nexperia

Application Guide

Sweet spots products example

4Q22 Update

November 2022 • 5th Edition

Nexperia Application Guide – 4Q22 Update
Target Applications & Sweet Spot Products

Automotive

ADAS
- Radar Sensor Module
- Rear and front view cameras

Body Control
- HVAC Blower Motor
- Front Led Lighting
- Interior Lighting

Chassis Safety
- Air bag controller
- ABS (Anti-lock Breaking System)
- EPS (Electric Power Steering)

Connectivity & Telematics
- Cross domain controller – In vehicle network
- 5G

Powertrain
- Electronic fuel injection
- On Board Charger (OBC)
- Traction inverter
- BMS
- HVAC compressor
- DCDC
- 48V starter generator
- Fan cooling

Infotainment
- Subunit

Industrial

Automation
- Factory Automation
- Industrial Robotics & Cobots
- Motion Control & Servo-Drive
- HVAC (Air Conditioning)
- Forklift
- Fluid Pumps
- Professional Power Tools

Power & Energy
- AC EV Wallbox Bi-directional AC Wallbox
- UPS
- AC/DC Power Supply
- DC/DC Power Supply
- Battery charger
- PV Inverter

Medical
- Medical Instruments
- Medical Imaging
- Wearable & Personal Portable Electronics

Building & Home
- Elevator, Escalators & Moving Walkaway
- E-metering
- Gas & Fluid metering
- Security & Access Control
- Roller shutter
- Smoke and Fire detector

Lighting
- Outdoor Lighting

Other Industrial
- E-bike
- Power Tools – Battery powered
- Professional Audio Amplifier
- Smart Watch

Consumer

Home Appliances
- Washing Machine Dishwasher
- Fridge & Freezer
- Oven
- Cooking Hob

Small Appliances
- Vacuum cleaner
- Vacuum robot

Sub-System Functions

DC/DC Topologies
- Buck
- Boost
- Buck-Boost
- SEPIC
- Flyback
- Resonant LLC

AC/DC Topologies
- Non-Isolated AC/DC Linear power supply
- Power Factor Corrector – PFC
- Vienna Rectifier for Three phase–isolated

Motor Control Topologies
- Brushed Motor Control
- Brushless (3Φ) Motor Control
- Stepper Motor Control

Automotive

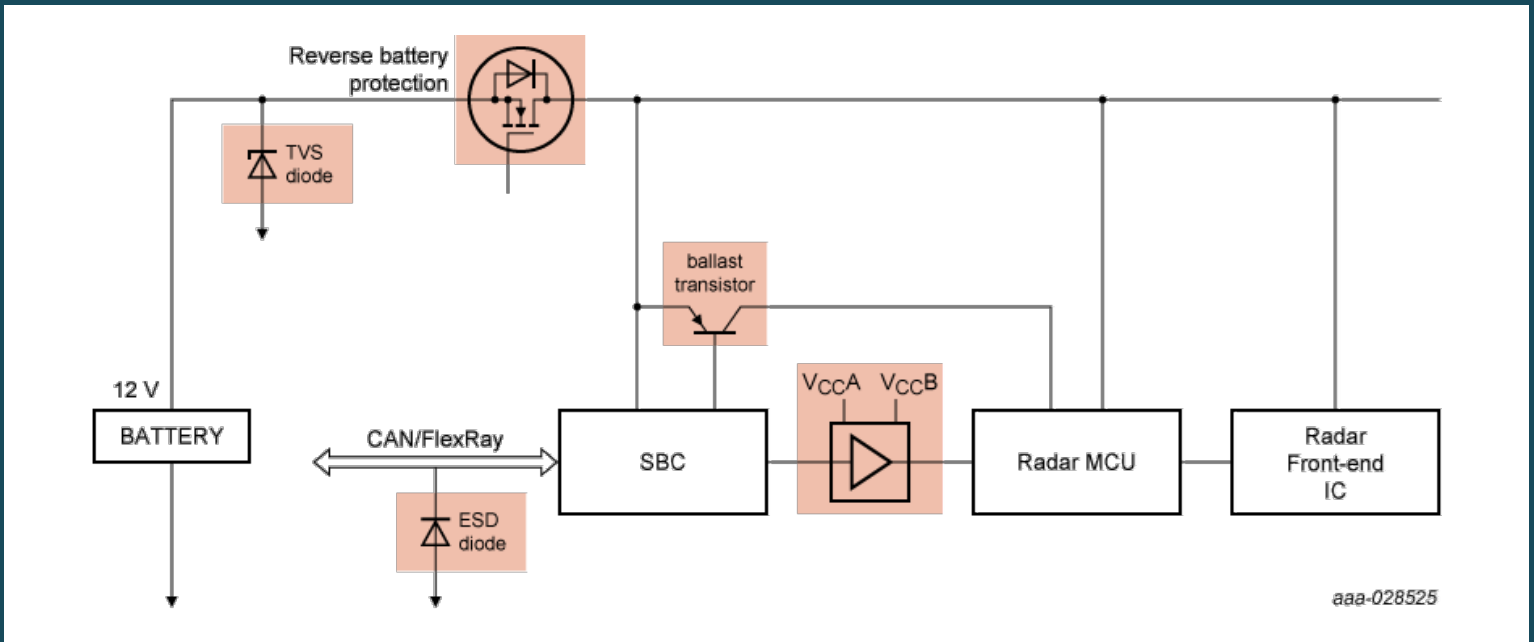
- ADAS
  - Radar Sensor Module
  - Rear and front view cameras
- Body Control
- Chassis safety
- Connectivity & Telematics
- Powertrain
- Infotainment

Radar Sensor Module

Applications

Nexperia value Proposition

- With various radar options and multiple sensors needed for full 360-degree sensing space is extremely limited
- Move to ‘postage stamp’ radar sensor modules to save overall system space
- Move to CFP and LFPAK packages for space saving, thermal efficiency and system robustness



Battery Protection

- Reverse battery: LFPAK56(E)/LFPAK88, 40 V, > 100 A
- PN or SiGe diode

Radar Sensor Control

- Dual supply voltage translation: AVC, LVC
- MUX input: single-pole switches

Communication

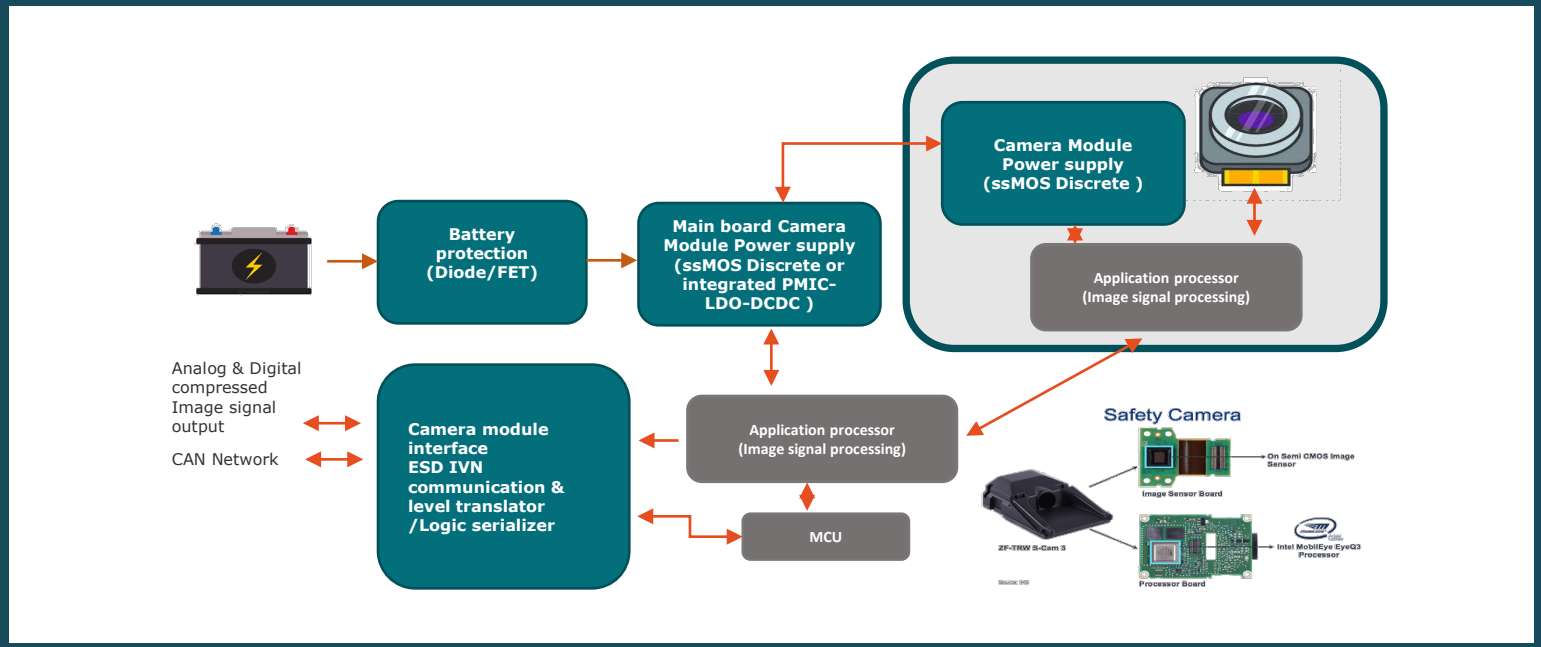
- ESD: TVS, 400 W/600 W
- ESD: CAN/LIN bus protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Rear and Front view cameras

Applications

Nexperia value Proposition

- MLPAK or LFPAK, 33 or 56 are the **same footprint for different power**
- **Miniaturization** of small signal in miniaturization package DFN (down to 0603), WLCSP package
- Miniaturization of logical package, Wettable flank package for **optical inspection**
- **ESD smallest package DFN1006**



* Coming soon

Battery Protection

- MOSFET 40 V to 60 V P and N channel
- Schottky diode DFN2020

Camera module power supply

- MOSFET N 40 V
- ssMOSFETs in DFN1010 and DFN2020
- Gate Driver: New NGD7xxx family of HS/LS driver *
- Buck: NEX30xx or NEX40xx families *

Communication

- ESD: communication bus protection (USB)
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family
- Shift register

Automotive

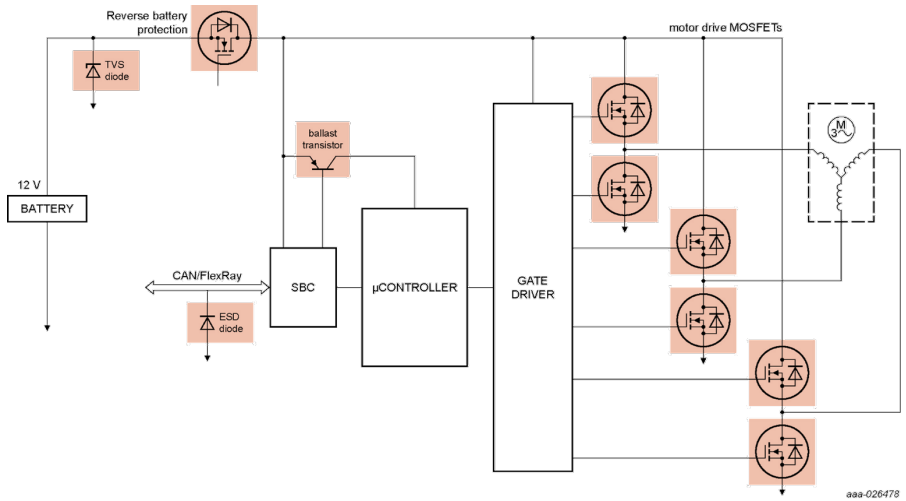
- ADAS
- **Body Control**
  - HVAC Blower Motor
  - Front Led Lighting
  - Interior Lighting
- Chassis Safety
- Connectivity & Telematics
- Powertrain
- Infotainment

HVAC Blower Motor

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow a **high-efficiency** on DCDC converter solutions running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- Dedicated ESD protection devices to ensure safe operation



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Battery Protection

- MOSFET 40 V to 60 V P and N channel
- Schottky rectifiers: 100 V

DC/DC power supply

- DCDC topologies:
- NEX30xx and NEX40xx families *
- MOSFET N-channel 40 V

Motor control

- MOSFET N 40 V
- Gate Driver: New NGD73xx family of HS/LS driver *

Communication

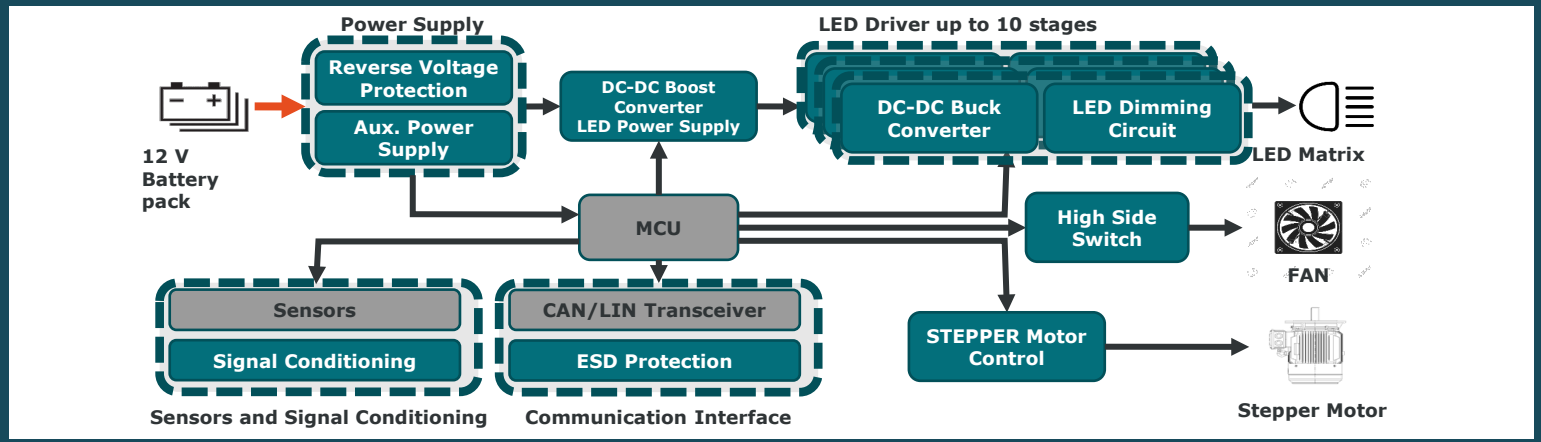
- Autosense translators: NXB/NXS series
- Control logic: LVC family
- ESD: CAN/LIN bus protection

Adaptive Front Led Lighting

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow a **high-efficiency** on DCDC converter solutions running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system could be enough versus water cooled system (cost saving)
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- **Package with top cooling** solution allow low R_{th} (j-a) with direct link to heatsink. Easier layout due to lane space under the component, thank to this to improve the critical switching loop.



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Battery Protection

- MOSFET 40 V to 60 V P and N channel
- PN or SiGe diode

DC/DC power supply

- Buck or Boost topologies: MOSFET N-channel 40 V

Actuator switch

- MOSFET N 40 V
- Gate Driver: New NGD73xx family of HS/LS driver *

Communication

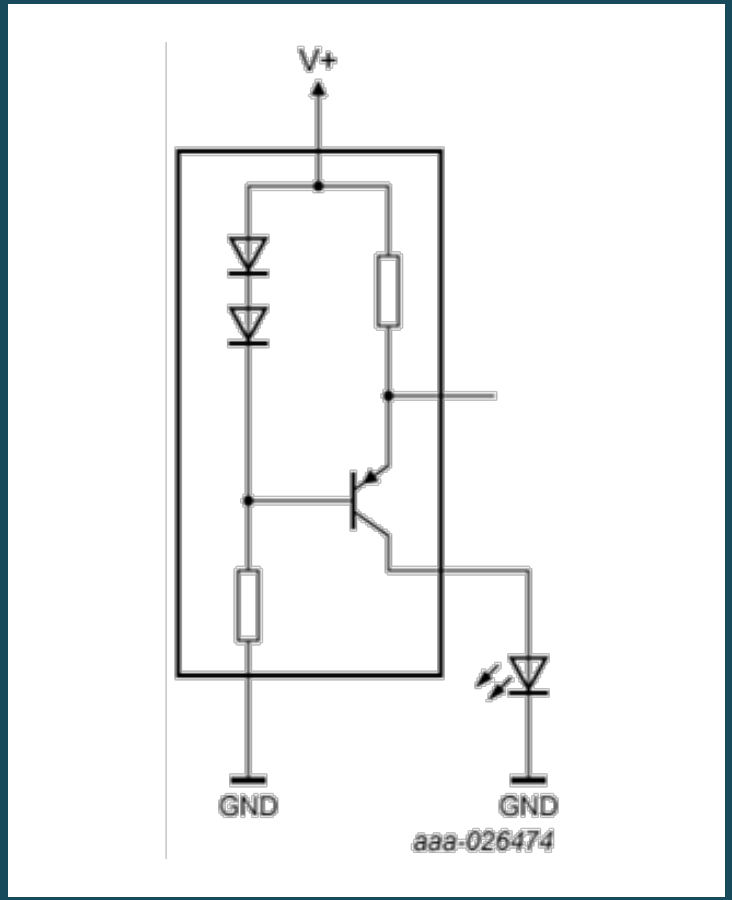
- ESD: communication bus protection (USB)
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Constant current source for interior LED lighting

Applications

Nexperia value Proposition

- Individually dimmable LED control
- Accurate LED current control
- Compact package (SOT23/SOT457)
- High efficiency driver design
- Low EMI solution using small scale highly integrated package technology
- Maximum drain current: 10 to 50 mA



Constant current source

- NCR series

Automotive

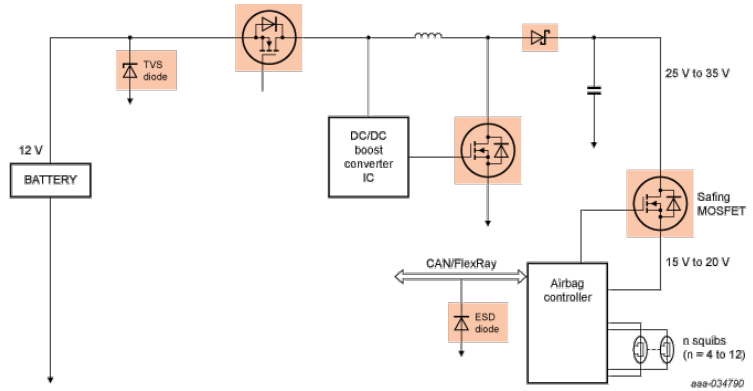
- ADAS
- Body Control
- **Chassis Safety**
  - Air bag controller
  - ABS (Anti-lock Breaking System)
  - EPS (Electric Power Steering)
- Connectivity & Telematics
- Powertrain
- Infotainment

Air Bag Controller

Applications

Nexperia value Proposition

- Traditional solutions to Airbag applications are being withdrawn from the market due to unsustainability
- Enhanced SOA technology provides similar linear mode performance in a sustainable silicon technology
- For pulsed linear mode applications, such as the Safing MOSFET in airbags Nexperia's ASFETs provide the required robustness while delivering significant board space savings (up to 84% with an LFPAK33 device) compared to traditional DPAKsolutions
- Airbag firing circuits need a stable voltage of 15 to 20 V, requiring a boost converter to step up the standard 12 V battery voltage to 25–35 V



Battery Protection

- MOSFET 40 V to 60 V P and N channel
- PN or SiGe diode

DC/DC power supply

- Safing MOSFET: ASFETs for Airbags, LFPAK33/56
- DC-DC boost low side switch: MOSFET, 60 V, LFPAK33
- DC-DC freewheeling: Schottky rectifier, 60–100 V, CFP
- ESD: TVS, 400 W/600 W

