFS5116PL	Single P	60	52	25	14	µ8FL
NVF2955	Single P	60	170	14.3	2.6	SOT-223
NVD2955	Single P	60	180	15	12	DPAK
NVTFS5124PL	Single P	60	260	6	8	µ8FL
ATP301*	Single P	100	75	73	28	ATPAK

* ON Semiconductor plans to introduce versions of these devices that are AEC qualified and PPAP capable, from 4Q14. The new versions will have unique part numbers.

Discrete Components for Antennas



JFET Features

- Large forward transfer admittance and low noise figure enhance receiver sensitivity
- High ESD immunity
- High V_{GDS} for robust circuit design
- Low capacitance improves receiver sensitivity
- High power and small package allows high power dissipation
- Dual configuration saves PCB board space

JFETs

Device	Configuration	V_{GDS} (V)	I_{DSS} (mA)	I_{VGSoff} (V)	g_m (mS)	C_{iss} (pF)	Package(s)
2SK3557	Single	15	10 – 32	-0.3 to -1.5	35	10	CP (SC-59)
CPH3910	Single	25	20 – 40	-0.6 to -1.8	40	6	CPH-3 (SC-59)
2SK2394	Single	15	10 – 32	-0.3 to -1.5	38	10	CP (SC-59)
MCH5908	Dual	15	10 – 32	-0.3 to -1.5	35	10	MCPH-5 (SOT-353)
CPH6904	Dual	25	20 - 40	-0.6 to -1.8	40	6	CPH-6 (SC-74)

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Discrete Components for Antennas

Pin Diodes

Device	V_R (V)	I_F (mA)	C Typ @ V_R = 50 V, f = 1 MHz (pF)	r_s @ I_F = 10 mA, f = 100 MHz (Ω)	Package(s)
1SV246	50	50	0.23	Typ 5.0	MCP (SC-70)
1SV267	50	50	0.23	Typ 2.5	CP (SC-59)

Pin Diode Features

- Small inter-terminal capacitance reduces loss of input signal at AGC off state
- Optimized forward series resistance reduces distortion of radio wave
- High power dissipation and small package enable use in high temperature environments

RF Schottky Barrier Diode Features

- Optimized inter-terminal capacitance suitable for detection of FM radio waves
- Small forward voltage enables reception of radio waves

RF Schottky Barrier Diode

Device	V_R (V)	V_F @ I_F = 1 mA (mV)	C Typ @ V_R = 50 V, f = 1 MHz (pF)	Package(s)
1SS351	5	230	0.69	SC-59

RF Transistors

Device	Maximum Ratings		f_T Typ (GHz)	Package(s)
	V_{CE} (V)	I_C (mA)		
MCH4009	3.5	40	25 @ VCE = 3 V, IC = 20 mA	SOT-343
MCH4014	12	30	10 @ VCE = 5 V, IC = 10 mA	SOT-343
MCH4015	12	100	10 @ VCE = 5 V, IC = 50 mA	SOT-343
MCH4020	8	150	16.5 @ VCE = 5 V, IC = 50 mA	SOT-343
2SC5501A	10	70	7 @ VCE = 5 V, IC = 20 mA	SC-82
2SC5536A	12	50	1.7 @ VCE = 2 V, IC = 3 mA	SC-81
55GN01FA	10	70	5.5 @ VCE = 5 V, IC = 20 mA	SC-81
CPH6001A	12	100	6.7 @ VCE = 5 V, IC = 30 mA	SC-74
2SC5488A	10	70	7 @ VCE = 5 V, IC = 20 mA	SC-81
2SC5490A	10	30	8 @ VCE = 5 V, IC = 10 mA	SC-81
MCH3007	12	30	8 @ VCE = 5 V, IC = 10 mA	SOT-323
2SC5245A	10	30	8 @ VCE = 5 V, IC = 10 mA	SC-70
2SC5646A	4	30	12.5 @ VCE = 3 V, IC = 15 mA	SC-81
2SC5374A	10	100	5.3 @ VCE = 3 V, IC = 7 mA	SC-75

