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Automotive Solutions

Pushing innovation to create intelligent power and sensing technologies that solve the most challenging customer problems.

onsemi™

onsemi.com

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  - Blind Spot Monitoring
  - Lane Departure Warning
  - Pedestrian, Vehicle, and Sign Detection
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  - In-Cabin Monitoring
  - Park Assist
  - Cross-Traffic Alert
  - Automatic Emergency Brake
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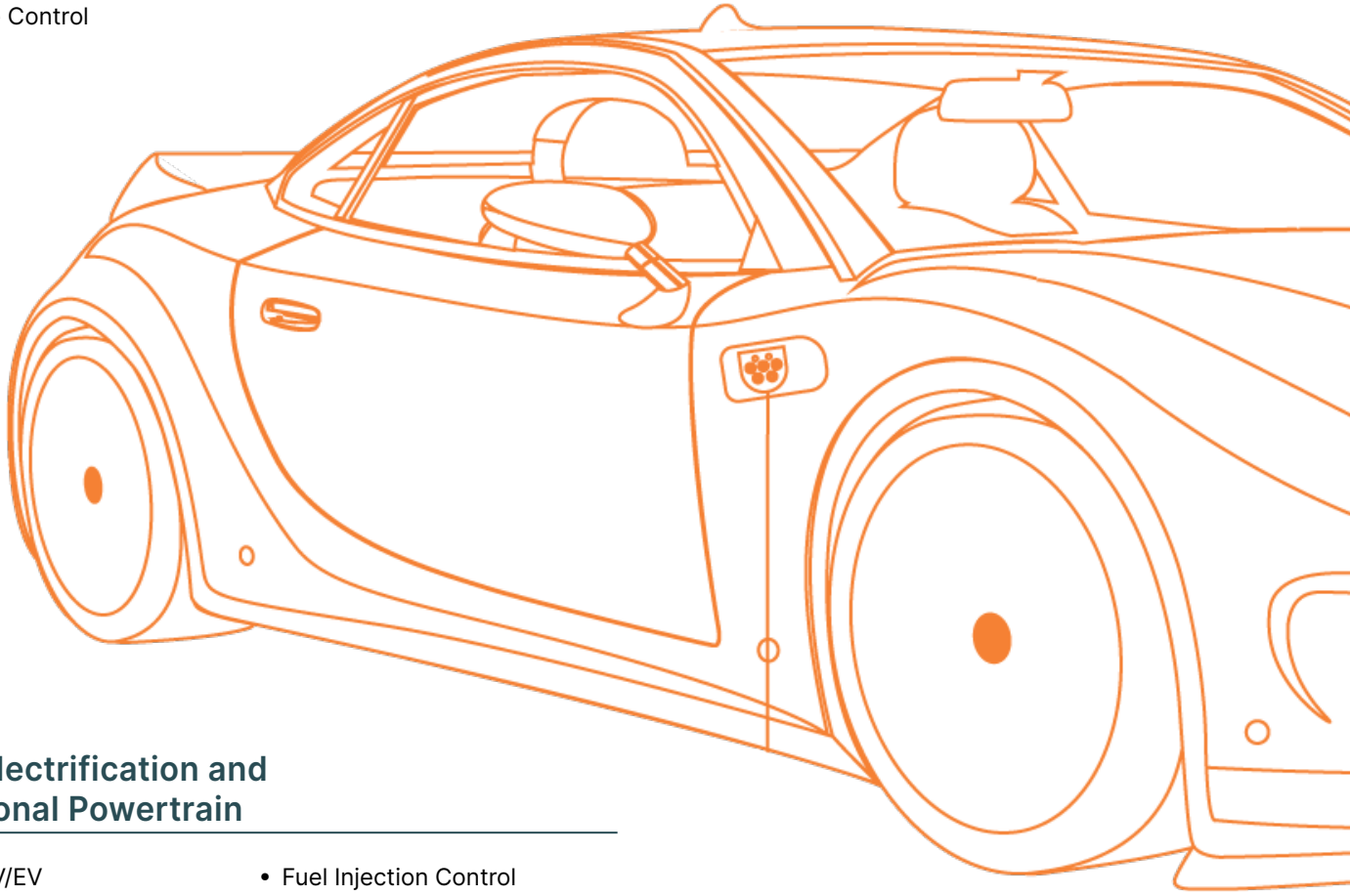


Vehicle Electrification and Conventional Powertrain

- HEV/PHEV/EV
  - On-Board Charger
  - DC-DC Converter
  - Traction Inverter
- 48 V Boardnet
- Engine Control (Gas/Diesel)
- Throttle Control
- Ignition Control
- Transmission Control
- Sensor Interface
- Power Supplies
- Fuel Injection Control
- Position Sensing
- Start-Stop Alternator
- Electric Pump & Fan Control
- Turbo and Compressor Control

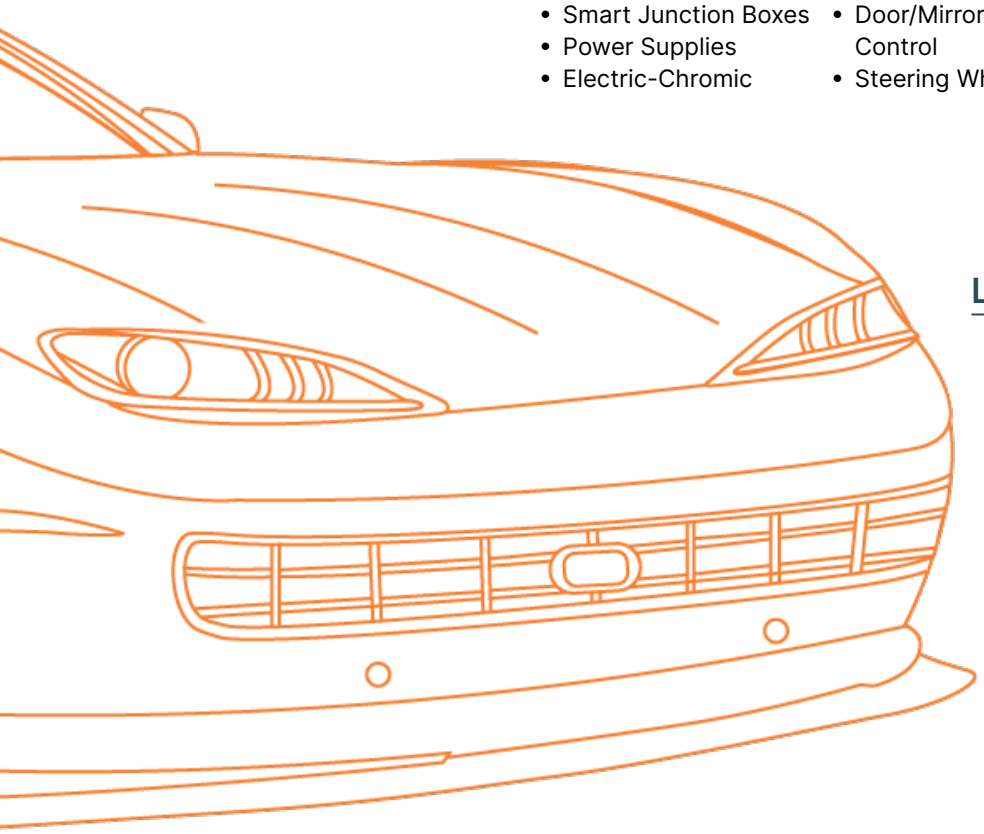
Audio & Infotainment

- Navigation Systems
- Satellite/Digital Radio
- Power Supplies
- Connectivity – HDMI, USB, USB-C PD, Bluetooth® Low Energy
- Active Antennas

onsemi 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 sensors (image, radar, and lidar), power devices (silicon, WBG, discretes, modules), power management, protection, processing, signal conditioning and control products.

Body & Convenience

- Climate Control
- Instrument Clusters
- Smart Junction Boxes
- Power Supplies
- Electric-Chromic Mirrors
- Seat Positioning
- Door/Mirror/Window Control
- Steering Wheel Sensors
- Occupant Restraint Controller
- Body Control Module



LED Lighting

- Interior: Door, Dome, RGB Accent, Puddle
- Exterior: CHMSLs, RCLs, Accent
- Advanced Front Lighting & Motor Control
  - Pixel Lighting
  - OLED Lighting

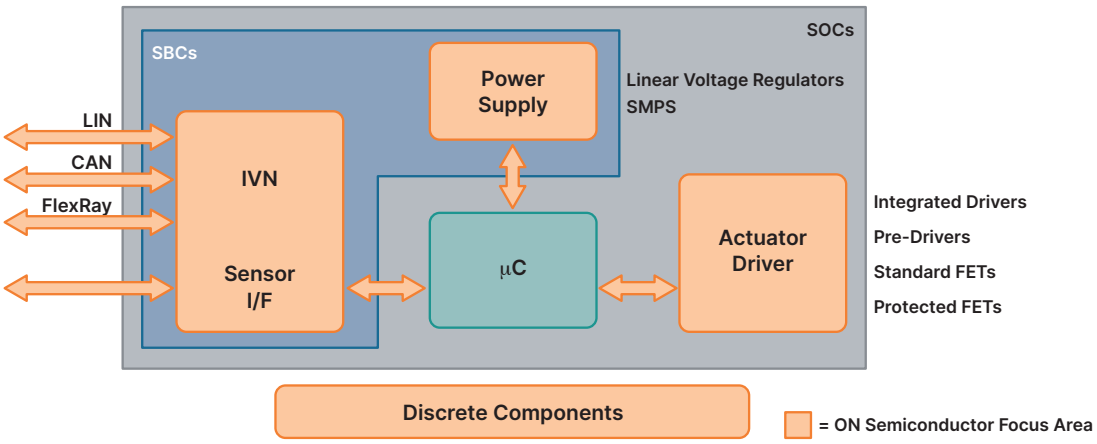
In-Vehicle Networking

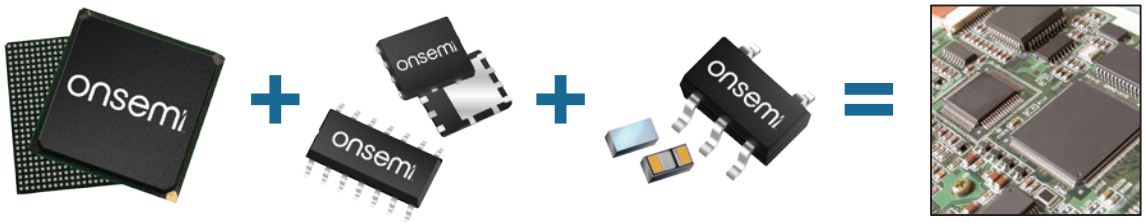
- LIN
- CAN
- System Basis Chips
- FlexRay™
- PSI5
- SENT
- Ethernet
- USB

Automotive Solutions

Automotive solutions from **onsemi** 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)
- Image sensors and co-processors
- In-vehicle networking
- Standard integrated circuits
- Discrete components
- Analog
- Mixed-signal
- SBCs and SoCs
- Sensor interfaces





Automotive Excellence

Automotive Expertise

onsemi 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
- Wafers and die

Solutions Engineering Centers

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

Global Supply Chain Operations

Advanced Capability

onsemi invests in EDI, VMI, and other logistics agreements.

Global Locations

Worldwide, **onsemi** employs ~32,000 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

onsemi 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.

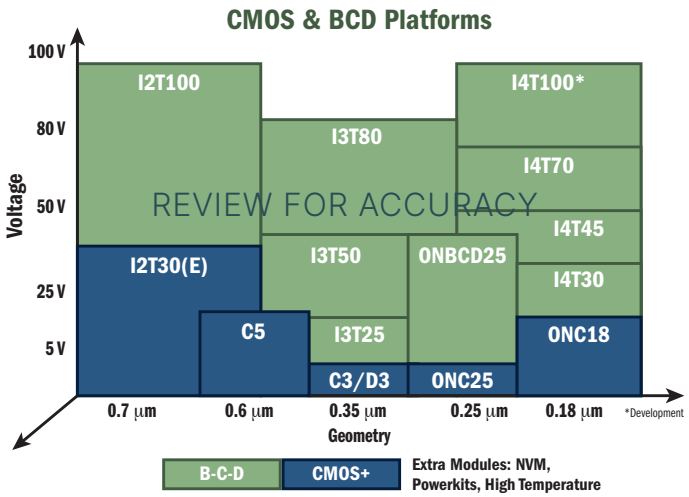
Automotive Long-Term Availability Statement

onsemi 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. **onsemi** 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.

Automotive Technology

Proven Automotive Technical Capabilities

onsemi 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. **onsemi** 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. **onsemi** offers best-in-class devices using I3T50/80 and I4T30/45/70 technologies, that provide advanced capabilities. Robust designs are achieved, for example, by deep trench isolation, which reduces the interference between the voltage domains on the chip.

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

onsemi 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

onsemi 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, **onsemi** 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 **onsemi** 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.

onsemi Quality Processes

- Certified to ISO 9001:2015
- Certified to IATF 16949:2016
- Implemented ISO 26262 Functional Safety Standard
- Quality System and Business Operating System are synonymous and are documented to meet the requirements of the Automotive Standards
- Corrective action systems use various methodologies to ensure we identify and correct the root cause of non-conformance. Preventive action is also used to ensure we eliminate potential non-conformances
- Quality System/Business Processes are documented and controlled

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 **onsemi** 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

onsemi'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. **onsemi** delivered over 78 billion parts in 2018, with average defect rates of less than 140 parts-per-billion.

Change Management Processes

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

- **onsemi** follows the JEDEC 46D and JEDEC 48C for all markets except automotive. For the automotive market we follow ZVEI – Guideline for Customer Notifications of Product and/or Process Changes (PCN) of Electronic Components for Automotive Market for our change management process.
- Automotive Reliability Testing performed per Automotive Electronic Council (AEC) Q100/Q101/Q104 and AQG324 Power Module Qualification Standard
- 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

Functional Safety Management: Development According to ISO 26262

*Functional Safety at **onsemi***

onsemi 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, **onsemi** created a dedicated Functional Safety structure 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.

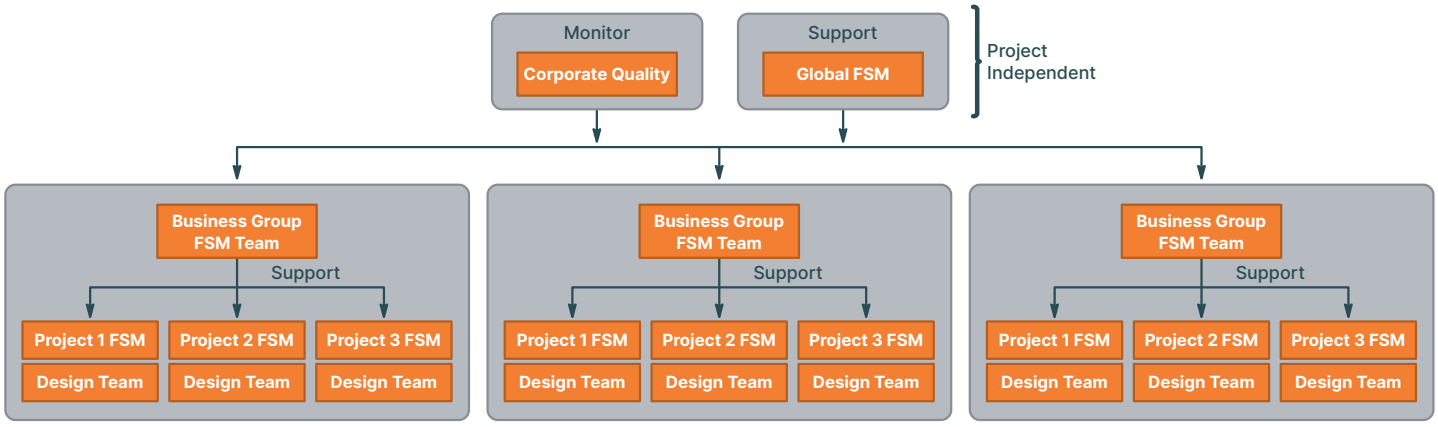
onsemi is highly involved in the Functional Safety community, especially in ISO 26262. The company is a member of the ISO 26262 work group (TC22/SC32/WG8), as well as part of the ISO 26262 related semiconductor sub-work group that clarified the standard for semiconductor developments and resulted in the release of ISO 26262-11:2018.

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 monitor and 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.

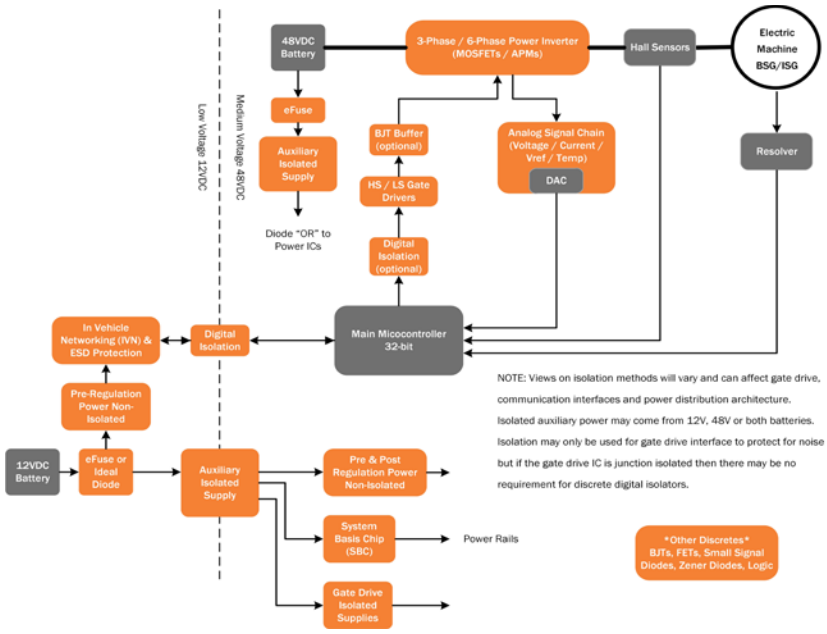
Enhancing Experience

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



Dedicated and Independent Team

48 V Starter/Generator



Key Products & Features

Current Sense Amplifiers: *NCV21xR, NCV7030/31/41*

- High-side and low-side current sensing
- Low offset zero-drift architecture
- Flexible system supply voltage
- Low value current sense resistors for better power efficiency
- Temperature sensitive applications
- Operate in conjunction with high-speed switching NSVS5003xSB buffer BJTs for high-speed switching
- AEC-Q100 Qualified
- NCV21xR for low side sensing applications in 48V systems or NCV7041 for high side sensing and increased margin on negative voltage at input.

System Basis Chip: *NCV7420/25/28/50/51/71*

- LIN + LDO (50mA, 70mA, 150mA)
- CANFD + LDO + HS Driver
- CANFD + LDO+ Wake
- LIN + CANFD + DC/DC

Medium Voltage MOSFETs: *FDBL86xxx_F085, NVBLS1D7N08H, NVBLS4D0N15MC, NVMTS1DxN08H, NVMTSxDxNxxMC, NVMTSC1D3N08M7, NVMTSC4D3N15MC*

- Flat-lead performance packages (TOLL, PWR88)
- Very low $R_{DS(ON)}$
- Small footprint, high current
- Superior reliability/robustness
- AEC-Q101 Qualified

Auxiliary and Gate Drive Isolated Supplies: *NCV1362, NCV3064, NCV1397*

- Quasi-Resonant with Valley Switching Operation
- Improved EMI Signature
- Enables Robust Designs
- Optimize Light Load Efficiency and Stand-by performance

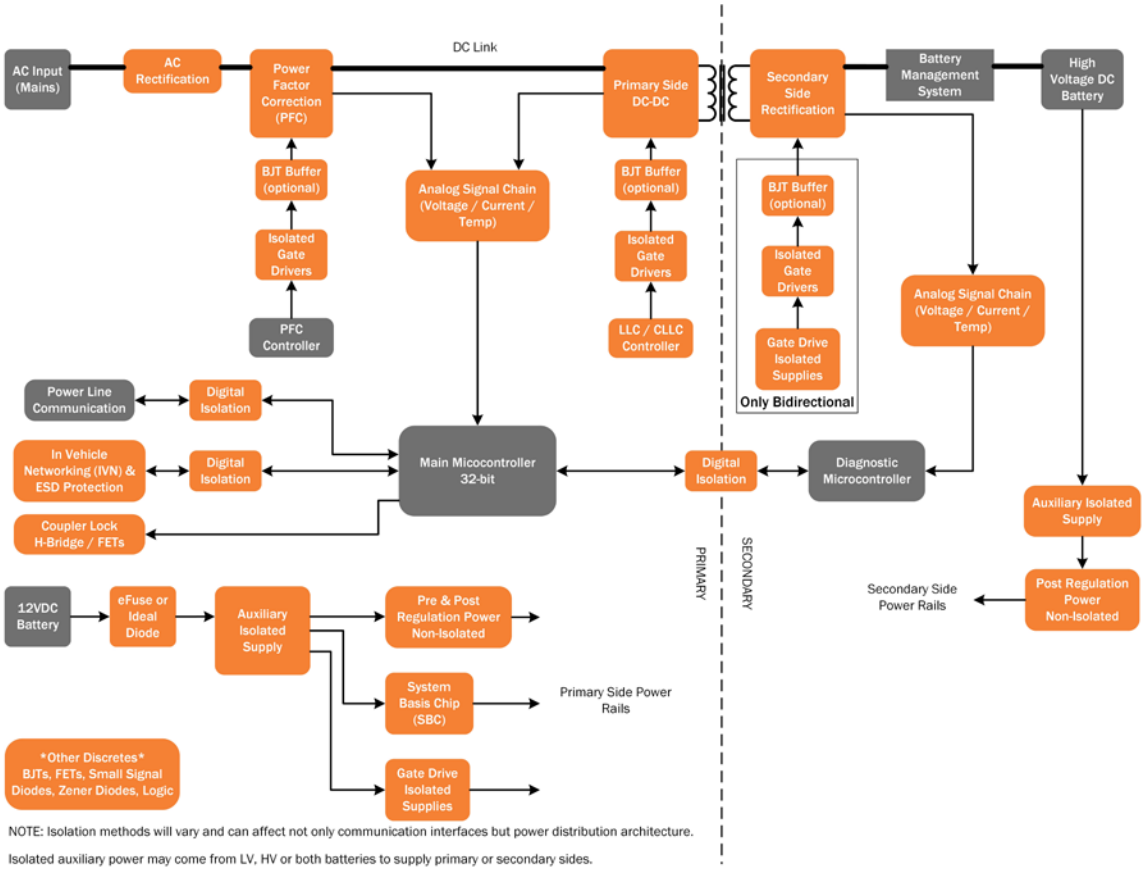
Precision Operational Amplifiers: *NCV2191x*

- Supply Voltage: 4 to 36V
- Quiescent Current: 570 µA Max
- Low Noise: 22 nV/√Hz typical
- Packages: SOT23-5, SOIC-8, MICRO-8, TSSOP-14, SOIC-14

High/Low Side MOSFET Drivers: *NCV515xx, FAD6263M1X, FAD8253MX, FAD7191, FAN708x_GF085, FAN71xx_F085, NCP51xx, NCV5106, NCV75xx, NCV5183*

- Junction Isolated Solutions
- High Current capabilities
- Down to 30 ns Propagation delay
- Pin-to-pin compatibility with industry standards
- AEC-Q100 Qualified

On-Board Charger



Key Products & Features

High Voltage MOSFETs (SuperFET®): *NVBxxxxxxS3x, NVH4LxxxxxxS3F, NVHLxxxxxxS3xx*

- Low on-resistance and low gate charge performance
- Low conduction loss
- Fast Switching speeds
- Withstand extreme dv/dt rate and higher avalanche energy
- AEC−Q101 Qualified

Discrete IGBTs: *AFGB30/40, AFGHL40/50/75, FGB20/40, FGH20/40/60/75*

- 650 and 1200 V options
- Fast switching
- Low cost
- AEC−Q101 Qualified

High Voltage Gate Drivers: *NCV57xxxx, NCV51xx, FAN71xx-F085, NCV5156x*

- Family of rail-to-rail high current drivers for lower system losses
- External (opto/silicon) or built-in galvanic isolation in multiple packages for design flexibility.
- Short propagation delays for faster switching
- Suitable for single ended, half-bridge, and full bridge topologies
- Operate in conjuction with high-speed switching NSVS5002xSB buffer BJTs for high current IGBT control
- AEC−Q100 Qualified

On-Board Charger (cont.)

Key Products & Features (cont.)

MOSFET Modules: *FAM65CRxx, FAM65HRxx, NXV65HRxx*

- 650 V
- High thermal performance
- Enhanced EMI, isolation, and current capabilities
- System level cost reduction
- Enable compact system solution with proven reliability
- AEC-Q101 and AQG-324 module qualification

Current Sense Amplifiers: *NCV21xR*

- Wide Common Mode Input Range: -0.3 to 26 V or -6 to 80 V
- Low Ohm value current sense resistor
- NCV21xR for low side sensing or NCV7041 for low side sensing with increased margin on negative voltage at input.
- Wide supply voltage range

System Basis Chip: *NCV7420/25/28/50/51/71*

- LIN + LDO (50 mA, 70 mA, 150 mA)
- CANFD + LDO + HS Driver
- CANFD + LDO+ Wake
- LIN + CANFD + DC/DC

High Voltage Rectifiers: *RURGxxxx-F085, RHRGxxxx-F085, ISL9Rxxxxx-F085,FFH50US60S-F085, RURPxxxxx-F085*

- Both low VF and high speed version available for rectification and fast switching
- Avalanche energy rated
- AEC-Q101 Qualified

SiC Rectifiers: *FFSPxxxxB-F085, FFSHxxxxB-F085, FFSDxxxB-F085, FFSBxxxxx-F085*

- Superior switching performance in comparison to silicon
- Excellent thermal performance
- Fast operating frequency
- Increase power density and reduced EMI

SiC MOSFETS - 650/900/1200 V

- 1200 V, RDS(ON) TYP: 20-160 (mΩ), D2PAK- 7L, TO247-4, TO247-3
- 900 V, RDS(ON) TYP: 20, 60 (mΩ), TO247-3, D2PAK-7L
- 650 V, RDS(ON) TYP: 15-45(mΩ), DA2PAK-7L, TO-247-4

670 V Flyback Converters: *NCV106x, NCV107x, NCV8878, NCV898031/32*

- Enables compact designs for isolated and non-isolated systems
- Output power from 2 W to 15 W
- AEC-Q100 Qualified

LLC Controllers: *NCV4390*

- Secondary-Side for LLC Resonant Converter with Synchronous-Rectifier Control
- AEC-Q100 Qualified

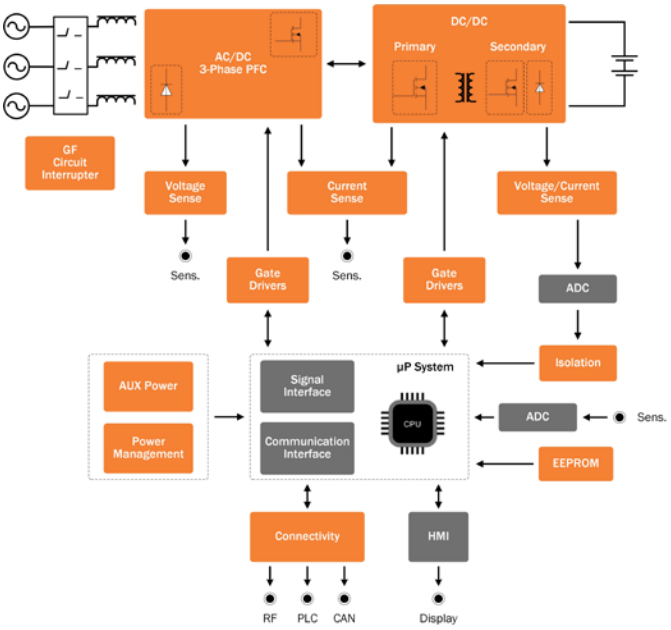
Isolated Supply Controllers: *NCV1362, NCV3064, NCV1397*

- Adjustable minimum switcing frequency with 3% accuracy
- Frequency operation up to 250 kHZ
- AEC-Qualified (NCV1362)

Precision Operational Amplifiers: *NCV2191x*

- Supply Voltage: 4 to 36V
- Quiescent Current: 570 µA Max
- Low Noise: 22 nV/√Hz typical
- Packages: SOT23-5, SOIC-8, MICRO-8, TSSOP-14, SOIC-14

EV Charging Stations



Key Products & Features

High Voltage MOSFETs (SuperFET®): *NTxyyyyN65S3*

- 3 types: Easy Drive (S3), FRFET (S3F), Fast (S3Hx)
- Low on-resistance and low gate charge performance
- Low conduction loss & fast switching speeds
- Withstand extreme dv/dt rate and higher avalanche energy

Discrete IGBTs: *FGH75T65SQD, NGTB40N120FL3*

- 650 V Best-in-class performance
- Best-in-class performance in existing 1200 V High Speed IGBTs
- SCR IGBT lineup with outstanding power loss performance
- Various options for co-pack diodes and packages

SiC MOSFETs: *NTH4L020N120SC1, NTHL020N090SC1*

- 900 & 1200 voltage nodes, 20 – 160 mΩ
- Wide package offering including die/wafer
- Designed for ruggedness and speed

High Voltage Rectifiers: *RHRGxxxxx, ISL9R3060G2*

- Ultrafast with low VF
- Hyperfast with a balanced design of VF and QRR
- Stealth with small IRRM and soft recovery

High Voltage Gate Drivers: *NCV5700x, NCV570x, NCV5156x*

- Family of rail-to-rail high current drivers for lower system losses
- External (opto/silicon) or built-in galvanic isolation in multiple packages for design flexibility
- DESAT, Miler Clamp, TSD, and fault reporting to prevent catastrophic failures
- Input signal conditioning and high noise immunity for reliable operation

SiC Diodes: *FFSP4065BDN, FFSH50120A, NDSH25170A*

- 650, 1200, 1700 voltage nodes
- Wide package offering including die/wafer
- Designed for ruggedness

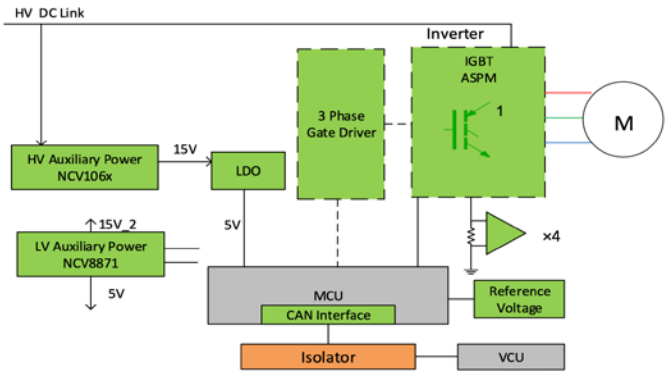
Current Sense Amplifiers: *NCV2007x, NCV21xR*

- High-side and low-side current sensing
- Low offset zero-drift architecture
- Low value current sense resistors for better power efficiency
- Temperature sensitive applications

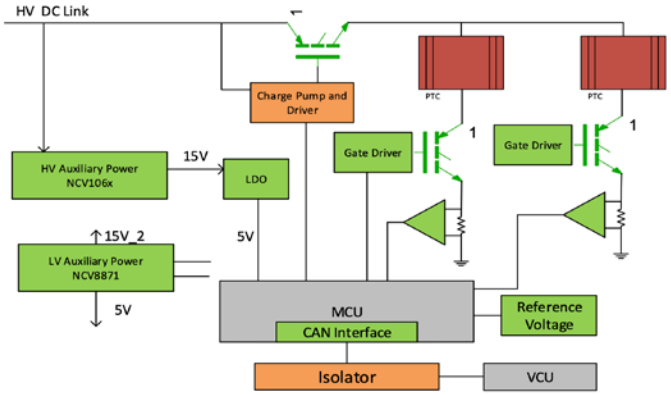
Optocouplers: *FOD8163, FOD8342, FOD8320*

- High common mode noise rejection (CMR) (>20 kV/µs)
- Fixed isolation gap for a consistent high input to output isolation voltage
- Up to 2.5 A output drive gate driver optocouplers

High Voltage Auxiliary



High Voltage Air Conditioning



High Voltage PTC Heater

Key Products & Features

Discrete IGBTs: *AFGB30/40, AFGHL25-75 (650 V), AFGHL25/40 (1,200 V) FGB20/40 (600 V), FGH20-75 (600 V)*

- Low saturation voltage
- Fast switching
- Tight parameter distribution
- AEC−Q101 Qualified

High Voltage Gate Drivers: *NCV570xx, NCV57xx*

- High drive current
- Short propagation delays
- Fault detection and reporting
- Designed for reliability
- Operate in conjunction with high-speed switching NSVS5003xSB buffer BJTs for high current IGBT control
- AEC−Q100 Qualified

670 V Flyback Converters: *NCV106x, NCV107x*

- Enables compact designs for isolated and non-isolated systems
- Output power from 2 W to 15 W
- AEC-Q100 Qualified

Auto Intelligent Power Module : *NFVA3xx65L32 (FS3 650 V, 30/40/50 A), NFVA3xx65L42 (FS4 650 V, 30/50/60 A), NFVA2xx12NP2T (NPT, 1200 V, 25/35/50 A)*

- AEC-Q100/101 qualified module & support AQG324
- 3-phase IGBT IPM with low loss IGBTs and soft recovery diodes optimized for auxiliary inverter in hybrid & electric vehicle applications
- Electrically isolated DBC substrate (AIN/AI2O3) with low thermal resistance (0.33°C/W & 650 V/60 A) and high isolation voltage (2.5 kVac)
- Adopted rugged Short Circuit Withstand Time FS Trench IGBT; over 5 μs & 400 V/175°C/15 V
- Integrated gate drivers with internal VS connection, under-voltage lockout, over-current shutdown, temperature sensing unit, and fault out

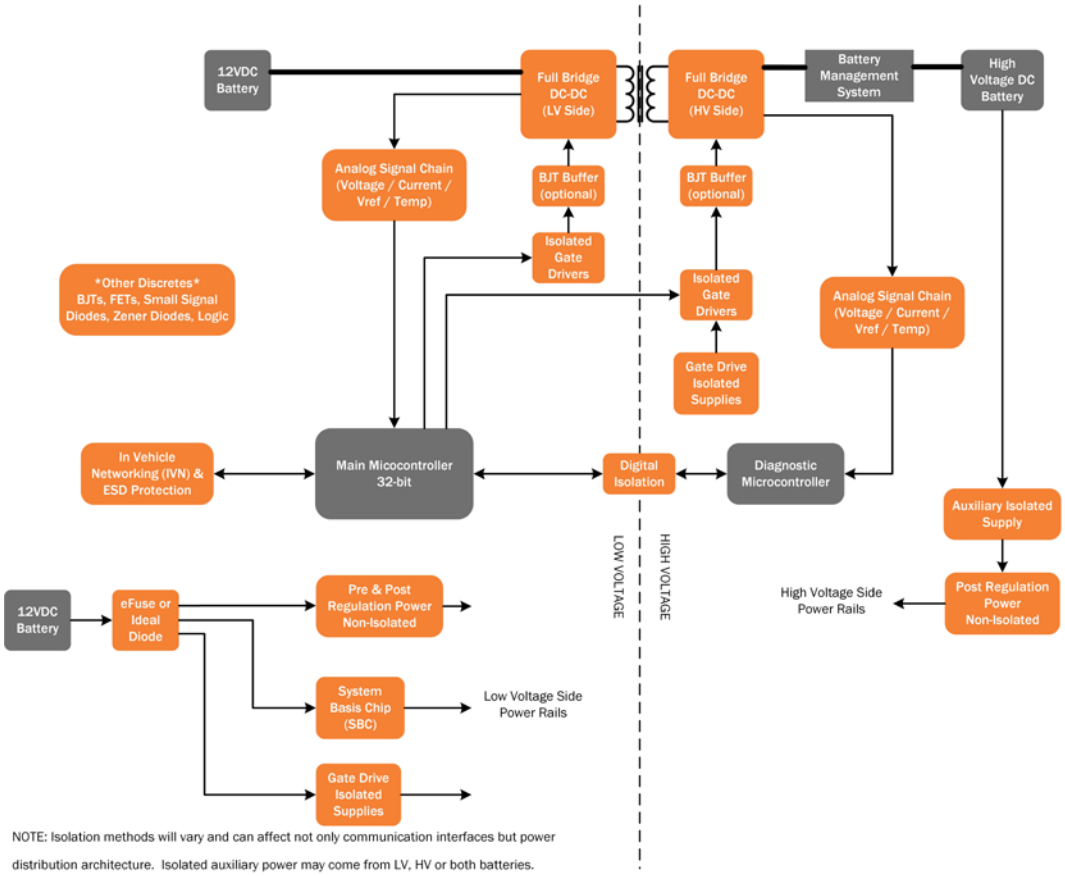
SiC MOSFETS - 650/900/1200 V

- 650 V, RDS(ON) TYP: 14-45(mΩ), DA2PAK-7L, TO-247-4
- 900 V, RDS(ON) TYP: 20, 60 (mΩ), TO247-3, D2PAK-7L
- 1200 V, RDS(ON) TYP: 20-160 (mΩ), D2PAK- 7L, TO247-4, TO247-3

PSR Controllers: *NCV1362*

- QR Primary side controller with CC-CV output regulation
- No opto coupler needed
- AEC-Q100 Qualified

High Voltage–Low Voltage DC-DC Conversion



Key Products & Features

High Voltage MOSFETs (SuperFET®): *NVBxxxxxxS3x, NVH4LxxxxxxS3F, NVHLxxxxxxS3xx*

- Low on-resistance and low gate charge performance
- Low conduction loss
- Fast switching speeds
- Withstand extreme dv/dt rate and higher avalanche energy
- AEC−Q101 Qualified

High Voltage Gate Drivers: *NCV57xxxx, NCV51xx and FAN71xx-F085, NCV5156x*

- Family of rail-to-rail high current drivers for lower switching losses
- External (opto/silicon) or built-in galvanic isolation in multiple packages for design flexibility
- Short propagation delays for faster switching
- Signal conditioning and noise immunity for reliable operation
- AEC−Q100 Qualified

Discrete IGBTs: *AFGB30/40, AFGHL40/50/75, FGB20/40, FGH20/40/60/75*

- Fast switching
- AEC−Q101 Qualified

Current Sense Amplifiers: *NCV21xR, NCV7041*

- Wide Common Mode Input Range: -0.3 to 26 V
- Low Ohm value current sense resistor
- NCV21xR for low side sensing or NCV7041 for low side sensing with increased margin on negative voltage at input
- Wide supply voltage range

Precision Operational Amplifiers: *NCV2191x*

- Supply Voltage: 4 to 36V
- Quiescent Current: 570 µA Max
- Low Noise: 22 nV/√Hz typical
- Packages: SOT23-5, SOIC-8, MICRO-8, TSSOP-14, SOIC-14

High Voltage–Low Voltage DC-DC Conversion (cont.)

Key Products & Features (cont.)