Communication

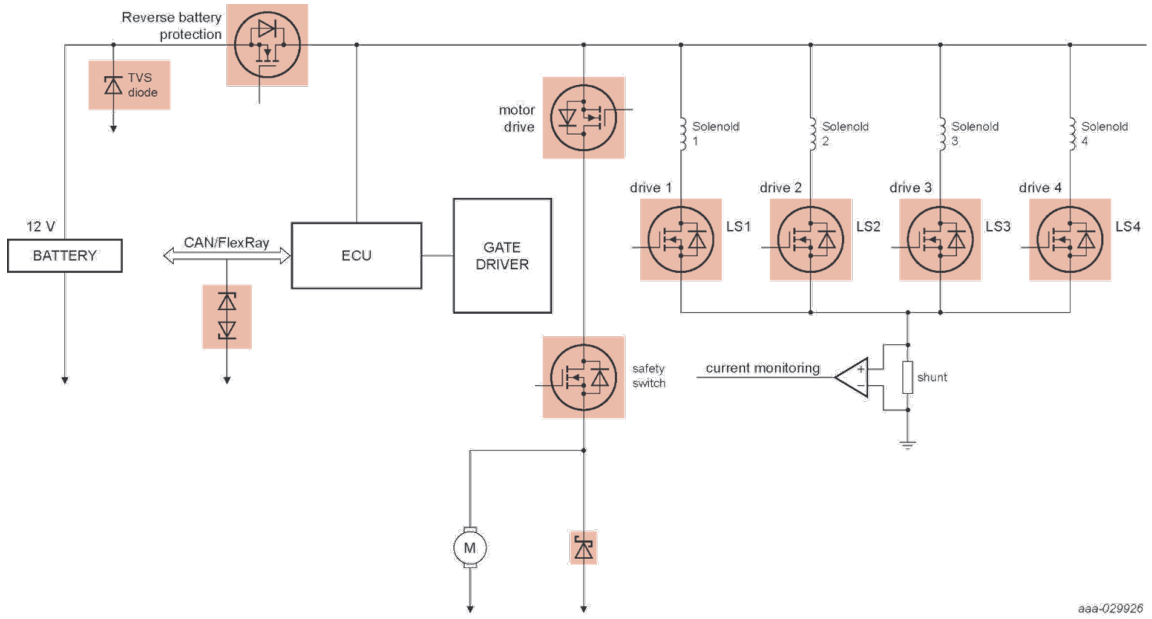
- ESD: CAN/LIN bus protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

ABS (Anti-lock Breaking System)

Applications

Nexperia value Proposition

- To improve solenoid drop out time the body diode is avalanched, hence the MOSFET must be avalanche rugged
- The safety switch MOSFET is normally continuously ON
- Protect against EMI noise by ensuring sufficient suppression and filtering



Battery Protection

- MOSFET 40 V to 60 V P and N channel, in LFPAK88
- PN or SiGe diode

DC/DC power supply

- DC/DC topologies
- MOSFET N-channel 40 V
- Schottky rectifiers: 100 V

Actuator switch

- Motor drive MOSFET: 40 V, LFPAK88
- Safety switch MOSFET: 40 V, LFPAK88
- Solenoid drive MOSFET: 40 V, LFPAK56
- Solenoid drive MOSFET: 60 V, Automotive ASFETs for Repetitive Avalanche

Communication

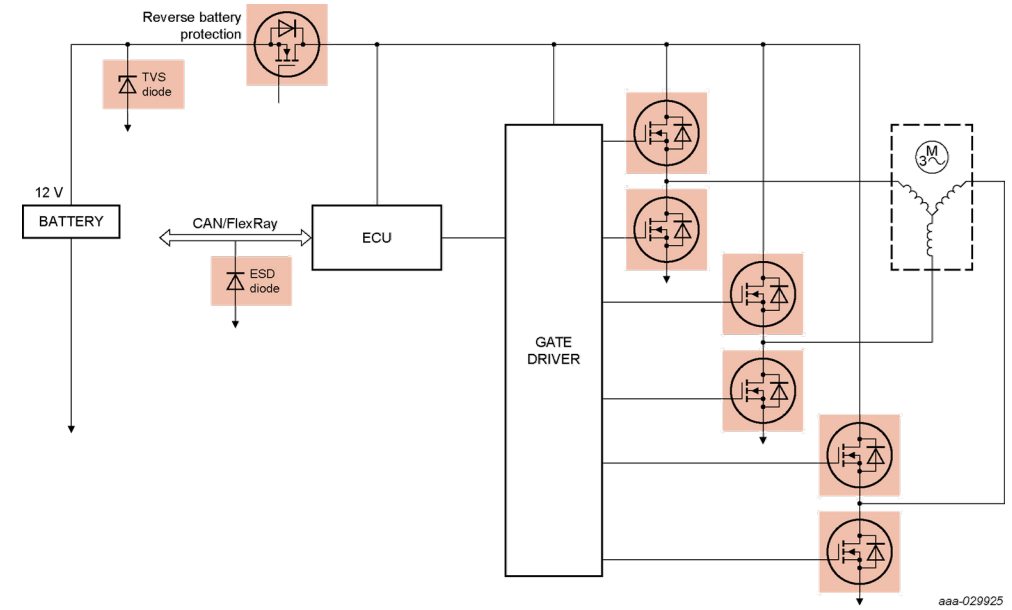
- ESD: CAN/LIN bus protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

EPS (Electric Power Steering)

Applications

Nexperia value Proposition

- Dual-redundancy designs require greater power densities and space saving, enabled by LFPAK88
- System must be able to handle worst-case current and thermal surges caused by torque assistant pulses
- Protect against EMI noise by ensuring sufficient suppression and filtering



* Coming soon

Battery Protection

- MOSFET 40 V to 60 V P and N channel
- PN or SiGe diode

DC/DC power supply

- Buck or Boost topologies: MOSFET N-channel 40 V

3ph. Motor control

- Motor drive MOSFETs: 40 V, LFPAK88
- Schottky rectifiers: 100 V
- Gate Driver: New NGD7xxx family of HS/LS driver *

Communication

- ESD: CAN/Flexray bus protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Automotive

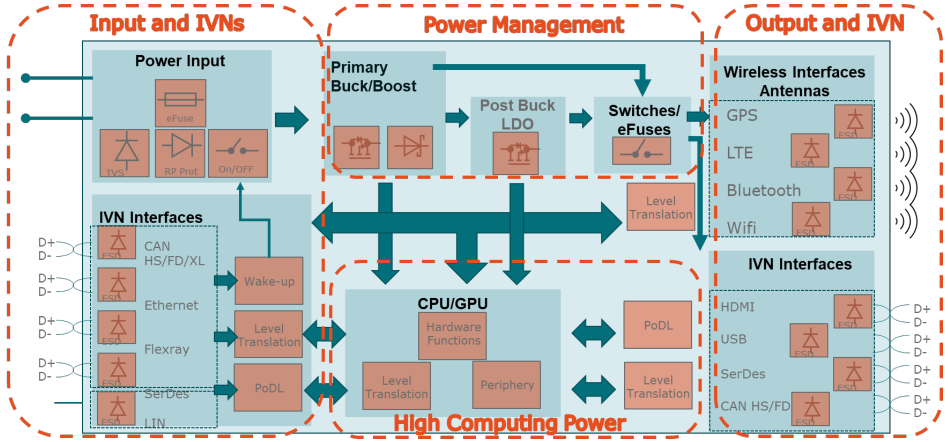
- ADAS
- Body Control
- Chassis Safety
- **Connectivity & Telematics**
  - Cross domain controller – In vehicle network
  - 5G
- Powertrain
- Infotainment

Cross Domain Controller – IN vehicle network

Applications

Nexperia value Proposition

- Qualified ESD protection at carmaker level
- As a worldwide leading producer of ESD components, the **Network protection** will be secured from any ESD damage
- High ESD robustness up to 30 kV and high surge currents up to 3.5 A (8/20µs)
- Excellent ESD clamping behavior
- Operate at a low capacitance avoiding any unwanted circuit disturbances
- Asymmetrical internal diode configuration, ensures optimized electromagnetic immunity



* Coming soon

Battery Protection

- PN or SiGe diode

DC/DC power supply

- Buck or Boost toplogies: MOSFET N channel 40 V, R_{DSon} below 2mW
- Schottky PMEGxxx, NID5100-Q100 ideal diode for higher efficiency *

Actuator switch

- MOSFET N 40 V
- Gate Driver: New NGD7xxx family of HS/LS driver*
- Load switch

Communication

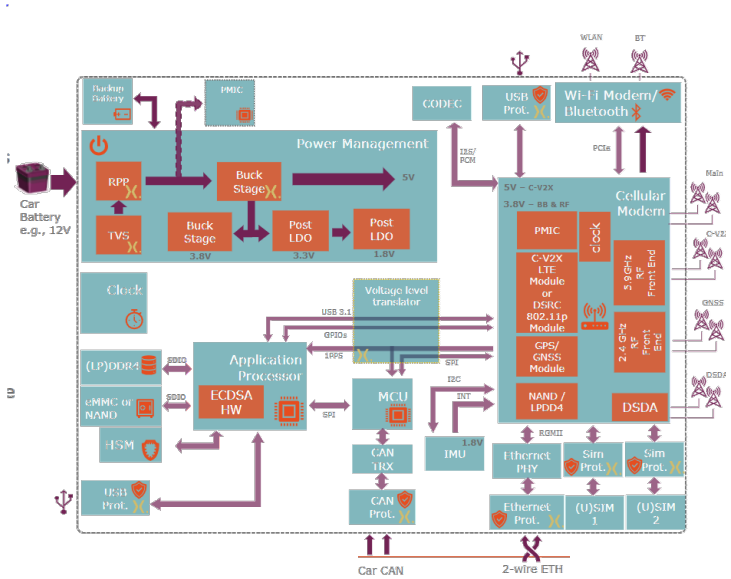
- All car buses: LIN, CAN_FD, Flexray
- All multimedia buses in a car: Ethernet, USB, SerDes, Video Link (HDMI)
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

5G

Applications

Nexperia value Proposition

- DFN & Clip bond package technology with a qualification beyond AEC-Q101 and improved thermal performance in a small form factor
- Ethernet ESD protection complying with the openAlliance norm for 100Base-T and 1000Base-T for optimal signal integrity
- Autosense voltage level translators for bi-directional push-pull and open drain applications (UART, GPIO, SPI, I²C and other interfaces)



* Coming soon

Battery Protection

- MOSFET 40 V to 60 V P and N channel
- PN or SiGe diode

DC/DC power supply

- Buck or Boost topologies: MOSFET N-channel 40 V

Actuator switch

- MOSFET N 40 V
- Gate Driver: New NGD73xx family of HS/LS driver *

Communication

- ESD: communication bus protection (USB)
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Automotive

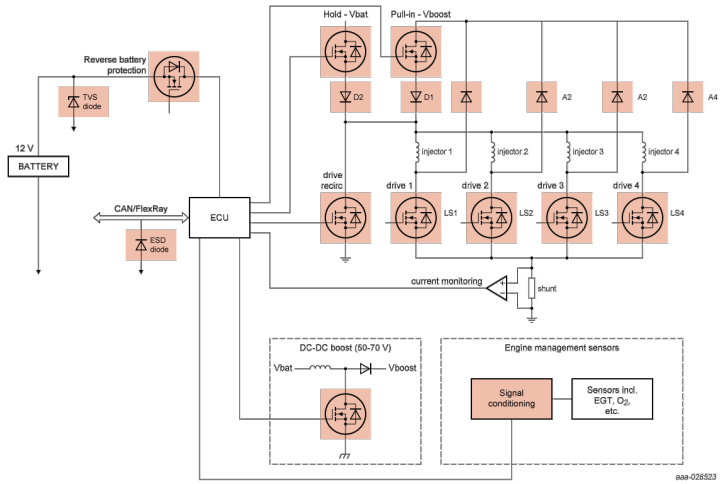
- ADAS
- Body Control
- Chassis Safety
- Connectivity & Telematics
- **Powertrain**
  - Electronic fuel injection
  - On Board Charger (OBC)
  - Traction inverter
  - BMS
  - HVAC compressor
  - DCDC
  - 48V starter generator
  - Fan cooling
- Infotainment

Electronic Fuel Injection

Applications

Nexperia value Proposition

- Controlling coil current is the key to injector fuel accuracy, with ‘pull-in’ requiring large currents while less current is needed to ‘hold’
- N-channel MOSFETs for switch pull-in, hold current and cylinder select need high current transient robustness
- Schottky rectifier or PN rectifier for freewheeling and protection of inductive load
- Ensure adequate suppression and filtering of EMI noise
- Using 100 V, ultra-low-leakage Schottky technology helps prevent thermal runaway



Products - Injector bank

- Pull-in transistor: MOSFET, 100 V, R_{DSon} 23–43 mOhm, LFPAK
- Hold current transistor: MOSFET, 100 V, LFPAK
- Cylinder select transistor: MOSFET, 100 V, LFPAK
- Cylinder select transistor: 60 V, Automotive ASFETs for Repetitive Avalanche
- Freewheeling: Schottky rectifier, CFP package, 30 A, 60–100 V
- Avalanche: PN rectifiers ≥ 1 A, 200–400 V

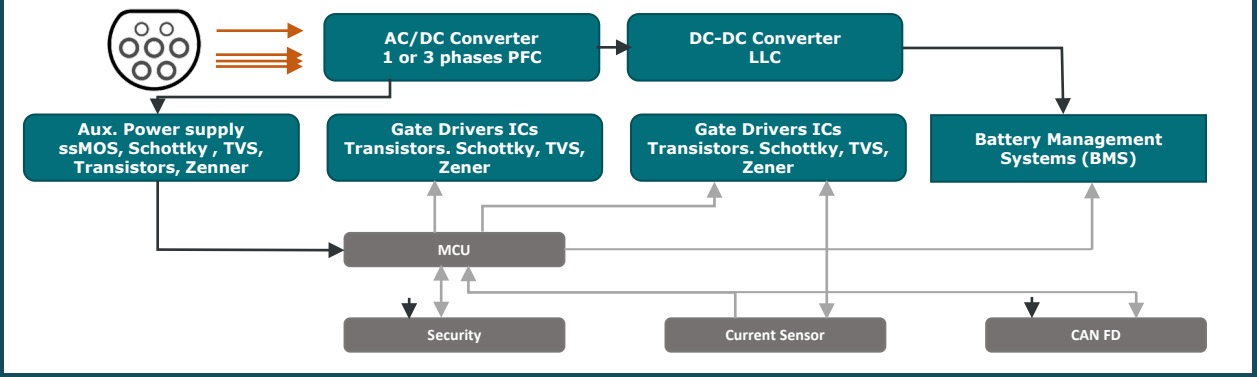
Products - Boost, battery, ESD

- DC-DC boost low side switch: MOSFET, 100 V, LFPAK
- DC-DC freewheeling: Schottky rectifier, 60–100 V
- ESD: CAN/LIN bus protection
- Reverse battery: LFPAK56, 40 V, > 100 A

On Board Charger (OBC)

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow **a high-efficiency** on DCDC converter solutions running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heatspreader, air cooled system could be enough versus water cooled system (cost saving)
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- **Package with top cooling** solution allow low R_{th} (j-a) with direct link to heatsink. Easier layout due to lane space under the component, thank to this to improve the critical switching loop.



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Applications

AC/DC (PFC)/Inverter

- GaN FET: 650 V, R_{DSon} 60 to 14mΩ CCPAK1212 (R_{th} < 0,5K/W) *
- IGBT: 650 V, 10A to 70A *
- SiC diode: 650 V to 1200 V, DPAK/ D²PAK/TO247 in dual pin *
- Gate Driver: New NGD7xxx family of HS/LS driver *

DC/DC LLC resonant, Full Bridge DAB

650 V solution for 400 V battery system

- GaN FET: 650 V, R_{DSon} 60 to 14mΩ CCPAK1212 (R_{th} < 0,5K/W) *
- IGBT: 650 V, 10A to 70A *
- SiC diode: 650 V to 1200 V, DPAK/ D²PAK/TO247 in dual pin *
- Gate Driver: New NGD7xxx family of HS/LS driver *

1200 V solutions for 800 V battery system

- IGBT: 1200 V, 10A to 70A *
- SiC diode: 1200 V, DPAK/ D²PAK/TO247 in dual pin *
- Gate Driver: New NGD7xxx family of HS/LS driver *

Battery management

- Charge balancing MOSFETs: 20 to 40 V R_{DSon} < 20mΩ
- Battery protection MOSFETs: 80 to 100 V R_{DSon} 0,55 to 4,8 mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

HMI/MMI

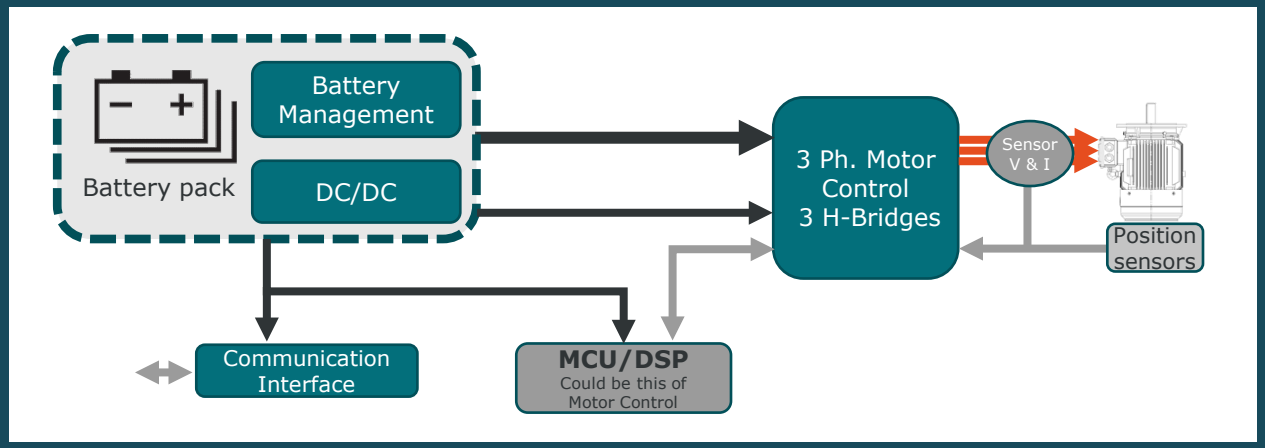
- ESD: communication bus protection (USB)
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Traction inverter

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow a **high-efficiency** on Motor Control with low Qrr, enabling better duty cycle precision.
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system.
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- **Package with top cooling** solution allow low R_{th} (j-a) with direct link to heatsink. Easier layout due to lane space under the component, thank to this to improve the critical switching loop.
- Qualified ESD protection at carmaker level
- As a worldwide leading producer of ESD components, the **Network protection** will be secured from any ESD damage



* Coming soon

DC/DC conversion

- MOSFET: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK & MLPALK 33/56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC topology

3 Ph. Motor Control

650 V solution for 400 V battery system

- GaN FET: 650 V, R_{DSon} 60 to 14mΩ CCPAK1212 (R_{th}< 0,5K/W) *
- IGBT: 650 V, 10A to 70A *

1200 V solutions for 800 V battery system

- IGBT: 1200 V, 10A to 70A *
- SiC diode: 1200 V, DPAK/ D²PAK/TO247 in dual pin *
- Gate Driver: New NGD7xxx family of HS/LS driver *

Battery management

- Charge balancing MOSFETs: 20 to 40 V R_{DSon}< 20mΩ
- Battery protection MOSFETs: 80 to 100 V RD_{Son} 0,55 to 4,8 mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400-600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

Communication

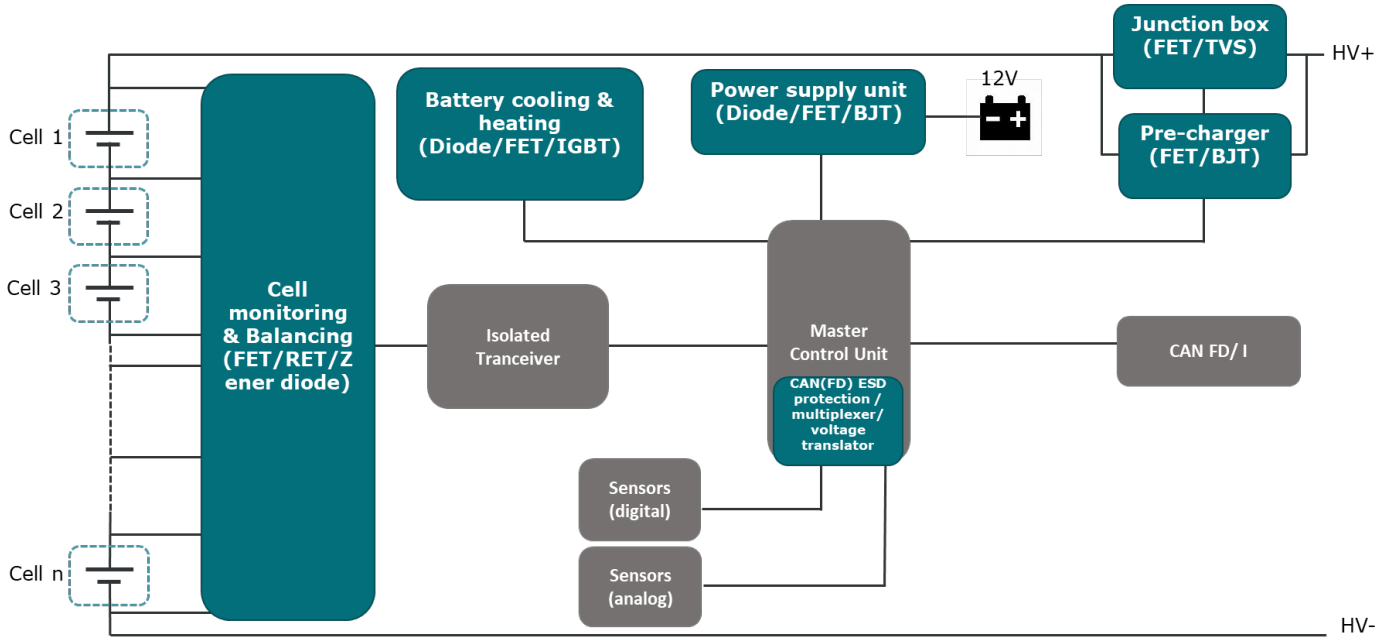
- ESD: CAN_FD, Flexray
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Battery Management System (BMS)