RF Transistor Features

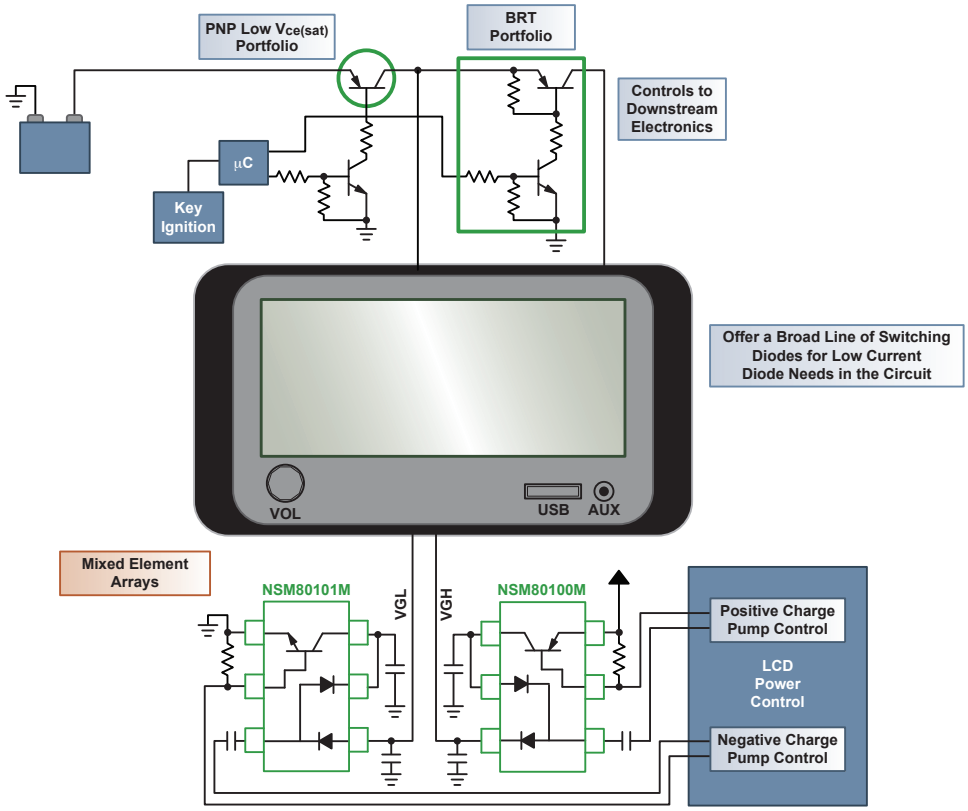
- Optimized inter-terminal capacitance suitable for detection of FM radio waves
- Small forward voltage enables reception of radio waves

ON Semiconductor plans to introduce versions of these devices that are AEC qualified and PPAP capable, from 4Q14. The new versions will have unique part numbers.

Wide Selection of Automotive Grade Small Signal Discretes

ON Semiconductor offers a wide range of devices that support infotainment systems, including diodes, JFETs, bipolar transistors, digital transistors (BRTs), and application specification discrete integration. Within these different technologies, the company offers a range of large to small packaging, meeting the smaller board space requirements of space constrained environments.

Device	Voltage Range	Current Range	Key Features	Functions	Package(s)
Schottky Diodes	7 – 70 V	20 mA – 1 A	Low Vf, Low Leakage, Duals	DC-DC converters, high-speed switching, Oring/rectifying	SOD-123, SOD-323, SOT-23, SC-70, SC-75, SOD-523, SOD-723
Switching Diodes	35 – 250 V	–	Switching speed, Low leakage	Broad range of applications	SC-59, SOT-23, SC-70, SC-88 6, SC-88A-5, SOT-563, SC-75, SOD-123, SOD-323, SOD-523
Low $V_{CE(sat)}$ Transistors	12 – 100 V	700 mA – 6 A	Ultra-low Vce(sat) Broad portfolio	Battery charging circuit, switching, fan control	DPAK, SOT-223, TSOP-6, ChipFET, SOT-23, SOIC-8
JFETs	25 – 30 V	20 – 150 mA	Interchangeable Drain and Source, high input resistance	Ideal for applications senstive to noise	SOT-23
Darlington Transistors	30 – 350 V	300 mA – 10 A	High HFE	–	D2PAK, DPAK, SOT-23
Audio Transistors	50 – 350 V	2 – 8 A	Linear gain Excellent SOA	High power audio amplifiers	DPAK
Bipolar Power Transistors	45 - 450 V	500 mA – 60 A	Low leakage Low saturation	Lamp ballast	SC-89, SOT-223, DPAK, SOT-23, SOT-723, WDFN, SOT-563
General Purpose Transistors	7 - 300 V	50 mA – 10 A	Broad product range	Broad range of applications	Multiple surface mount packages available
Digital Transistors (BRTs)	15 – 50 V	100 mA – 3 A	Broad Portfolio of R1 and R2 combinations	Power switching	SC-59, SOT-23, SC-70, SC-88-5, SC-88A-6, SOT-563