Medium Voltage MOSFETs: *FDBL86xxx_F085, NVMFS/D68xx, NVTFS6Hxx, NVMTSC1D3N08M7xxx, NVTFS010N10MCLxxx, FDD863xx-F085, NVMFS3D6N10MCL, NVMFS015N10MCL*

- Flat-lead performance packages (SO-8 FL, TOLL, PWR88, µ8 Flat-Lead)
- Very low $R_{DS(ON)}$
- Small footprint, high current
- Superior reliability/robustness
- AEC−Q101 Qualified

670 V Flyback Converters: *NCV106x, NCV107x, NCV8878, NCV898031/32*

- Enables compact designs for isolated and non-isolated systems
- Output power from 2 W to 15 W
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SiC MOSFETS - 650/900/1200 V

- 1200 V, RDS(ON) TYP: 20-160 (mΩ), D2PAK- 7L, TO247-4, TO247-3
- 900 V, RDS(ON) TYP: 20, 60 (mΩ), TO247-3, D2PAK-7L
- 650 V, RDS(ON) TYP: 15-45(mΩ), DA2PAK-7L, TO-247-4

LLC Controllers: *NCV4390*

- Secondary-Side for LLC Resonant Converter with Synchronous-Rectifier Control
- AEC-Q100 Qualified

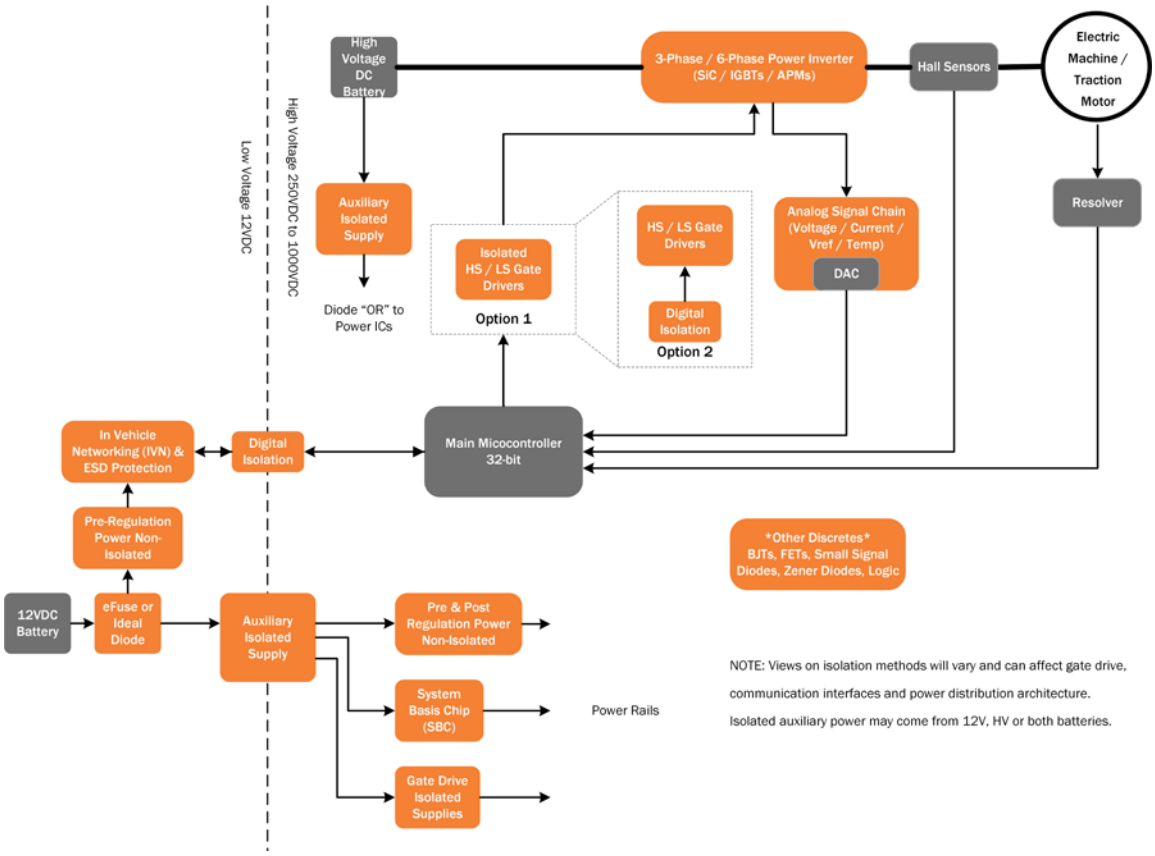
Isolated Supplies Controllers: *NCV1362, NCV3064, NCV1397*

- Adjustable minimum switcing frequency with 3% accuracy
- Frequency operation up to 250 kHZ
- AEC-Qualified (NCV1362)

System Basis Chip: *NCV7420/25/28/50/51/71*

- LIN + LDO (50 mA, 70 mA, 150 mA)
- CANFD + LDO + HS Driver
- CANFD + LDO+ Wake
- LIN + CANFD + DC/DC

Traction Inverter for HEV/EV



Key Products & Features

VE-Track-Power Integrated Modules for Traction Inverters: *NVHxxxS75L4SPx, NVH660S75L4SPFB, PCGLA200T75NF8,PCGLA200T75NF8M2, PCRKA20075F8, PCRKA20075F8M2, NVG800A75L4DSx, NVGxxxA75L4DSx2*

- Six-pack integrated power module with highly compact footprints for HEV and EV traction inverter applications
- Transfer molded modules in half-bridge configuration
- Press-fit and soldered pins
- Low conduction losses
- Scalable design for best-in-class $/kW
- Ultra-low package inductance(<7 nH)
- AEC−Q101 Qualified

Discrete IGBTs: *FGY120/AFGY100/120/160,PCG,PCRK*

- Very low saturation voltage
- Tight parameter distribution
- 100% transient immunity tested
- Short circuit ruggedness > 6 μs
- AEC−Q101 Qualified

High Voltage Gate Drivers: *NCV570xxxx, NCV51705, NCV5156x*

- Family of rail to rail high current drivers for lower system losses
- External (opto/silicon) or built-in galvanic isolation in multiple packages for design flexibility
- DESAT, Miller Clamp, TSD and fault reporting to prevent catastrophic failures
- Input signal conditioning and high noise immunity for reliable operation
- Operate in conjunction with high-speed switching NSVS5003xSB buffer BJTs for high current IGBT control
- AEC−Q100 Qualified

670 V Flyback Converters: *NCV106x, NCV107x, NCV8878, NCV898031/32*

- Enables compact designs for isolated and non-isolated systems
- Output power from 2 W to 15 W
- AEC-Q100 Qualified

Traction Inverter for HEV/EV (cont.)

Key Products & Features (cont.)

SiC MOSFETS - 650/900/1200 V

- 1200 V, RDS(ON) TYP: 20-160 (mΩ), D2PAK- 7L, TO247-4, TO247-3
- 900 V, RDS(ON) TYP: 20, 60 (mΩ), TO247-3, D2PAK-7L
- 650 V, RDS(ON) TYP: 15-45(mΩ), DA2PAK-7L, TO-247-4

PSR Controllers: *NCV1362*

- QR Primary side controller with CC-CV output regulation
- No opto coupler needed
- AEC-Q100 Qualified

Isolated Supply Controllers: *NCV1362, NCV3064, NCV1397*

- Adjustable minimum switcing frequency with 3% accuracy
- Frequency operation up to 250 kHZ
- AEC-Qualified (NCV1362)

Current Sense Amplifiers: *NCV21xR, NCV7041*

- Wide Common Mode Input Range: -0.3 to 26 V
- Low Ohm value current sense resistor
- NCV21xR for low side sensing or NCV7041 for low side sensing with increased margin on negative voltage at input
- Wide supply voltage range

Precision Operational Amplifiers: *NCV2191x*

- Supply Voltage: 4 to 36V
- Quiescent Current: 570 µA Max
- Low Noise: 22 nV/√Hz typical
- Packages: SOT23-5, SOIC-8, MICRO-8, TSSOP-14, SOIC-14

System Basis Chip: *NCV7420/25/28/50/51/71*

- LIN + LDO (50 mA, 70 mA, 150 mA)
- CANFD + LDO + HS Driver
- CANFD + LDO+ Wake
- LIN + CANFD + DC/DC

RB-Series – NIR Enhanced SiPMs for LiDAR

Features

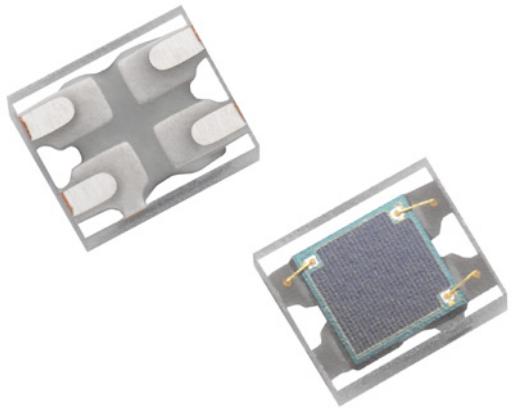
- PDE >9% @ 905 nm
- Gain of ~1E6
- Unique fast output
- 1 mm pixel size
- Compact, robust package

Benefits

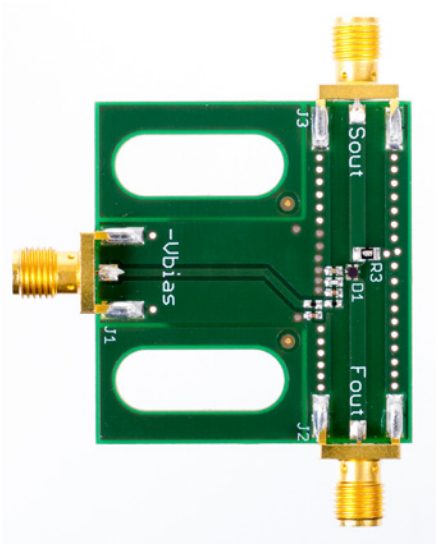
- Single photon sensitivity
- Low operating voltage (<50 V)
- Evaluation board available

Applications/Markets

- LiDAR
- Industrial 3D imaging
- Robots & consumer 3D imaging



MicroRB 1 mm SiPM in MLP



MicroRB 1 mm SiPM Evaluation Board

NIR Enhanced Silicon Photomultipliers for LiDAR Applications

Device	Microcell Size (μm)	PDE @ 905 nm (%)	Recovery Time (RC Constant) (ns)	Dark Count Rate (Mcps)
MicroRB-10010-MLP	10	4.0	12	2.5
MicroRB-10020-MLP	20	5.6	21	2.7
MicroRB-10035-MLP	35	9.1	73	2.6

ArrayRDM – SiPM Arrays for LiDAR Applications

Features

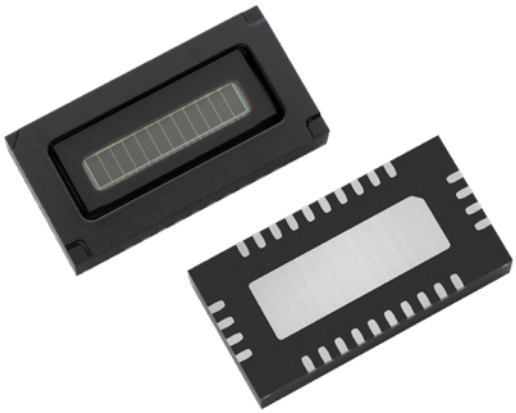
- Market leading PDE of 16% @ 905 nm
- Gain of ~1E6
- 1 × 12 and 1 × 16 pixel arrays available
- Compact, robust packages

Benefits

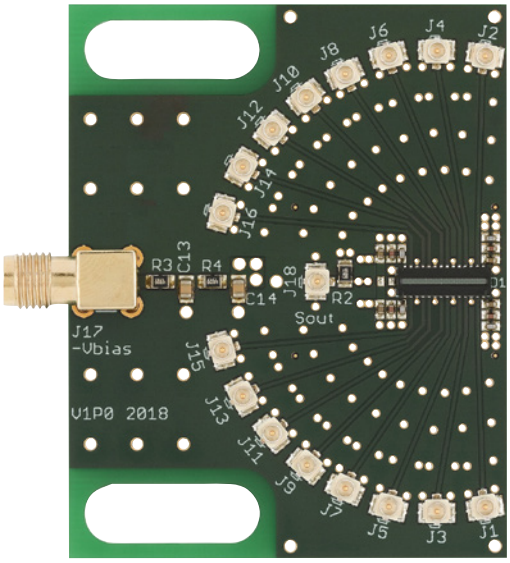
- Single photon sensitivity
- Low operating voltage (<50 V)
- Automotive qualification

Applications/Markets

- Scanning LiDAR applications
- Automotive LiDAR
- Industrial 3D imaging
- Robots & consumer 3D imaging



ArrayRDM-0112A20-QFN 1 × 12 Pixel Array



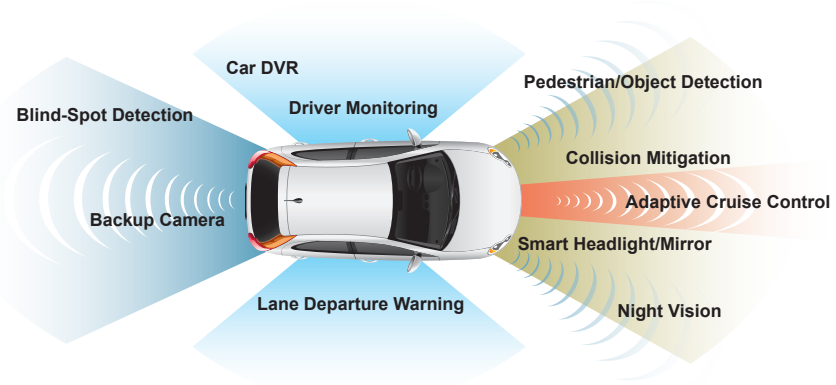
ArrayRDM-0116A10-GEVB 1 × 16 Pixel Array Evaluation Board

Silicon Photomultiplier Arrays for LiDAR Applications

Device	Array Format	Microcell Size (µm)	PDE @ 905 nm (%)	Recovery Time (RC Constant) (ns)	Dark Count Rate (Per Pixel) (kcps)
ArrayRDM-0112A20-QFN	1 x 12	20	16	34	100
ArrayRDM-0116A10-DFN	1 x 16	10	16	18	40

Imaging Products for Automotive Applications

onsemi image sensors and co-processors enhance driver experience and safety. Since 2004, we have been the leading supplier of imaging solutions for human viewing (backup, surround view and night vision) and machine vision applications (ADAS – advanced driver assistance systems including lane departure warning, adaptive cruise control, pedestrian detection and more.) Recent innovations targeted at the automotive market optimize our products for these, and other emerging applications include smart headlights and driver monitoring.



CMOS Image Sensors

Device	Sensor/ SOC	Resolution (MP)	Optical Format	Frame Rate	Pixel Size (µm)	Shutter Type	CFA	Operating Temp (°C)
AR0140AT	Sensor	1	1/4”	60 fps	3	Electronic Rolling Shutter	Color	-40 to +105
AR0132AT	Sensor	1.2	1/3”	1.2 45 fps, 720p 60 fps	3.8	Electronic Rolling Shutter	Color, Mono, RCCC	-40 to +105
AR0135AT	Sensor	1.2	1/3"	60 fps @ 720p, 54 fps @ full res	3.8	Global Shutter	Mono	-40 to +105
AR0138AT	Sensor	1.2	1/2.6"	69 fps @ 720p	4.2	Electronic Rolling Shutter	RGB, RCCC	-40 to +105
AR0143AT	Sensor	1.3	1/4"	30 fps	3.0	Electronic Rolling Shutter	RGB, RCCB	-40 to +105
AR0144AT	Sensor	1	1/4"	60 fps @ 720p	3.0	Global Shutter	Mono	-40 to +105
AR0147AT	Sensor	1.3	1/4"	60 fps	3.0	Electronic Rolling Shutter	RGB	–40 to +110
AR0220AT	Sensor	1.7	1/1.8"	60 fps	4.2	Electronic Rolling Shutter	RGB, RCCC, RCCB	-40 to +105
AR0230AT	Sensor	2	1/3"	30 @ fps 1080p	3.0	Electronic Rolling Shutter	Mono, RGB	-40 to +105
AR0231AT	Sensor	2.3	1/2.7"	60 fps full res @ 2 exp, 40 fps full res @ 3 exp	3.0	Electronic Rolling Shutter	RGB	-40 to +125
AR0233AT	Sensor	2.6	1/2.5"	60 fps	3.0	Electronic Rolling Shutter	RGB, RCCB	-40 to +105
AR0234AT	Sensor	2.3	1/2.6"	120 fps	3.0	Global Shutter	Mono, RGB	-40 to +85
AR0237AT	Sensor	2.1	1/2.7"	60 fps	3.0	Electronic Rolling Shutter	RGB	-40 to +105
AR0239AT	Sensor	2.3	1/2.7"	30 fps @ 3 exp, 90 fps @ 1080p	3.0	Electronic Rolling Shutter	RGB	-30 to +85
AR0323AT	Sensor	3.1	1/2"	60 fps	3.0	Electronic Rolling Shutter	RGB, RCCB	-40 to +105
AR0820AT	Sensor	8.3	1/2"	40 fps	2.1	Electronic Rolling Shutter	RGB, RCCC, RCCB	-40 to +105
ARX550AT	Sensor	VGA	1/5"	66.37 fps @ full res	3.8	Electronic Rolling Shutter	RGB	-40 to +105
MT9V024	Sensor	WVGA	1/3”	60 fps	6.0	Global Shutter	Color, Mono, RCCC	-40 to +105
AS0140AT	SOC	1	1/4"	60 fps	3.0	Electronic Rolling Shutter	RGB	-40 to +105
AS0142AT	SOC	1	1/4"	45 fps at 1.0 MP, 60 fps at 720p	3.0	Electronic Rolling Shutter	RGB888, RGB565, YUV422 8-/10-bit	-40 to +105
AS0147AT	SOC	1.3	1/4"	45 fps @ full res (3 exposure), 60 fps @ 720p	3.0	Electronic Rolling Shutter	RGB	-40 to +105
AS0148AT	SOC	1.3	1/4"	45 fps @ full res (3 exposure), 60 fps @ 720p	3.0	Electronic Rolling Shutter	RGB	-40 to +105
AS0149AT	SOC	1.3	1/4"	30 fps @ 1280 x 960	3.0	Electronic Rolling Shutter	RGB	-40 to +105
ASX340AT	SOC	VGA	1/4”	60 fps digital, 30 fps analog	5.6	Electronic Rolling Shutter	Color	-40 to +105
ASX342AT	SOC	VGA	1/4"	50/60 fps	5.6	Electronic Rolling Shutter	RGB	-40 to +105
ASX344AT	SOC	VGA	1/4"	60 fps NTSC, 50 fps PAL interlaced, 60 fps progressive	5.6	Electronic Rolling Shutter	RGB	-40 to +105
ASX350AT	SOC	VGA	1/5"	60 fps digital, 30 fps analog	3.8	Electronic Rolling Shutter	Color	-40 to +105

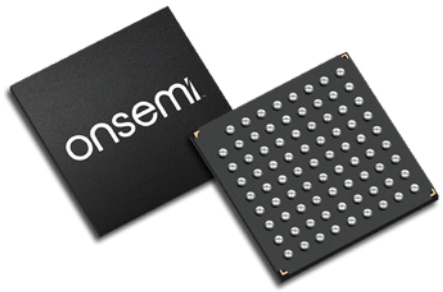
Co-Processors for Image Sensors

Image Co-Processors

Device	Maximum Resolution	Supported Sensors	Frame Rate	HDR with ALTM	Dewarp	Spatial Transform Engine Software Add-on	Overlays	GPIOs	Sensor Interfaces	Output Interfaces	Input Clock (MHz)	Output Clock	Operating Temp (°C)	Package
AP0100	1.2 MP	AR0132AT, AR0140AT, ARX550AT	1.2 MP 45 fps 720p60	Yes	Yes, Up to 165°	Yes, Multiple viewing options, PTZ	Yes	Up to 5	2-lane HiSPi, 12-bit parallel	NTSC/PAL, 16-bit parallel	6-30	27 MHz (NTSC/PAL) 84 MHz parallel	-30 to +70 (CS Version) -40 to +105 (AT Version)	VFBGA-100
AP0101	1.2 MP	AR0132AT, AR0140AT, ARX550AT	1.2 MP 45 fps	Yes	No	No	No	Up to 5	12-bit parallel	16-bit parallel	6-30	84 MHz parallel	-30 to +70 (CS Version) -40 to +105 (AT Version)	VFBGA-81
AP0102AT	2.0 MP	AR0132AT, AR0140AT, AR0136AT	30 fps @ 1080p, 45 fps @ 1.2Mp, 60 fps @ 720p	Yes	No	Yes	Yes	Up to 7	Parallel and HiSPi	Up to 24-bit parallel	6-30 MHz	125 MHz	-40°C to +105°C	VFBGA-100
AP0200AT	2.0 MP	AR0132AT, AR0136AT, AR0140AT, AR0230AT	30 fps @ 1080p, 45 fps @ 1.2Mp, 60 fps @ 720p	Yes	No	Yes	Yes	Up to 7	12-bit Parallel and HiSPi	Ethernet-MII, RMII, GMII	10-29 MHz	125 MHz	-40°C to +105°C	VFBGA-100
AP0201AT	2.0 MP	AR0132AT, AR0136AT, AR0140AT, AR0230AT	30 fps @ 1080p, 45 fps @ 1.2Mp, 60 fps @ 720p	Yes	No	No	No	Up to 7	12-bit Parallel and HiSPi	Ethernet-MII, RMII, GMII	10-29 MHz	125 MHz	-40°C to +105°C	VFBGA-100
AP0202AT	2.0 MP	AR0132AT, AR0136AT	30 fps @ 1080p, 45 fps @ 1.2Mp, 60 fps @ 720p	Yes	No	No		Up to 7	12-bit Parallel and HiSPi	Up to 24–bit Parallel	10–29 MHz	125 MHz	-40°C to +105°C	VFBGA-100

Available SOC and Co-Processor Functionality*

- Spatial Transform Engine (STE) with dual transform support/software add-on
- Optimized for use with HDR (High Dynamic Range) sensors/HDR with ALTM
- Full auto-functions support (AWB and AE) and ALTM (Adaptive Local Tone Mapping) to enhance HDR images
- Pre-rendered graphical overlays
- Multi-camera synchronization support
- LED flicker detection and avoidance
- Dewarp, up to 165 degrees
- Overlays
- GPIOs, up to 5
- Next generation color pipe with improved noise filtering & reduced chromatic aliasing
  - Demosaic
  - Gamma correction
  - Auto white balance
  - Defect correction
  - Noise reduction
  - Auto exposure



* See product information for device-specific functionality.

Modular Automotive Reference System

The Modular Automotive Reference System (MARS) is a complete imaging solution for camera system developers and software developers working on automotive imaging applications. MARS gives engineers and software developers the fundamental building blocks needed to create next generation imaging systems, while reducing the design effort and resources required to develop a working solution.

Using the modular mix & match approach offered by this unique compact form factor platform, designers can bring together different combinations of image sensors, co-processors (Image Signal Processor) and communication standards. The component boards have consistent signal/power interconnect definitions to enable users to swap individual boards, creating a wide range of options for experimenting, while eliminating the need for constructing custom boards. The result is a highly flexible solution where the various modules are fully interchangeable.

For videos, tools and more information visit www.onsemi.com/MARS

Features

- Ready to use camera solution
- Compact form factor
- Modular and interchangeable building blocks
- Supported by comprehensive ecosystem
- Software development platforms
- Lens partners
- Schematic, gerbers, BOM

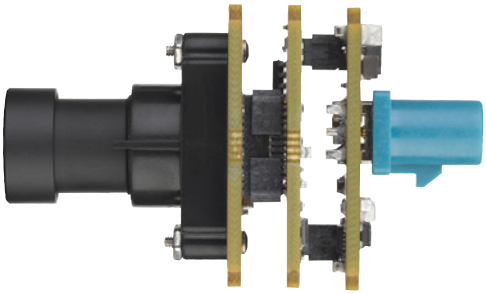
Benefits

- Accelerates development cycles
- Reduces need for technical resources
- Reduces development costs
- Eliminates redundant work

Modular Automotive Reference System

- ADAS
- Autonomous driving
- Viewing systems
- Backup cameras
- Surround view systems
- Electronic mirrors

- In-cabin cameras for
  - Gesture recognition
  - Driver eye monitoring
  - Light level inspection

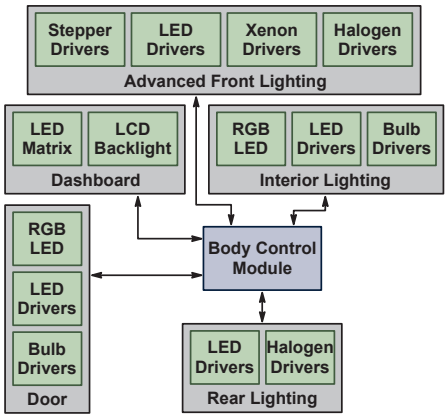


Individual MARS Board Order Descriptions

Sensor Board OPNs	Short Description	Sensor Board Description
MARS1-AR0230ATS-GEVB	2.1 MP, 1/2.7" MARS Sensor Board	MARS sensor board with 2.1 MP, 1/2.7" high-dynamic range color AR0230AT image sensor
MARS1-AR0231AT6-GEVB	2.3 MP, 1/2.7" MARS Sensor Board	MARS sensor board with 2.3 MP, 1/2.7" high-dynamic range color AR0231AT image sensor with LED Flicker Mitigation and BSI pixel technology for superior low-light performance
MARS1-AR0132AT6-GEVB	1.2 MP, 1/3" MARS Sensor Board	MARS sensor board with 1.2 MP, 1/3" high-dynamic range color AR0132AT image sensor
MARS1-AR0136AT3-GEVB	1.2 MP, 1/3" MARS Sensor Board	MARS sensor board with 1.2 MP, 1/3" high-dynamic range color AR0136AT image sensor and BSI pixel technology
MARS1-AR0140AT3-GEVB	1.0 MP, 1/4" MARS Sensor Board	MARS sensor board with 1.0 MP, 1/4" high-dynamic range color AR0140AT image sensor
MARS1-AR0135AT2-GEVB	1.2 MP, 1/3" MARS Sensor Board	MARS sensor board with 1.2 MP, 1/3" global shutter AR0135AT image sensor with high global shutter efficiency and superior NIR performance
Co-Processor Board OPNs		**Image Co-Processor Description**
MARS1-AP0200AT2-GEVB	Up to 2.0 MP MARS Image Co-processor Board	MARS Image Co-Processor (ICP)AP0200AT High-Dynamic Range (HDR) ICP with built-in MJPEG and H.264 encoder and Ethernet-MII, RMII, GMII output interface
MARS1-AP0202AT2-GEVB	Up to 2.0 MP MARS Image Co-processor Board	MARS Image Co-Processor (ICP) with AP0202AT High-Dynamic Range (HDR) ICP with parallel ouput
MARS1-AP0100AT2-GEVB	Up to 1.2 MP MARS Image Co-processor Board	MARS Image Co-Processor (ICP) with AP0100AT High-Dynamic Range (HDR) ICP with sophisticated lens distortion correction and integrated video encoder for NTSC/PAL output
MARS1-AP0101AT2-GEVB	Up to 1.2 MP MARS Image Co-processor Board	MARS Image Co-Processor (ICP) with AP0101AT High-Dynamic Range (HDR) ICP and parallel output
MARS1-AP0102AT2-GEVB	Up to 1.2 MP MARS Image Co-processor Board	MARS Image Co-Processor (ICP) with AP0102AT High-Dynamic Range (HDR) ICP with sophisticated lens distortion correction and parallel output
Serializer OPNs		**Serializer Description**
MARS1-TI913-GEVK	MARS Serializer Board	Texas Instruments DS90UB913 Parallel to LVDS FPD-Link Serializer
MARS1-MAX96705-GEVB	MARS Serializer Board	Maxim MAX96705 Parallel to LVDS GMSL Serializer
Deserializer OPNs		**Desrializer Description**
MARS1-TI914	MARS Deserializer Board	Texas Instruments DS90UB914 LVDS to Parallel FPD-Link Deserializer
MARS1-MAX9706	MARS Deserializer Board	Maxim MAX96706 LVDS to Parallel GMSL Deserializer
Ethernet PHY OPNs		**Ethernet PHY Description**
MARS1-KSZ8081MNX-GEVB	MARS Ethernet PHY Board	MARS Micrel KSZ8081MNX-GEVB Ethernet PHY Board
Demo3 Adapter Board OPNs		**Demo3 Adapter Board Description**
MARS1-DEMO3-ADAPTER-GEVB	MARS Parallel to Demo3 Adapter	MARS Adapter for adapting the parallel serializer boards into Demo3 Demo Kit Tool
Demo3 Board OPNs		**Demo3 Board Description**
AGB1N0CS-GEVK	Demo3	Demo3 Demo Kit Tool

Automotive Lighting Systems

onsemi offers standard products and custom devices for automotive lighting applications. The company plays a prominent role in the market for Xenon driver ASICs, developed the defacto standard stepper driver for headlight leveling and swiveling, and is a leader in LED exterior lighting solutions.



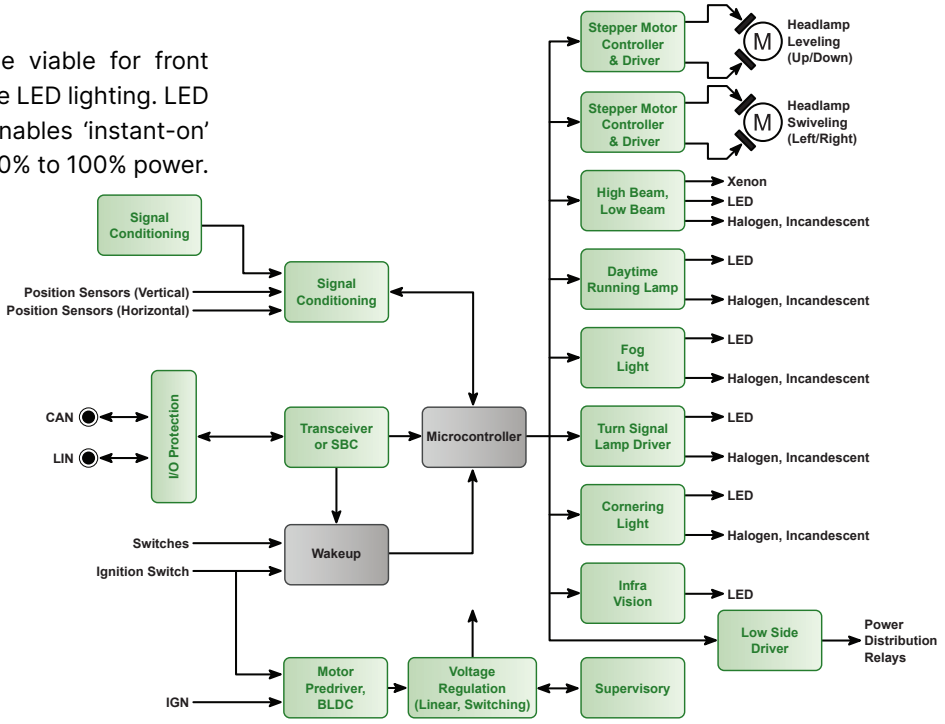
Front Lighting

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.

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.

onsemi 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.

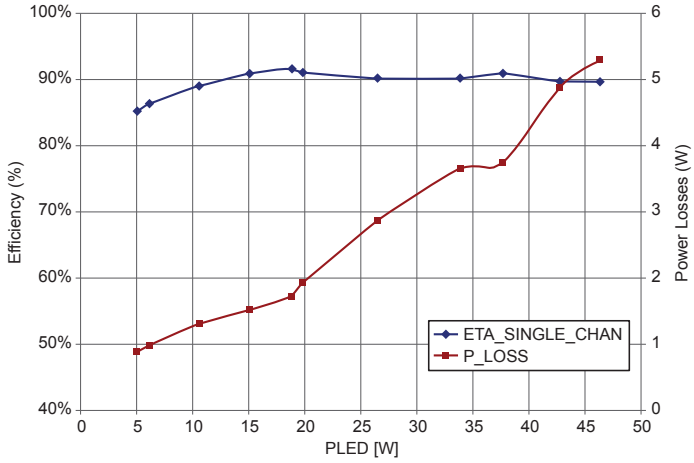


Front Lighting — Power Ballast and Dual LED Driver for Advanced LED

The NCV78763 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 NCV78763 offers integrated, energy efficient solutions for comprehensive front lighting control.

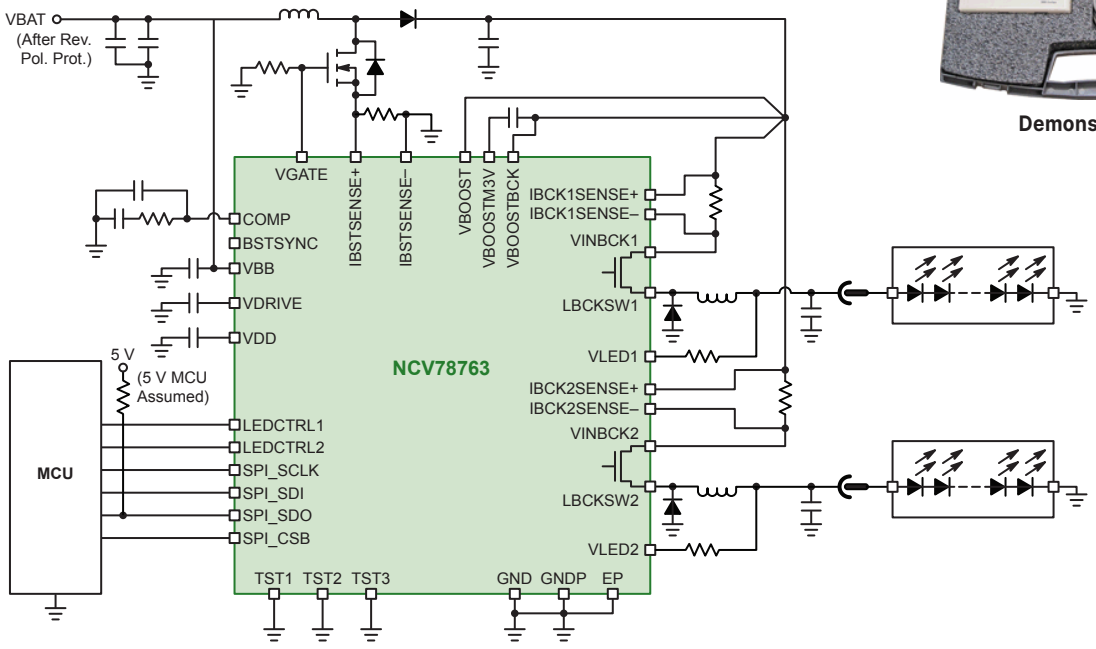
Features – NCV78763

- System integrated solution with few external components.
- Buck-boost topology
- LED current regulator
  - Constant average current
  - Efficient integrated buck switches (high-side)
  - Current per output up to 1.6 A
  - Extended diagnostics: detection of open circuit or failing driver, short, over-current protection, single LED failures
  - Thermal protection
- System customization by SPI interface
  - 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%)



NCV78763 Demonstration Board Efficiency

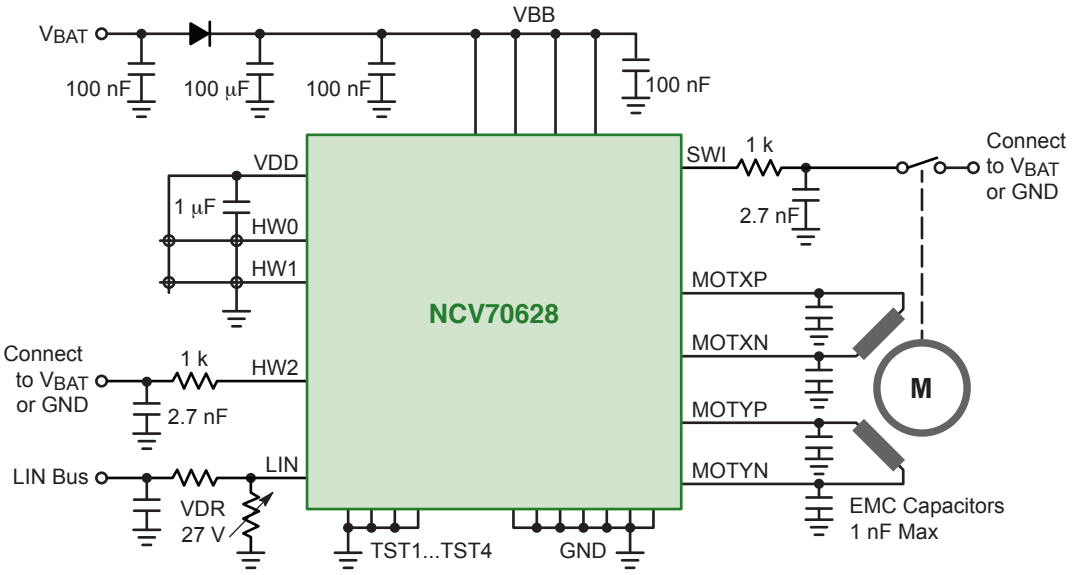
Demonstration Kit



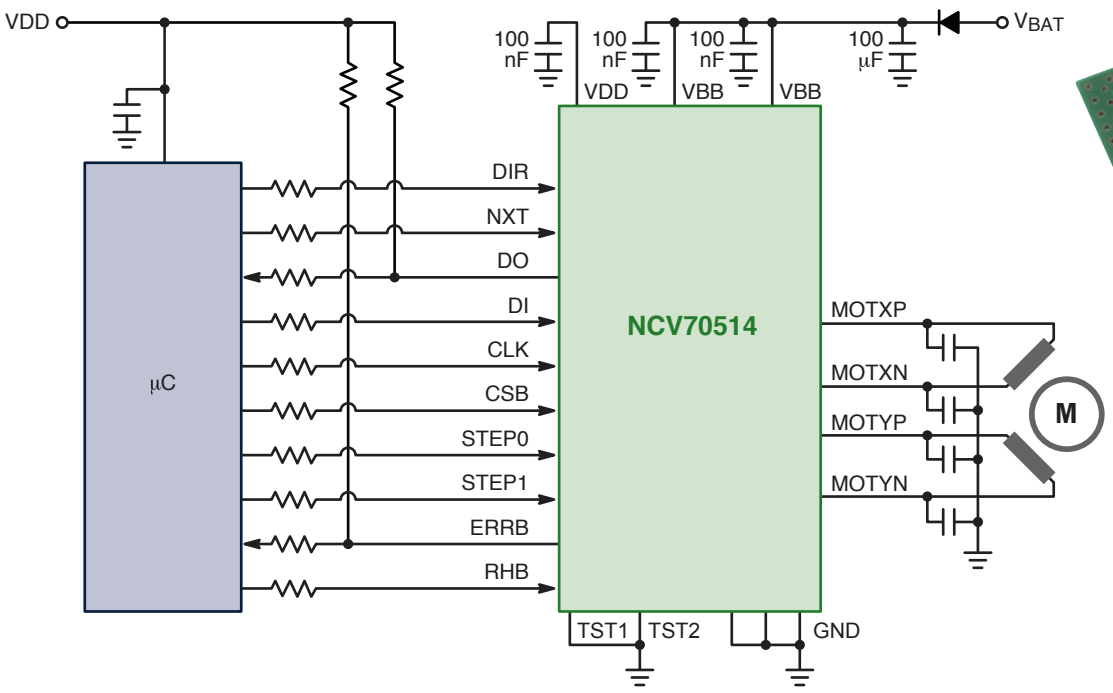
NCV78763 Application Diagram

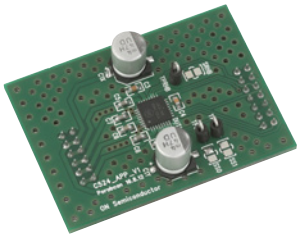
Front Lighting — Leveling and Swiveling

The NCV70628 is a single-chip micro-stepping motor driver with position controller and control/diagnostic interface, making it ideal for dedicated mechatronics solutions, connected remotely through a LIN master.



The NCV70514 is a micro-stepping motor driver that is fully compatible with automotive voltage requirements, and is especially well-suited for use in applications with fluctuating battery supplies.



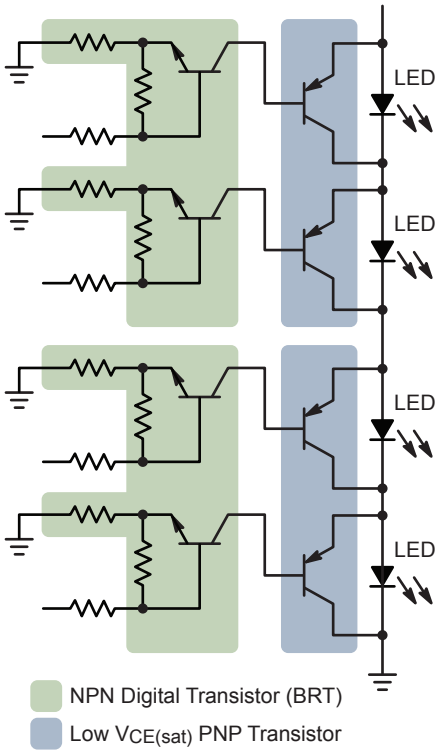


Evaluation Board
NV705143R1DBGEVB

Front Lighting — Small Signal Solutions for Pixel (Matrix) Control

Today's adaptive front lighting systems (AFLS) utilize a combination of sensors, motors, and a LED matrix to adjust the direction and intensity of the light beam. One AFLS method involves blanking of certain LED strings within the matrix, which can be controlled by a combination of small signal components such as Low $V_{CE(sat)}$ bipolar transistors and digital transistors (BRT – bias resistor transistor).

The collector of the NPN digital transistor is connected to the base of the Low $V_{CE(sat)}$ PNP transistor, thereby forming an ultra-low saturation voltage ($V_{CE(sat)}$) and high current gain capability of the combination. The high current gain allows this combination to be driven directly from an MCU or PMU's control outputs, reducing overall system complexity and cost.



Features

- AEC-Q101 discrete & Mixed Element Array (MEA) components
- Low $V_{CE(sat)}$ ensures shunting of LED
- Simplifies circuit design & reduces component count
- PCB space saving with 2 mm x 2 mm wettable flank DFN packaging

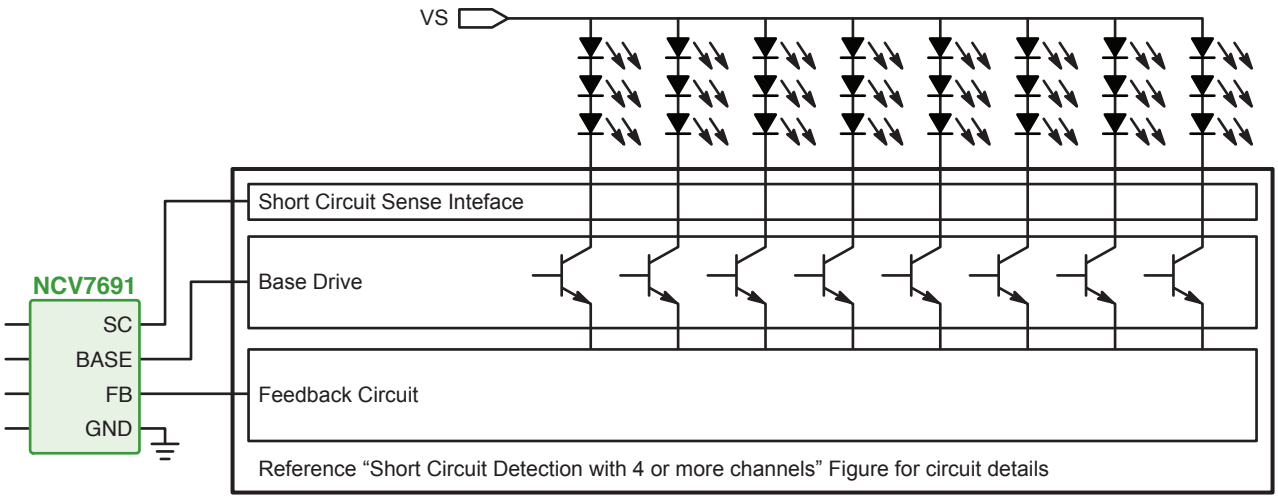
Device	V_{CEO} (V)	I_C (A)	$V_{CE(sat)}$ (V)	Description	Package(s)
NSV60100DMTW	-60	1.0	-0.35	60 V, 1 A Dual PNP Low $V_{CE(sat)}$ BJT	WDFNW-6
NSV60200DMTW	-60	2.0	-0.45	60 V, 2 A Dual PNP Low $V_{CE(sat)}$ BJT	
NSV20200DMTW	-20	2.0	-0.39	20 V, 2 A Dual PNP Low $V_{CE(sat)}$ BJT	
NSVMUN5214D	50	0.1	0.25	Dual NPN BRT, R1 = 10kΩ, R2 = 47kΩ	SC-88 (SOT-363)
NSVBC114YD	50	0.1	0.25	Dual NPN BRT, R1 = 10kΩ, R2 = 47kΩ	SOT-563

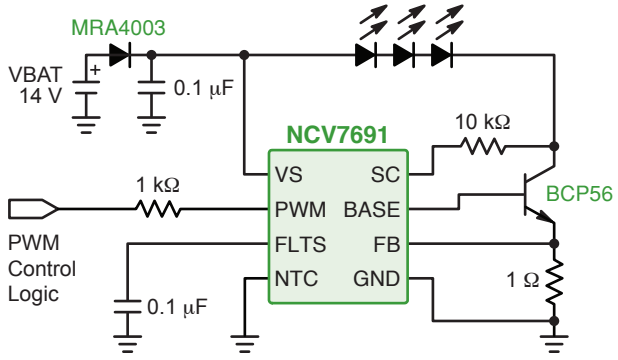
RCL, DRL, CHMSL Lighting — Linear LED Pre-Driver

NCV7691 and NCV7692 are pre-drivers intended for linear drive of LEDs. They can operate from the car battery, and multiple LED strings can be driven by a single device.