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system could be enough versus water cooled system (cost saving)
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system



Power Supply

- Buck or Boost topologies: ssMOSFET 3.3 V to 40 V

Junction Box

- MOSFET: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK & MLPALK 33/56

Cell monitoring and balancing

- Charge balancing MOSFET: 20 to 40 V R_{DSon} < 20mΩ
- Battery protection MOSFET: 80 to 100 V R_{DSon} 0,55 to 4,8 mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

Communication Interface

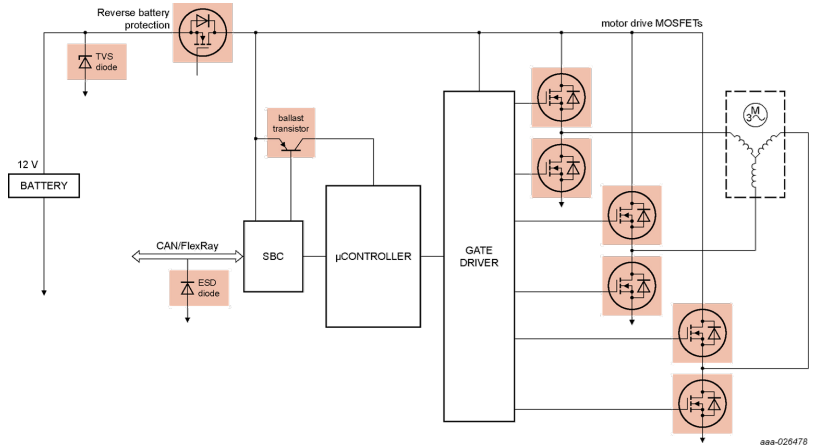
- ESD: communication bus protection (CAN-FD, USB)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

HVAC compressor

Applications

Nexperia value Proposition

- LFPAK, CFP, CCPAK, **top cooling package** solution allow **low R_{th} (j-a)** with direct link to heatsink.
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve the thermal behavior. This allow cheaper heat spreader.
- **Easier layout** due to lane space under the component, thank to this to improve the critical switching loop.
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- Improve the application behavior in a critical ambient temperature space
- As a worldwide leading producer of ESD components, the **Network protection** will be secured from any ESD damage
- Qualified ESD protection at carmaker level



* Coming soon

DC/DC conversion

- MOSFET: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK & MLPALK 33/56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC topology
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

3 Ph. Motor Control

- MOSFET: 40 to 100 V, R_{DSon} 1 to 5 mΩ LFPAK
- SiC diode: 1200 V, DPAK/ D²PAK/TO247 in dual pin *
- Gate Driver: New NGD73xx family of HS/LS driver *

Battery Protection

- MOSFET 40 V to 60 V P and N channel
- PN or SiGe diode

Communication

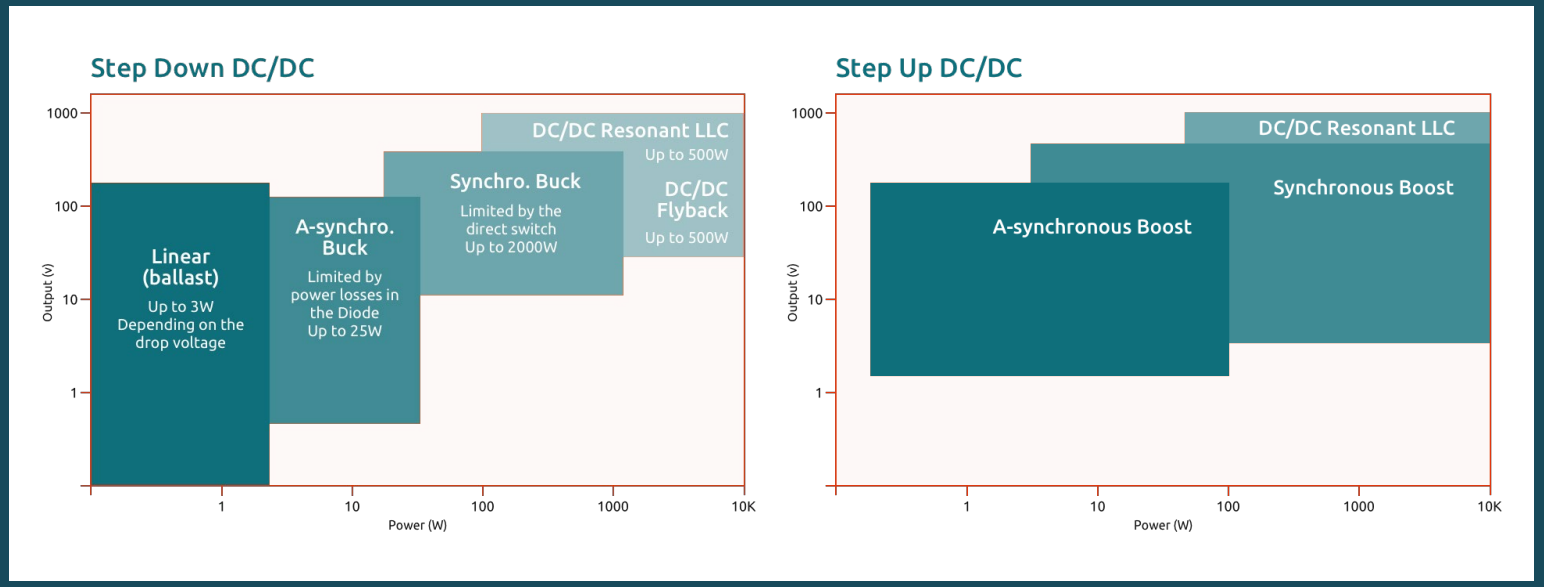
- ESD: CAN_FD, Flexray
- Autosense translators: NXB/NXS series
- Control logic: LVC family

DC/DC converter

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- **Allow to extend the battery lifetime (x2 to x5)** with integrated solution for battery cell
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions while reducing costs (less heating to dissipate, smaller inductance and capacitor)



See the following functions on dedicated one pager

Non isolated function

- DC/DC Buck synch.: V_{IN} =5 V–500 V, V_{out} = 0,9 V–200 V, $P_{out} \geq$ 20W
- DC/DC Buck asynch: V_{IN} =3 V–200 V, V_{out} = 0,9 V–100 V, $P_{out} \leq$ 50W
- DC/DC Boost synch.: V_{IN} =3 V–150 V, V_{out} = 5 V–500 V, $P_{out} \geq$ 10W
- DC/DC Boost asynch.: V_{IN} =3 V–24 V, V_{out} = 5 V–100 V, $P_{out} \leq$ 100W
- DC/DC Buck-Boost: V_{IN} =5 V–150 V, V_{out} = 3 V–500 V, $P_{out} \leq$ 500W
- DC/DC SEPIC: V_{IN} =3 V–150 V, V_{out} = 5 V–500 V, P_{out} = 5W to 150W

Isolated function

- DC/DC Flyback: V_{IN} =36 V–20 V, V_{out} < 100 V, P_{out} < 500W
- DC/DC Resonant LLC: Vin=36 V–400 V, V_{out} = 100 V to 450 V, P_{out} up to 11kW
- DC/DC Forward
- DC/DC Push Pull (coming soon)
- DC/DC Half Bridge

Integrated solutions

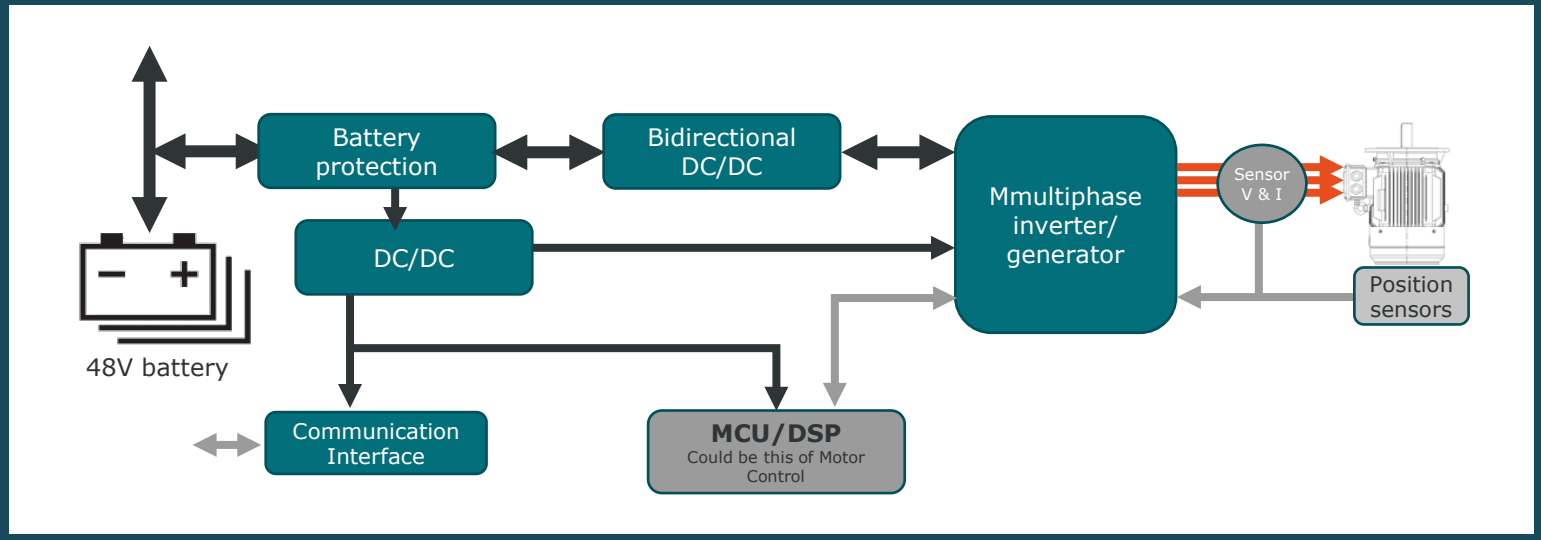
- Battery booster: SMB family

48V BSG (Belt Starter Generator)

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow a **high-efficiency** on Motor Control with low Q_{rr}, enabling better duty cycle precision.
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system.
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- **Package with top cooling** solution allow low $R_{th\ (j\text{-}a)}$ with direct link to heatsink. Easier layout due to lane space under the component, thank to this to improve the critical switching loop.
- Qualified ESD protection at carmaker level
- As a worldwide leading producer of ESD components, the **Network protection** will be secured from any ESD damage



* Coming soon

DC/DC conversion

- MOSFET: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK & MLPALK 33/56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC topology
- ESD: TVS diodes 400-600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

3 Ph. Motor Control (SR switch reluctance)

- MOSFET: 40 to 100 V, R_{DSon} 1 to 5 mΩ LFPAK
- SiC diode: 1200 V, DPAK/ D²PAK/TO247 in dual pin *
- Gate Driver: New NGD7xxx family of HS/LS driver

Battery Protection

- MOSFET: 40 V to 60 V P and N channel
- PN or SiGe diode

Communication

- ESD: CAN_FD, Flexray
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Fan Cooling

Applications

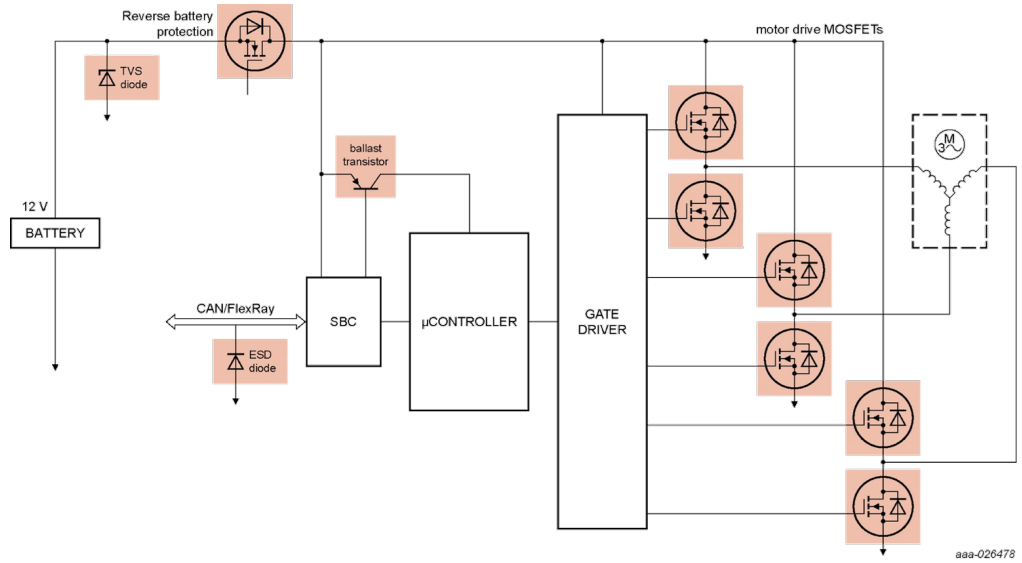
Nexperia value Proposition

1.2 kW Brushless DC motor drive

- LDC preferred for controllability and low power performance

Controlled by 6 MOSFETs operated with PWM

- puts the focus on switching losses and EMC performance
- power saving of 100 W on average
- emission reduction of approx. 0.24 kg CO_2 per 100 km.



Products

- Motor drive MOSFETs: 40 V, < 15 mOhm, LFPAK33/LFPAK56(D)
- Gate Driver: New NGD7xxx family of HS/LS driver *
- Schottky rectifiers: 100 V
- ESD: CAN/LIN bus protection
- ESD: TVS, 24/40 W
- Reverse battery: LFPAK56, 40 V, > 100 A

Automotive

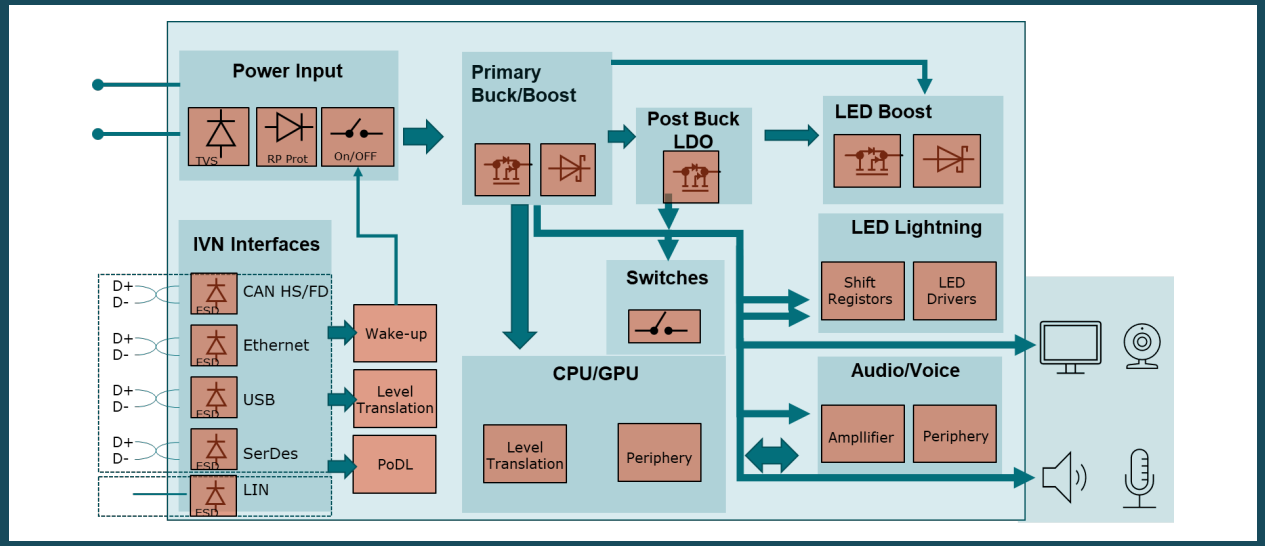
- ADAS
- Body Control
- Chassis Safety
- Connectivity & Telematics
- Powertrain
- **Infotainment**
  - Subunit

Subunits

Applications

Nexperia value Proposition

- High ESD robustness up to 30 kV and high surge currents up to 3.5 A (8/20µs). Excellent ESD clamping behavior
- Low capacitance and high surge robustness, in automotive qualified ESD protection all IVN Interfaces
- LFPAK MOSFETs with best thermal and EMC performance
- DFN packages as alternative for leaded packages
- Very short latency logic package (robust)



Primary DC/DC

- MOSFET: 40–80 V, Low $R_{DS(on)}$ (0.003to 0.021Ω) in LFPAK33/56
- Diodes: 60–100 V, Low V_F in CFP3/5/15

INV interface

- Serdes, Video Link, USB, CAN_FD, Ethernet
- Bi-Directional ESD Protection, PESD4USBxxx, PESD5V0C…, V_{RWM} of 3.3 and 5 V, C_D< 0.25pF, up to 15kV

LED Lighting

- BCPxxx, bipolar 20–80 V, 1-2A in DFN2020D-3
- PHPT6xxxxxY, 40–100 V, 3-15A in LFPAK56
- NCRxXx, 16–40 V, 10-250mA, SOT457/223
- 74HCxxx, shift register

Haptic and Touch

- Buffer 74AVCxxx, Inverter 74AHCUxxx
- MOSFET: BUK 6/7/9xxx, 30–60 V, Low $R_{DS(on)}$ in LFPAK56/33

ESD Protection

- Automotive high-speed network protection

Industrial

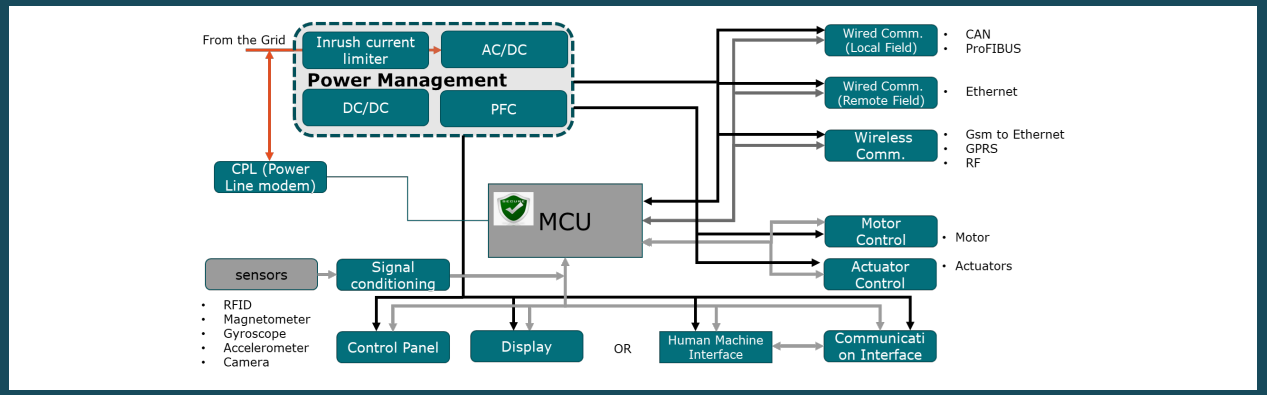
- Automation
  - Factory Automation
  - Industrial Robotics
  - Cobots
  - Motion Control & Servo-Drive
  - HVAC (Air Conditioning)
  - Forklift
  - Fluid Pumps
  - Professional Power Tools
- Power & Energy
- Medical
- Building & Home
- Lighting
- Other Industrial

Factory Automation (PLCs, I/O, Sensors & Actuators)

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

AC/DC (PFC)

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *

Motor control

- Motor Control MOSFETs: 40 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Actuator control MOSFETs 40 V, 3 mΩ < R_{DSon} < 7 mΩ LFPAK33 (R_{th} < 2K/W)
- Gate Driver: New NGD73xx family of HS/LS driver *
- Discrete Driver: BJT, RETs, Diodes
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *

DC/DC conversion

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC Buck topology
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Buck: 40 V, 600mA Synchronous Buck Converter *

Control Panel/Display/Comm.