Wide Selection of Automotive Grade Operational Amplifiers and Comparators

Comparators

Device	Channels	V_S Min (V)	V_S Max (V)	I_Q/Channel (µA)	$t_{RESP\ (H-L)}$ (µs)	V_{OS} Max (mV)	Input Range (V)	I_{OUT} (mA)	Output Type	Features	Package(s)
NCV2393	2	2.7	16	6	0.8	-	Vee to Vdd-1.5	20	Open Drain	Ultra-Low I_Q	SOIC-8
NCV2200	1	0.85	6	10	0.5	5	Vee to Vdd	70	Complementary	Low I_Q, Fast t_{RESP}	SOT-23-5, SC-70
NCV2202	1	0.85	6	10	0.5	5	Vee to Vdd	70	Open Drain	Low I_Q, Fast t_{RESP}	SOT-23-5, SC-70
NCV331	1	2.7	5	40	0.6	9	Vee to Vdd-0.7	23	Open Drain	Low I_Q, Low Cost	SOT-23-5
NCV2903	2	2	36	200	1.5	7	Vee to Vdd-1.5	16	Open Collector	36 V, Low Cost	SOIC-8, MICRO8
NCV2901	4	3	36	200	1.3	7	Vee to Vdd-1.5	16	Open Collector	36 V, Low Cost	SOIC-14, TSSOP-14, Bare Die
NCV391	1	2	36	500	0.5	9	Vee to Vdd-1.5	16	Open Collector	36 V, Fast t_{RESP}	SOT-23-5

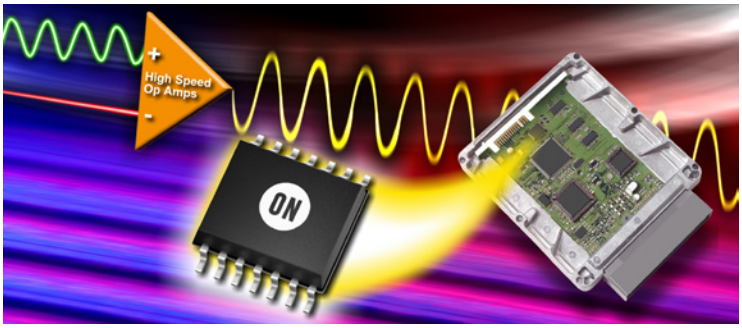
Operational Amplifiers

Device	Channels	V_S Min (V)	V_S Max (V)	I_Q/Channel (mA)	GBW (MHz)	V_{OS} Max (mV)	V_{OS} Drift (µV/°C)	I_B (nA)	CMRR (dB)	e_N (nV/√Hz)	Rail to Rail	Features	Package(s)
NCV33172	2, 4	3	44	0.18	1.8	6.5	10	20	90	32	-	Low I_Q &V_S range	SOIC-8, TSSOP-14
NCV20074	4	2.7	36	0.41	3	3	2	0.005	111	20	Output	36 V Rail-to-Rail	SOIC-14, TSSOP-14
NCV2002	1	0.9	7	0.48	0.9	6	8	0.01	82	100	I/O	Shutdown, Ultra-Low V_S	TSOP-6
NCV2003*	1	1.7	5.5	0.3	7	4	2	0.001	70	20	Output	High GBW	SOT-23-5
NCV2902	4	3	32	1.2	1	7	7	90	70	-	-	Low Cost	SOIC-14, TSSOP-14
NCV2904	2	3	32	0.75	1	7	7	45	70	-	-	Low Cost	SOIC-8, Micro8
NCV33202/4	2, 4	1.8	12	0.9	2.2	6	2	80	90	20	I/O	High Output Current	SOIC-8, Micro8, SOIC-14, TSSOP-14
NCV952	2	2.7	12	0.9	3	8	2	35	80	25	I/O	Rail-to-Rail I/O	TSSOP-8
NCV7101	1	1.8	10	1	1	9	8	0.001	60	140	I/O	Ultra-Low I_B	SOT-23-5
NCV33072/4	2, 4	3	44	1.6	4.5	3	10	100	97	32	-	V_S Range	SOIC-8, TSSOP-14
NCV833	2	10	36	2	15	5	2	300	100	4.5	-	V_S Range, Low e_N	SOIC-8
NCV33078/9	2, 4	5	18	2.1	16	2	2	300	100	4.5	-	Wide GBW, Low V_{OS} & e_N	SOIC-8, SOIC-14
NCV33272/4A	2, 4	3	36	2.2	24	1	2	300	100	18	-	Wide GBW, V_S range	SOIC-8, SOIC-14, TSSOP-14
NCV5652*	2	3.3	13.2	6	0.35	5	2	200	80	-	-	High Drive & Current	UDFN-12

* Pending 2H14.