Features

- NCV7691 Open Load detection threshold level: 9.5 V rising, 8.8 V falling
- NCV7692 Open Load detection threshold level: 5.1 V rising, 4.95 V falling
- Constant Current Output for LED String Drive External Programming Current Resistor
- Wide Current Range using External Bipolar Device
- Pulse Width Modulation (PWM) Control
- Negative Temperature Coefficient (NTC) Current Control
- Open LED String & Short−Circuit LED String Diagnostic
- Overvoltage Set Back Power Limitation
- Multiple LED String Control



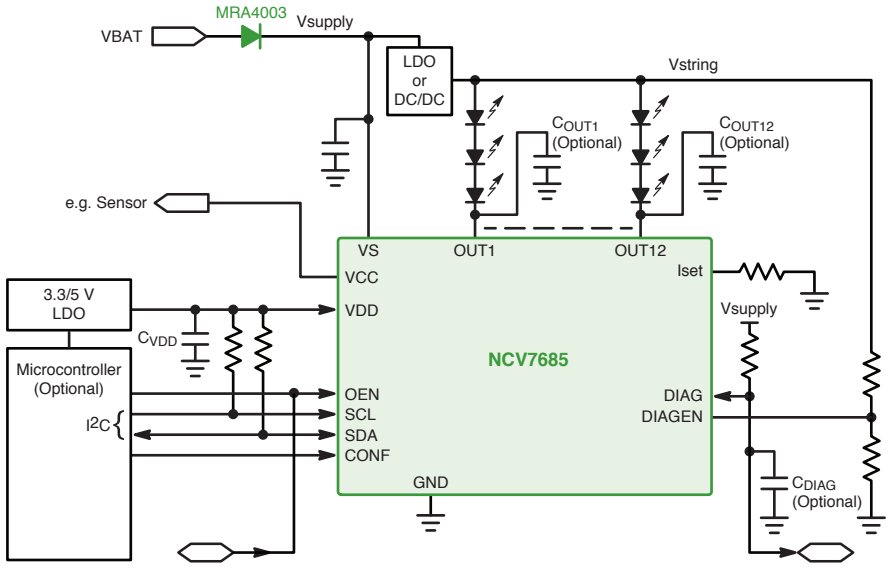


Rear Lighting — Linear Current Regulators/Controllers

for Rear Combination Lamps, Daytime Running Lights, Fog Lights, CHMSLs, Turn Signals

The NCV7685 is a 12-channel linear programmable constant current source with common reference, designed for the regulation and control of LED-based lighting.

- Allow for 128 duty cycle levels, adjustable with I2C-programmable PWM
- 3.3 V voltage reference for loads up to 1 mA
- OTP bank for stand-alone operation (2 configurations)



Application Diagram

The NCV7683 is an 8-channel linear programmable constant current source, designed for the regulation and control of LED-based lighting.

- Allow for two programmed levels for Stop and Tail illumination, or optional external PWM
- Slew rate control to eliminate EMI concerns
- Sequencing functionality

Device	Channels	V_I Max (V)	I_O Max (mA)	Max LEDs in Series	Max LEDs in Parallel	Package(s)
NCV7683	8	40	200	4	24	SSOP-24 NB EP
NCV7685	12	40	60	4	12	SSOP-24 NB EP

Interior Lighting and Center High Mount Stop Lamp (CHMSL) — Constant Current Regulators

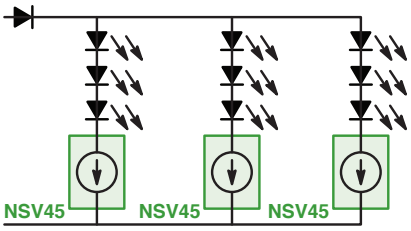
The two-terminal linear constant current regulators (CCRs) are simple, economical, and robust devices that provide an effective solution for regulating current in cost-sensitive LED applications. The devices require no external components, allowing them to be implemented as high or low−side regulators. 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

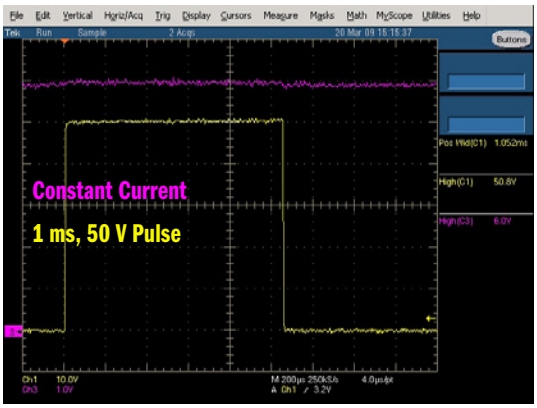
Resources

- 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
NSV45xxx	45	1.8	Fixed: 15, 20, 25, 30	±15%, ±10%	150	SOD-123, SOT-223
NSV50xxx	50	2.0	Fixed: 10, 350	±10%	175	SMC, DPAK
NSVC20xx	120	1.8	Fixed: 20, 30, 50	±15%	175	SMB
NSV45xxxJ	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.



Constant Current Supply During Vehicle Battery Load Dump

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.

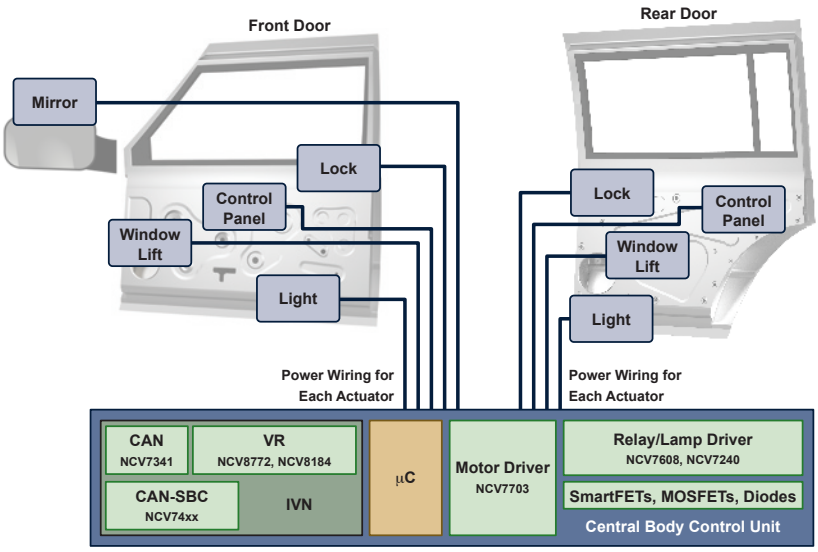
There are different door electronic topologies available:

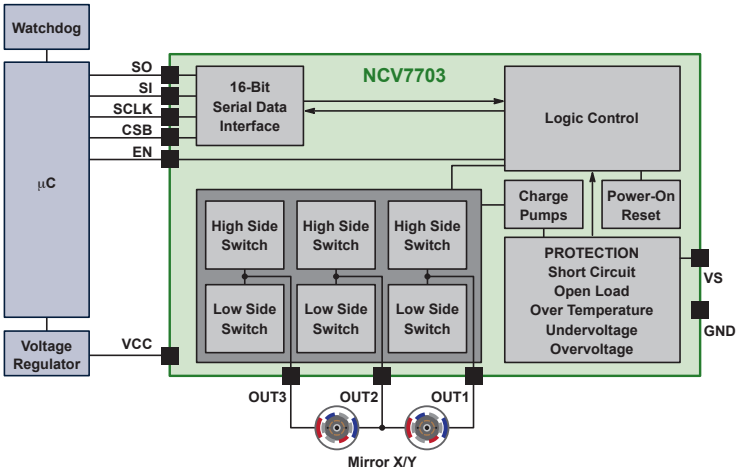
- Centralized door electronics
- De-centralized door electronics
- Mixed door electronics

The most common topology is centralized electronics, where the electronics system is implemented in the Body Control Unit (BCU). **onsemi** 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

Centralized Door Electronics System

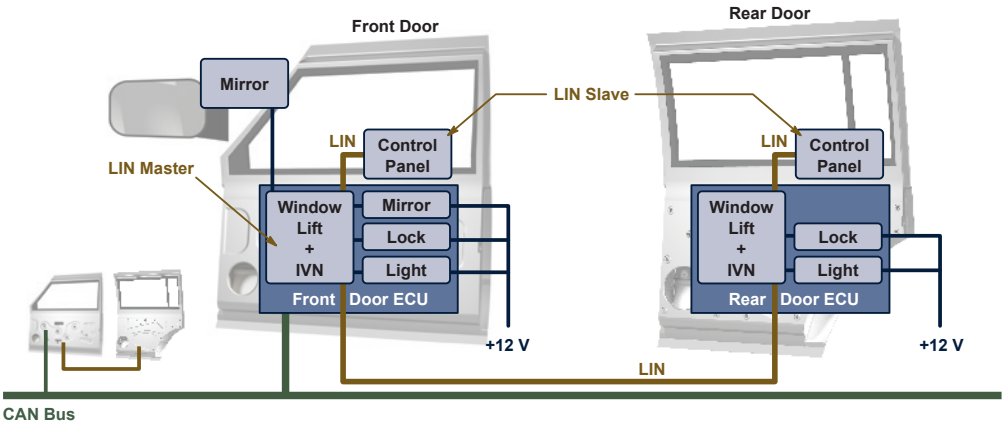




For mirror positioning, two motors adjust the glass along x and y axes. The NCV7703 features three integrated half-bridge drivers. The output stages are controlled by a 16-bit SPI interface. Complete diagnostic information is provided to the microcontroller through the SPI.

Door Electronics Systems

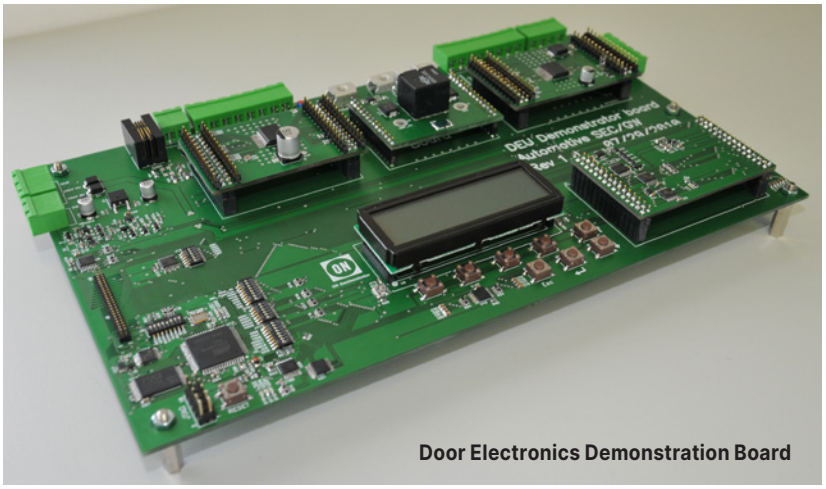
De-Centralized Door Electronics System



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:

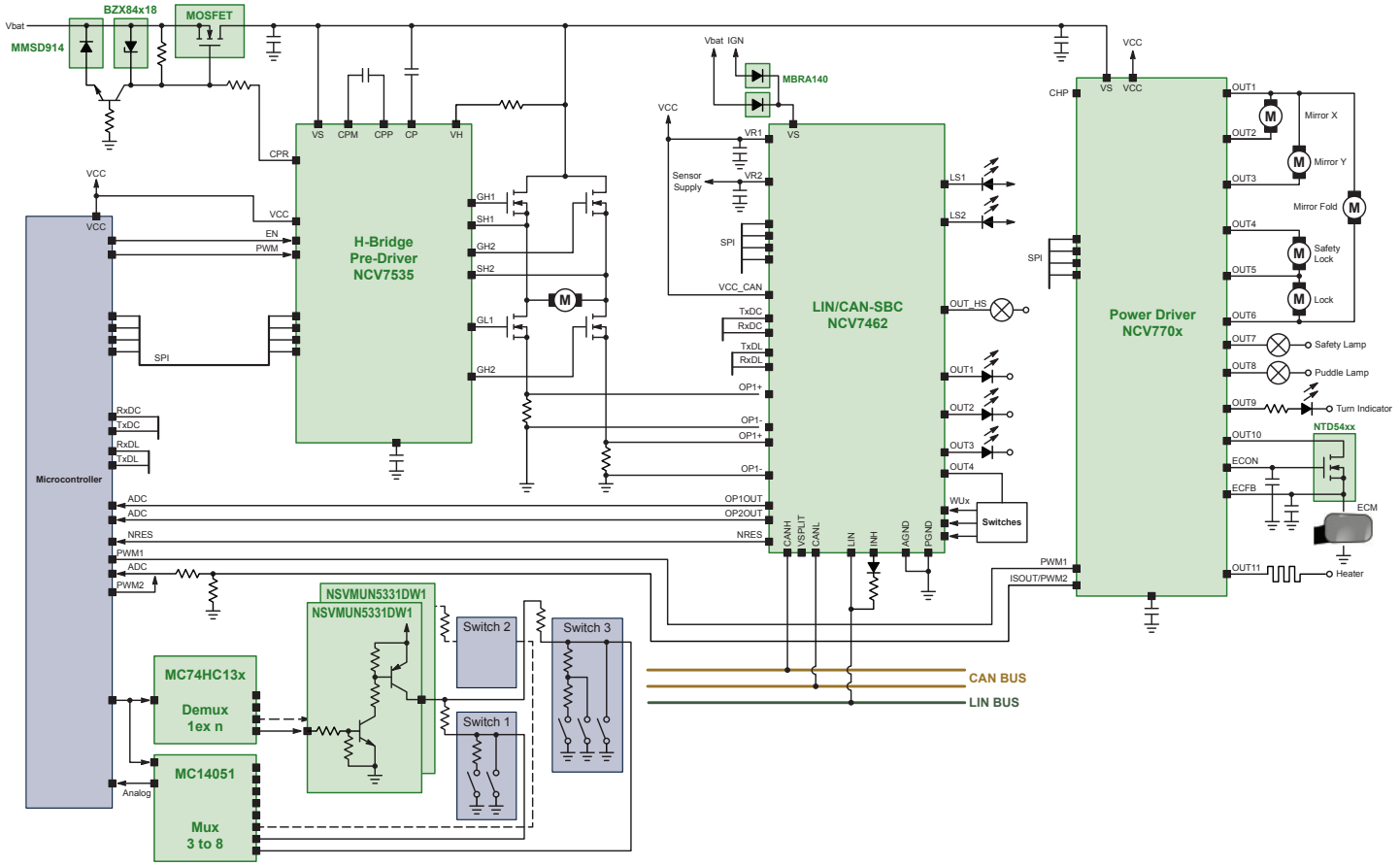
- Reduced use of wiring harness
- Reduced weight and power consumption positively impact fuel consumption
- Enables modular architectures through use of sub-modules



Door Electronics Demonstration Board

Solution for De-Centralized Front Door Electronics Systems

onsemi 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 **onsemi** the opportunity to support complete customer designs.



Control, Communication, and Power for Body HVAC

The HVAC system includes several subsystems

Vehicle heating & ventilation systems

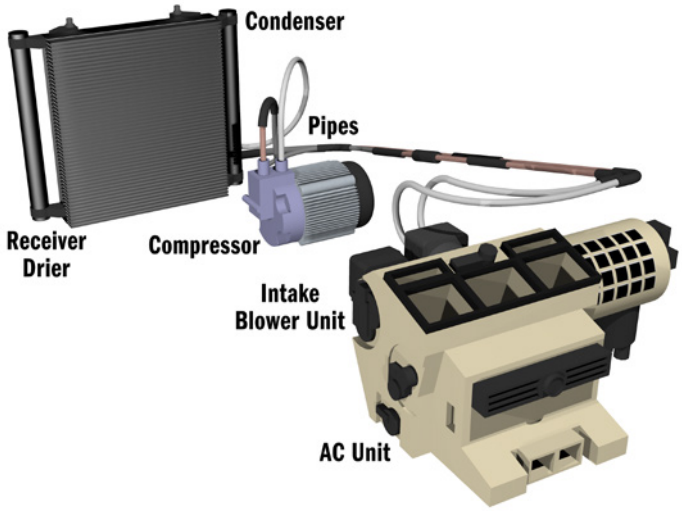
To improve passenger comfort and safety, fresh air is drawn from outside ducts and directed to the passenger compartment. Incoming air can be heated by passing over a small heating core connected to the engine's cooling system.

Air conditioning refrigerant

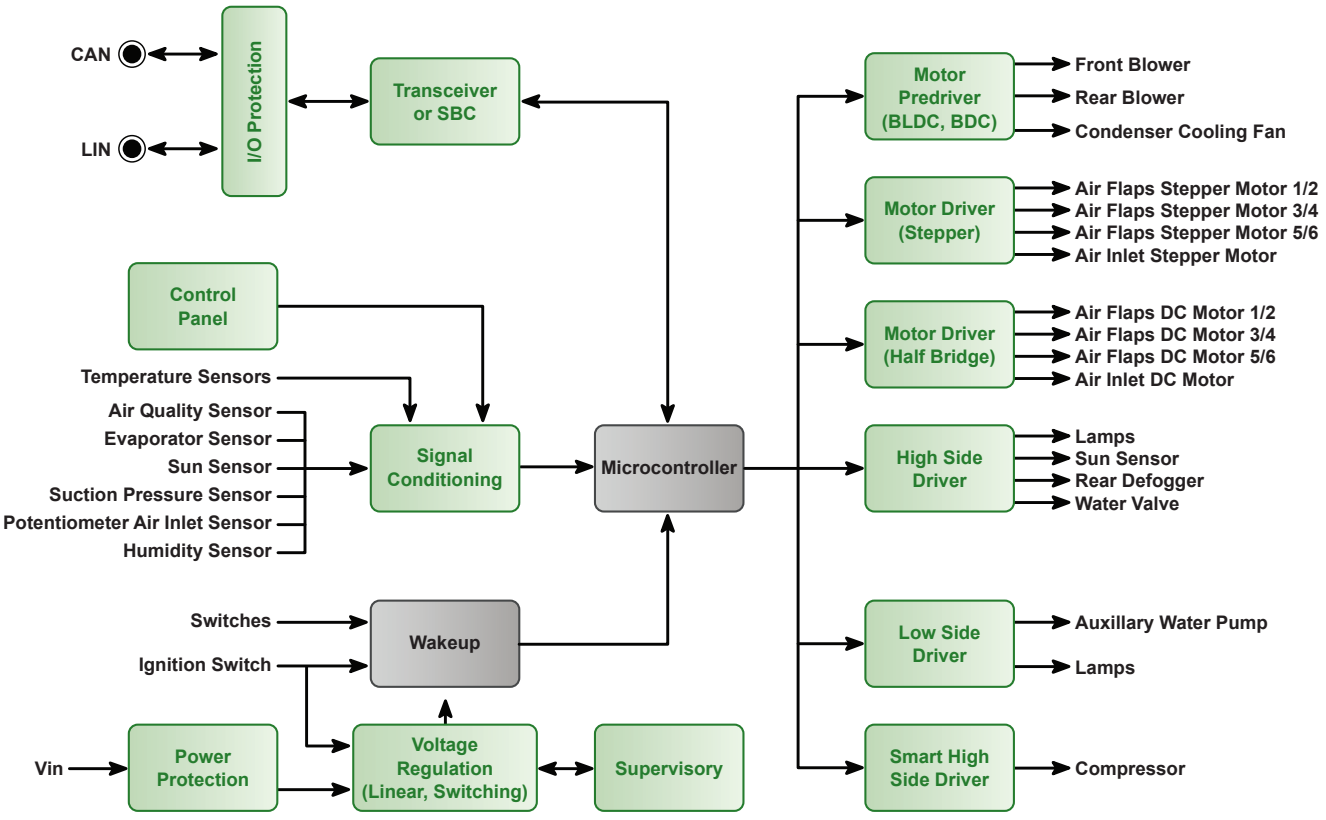
The refrigerant removes heat from the vehicle interior and transfers it to the outside air in a continuous cycle of vaporization and condensation. Reducing the temperature of the air also reduces its humidity. Cold air will not hold as much water vapor as warm air.

Control head

ECU (Electronic Control Unit) with user interface.



Interior Air Conditioning Unit



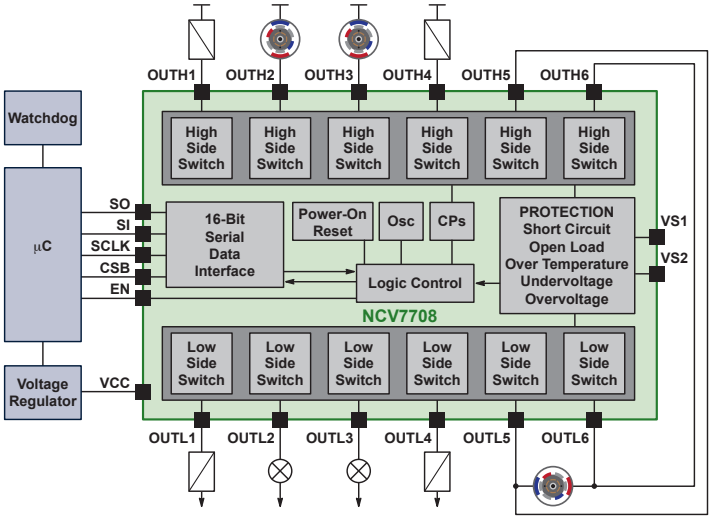
DC Motor Drivers for Body HVAC

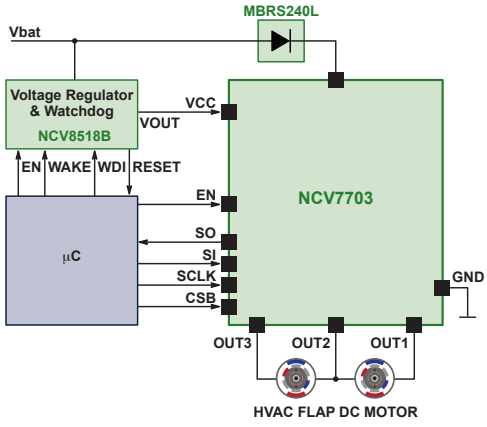
The most popular flap actuators are simple DC motors with position signal feedback to the microcontroller. To control a DC motor in forward and reverse direction, two high-side and two low-side power stages are necessary, in full-bridge configuration. Typically, these drivers integrate required features 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. **onsemi** has custom ASICs for these types of circuits, in production today.

Dual Hex High/Low-Side Driver

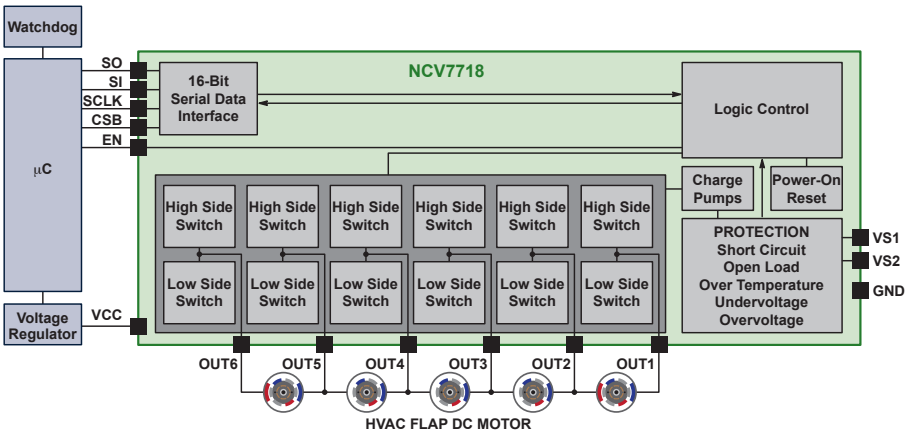
The NCV7708 is a flexible, single sided high/low-side driver. The six high and low-side channels are specifically designed for motor control configurations, like half or full bridges. NCV7708 will control five DC motors via a 16-bit SPI interface. The device can also control relays or LEDs.





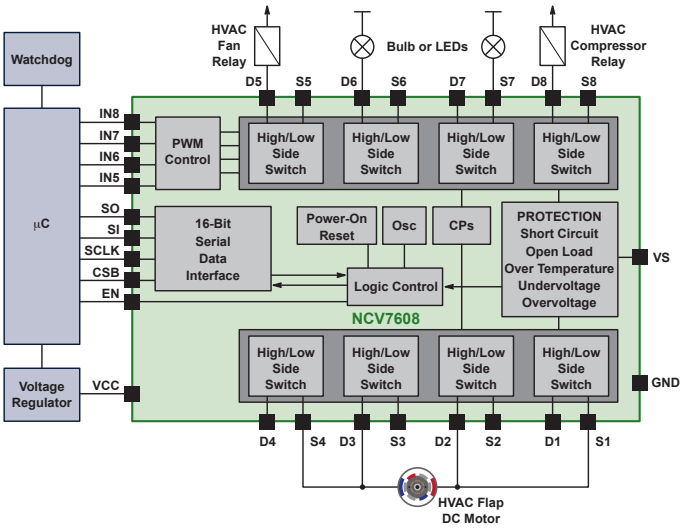
Half-Bridge Drivers

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. NCV7719 and NCV7720 increases the number of outputs to 8-channel and 10-channel, respectively.

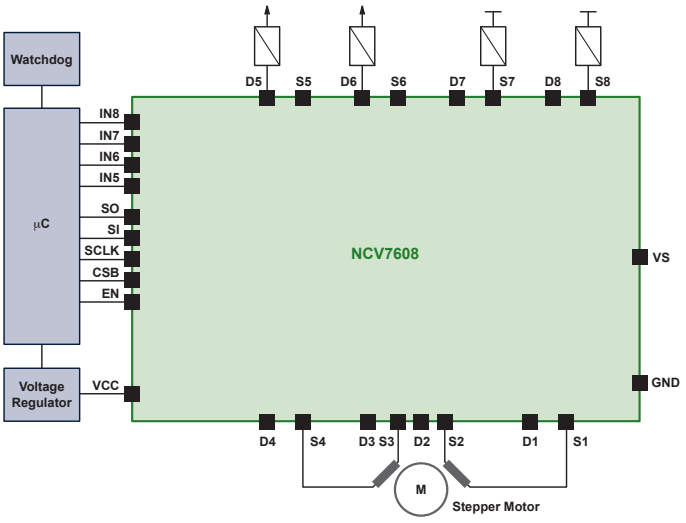


Configurable Motor, Relay, and LED Driver for Body HVAC

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.

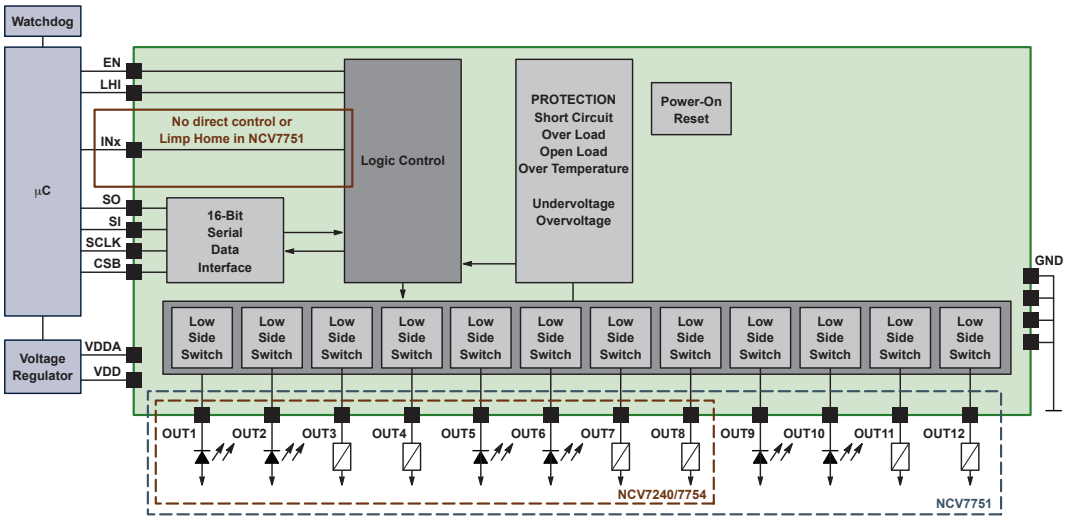


Highest Flexibility with NCV7608



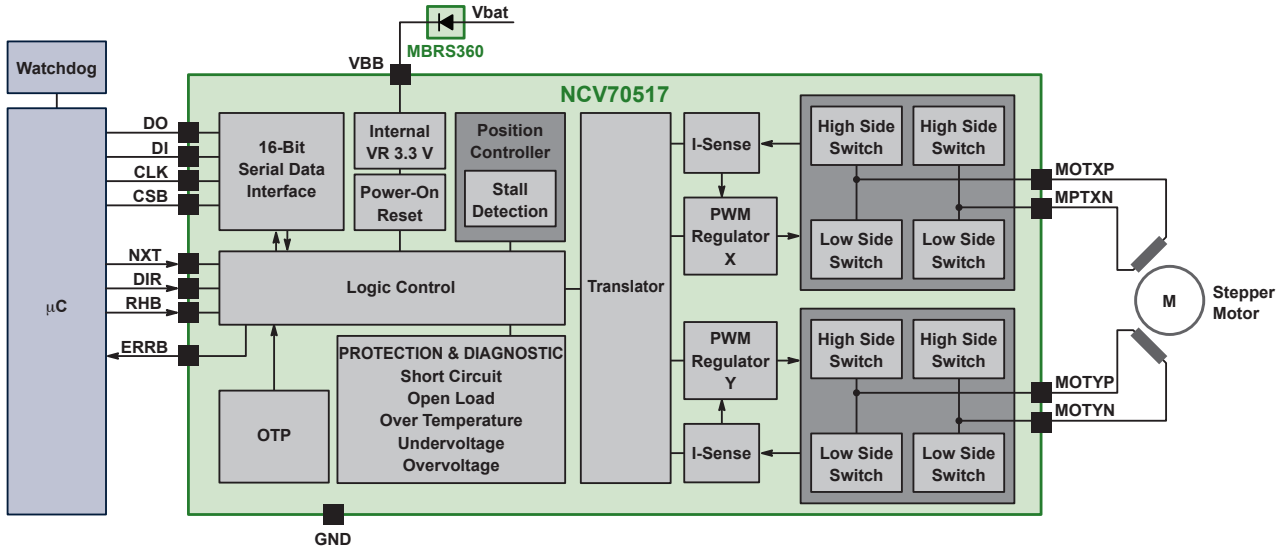
NCV7608 Supports Unipolar and Bipolar Stepper Motor Control

The NCV7240 and NCV7754 eight channel low-side drivers, and NCV7751 twelve channel low-side driver, provide 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 devices are able to drive loads like LEDs, relays, or unipolar stepper motors.



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.



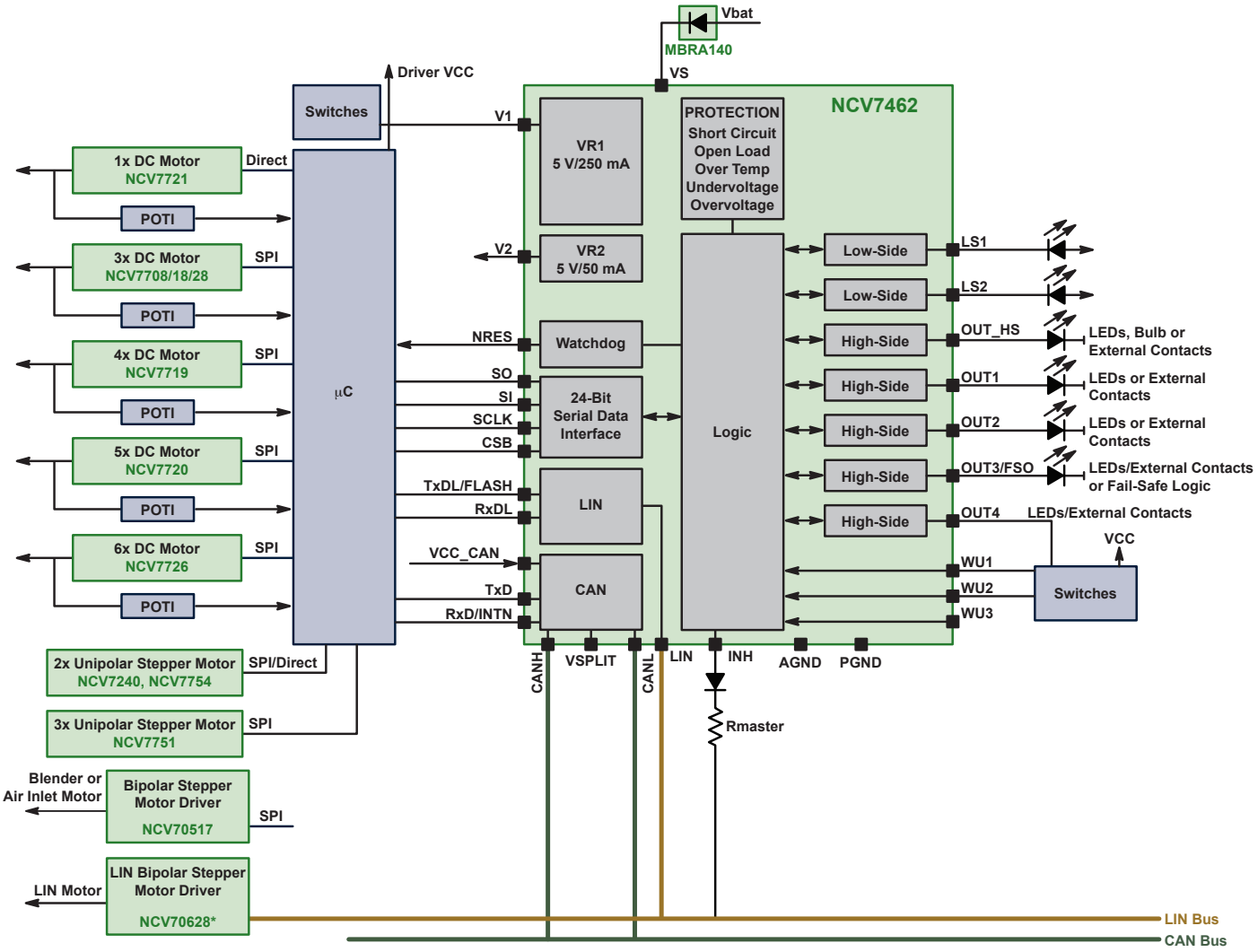
Air-inlet flaps require low acoustic noise because the actuator operates in a continuous manner. Low acoustic noise can be achieved by using stepper motors, such as the NCV70517 micro−stepping stepper motor driver for bipolar stepper motors. NCV70517 controls the current through the windings of the bipolar 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.

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

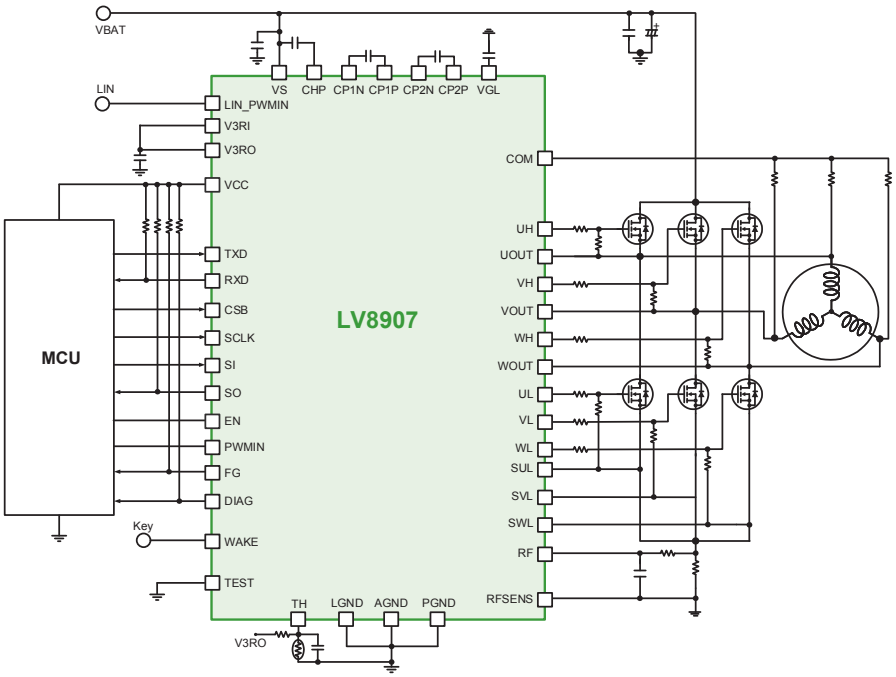
- Direct controlled actuators
  - DC motors (with and without position feedback)
  - Unipolar stepper motors
  - Bipolar stepper motors
- Bus connected mechatronic actuators
  - LIN bipolar stepper motors



* Customer specific embedded software

BLDC Motor Drivers
for Fans & Auxiliary Pumps

BLDC motors enable higher efficiency and torque, and are therefore increasingly being adapted into automotive applications. Designs can be optimized with specialized pre-drivers and gate drivers.