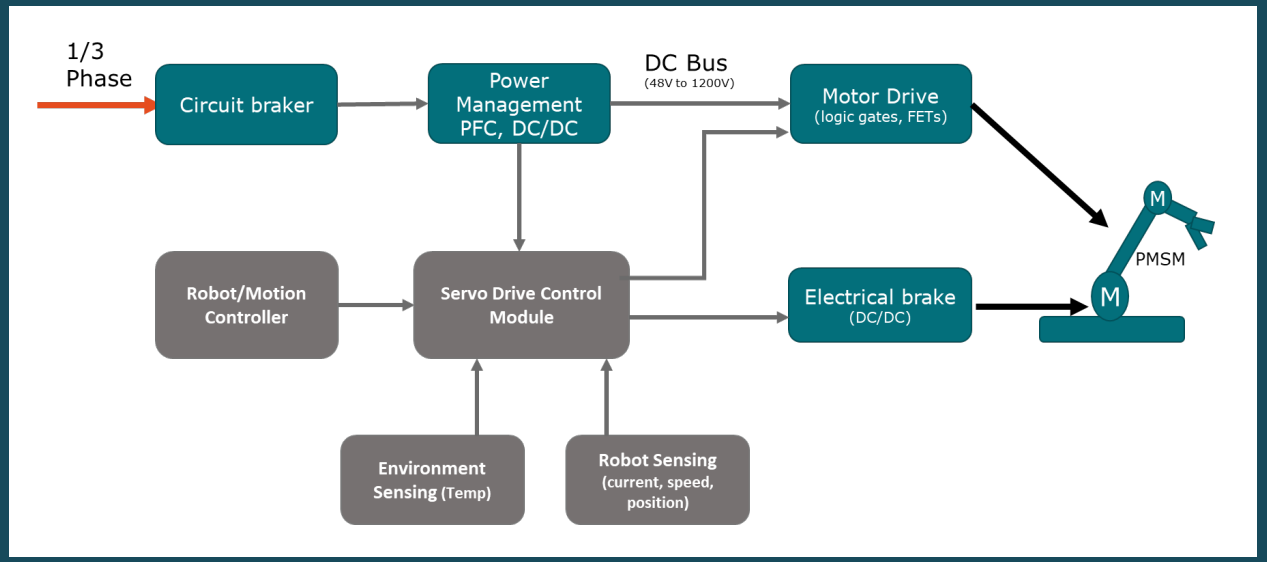
- ESD: protection (CAN-FD, Ethernet)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Industrial Robotics and Robots

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- **GaN FET low power**, working from 300 V to 600 V at high frequency **to reduce transformer size and cost**
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC electrical vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

AC/DC (PFC)

- MOSFETs: 60 V to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- GaN FETs: 650 V, R_{DSon} 12 to 90mΩ, CCPAK1212 *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B

Motor control

- Motor Control MOSFETs: 40 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- GaN FETs: 650 V, R_{DSon} 12 to 90mΩ, CCPAK1212
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Gate Driver: New NGD73xx family of HS/LS driver *
- Discrete Driver: BJT, RETs, Diodes

DC/DC conversion

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

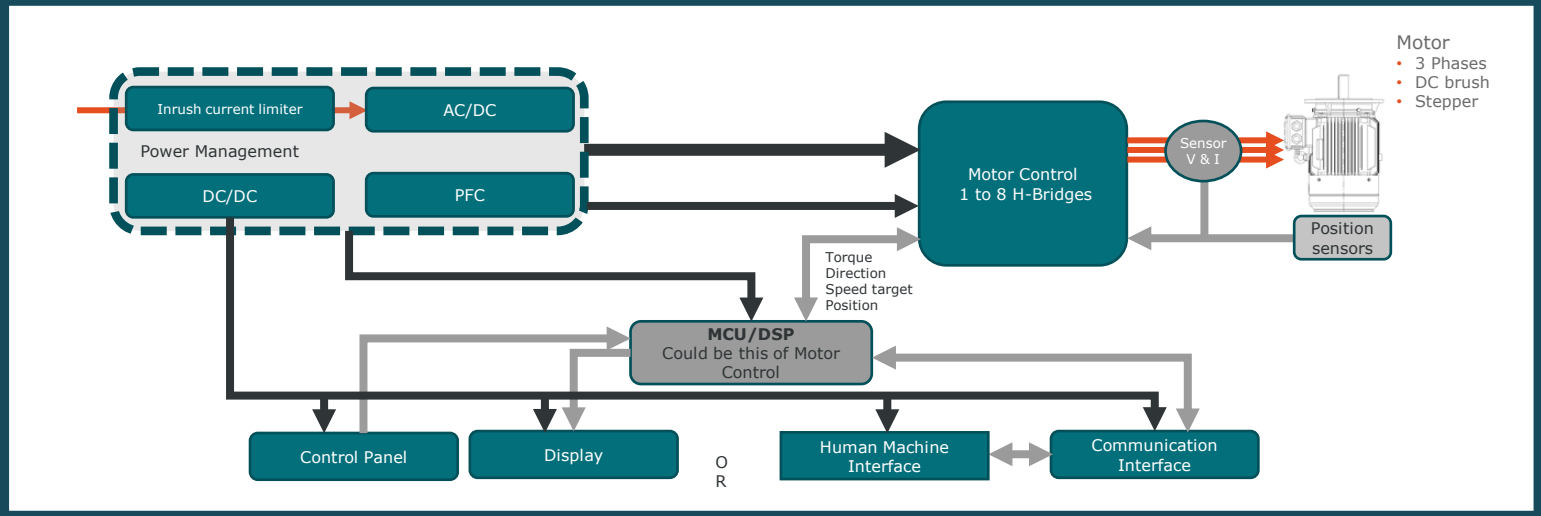
Control Panel/Display/Comm.

- ESD protection (CAN-FD, Ethernet)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Motion Control & Servo Drive

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- **GaN FET low power**, working from 300 V to 600 V at high frequency **to reduce transformer size and cost**
- **15–20kV ESD protection** for standard industrial interface
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

Applications

AC/DC (PFC)

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/ LFPAK88
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- GaN FETs: 650 V, R_{DSon} 12 to 90mΩ, CCPAK1212 *
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B

Motor control

- Motor Control MOSFETs: 60 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Actuator control MOSFETs 40 V, 3 mΩ < R_{DSon} < 7 mΩ LFPAK33 (R_{th} < 2K/W)
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Gate Driver: New NGD73xx family of HS/LS driver *
- Discrete Driver: BJT, RETs, Diodes

DC/DC conversion

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter

Control Panel/ Display/Comm.

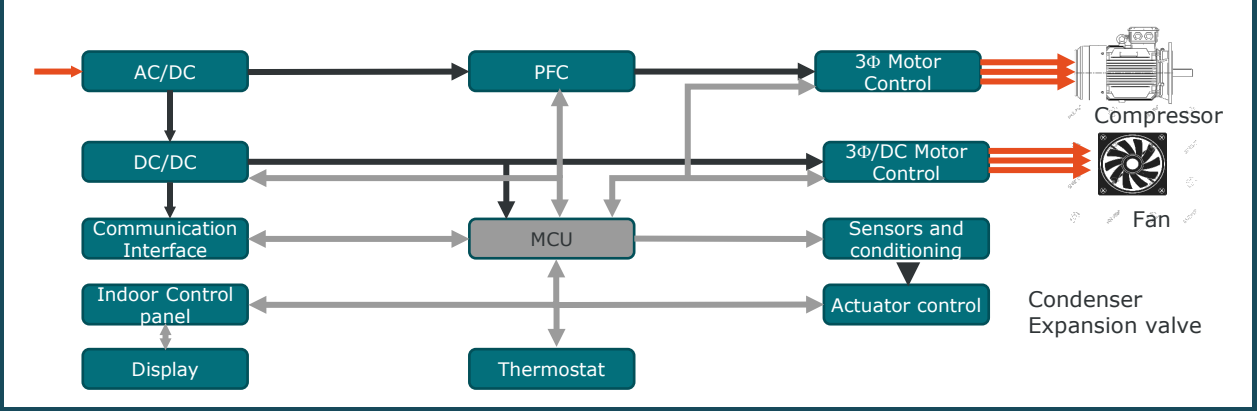
- ESD protection (CAN-FD, Ethernet)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

HVAC (Air Conditioning)

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow an **high-efficiency** on Motor control (better duty precision) and DCDC converter solution running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system could be enough versus water cooled system (cost saving)
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Battery booster allow to **extend the life time of cell battery** by 3 times



* Coming soon

Motor Control Compressor (inverter control)

- GaN FET: 650 V, R_{DSon} 60 to 14mΩ TO-247 or CCPAK1212 (R_{th} < 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247*
- MOSFETs: 80 to 100 V, R_{DSon} 1.8 to 3,5 mΩ, LFPAK56E or LFPAK88
- Gate Driver: New NGD73xx family of HS/LS driver *
- SiC diode:650 V to 1200 V, DPAK/ D2PAK/TO-247 in dual pin *
- Recovery rectifier 200 V/650 V, CFP low inductance, DPAK/ D²PAK

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control Fan

- MOSFETs: 40–100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56
- Gate Driver: New NGD73xx family of HS/LS driver *
- HC(T) buffer/drivers/Schmitt triggers/Translator
- Bipolar transistors ≤ 100 V,

Display/Control panel/ Thermostat

- LED drivers, NCR family for backlighting and signaling
- High bandwidth ESD protection PESD family (TreOS)
- Analog switches for sensors
- Battery booster NBM5100X and NBM7100X families

Actuator control

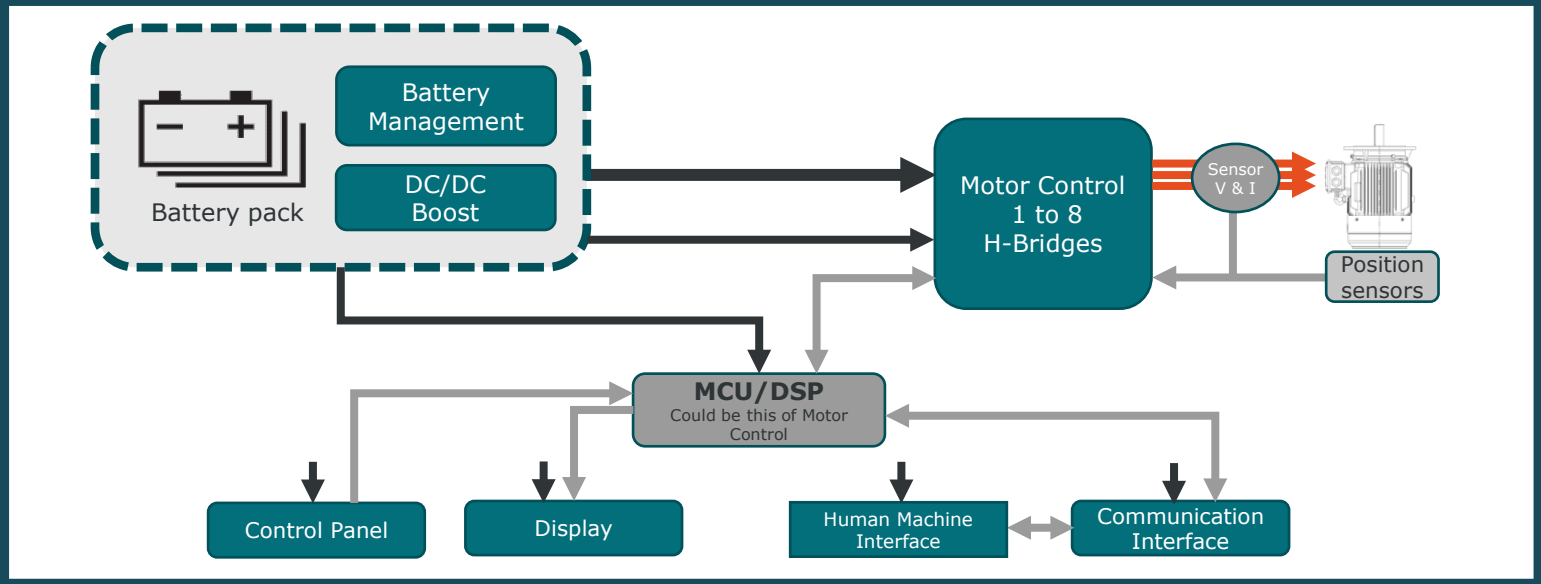
- P-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

Forklift

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

Motor control

- Motor Control MOSFETs: 60 to 150 V, R_{DSon} < 3mΩ, LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Actuator control MOSFETs 40 V, 3 mΩ < R_{DSon} < 7 mΩ, LFPAK33 (R_{th} < 2K/W)
- Gate Driver: New NGD73xx family of HS/LS driver *

DC/DC conversion

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10mΩ, LFPAK33/56
- Schottky diodes: 40 to 100 V, I_F > 1 to 5A, CFP 3, 5

Battery management

- Charge balancing MOSFETs: 20 to 40 V, R_{DSon} < 20mΩ
- Battery protection MOSFETs: 25 to 100 V R_{DSon} 0,55 to 4,8mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

HMI/MMI

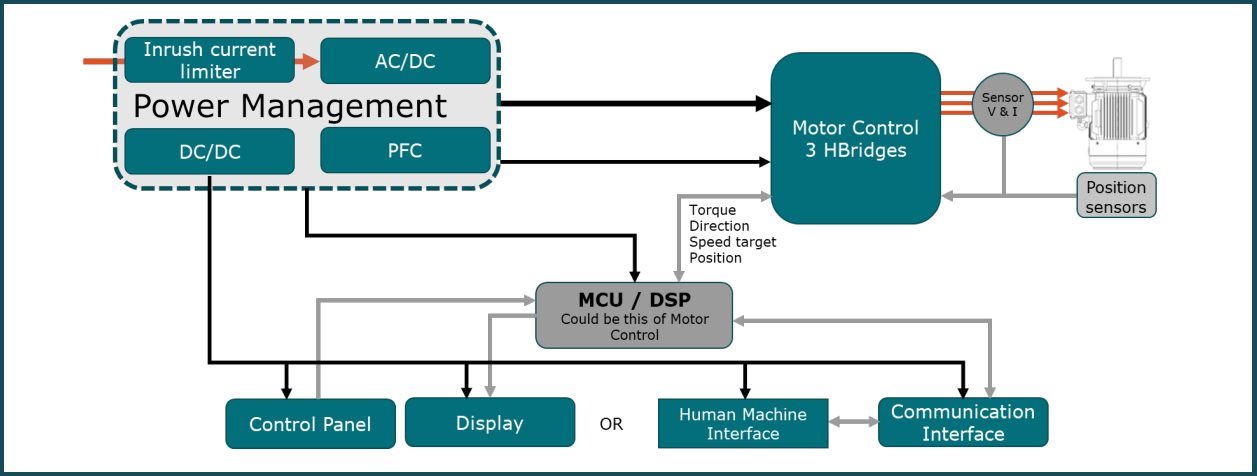
- ESD: CAN/CAN-FD bus protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Fluid Pumps

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **HMI and Displays Protection** will be secured from any ESD damage
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **Wide range of translator** for signal conditioning voltage configurable. **Latest Nexperia analog mux** reduces number of analog input of the MCU (cost reduction). **Voltage translation capabilities directly part of I/O expander**



* Coming soon

AC/DC (PFC)

- 40–100 V MOSFET, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- PN Rectifiers 200 V CFP, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B

DC/DC

- MOSFETs: 40 to 100 V, low R_{DSon} 1,8 to 3,5mΩ, LFPAK56(D)
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/ D²PAK
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Buck: 40 V, 600mA Synchronous Buck Converter *
- Sub-system power supply: see DC/DC Buck topology

Motor Control

- MOSFETs: 40 to 100 V, R_{DSon} 1 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *

Display/Control panel/Sensors

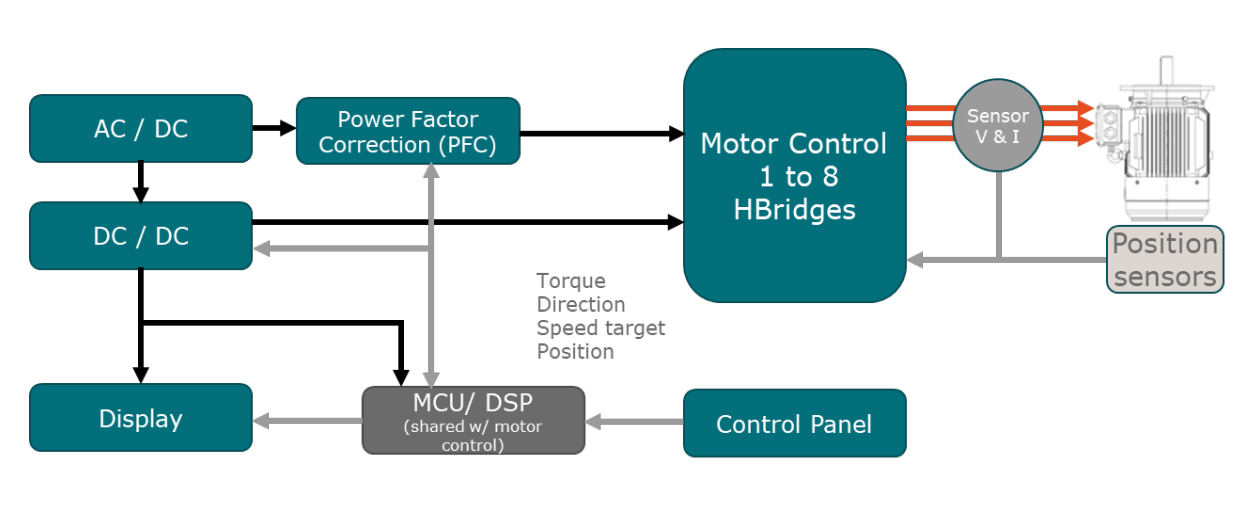
- LED drivers, NCR family for backlighting and signaling
- High speed ESD protection PESD family
- Analog switches for sensors
- I/O expander
- Level Shifter

Professional Power Tools

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

Motor control

- Motor Control MOSFETs: 40 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Actuator control MOSFETs 40 V, 3 mΩ < R_{DSon} < 7 mΩ, LFPAK33 (R_{th} < 2K/W)
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Gate Driver: New NGD73xx family of HS/LS driver *
- Discrete Driver: BJT, RETs, Diodes

DC/DC conversion

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10 mΩ, LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, I_F > 1 to 5A, CFP 3, 5
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Buck: 40 V, 600mA Synchronous Buck Converter *

Power Factor Correction (PFC)

- Boost Converter: SiC Diode when available
- Switch: MOSFET and IGBT (TO247/D²PAK) when available
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *

Control Panel/Display

- ESD protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Industrial

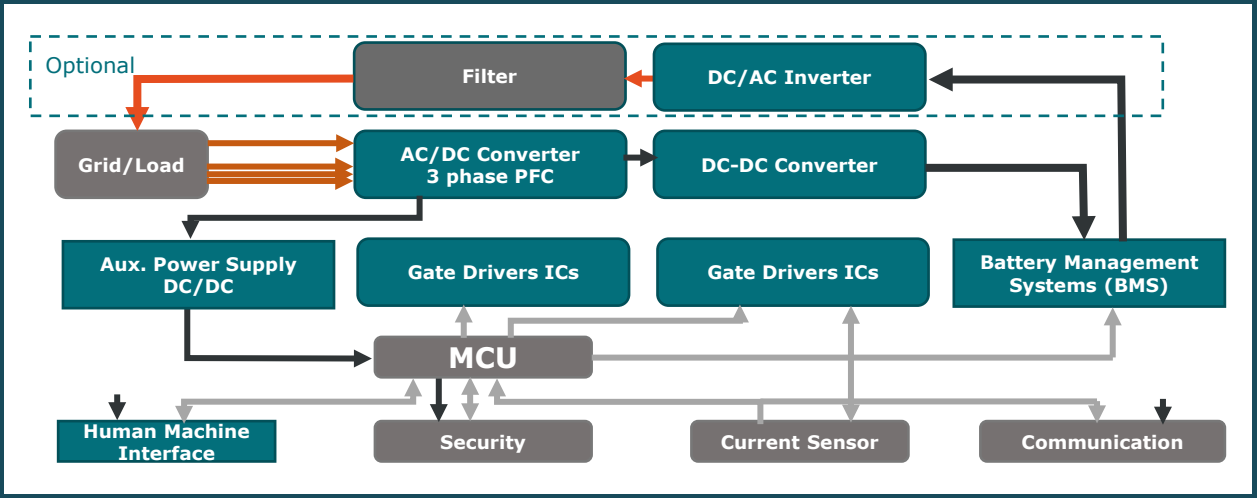
- Automation
- Power & Energy
  - AC EV Wallbox Bi-directional AC Wallbox
  - UPS
  - AC/DC Power Supply
  - DC/DC Power Supply
  - Battery charger
  - PV Inverter
- Medical
- Building & Home
- Lighting
- Other Industrial

AC EV Wallbox/Bi-directional AC Wallbox

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow a **high-efficiency** on DCDC converter solutions running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system could be enough versus water cooled system (cost saving)
- **High SOA and avalanche capabilities** increase Robustness and reliability of the system
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage



* Coming soon

AC/DC (PFC)/Inverter

- GaN FET: 650 V, R_{DSon} 60 to 14mΩ TO247 or CCPAK1212 (R_{th} < 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- SiC diode: 650 V to 1200 V, DPAK/D²PAK/TO247 in dual pin *
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/ drivers/Schmitt triggers/Translator