Transconductance Amplifier

Device	Type	Voltage Range (V)	Input Bias Current (µA)	Input Offset Voltage Max (mV)	Quiescent Current (mA)	Peak Transient (V)	Gai Bandwidth (MHz)	Slew Rate (V/µs)	Temperature Range (°C)	Package(s)
AU5517	Dual	6 - 44	5	2	4	44	2	50	-40 to +125	SOIC-16

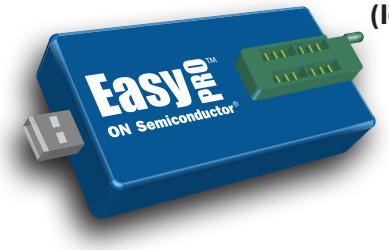


EEPROMs for Personalization of Comfort and Entertainment Features

Features

- AEC-Q100 automotive grade 1: -40°C to +125°C
- 1 kb to 1 Mb density range available
- 1 million cycle program/erase

EasyPRO™ is a user-friendly, portable programming tool for ON Semiconductor serial EEPROMs (I^2C, SPI, Microwire)



EEPROMs

Interface Protocol	Device	Density	Organization	V_{CC} Min (V)	V_{CC} Max (V)	f_{clk} Max (MHz)	Package(s)
I2C	CAV24M01	1 Mb	128k x 8	2.5	5.5	1	SOIC-8, TSSOP-8
	CAV24C512	512 kb	64k x 8	2.5	5.5	1	SOIC-8, TSSOP-8
	CAV24C256	256 kb	32k x 8	2.5	5.5	1	SOIC-8, TSSOP-8
	CAV24C128	128 kb	16k x 8	2.5	5.5	1	SOIC-8, TSSOP-8
	CAV24C64	64 kb	8k x 8	2.5	5.5	0.4	SOIC-8, TSSOP-8
	CAV24C32	32 kb	4k x 8	2.5	5.5	0.4	SOIC-8, TSSOP-8
	CAV24C16	16 kb	2k x 8	2.5	5.5	0.4	SOIC-8, TSSOP-8
	CAV24C08	8 kb	1k x 8	2.5	5.5	0.4	SOIC-8, TSSOP-8
	CAV24C04	4 kb	512 x 8	2.5	5.5	0.4	SOIC-8, TSSOP-8
	CAV24C02	2 kb	256 x 8	2.5	5.5	0.4	SOIC-8, TSSOP-8
SPI	CAV25M01	1 Mb	128k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25512	512 kb	64k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25256	256 kb	32k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25128	128 kb	16k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25640	64 kb	8k x 8	2.5	5.5	10	SOIC-8, TSSOP-8, TDFN-8
	CAV25320	32 kb	4k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25160	16 kb	2k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25080	8 kb	1k x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25040	4 kb	512 x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25020	2 kb	256 x 8	2.5	5.5	10	SOIC-8, TSSOP-8
	CAV25010	1 kb	128 x 8	2.5	5.5	10	SOIC-8, TSSOP-8
Microwire	CAV93C86	16 kb	2k x 8 / 1k x 16	2.5	5.5	2	SOIC-8, TSSOP-8
	CAV93C76	8 kb	1k x 8 / 512 x 16	2.5	5.5	2	SOIC-8, TSSOP-8
	CAV93C66	4 kb	512 x 8 / 256 x 16	2.5	5.5	2	SOIC-8, TSSOP-8
	CAV93C56	2 kb	256 x 8 / 128 x 16	2.5	5.5	2	SOIC-8, TSSOP-8
	CAV93C46	1 kb	128 x 8 / 64 x 16	2.5	5.5	2	SOIC-8, TSSOP-8

Robust Standard Logic Families

Standard CMOS

Metal Gate*
- 3.0 to 18.0 V
- 3 mA Drive
- Typical Propagation Delay 35 ns
- -55 to +125°C

High Speed*
- 2.0 to 6.0 V
- 4 mA Drive
- Typical Propagation Delay 25 ns
- -55 to +125°C

FACT
- 3.0 to 5.0 V
- 24 mA Drive
- Typical Propagation Delay 10 ns
- -40 to +85°C

Low Voltage CMOS

VHC*
- 2.0 to 5.5 V
- 8 mA Drive
- Typical Propagation Delay 8 ns
- -55 to +125°C

LCX*
- 1.65 to 5.5 V
- 24 mA Drive
- Typical Propagation Delay 5 ns
- -40 to +85°C

LVX*
- 2.0 to 3.6 V
- 6 mA Drive
- Typical Propagation Delay 20 ns
- -40 to +85°C

MiniGate™*
- 0.9 to 5.5 V
- 2 to 24 mA Drive**
- Typical Propagation Delay 2 to 7 ns**
- -55 to +125°C

* Automotive grade available. **Specifications dependent on device type.