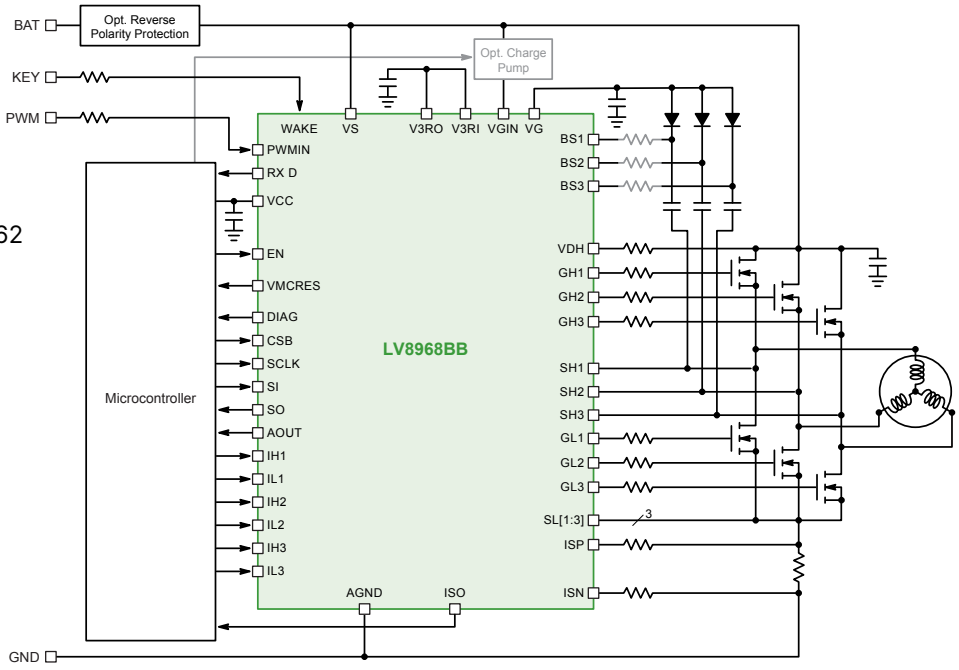
LIN-Based Control Configuration Application Diagram

LV8907UW Features

- Integrated sensor-less control
- Gate drivers for external power MOSFETs
- Protection (under-voltage, over-temperature, over-current, locked rotor, PWM fault)
- V_{IN} of 5.5 – 20 V
- Operation up to 175°C junction temperature
- LIN transceiver with UART ports and LDO
- SPI for MCU control
- Built-in OTP memory for configuration and standalone operation without MCU

LV8968BB Features

- AEC-Q100 Qualified; ASIL B product developed in compliance with ISO 26262
- Operation up to 175°C junction temperature
- Separate power-stage supply for optional charge pump
- Integrated 3.3/5 V, 50 mA LDO
- SPI for real time configuration, control and diagnostics
- Supports multiple commutation algorithms (BEMF detection type and hall input)
- VBAT operating: 8-25 V using standard MOSFET; 6-33 V using logic level MOSFET

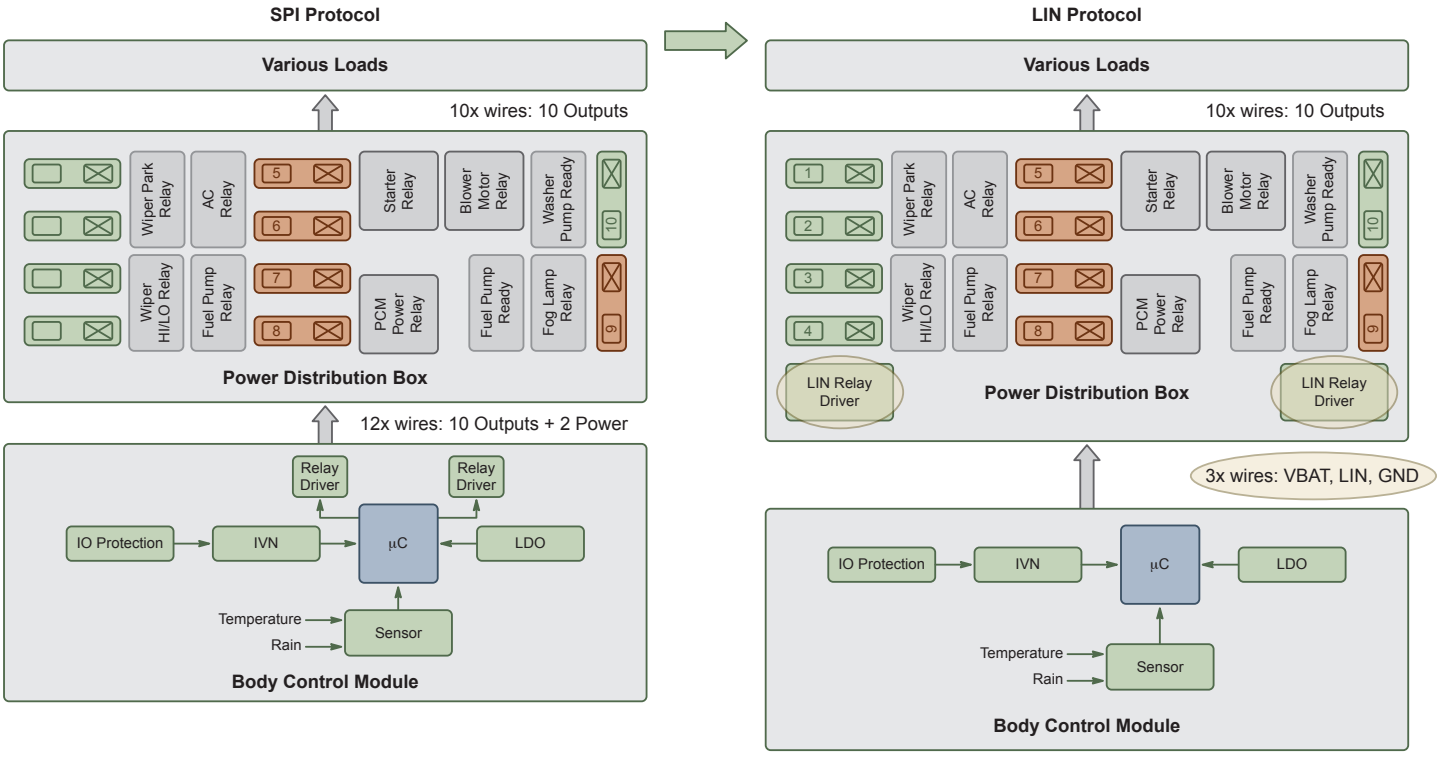


Typical Application Diagram

LIN-Based Low-Side Relay Drivers for Automotive Power Distribution Relays

NCV7748 Features

- Reduce harness complexity for Power Distribution Boxes
- Scalable between 4 or 8 channels
- Ability to control up to 32 relays with Virtual Node concept
- Diagnostics for abnormal load conditions
- Integrated clamps for inductive loads
- Designed for both PCB mounted or socketed relays
- Reduce PCB area and weight



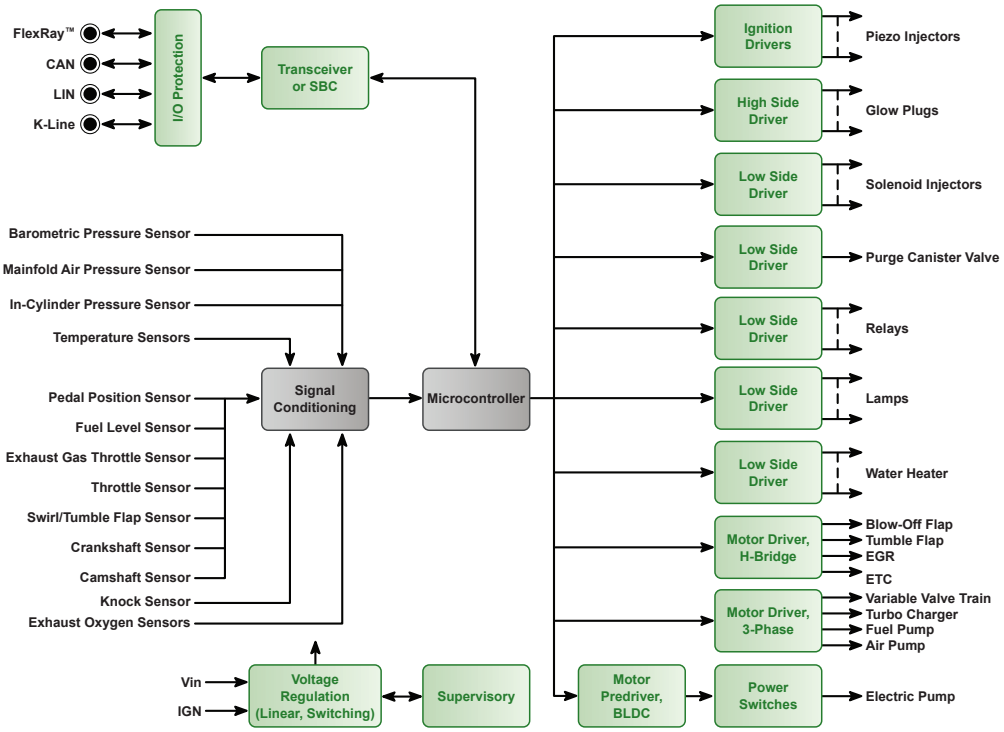
Saves nine interconnect wires between the Body Control Module (BCM) and the Power Distribution Box (PDB)

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%.

onsemi 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

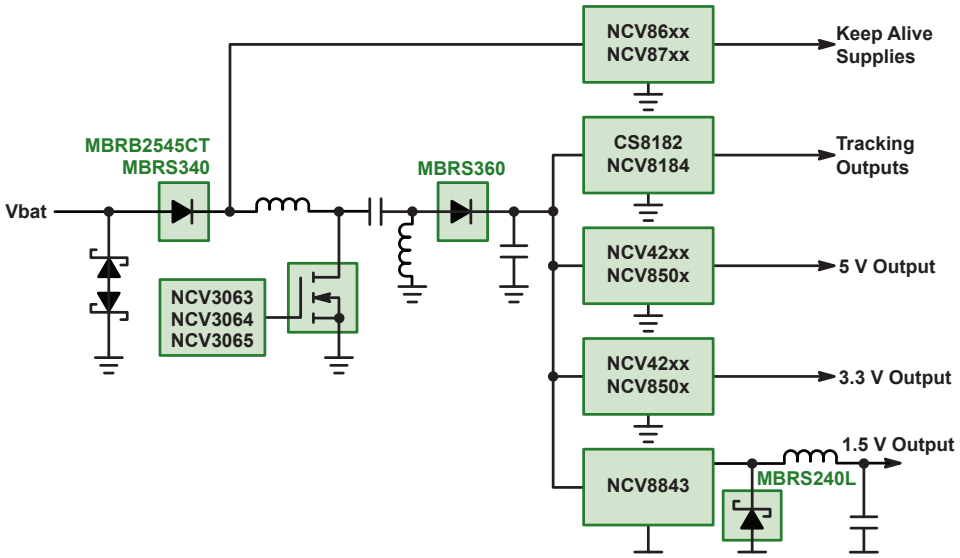
Product Portfolio

- 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.



onsemi 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 NCV8843, to supply the high current, low voltage microcontroller cores.

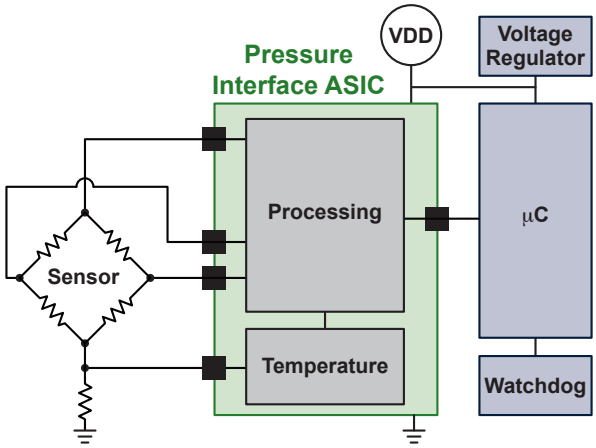
To support 'keep alive' 5 V and 3.3 V voltage rails in an ECU, **onsemi** offers a wide selection of low Iq and standard linear voltage regulators. In addition, fully protected tracking regulators — such as NCV4250-2C, NCV8184, CS8182, and CS8361 — that can power external sensors, complete the portfolio.

Along with the linear regulators and switch mode power supplies, **onsemi**s 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

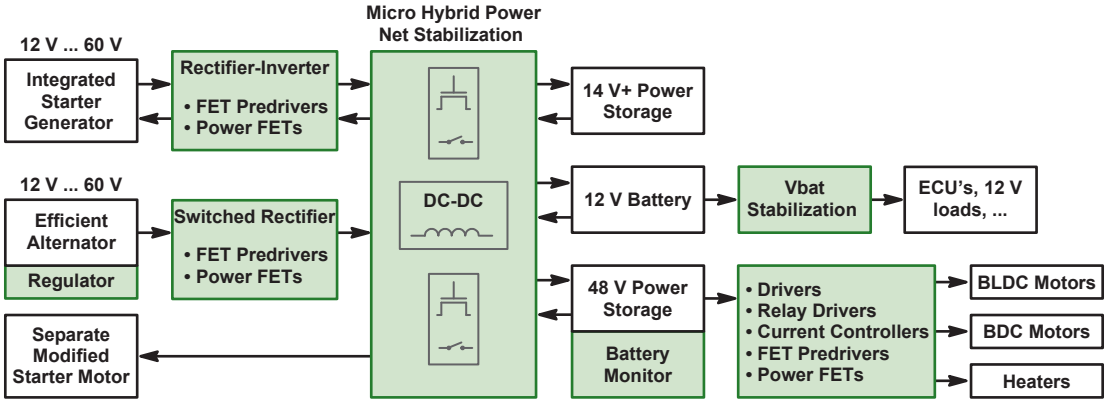
Cylinder Pressure Sensing

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

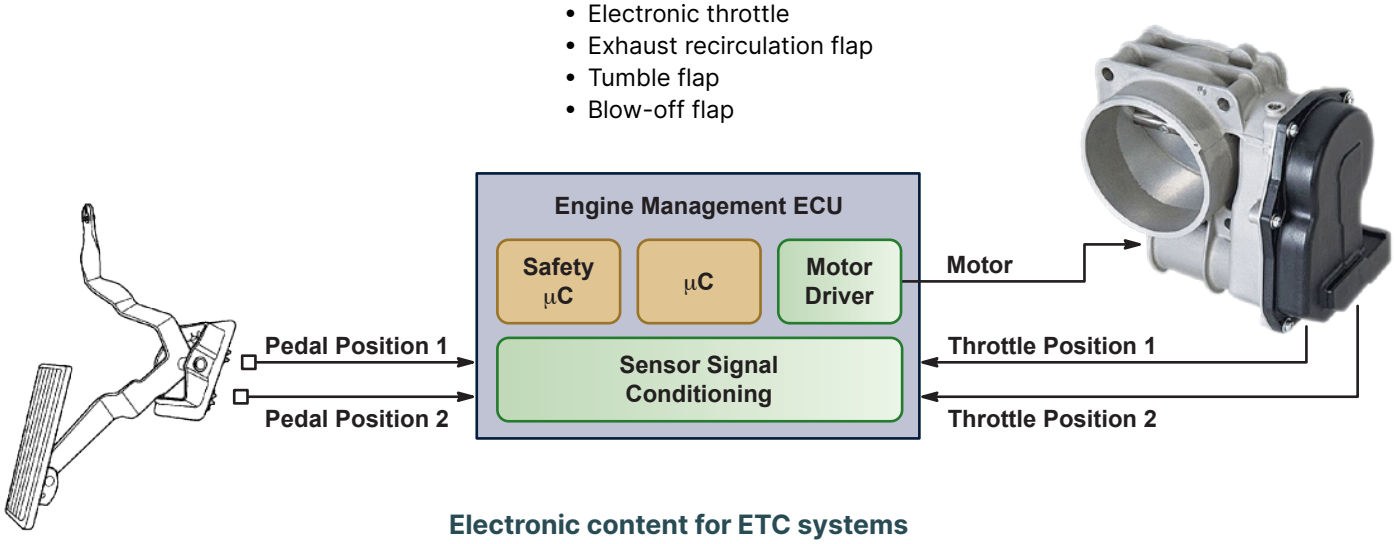
Micro-Hybrids are start-stop vehicles with additional features to reduce CO2 emissions: the internal combustion engine is switched-off while the vehicle is still moving; regenerative brake energy can be captured in a dedicated power-storage system; and electricity generation is avoided during acceleration. 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. **onsemi** offers robust technologies, key intellectual property, and production proven solutions that address the harsh environments in these emerging applications.



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

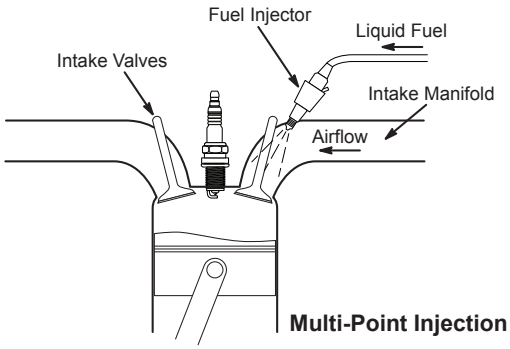


Electronic content for ETC systems

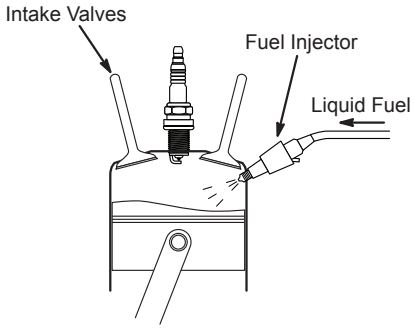
- Pedal position sensor (inductive or Hall effect)
- Throttle position sensor (potentiometer, inductive, or Hall effect)
- DC motor control

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



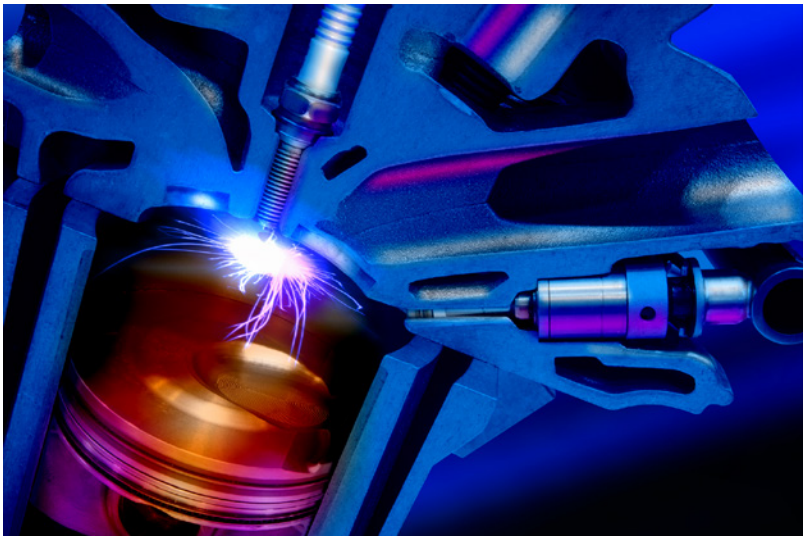
Direct Injection

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

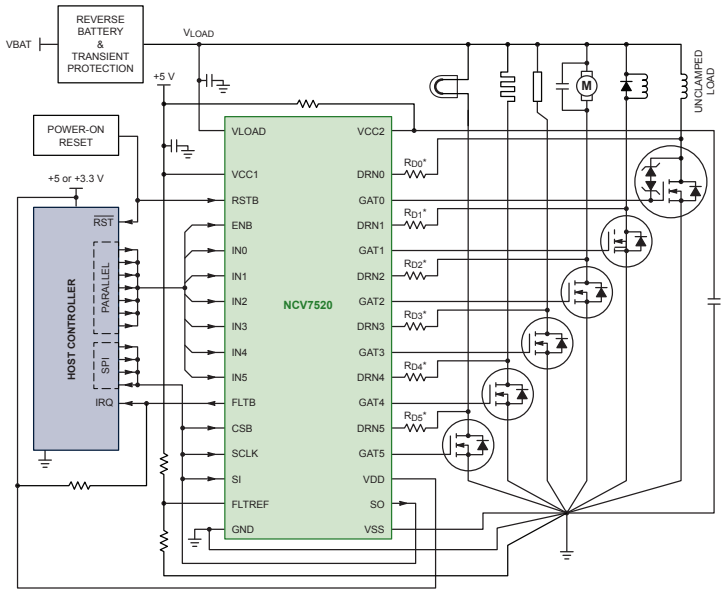
Many diesel engines feature direct injection (DI) technology. The injector nozzle is placed inside the combustion chamber itself. The gasoline direct injection engine (GDI) utilizes this system as well, since it gives a better volumetric efficiency as only air is drawn in through the induction system, 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.

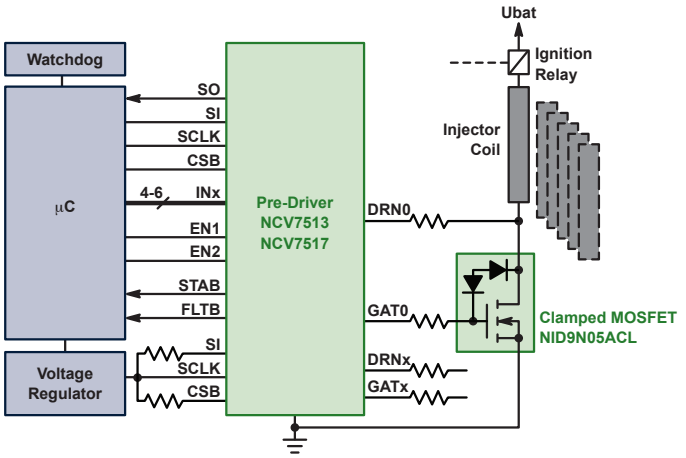


Solutions for Injection Systems

Multi-Point Indirect Injection

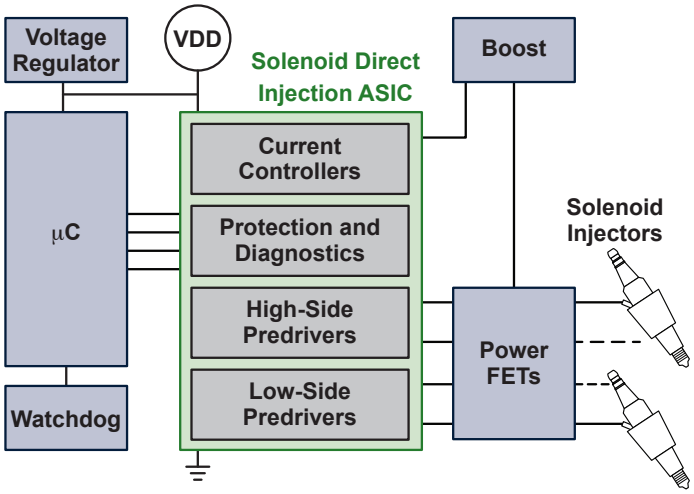
The FLEXMOS™ family from **onsemi** offers application specific scalability through the choice of external MOSFETs. These low-side pre-drivers are programmable six channel products for driving logic-level MOSFETs. The devices are controllable by a combination of serial SPI and parallel inputs. They feature 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.

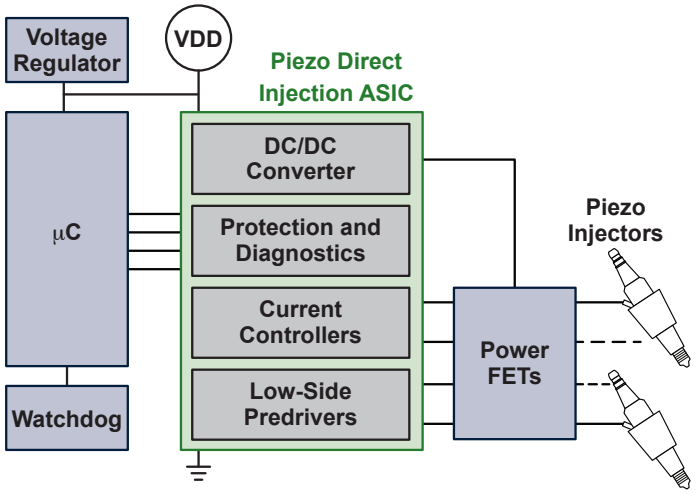




Direct Injection

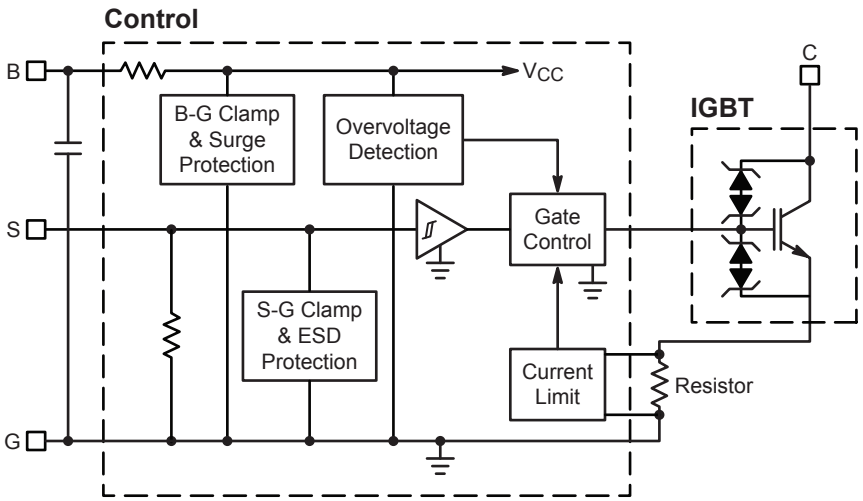
Engine management systems - in particular, injection functions - are subject to extensive qualification cycles, due to the harsh operating conditions of wide temperature and voltage ranges, and switching of inductive and capacitive loads. **onsemi** has developed multiple drivers for injection systems,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





Igniters for Ignition Systems

Provides the power electronic circuit to energize an ignition coil for creating a spark across the spark plug.



Features

- Overcurrent protection
- Overvoltage shutdown
- B input resistor & B-G clamp
- B-G capacitor (filter)
- Clamp voltages 350 - 600 V
- Output current 8 - 20 A

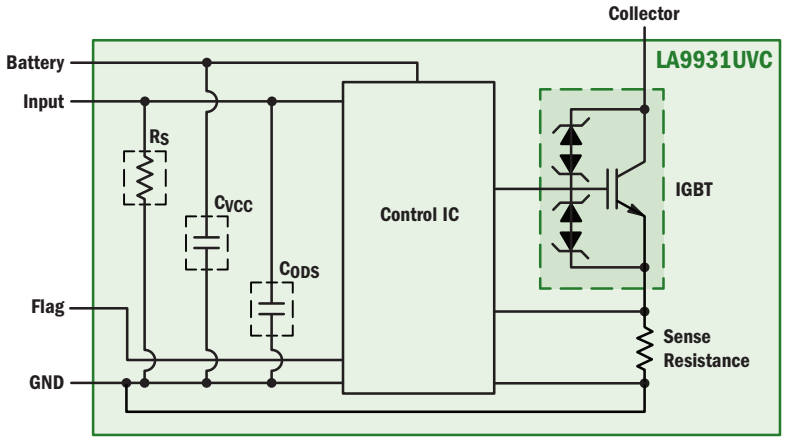
Igniter Module Requirements

- Compact – space constraint in coil head
- Highly robust and reliable – life time > 15 years, under hood

LA9931UVC Igniter Module

Features

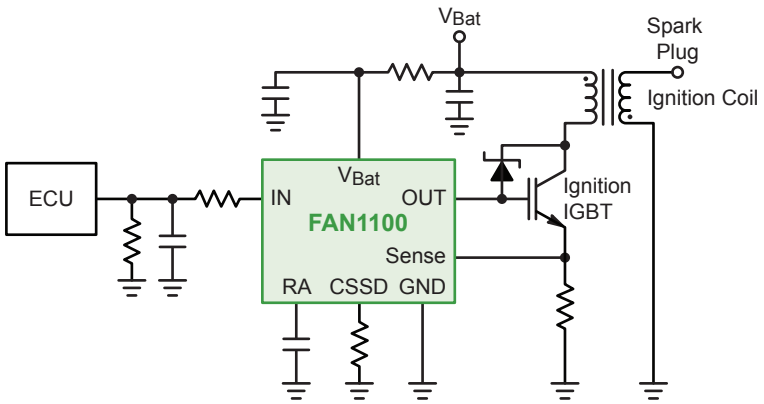
- Complete solution for coil-on-plug applications
- Integrates control circuit, IGBT, passives
- 400 V clamp voltage; 12 A IGBT collector current
- 250 mJ IGBT collector-emitter avalanche energy
- ESD, EMC, ISO pulse: ISO7637-2
- SIP-5J package



Ignition IGBTs

Features

- Stand alone Ignition IGBTs with integrated collector-gate clamp and ESD protection
- Wide product portfolio including customized die/wafer solutions
- Smart Ignition solutions including
- Current sense IGBT
- Integrated control IC
- Stand alone Ignition control IC
- Fully integrated Igniter custom solutions

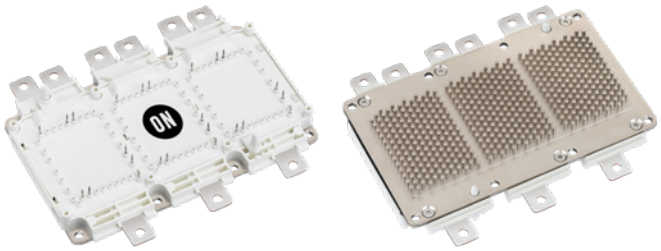


Ignition IGBTs

Device	Clamp Voltage (V)	SCIS Energy (mJ)	I_C @110°C (A)	$V_{CE(sat)}$ Max @25°C (V)	Package(s)
FGD3325G2-F085	250	330	25	1.25	TO-252
ISL9V5036P3-F085	360	500	31	1.6	TO-220
ISL9V5036S3	360	500	31	1.6	TO-262
FGB3236-F085	360	320	26	1.4	TO-263
FGI3236-F085	360	320	26	1.4	TO-263
ISL9V3036S3ST	360	300	17	1.6	TO-263
ISL9V5036S3ST	360	500	31	1.6	TO-263
FGD2736G3-F085	360	270	18	1.35	TO-252
FGD1240G2-F085	400	100	20	1.1	TO-252
FGP3040G2-F085	400	330	25	1.25	TO-220
FGP3440G2-F085	400	335	25	1.2	TO-220
ISL9V3040P3	400	300	17	1.6	TO-220
FGD3040G2-F085	400	330	25	1.25	TO-252
FGD3440G2-F085	400	335	25	1.2	TO-252
FGI3040G2-F085	400	330	25	1.25	TO-252
ISL9V2040D3ST	400	200	10	1.9	TO-252
ISL9V3040D3ST	400	300	17	1.6	TO-252
FGB3040G2-F085	400	330	25	1.25	TO-263
FGB3440G2-F085	400	335	25	1.2	TO-263
ISL9V2040S3ST	400	200	10	1.45	TO-263
ISL9V2540S3ST	400	250	10	1.8	TO-263
ISL9V3040S3ST	400	300	17	1.6	TO-263
FGB3040CS	400	300	19	1.6	TO-263-6
FGD3245G2-F085	450	320	23	1.25	TO-252
FGB3245G2-F085	450	320	23	1.25	TO-263
ISL9V5045S3ST-F085	450	500	43	1.6	TO-263
FGD3050G2-F085	500	300	27	1.2	TO-252
FGB3056-F085	560	300	24	1.1	TO-263

VE-Trac™ Power Integrated Modules for Traction Inverters

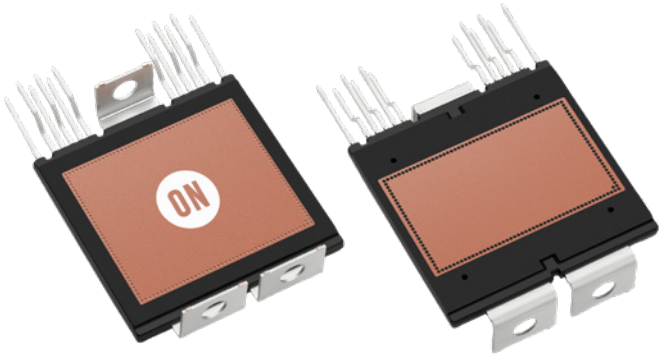
VE-Trac Direct Six-Pack



- Six-pack integrated power module with highly compact footprints for Hybrid (HEV) and Electric Vehicle (EV) traction inverter applications
- Press-fit and soldered pins
- Direct liquid cooling for class-leading low thermal impedance
- T_{jmax} = 175°C continuous operation

Device	Current Rating (A)	Voltage Rating (V)	Package
NVH820S75L4SPA NVH820S75L4SPB NVH820S75L4SPC	820	750	VE-Trac Direct
NVH950S75L4SPB NVH950S75L4SPC	950	750	
NVH660S75L4SPFB NVH660S75L4SPFB	660	750	
NVH640S75L4SPB NVH640S75L4SPC	640	750	

VE-Trac Dual Half-Bridge

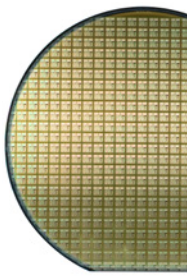


- High-power transfer molded half-bridge modules with Dual-Side Cooling (DSC) technology offers unparalleled value in traction drives for EV/HEVs
- Scalable design for best-in-class $/kW
- Chip level current and temperature sensors
- Ultra-low package inductance (< 7 nH)
- Wire-bond free for extended lifetime
- T_{jmax} = 175°C continuous operation

Device	Current Rating (A)	Voltage Rating (V)	Package
NVG800A75L4DSC	800	750	VE-Trac Dual
NVG800A75L4DSB	800	750	
NVG600A75L4DSE2	600	750	VE-Trac Dual Gen II
NVG500A75L4DSF2	500	750	

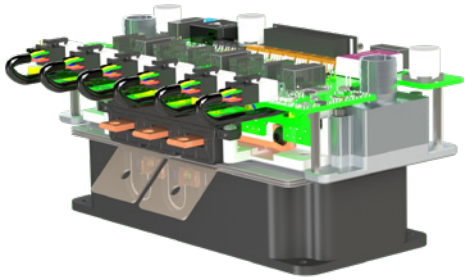
VE-Trac Chip

- T_{jmax} = 175°C continuous operation
- Low conduction losses
- Solderable and sinterable top and back metal
- Optimized for traction modules
- AEC-Q101 Qualified



Device	Tech	Die Size (mm x mm)
PCGLA200T75NF8	IGBT FS4	10x10
PCRKA20075F8	FRD EF2	10x5
PCGLA200T75NF8M2	IGBT FS4	10x10
PCRKA20075F8M2	FRD EF2	10x5

Inverter Evaluation Kits



Dual 750 V/800 A Half-Bridge Reference Inverter

- Direct (750 V/820 A) and dual (750 V/800 A) inverter kits
- Ultra-low inductance design
- Versatile assembly for efficient evaluation
- NCV57000 isolated gate driver with protection features

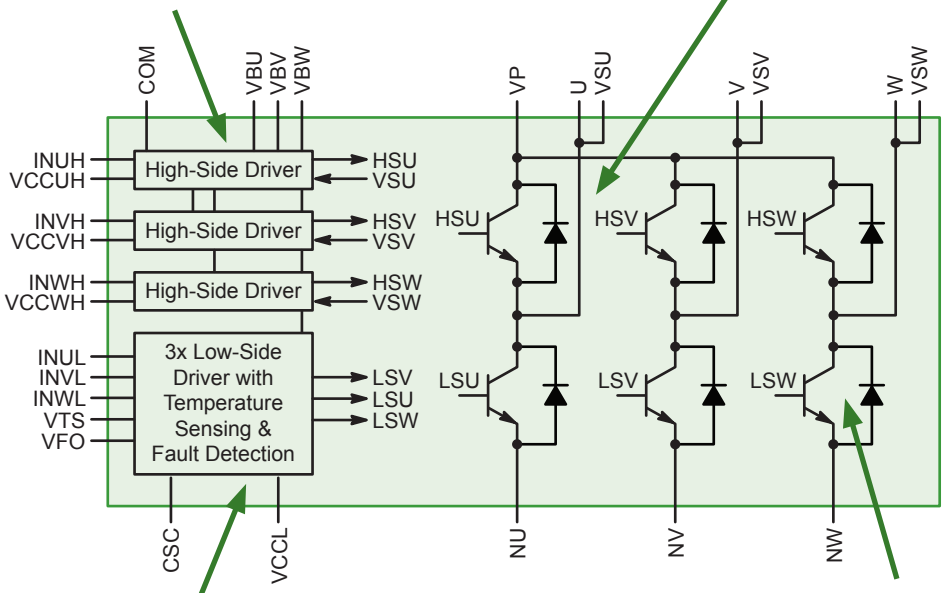
High Voltage Power Modules

HVIC

- 2 A source / 4 A sink
- fpwm up to 20 kHz
- UVLO protection

Diode

- Soft recovery for easy drive and low EMI



LVIC

- 2 A source / 4 A sink
- fpwm up to 20 kHz
- Protection UVLO, OCP, TSU Fault out
- Thermal Sensing 0°C~150°C via Vts

IGBT

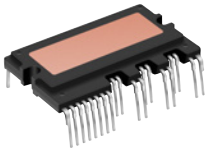
- Low conduction and switching losses
- Optimized switching dv/dt for motor control
- Short circuit rated

Features

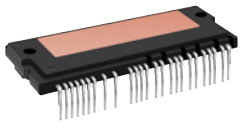
- Ultra low Rth (<0.35°C/W) via outstanding substrate DBC
- Guaranteed Tj = 175°C
- Outstanding ruggedness via SCWT is over 5 µs @ worst case
- Reduced design cycle & assembly process as IPM fully optimized for stable EMI & thermal performance

Motor Driver Modules

Device	Series	BV (V)	Current Rating (A)	Gate Driver	$R_{th(j-c)}$ Max (°C/W)	Substrate	Package(s)
NFVA25012NP2T	ASPM34	1200	50	Integrated	0.36	AIN	ASPM-34
NFVA23512NP2T	ASPM34	1200	35	Integrated	0.73	Al_2O_3	ASPM-34
NFVA22512NP2T	ASPM34	1200	25	Integrated	0.81	Al_2O_3	ASPM-34
NFVA35065L32	ASPM27-V2	650	50	Integrated	0.35	AIN	ASPM-27
NFVA34065L32	ASPM27-V2	650	40	Integrated	1.40	Al_2O_3	ASPM-27
NFVA33065L32	ASPM27-V2	650	30	Integrated	1.55	Al_2O_3	ASPM-27
NFVA36065L42*	ASPM27-V3	650	60	Integrated	0.33	AIN	ASPM-27
NFVA35065L42*	ASPM27-V3	650	50	Integrated	1.30	Al_2O_3	ASPM-27
NFVA33065L42*	ASPM27-V3	650	30	Integrated	1.50	Al_2O_3	ASPM-27



SPM-27



SPM-34

Charge Pumps for Power Supplies

Charge Pump Regulators are flexible devices providing buck, boost or buck/boost conversion. The main advantage of using charge pump architectures is an inductor is not required, reducing application cost and design effort compared to SMPS converters utilizing an inductor. Charge pumps are suitable for applications where am LDO dissipates too much power or boost (or buck/boost) operation is mandatory.

Main Features of Automotive Charge Pumps

Small components count and PCB area

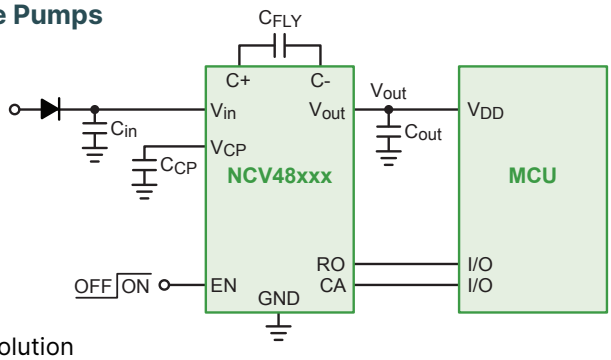
- No inductor needed
- Works with ceramic capacitors

Variable topology

- Buck or Pass mode (LDO)
- Boost
- Buck/Boost

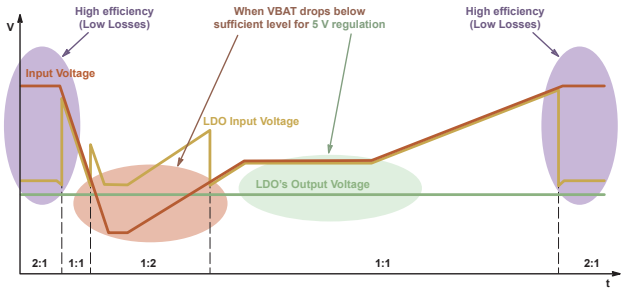
Efficiency

- Twice as efficient compared to LDO solution

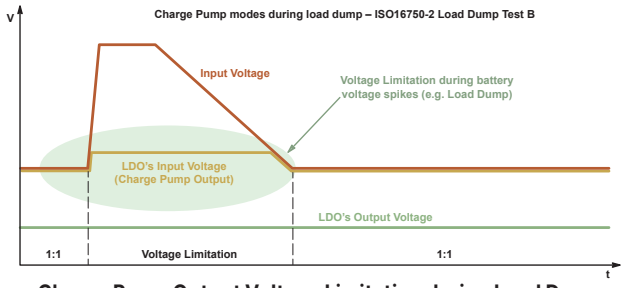


The NCV48xxx charge pump portfolio includes buck, boost, and buck/boost architectures with various output current and features. Compared to charge pumps on market, specific feature of used architectures is access to charge pump output allowing its voltage limitation during battery voltage transients (e.g. Load Dump). This feature enables placing lower voltage rating bulk capacitor at the charge pump output, and reduces overall application cost. Current limitation function inrush current charging reduces the bulk capacitor size as well.

Additional features such as Reset Output (RO) and Charge Pump Active Output (CA, optional feature) are available for communication with MCU.



Buck, Boost and Pass (LDO) Operation Modes



Charge Pump Output Voltage Limitation during Load Dump

Comparison of Battery Connected LDO, Charge Pump and SMPS

Converter Type	Efficiency	Output Current	Inductor	Buck (or LDO)	Boost	Buck/ Boost
LDO	Low	Low		✓		
Charge Pump	Middle	Middle		✓	✓	✓
SMPS	High	High	✓	✓	✓	✓

Charge Pumps

Device	Buck	Boost	Pass Mode (LDO)	Output Current In Buck Mode	Output Current In Boost Mode	Output Current In Pass Mode	FSW	Output Voltage	Tolerance	Sleepmode Current (Typ)	Quiescent Current (Max) @ Low Load (Load)	Enable	Reset	Charge Pump Active Output	TSD	UVLO	Overvoltage	Short Circuit	Current Limit	Peak Transient (V)	Package(s)
NCV48220		✓	✓	–	Up to 150 mA	Up to 150 mA	450 kHz	5 V	±2 %	1 μA	40 μA (100 μA)	✓	✓		✓	✓	✓	✓	✓	45	SOIC-16W
NCV48920	✓	✓		Up to 600 mA	Up to 300 mA		450 kHz	5 V	±2 %	1 μA	50 μA (100 μA)	✓	✓	✓	✓	✓	✓	✓	✓	45	TSSOP-14 Epad, DFN

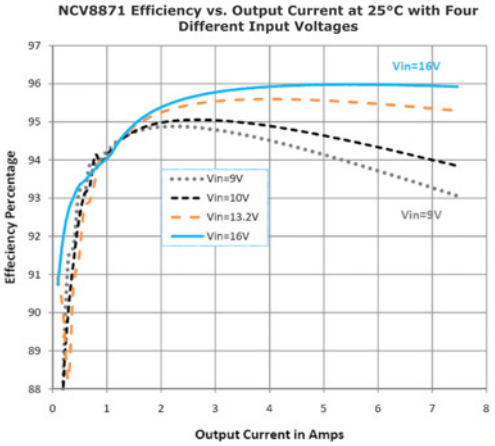
Switch Mode Power Supplies (SMPS)

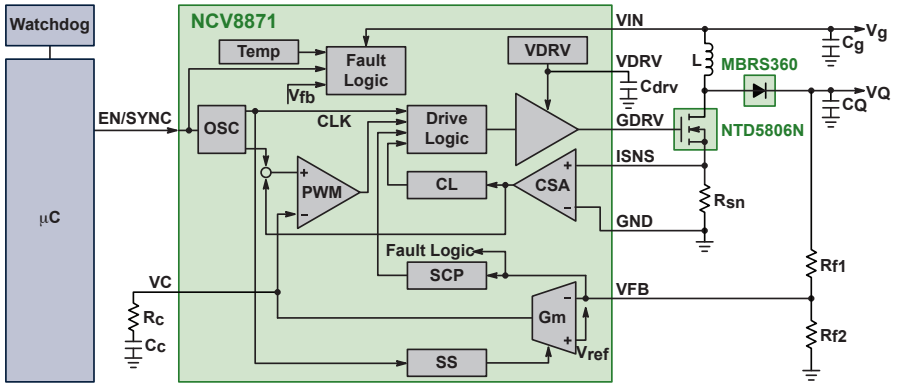
Boost SMPS
- Standard Regulators
- Standard Controllers

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

Boost SMPS

The NCV887x and NCV89803x boost family (with adjustable output and non-synchronous boost controllers) drive an external N-channel MOSFET. The devices use peak current mode control with internal slope compensation. These boost products incorporate an internal regulator that supplies charge to the gate driver. Designed for powertrain, start-stop, and display applications, the devices can be configured as a SEPIC converter to regulate the car battery voltage, which can vary from 4.5-18 V to a regulated output of 6 V in an engine ECU. Any boost controller 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.