DC/DC conversion

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Schottky diodes: 40 to 100 V, I_F > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC Buck topology
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Buck: 40 V, 600mA Synchronous Buck Converter *

Battery management

- Charge balancing MOSFETs: 20 to 40 V R_{DSon} < 20mΩ
- Battery protection MOSFETs: 80 to 100 V R_{DSon} 0,55 to 4,8 mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

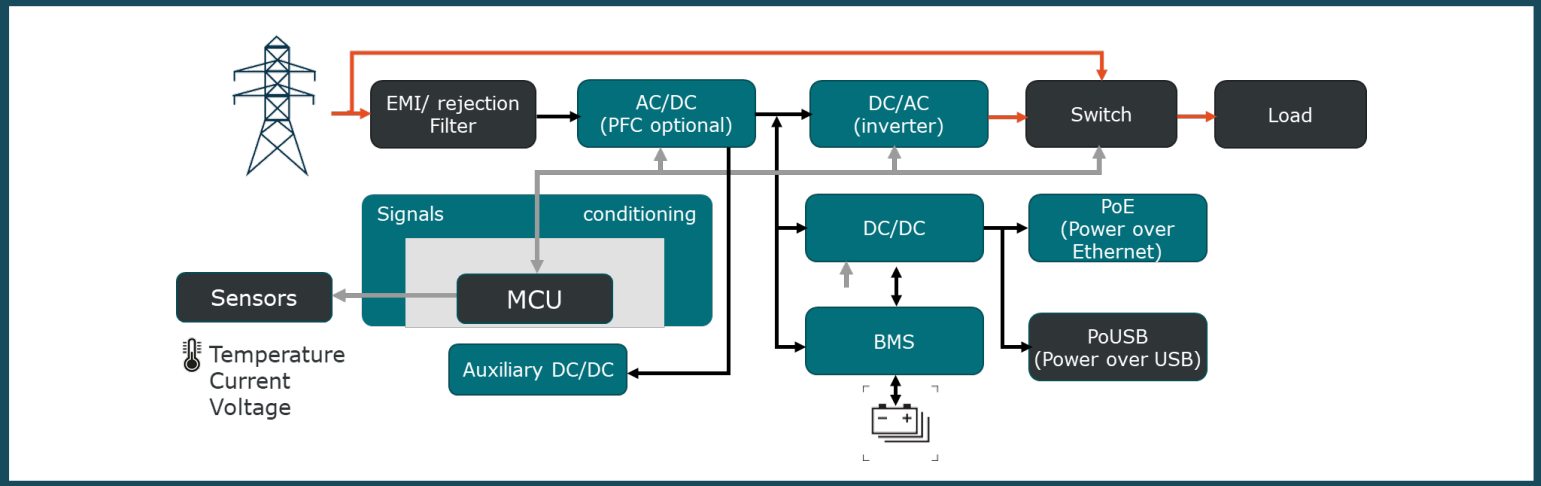
HMI/MMI

- ESD: communication bus protection (USB)
- Antenna: protection (Wi-Fi, BT)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

UPS (Uninterruptible Power Supply)

Nexperia value Proposition

- CCPAK, LFPAK and CFP (both clip-bond package) allow an **high-efficiency** on switching power supply, converter and inverter solution running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system could be enough versus water cooled system (cost, weight saving)
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- Cascode structure allow **standard MOSFET driver for GAN solution**
- Wide range of signal conditioning component, voltage selectable.



* Coming soon

Applications

AC/DC (PFC) or DC/AC (Inverter)

- GaN FET: 650 V, R_{DSon} 60 to 13mΩ, TO-247 or CCPAK1212 (R_{th}< 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- MOSFETs: 100 V, Low R_{DSon} 2mΩ, LFPAK88
- SiC diode:650 V to 1200 V, DPAK/D2PAK/ TO-247 in dual pin *
- Recovery rectifier 200 V/650 V, CFP low inductance, DPAK/ D²PAK

DC/DC (Converter)

- MOSFETs: 40–100 V, R_{DSon} 0,5 to 10mΩ, LFPAK56E/LFPAK88
- GaN FET: 650 V, R_{DSon} 60 to 13mΩ, TO-247 or CCPAK1212 (R_{th}< 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Auxiliary DCDC/ PoE

- Sub-system power supply: see DC/DC Buck topology
- Ethernet power supply: *see Power sourcing Equipment/ Power over Ethernet (coming soon)*

Signal conditioning

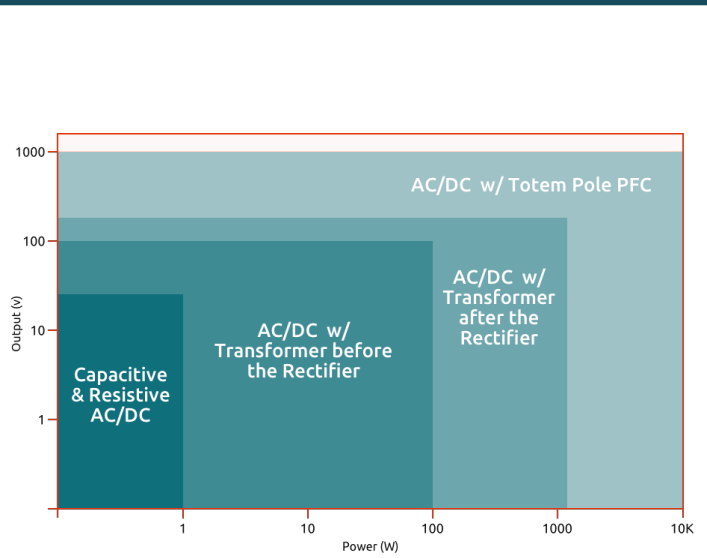
- Level shifter, voltage translator
- I/O expander
- Analog multiplexer

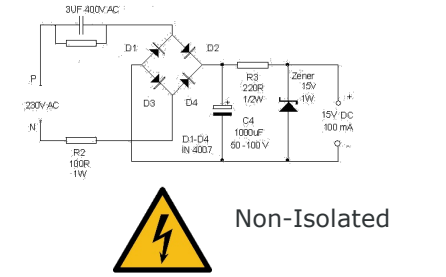
AC/DC Power Supply

Applications

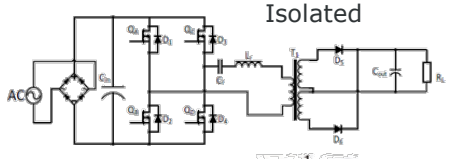
Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)





Non-Isolated



Isolated

* Coming soon

Design considerations: Isolated solutions

- The transformer always stands on the AC stage
- Vienna topologies are isolated between the rectifier stage and the correction/filter stage
- Isolation can be done before or after the switching rectifier stage, depending on voltage, current and price of the complete solution. Putting the transformer before the rectifier could allow lower voltage switches (cheaper) but need then more copper rings in the transformer

Power Factor Correction (PFC Totem Pole)

- Rectifier diodes PNE, SiC family
- MOSFETs 100 V, Low R_{DSon} 2 mΩ, LFPAK56E/LFPAK88
- GAN FET 650 V, R_{DSon} 12 to 63 mΩ, TO-247/CCPAK1212 *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Schottky diodes: 40–100 V, IF > 1–5 A, CFP 3 ,5

Vienna Rectifier(for multiphase input)

- Rectifier diodes PNE, SiC family
- MOSFETs 100 V, Low R_{DSon} 2 mΩ, LFPAK56E/LFPAK88
- GaN FET 650 V, R_{DSon} 12 to 63 mΩ, TO-247/CCPAK1212 *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *

Non-isolated linear supply

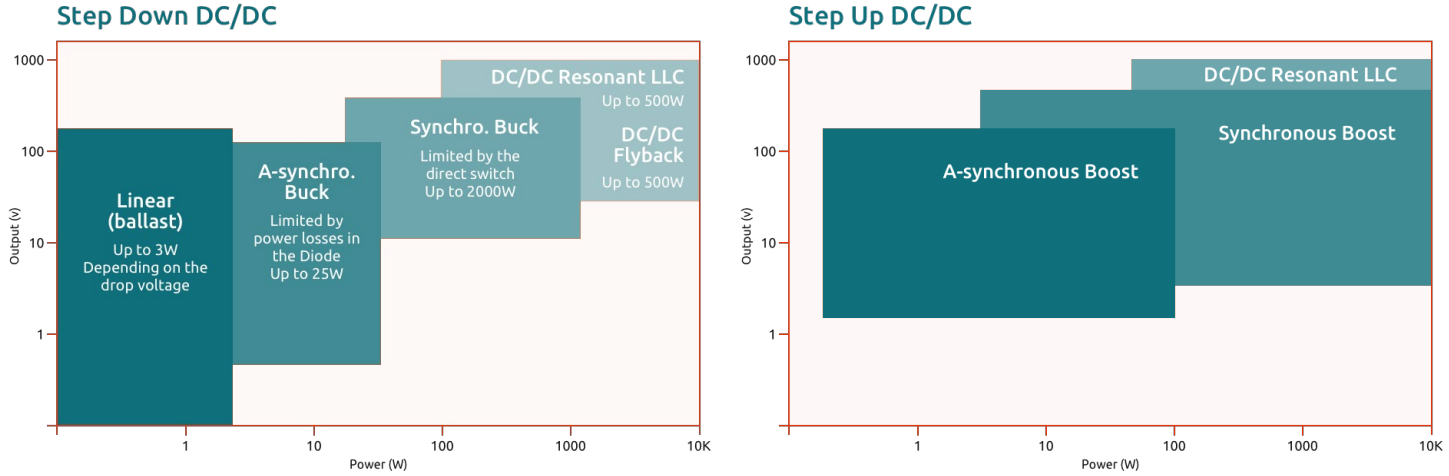
- Rectifier Diodes PNE family
- Zener Diodes
- Bipolar transistor

DC/DC Power supply

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- **Allow to extend the battery lifetime (x2 to x5)** with integrated solution for battery cell
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

See the following functions on dedicated one pager

Non isolated function

- DC/DC Buck synch.: V_{IN} =5 V–500 V, V_{out} = 0,9 V–200 V, $P_{out} \geq$ 20W
- DC/DC Buck asynch: V_{IN} =3 V–200 V, V_{out} = 0,9 V–100 V, $P_{out} \leq$ 50W
- DC/DC Boost synch.: V_{IN} =3 V–150 V, V_{out} = 5 V–500 V, $P_{out} \geq$ 10W
- DC/DC Boost asynch.: V_{IN} =3 V–24 V, V_{out} = 5 V–100 V, $P_{out} \leq$ 100W
- DC/DC Buck-Boost: V_{IN} =5 V–150 V, V_{out} = 3 V–500 V, $P_{out} \leq$ 500W
- DC/DC SEPIC: V_{IN} =3 V–150 V, V_{out} = 5 V–500 V , P_{out} = 5W to 150W

Isolated function

- DC/DC Flyback: V_{IN} =36 V–20 V, V_{out} < 100 V, P_{out} < 500W
- DC/DC Resonant LLC: Vin=36 V–400 V, V_{out} =100 V to 450 V, P_{out} up to 11kW
- DC/DC Forward
- DC/DC Push Pull (coming soon)
- DC/DC Half Bridge

Integrated solutions

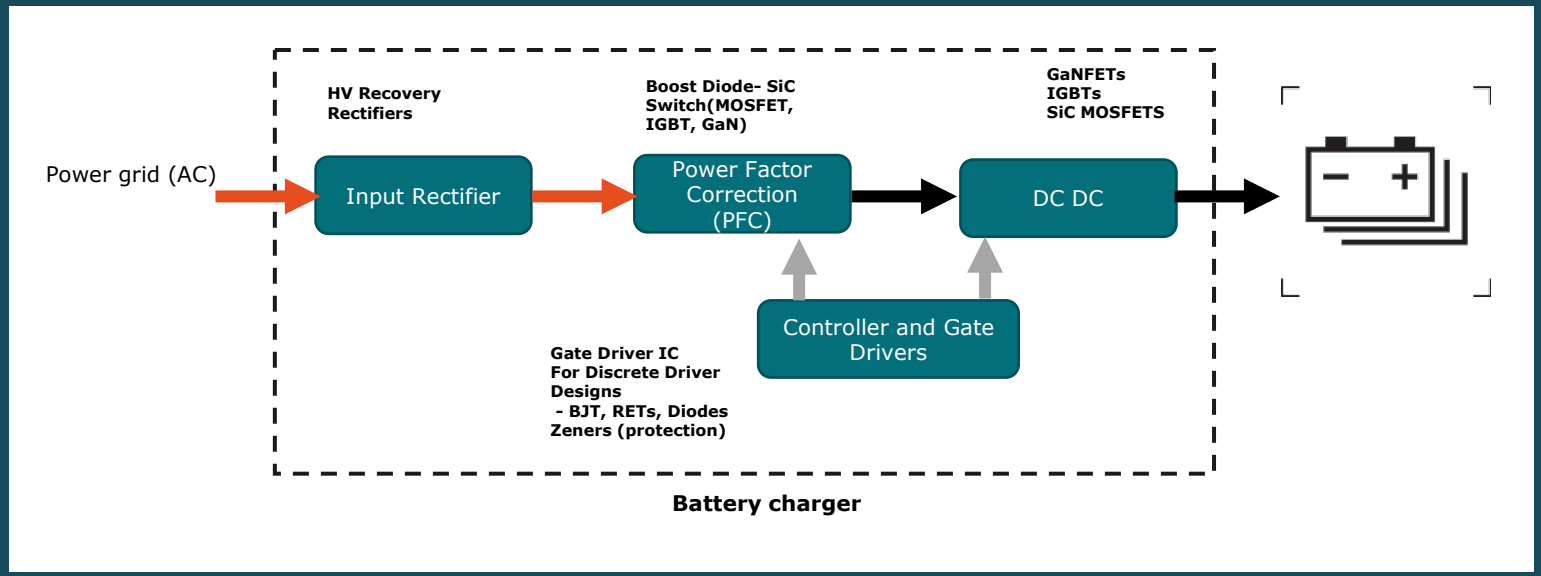
- Battery booster: SMB family

Grid powered battery charger

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- **Less weight** due to higher FSW allowing the reduction of inductance and capacitor of DCDC, and smaller heat spreader due to thermal performance
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

AC/DC: (See ACDC Power Supply)

- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- GaN FET: 650 V, R_{DSon} 60 to 14mΩ, TO-247 or CCPAK1212 (R_{th}< 0,5K/W) *
- MOSFETs: 80 to 100 V, R_{DSon} 1 to 3,5 mΩ, LFPAK56E or LFPAK88

DC/DC: (See DCDC Power Supply)

- GaN FET: 650 V, R_{DSon} 90 to 39mΩ, TO-247 or CCPAK1212 (R_{th}< 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK33/LFPAK56E
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Battery management

- Charge balancing MOSFETs: 20 to 40 V, R_{DSon} < 20mΩ
- Battery protection MOSFETs: 25 to 100 V, R_{DSon} 0,55 to 4,8mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

Signal conditioning

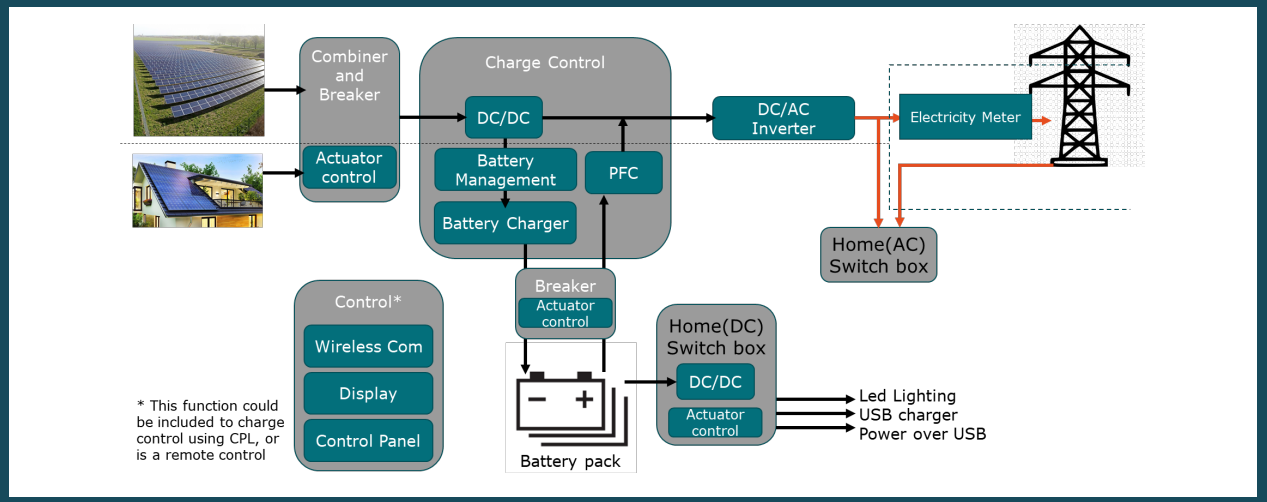
- Voltage translator: NXB/ NXS series
- IO Expander NCA family
- Analog Switches

PV Inverter

Applications

Nexperia value Proposition

- CCPAK, LFPAK and CFP (all clip-bond package) allow **high-efficiency** on DCDC converter solution running at higher frequency, while reducing costs (less heating to dissipate, smaller inductance and capacitor)
- GAN Cascode Topology allow **standard MOSFET driver**, reduce the switching losses and natively off (remove parasitic turn ON)
- **Best thermal performance** thanks to Clip-bonding package, **Lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader, air cooled system could be enough versus water cooled system (cost saving)
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)



DC/AC inverter (PFC)

- GaN FET: 650 V, R_{DSon} 60 to 14 mΩ, TO-247 or CCPAK1212 (R_{th} < 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- SiC diode: 650 V to 1200 V, DPAK/ D²PAK/TO-247 in dual pin *
- Recovery rectifier 200 V/650 V, CFP low inductance, DPAK/ D²PAK

DC/DC

- MOSFETs: 25–100 V, R_{DSon} 0,5–10 mΩ, LFPAK33 to LFPAK88
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/ drivers/Schmitt triggers/Translator
- Schottky diodes: 40 to 100 V, I_F > 1 to 5A, CFP 3, 5
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Battery management

- Charge balancing MOSFETs: 20 to 40 V, R_{DSon} < 20mΩ
- Battery protection MOSFETs: 80 to 100 V R_{DSon} 0,55 to 4,8 mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400 to 600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

Display/Control panel

- LED drivers, NCR family for backlighting and signaling
- High speed ESD protection even for antenna
- Battery booster NBM5 and NBM7 families

Industrial

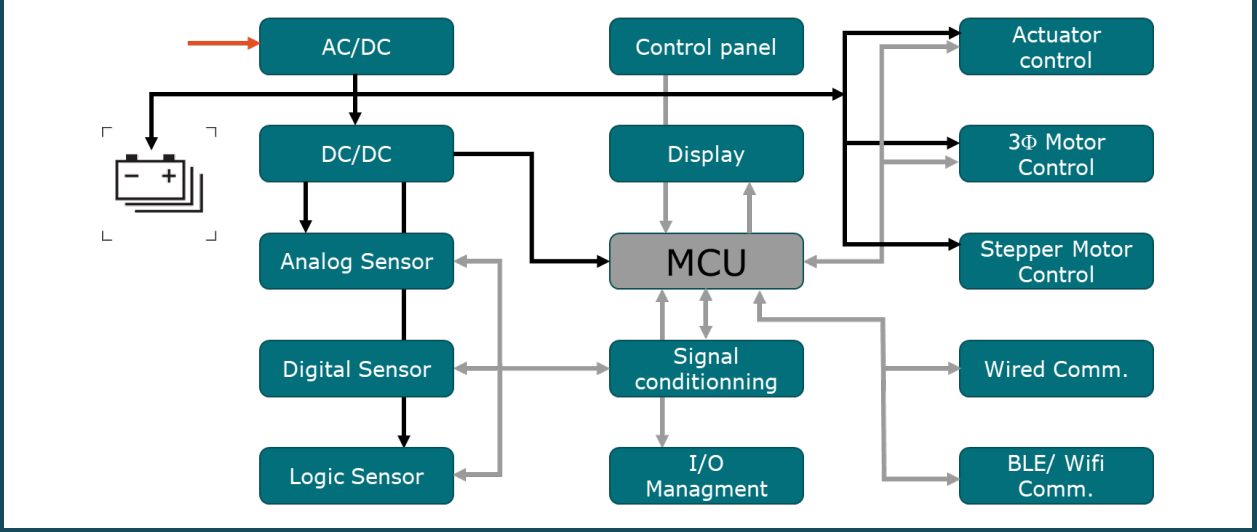
- Automation
- Power & Energy
- **Medical**
  - Medical Instruments
  - Medical Imaging
  - Wearable & Personal Portable Electronics
- Building & Home
- Lighting
- Other Industrial