Standard Logic Nomenclature

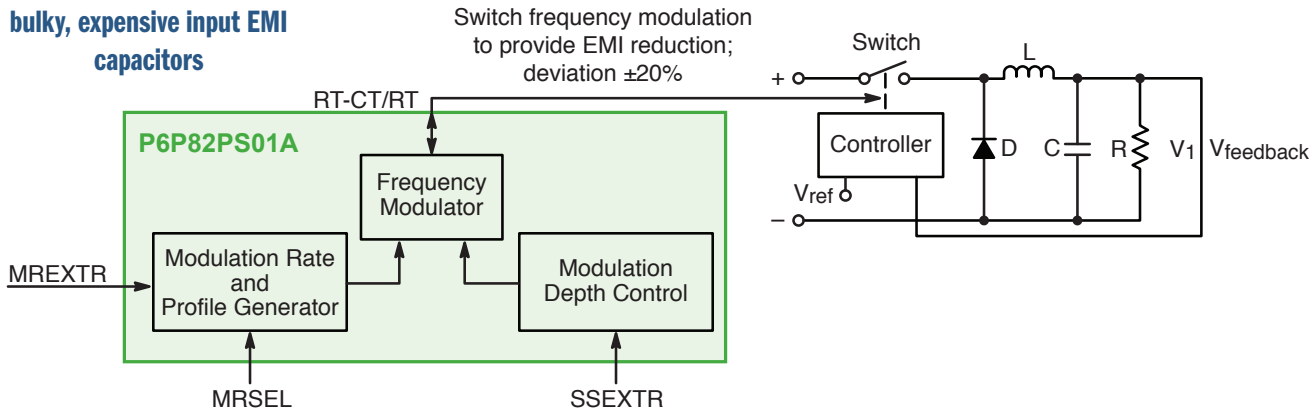
	Family	Nomenclature
Standard	Metal Gate	MC14xxx
	High Speed	MC74HCxxx, 74HCxxx
	FACT	MC74AC/Txxx
Low Voltage	VHC	MC74VHC/Txxx
	LCX	MC74LCXxxx
	LVX	MC74LVXxxx
MiniGate™	High Speed	MC74HC1Gxxx
	VHC	MC74VHC/T1Gxxx
	LCX	NL17SZxxx, NL27WZxxx, NL37WZxxx
	NLU	NLUnGxxx

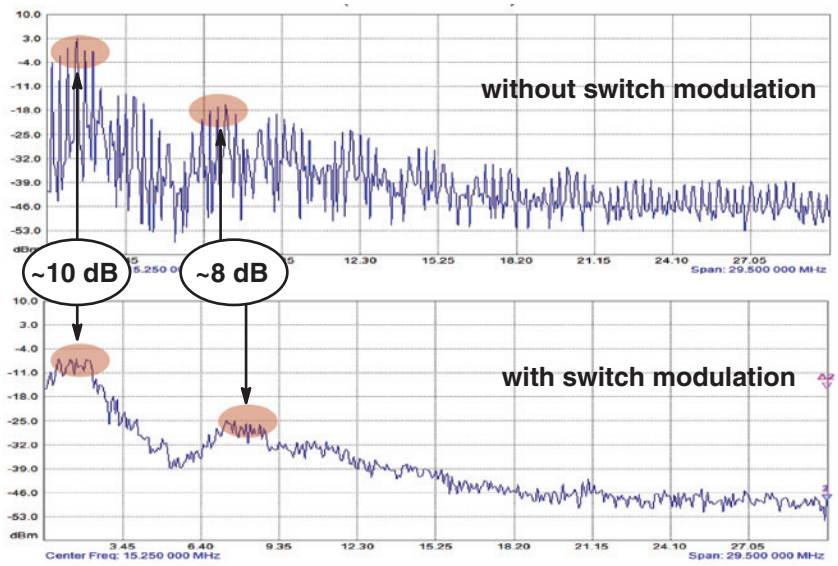
P6P82PS01A Suppresses EMI as Companion to PWM Controller

P6P82PS01A Key Features

- Companion device can be seamlessly integrated into existing converter designs
- Modulates impedance of existing RT or RT/CT node on PWM controller to reduce EMI
- User selectable control for critical spread spectrum parameters, like deviation and modulation rate, achieves optimal EMI reduction; flexible control ensures no impact on key performance metrics, such as voltage ripple and efficiency
- EMI reduction from 4 to 10 dB achievable across the spectrum, at fundamental as well as harmonics