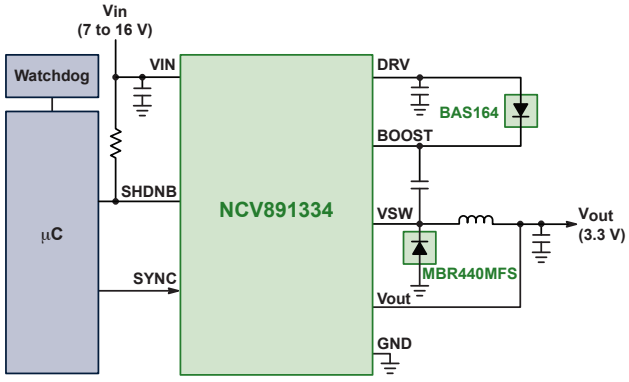




Buck SMPS

onsemi is developing high efficiency, high frequency switch mode power supplies that can withstand automotive load transients up to 45 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 2 MHz operation with high output current capability (up to 3A for regulators and much more for controllers).

The NCV891×34 is a dual mode regulator intended for battery-connected applications that must operate up to a 45 V input supply. Hybrid Low Power Mode allows the NCV891×34 to operate either as a PWM buck converter, or as a low drop-out linear regulator, and the NCV891×34 is suitable for systems with low noise and low quiescent current requirements, often encountered in automotive driver information systems. In addition to synchronization and protection features, the high switching frequency produces low output voltage ripple, even when using small inductor values and an all-ceramic output filter capacitor — forming a space-efficient switching regulator solution.

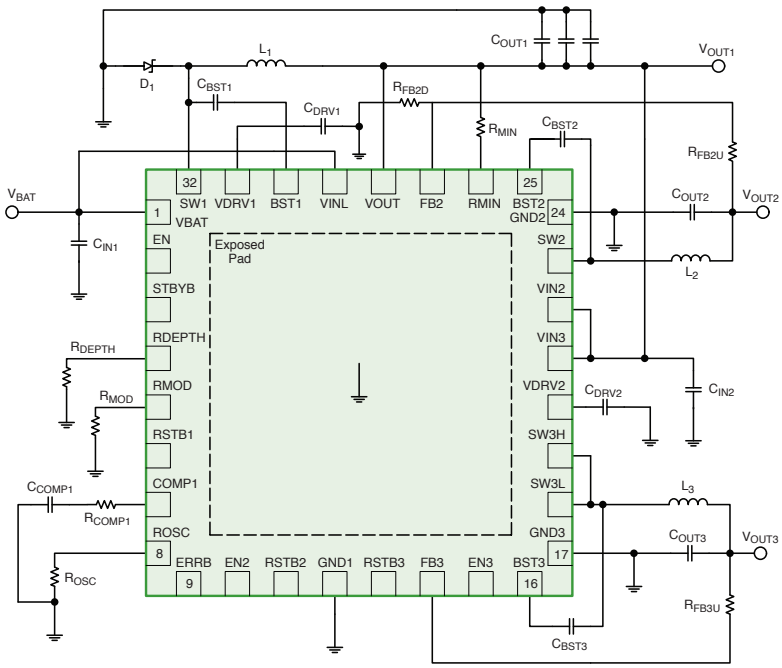


Battery-Connected SMPS Power Management Units (PMUs)

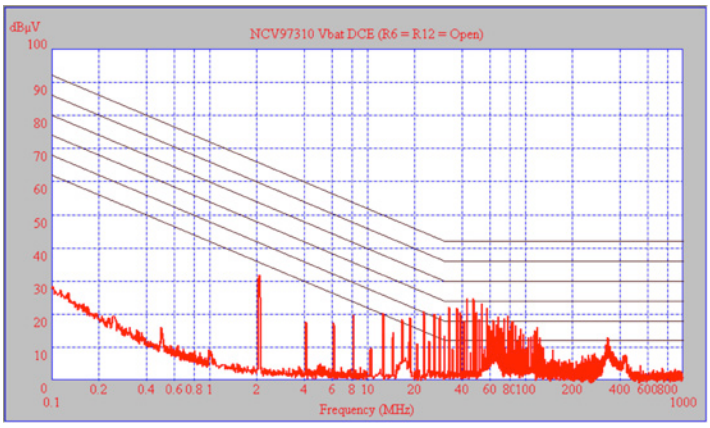
The NCV9731x is a high-frequency multi-output regulator consisting of one battery-connected non-synchronous buck regulator with a user-selected low-Iq linear standby mode, and two low-voltage synchronous buck regulators.

Features

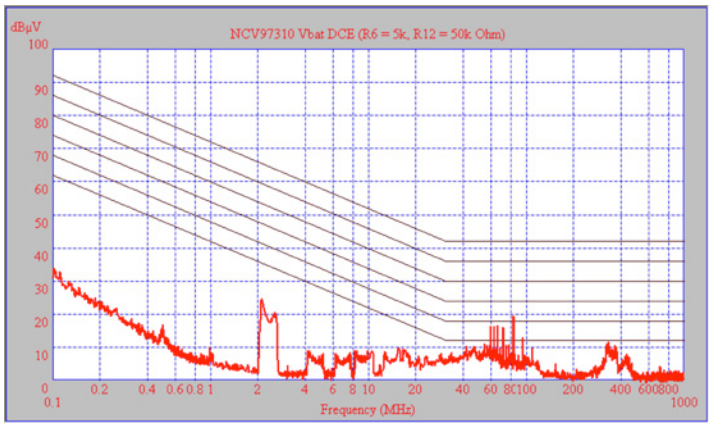
- 2 MHz switching frequency
- Operation down to 4.1 V input
- Withstands 45 V load dump
- Downstream buck regulators adjustable from 1.2 V to 3.3 V
- 3 independent reset pins
- -40 °C to 150°C operation



Device	Type	I_q Max (V)	Outputs	Primary Output (V)	Spread Spectrum	OVSD Threshold Max (A)	Package(s)
NCV97310	Switching	25	3	3.3 or 5.0	Yes	36	QFN-32 EP
NCV97311	Switching	25	3	3.3 or 5.0	Yes	40	QFN-32 EP



Typical Emissions Profile



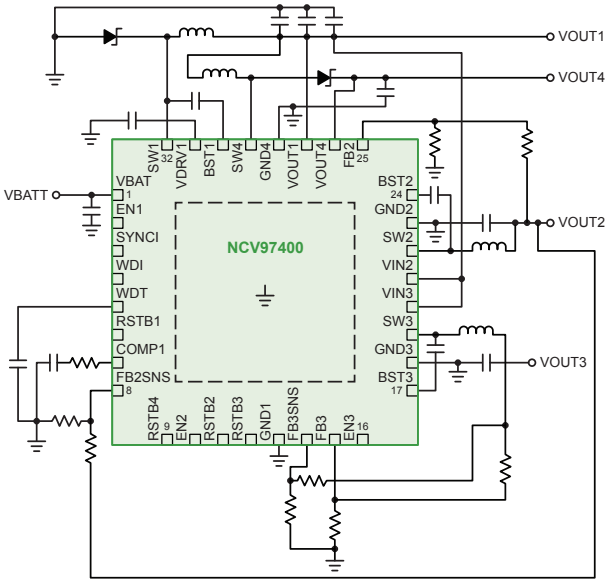
Emissions with Spread Spectrum

Battery-Connected SMPS Power Management Units (PMUs)

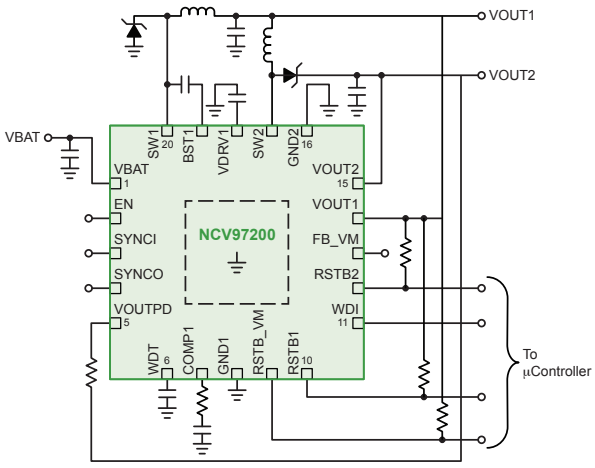
The NCV97400 is a 4-output monolithic regulator consisting of 3 buck regulators and 1 boost regulator, with supervisory functions including window voltage monitoring on all outputs and a window watchdog. This device is ideal for ADAS (Advanced Driver Assistance Systems) applications, and utilizes an independent voltage reference and an adjustable independent oscillator to realize the supervisory features.

Features

- 4 outputs
  - 3.3 V primary buck which delivers up to 3 A
  - 5 V boost to supply, for example, IVN circuits
  - 2 adjustable secondary bucks (0.8 - 2.5 V) which deliver up to 2 A
- 3 Enabled Buck Converters
- Voltage monitoring
- Wide input of 4.1 to 40 V with Undervoltage Lockout (UVLO)
- 2 MHz operation with spread spectrum capability
- Window Watchdog with independent references
- Safety Design – ASIL B



The NCV97200 is a 2-output monolithic regulator consisting of 1 buck regulator and 1 boost regulator, with supervisory functions including window voltage monitoring on all outputs and a window watchdog. This device is ideal for ADAS (Advanced Driver Assistance Systems) applications and utilizes an independent voltage reference and an adjustable independent oscillator to realize the supervisory features.



Features

- 3.3 V primary buck which delivers up to 3 A
- 5 V boost to supply, for example, IVN circuits
- 1 Boost Converter for IVN supply
- Wide input of 4.1 to 40 V with Undervoltage Lockout (UVLO)
- 2 MHz operation with spread spectrum capability
- Window Watchdog with independent references
- Safety Design – ASIL B

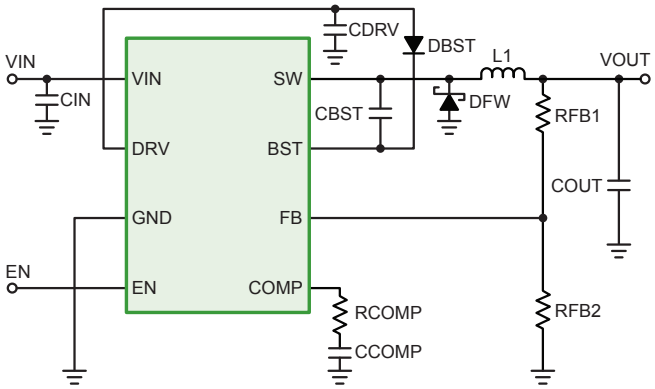
Battery-Connected Buck SMPS for Primary Power Conversion

The 2 MHz NCV890xxx and NCV891xxx 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

- Maximum DC current from 0.6 A to 3 A
- 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
- Low I_q: some versions have low I_q in light load conditions
- Standard features: Under-voltage lock-out, frequency fold back, peak current limit, thermal shut down, and low Iq sleep mode

Device	DC Current Max (A)	Sync	Load Dump (V)	I_q (μA)	Package(s)
NCV891330	3.0	Yes	45	30	SOIC-8
NCV890201	2.0	Yes	40	–	DFN-10
NCV890231	2.0	Yes	45	–	DFN-10
NCV890131	1.2	Yes	45	–	DFN-10
NCV890130	1.2	No	45	–	DFN-8
NCV890101	1.2	Yes	40	–	DFN-10
NCV891130	1.2	No	45	30	SOIC-8
NCV890100	1.2	No	40	–	DFN-8, SOIC-8 EP
NCV890430	0.6	Yes	45	–	DFN-8



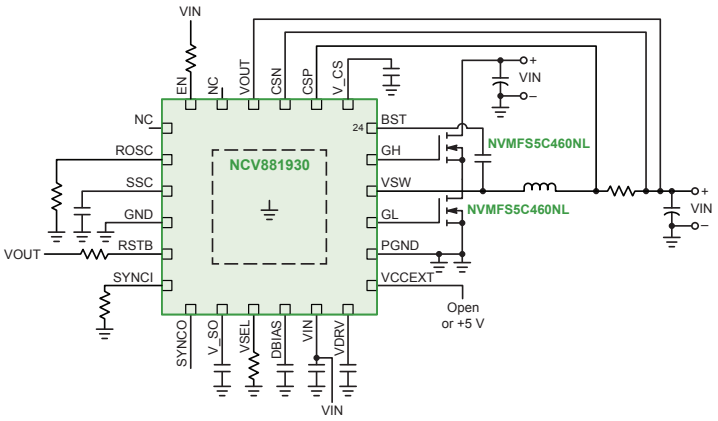
Battery-Connected Low Iq Buck SMPS Controllers

The NCV891930 is a 2 MHz fixed-frequency, low quiescent current, synchronous buck controller with spread spectrum that operates up to 38 V (typical). The NCV891930 is capable of converting from an automotive input voltage range of 3.5 V (4.5 V during startup) to 18 V at a constant base switching frequency, eliminating the need for costly filters and EMI countermeasures. Several protection features such as UVLO, current limit, short circuit protection, and thermal shutdown are provided.

High switching frequency produces low output voltage ripple even when using small inductor values and an all-ceramic output filter capacitor, forming a space-efficient switching solution.

Features

- Fixed output : 3.3, 3.65, 4.0 or 5.0 V
- 30 μA operating current at no load
- 75 mV current limit sensing
- Wide input of 3.5 to 38 V with Over- and Undervoltage Lockout
- Input and output synchronization
- 2 MHz operation with spread spectrum capability
- Adaptive non-overlap circuitry
- Short Circuit Protection; Thermal Shutdown

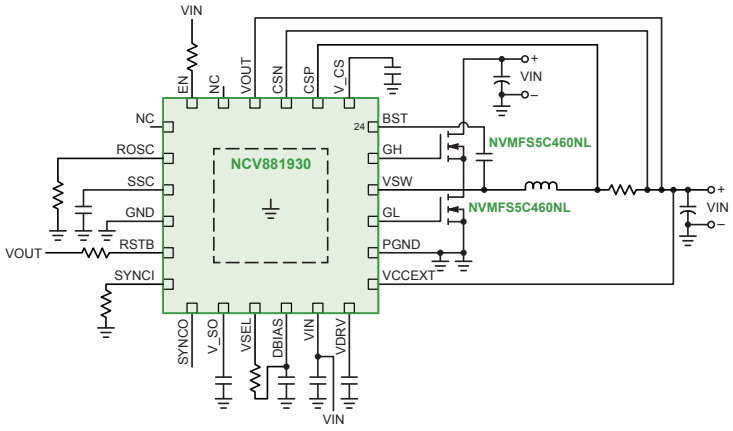


3.3 V Application Schematic Example

The NCV881930 is a 410 kHz fixed-frequency, low quiescent current, synchronous buck controller with spread spectrum that operates up to 38 V (typical). The NCV881930 is capable of converting from an automotive input voltage range of 3.5 V (4.5 V during startup) to 18 V at a constant base switching frequency. Several protection features such as UVLO, current limit, short circuit protection, and thermal shutdown are provided.

Features

- Fixed output: 3.3 or 5.0 V
- 30 μA operating current at no load
- 50 mV current limit sensing
- Wide input of 3.5 to 38 V with Over- and Undervoltage Lockout
- Input and output synchronization
- 410 kHz operation with spread spectrum capability
- Adaptive non-overlap circuitry
- Short Circuit Protection; Thermal Shutdown



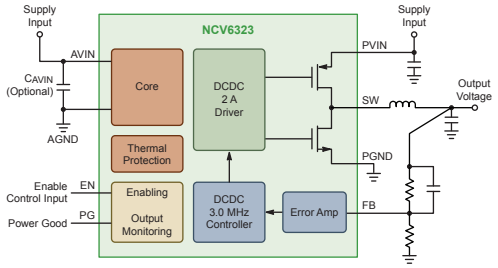
5 V Application Schematic Example

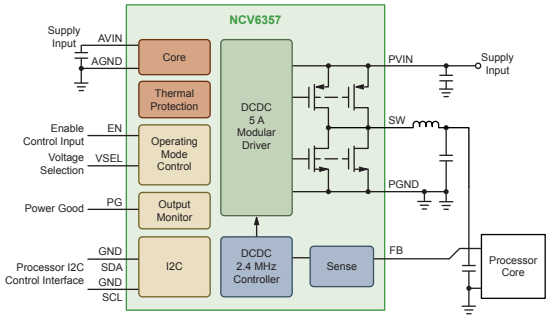
Low Voltage Buck SMPS and PMU for Secondary Power Conversion

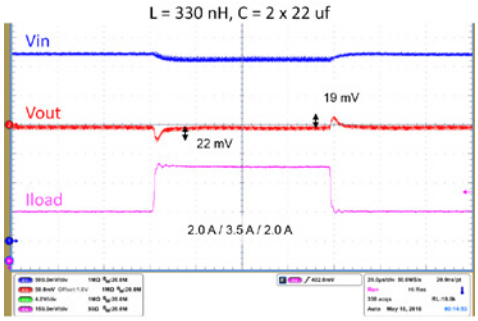
Supplied from a pre-regulated voltage rail, the low voltage buck SMPS and PMU support a wide variety of end applications such as clusters, cameras, radars and other peripherals.

NCV6323, NCV6324 – 2 A PFM/PWM Buck

NCV6323 and NCV6324 are adjustable monolithic synchronous buck converters with integrated power stage. They are able to deliver up to 2 A DC and operate in forced PWM (NCV6323) or in automatic PFM/PWM (NCV6324) for optimized low load efficiency. The devices come in a small DFN package, and the 3 MHz switching frequency allows the use of small size inductors and capacitors. They are therefore ideally suited for space constrained applications.





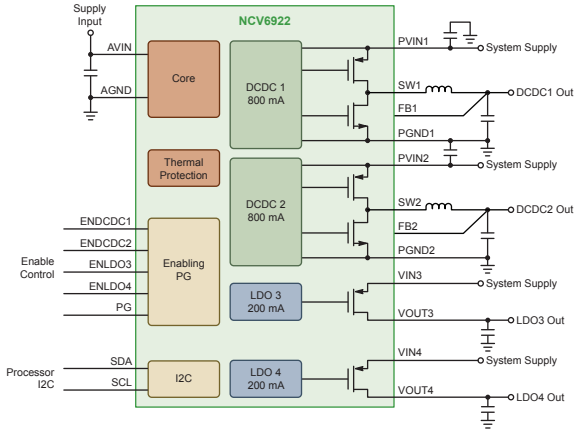


NCV6356, NCV6357 – 5 A AOT Buck

NCV6356 and NCV6357 are programmable monolithic synchronous buck converters with integrated power stage and dynamic voltage scaling support. They are able to deliver up to 3 A DC at 105°C ambient and up to 6 A of peak current. Their adaptive constant-on-time architecture allows for the use of low valued inductors and provides a very fast transient load response (20 mV/1.5 A/500 ns) which makes them ideally suited for high performance applications. The NCV6356 comes with I2C and Interrupt pin; the NCV6357 with I2C and Power Good pin.

NCV6922 – PMU 2 Buck 2 LDO

The NCV6922 is a low voltage PMU including 2 buck converters of 800 mA and 2 low dropout, low noise regulators of 200 mA. The device is fully programmable through I2C and also through factory programming. Virtually any power up sequence and output voltage combination can be created. The NCV6922 is ideally suited for surround and rearview camera designs in conjunction with **onsemi** image sensors.

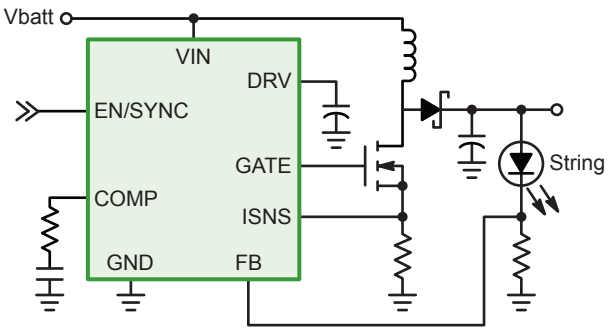


Boost/Flyback/SEPIC SMPS Controllers

The highly flexible NCV8871, NCV8873, and NCV89803x 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 NCV89803x 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:

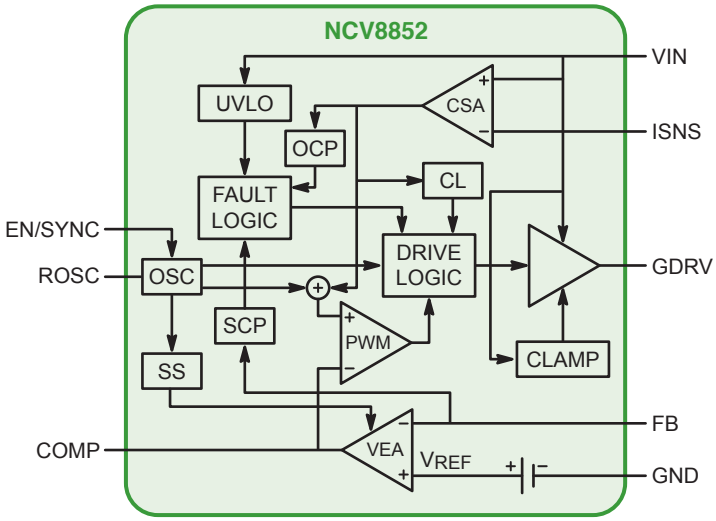
- Fsw:170 kHz to 1 MHz for NCV887x;
  170 kHz to 2 MHz for NCV89803x
- Minimum on-time
- Max duty cycle
- Slope compensation
- Current limit
- Gate drive voltage
- Gate drive strength

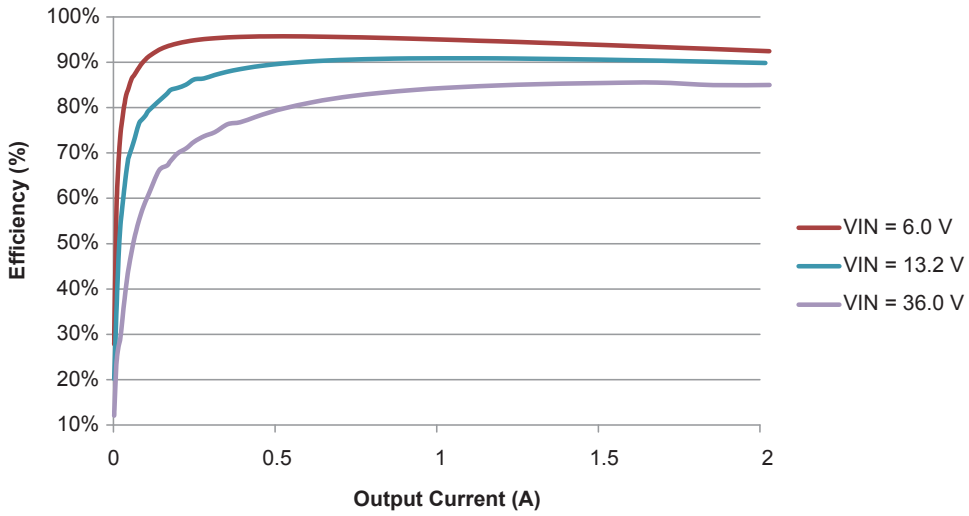
Low Dropout Buck SMPS for System Supply

NCV8852 and NCV8853 adjustable-output non-synchronous buck controllers drive an external P-channel MOSFET. The devices use peak current mode control with internal slope compensation, and incorporate an internal regulator that supplies charge to the gate driver.

Features

- Ultra low Iq sleep mode
- Adjustable output with 800 mV ±2% reference voltage
- Wide input of 3.1 to 44 V
- 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



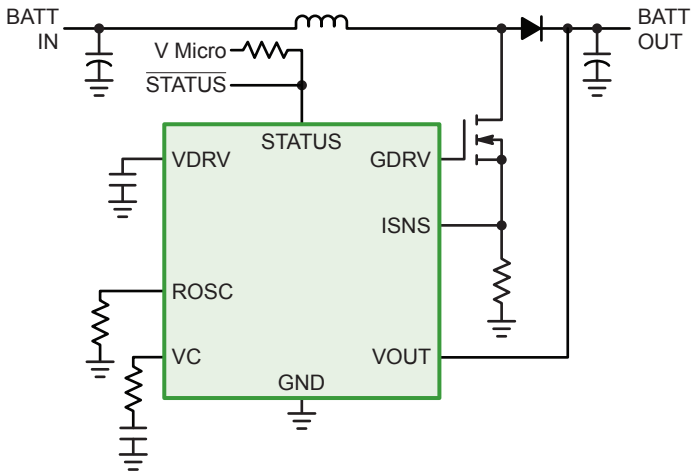


Pre-Boost Controllers for Low Battery Conditions

The NCV887xxx portfolio comprises a Non-Synchronous Pre-Boost controller family designed to supply a minimum output voltage during Start-Stop vehicle operation and other battery voltage sags. The controllers drive an external N-channel MOSFET.

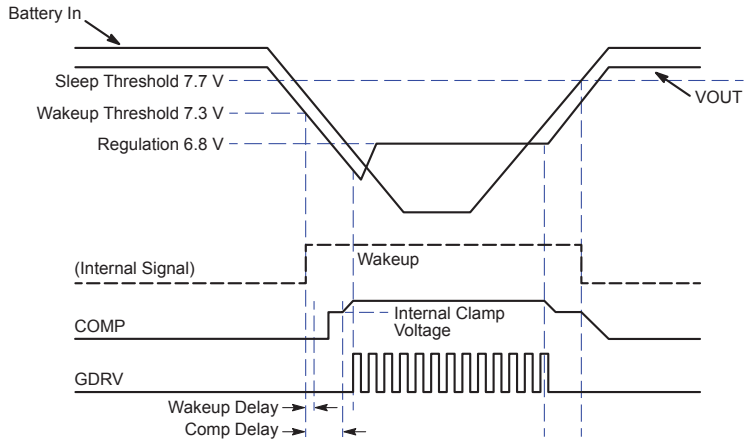
Features

- Wide Input Voltage Range of 2 V to 40 V, 45 V Load Dump
- Automatic Enable Below Wake Up Threshold Voltage (Factory Programmable)
- Factory programmable frequency options or frequency adjust resistor option
- Boost Mode Operation at Regulation Set Point
- 2% Output Accuracy Over Temperature Range
- Peak Current Mode Control with Internal Slope Compensation
- Low Quiescent Current in Sleep Mode (<12 mA Typical)



NCV887600 Simplified Application

Device	V_{out} (V)	Frequency (kHz)	Slope Compensation (mV/µs)	Current Limit (mV)	Osc Frequency Adjust	Status Pin	Disable Pin	Package(s)
NCV887600	6.8	170	34	400	✓	✓		SOIC-8
NCV887601	6.8	170	53	200	✓	✓		SOIC-8
NCV887700	6.8	170	34	400	✓		✓	SOIC-8
NCV887701	6.8	170	53	200	✓		✓	SOIC-8
NCV887720	10	170	53	200	✓		✓	SOIC-8
NCV887740	12	170	53	200	✓		✓	SOIC-8
NCV887801	6.8	450	53	200		✓	✓	SOIC-8

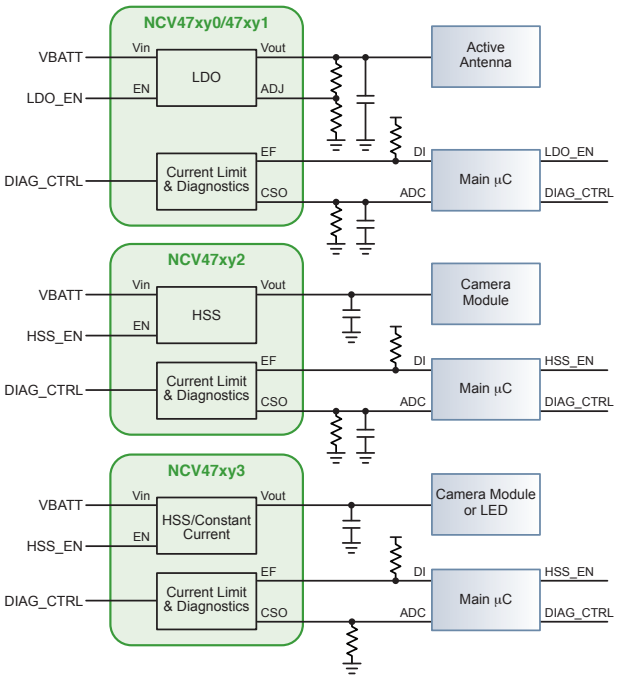


Typical Output Waveforms Through Battery Cranking Profile

Current Sense LDO and High Side Switch Applications

Current sense LDO linear voltage regulators and High Side Switches (HSS) 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 to implement required steps (e.g., switch off the LDO or HSS with overloaded or unloaded output, or short to battery). 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. Typical applications are: active antenna, camera module and microphone. Current sense LDOs and HSS also provide reverse battery, reverse bias, short-to-battery, short-to-ground, and thermal shutdown protection features.

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, and its guaranteed ratio and precision is shown in the table Current Sense Regulators/Switches. This information can be processed by ADC converter of MCU. Error Flag is open collector output and it provides digital signal to MCU indicating open load, overcurrent, short to ground or short to battery information, and it can be processed by digital input of MCU.



The NCV47xx0 and NCV47xx1 product families are Current Sense LDOs with analog or analog/digital diagnostics. These are primarily used for supplying active antennae or microphones.

The NCV47xx2 product families are Current Sense HSS parts with analog and digital diagnostics. These are primarily used for supplying out of module loads (e.g. camera module).

The NCV47xx3 product families are Current Sense HSS/Constant Current parts with analog and digital diagnostics. These parts have enhanced current limitation features eliminating input inrush current and very low reverse bias currents, and are primarily used for supplying out of module loads (e.g. camera module) or constant current loads (e.g. LEDs). Only RCSO is required for current limitation.

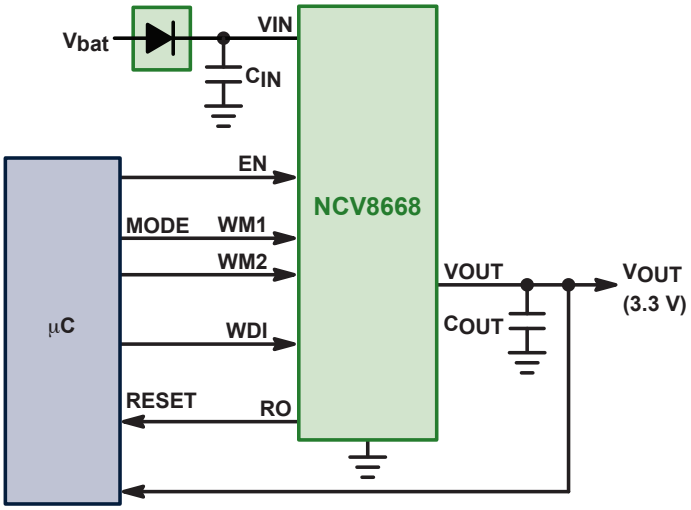
Current Sense Regulators/Switches

Device	Output Current (mA)	Output Voltage (V)	Dropout Max (mV)	Sleepmode Current Max (µA)	Quiescent Current (Max) @ Low Load (Load)	Current Mirror Precision	Current Mirror Ratio	Error Flag	Package(s)
NCV47551	20	Adj	500	10	380 µA (100 µA)	±10%	1:1		SOIC-8
NCV47411	2x 100	Dual Adj	550	10	370 µA (500 µA)	±10%	50:1		TSSOP-14 EP
NCV47721	200	Adj	500	10	1 mA (500 µA)	±5%	100:1	✓	TSSOP-14 EP
NCV47821	2x 200	Dual Adj	500	10	1 mA (500 µA)	±5%	100:1	✓	TSSOP-14 EP
NCV47722	250	High Side Switch	400	10	1.3 mA (500 µA)	±5%	300:1	✓	TSSOP-14 EP
NCV47822	2x 250	Dual High Side Switch	400	10	1.5 mA (500 µA)	±5%	300:1	✓	TSSOP-14 EP
NCV47823	2x 250	Dual HSS/Constant Current	400	20	1.5 mA (500 µA)	±5%	300:1	✓	TSSOP-14 EP
NCV47700/10/01/11	350	Adj	500	10	230 µA (1 mA)	±10%	100:1		SOIC-8, SOIC-8 EP

Watchdog and Tracking LDOs for Power Supplies

Watchdog LDOs

Watchdog LDOs from **onsemi** 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.

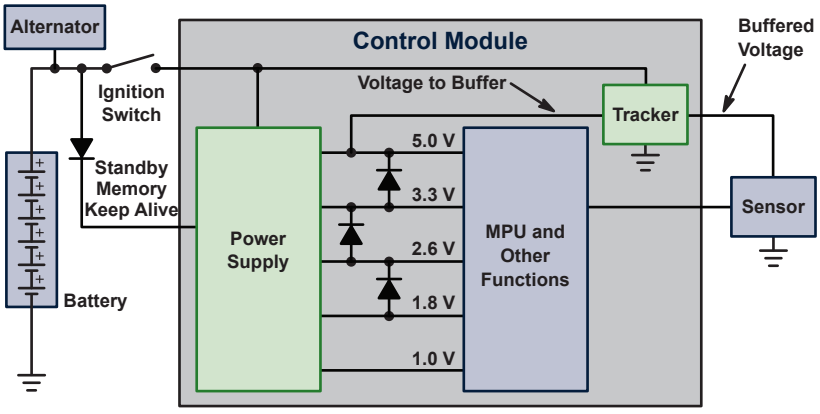


The NCV8518B 250 mA LDO voltage regulator incorporates a watchdog feature which continuously monitors the WDI input from the microprocessor in order to determine the output state.

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. **onsemi** offers a wide range of single and dual tracking regulators — including CS8182, CS8361, NCV8184, and NCV4250-2C — 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

Post Regulation Linear Regulators

Device	Output Current	Output Voltage (V)	Dropout Max	Sleepmode Current Max (µA)	Quiescent Current (Max) @ Low Load (Load)	Tolerance (%)	Enable	Power Good	Package(s)
NCV8715	50 mA	1.2, 1.5, 1.8, 2.5, 3.0, 3.3, 5.0	260 mV	–	4.7 µA	±2			XDFN-6
NCV8716	80 mA	1.5, 1.8, 2.5, 3.0, 3.3, 5.0	400 mV	–	4.7 µA	±2			WDFN-6
NCV662	100 mA	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5	300 mV	1	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	300 mV	–	6 µA (1 mA)	±4			SC-82
NCV78LxxA	100 mA	5, 8, 12, 15, 24	1.7 V (Typ)	–	–	±4			SOIC-8, TO-92
NCV8711	100 mA	3.0, 3.3, 5.0, ADJ	355 mV	1.5 µA	2.5 µA	-1%/+2%	✔	✔	WDFNW6, TSOP5
NCV551	150 mA	1.4, 1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.1, 3.2, 3.3, 5	220 mV	1	8 µA (1 mA)	±3	✔		TSOP-5
NCV571	150 mA	0.8, 0.9, 1.0, 1.2	450 mV	1	8 µA (150 mA)	±4	✔		TSOP-5, DFN-6
NCV8560	150 mA	Adj., 1.3, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, 3.5, 5	125 mV	1	180 µA (150 mA)	±2	✔		DFN-6, TSOP-5
NCV8152	150 mA	1.8/2.8, 2.8/1.8, 3.0/1.8, 3.3/1.8	140 mV	1	50 µA (100 µA)	±3	✔		XDFN-6
NCV8170	150 mA	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.1, 3.3,	350 mV	1	50 µA (90 µA)	±2	✔		XDFN-4, SOT-563
NCV8730	150 mA	1.8, 3.0, 3.3, 5.0, ADJ	480 mV	1.5 µA	2.5 µA	-1%/+2%	✔	✔	WDFNW6, TSOP5
NCV8702	200 mA	1.8, 2.8, 3.0, 3.3	140 mV	1	60 µA (1 mA)	±2	✔		DFN-6, TSOP-5
NCV8570B	200 mA	1.8, 2.5, 2.8, 3.0, 3.3	155 mV	1	75 µA (1 mA)	±2	✔		DFN-6, TSOP-5
NCV8752	200 mA	1.8, 2.8, 3.0, 3.3	140 mV	1	12 µA	±2	✔		XDFN-6, TSOP-6
NCV8160	250 mA	1.8, 2.5, 2.8, 2.9, 3.0, 3.3	90 mV	1	18 µA	±2	✔		XDFN-4
NCV8163	250 mA	1.2, 1.5, 1.8, 2.1, 2.5, 2.8, 3.0, 3.3	80 mV	1	12 µA	±2	✔		XDFN-2
NCV8703	300 mA	1.8, 2.8, 3.0, 3.3	180 mV	1	60 µA (1 mA)	±2	✔		DFN-6, TSOP-5
NCV8114	300 mA	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3	135 mV	1	55 µA (95 µA)	±2	✔		TSOP-5
NCV8154	300 mA	3.0/3.0, 3.3/1.8, 1.8/2.8, 3.3/3.3	140 mV	1	55 µA (100 µA)	±3	✔		DFN-10
NCV8164	300mA	1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3, ADJ	205 mV	1.5 µA	40 µA	±2	✔	✔	WDFNW6, DFNW8, TSOP5
NCV8718	300 mA	Adj.	300 mV	1	4 µA	±2	✔		WDFN-6
NCV8130	300 mA	0.8, 1.0, 1.1, 1.2, 1.3, 1.5, 1.8	150 mV	1	80 µA	±1.5	✔		XDFN-6
NCV8720	350 mA	1.0, 1.05, 1.10, 1.15, 1.2, 1.25, 1.3, 1.4, 1.45	110 mV	1	–	±2	✔		WDFN-6
NCV8161	450 mA	1.8, 2.5, 2.8, 2.9, 3.0, 3.3	225 mV	1	18 µA	±2	✔		XDFN-4
NCV78MxxA	500 mA	5	**	–	**	±4			DPAK-3
NCV5501	500 mA	1.5, 3.3, 5	700 mV	–	500 µA (100 µA)	±4.9			DPAK-3
NCV5500	500 mA	Adj, 1.5, 3.3, 5	700 mV	50	500 µA (100 µA)	±4.9	✔		SOIC-8, DPAK-5
NCV8133	500 mA	0.8, 1.0, 1.1, 1.2, 1.3, 1.5, 1.8	140 mV	1	80 µA	±1.5	✔		XDFN-6
NCV8535	500 mA	Adj, 1.5, 1.8, 2.5, 2.8, 2.85, 3.0, 3.3, 5	340 mV	1	190 µA (100 µA)	±1.5	✔		DFN-10
NCV8537	500 mA	Adj, 1.8, 2.5, 3.3, 5.0	340 mV	1	190 µA (100 µA)	±1.5	✔	✔	DFN-10
NCV8177	500 mA	0.75, 1.2, 1.5, 1.8, 2.5, 3.3,	200 mV	–	60 µA (90 µA)	±2	✔		XDFN-4
NCV33269	800 mA	Adj, 3.3, 5, 12	1.35 V	–	–	±2			DPAK-3
NCV78xxA	1 A	5, 12	**	–	–	±4			D2PAK-3, TO-220
NCV8186	1 A	1.2, 1.75, 1.8, 1.85, 2.5, 2.8, 3.3, 3.5, 3.9	100 mV	–	90 µA (140 µA)	±1	✔		XDFN-8
NCV1117	1 A	Adj, 1.5, 1.8, 2, 2.5, 3.3, 5, 12	1.2 V	–	–	±2			DPAK-3, SOT-223
NCV5661	1 A	Adj, 1.2, 1.5, 1.8, 2.5, 2.8, 3.0, 3.3	1.3 V	300	–	±2	✔		DPAK-5, DFN-6
NCV8187	1.2A	0.8, 0.9, 1.1, 1.2, 1.8, 3.3, ADJ	335 mV	5 µA	45 µA	±2	✔	✔	WDFNW6, WDFN6, DFN6, DFNW6, DPAK-5
NCV59152	1.5 A	Adj, 1.8, 2.5, 2.8, 3.0, 3.3, 5.0	500 mV	5	–	±1.5	✔		DFN-8, D2PAK-3, D2PAK-5
NCV59748	1.5 A	Adj.	60 mV	–	–	±2	✔	✔	DFN-10
NCV5662	2 A	Adj, 1.5	1.3 V	300	–	±2	✔		D2PAK-5
NCV59744	3 A	Adj.	115 mV	–	–	±2	✔	✔	QFN20
NCV59745	3 A	1.0, 1.015, 1.8, 2.5	195 mV	15 µA	2 mA	±1	✔	✔	QFNW20
NCV59302	3 A	Adj, 1.8, 2.5, 2.8, 3.0, 3.3, 5.0	500 mV	5	–	±2	✔		D2PAK-5
NCV5663	3 A	Adj, 1.5	1.3 V	300	–	±2	✔		D2PAK-5