Medical Instruments

Applications

Nexperia value Proposition

- **Best thermal performance** where power management needs to be carefully controlled and isolated
- For the range of actuators and motors from simple switch and cost-effective steppers to 3-phase motors for fine control over pumps Reliable Clip-bonding package technology for **High anti stall Robustness**
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Reliable and efficient DC:DC conversion through combination of low-voltage MOSFETs in **LFPAK** and **CFP Schottky Diodes**



Motor control

- 3-phase motor MOSFETs: 25 to 40 V, LFPAK33 and LFPAK Dual
- Actuators: Small-signal MOSFETs, 30 V, N-channel in DFN packages
- Gate Driver: New NGD73xx family of HS/LS driver *
- Stepper motor: Bipolar transistors

DC/DC conversion

- Schottky diodes and rectifiers $I_F \geq 1$ A
- Small signal MOSFETs up to 60 V PMV family DFN2020
- Buck: 40 V, 600mA Synchronous Buck Converter *

AC/DC conversion

- Schottky diodes: $I_F \geq 1$ A
- Silicon Germanium (SiGe) rectifiers
- Secondary side MOSFETs: 60 to 100 V, MLPAK33

HMI/Display

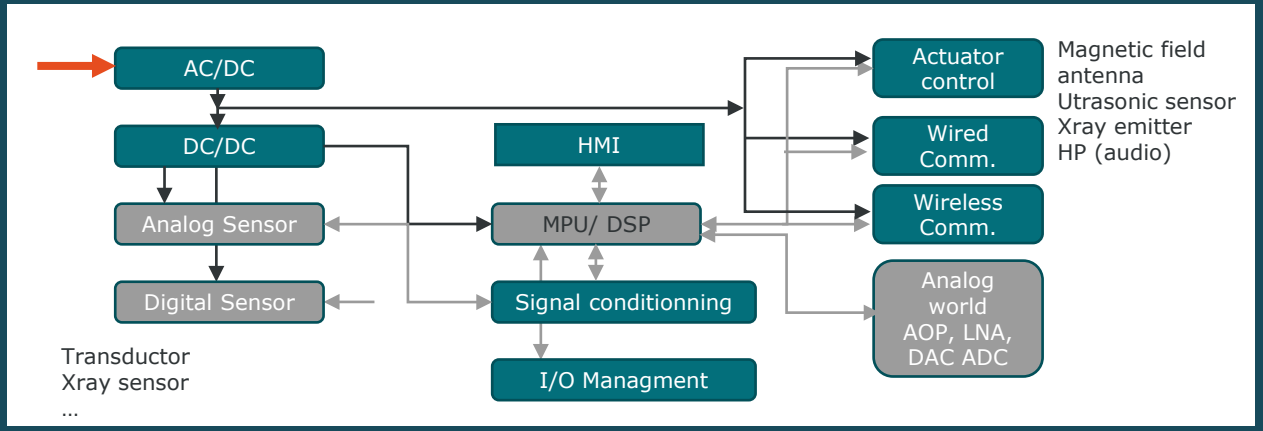
- LVC family Translators Voltage translators (level-shifters)
- Low speed Shift registers I/O expansion logic
- Low voltage ESD protection
- Dual output LCD bias – NEX10xx *

Medical Imaging

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- **15–20kV ESD protection** for standard industrial interface
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher I_D current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



AC/DC: (see AC/DC Power Supply)

- MOSFETs: 60 V to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/ LFPAK88
- GaN FETs: 650 V, R_{DSon} 12 to 90mΩ, CCPAK1212i *
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- SiC Diodes: 650 to 1200 V, 6A to 20A, DPAK, D2PAK and new CFP *

DC/DC: (see DC/DC Power Supply)

- Motor Control MOSFETs: 60 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Recovery rectifier 10 V/100 V, CFP low inductance
- Gate Driver IC *
- Buck: 40 V, 600mA Synchronous Buck Converter *

Actuator Control

- MOSFETs: 60 V to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/ LFPAK88
- GaN FETs: 650 V, R_{DSon} 12 to 90mΩ, CCPAK1212i *
- Discrete Driver: BJT, RETs, Diodes

IO management/Signal conditioning

- Voltage translator: NXB/NXS series
- IO Expander
- Analog Switches

Control Panel/HMI/Wifi.

- ESD protection (CAN-FD, Ethernet)
- Control logic: LVC family
- LED Drivers: NCR family
- Antenna protection
- Dual output LCD bias – NEX10xx *

Wearables and Portables Personal electronics

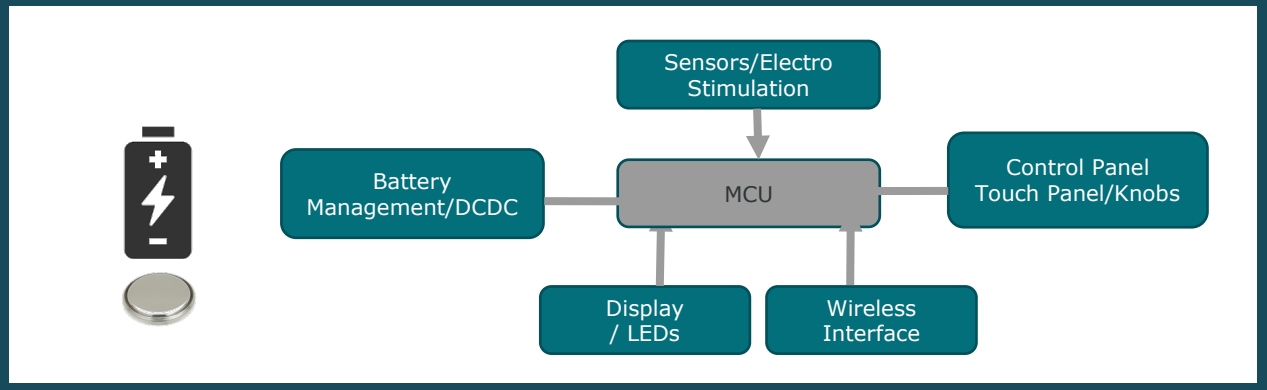
Applications

Nexperia value Proposition

- **Very low standby** current from logic, down to 0.5 nA
- **Wide range of very small package**, DFN, WLCSP, XQFN, X2SON for higher integration and miniaturisation
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- **Extended battery lifetime**, up to 3x, to achieve and exceed 10 years lifetime on battery cell

Examples

- Blood pressure and pulse meter
- Thermometer
- Scale
- Cardio meter
- Ultrasonic therapy
- Electro stimulation
- Hearing



* Coming soon

Battery Management and DCDC

- Battery Booster: Buck-Boost NBM family
- Buck converter NEX3060: 5.5V Sync Buck with 200nA Ultra-Low Iq *
- Boost converter NEX2080x: 5.5V Output Sync Boost with < 300nA Ultra-Low Iq *

Sensor/Electro simulator

- ssMOSFET – 12 to 40 V, compact package DFN1010D-3, P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Analog Switches

Signal conditioning

- Voltage translator: NXB/ NXS series
- IO Expander
- Analog Switches

Control Panel/Display/Wifi.

- ESD protection protection (standard capacitance and high-speed): PESD family
- Control logic: LVC family
- LED Drivers: NCR family
- Antenna protection
- Dual output LCD bias – NEX10xx *

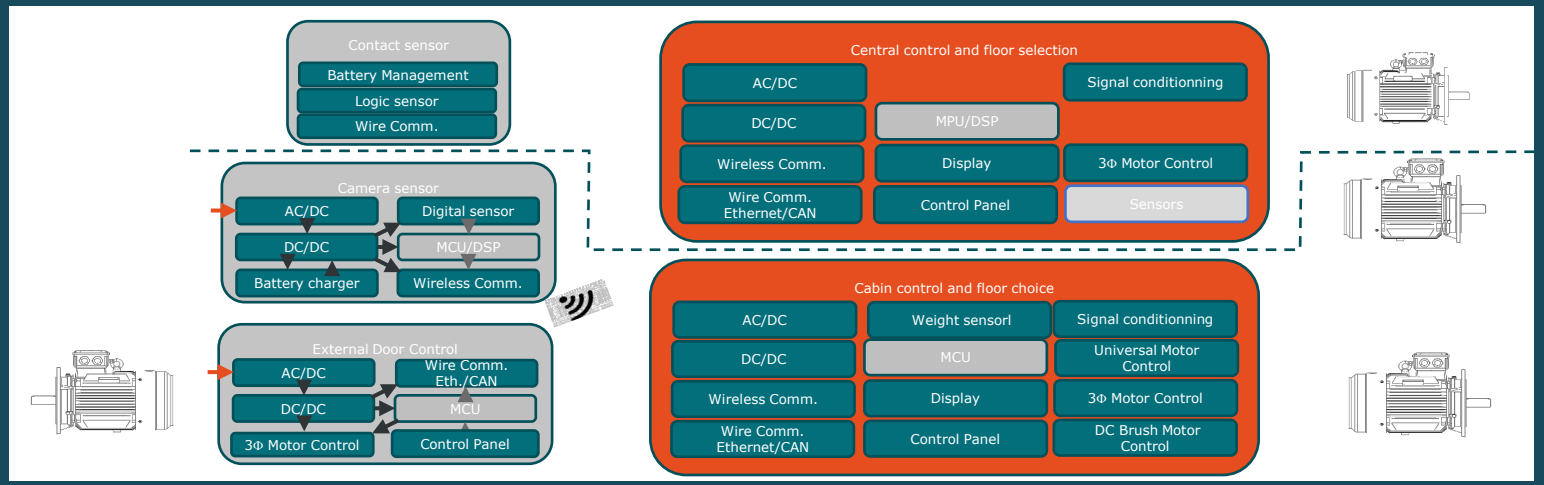
Industrial

- Automation
- Power & Energy
- Medical
- **Building & Home**
  - Elevator, Escalators & Moving Walkaway
  - E-metering
  - Gas & Fluid metering
  - Security & Access Control
  - Roller shutter
  - Smoke and Fire detector
- Lighting
- Other Industrial

Elevator, Escalator and Moving Walkaway

Nexperia value Proposition

- **Up to 30kV ESD protection** for standard industrial interface
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC, while reducing costs (less heating to dissipate, smaller inductance and capacitor). Reliability for **High anti stall Robustness**
- **GaN FET low power**, working from 300 V to 600 V at high frequency **to reduce transformer size and cost**
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- Battery booster allow to **extend the lifetime of cell battery** by 3 times



* Coming soon

Applications

AC/DC: (See ACDC Power Supply)

- GaN FET: 650 V, R_{DSon} 60 to 14mΩ, TO-247 or CCPAK1212 (R_{th}< 0,5K/W) *
- MOSFETs: 80 to 100 V, R_{DSon} 1 to 3,5 mΩ, LFPAK56E or LFPAK88

DC/DC: (See DCDC Power Supply)

- MOSFETs: 40 to 100 V, R_{DSON} 5 to 10 mΩ LFPAK33/LFPAK56E
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor control

- GaN FET *, MOSFET, Diodes PN and SiC *, MOSFET driver *
- Brushless (3Φ) Motor Link Here
- Brushed Motor Link Here
- Universal Motor: Diodes Schottky, PN and SiC, Bipolar relay driver

Control Panel/ Display/Comm.

- ESD protection (CAN-FD, Ethernet)
- Autosense translators: NXB/NXS series
- Control logic: LVC family
- Antenna protection
- Battery Booster: NBM family

Signal conditioning

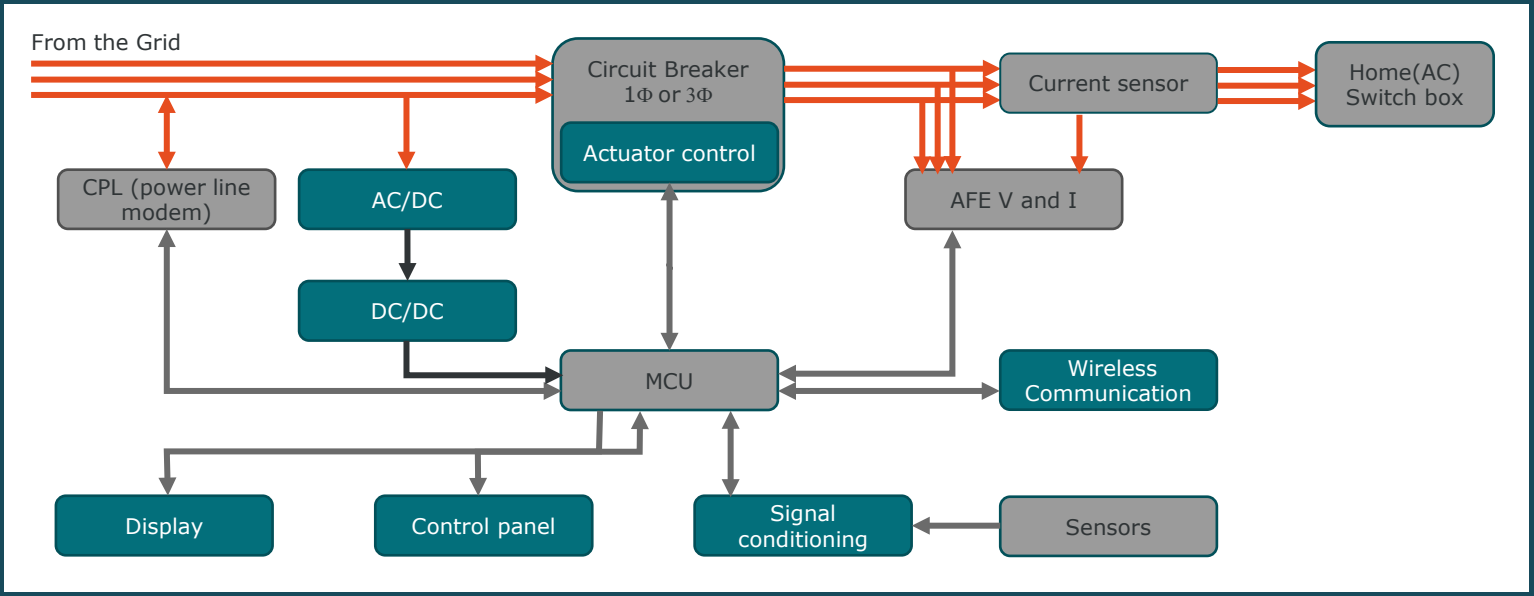
- Voltage translator: NXB/NXS series
- IO Expander NCA family
- Analog Switches
- SIM card translator

E-metering

Applications

Nexperia value Proposition

- LFPAK series of low-voltage MOSFETs together with high-performance CFP Schottky Diodes will help to design a **high-efficiency** DCDC converter solutions
- Our wide portfolio in discrete and logic allows **size reduction** and improve **thermal performance** with new leadless DFN/QFN package
- **Wide range of translator** for signal conditioning voltage configurable, very low standby current
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage



* Coming soon

AC/DC/DC/DC

- MOSFET 20 V to 100 V, very small power package 3x3, low parasitic inductance
- Schottky and rectifier diodes, small leadless and CFP (clip bond) high switching frequency.
- Wide range of Zener diodes: SOT23/SOD32(F)/SOD123(F)
- Buck: 40 V, 600mA Synchronous Buck Converter *

Signal conditioning

- Voltage translator NFS/LFS family, Analog switches, driver buffers
- I²C or SPI I/O expander, NCA9555 *

Display/Control panel

- Led drivers, NCR family for backlighting or signaling
- High speed ESD protection, PESD family
- Analog switches for sensors

Actuator control

- P-MOSFET or small signal MOSFET
- Freewheeling diodes

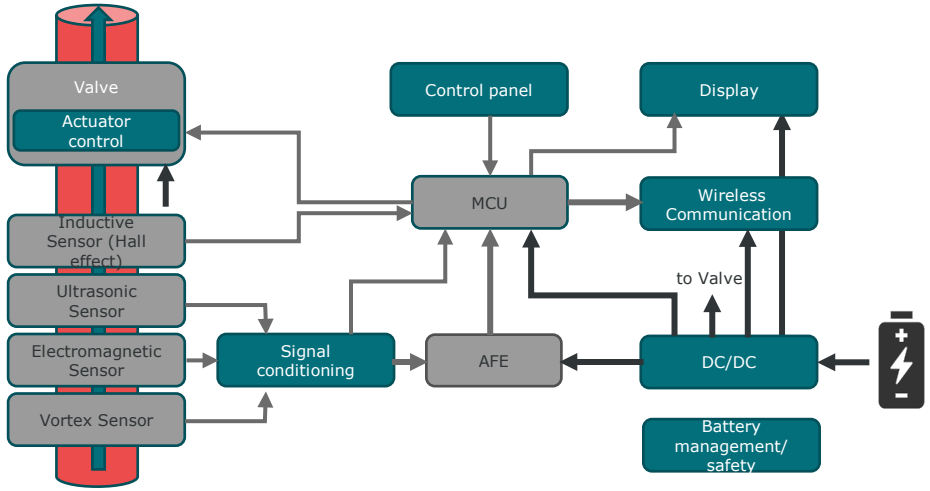
Gas and Fluid-metering

Applications

Nexperia value Proposition

- Our wide portfolio in discrete and logic allows **size reduction** and improve **thermal performance** with new leadless DFN/QFN package
- **Battery booster**, increase the battery lifetime x3
- **Wide range of translator** for signal conditioning voltage configurable, very low standby current
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage

Flow sensors can be Turbine with hall effect sensor (inductive for both), Ultrasonic sensor (for both), Vortex sensor (pressure and temp. for gas only) and Electromagnetic field sensor (for water only)



* Coming soon

DC/DC

- Small Signal MOSFET, 12 V to 25 V for buck boost DCDC
- Wide range of Zener diodes: SOT23/SOD32(F)/SOD123(F)
- Buck converter NEX3060: 5.5V Sync Buck with 200nA Ultra-Low Iq *
- Boost converter NEX2080x: 5.5V Output Sync Boost with < 300nA Ultra-Low Iq *

Signal conditioning

- Voltage translator NFS/LFS family, Analog switches, driver buffers
- I²C or SPI I/O expander *

Display/Control panel

- Led drivers, NCR family for backlighting or signaling
- High speed EDS protection, PESD family
- Analog switches for sensors

Actuator control

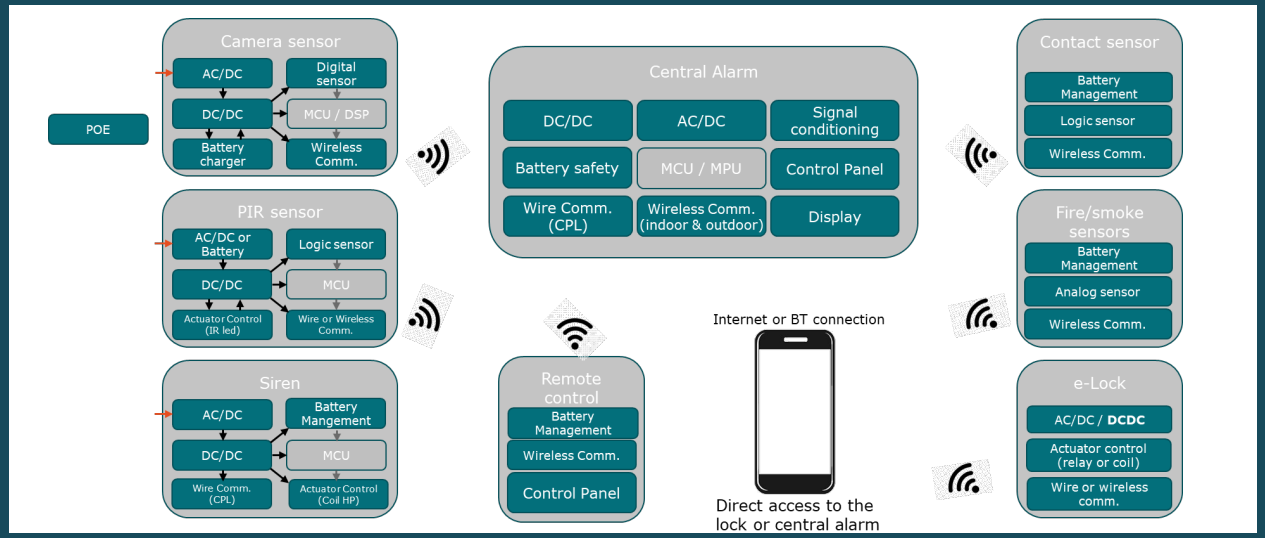
- Small Signal P-MOSFET
- Freewheeling diodes

Security & Access Control

Applications

Nexperia value Proposition

- **Lower switch losses** improve even more the thermal behavior
- As a worldwide leading producer of ESD components, the **HMI and Displays** protection will be secured from any ESD damage
- **Wide range of very small package**, DFN, WLCSP, XQFN, X2SON for higher integration and miniaturisation
- **Extended battery lifetime**, up to 3x, to achieve and exceed 10 years lifetime on battery cell
- **Very low standby** current from logic, down to 0.5 nA



* Coming soon

AC/DC (PFC)

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56
- PN Diodes: 200 to 400 V, I_F > 1 to 5A, CFP15B
- Sub-system power supply: see AC/DC Topologies

Actuator control

- Actuator control MOSFETs 40 V, 3 mΩ < R_{DSon}< 7 mΩ LFPAK33 (R_{th} < 2K/W)
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3, P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Discrete Driver: BJT, RETs, Diodes

DC/DC conversion

- Sub-system power supply: see DC/DC Topologies
- Buck converter NEX3060: 5.5 V Sync Buck with 200nA Ultra-Low Iq *
- Boost converter NEX2080x: 5.5 V Output Sync Boost with < 300nA Ultra-Low Iq *
- Buck: 40 V, 600mA Synchronous Buck Converter *

Control Panel/Display/Comm.