Reduces or eliminates bulky, expensive input EMI capacitors

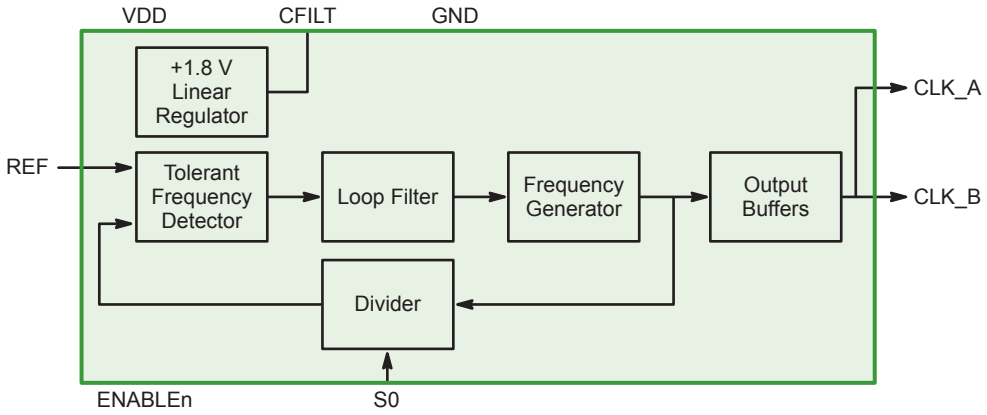




Audio Oversampling Clock Generator for USB

NB3N3010B Features

- Accepts 8 kHz or 4 kHz reference inputs derived from USB Start-of-Frame
- Generates 12.288 MHz frequency-locked to the reference
- Fully integrated frequency-lock-loop with internal loop filter
- Low skew dual LVCMOS outputs
- 3.3 V operation
- 0°C to +85°C operating range
- DFN-8, SOIC-8 packages

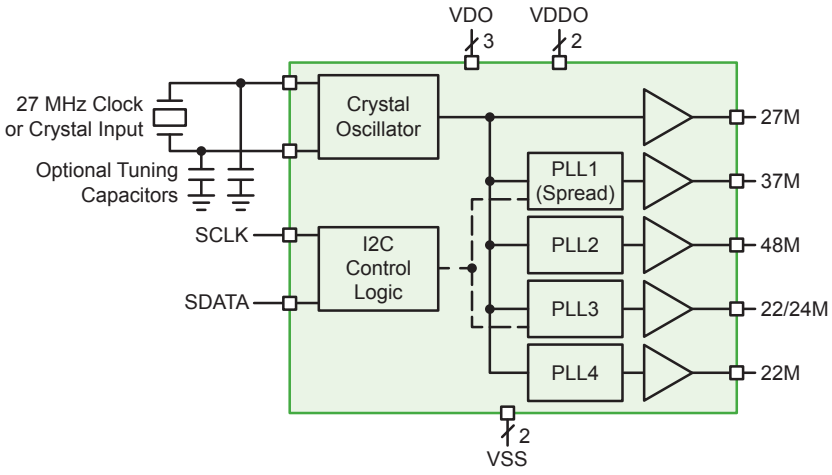


NB3N3010B Simplified Block Diagram

4-PLL Audio/Video Clock Generator with Spread Spectrum Clock

P1P40167 Features

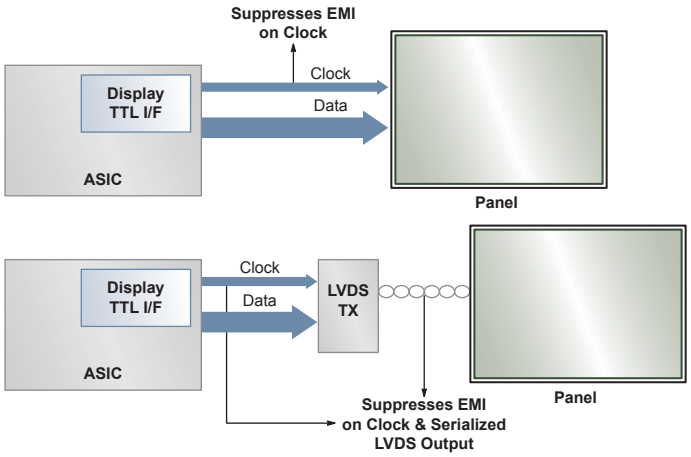
- Generates frequencies for USB, audio, and video for infotainment
- Spread spectrum operation suppresses EMI
- I2C serial interface controls output enable/ disable, spread spectrum selection, and PLL frequency selection