** See data sheet for details.

Wide Selection of Automotive Qualified Linear Regulators

Tracking Regulators

Device	Output Voltage	Tolerance	Output Current	Dropout Max	Sleepmode Current Max	Quiescent Current [Max] @ Low Load (Load)	Enable	Reset	Current Limit	Overvoltage Shutdown	Overtemperature	Peak Transient (V)	Package(s)
NCV4250-2C	Tracking	±5 mV	50 mA	0.3 V	20 μA	150 μA (1 mA)	✓		✓		✓	45	TSOP-5
CS8182	Tracking	±10 mV	200 mA	0.6 V	55 μA	150 μA (100 μA)	✓		✓		✓	45	DPAK-5, D2PAK-5, SOIC-8 Fused
CS8361	Tracking 5 V	±25 mV ±2 %	250 mA 100 mA	0.7 V 0.6 V	200 μA	200 μA (300 μA)	✓	✓	✓	✓	✓	60	D2PAK-7, SOIC-16 Fused
NCV4254C	Tracking	±3 mV	70 mA	0.4 V		80 μA (100 μA)	✓		✓		✓	45	SOIC-8, SOIC-8 ePad

Battery Connected Linear Regulators

Device	Output Current	Output Voltage (V)	Dropout Max (V)	Sleepmode Current Max (μA)	Quiescent Current (Max) @ Low Load (Load)	Tolerance (%)	Enable	Package(s)
NCV4294C	30 mA	3.3, 5	0.25	–	170 μA (100 μA)	±4		TSOP-5
NCV4295C	30 mA	3.3, 5	0.25	–	170 μA (100 μA)	±4		TSOP-5
NCV4296-2C	30 mA	3.3, 5	0.25	1	170 μA (100 μA)	±4	✔	TSOP-5
NCV4949C	100 mA	5	0.5	–	260 μA (300 μA)	±2		SOIC-8, SOIC-8 EP
NCV2951A	100 mA	Adj, 3.3, 5	0.45	–	120 μA (100 μA)	±1.5	✔	SOIC-8
NCV317L	100 mA	Adj	1.9 (Typ)	–	–	±4		SOIC-8, TO-92
NCV4299C	150 mA	3.3, 5	0.5	1	95 μA (100 μA)	±2	✔	SOIC-8, SOIC-14
NCV4279C	150 mA	5	0.5	–	250 μA (1 mA)	±2		SOIC-14
NCV4269C	150 mA	5	0.5	–	250 μA (1 mA)	±2		SOIC-8, SOIC-8 EP, SOIC-14,TSSOP-14 EP
NCV4266-2C	150 mA	3.3, 5	0.5	1	70 μA (100 μA)	±2	✔	SOT-223
NCV4264-2C	150 mA	3.3, 5	0.5	–	70 μA (100 μA)	±2		SOT-223
NCV8669	150 mA	5	0.6	–	50 μA (150 mA)	±2		SOIC-14
NCV8668	150 mA	3.3, 5	0.6	1	44 μA (100 μA)	±2	✔	SOIC-8, SOIC-8 EP, SOIC-14
NCV8664C	150 mA	3.3, 5	0.6	–	30 μA (100 μA)	±2		SOT-223, DPAK-3
NCV8660B	150 mA	3.3, 5	0.6	–	40 μA (150 mA)	±2		DPAK-5, SOIC-8
NCV8502	150 mA	Adj, 2.5, 3.3, 5, 8, 10	0.6	–	75 μA (100 μA)	±2		SOIC-8, SOIC-16 EP
NCV8501	150 mA	Adj, 2.5, 3.3, 5, 8, 10	0.6	30	75 μA (100 μA)	±2	✔	SOIC-8, SOIC-16 EP
NCV8730	150 mA	1.8, 3.3, 5.0, 15, Adj	0.48	1.5 μA	1.3 μA (3 μA)	-1/+2	✔	WDFNW6, TSOP5
NCV8508B	250 mA	3.3, 5	0.9	–	150 μA (150 mA)	±3		SOIC-8 EP, D2PAK-7
NCV8518B	250 mA	5	0.75	1	150 μA (150 mA)	±2	✔	SOIC-8 EP, SOIC-16 EP
NCV8674	350 mA	5	0.6	–	38 μA (100 μA)	±2		D2PAK-3
NCV8675	350 mA	3.3, 5	0.6	–	50 μA (100 μA)	±2, ±2.5		DPAK-5, D2PAK-5
NCV8772	350 mA	3.3, 5	0.875	1	30 μA (350 mA)	±1.5	✔	D2PAK-7, D2PAK-5, DPAK-5
NCV4274C	400 mA	3.3, 5	0.5	–	250 μA (1 mA)	±2		SOT-223, DPAK-3, D2PAK-3
NCV4276C	400 mA	Adj, 3.3, 5	0.5	10	220 μA (1 mA)	±2	✔	DPAK-4, D2PAK-5
NCV8506	400 mA	Adj, 2.5, 3.3, 5	0.6	–	150 μA (100 μA)	±2		D2PAK-7
NCV8505	400 mA	Adj, 2.5, 3.3, 5	0.6	1	350 μA (100 μA)	±2	✔	D2PAK-7
NCV8504	400 mA	Adj, 2.5, 3.3, 5	0.6	–	150 μA (100 μA)	±2		SOIC-16 EP
NCV8503	400 mA	Adj, 2.5, 3.3, 5	0.6	1	350 μA (100 μA)	±2	✔	SOIC-16 EP
NCV4275C	450 mA	3.3, 5	0.5	–	200 μA (1 mA)	±2		DPAK-5, D2PAK-5
NCV8141	500 mA	5	1.5	50	**	±3	✔	D2PAK-7
NCV317M	500 mA	Adj	2.2 (Typ)	–	–	±4		DPAK-3
NCV33269	800 mA	Adj, 3.3, 5, 12	1.35	–	–	±2		DPAK-3
NCV317	1.5 A	Adj	2.25 (Typ)	–	–	±4	✔	D2PAK-3, TO-220

** See data sheet for details.

Multiple Voltage Regulators for Audio Subsystems

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			5.7 V, 200 mA	7 V, 1.3 A							
LV56801P			3.3 V, 200 mA	8 V, 1.3 A							
LV5683P		100	3.3/5.0 V, 300 mA	5/8 V, 1.1 A	8.5 V, 400 mA	–	3.3 V, 500 mA	–	–	–	HZIP-15
LV56831P				–		12 V, 500 mA	3.3/5 V, 500 mA				
LV5684NPVD			3.3 V, 350 mA	5/8 V, 1.3 A	5-12 V (Adj), 250 mA	5–12 V (Adj), 300 mA	3.3 V, 450 mA	–	–	350, 300	
LV56841PVD				6 V, 1.5 A	5-12 V (Adj), 300 mA		3.3 V, 350 mA			500, 300	
LV5685PV			3.3 V, 350 mA	5/6/7/8 V, 1.3 A	5/8.5/9/11.5 V, 250 mA	5/8/10.5/12 V, 300 mA	3.3/5 V, 450 mA	–	–	350, 300	
LV5686PVC			5.0 V, 300 mA	–	9.0 V, 500 mA	9.85 V, 300 mA	–	–	–	300 x 2, 350 x 1, 500 x 3	
LV5692P			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			5.7 V, 300 mA								
LV5694P			3.3/5.0 V, 300 mA	7.6/8.1 V, 2.0 A	8.45 V, 800 mA	9.0 V, 500 mA	–	5 V, 500 mA	–	500, 350	
LV5695P				8 V, 2.0 A		8.5 V, 500 mA					
LV5696P			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			200	

Switching Regulators and Controllers

Features

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

Switching Regulators

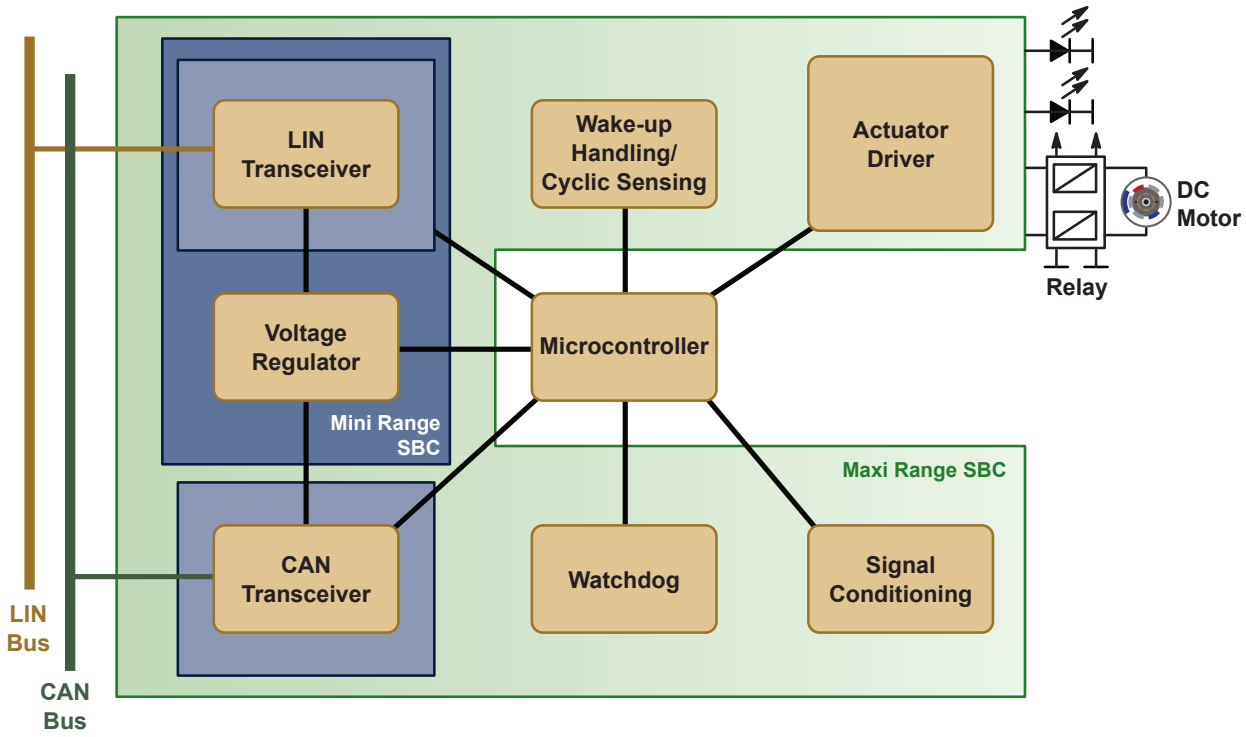
Device	I_{OUT} (A)	f_{SW} (kHz)	V_{in} Min (V)	V_{in} Max (V)	Comments	Package
NCV2574	0.5	52	4.75	40	Internal compensation	SOIC-16W
NCV2575	1.0	52	4.75	40	Internal compensation	D2PAK
NCV890100	1.2	2000	4.5	40	–	DFN-8
NCV890101	1.2	2000	4.5	40	–	DFN-10
NCV8843	1.5	Up to 700	4	40	V^2	SOIC-8, SOIC-16W, 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 150	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
NCV3066	1.5	Up to 250	3	40	LED driver with ENABLE	DFN-8, SOIC-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	280	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	2.5	Up to 150	2.5	60	High input voltage	SOIC-16W

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
NCV8852	Down to 0.8	170 to 455	3.1	44	For external P-channel MOSFET	SOIC-8
NCV8853	Down to 0.8	340	3.1	44	For external P-channel MOSFET	SOIC-8
NCV881930	3.3, 5.5	410	3.5	45	Low I_q; low frequency	QFN-24
NCV891930	3.3, 3.65, 4.0, 5.0	2000	3.5	45	Low I_q; high frequency	QFN-24
NCV1034	1.25	Up to 500	10	100	Synchronous Buck	SOIC-16

In-Vehicle Networking Solutions

Automobile manufacturers today design decentralized, distributed systems, connected through industry interface standards. **onsemi** offers an innovative in-vehicle networking portfolio, including LIN, CAN, CANFD, and FlexRay™ transceivers – AEC 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

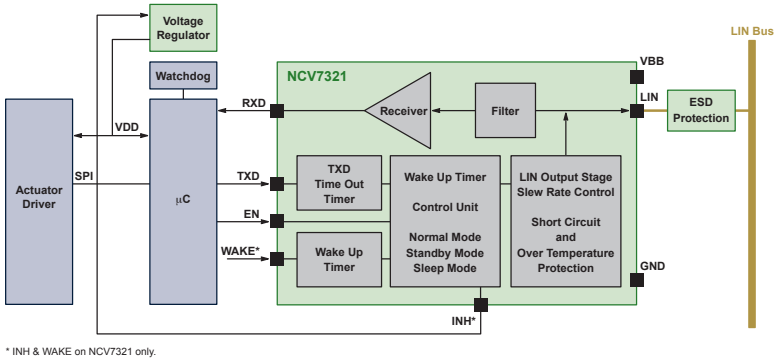
Standalone LIN Transceivers

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. **onsemi** transceivers are compliant to ISO 17987-4 (backwards compatible to LIN specification rev 2.x, 1.3) and SAE J2602.

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

LOCAL INTERCONNECT NETWORK



Standalone LIN Transceiver NCV7321/NCV7329

LIN Transceivers

Device	Description	Bus Speed (Baud)	ISO 9141	LIN 2.0/2.1/2.2	J2602	Sleep Mode Current (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 , DFN-8
NCV7424	Quad LIN Transceiver	20 k	✓	✓	✓	30	>12 kV	TSSOP-16
NCV7329	LIN Transceiver	20 k	✓	✓	✓	10	>12 kV	SOIC-8 , DFN-8
NCV7327*	LIN Transceiver	20 k	✓	✓	✓	10	>12 kV	SOIC-8 , DFN-8
NCV7420	LIN Transceiver with Voltage Regulator (50 mA, 3.3 or 5.0 V)	20 k	✓	✓	✓	20	>12 kV	SOIC-14
NCV7425	LIN Transceiver with Voltage Regulator (150 mA, 3.3 or 5.0 V)	20 k	✓	✓	✓	20	>12 kV	SOIC-16W EP
NCV7428	LIN (low slope, normal slope) Transceiver with Voltage Regulator (70 mA, 3.3 or 5.0 V)	20 k	✓	✓	✓	25	>12 kV	SOIC-8
NCV7429	System Basis Chip with LIN, LS and HS Switches	20k	✓	✓	✓	30	>6 kV	TSSOP−20 EP

*** No time out for low speed communication.**

FlexRay™ Transceivers

Features

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

FlexRay™ Transceivers

Product	Description	Bus Speed (Baud)	FlexRay Standard	Host Interface	ESD Protection IEC61000-4-2 (CAN pins)	Package(s)
NCV7381A	Clamp-30 FlexRay Transceiver	10 M	v3.0.1.	ERRN pin	>10 kV	SSOP-16
NCV7381B	Clamp-30 FlexRay Transceiver	10 M	v3.0.1.	ERRN pin	>10 kV	SSOP-16
NCV7381C*	Clamp-30 FlexRay Transceiver	10 M	v3.0.1.	ERRN pin	>10 kV	SSOP-16
NCV7383	Clamp-15 FlexRay Transceiver	10 M	v3.0.1.	SPI	> 10 kV	TSSOP-14

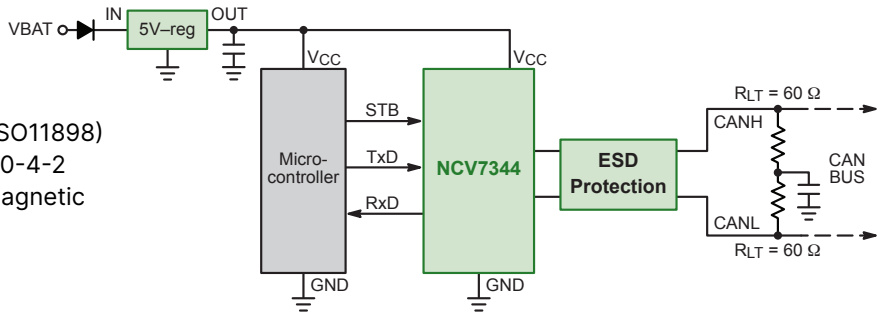
***High Temperature Class 0.**

Standalone CAN Transceivers

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

Features

- Portfolio includes transceivers specifically designed for:
  - Low Speed Fault Tolerant
  - High Speed
  - Low Power
  - Single Wire
  - Flexible Data Rate
- 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)



NCV7344 Typical Application

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, DFN-8
NCV7344	High Speed Low Power CAN, CAN FD Transceiver	ISO11898-2:2016	15	5 Mbps	>8 kV	SOIC-8, DFN-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
NCV7446	Two channel High Speed, Low Power CAN, CAN FD Transceiver	ISO11898-2:2016	30	5 Mbps	8 kV	DFN-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
NCV7351F	High Speed CAN, CANFD Transceiver	ISO11898-2:2016	N/A*	2 Mbps	>12 kV	SOIC-8
NCV7357	High Speed Low PowerCAN, CAN FD Transceiver	ISO11898-2:2016	15	5 Mbps	>8 kV	SOIC-8, DFN-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. **Meets VeLIO test requirements.**

System Basis Chips

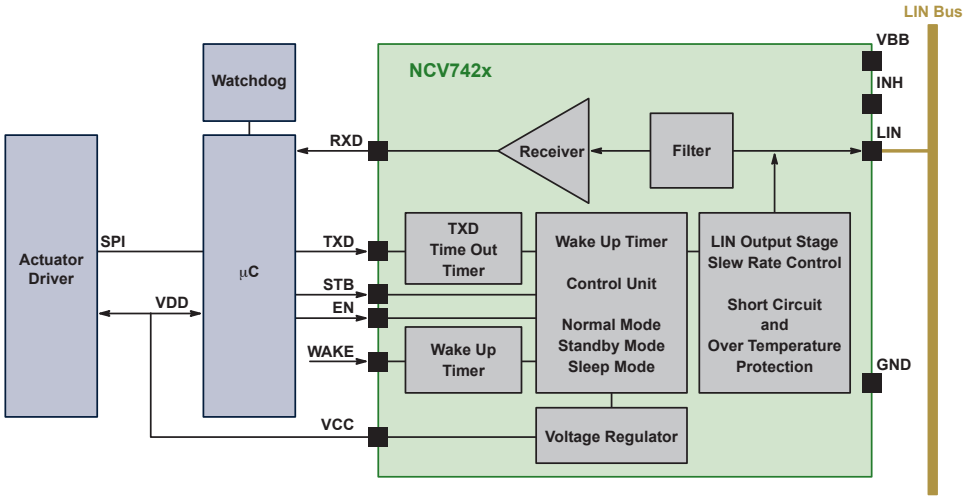
Integration of key system components, like LIN, CAN, and voltage regulators, within ECUs delivers:

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

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

NCV742x 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
- NCV7428 includes 70 mA voltage regulator



NCV742x LIN-SBC: LIN +LDO (5 or 3.3 V) up to 150 mA

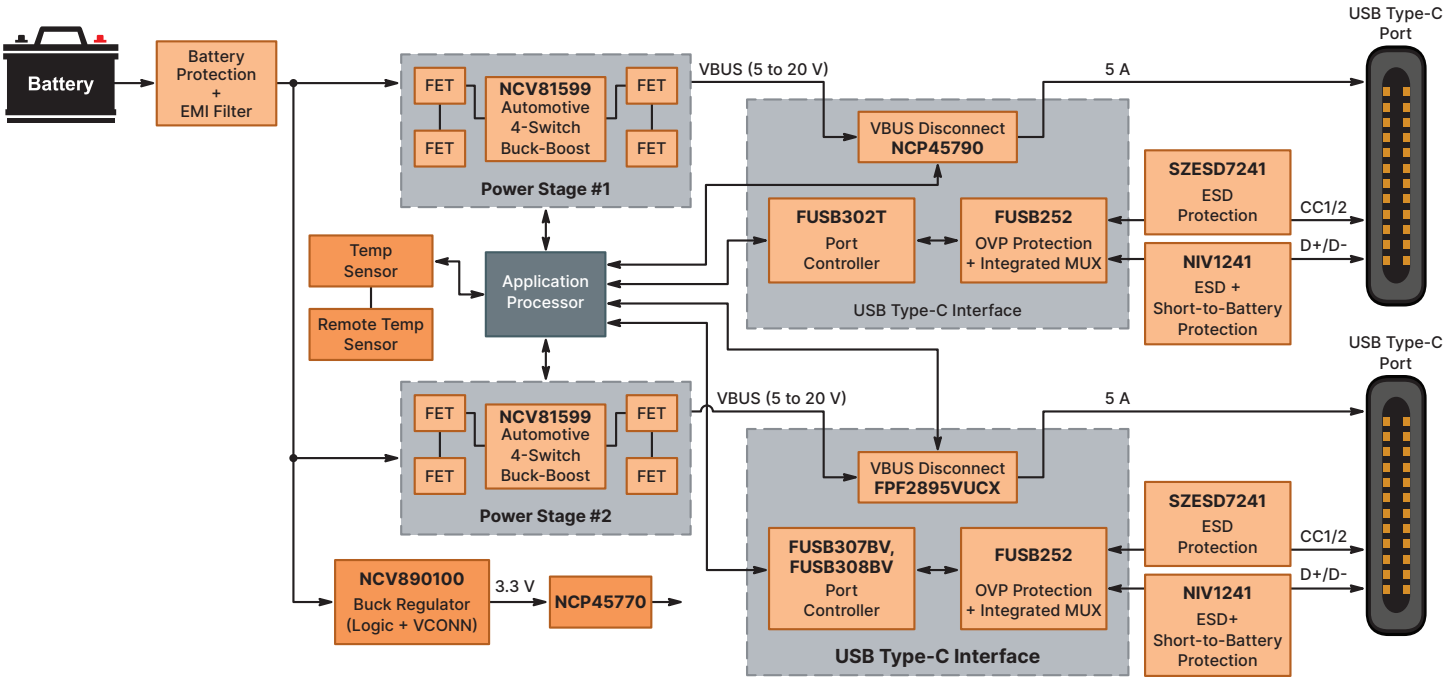
System Basis Chips

Device	Description	Data Transmission Standard	I_O Max (mA)	Number of Drivers	Number of Transceivers	V_{CC} Min (mA)	V_{CC} Max (mA)	Package(s)
NCV7420	System Basis Chip with LIN and Voltage Regulator (WAKE, INH)	LIN	50	0	1	5	26	SOIC-14
NCV7425	System Basis Chip with LIN and Voltage Regulator (WAKE, INH, RSTN)	LIN	150	0	1	5	28	SOIC-16W EP
NCV7428	LIN (low slope, normal slope) Transceiver with Voltage Regulator (70 mA, 3.3 or 5.0 V)	LIN	70	0	1	3.234, 4.9	3.366, 5.1	SOIC-8, DFN-8
NCV7429	System Basis Chip with LIN, LS and HS Switches	LIN	150	5	1	4.9	5.1	TSSOP−20 EP
NCV7462	System Basis Chip with LIN, CAN, 2 Voltage Regulators, and HS/LS Drivers	LIN; CAN	250	7	2	5	28	SSOP-36 EP
NCV7471	System Basis Chip with Dual LIN, CAN, Voltage Regulator, and Buck-Boost DC-DC	LIN; CAN	500	0	3	2.5	28	SSOP-36 EP
NCV7441	Dual High Speed, Low Power CAN Transceiver	CAN	NA	0	2	NA	NA	SOIC-14
NCV7450	CAN + LDO + HS Driver System Basis Chip	CAN	250	1	1	4.75	5.25	TSSOP−16 EP
NCV7446	Two channel High Speed, Low Power CAN, CAN FD Transceiver	CAN/CANFD	NA	0	2	NA	NA	DFN-14
AMIS-42700/70	Dual High Speed CAN Transceiver	CAN	NA	0	2	NA	NA	SOIC-20

USB-PD Dual Port 100 W

Features

- Complete solution = power + port + policy + management + protection + software
- Future ready = 100% voltage/power coverage
  - SW update = no hardware spin required
- Power management / metering
  - Input voltage monitoring
  - De-rate power based on input (battery) voltage – customizable limit
- Temperature protection
  - De-rate power based on temperature of PCB – customizable limit
- Scalable multi-port solution
  - 1 MCU = 2, 3, 4, etc. ports
  - Copy & paste power stage (power + port control)



Function	Device	Description
Port Control	FUSB302BV	Programmable USB Type-C Controller with PD (Default SRK)
	FUSB302TV	Programmable USB Type-C Controller with PD (Default SRK)
	FUSB307BV	Programmable USB Type-C Controller with PD
	FUSB308BV	Programmable USB Type-C Controller with PD
Buck-Boost Controller	NCP81599	4-Switch Buck Boost Controller for USB-PD Power Delivery and Type-C Applications
Protection Switch	FUSB252	CCx and HSD± Protection Switch for USB Type-C
	FPF2895V	28 V/5 A Rated Current limit Switch with OVP and TRCB

Protection for USB

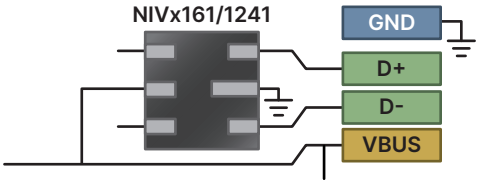
Three High Speed Pairs, V_{BUS} Low Capacitance ESD, Common Mode Filter

Key Requirement

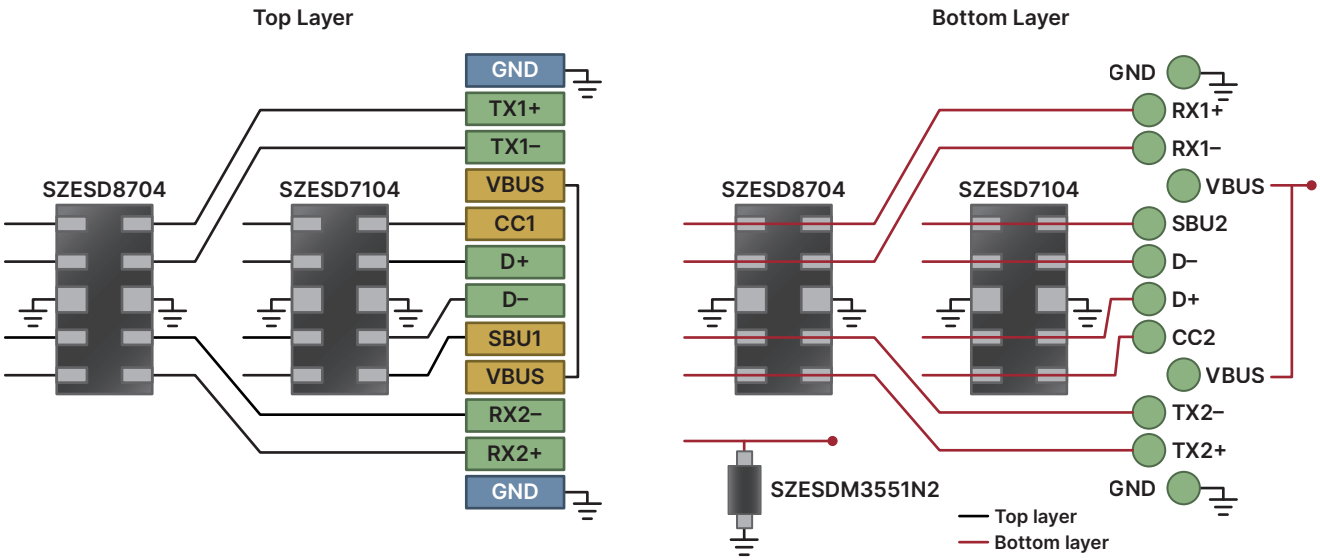
- Capacitance < 1.5 pF for data lines

Features

- Capacitance 0.3 - 1.0 pF for data lines
- Integrated EMI suppression with ESD Protection
- Industry leading low capacitance and clamping voltage with short-to-battery (STB) capability

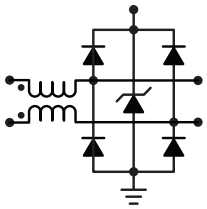


Type-C Hybrid Top Mount Connector



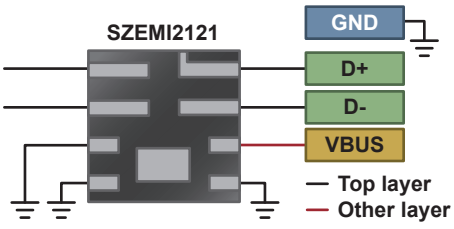
ESD Protection

Device	V_{BR} Min (V)	Lines	Capacitance (pF)	Protection Scheme	Package
SZESDM3551	5.6	1	21	VBUS ESD + Surge	X2DFNW-2 (SOD-882)
SZESD7241	24.0	1	1.0	VBUS ESD + Surge	X2DFNW-2 (SOD-882)
SZESD7205	5.2	2	0.55	D+/D- ESD	SOT-723, SC-70
SZESD7002	16.0	2	0.85	D+/D- ESD	SC-70 (SOT-323)
SZESD7104	5.5	4	0.35	D+/D-, CC1-2, SBU1-2 ESD	WDFNW-10
SZESD8704	3.3	4	0.30	SSTX ±, SSRX ± ESD	WDFNW-10
NIV1161	16.5	2	0.65	D+/D- ESD + STB Limiting	WDFNW-6
NIV1241	24.0	2	0.55	D+/D- ESD + STB Limiting	WDFNW-6
NIV2161	16.5	2	0.65	D+/D- ESD + STB & STG Limiting	WDFN-10



EMI Filter + ESD Protection

Device	Pairs	Capacitance @ 2.5 V (pF)	CM Attenuation @ 750 MHz (−dB)	DM Bandwidth F3dB (GHz)	Package
SZEMI2121	1	0.9	-35	2.5	WDFN-8



Protection for USB

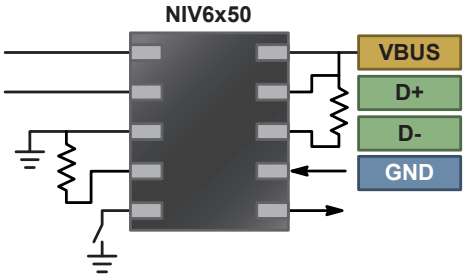
Electronic Fuse (eFuse): Short-to-Battery (STB) and Short-to-Ground (STG) Protection

Key Requirement

- <200 mΩ $R_{DS(ON)}$ V_{BUS} switch & Fault Identification
- Adjustable over-current and over-voltage protection

Features

- Integrated V_{BUS} power switch with adjustable over-current (for short-to-ground protection) and over-voltage protection
- Integrated reverse current for short-to-battery protection
- 50 – 200 mΩ $R_{DS(ON)}$ options
- Fault identifier (FLAG) and current monitor (IMON) diagnostic pins



Electronic Fuse (eFuse)

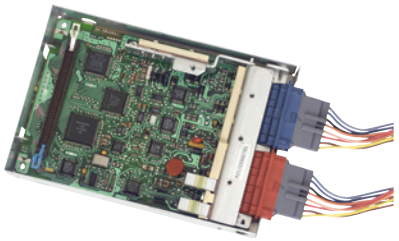
Device	V_{BR} Min (V)	I_{DC} Max (A)	$R_{DS(ON)}$ (mΩ)	Lines	Capacitance (pF)	Protection Scheme	Package
NIV6150	–	1	200	1	–	V_{BUS} STB & STG Clamping	WDFNW-10
NIV6350	–	3	85	1	–	V_{BUS} STB & STG Clamping	WDFNW-10

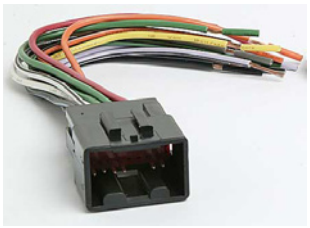
Enhance Reliability of Electronic Modules with ESD Protection Devices

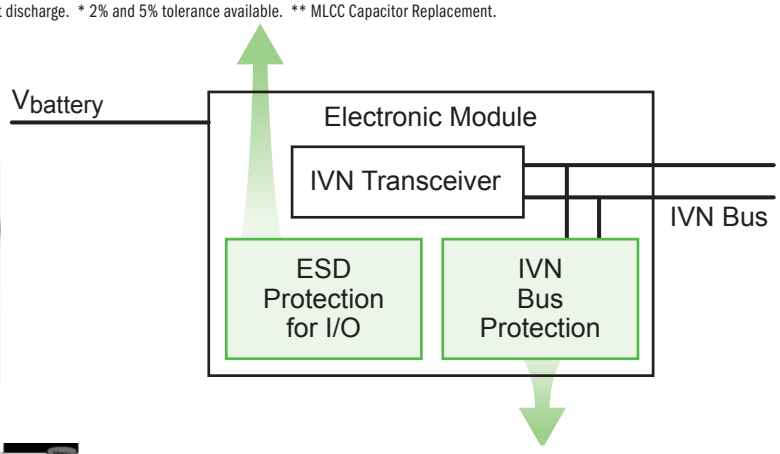
I/O & Sensor Protection

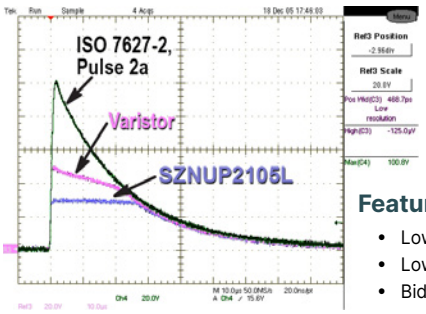
Device	Diode Configuration	V_{BR} Range	P_{pk}[1]	ESD Rating	C_j	Package
SZMM5Z Series	Single Unidirectional	4.0 to 15 V	175 W	>30 kV[2]	<150 pF	SOD-523
SZMM3Z Series	Single Unidirectional	2.4 to 75 V	–	>16 kV[2]	<300 pF	SOD-323
SZMMSZ Series	Single Unidirectional	1.8 to 110V	–	>16 kV[2]	<300 pF	SOD-123
SZMMSZ E Series	Energy Rated Single	1.8 to 110V	225 W	>16 kV[2]	<300 pF	SOD-123
SZMMBZ Series	Single Unidirectional	2.4 to 91 V	–	>16 kV[2]	<300 pF	SOT-23
SZMMBZ E Series	Energy Rated Single	2.4V to 91 V	225 W	>16 kV[2]	<300 pF	SOT-23
SZMMBZ A Series	Dual Common Anode	5.6 to 33 V	–	>16 kV[2]	<300 pF	SOT-23
SZBZX84 Series*	Single Unidirectional	2.4 to 75 V	–	>16 kV[2]	<450 pF	SOT-23
SZBZX84 E Series	Energy Rated Single	2.4 to 75 V	225 W	>16 kV[2]	<450pF	SOT-23
SZNZD Series	Single Bi-Directional	5.6 to 47 V	–	>30 kV	<300 pF	X2DFNW-2 (SOD-882)
SZNZ8F Series*	Single Unidirectional	2.4 to 47 V	–	>16 kV[2]	<210 pF	X2DFNW-2 (SOD-882)
SZNZ9F Series*	Single Unidirectional	2.4 to 24 V	–	>16 kV[2]	<210 pF	SOD-923
SZESD7272**	Unidirectional	27 V	–	>15 kV[2]	<1 pF	SOT-23

1. 8/20 μs surge waveform. 2. IEC 61000-4-2 contact discharge. * 2% and 5% tolerance available. ** MLCC Capacitor Replacement.



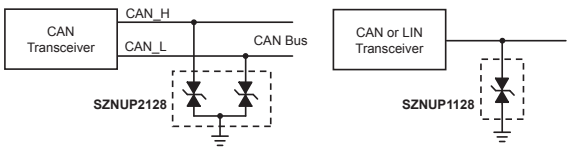






Features

- Low Clamping Voltage
- Low Capacitance
- Bidirectional Clamping



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.

In-Vehicle Networking Protection

Device	Network	Diode Configuration	V_{BR} Min (V)	V_{clamp} Max (V)	I_{pp} (A)	Capacitance Max (pF)	Package
SZNUP2115	FlexRay	Dual Bi-Directional	26.2	50	3	10	SOT-23
SZNUP2105	CAN	Dual Bi-Directional	26.2	44	8	30	SOT-23
SZNUP3105	CAN	Dual Bi-Directional	35.6	66	8	30	SOT-23
SZNUP3125	CAN	Dual Bi-Directional	35.6	65	3	10	SC-70 (SOT-323)
SESDONCAN1	CAN-FD	Dual Bi-Directional	26.2	50	3	10	SOT-23
SZNUP2124	CAN-FD	Dual Bi-Directional	26.0	40	3	10	XDFNW-3
SZNUP2125	CAN-FD	Dual Bi-Directional	26.2	50	3	10	SC-70 (SOT-323)
SZNUP2128	CAN	Dual Bi-Directional	28.0	70	3	15	SC-70 (SOT-323)
SZNUP1128	LIN	Single Bi-Directional	28.0	70	3	15	SOD-323
SZESD1L001	10/100 Base-T Ethernet	Quad Uni-Directional	16.5	–	–	1	SC-88 (SOT-363)
SZCM1213A-02SR	10/100 Base-T Ethernet	Dual Uni-Directional	6.5	–	–	1.2	SOT-143
SZESD9901	10/100/ 1000 Base-T Ethernet	Single Bi-Directional	100	–	–	2.6	X2DFNW2 (SOD-882)
SZESD9902	10/100/ 1000 Base-T Ethernet	Dual Bi-Directional	100	–	–	2.6	SOT-23
SZNSP8814L	HDBase-T	Quad Uni-Directional	3.2	35	15	5	WDFNW-10

Silicon Carbide Diodes

Features

- High power density, efficiency, and reliability
- High surge and avalanche capability
- Low system losses via no reverse Q_{rr} recovery, no forward recovery, and low V_F
- Minimized reverse recovery charge (Q_{rr}) reduces switching losses & enables high speed switching
- Stable temperature characteristics enable high-temperature operation without increasing switching losses
- High temperature operation and life time for automotive applications

650 V SiC Diodes

Device	Configuration	$I_{F(ave)}$ (A)	V_F Max (V)	I_{FSM} (A)	I_R Max (μA)	Package(s)
FFSH2065B-F085	with Schottky Diode	20	1.7	84	160	TO-247-2LD
FFSB0665B-F085	with Schottky Diode	6	1.7	45	160	D2PAK2 (TO-263-2L)
FFSB0865B-F085	with Schottky Diode	8	1.7	56	160	D2PAK2 (TO-263-2L)
FFSB1065B-F085	with Schottky Diode	10	1.7	45	160	D2PAK2 (TO-263-2L)
FFSB2065B-F085	with Schottky Diode	20	1.7	88	160	D2PAK2 (TO-263-2L)
FFSB2065BDN-F085	with Schottky Diode	20	1.75	45	160	D2PAK-3 / TO-263-2
FFSB3065B-F085	with Schottky Diode	30	1.7	120	120	D2PAK2 (TO-263-2L)
FFSD0665B-F085	with Schottky Diode	6	1.7	28	160	DPAK-3 / TO-252-3
FFSD0865B-F085	with Schottky Diode	8	1.7	42	160	DPAK-3 / TO-252-3
FFSD1065B-F085	with Schottky Diode	10	1.7	45	160	DPAK-3 / TO-252-3
FFSH1065B-F085	with Schottky Diode	10	1.7	42	160	TO-247-2LD
FFSH1265BDN-F085	with Schottky Diode	12	1.7	24	160	TO-247-3LD
FFSH2065BDN_F085	Dual Common Cathode	20	1.7	42	160	TO-247-3
FFSH3065B_F085	with Schottky Diode	30	1.7	110	160	TO-247-2
FFSH4065BDN-F085	Dual Common Cathode	40	1.7	84	160	TO-247-3LD
FFSH5065B-F085	with Schottky Diode	50	1.7	189	160	TO-247-2LD
FFSP1065B-F085	with Schottky Diode	10	1.7	45	160	TO-220-2
FFSP2065B-F085	with Schottky Diode	20	1.7	88	160	TO-220-2
FFSP2065BDN-F085	Dual Common Cathode	20	1.7	42	40	TO-220-3
FFSP3065B-F085	with Schottky Diode	30	1.7	120	160	TO-220-2
FFSP4065BDN-F085	Dual Common Cathode	40	1.7	84	40	TO-220-3

1200 V SiC Diodes

Device	Configuration	$I_{F(ave)}$ (A)	V_F Max (V)	I_{FSM} (A)	I_R Max (μA)	Package(s)
FFSB10120A-F085	with Schottky Diode	10	1.75	90	400	D2PAK2 (TO-263-2L)
FFSB20120A-F085	with Schottky Diode	20	1.75	135	400	D2PAK2 (TO-263-2L)
FFSH10120A-F085	with Schottky Diode	10	1.75	90	200	TO-247-2
FFSH20120A-F085	with Schottky Diode	20	1.75	135	200	TO-247-2
FFSH20120ADN-F085	Dual Common Cathode	10	1.75	96	200	TO-247-3
FFSH40120ADN-F085	Dual Common Cathode	20	1.75	135	200	TO-247-3

Silicon Carbide MOSFETs

- Max Junction temperature 175°C
- High Switching Speed and Low Capacitance
- 100% UIL Tested
- AECQ-101 and PPAP Capable
- Applications: On-board Chargers, DC-DC Converters, Traction Inverters

900 V Gen1 SiC MOSFETs

$R_{DS(ON)}$ TYP (mΩ)	 TO247-3	 D2PAK-7L
20	NVHL020N090SC1	NVBG020N090SC1
60	NVHL060N090SC1	NVBG060N090SC1

1200 V Gen1 SiC MOSFETs

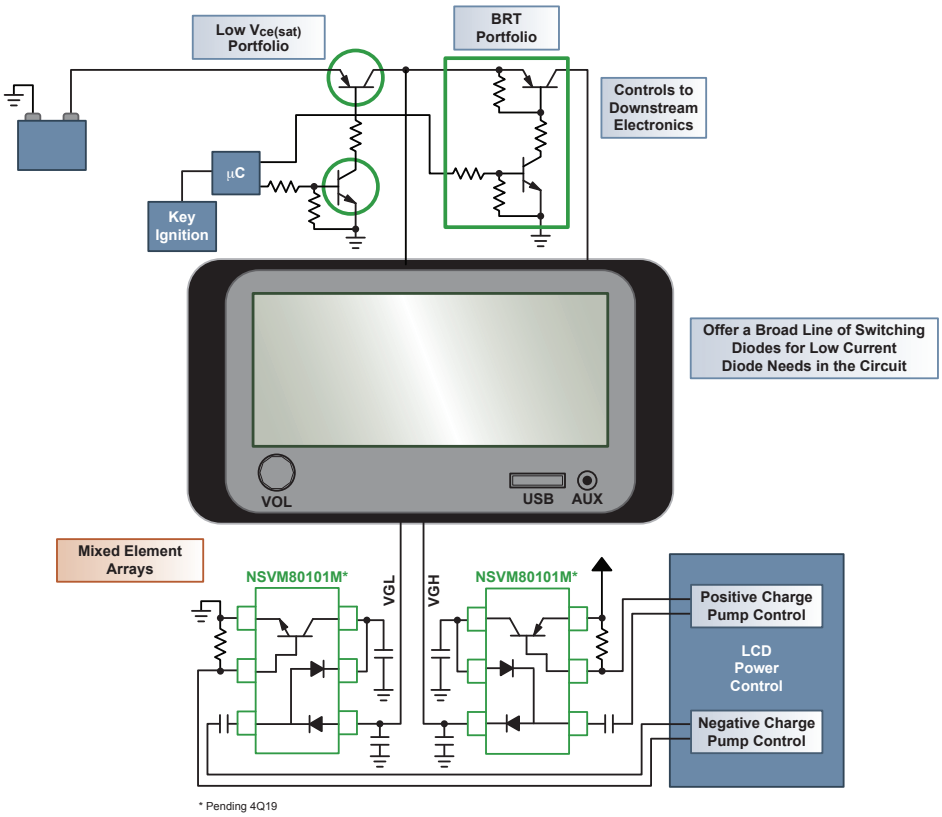
$R_{DS(ON)}$ TYP (mΩ)	 TO247-3	 TO247-4	 D2PAK-7L
20	NVHL020N120SC1	NVH4L020N120SC1	NVBG020N120SC1
40	NVHL040N120SC1	NVH4L040N120SC1	NVBG040N120SC1
80	NVHL080N120SC1A	NVH4L080N120SC1	NVBG080N120SC1
160	NVHL160N120SC1	NVH4L160N120SC1	NVBG160N120SC1

Wide Selection of Automotive Grade Small Signal Discretes

onsemi 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.