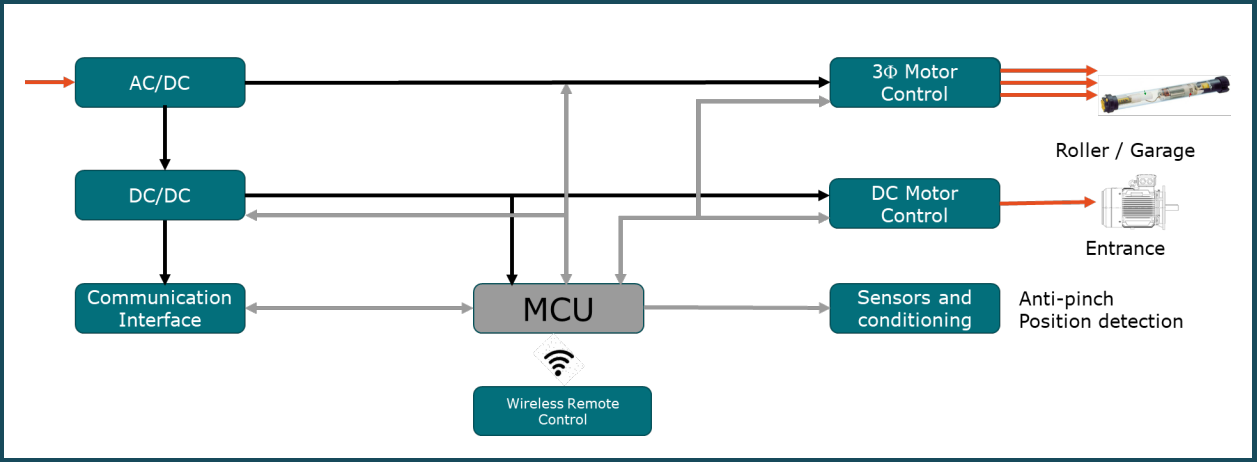
- ESD protection (Ethernet, HDMI, USB)
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Roller shutter/Garage & Entrance Door

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **HMI and Displays Protection** will be secured from any ESD damage
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **Wide range of translator** for signal conditioning voltage configurable. **Latest Nexperia analog mux** reduces number of analog input of the MCU (cost reduction). **Voltage translation capabilities directly part of I/O expander**



* Coming soon

AC/DC (PFC)

- 40–100 V MOSFET, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- PN Rectifiers 200 V CFP, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B

DC/DC

- MOSFETs: 40 to 100 V, low R_{DSon} 1,8 to 3,5mΩ, LFPAK56(D)
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/ D²PAK
- Sub-system power supply: see DC/DC topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control

- MOSFETs: 40 to 100 V, R_{DSon} 1 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator

Wireless Remote Control/Sensors

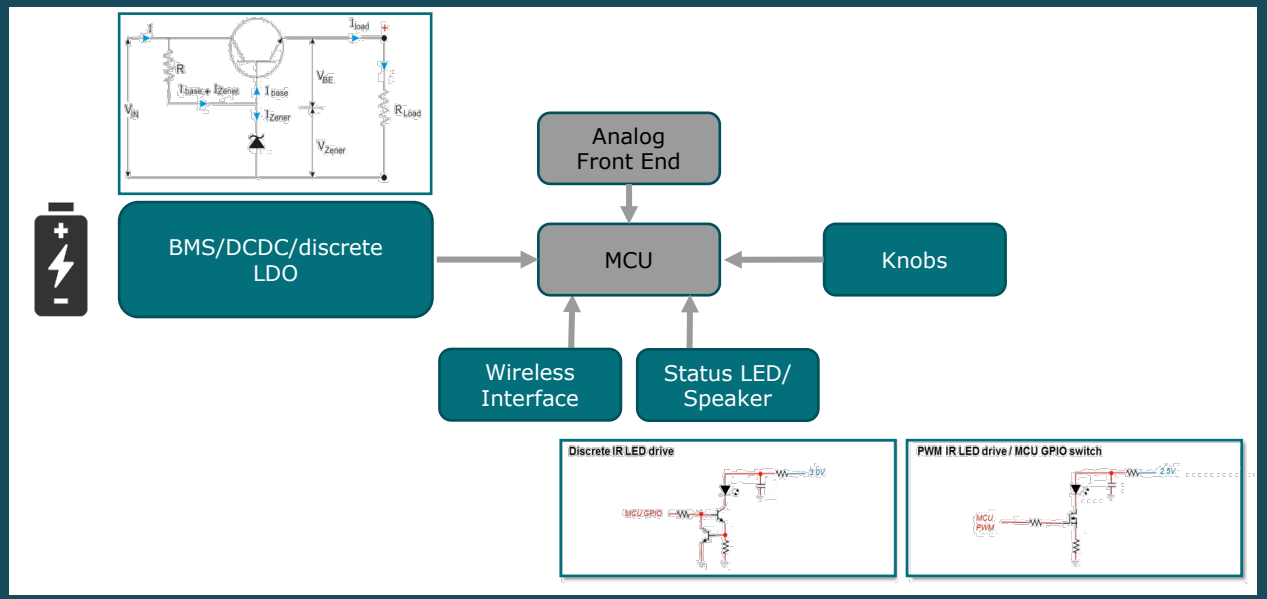
- LED drivers, NCR family for backlighting and signaling
- High speed ESD protection PESD family
- Analog switches for sensors
- I/O expander
- Level Shifter

Smoke and Fire detector

Applications

Nexperia value Proposition

- **Very low standby** current from logic, down to 0.5 nA
- **Wide range of very small package**, DFN, WLCSP, XQFN, X2SON for higher integration and miniaturisation
- As a worldwide leading producer of ESD components, the **HMI and Displays protection will be secured from any ESD damage**
- **Extended battery lifetime**, up to 3x, to achieve and exceed 10 years lifetime on battery cell



* Coming soon

Battery Management and DCDC

- Battery Booster: Buck-Boost NBM family
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3, P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Zener Diodes
- Buck converter NEX3060: 5.5 V Sync Buck with 200nA Ultra-Low Iq *
- Boost converter NEX2080x: 5.5 V Output Sync Boost with < 300nA Ultra-Low Iq *

Signal conditioning

- IO Expander
- Analog Switches

Wireless/Wi-Fi.

- ESD protection
- Control logic: LVC family
- LED Drivers: NCR family
- Antenna protection

Industrial

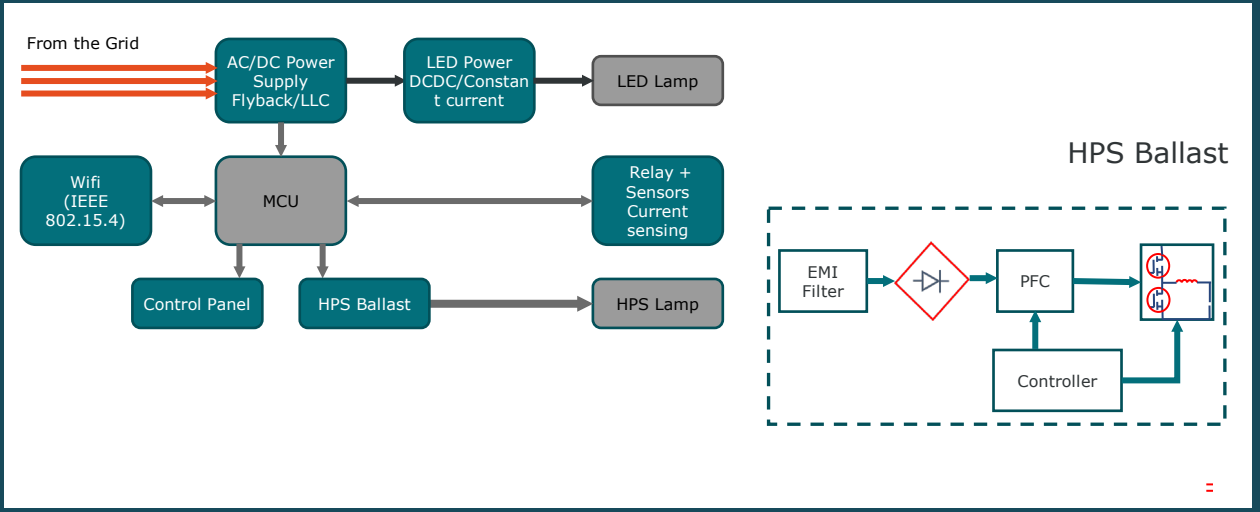
- Automation
- Power & Energy
- Medical
- Building & Home
- **Lighting**
  - Outdoor Lighting
- Other Industrial

Outdoor intelligent Street Lighting

Applications

Nexperia value Proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- **15–20kV ESD protection** for standard industrial interface
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC electrical vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

AC/DC (Flyback/LLC)

- MOSFETs: 40 V to 100 V, R_{DSon}12 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B

HPS Ballast

- MOSFETs: 40 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Gate Driver IC *

Relay + Sensor

- Discrete Driver: BJT, RETs, Diodes
- Analog switch

Led Power DC/

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10 mΩ LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP3,5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Control Panel/Wifi.

- ESD protection (CAN-FD, Ethernet)
- Control logic: LVC family
- Antenna protection

Industrial

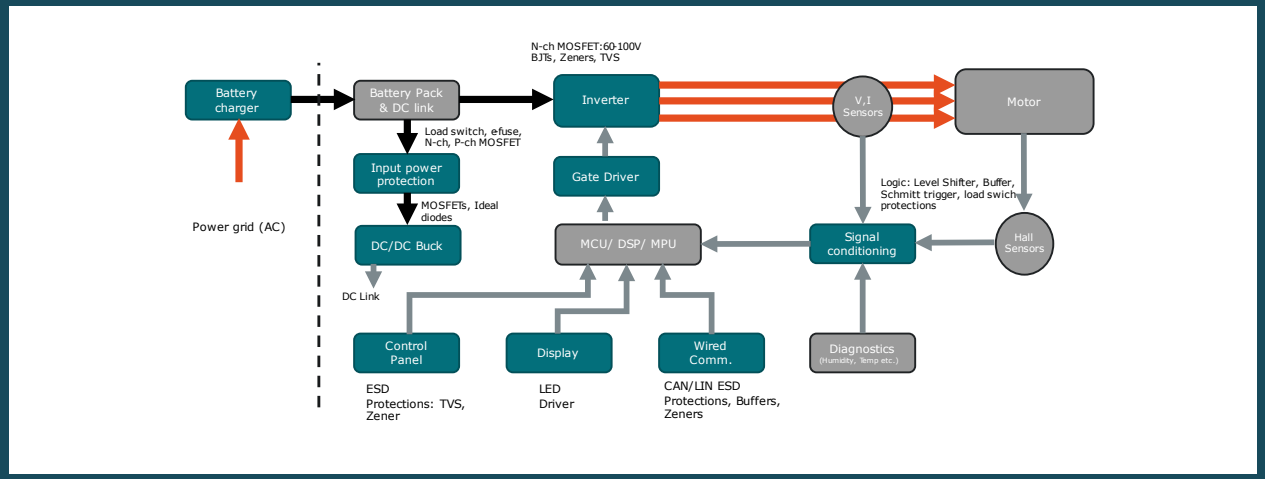
- Automation
- Power & Energy
- Medical
- Building & Home
- Lighting
- **Other Industrial**
  - E-bike
  - Power Tools – Battery powered
  - Professional Audio Amplifier
  - Smart Watch

E-Bike

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- **Less weight** due to higher F_{SW} allowing the reduction of inductance and capacitor of DCDC, and smaller heat spreader due to thermal performance
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** motor drive and DCDC converter solutions for forklifts and other lifting vehicles, while reducing costs (less heating to dissipate, smaller inductance and capacitor)



* Coming soon

Motor control (see brushless (3Φ) motor control)

- Motor Control MOSFETs: 60 to 150 V, R_{DSon} < 3mΩ LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Gate Driver: New NGD73xx family of HS/LS driver *
- Discrete Driver: BJT, RETs, Diodes

DC/DC (see DCDC Buck)

- MOSFETs: 40 to 100 V, R_{DSon} 5 to 10mΩ, LFPAK33/56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Battery management

- Charge balancing MOSFETs: 20 to 40 V, R_{DSon} < 20mΩ
- Battery protection MOSFETs: 25 to 100 V, R_{DSon} 0,55 to 4,8mΩ; LFPAK56E/LFPAK88
- ESD: TVS diodes 400–600 W
- Zener diodes: SOT23/SOD32(F)/SOD123(F)

Panel/Display/Comm.

- ESD protection (CAN-FD, Ethernet)
- Autosense translators: NXB/NXS series
- Control logic: LVC family
- Antenna protection
- Battery Booster: NBM family

Signal conditioning

- Voltage translator: NXB/ NXS series
- IO Expander NCA family
- Analog Switches

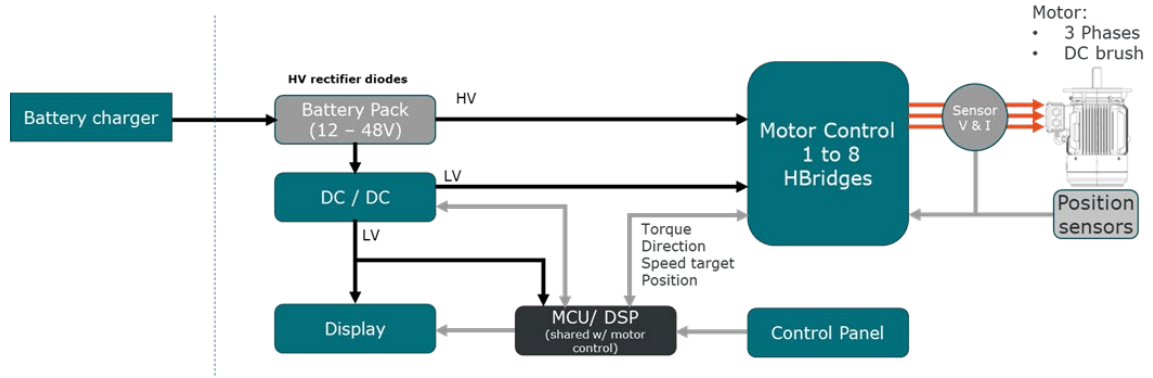
Battey charger (see link here)

Power Tools – Battery powered

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- **Less weight** due to higher FSW allowing the reduction of inductance and capacitor of DCDC, and smaller heat spreader due to thermal performance.
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- Lower tON, tOFF result in **higher motor efficiency** at 20 to 25Khz switching frequency allowing a duty on 7bits. Thanks to LFPAK, CCPAK (both are clip-bond package) reducing parasitic inductance.
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage



* Coming soon

Motor control

- Motor Control MOSFETs:
  20 to 80 V, R_{DSon} < 2mΩ
  LFPAK88 or LFPAK56E (R_{th} < 0,4K/W)
- Actuator control MOSFETs 40 V,
  3 mΩ < R_{DSon} < 7 mΩ
  LFPAK33 (R_{th} < 2K/W)
- Gate Driver: New NGD73xx family of HS/LS driver *
- Discrete Driver: BJT, RETs, Diodes

DC/DC conversion

- MOSFETs: 40 to 100 V, R_{DSon} 2 to 10 mΩ LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Control Panel/Display

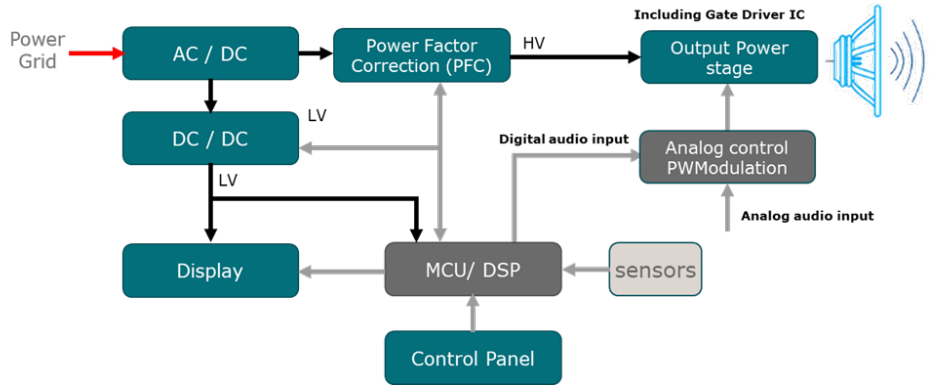
- ESD protection
- Autosense translators: NXB/NXS series
- Control logic: LVC family

Professional Audio Amplifier

Applications

Nexperia value proposition

- **Weight reduction** by increasing switching frequency which allow smaller inductance and capacitor. By using high performance package which allow smaller heat spreader.
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- **Top Colling package** allow direct dissipation to heat spreader not going through PCB. Better R_{th} (case to ambient)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage (HDMI, USB, Ethernet)



* Coming soon

Design considerations: Low Noise

- Doing the AC/DC and PFC with GAN switches allow to increase FSW and benefit of low EMI
- High FSW allow to have smaller inductance value and capacitor, easier to adjust the filter
- Higher Voltage allow smaller current and smaller magnetics

AC/DC and PFC Totem Pole (see power supply section)

- Rectifier diodes PNE, SiC family *
- MOSFETs 100 V, Low R_{DSon} 2 mΩ,/ LFPAK88
- GaN FET 650 V, R_{DSon} 12 to 63 mΩ, TO-247/ CCPAK1212 *

DC/DC (see DCDC topologies section)

- MOSFETs 20 V–100 V, Low R_{DSon} 2 mΩ, LFPAK56E/ LFPAK88
- Diodes Schottky and Zener
- Buck: 40 V, 600mA Synchronous Buck Converter *

Output power stage (Class D)

- GANFET 650 V, R_{DSon} 12 to 63 mΩ, TO-247 or CCPAK1212 *
- PNE and SiC diodes *

Display/Control panel

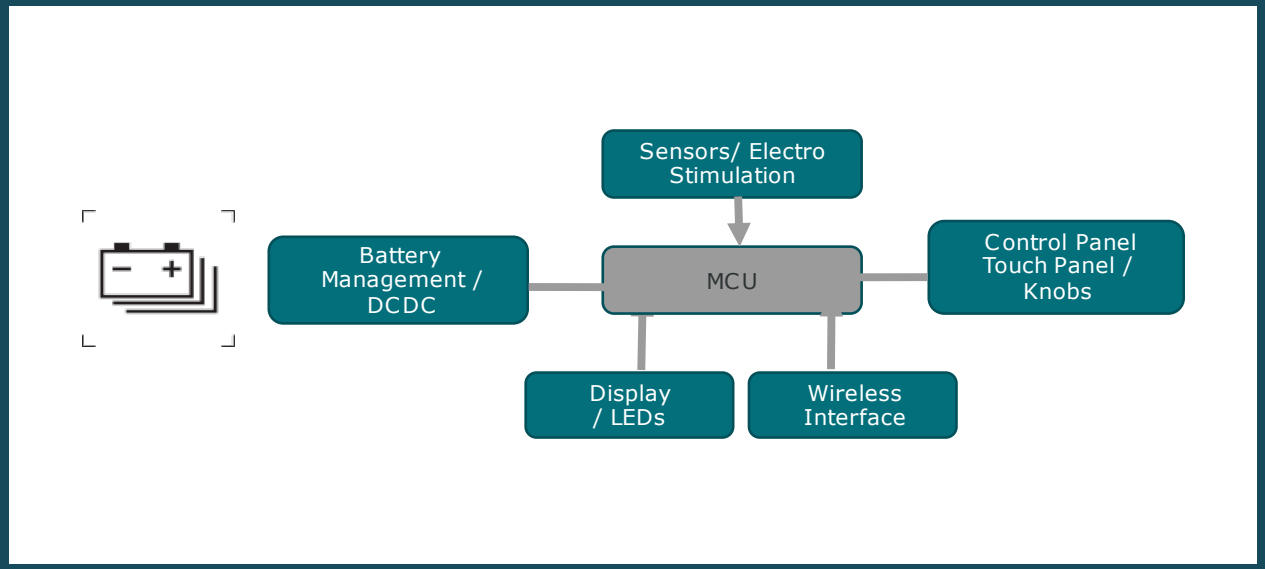
- HDMI, USB, Ethernet: PESD family (up to 40Gbps and 15kV)
- Led Driver: NCR family (up 250mA and 75 V)

Smart Watch

Applications

Nexperia value proposition

- **Very low standby** current from logic, down to 0.5 nA
- **Wide range of very small package**, DFN, WLCSP, XQFN, X2SON for higher integration and miniaturisation
- As a worldwide leading producer of ESD components, the **HMI and Displays protection** will be secured from any ESD damage
- **Extended battery lifetime**, up to 3x, to achieve and exceed 10 years lifetime on battery cell



* Coming soon

Battery Management and DCDC

- Buck converter NEX3060: 5.5 V Sync Buck with 200nA Ultra-Low Iq *
- Boost converter NEX2080x: 5.5 V Output Sync Boost with < 300nA Ultra-Low Iq *

Sensor/Electro simulator

- ssMOSFET – 12 to 40 V, compact package DFN1010D-3, P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Analog Switches

Signal conditioning

- Voltage translator: NXB/ NXS series
- IO Expander
- Analog Switches

Control Panel/Display/Wifi.