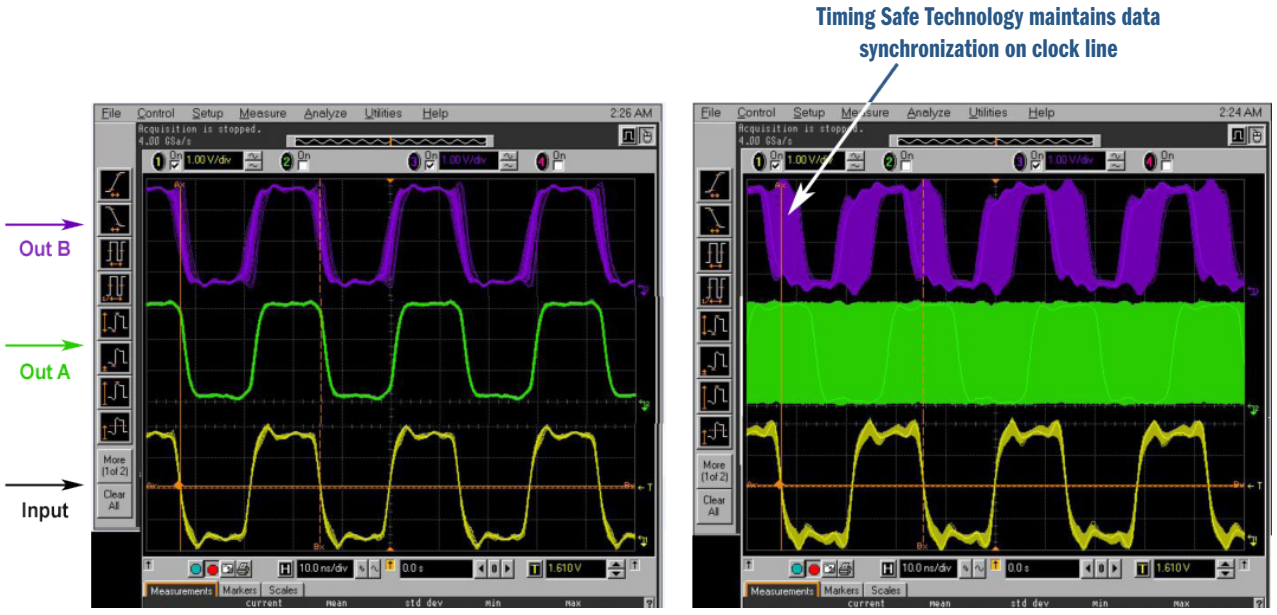
P1P40167 Block Diagram

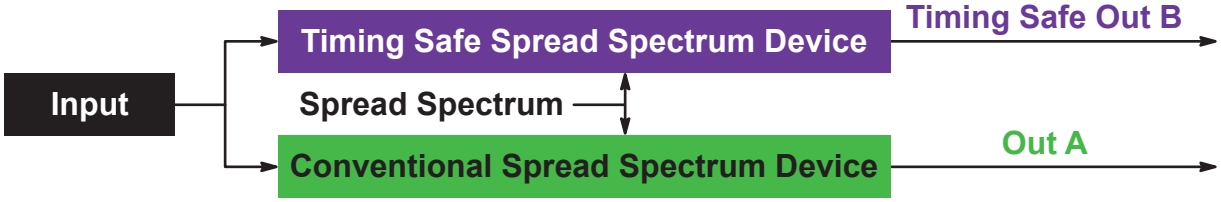
Active EMI Solutions for Display Interfaces

The display interface in infotainment applications is usually routed using flex-PCB cables, which may cause EMI problems. Timing-Safe™ technology from ON Semiconductor allows active EMI reduction in interfaces where the data and clock are synchronized, and still maintain the synchronization of data and clock after SSC is applied to the clock. The active EMI portfolio supports different frequency ranges, supply voltages, spread settings, output drives, and packages.