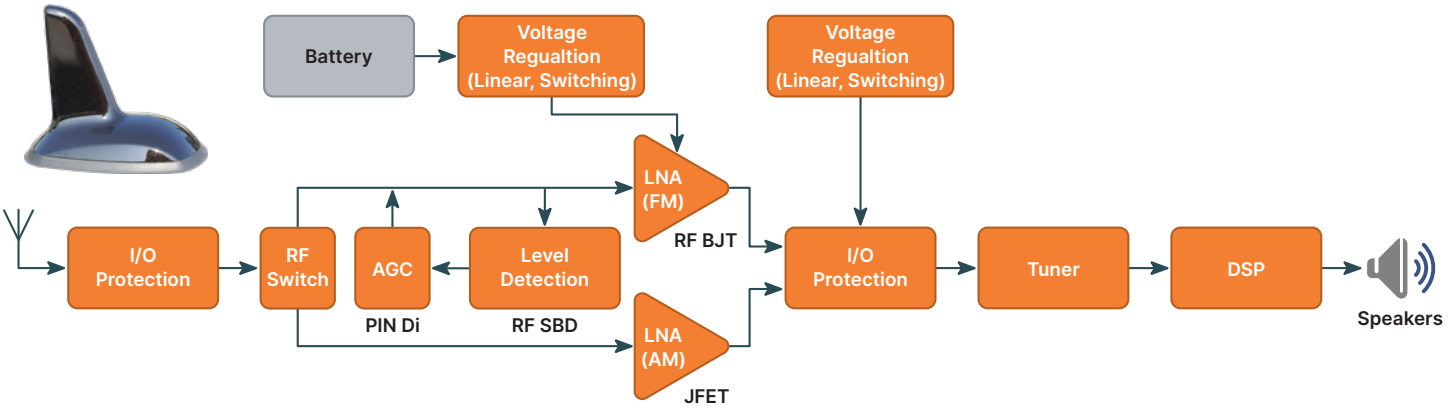
Device	Voltage Range	Current Range	Key Features	Functions	Package(s)
Schottky Diodes	7 – 70 V	20 mA – 1 A	Low Vf, Low Leakage, Duals	DC-DC converters, high-speed switching, Oring/rectifying	SOD-123, SOD-323, SOT-23, SC-70, SC-75, SOD-523, SOD-723, X2DFNW-2 (SOD-882)
Switching Diodes	35 – 350 V	–	Switching 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, X2DFNW-2 (SOD-882)
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, WDFN*, LFPAK
JFETs	25 – 30 V	20 – 150 mA	Interchangeable Drain and Source, high input resistance	Ideal for applications senstive to noise	SOT-23, TSOP-6, SOT-363
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, D2PAK, SOT-23, SOT-723, WDFN, SOT-563, LFPAK
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

* With wettable flanks.



* Pending 4Q19

Discrete Components for Radio 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 density

JFETs

Device	Configuration	V_{GDS} (V)	I_{DSS} (mA)	I_{VGSoff} (V)	g_m (mS)	C_{iss} (pF)	Package(s)
NSVJ2394SA3	Single	15	10-32	-1.5 to -0.3	38	10	SC-59
NSVJ3557SA3	Single	15	10-32	-1.5 to -0.3	35	10	SC-59
NSVJ3910SB3	Single	25	20-40	-1.8 to -0.6	40	6	SOT-346 (CPH-3)
NSVJ5908DSG5	Dual	15	10-32	-1.5 to -0.3	35	10	MCPH-5
NSVJ6904DSB6	Dual	25	20-40	-1.8 to -0.6	40	6	SOT-26 (CPH-6)

RF Transistor Features

- High gain and low noise for receiver sensitivity
- Low distortion input
- High power capability for use in high temperature applications

RF Transistors

Device	Max Ratings		f_T Typ (GHz)	Package(s)
	V_{CE} (V)	I_C (mA)		
NSVF6003SB6	12	150	7 @ V_{CE} = 5 V, I_C = 50 mA	SOT-26 (CPH-6)
NSVF6001SB6	12	100	6.7 @ V_{CE} = 5 V, I_C = 30 mA	SOT-26 (CPH-6)
NSVF4015SG4	12	100	10 @ V_{CE} = 3 V, I_C = 30 mA	SOT-343 (MCPH-4)
NSVF4017SG4	12	100	10 @ V_{CE} = 3 V, I_C = 30 mA	SOT-343 (MCPH-4)
NSVF3007SG3	12	30	8 @ V_{CE} = 5 V, I_C = 10 mA	SOT-323 (MCPH-3)
NSVF5501SK	10	70	5.5 @ V_{CE} = 5 V, I_C = 20 mA	SC-81 (SSFP)
NSVF4020SG4	8	150	16.5 @ V_{CE} = 5 V, I_C = 50 mA	SOT-343 (MCPH-4)
NSVF4009SG4	3.5	40	25 @ V_{CE} = 3 V, I_C = 20 mA	SOT-343 (MCPH-4)

RF Schottky and Pin Diode Features

- Series connection of two elements in small package
- Low forward voltage and inter-terminal capacitance

Schottky and PIN Diodes

Device	Type	V_R (V)	I_F (mA)	V_F[1] (mA)	C Typ[2] (pF)	r_s Typ[3] (Ω)	Package(s)
NSVR201MX	Schottky	2	–	320	0.15	–	X2DFN2 (SOD-882)
NSVR351SDSA3	Schottky	5	–	230	0.69	–	SOT-346 (CP)
NSVP249SDSF3	Pin	50	50	–	0.23	4.5	SOT-323 (MCP)
NSVP264SDSA3	Pin	50	50	–	0.23	2.5	SOT-323 (MCP)
NSVDP301MX2W	Pin	80	100	–	0.33	1.3	X2DFNW-2 (SOD-882)

1. VF @ I_F = 1 mA. 2. C Typ @ V_R = 50 V, f = 1 MHz. 3. r_s Typ @ I_F = 10 mA, f = 100 MHz.

RF Switch Features

- Low insertion loss
- High isolation and output power

RF Switch

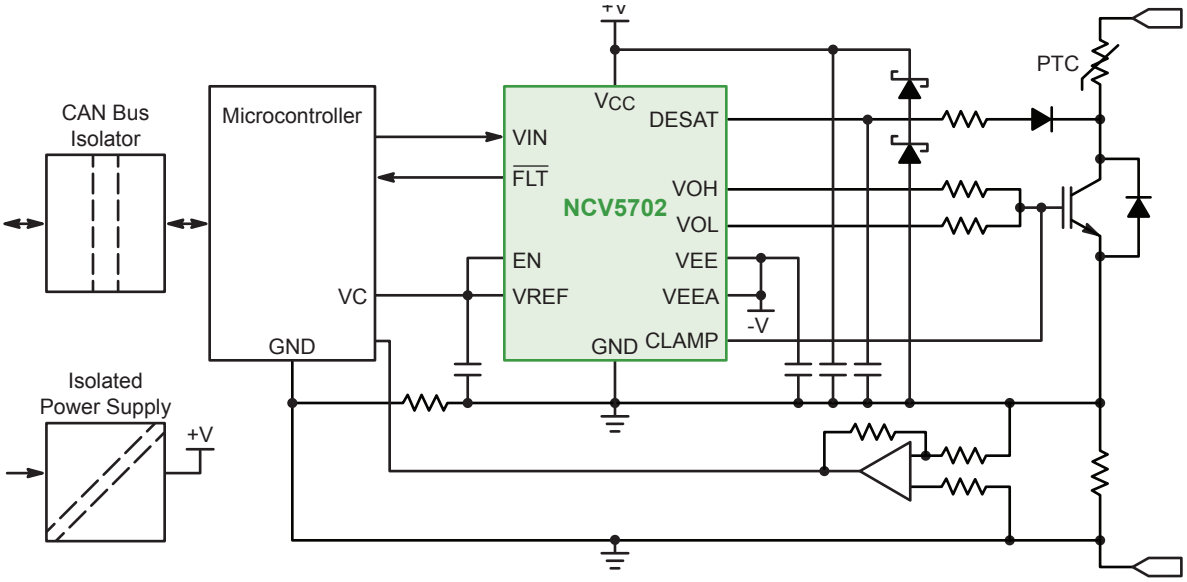
Device	Config	V_{CTL} (V)	Pin 1 dB[1] (dBm)	IL & ISL[1] (dB)	TS (ns)	Package(s)
NSVG1001	SPDT	1.8 - 6	30	0.65 & 25	250	X2DFNW-6

1. f = 6 GHz.

IGBT Gate Drivers for High Voltage and High Power Applications

Features

- High current output (+4 A/-6 A) at Miller Plateau for higher system efficiency
- Short propagation delays with accurate matching for improved system reliability
- UVLO, DESAT, Miller Clamp, Negative VEE for system protection
- 5 V reference for external logic
- AEC-Q100 Qualified



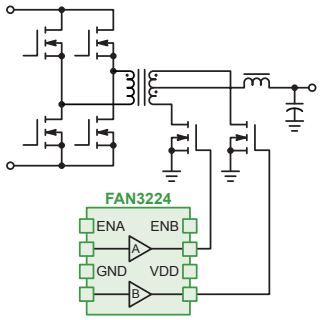
PTC Heater Application Schematic

Device	Isolation	Features + Options	Inverted Output	Fault Output	V_{IN} Max (V)	V_{CC} Max (V)	Drive Source/ Sink Typ (A)	Rise/Fall Time (ns)	t_{pd} Max (ns)	Package
NCV57000	Yes (5 kVRMS)	DESAT + CLAMP + VEE + VOH/VOL	No	Open Drain	5.5	24	4/6	10/15	90	SOIC-16 Wide
NCV57001	Yes (5 kVRMS)	DESAT + CLAMP + VEE	No	Open Drain	5.5	24	4/6	10/15	90	SOIC-16 Wide
NCV57080A	Yes (3.75 kVRMS)	Active Miller Clamp	No	N/A	5.5	24	4/6	10/15	90	SOIC-8 Narrow
NCV57080B	Yes (3.75 kVRMS)	Negative Output Supply	No	N/A	5.5	24	4/6	10/15	90	SOIC-8 Narrow
NCV57080C	Yes (3.75 kVRMS)	Split Output	No	N/A	5.5	24	4/6	10/15	90	SOIC-8 Narrow
NCV57090A	Yes (5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	6.5/6.5	13/13	90	SOIC-8 Wide
NCV57090B	Yes (5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	6.5/6.5	13/13	90	SOIC-8 Wide
NCV57090C	Yes (5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	6.5/6.5	13/13	90	SOIC-8 Wide
NCV57090D	Yes (5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	6.5/6.5	13/13	90	SOIC-8 Wide
NCV57090E	Yes (5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	6.5/6.5	13/13	90	SOIC-8 Wide
NCV57090F	Yes (5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	6.5/6.5	13/13	90	SOIC-8 Wide
NCV57084	Yes (2.5 kVRMS)	Single Channel IGBT Driver	No	N/A	20	30	7/7	10/15	90	SOIC-8 Narrow
NCV57085	Yes (2.5 kVRMS)	Single Channel IGBT Driver	No	N/A	22	32	7/7	10/15	90	SOIC-8 Narrow
NCV57200	Yes (3.75 kVRMS)	Half Bridge, Isolated High & Non-Isolated Low	No	N/A	5.5	24	1.9/2.3	10/15	90	SOIC-8 Narrow
NCV57252	Yes (2.5 or 5 kVRMS)	Two-Channel Output IGBT Driver	No	N/A	20	32	6.5/3.5	12/10	80	SOIC-16 Wide
NCV57255	Yes (2.5 or 5 kVRMS)	Two-Channel Output IGBT Driver	No	N/A	20	32	6.5/3.5	12/10	80	SOIC-16 Narrow

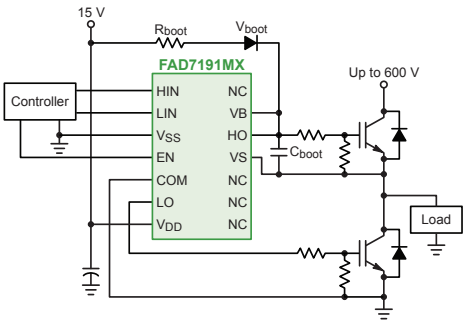
MOSFET & IGBT Gate Drivers for ICE, EV/HEV, and 48 V

Features

- Large sink and source current capability
- Fast drivers with short propagation delay
- SOIC-14 and SOIC-16 packages for applications with HV clearance requirements
- Separate power and signal ground for higher immunity against high dI/dt
- Various protection features such as UVLO and shoot-through prevention
- Custom options



Synchronous Rectification Application



Motor Drive Application

Device	Description	Sink/Source Output Current	Undervoltage Lockout	Peak Transient (V)	Shoot Through Prevention	Enable/ Shut Down Pin	Input level	Inverted Output	Package(s)
FAN3229 (F085)	Dual Low Side Gate Driver	1.6/2.4 A	✔	20			CMOS/TTL**		SOIC-8
FAN3121 (F085)	Single Low Side Gate Driver	7.1/9.7 A	✔	20		✔	CMOS/TTL	✔	SOIC-8
FAN3122 (F085)	Single Low Side Gate Driver	7.1/9.7 A	✔	20		✔	CMOS/TTL		SOIC-8, SOIC-8 EP
FAN3213 (F085)	Dual Low Side Gate Driver	2.8/4.3 A	✔	20			TTL	✔	SOIC-8
FAN3214 (F085)	Dual Low Side Gate Driver	2.8/4.3 A	✔	20			TTL		SOIC-8
FAN3216 (F085)	Dual Low Side Gate Driver	1.6/2.4 A	✔	20			TTL	✔	SOIC-8
FAN3217 (F085)	Dual Low Side Gate Driver	1.6/2.4 A	✔	20			TTL		SOIC-8
FAN3223 (F085)	Dual Low Side Gate Driver	2.8/4.3 A	✔	20		✔	CMOS/TTL	✔	SOIC-8
FAN3224 (F085)	Dual Low Side Gate Driver	2.8/4.3 A	✔	20		✔	CMOS/TTL		SOIC-8, SOIC-8 EP
FAN3225 (F085)	Dual Low Side Gate Driver	2.8/4.3 A	✔	20			CMOS/TTL**		SOIC-8
FAN3226 (F085)	Dual Low Side Gate Driver	1.6/2.4 A	✔	20		✔	CMOS/TTL	✔	SOIC-8
FAN3227 (F085)	Dual Low Side Gate Driver	1.6/2.4 A	✔	20		✔	CMOS/TTL		SOIC-8
FAN3228 (F085)	Dual Low Side Gate Driver	1.6/2.4 A	✔	20			CMOS/TTL**		SOIC-8
FAN1100 (F085)	Ignition IGBT Driver	–		28			1.2 V VINL / 2 V VINH		SOIC-8
NCV51705	Low side SiC Driver	6/6 A	Adjustable	28	✔	✔	TTL	✔	QFN-24
NCV51511	High Frequency, High Side and Low Side Gate Driver with Bootstrap Diode	3/6 A		100			TTL		SOIC-8 EP
NCV51513	High and Low Side Drivers with Dead Time & Interlock	2/3 A	✔	130	✔	✔	3.3 & 5 V logic compatible		DFNW-10
FAN7085 (F085)	High Side Gate Driver with Cboot Recharge Path	450/450 mA	✔	300		✔	CMOS		SOIC-8
NCV5183	High and Low Side Gate Driver	4.3/4.3 A	✔	600			3.3 & 5 V logic compatible		SOIC-8
NCV5106A	High and Low Side Gate Driver	250/500 mA	✔	600			3.3 & 5 V logic compatible		SOIC-8
FAN7080 (F085)	Half Bridge Gate Driver	300/600 mA	✔	600	✔	✔	3.3 / 5 V logic compatible		SOIC-8
FAN7081 (F085)	High Side Gate Driver	250/500 mA	✔	600			CMOS		SOIC-8
FAN7083 (F085)	High Side Gate Driver	200/400 mA	✔	600		✔	CMOS		SOIC-8
NCV5104	Single Input High and Low Side Gate Driver	250/500 mA	✔	600	✔	✔	3.3 & 5 V logic compatible		SOIC-8
FAN7171 (F085)	High Side Gate Driver	4/4 A	✔	600			3.3 / 5 V logic compatible		SOIC-8
FAN7191 (F085)	High Side and Low Side High Gate Driver	4.5/4.5 A	✔	600			3.3 / 5 V logic compatible		SOIC-8
FAD7191M1X	High Side and Low Side Gate Driver with Separate Grounds	4.5/4.5 A	✔	600		✔	3.3 / 5 V logic compatible		SOIC-14
FAD6263M1X	Half Bridge Gate Driver with Separate Pullup and Pulldown Outputs	3/3 A	✔	600	✔	✔	3.3 / 5 V logic compatible		SOIC-16
FAD8253MX*	Half Bridge Gate Driver with Separate Grounds	2/2.5 A	✔	1200	✔	✔	3.3 / 5 V logic compatible		SOIC-14

* Pending 4Q19. ** Differential input.

MOSFET & IGBT Gate Drivers for ICE, EV/HEV, and 48 V

Galvanic Isolation Driver for MOSFET & SiC

Device	Description	Type of Switch	Isolation Level (kV)	Drive Source/Sink Typ (A)	No of Channels	CMTI Min (V/nS)	EN/DIS			Package(s)
							UVLO	EN/DIS	Other	
NCV57000/1	Isolated High Current Gate Driver	IGBT	5	4/6	1	100	13 V	–	Clamp/DESAT/Split Output	SOIC-16 WB
NCV57080/1	Isolated High Current Gate Driver	IGBT/MOS	5	6.5/6.5	1	100	9/13 V	–	Clamp/Split Output	SOIC-8 NB
NCV57090/1	Isolated High Current Gate Driver	IGBT/MOS	5	6.5/6.5	1	100	9/13 V	–	Clamp/Split Output	SOIC-8 NB
NCV57252/3	Isolated High Current Gate Driver	IBGT/MOS	5	6.5/6.5	2	100	9/13 V	DIS	ANB	SOIC-16 WB
NCV57255/6	Isolated High Current Gate Driver	IBGT/MOS	5	3.5/3.5	2	100	9/13 V	DIS	ANB	SOIC-16 NB
NCV51561	Isolated High Current Gate Driver	MOS/SIC	5	4.5/9	2	200	8/17 V	EN/DIS	ANB	SOIC-16 WB
NCV51563	Isolated High Current Gate Driver	MOS/SIC	5	4.5/9	2	200	8/13 V	EN/DIS	ANB	SOIC-14 WB

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.

onsemi 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

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
NCV7518	Hex Low-Side	16-bit	✔	external MOSFET	✔	48 V (load)	✔	✔	QFN-32
NCV7519	Hex Low-Side	16-bit	✔	external MOSFET	✔	48 V (load)	✔	✔	QFN-32
NCV7520	Hex Low-Side	16-bit	✔	external MOSFET	✔	48 V (load)	✔	✔	QFN-32, TQFP-32 EP
NCV33152	High Speed Dual PreDrvier	–	✔	external MOSFET		20 V (V_{DD})			SOIC-8
NCV7535	H-Bridge	24-bit	✔	external MOSFET	5 V	40 V		✔	TSSOP-20

Smart Drivers & Bridges

Multi-Channel Drivers

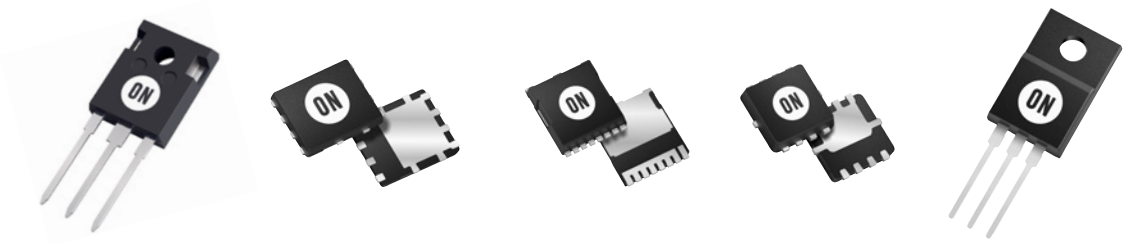
Device	Description	SPI	Output Current	Current Limit Min (A)	$R_{DS(on)}$ @ 25°C	Vs_op (V)	Vs Peak Transient (V)	Sleep Mode	On-Chip Flyback Diode	Active Output Clamp	Parallel Inputs	Fault Reporting	Undervoltage Lockout	Open Load Detect	Current Limit	Overvoltage	Overtemperature	Low Duty Cycle Overcurrent Mode	Package(s)
NCV1413	Darlington Transistor Array	–	500 mA	–	–	30	50		✓		✓								SOIC-16
NCV7608	Configurable 8-Fold High/ Low-Side Driver	16-bit	350 mA	0.8	1.2	3 - 28	40	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		SOIC-28, SSOP-36 EP
NCV7702B	Dual Half-Bridge Driver	–	–	1	–	7 - 16	60	✓	✓		✓	✓			✓	✓	✓	✓	SOIC-24
NCV7721	Dual Half-Bridge Driver	–	500mA	1	0.8	5.5 - 32	40	✓	✓		✓	✓	✓	✓	✓	✓	✓		SOIC-14
NCV7703C	Triple Half-Bridge Driver	16-bit	499 mA	1	0.8	5.5 - 33	40	✓	✓		✓	✓	✓	✓	✓	✓	✓		SOIC-14
NCV7708F	Dual Hex High/Low-Side Driver	16-bit	500 mA	1	0.8	4.5 - 28	40	✓	✓	✓		✓	✓	✓	✓	✓	✓		SSOP-24
NCV7718	Hex Half-Bridge Driver	16-bit	550 mA	0.8	1	4.5 - 28	40	✓	✓			✓	✓	✓	✓	✓	✓		SSOP-24
NCV7719	Octal Half-Bridge Driver	16-bit	550 mA	0.8	1	4.5 - 28	40	✓	✓			✓	✓	✓	✓	✓	✓		SSOP-24 EP
NCV7720	Deca Half-Bridge Driver	16-bit	550 mA	0.8	1	4.5 - 28	40	✓	✓			✓	✓	✓	✓	✓	✓		SSOP-24 EP
NCV7726	12x Half-Bridge Driver	16-bit		1.1	0.9	4.5 - 32	40	✓	✓		✓	✓	✓	✓	✓	✓	✓		SSOP-24 EP
NCV7240	8x Low-Side Driver	16-bit	300 mA	0.6	1.5	(VDD) 4.5 - 5.5	(VDD) 5.5	✓	✓	✓	✓	✓		✓	✓		✓		SSOP-24
NCV7728	Hex Half-Bridge Driver	16-bit	550 mA	0.8	1	4.5 - 28	40	✓	✓			✓	✓	✓	✓	✓	✓		SSOP-24
NCV7750	4x Low Side Driver	16-bit	300 mA	0.6	1.5	(VDD) 4.5 - 5.5	(VDD) 5.5	✓	✓	✓	✓	✓		✓	✓		✓		SSOP-24
NCV7751	12x Low-Side Driver	16/24/ 32-bit	300 mA	0.6	1.3	(VDD) 4.5 - 5.5	(VDD) 5.5	✓	✓	✓	✓	✓		✓	✓		✓		SSOP-24 EP
NCV7754	8x Low-Side Driver	16-bit	300 mA	0.5	0.8	(VDD) 4.5 - 5.5	(VDD) 5.5	✓	✓	✓	✓	✓		✓	✓		✓		SSOP-24

Door Drivers

	Device	SPI	Safe Lock	Door Locking	Mirror Fold	Mirror X-Axis	Mirror Y-Axis	ECM	Morror Defroster	LED Blinker	LED Floor Step Light (LED/ Bulb)	Safety Light (LED/ Bulb)	Protection (Over Voltage & Under Voltage)	Protection (Over Current, Under Load & Thermal)	Current Sense & PWM	Package(s)
Front Door/ Mirror	NCV7707	24-bit	0.15, 0.3 Ω	0.15 Ω	0.3 Ω	1.6 Ω	1.6 Ω	DAC + LS	0.1 Ω	1.4 Ω	0.3, 1.4 Ω	1.4 Ω	✓	✓	✓	SSOP-36
Back Door Lock	NCV7710	24-bit	–	0.15 Ω	–	–	–	–	–	–	–	–	✓	✓	✓	SSOP-36
Mirror Module	NCV7704	24-bit	–	–	–	1.6 Ω	1.6 Ω	–	0.1 Ω	1.4 Ω	0.3, 1.4 Ω	–	✓	✓	✓	SSOP-36
	NCV7705	24-bit	–	–	0.3 Ω	1.6 Ω	1.6 Ω	–	0.1 Ω	1.4 Ω	0.3, 1.4 Ω	0.6/1.4 Ω	✓	✓	✓	SSOP-36
	NCV7714	24-bit	–	–	–	1.6 Ω	1.6 Ω	DAC + LS	0.1 Ω	1.4 Ω	0.3, 1.4 Ω	–	✓	✓	✓	SSOP-36

Wide Selection of Automotive Grade Power MOSFETs

onsemi offers an expansive portfolio of Power MOSFETs, utilizing advanced Trench and SuperFET® Technology. Devices enable increased system level efficiency through low switching losses and low conduction losses, and are available in a range of standard and innovative packages.



TO-247 | SO-8 FL | TO-Leadless | m8FL | TO-220

Low to Medium Voltage

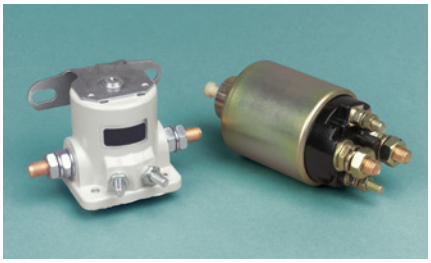
- 20 V to 200 V, Standard Gate & Logic Level
- N & P Channel, Singles & Duals
- Wide $R_{DS(on)}$ range from 0.5 mW for 40 V in 5 × 6 mm package, to 7.5 W general purpose switches
- Planar & multiple Trench technologies
- Package types including:
  - Small footprint – SOT-23, SC-70/75/88, SSOT-3/6, TSSOP-6, SO-8
  - Traditional – DPAK, D2PAK, TO-220, SOT-223
  - Surface Mount – m8FL, SO-8 FL, Power88, TO-Leadless
  - With Dual Cool, & DFN being introduced

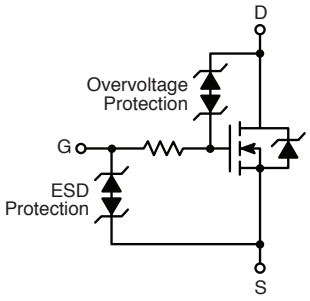
High Voltage Fast Switching

- 600 V to 650 V, N Channel, Standard Gate Level
- 650 V SuperFET II – Typical $R_{DS(on)}$ of 41 - 190 mΩ
- 650 V MOSFET KGD Dies SuperFET I and II –Typical $R_{DS(on)}$ of 41, 77, and 190 mΩ
- New SuperFET III technology in development with typical $R_{DS(on)}$ of 23 - 70 mΩ
- Lowest $R_{DS(on)}$ for the Automotive Qualified Super junction HV MOSFET's in different threw hole packages – TO-247-3L and TO-220
- MOSFET Modules in development
- High thermal performance
- Enhanced EMI, isolation, and current capabilities
- System level cost reduction
- Enable compact system solution with proven reliability
- One of best-in-class Figure of Merit (Q_g* $R_{DS(on)}$) for automotive qualified MOSFETs

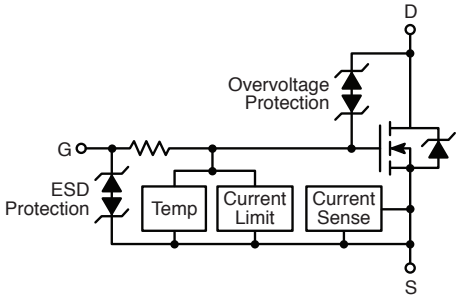
Integrated Circuit Elements with Self-Protected MOSFET Solutions

onsemi 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.

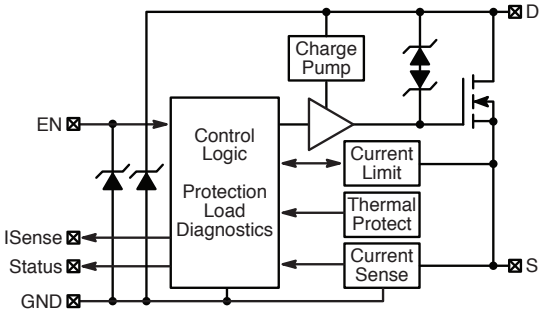




Clamping MOSFET



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
- Best-in-class Repetitive Short Circuit robustness

Protected High-Side Switch

- Charge pump
- Short circuit protection
- Current limit
- Current sense output
- 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			
NCV8401B	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/B	Low Side Protected MOSFET, 60 mΩ	1	SOT-223, DPAK
NCV8405A	Low Side Protected MOSFET, 60 mΩ	1	SOT-223, DPAK
NCV8406A/B	Low Side Protected MOSFET, 210 mΩ	1	SOT-223, DPAK
NCV8408B	Low Side Protected MOSFET, 65 mΩ	1	DPAK
NCV8440A	Clamped MOSFET, 95 mΩ	1	SOT-223
NCV8411	Low Side Protected MOSFET with Inrush Current Management, 23 mΩ	1	DPAK
NCV8413	Low Side Protected MOSFET with Inrush Current Management, 60 mΩ	1	SOT-223, DPAK
NCV8412	Low Side Protected MOSFET with Inrush Current Management, 165 mΩ	1	SOT-223
NCV8412D	Dual Low Side Protected MOSFET with Inrush Current Management, 165 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
NCV8445	High Side Protected MOSFET w\Digital Diagnostics, 45 mΩ	1	SOIC-8
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
NCV84160	High Side Protected MOSFET w\Current Sense, 160 mΩ	1	SOIC-8
NCV84140	High Side Protected MOSFET w\Current Sense, 140 mΩ	1	SOIC-8

Wide Selection of Automotive Grade Operational Amplifiers and Comparators

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)
NCV21911, 2, 4	1, 2	4	36	0.475	2	0.025	0.02	100	130	22	Output	Zero-Drift	SOT-23-5, Micro-8, SOIC-8, SOIC-14, TSSOP-14
NCVx333	1, 2, 4	1.8	5.5	0.021	0.35	0.03	0.095	60	123	62	Input/ Output	Zero-Drift	SOIC-14, TSSOP-14, SOT-23-5, SC-70-5, Micro-8, SOIC-8
NCV2001	1	0.9	7	0.51	1.4	6	8	10	70	100	Input/ Output	Sub 1V Operation	SC-70-5, SOT-23-5
NCV2002	1	0.9	7	0.48	0.9	6	8	0.01	82	100	Input/ Output	Sub 1V Operation	TSOP-6
NCV2003,32,34	1, 2, 4	1.7	5.5	0.27	7	5	2	0.001	80	20	Output	8 V/µus Slew Rate	SOT-23-5, SOT-553, Micro-8, SOIC-8, TSSOP-8, SOIC-14
NCV20061,2,4	1, 2, 4	1.8	5.5	0.14	3	4	1	0.001	80	20	Input/ Output	Low power & RRIO	TSOP-5, SC-70-5, MICRO-8, TSSOP-8, SOIC-8, SOIC-14, TSSOP-14
NCV20071,2,4	1, 2, 4	2.7	36	0.4	3	4	2	0.005	110	30	Output	Up to 36 V supply & RRO	SOT-553, TSOP-5, Micro8, SOIC-8, TSSOP-8, TSSOP-14, SOIC-14
NCV20081,2,4	1, 2, 4	1.8	5.5	0.05	1.2	4	1	0.001	80	30	Input/ Output	Low power & RRIO	TSOP-5, SC-70-5, MICRO-8, TSSOP-8, SOIC-8, SOIC-14, TSSOP-14
NCV20091,2,4	1, 2, 4	1.8	5.5	0.02	0.35	4	1	0.001	80	40	Input/ Output	Low power & RRIO	TSOP-5, SC-70-5, MICRO-8, TSSOP-8, SOIC-8, SOIC-14, TSSOP-14
NCV20166	1	3	5.5	1.25	10	0.55	1	1	92	10	Input/ Output	Wide GBW, low VOS & eN	SC-74A
NCV272, 4	2, 4	2.7	36	0.416	3	3	2	5	110	20	Output	Low Power	Micro8™, SOIC-8, SOIC-14, TSSOP-14
NCV2902	4	3	32	0.35	1	7	7	-90000	70	-	No	General Purpose	SOIC-14, TSSOP-14
NCV2904	2	3	32	0.75	1	7	7	-45000	70	-	No	General Purpose	Micro8™, SOIC-8
NCV321	1	2.5	5.5	0.08	1	9	5	1000	65	50	Output	Low Power & Rail to Rail Out	TSOP-5
NCV33072,4	2, 4	3	44	1.6	4.5	3	10	100	97	32	No	44 V supply & fast Slew Rate	SOIC-8, TSSOP-14
NCV33078, 79	2, 4	5	18	2.1	16	2	2	300	100	4.5	No	Wide GBW, low VOS & eN	SOIC-8, SOIC-14
NCV33172, 4	2, 4	3	44	0.18	1.8	6.5	10	20	90	32	No	Up to 44 V supply	SOIC-8, TSSOP-14
NCV33202,4	2, 4	1.8	12	0.9	2.2	6	2	80	90	20	Input/ Output	High output current & drive	SOIC-8, MICRO8, SOIC-14, TSSOP-14
NCV33272/4A	2, 4	3	36	2.2	24	1	2	300	100	18	No	Wide GBW, VS range	SOIC-8, SOIC-14, TSSOP-14
NCV34074	4	3	44	1.9	4.5	3	10	100000	97	32	No	High Slew Rate	SOIC-14
NCV7101	1	1.8	10	1.0	1	9	8	0.001	60	140	Input/ Output	Ultra-low IB	SOT-23-5
NCV833	2	10	36	2	15	5	2	300	100	4.5	No	VS Range, low eN	SOIC-8
NCV952	2	2.7	12	0.9	3	8	2	35	80	25	Input/ Output	26 V rail-to-rail I/O	TSSOP-8

Zero Drift Operational Amplifiers

Device	Channels	V_S Min (V)	V_S Max (V)	Input CM Range (V)	I_Q/Channel (mA)	GBW (MHz)	V_{OS} Max (mV)	V_{OS} Drift (µV/°C)	Gain Error (%)	CMRR (dB)	e_{p-p} (nV/√Hz)	Features	Package(s)
NCV2191x	1, 2, 4	4	36	VSS to VDD-1.5V	570	2	25	0.085	500	140	22	RR Out	SOT-23, Micro8, TSSOP-14, SOIC-8,SOIC-14
NCV2180x	1, 2, 4	1.8	5.5	VSS-0.1 to VDD+0.1	100	1.5	10	0.075	200	110	42	RR IN & Out	SOT-23-5, SC-70-5, MICRO-8, TSSOP-14
NCV2187x	1, 2, 4	1.8	5.5	VSS-0.1 to VDD+0.1	40	0.27	45	0.4	400	118	62	RR IN & Out	SOT-23-5, SC-70-5, MICRO-8, SOIC-8, SOIC-14
NCV333/2333/4333	1, 2, 4	1.8	5.5	VSS-0.1 to VDD+0.1	21	0.35	30	0.03	400	120	62	RR IN & Out	SOT-23-5, SC-70-5, MICRO-8, SOIC-8, SOIC-14
NCV21x*	1	2.7	26	2.7 to 26	65	14	35	0.5	1	140	-	Up to 26 V CMVIR	SC-70
NCV703x/41	1	3	5.5	-6.0 to 50'	800	0.1	0.4	3	0.3	90	2.45	Up to 80 V CMVIR	MICRO-8, SOIC-8

*Fixed Gain options = 50, 75, 100, 200, 500, 1000.

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)	I_{OUT} (mA)	Output Type	Features	Package(s)
NCV2393	2	2.7	16	9	0.8	5	20	Open Drain	VS Range, Ultra-Low IQ	SOIC-8
NCV2200	1	0.85	6	10	0.7	5	70	Complementary	Low IQ, Fast tRESP	SOT-23-5
NCV2200	1	0.85	6	10	1100	5	70	Push-Pull	Sub 1V Operation	DFN-6, SC-70-5, SOT-23-5
NCV2200A	1	0.85	6	10	1100	5	60	Push-Pull	Sub 1V Operation	UDFN-6
NCV2202	1	0.85	6	10	1100	5	70	Open-Drain	Sub 1V Operation	SC-70-5, SOT-23-5
NCV2250	1	1.8	5.5	10	50	6	50	Push-Pull	High Speed	SC-70-5, SOT-23-5
NCV2252	1	1.8	5.5	10	50	6	50	Open-Drain	High Speed	SC-70-5, SOT-23-5
NCV331	1	2.7	5	40	0.5	9	84	Open Drain	Ultra-Low IQ	SOT-23-5
NCV2903	2	2	36	200	1.5	15	16	Open Collector	General Purpose	SOIC-8, MICRO8
NCV2901	4	3	36	250	1.3	7	16	Open Collector	General Purpose	SOIC-14, TSSOP-14, Bare Die
NCV391	1	2	36	500	0.35	9	16	Open Collector	Small Package, Fast tRESP	SOT-23-5

EEPROMs for Personalization of Comfort and Entertainment Features

Grade 0 EEPROMs

Device	Density	Vcc Min (V)	Vcc Max (V)	Temperature Range (°C)	Package(s)
NV25010	1 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8
NV25020	2 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8
NV25040	4 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8
NV25080	8 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8
NV25160	16 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8
NV25320	32 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8
NV25640	64 kb	1.7 / 2.5	5.5	-40 to +150	SOIC-8, TSSOP-8

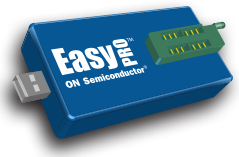
Grade 0 Features

- -40 to +150°C
- SPI interface protocol
- Voltage supply range: 1.7 – 5.5 V up to +125°C; 2.5 – 5.5 V up to +150°C

Grade 1 Features

- -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 onsemi serial EEPROMs (I²C, SPI, Microwire)



Grade 1 EEPROMs

Interface Protocol	Device	Density	Organization	Vcc Min (V)	Vcc Max (V)	f_{clk} Max (MHz)	Package(s)
I2C	CAV/NV24M01	1 Mb	128k x 8	2 .5	5 .5	1	**CAV**: SOIC-8, TSSOP-8 **NV**: UDFN-8
	CAV/NV24C512	512 kb	64k x 8	2 .5	5 .5	1	
	CAV/NV24C256	256 kb	32k x 8	2 .5	5 .5	1	
	CAV/NV24C128	128 kb	16k x 8	2 .5	5 .5	1	
	NV24C64LV	64 kb	8k x 8	1.7	5 .5	1	SOIC-8, TSSOP-8, UDFN-8, US8
	NV24C32LV	32 kb	4k x 8	1.7	5 .5	1	
	NV24C16LV	16 kb	2k x 8	1.7	5 .5	1	
	NV24C08LV	8 kb	1k x 8	1.7	5 .5	1	
	NV24C04LV	4 kb	512 x 8	1.7	5 .5	1	
	CAV24C02	2 kb	256 x 8	2 .5	5 .5	0 .4	SOIC-8, TSSOP-8
SPI	CAV/NV25M01	1 Mb	128k x 8	2 .5	5 .5	10	**CAV**: SOIC-8, TSSOP-8 **NV**: UDFN-8
	CAV/NV25512	512 kb	64k x 8	2 .5	5 .5	10	
	CAV/NV25256	256 kb	32k x 8	2 .5	5 .5	10	
	CAV/NV25128	128 kb	16k x 8	2 .5	5 .5	10	
	NV25640LV	64 kb	8k x 8	1.7	5 .5	20	SOIC-8, TSSOP-8, UDFN-8, US8
	NV25320LV	32 kb	4k x 8	1.7	5 .5	20	
	NV25160LV	16 kb	2k x 8	1.7	5 .5	20	
	NV25080LV	8 kb	1k x 8	1.7	5 .5	20	
	NV25040LV	4 kb	512 x 8	1.7	5 .5	20	
	NV25020LV	2 kb	256 x 8	1.7	5 .5	20	
	NV25010LV	1 kb	128 x 8	1.7	5 .5	20	
Microwire	CAV/NV93C86	16 kb	2k x 8 / 1k x 16	2 .5	5 .5	2	**CAV**: SOIC-8, TSSOP-8 **NV**: UDFN-8
	CAV/NV93C76	8 kb	1k x 8 / 512 x 16	2 .5	5 .5	2	
	CAV/NV93C66	4 kb	512 x 8 / 256 x 16	2 .5	5 .5	2	
	CAV/NV93C56	2 kb	256 x 8 / 128 x 16	2 .5	5 .5	2	
	CAV/NV93C46	1 kb	128 x 8 / 64 x 16	2 .5	5 .5	2	

Micro-Stepping Motor Drivers for Enhanced Positioning Resolution

Features

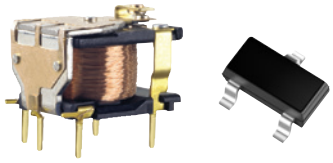
- Micro-stepping technology
- Embedded sensorless step-loss and stall detection
- Configurable for different motor types
- On-chip positioner — NCV70628

Stepping Motor Drivers

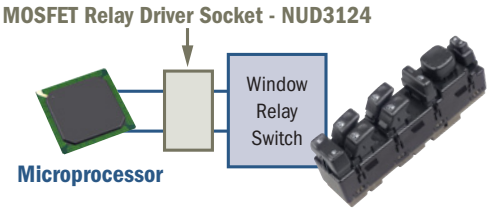
Device	Interface	Integrated Linear Regulator	Sensorless Stall Detection	Peak Transient (V)	Peak Current (mA)	Package
NCV70627	LIN1.3	✔	✔	40	800	SSOP36EP, QFNW32
NCV70628	LIN2.2	✔	✔	40	800	QFNW32

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



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

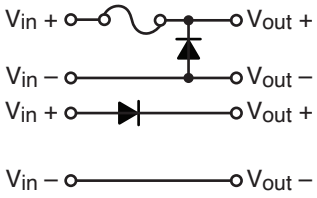
Device	Configuration	Circuit Type *	Voltage (V)	Current (mA)	Package(s)
SZNUD3124	Single	MOSFET	24	150	SOT-23
SZNUD3124D	Dual	MOSFET	24	150	SC-74
SZNUD3160	Single	MOSFET	60	150	SOT-23
SZNUD3160D	Dual	MOSFET	60	150	SC-74
NCV7750	Quad	MOSFET	40	300	SSOP-24
NCV7608	Octal	MOSFET	40	300	SSOP36-EP
NCV7240	Octal	MOSFET	40	300	SSOP-24
NCV7751	12x	MOSFET	40	300	SSOP24-EP
NCV7754	Octal	MOSFET	40	300	SSOP-24
NCV7748	Octal	MOSFET	40	300	SOIC-14

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

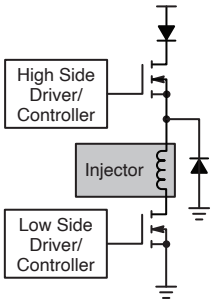
New Rectifier Packaging Solutions for Automotive

Features

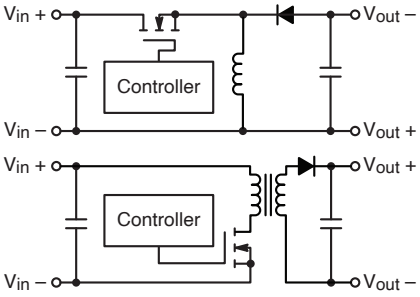
- Low forward voltage drop for improved efficiency
- High forward surge current capabilities
- Fast switching Schottky rectifiers can operate at high frequencies
- Small SOD-123FL, SMA, SMB, SMC and DPAK options to reduce board area
- Capable of use as freewheeling diodes, output rectifiers, energy recirculation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



Polarity Protection



Engine Control and Energy Recirculation Diodes



Freewheeling and Output Rectification

SO-8 Flat Lead and TO-277 Rectifiers

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVTS1045EMFS	45	10	SO-8FL
NRVTS1245EMFS	45	12	SO-8FL
NRVTS1545EMFS	45	15	SO-8FL
NRVTS560EMFS	60	5	SO-8FL
NRVTS860PFS	60	8	TO-277
NRVTS1060PFS	60	10	TO-277
NRVTS1260PFS	60	12	TO-277
NRVTS1560PFS	60	15	TO-277
NRVTS6100PFS	100	6	TO-277
NRVTS8100PFS	100	8	TO-277
NRVTS10100PFS	100	10	TO-277
NRVTS12100PFS	100	12	TO-277
NRVTS15100PFS	100	15	TO-277

LED Lighting – Boost Converter

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVTSS3100E	100V	3A	SMB
NRVTSAF5100E	100V	5A	SMA-FL
NRVTS8100MFS	100V	8A	S08-FL
NRVTS10100EMFS	100V	10A	S08-FL
NRVTS8H120EMFS	120V	8A	S08-FL
NRVTS10120EMFS	120V	10A	S08-FL
NRVBAF3200	200V	3A	SMA-FL
NRVHPAF320	200V	3A	SMA-FL
NRVHP8H200MFD	200V	8A	S08-FL

LED Lighting – Buck Converter

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVTS245ESF	45V	2A	SMA-FL
NRVTSM245E	45V	2A	Power-Mite
NRVTS1045EMFS	45V	10A	S08-FL
NRVTS2H60ESF	60V	2A	SOD123-FL
NRVTSM260EV2	60V	2A	Power-Mite
NRVTS360TFS	60V	3A	u8-FL
NRVTS560ETFSWF	60V	5A	u8-FL
NRVTS860EMFS	60V	8A	S08-FL
NRVTSAF5100E	100V	5A	SMA-FL

New Rectifier Packaging Solutions for Automotive

Reverse Battery Protection

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVBA130LN	30V	1A	SMA
NRVBS240LN	40V	2A	SMB
NRVBA340N	40V	3A	SMA
SBRS8340	40V	3A	SMC
NRVB540MFS	40V	5A	SO8-FL
NRVTSAF345	45V	3A	SMA-FL
SBRB2545CT	45V	30A	D2PAK
NRVBA160N	60V	1A	SMA
NRVBS260N	60V	2A	SMB
NRVTS860EMFS	60V	8A	SO8-FL
NRVB860MFS	60V	8A	SO8-FL
NRVBA1H100N	100V	1A	SMA
NRVBA1H100N	100V	1A	SMB
NRVBA1H100N	100V	1A	SOD123-FL
NRVBA1H100N	100V	2A	SOD123-FL
NRVBA1H100N	100V	5A	DPAK
NRVBA1H100N	100V	8A	SO8-FL
NRVBA1H100N	120V	12A	SO8-FL
NRVBA1H100N	200V	3A	SMA-FL

Energy Recirculation Rectifiers

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVB1H100SF	100	1	SOD-123FL
NRVBA1H100N	100	1	SMA
SBRS81100N	100	1	SMB
SURA8110	100	1	SMA
SURS8110	100	1	SMB
NRVB2H100SF	100	2	SOD-123FL
NRVBA2H100N	100	2	SMA
NBRS2H100	100	2	SMB
SURA8210	100	2	SMA
SURS8210	100	2	SMB
NRVBS3100	100	3	SMC
SURA8120	200	1	SMA
SURS8120	200	1	SMB
NRVHPM220	200	2	Powermite
NRVHP220SF	200	2	SOD-123FL
SURA8220	200	2	SMA
SURS8220	200	2	SMB
NRVBS3200N	200	3	SMB
SURS8320	200	3	SMC
NRVBS4201	200	4	SMC

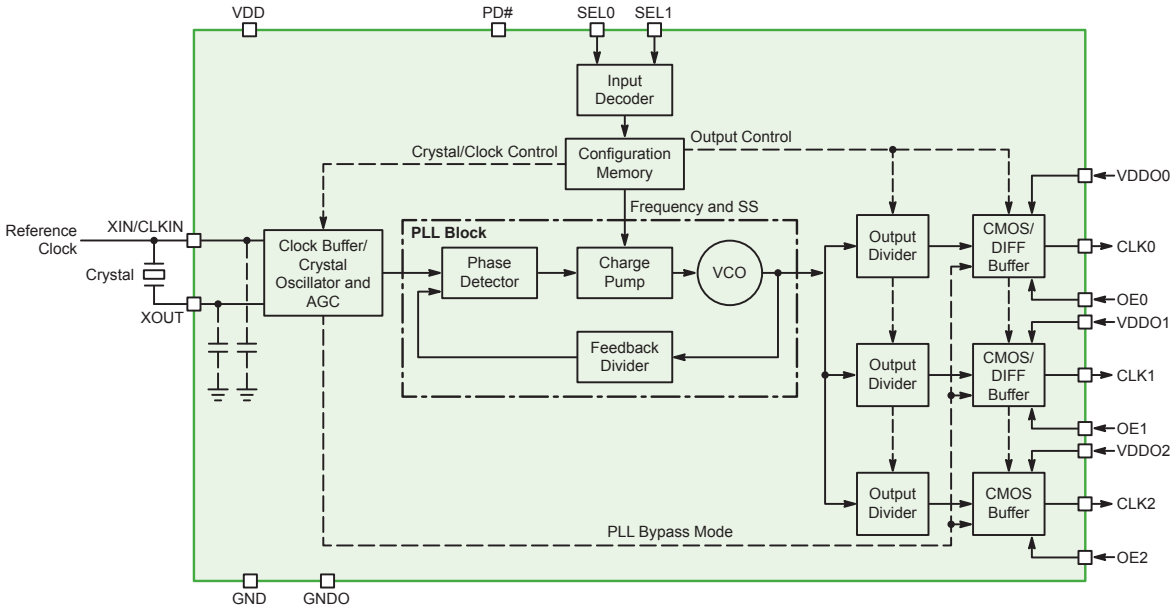
Freewheeling and Output Rectification Rectifiers

Device	V_{RRM} (V)	$I_{O(rec)}$ (A)	Package
NRVBB3030CTL	30	30	D2PAK
NRVB140SF	40	1	SOD-123FL
NRVB140ESF	40	1	SOD-123FL
NRVBA140N	40	1	SMA
SBRS8140N	40	1	SMB
NRVBAF1540	40	1.5	SMA-FL
NRVBS2040LN	40	2	SMB
NRVBS240LN	40	2	SMB
NRVBA340N	40	3	SMA
SBRS8340	40	3	SMC
SBRD8340	40	3	DPAK
MBRAF440	40	4	SMA-FL
NRVBS540	40	5	SMC
NRVBD640CT	40	6	DPAK
SBRB1545CT	45	15	D2PAK
NRVB1H60SF	60	1	SOD-123FL
NRVBA160N	60	1	SMA
NRVTSM260	60	2	Powermite
NRVB2H60SF	60	2	SOD-123FL
NRVBAF260	60	2	SMA-FL
NRVBS260N	60	2	SMB
NRVBAF360	60	3	SMA-FL
MBRAF1100	100	1	SMA-FL
MBRAF2H100	100	2	SMA-FL
NRVBAF3200	200	3	SMA-FL

OmniClock Programmable Clock Synthesizers

Features

- Single PLL
- Input Frequency Range:
  - Crystal: 3 – 50 MHz (low cost ESR crystal compatible)
  - Clock: 3 – 200 MHz (single-ended only)
- Up to 3 single-ended (LVCMOS/LVTTL) outputs, or up to 1 differential (LVPECL, LVDS, HCSL or CML) output + 1 single-ended (LVCMOS/LVTTL) output
- Output Frequency Range: 8 kHz (Min), 200 MHz (Max)
- Programmable Spread Spectrum Capabilities for EMI Suppression
  - Center Spread (0.125% steps): ± 0.125% to ± 3%
  - Down Spread (0.25% steps): -0.25% to -4%
  - Modulation Rate: 30 kHz – 130 kHz
- PLL Bypass mode
- Individual Output Enable pin for each output and Power Down Capability
- Individual Output Voltage pins per output, allowing setting of output voltage (1.8 V, 2.5 V or 3.3 V; equal to or less than VDD)
- Automatic Gain Control (Crystal Power Limiting)
- Programmable internal input crystal load capacitors
- Programmable Output Drive current
- Up to 4 independent configurations using SELx pins
- Supply Voltage: 3.3 V ±10%; 2.5 V ± 10%; 1.8 V ± 0.1 V
- Temperature Range: -40°C to +85°C
- Available in QFN-16 (3 mm x 3 mm) and WDFN-8 (2 mm x 2 mm) packages



Block Diagram

OmniClock Programmable Clock Synthesizers

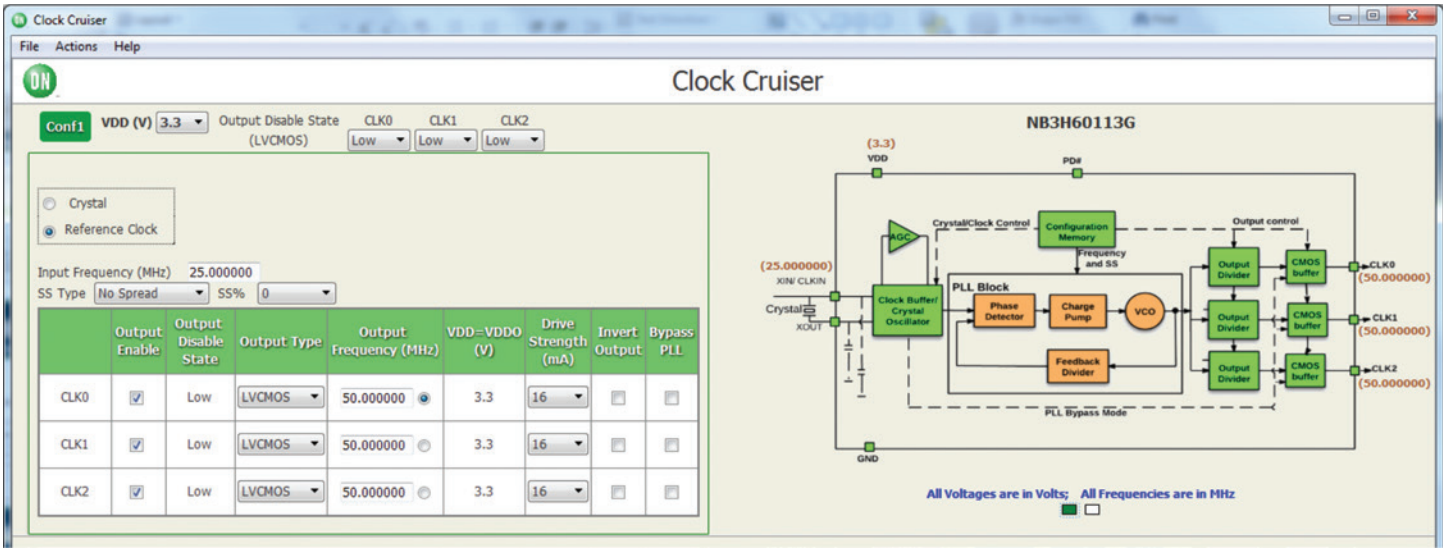
Using Omniclock in Your System

Customer orders blank Omniclock devices

Customer uses free GUI and supplied evaluation board to configure the blank device to the desired parameters: frequency, drive strength, spread spectrum, etc.

Customer provides configuration file to ON Semiconductor sales channel

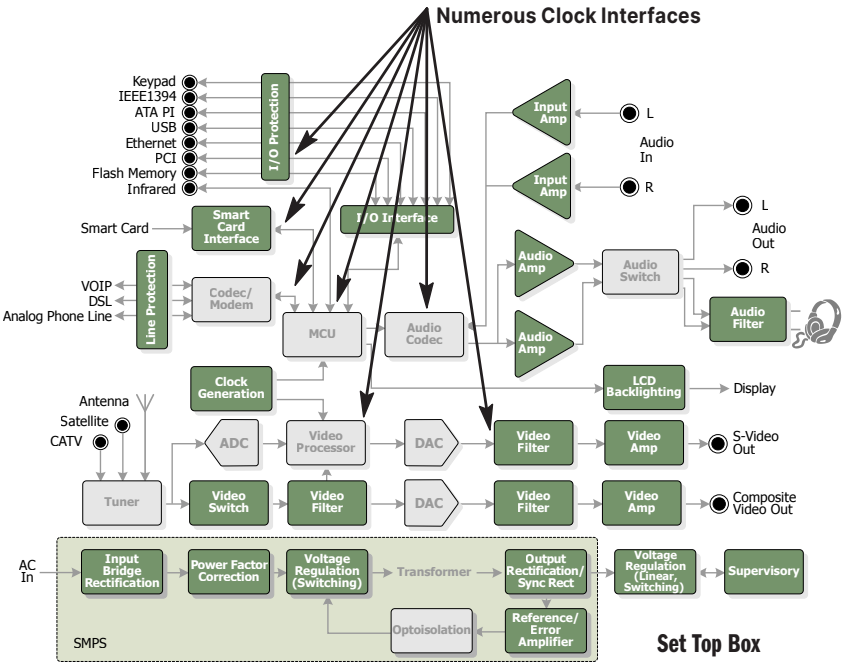
ON Semiconductor programs device in factory with desired customer configuration, and creates customer-specific part number



Configuration GUI

Device	Individual OE	Individual V_{ddo}	Supply Voltage (V)	Number of Configurations	Number of Outputs	Package
NB3H63143G	Yes	Yes	2.5 / 3.3	4	3	QFN-16
NB3H60113G	No	No	2.5 / 3.3	1	3	DFN-8
NB3V63143G	Yes	Yes	1.8	4	3	QFN-16
NB3V60113G	No	No	1.8	1	3	DFN-8

Clock Generation and Distribution



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
  - Three PLL I2C EEPROM: FS6370, FS6377

Clock Buffers

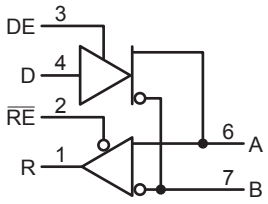
Device	VCC (V)	Output Freq (MHz)	Outputs	Type	Package
NB3N551	3.3, 5.0	180	4	Fanout Buffer	SOIC-8, DFN-8
NB3L553	2.5, 3.3, 5.0	200	4	Fanout Buffer	SOIC-8, DFN-8
NB3N2304NZ	3.3	140	4	Low Skew Fanout Buffer	TSSOP-8, DFN-8
NB2305A	3.3	15-133	5	Zero Delay Buffer	TSSOP-8, SOIC-8
NB2309A	3.3	15-133	9	Zero Delay Buffer	TSSOP-16, SOIC-16
NB2304A	3.3	15-133	4	Zero Delay Buffer	SOIC-8
NB3N200S	3.3	100	1	M-LVDS Driver/ Receiver	SOIC-8
NB3N201S	3.3	100	1	M-LVDS Driver/ Receiver	SOIC-8
NB3N206S	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
NB3N3002	25, 125, 200	PCI-e, Gigabit Ethernet	TSSOP-16
NB3N502	14-120	CPU, USB, PCI, Network, Ethernet	SOIC-8
NB3N5573	25, 100, 125, 200	PCI-e, DIMM, CPU	TSSOP-16
NBA3N5573	25-200	PCI-e, DIMM, CPU	QFNW-16

Multipoint M-LVDS Drivers/Receivers

Low voltage (3.3 V) differential 30-55 ohm line drivers and receivers, for signaling rates up to 200 Mbps.



Features

- Threshold to Detect Open-Circuit and Idle-Bus conditions
- Controlled driver output voltage transition times for improved signal quality
- -1 V to 3.4 V common-mode voltage range allows data transfer up to 2 V of ground noise
- Supports Simplex and Half Duplex bus configuration
- Temperature range -40°C to 125°C

M-LVDS Drivers & Receivers

Device	V_{CC} Typ (V)	Operating Temperature (°C)	Signaling Rate (Mbps)	Input/Output Type	Driver Propagation Delay Max (ns)	Driver Rise/Fall Time Max (ns)	Driver RMS Period Jitter Max (ps)	Receiver Type	Receiver Propagation Delay Max (ns)	Receiver Rise/Fall Time Max (ns)	Receiver RMS Period Jitter Max (ps)	Package(s)
NBA3N200S	3.3	-40 to +125	200	LVCMOS/MLVDS	2.4	1.6	3.5	Type 1	6	2.3	8	SOIC-8
NBA3N201S	3.3	-40 to +125	200	LVCMOS/MLVDS	2.4	1.6	3.5	Type 1	6	2.3	8	SOIC-8
NBA3N206S	3.3	-40 to +125	200	LVCMOS/MLVDS	2.4	1.6	3.5	Type 2	6	2.3	8	SOIC-8
NBA3N011S	3.3	-40 to +125	400	LVCMOS/LVDS	1.5	1.0	N/A	N/A	N/A	N/A	N/A	SOT-23-5
NBA3N012C	3.3	-40 to +125	400	LVDS/LVCMOS	3.5	0.8	N/A	N/A	N/A	N/A	N/A	SOT-23-5

Robust Standard Logic Families

Standard Logic

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

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

Standard Logic Families – Automotive

Series	Device Numbers	Operating Min	Operating Max	Propagation Delay, t_{PD} (nS)	Output Drive, I_{OUT} (mA)	Input Logic Level	Input Voltage Range (V)	Output Voltage Range (V)
Metal Gate	NLV14xxx	3	18	50 @ VCC = 15 V	±4.2 @ VCC = 15 V	CMOS	0 to VCC	0 to VCC
AC	NLV74ACxxx	2	6	6 @ VCC = 5 V	±24 @ VCC = 4.5 V	CMOS	0 to VCC	0 to VCC
ACT	NLV74ACTxxx	4.5	5.5	5.5 @ VCC = 5 V	±24 @ VCC = 4.5 V	TTL	0 to VCC	0 to VCC
HC	NLV74HCxxx	2	6	13 @ VCC = 6 V	±5.2 @ VCC = 6 V (Std) ±7.8 @ VCC = 6 V (Bus)	CMOS	0 to VCC	0 to VCC
HCT	NLV74HCTxxx	4.5	5.5	15 @ VCC = 5 V	±4.0 @ VCC = 4.5 V (Std) ±6.0 @ VCC = 4.5 V (Bus)	TTL	0 to VCC	0 to VCC
LCX	NLV74LCXxxx	2.3	3.6	5.5 @ VCC = 3 V	±24 @ VCC = 3 V	LVTTL	0 to 5.5	0 to 5.5
LVX	NLV74LVXxxx	2	3.6	6.6 @ VCC = 3 V	±4 @ VCC = 3 V	LVTTL	0 to 5.5	0 to VCC
VHC	NLV74VHCxxx	2	5.5	5.2 @ VCC = 4.5 V	±8 @ VCC = 4.5 V	CMOS	0 to 5.5	0 to VCC
VHCT	NLV74VHCT	4.5	5.5	3.6 @ VCC = 4.5 V	±8 @ VCC = 4.5 V	TTL	0 to 5.5	0 to 5.5

MiniGate™ Logic

High Speed*
- 2.0 to 6.0 V
- 2 mA Drive
- Typical Propagation Delay 7 ns
- -55 to +125°C

VHC*
- 2.0 to 5.5 V
- 8 mA Drive
- Typical Propagation Delay 4 ns
- -55 to +125°C

LCX* (SZ)
- 1.65 to 5.5 V
- 32 mA Drive
- Typical Propagation Delay 2.6 ns
- -55 to +125°C

SG*
- 0.9 to 3.6 V
- 8 mA Drive
- Typical Propagation Delay 2.1 ns
- -55 to +125°C

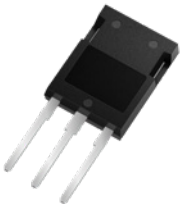
MiniGate Logic Families – Automotive

Family	VCC (V)	IO (mA)	tPD (nS)
NLV74HC1Gxxx	2.0 – 6.0	2.6 @ 5 V	7
NLV74VHC1Gxxx	2.0 – 5.5	8 @ 5 V	4.2
NLV17SZxxx	1.65 – 5.5	24 @ 3 V	2.6
NLV17SGxxx	0.9 – 3.6	8 @ 3 V	2.1

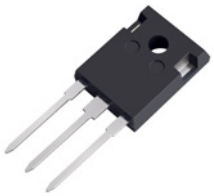
* Automotive grade available. **Specifications dependent on device type.

IGBTs

- Wide portfolio of products covering all typical applications EV/HEV
- Traction IGBT available as standard products with and without binning
- Latest FS4 technology based standard and hybrid IGBT solutions for OBC
- Broad portfolio of SMD and through hole parts for PTC and E-compressor applications



TO-247-3LD
Case 340CU



TO-247-3L
Case 340CX

D2PAK (3-Lead)
Case 418AJ

IGBTs

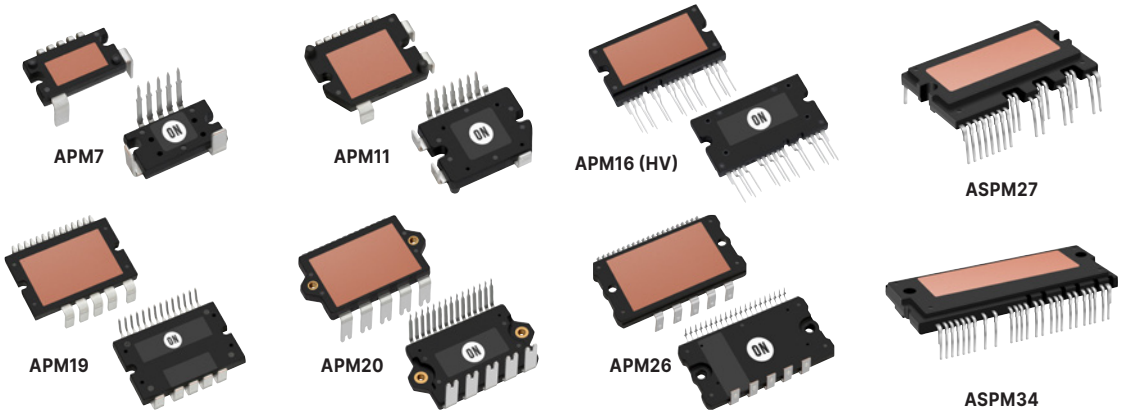
Device	V_{CES} (V)	I_C (A)	V_{CESAT} @25°C (V)	SC Time (µs)	I_F (A)	Package(s)
FGB20N60SFD_F085	600	20	2.2	–	10	D2PAK
FGH20N60SFDTU_F085	600	20	2.2	–	20	TO247
FGH40N60SFDTU_F085	600	40	2.3	–	20	TO247
FGH60N60SFDTU_F085	600	60	2.3	–	30	TO247
FGH60N60UFDTU_F085	600	60	1.9	–	20	TO247
FGH40N65UFDTU_F085	650	40	1.8	–	20	TO247
FGH40N60SMD_F085	600	40	1.9	–	20	TO247
FGH40N60SMDF_F085	600	40	1.9	–	20	TO247
FGH60N60SMD_F085	600	60	1.8	–	30	TO247
FGH75T65UPD_F085	650	75	1.69	5	50	TO247
FGB40T65SPD_F085	650	40	1.85	5	20	D2PAK
FGH40T65SPD_F085	650	40	1.85	5	20	TO247
AFGHL40T65SPD	650	40	1.85	5	20	TO247 LL
FGY120T65SPD_F085	650	120	1.5	6	120	TP247
FGY160T65SPD_F085	650	160	1.7	6	160	TP247
AFGB40T65SQDN	650	40	1.6	–	40	D2PAK
AFGB30T65SQDN	650	30	1.6	–	30	D2PAK
AFGHL50T65SQDC	650	50	1.6	–	20	TO247-3L
AFGHL75T65SQDT	650	75	1.6	–	75	TO247-3L
AFGHL75T65SQD	650	75	1.6	–	50	TO247-3L
AFGHL50T65SQD	650	50	1.6	–	30	TO247-3L
AFGHL50T65SQ	650	50	1.6	–	–	TO247-3L
AFGHL40T65SQD	650	40	1.6	–	20	TO247-3L
AFGHL40T65SQ	650	40	1.6	–	–	TO247-3L
PCGA200T65NF8M1	650	200	1.53	5	–	IGBT Wafer
PCGA300T65DF8M1	650	300	1.36	5	–	IGBT Wafer
PCRKA20065F8M1	650	200	1.35	–	–	FRD Wafer
PCRKA30065F8M1	650	300	1.2	–	–	FRD Wafer
PCGLA200T75NF8	750	200	1.45	4	–	IGBT wafer
PCRKA20075F8	750	200	1.5	–	–	FRD wafer
AFGY160T65SPD-B4	650	160	1.6	–	240	TO247
AFGY120T65SPD-B4	650	120	1.5	–	240	TO247
AFGY120T65SPD	650	120	1.6	–	160	TO247
AFGY100T65SPD	650	100	1.6	–	120	TO247
AFGHL75T65SQDC	650	75	1.6	–	20	TO247
AFGHL75T65SQDT	650	75	1.6	–	35	TO247
AFGHL40T120RHD	1200	40	2	–	48	TO247
AFGHL40T120RLD	1200	40	1.73	–	48	TO247
AFGHL25T120RHD	1200	25	2	–	48	TO247
AFGHL25T120RLD	1200	25	1.75	–	48	TO247

* Hybrid IGBT

Automotive Power Modules (APM) for ICE, 48 V and EV/HEV

Automotive Power Modules are used for Electric Power Steering, Braking Systems, DC-DC Converter, On-Board Charging and 48 V Auxilliary applications. These devices consist of MOSFETs, IGBTs, Diodes, a snubber circuit, temperature sensor and current sensor.

In addrition, there are 3 phase inverter module with gate driver IC. This IC including various circuit protection functions. Automotive Power Modules enable compact efficient and rellable system design to facilitate reductions in c02 emissions. This technology is available in solderable or press-fit pin options in a selection of DBC substrates.



APMs for ICE, 48 V, and EV/HEV

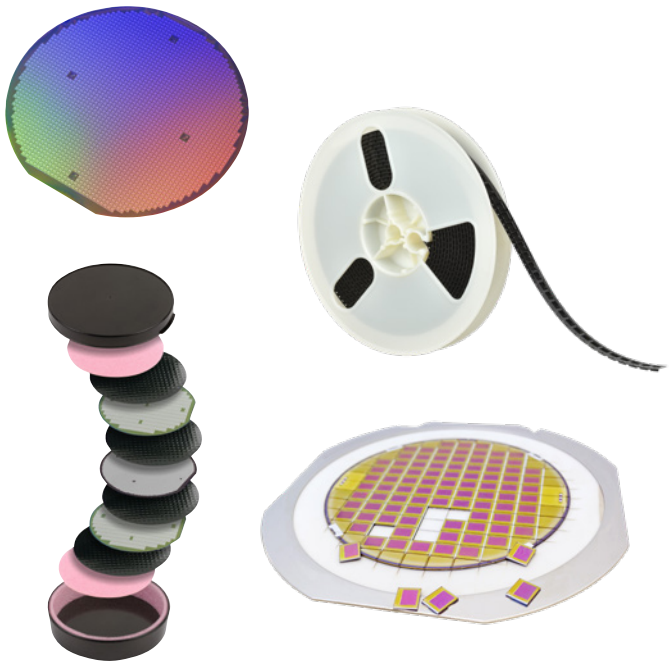
Device	Description	BV (V)	Component	Package(s)
FAM04A08DZ1	Battery Switch / Load Switch	40	MOSFET	APM7
FAM04A08DT1	Single Phase inverter	40	MOSFET, NTC, R-C Snubber	APM11
FAM04A08DC1	Single Phase inverter	40	MOSFET, Current Sense IC, R-C Snubber	APM11
FAM65CR51ADZ1/2	Boost Converter stage for Multiphase and Semi-bridgless PFC	650	SiC Diode + MOSFET	APM16
FAM65CR51AXZ1/2	Boost Converter stage for Multiphase and Semi-bridgless PFC	650	SiC Diode + MOSFET	APM16
FAM65CR51DZ1/2	Boost Converter stage for Multiphase and Semi-bridgless PFC	650	Si Diode + MOSFET	APM16
FAM65CR51XZ1/2	Boost Converter stage for Multiphase and Semi-bridgless PFC	650	Si Diode + MOSFET	APM16
FAM65HR51DS1/2	H-Bridge for LLC and Phase-Shifted DC-DC Converter	650	Snubber Capacitor, MOSFET	APM16
FAM65HR51XS1/2	H-Bridge for LLC and Phase-Shifted DC-DC Converter	650	Snubber Capacitor, MOSFET	APM16
NXV65HR51DZ2	H-Bridge for LLC and Phase-Shifted DC-DC Converter	650	MOSFET	APM16
NXV65HR82DS1/2	H-Bridge for LLC and Phase-Shifted DC-DC Converter	650	Snubber Capacitor, MOSFET	APM16
NXV65HR82DZ1/2	H-Bridge for LLC and Phase-Shifted DC-DC Converter	650	MOSFET	APM16
SXV65CR51DZ2	Boost Converter stage for Multiphase and Semi-bridgless PFC	650	MOSFET	APM16
FTCO3V455A1/2	3-Phase Inverter	40	MOSFET, NTC, R-C Snubber, Current Sense Resistor	APM19
FTCO3V85A1	DC-DC Converer	80	MOSFET, NTC, R-C Snubber, Current Sense Resistor	APM19
NXV04V120DB1	3-Phase Inverter	40	MOSFET, NTC, R-C Snubber, Current Sense Resistor	APM19
NXV08V080DB1	3-Phase Inverter	80	MOSFET, NTC, R-C Snubber, Current Sense Resistor	APM19
NXV08V110DB1	3-Phase Inverter	80	MOSFET, NTC, R-C Snubber, Current Sense Resistor	APM19
NFVA33065L32	3-Phase Inverter with gate drivers and Protections	650	NTC, IGBT, HVIC, LVIC	ASPM27 (V2)
NFVA34065L32	3-Phase Inverter with gate drivers and Protections	650	NTC, IGBT, HVIC, LVIC	ASPM27 (V2)
NFVA35065L32	3-Phase Inverter with gate drivers and Protections	650	NTC, IGBT, HVIC, LVIC	ASPM27 (V2)
NFVA33065L42	3-Phase Inverter with gate drivers and Protections	650	NTC, IGBT, HVIC, LVIC	ASPM27 (V3)
NFVA35065L42	3-Phase Inverter with gate drivers and Protections	650	NTC, IGBT, HVIC, LVIC	ASPM27 (V3)
NFVA36065L42	3-Phase Inverter with gate drivers and Protections	650	NTC, IGBT, HVIC, LVIC	ASPM27 (V3)
NFVA22512NP2T	3-Phase Inverter with gate drivers and Protections	1200	NTC, IGBT, Sense IGBT, HVIC, LVIC, BSD	ASPM34
NFVA23512NP2T	3-Phase Inverter with gate drivers and Protections	1200	NTC, IGBT, Sense IGBT, HVIC, LVIC, BSD	ASPM34
NFVA25012NP2T	3-Phase Inverter with gate drivers and Protections	1200	NTC, IGBT, Sense IGBT, HVIC, LVIC, BSD	ASPM34

Automotive Bare Die Si MOSFET and Rectifier

- Rich portfolio and market leading technology
- Field proven, high quality
- Several options for packaging and test
- Bare Die offerings:
  - MOSFET: T6 (30, 40, 60 V), T8 (80 V), MV7 (80 V), PTNG (100, 150 V), Superjunction SF3 (650 V; Fast, Easy, FRFET)
  - Rectifier: SBD (10 to 200 V), FRD (600 V; Ultrafast, Hyperfast, Stealth)
  - All production released MOSFET and Rectifier parts are available as bare dies
- Customization to existing portfolio offerings are available with the following options:
  - Die size
  - Wafer thickness
  - Pad size and location (MOSFET)
  - Optional STM (Solderable Top Metal)
  - Optional Cu plating for STM and BM (Back Metal) For Chip Embedded PCB Technology

Bare Dire Packing & Testing Options

Bare Die	100% Probe Test	Sawn	100% Final Test	Shipping Form
Unsawn	Yes	–	–	Jar
Sawn Ring	Yes	Yes	–	Wafer on Foil
Sawn Tray	Yes	Yes	–	Waffle Tray
Sawn TnR	Yes	Yes	–	Tape & Reel
KGD	Yes	Yes	Yes	Tape & Reel



Rain and Light Sensor Interface with SPI

Features

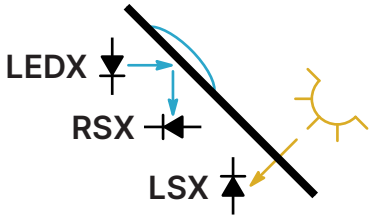
- Periodic Measurement of 4 (optionally 5) Light Sensor Signals and of 2 (optionally 1) Rain Sensor Signals
- Environmental Light Cancellation Circuitry
- Watchdog functionality and diagnostic circuitry compliant to ASIL-B
- AEC−Q100 Qualified and PPAP Capable

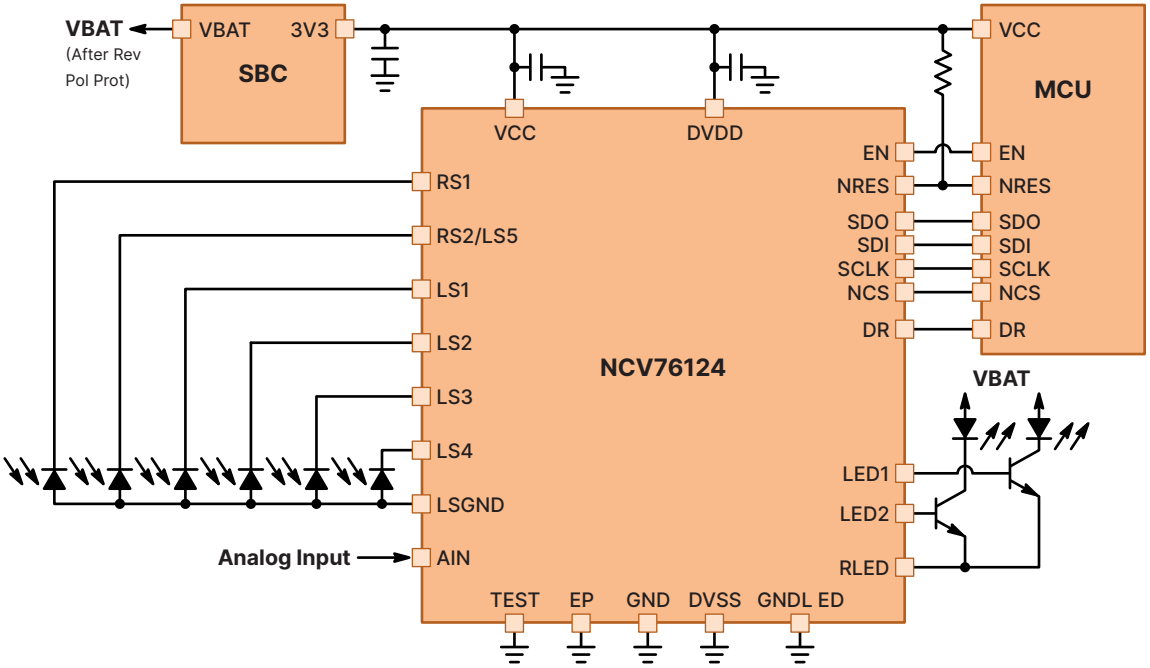
Benefits

- High Versatility, low Microcontroller Code Complexity
- Support High Dynamic Range for Optics
- Minimized Power Consumption for the desired Rain Signal Excitation

Applications/Markets

- Rain sensor for wipers
- Ambient light sensor
- Front lighting
- Head-up display





The NCV76124 is an interface chip for rain and light detection in automotive applications. It measures external photodiode currents that represent rain and light signals and transfers the converted signals to a master microcontroller on request via the SPI interface. The rain measurement data can be used to control the rain wipers. The light intensity signals can be used for e.g. brightness control of displays, the headlamp control and others. Thanks to the SPI programmability, one single hardware configuration can support various applications.

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