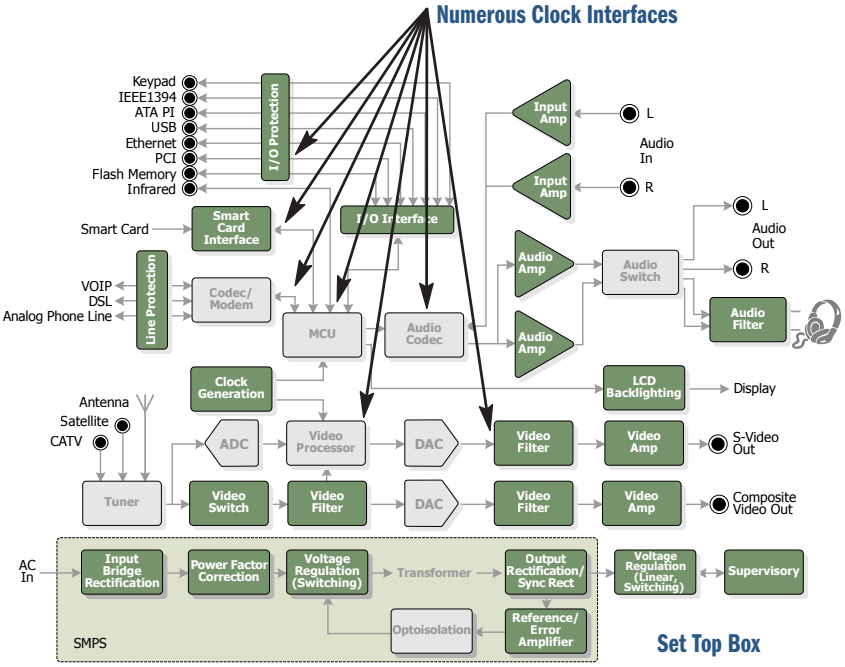


Device	VCC (V)	Frequency Range (MHz)	Temperature Range (°C)	Features	Package(s)
P3PS850BH	2.3 - 3.6	18 - 72	-20 to +85	Power down pin; analog SS % control; in-out delay control	WDFN-8
P3P76Z11DH	1.8	15 - 75	0 to +70	Power down pin; analog SS % control; MR control	WDFN-8





Clock Generation and Distribution



Set Top Box

Programmable PLL Clocks can satisfy all clock tree requirements in a single device

- Replace all clock interfaces with one Multi-PLL Programmable Clock
- Maintain clock architecture flexibility by being able to program new clock configurations through software
- Key devices
  - Clock Multiplier: NB3N3020
  - Single PLL I2C: FS7140, FS7145
  - Three PLL I2C EEPROM: FS6370, FS6377

Clock Buffers

Device	VCC (V)	Output Freq (MHz)	Outputs	Type	Package
NB3N551	3.3, 5.0	180	4	Fanout Buffer	SOIC-8, DFN-8
NB3L553	2.5, 3.3, 5.0	200	4	Fanout Buffer	SOIC-8, DFN-8
NB3N2304NZ	3.3	140	4	Low Skew Fanout Buffer	TSSOP-8, DFN-8
PCS2P2309NZ	3.3	133	9	Clock Fanout Buffer	SOIC-16
NB2305A	3.3	15-133	5	Zero Delay Buffer	TSSOP-8, SOIC-8
NB2309A	3.3	15-133	9	Zero Delay Buffer	TSSOP-16, SOIC-16
NB2304A	3.3	15-133	4	Zero Delay Buffer	SOIC-8
NB2308A	3.3	15-133	8	Zero Delay Buffer	TSSOP-16, SOIC-16
NB3N2302	3.3, 5.0	5-133	2	Zero Delay Buffer	SOIC-8
NB3N200S	3.3	100	1	M-LVDS Driver/ Receiver	SOIC-8
NB3N201S	3.3	100	1	M-LVDS Driver/ Receiver	SOIC-8
NB2N206S	3.3	100	1	M-LVDS Driver/ Receiver	SOIC-8

3.3 V Clock Generators with Fixed Frequency Outputs

Device	Output Frequency (MHz)	Application	Package
PCS1P2192A	25, 27, 33.25, 40, 45, 65, 85, 108	Ethernet, PCI	SOIC-8
ASM3P2111B	48, 66	USB, PCI-e	SOIC-8
NB3N3002	25, 125, 200	PCI-e, Gigabit Ethernet	TSSOP-16
NB3N511	14-200 with selectable multiplier ratios	USB, PCI, PCI-e, SDRAM, Ethernet, Gigabit Ethernet, CPU	SOIC-8
NB3N501	13-160	CPU, USB, PCI, Network	SOIC-8
NB3N502	14-120	CPU, USB, PCI, Network, Ethernet	SOIC-8
NB3N5573	25, 100, 125, 200	PCI-e, DIMM, CPU	TSSOP-16
NB3N65027	27, 33.33, 66.66, 75, 83, 100, 125, 133	SDRAM, SATA, Ethernet, CPU, Video	QSOP-20
NBVSPA027	148.5	SD/HD Clock	CLCC-6
NBVSPA042	74.25	SD/HD Clock	CLCC-6

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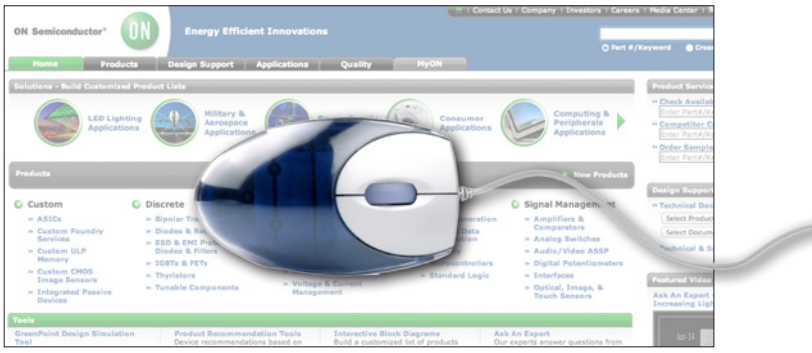

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