- ESD protection (standard capacitance and high-speed): PESD
- Control logic: LVC family
- LED Drivers: NCR family
- Antenna protection
- Dual output LCD bias – NEX10xx *

Consumer

Home Appliances

- Washing Machine Dishwasher
- Fridge & Freezer
- Oven
- Cooking Hob

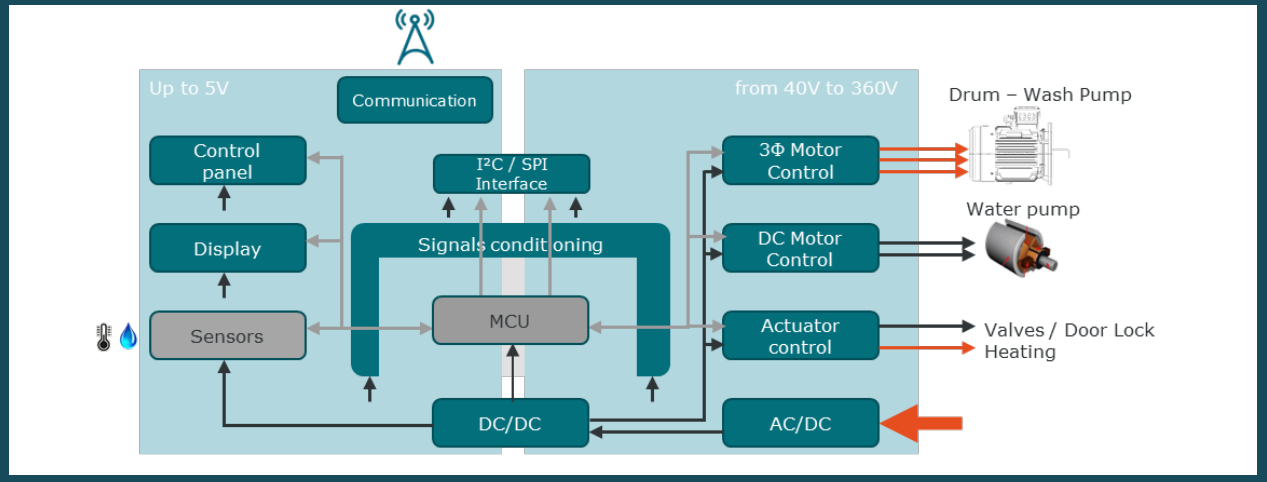
Small Appliances

Washing Machine - Dishwasher

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **Wide range of translator** for signal conditioning voltage configurable. **Latest Nexperia analog mux** reduces number of analog input of the MCU (cost reduction). **Voltage translation capabilities directly part of I/O expander**



* Coming soon

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control (inverter control)

- MOSFETs: 60 to 100 V, R_{DSon} 1,8 to 3,5mΩ, LFPAK56E or LFPAK88
- Gate Driver: New NGD73xx family of HS/LS driver *
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/D²PAK
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T)

Motor Control DC

- MOSFETs: 40 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator

Actuator control

- p-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

Display/Control panel/Sensors

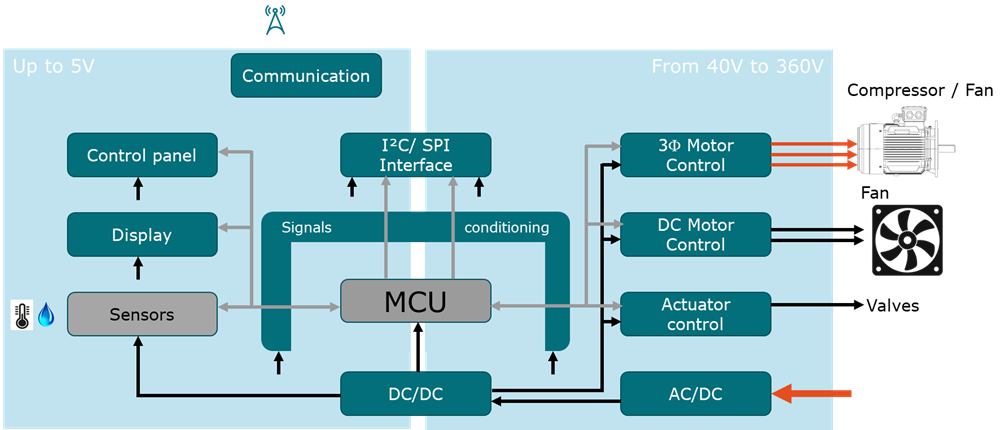
- LED drivers, NCR family for backlighting and signaling
- ESD protection (standard capacitance and high-speed): PESD family
- Analog switches for sensors
- I/O expander
- Level Shifter
- Dual output LCD bias – NEX10xx*

Fridge & Freezer

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **Wide range of translator** for signal conditioning voltage configurable. **Latest Nexperia analog mux** reduces number of analog input of the MCU (cost reduction). **Voltage translation capabilities directly part of I/O expander**



* Coming soon

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control (inverter control)

- MOSFETs: 60 to 100 V, R_{DSon} 1,8 to 3,5mΩ, LFPAK56E or LFPAK88
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/ D²PAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T)

Motor Control DC

- MOSFETs: 40 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator

Actuator control

- p-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

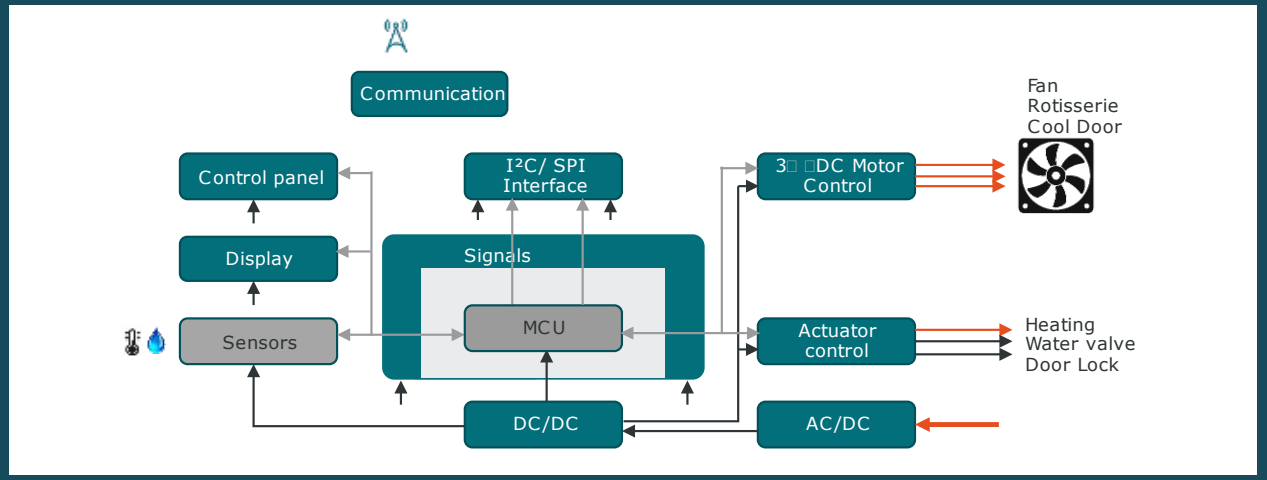
Display/Control panel/Sensors

- LED drivers, NCR family for backlighting and signaling
- ESD protection (standard capacitance and high-speed): PESD family
- Analog switches for sensors
- I/O expander
- Level Shifter
- Dual output LCD bias – NEX10xx*

Oven

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. Can work at higher ambient temperature.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **Wide range of translator** for signal conditioning voltage configurable. **Latest Nexperia analog mux** reduces number of analog input of the MCU (cost reduction). **Voltage translation capabilities directly part of I/O expander**



* Coming soon

Applications

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 20mΩ, LFPAK33/LFPAK56/LFPAK88
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control (inverter control)

- MOSFETs: 40 to 100 V, R_{DSon} 3,5 to 20mΩ, LFPAK56E or D
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/ D²PAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T)

Motor Control DC

- MOSFETs: 40 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator

Actuator control

- p-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

Display/Control panel/Sensors

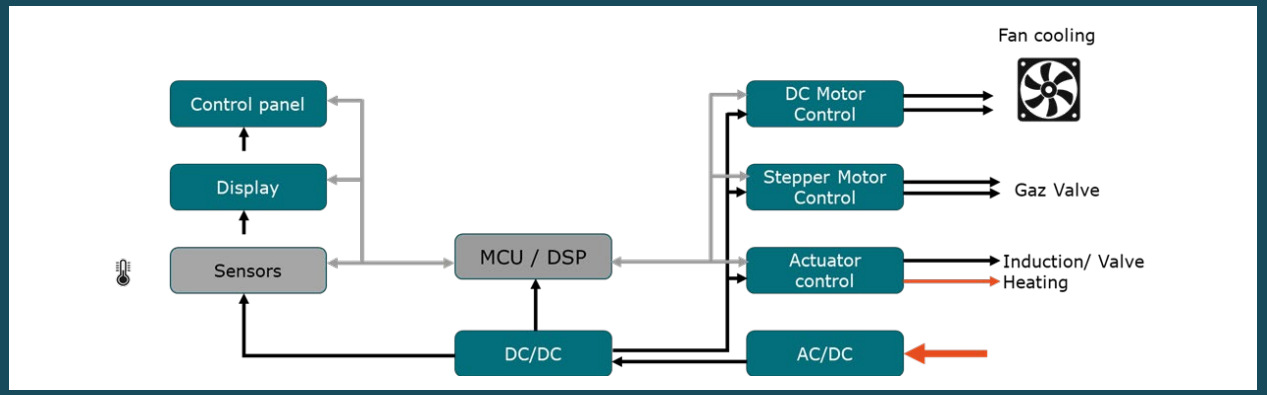
- LED drivers, NCR family for backlighting and signaling
- ESD protection (standard capacitance and high-speed): PESD family
- Analog switches for sensors
- I/O expander
- Level Shifter
- Dual output LCD bias –NEX10xx *

Cooking Hob

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **SiGe diode are not affect by thermal runaway (working up to 175°C)**



* Coming soon

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchro-nous Buck Converter *

Actuator Control (Half bridge or single switch)

- MOSFETs: 60 to 100 V, R_{DSon} 1,8 to 3,5mΩ, LFPAK56E or 88
- Recovery rectifier 100 V, CFP low inductance, DPAK/ D²PAK
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T)
- p-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

Motor Control DC

- MOSFETs: 40 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/ Schmitt triggers/Translator

Display/Control panel/Sensors

- LED drivers, NCR family for backlighting and signaling
- ESD protection (standard capacitance and high-speed): PESD family
- I/O expander

Consumer

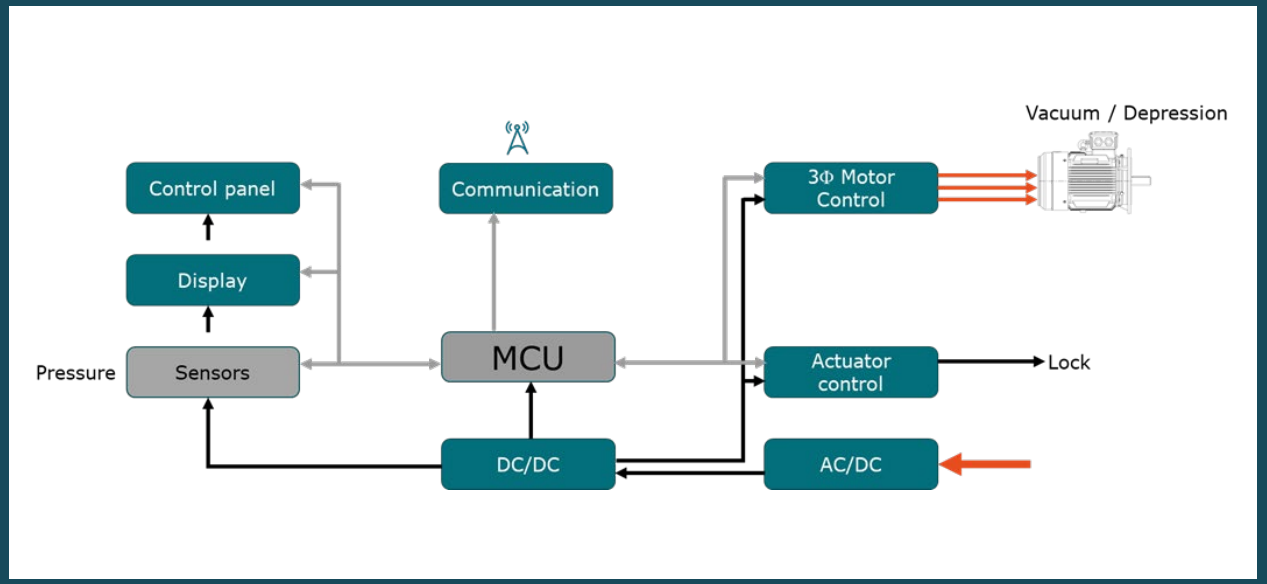
- Home Appliances
- **Small Appliances**
  - Vacuum cleaner
  - Vacuum robot

Vacuum cleaner

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allow cheaper heat spreader.
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher I_D current in PWM mode allowed)
- Wide range of Zener diodes
- Schottky with back EMF protection
- Half bridge package with internal connection: **simplify the layout and reduce EMI**



* Coming soon

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/ LFPAK88
- Schottky diodes: 40 to 100 V, IF > 1 to 5A, CFP 3, 5
- PN Diodes: 200 to 400 V, IF > 1 to 5A, CFP15B
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control (inverter control)

- MOSFETs: 40 to 100 V, R_{DSon} 0,55 to 3,5mΩ, LFPAK56E or LFPAK88
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/D²PAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T)

Motor Control DC

- MOSFETs: 40 to 100 V, R_{DSon} 2 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator

Actuator control

- p-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

Display/Control panel/Sensors

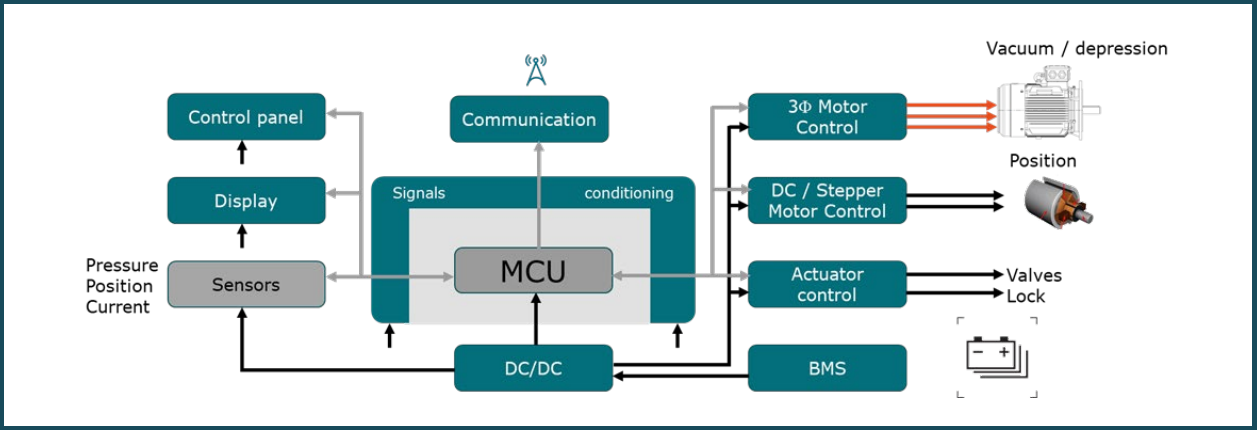
- ESD protection (standard capacitance and high-speed): PESD family
- Analog switches for sensors
- Dual output LCD bias –NEX10xx *

Vacuum robots

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, or **Low-cost package** same footprint MLPAK
- **Best in class SOA and avalanche capabilities** increase Robustness and reliability of the system (Higher ID current in PWM mode allowed)
- As a worldwide leading producer of ESD components, the **protection HMI and Displays** will be secured from any ESD damage
- Schottky with back EMF protection
- Half bridge package with internal connection: **simplify the layout and reduce EMI**
- **Wide range of translator** for signal conditioning voltage configurable. **Latest Nexperia analog mux** reduces number of analog input of the MCU (cost reduction). **Voltage translation capabilities directly part of I/O expander**



* Coming soon

AC/DC (PFC)/DC/DC

- MOSFETs: 25 to 100 V, R_{DSon} 2 to 10mΩ, MLPAK 33/56 or LFPAK 33/56
- Schottky diodes: 20 to 100 V, IF > 0,1 to 5A, CFP 3, 5 or standard package
- Sub-system power supply: see DC/DC Buck topology
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor Control (inverter control)

- MOSFETs: 20 to 60 V, R_{DSon} 0,7 to 3,5mΩ, LFPAK33/LFPAK56
- Recovery rectifier 10 V/100 V, CFP low inductance, DPAK/ D²PAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) of HS/LS driver *

Motor Control DC

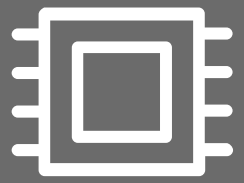
- MOSFETs: 20 to 60 V, R_{DSon} 1 to 10mΩ, LFPAK33/56
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator

Actuator control

- p-MOSFET or small signal MOSFET
- Freewheeling diodes, PNE/PNU diodes, SiGe

Display/Control panel/Sensors

- ESD protection (standard capacitance and high-speed): PESD family
- Analog switches for sensors
- I/O expander
- Level Shifter
- Dual output LCD bias – NEX10xx*



Sub-System Functions

DC/DC Topologies

- Buck
- Boost
- Buck-Boost
- SEPIC
- Flyback
- Resonant LLC

AC/DC Topologies

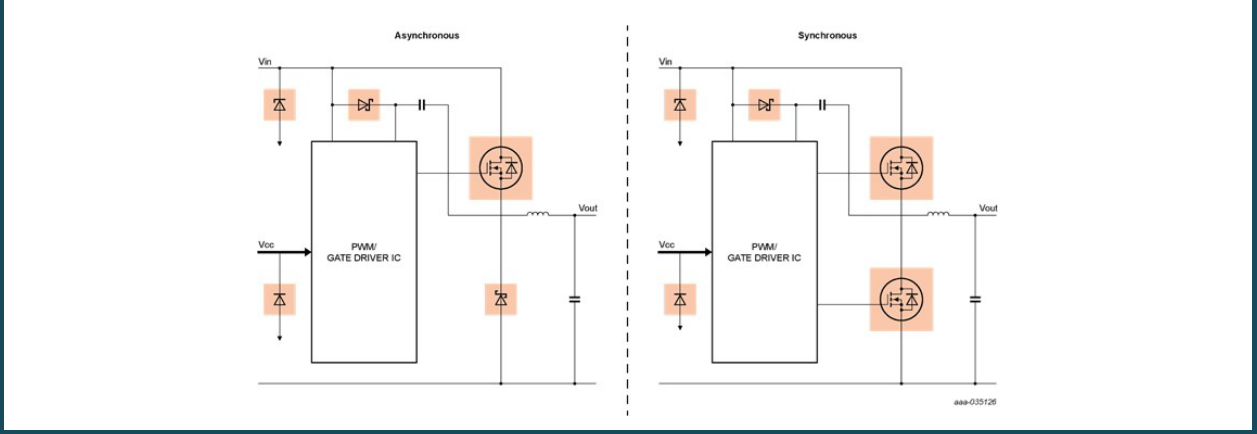
Motor Control Topologies

DC/DC Topologies
DC/DC Buck

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions, while reducing costs (less heating to dissipate)
- Therefore, the possibility to go to **higher switching frequency (F_{SW})**, which **leads to smaller inductances and smaller capacitors**
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- High thermal environment issues solved with **SiGe diodes** that have **no thermal runaway.**



* Coming soon

Design considerations

- **Point of load** non-isolated DC-to-DC synchronous buck converter circuit
- Economical, two-MOSFET design - **low Q_G(tot) & low FOM** for best efficiency
- Step-down of voltage while stepping up current

Products Power

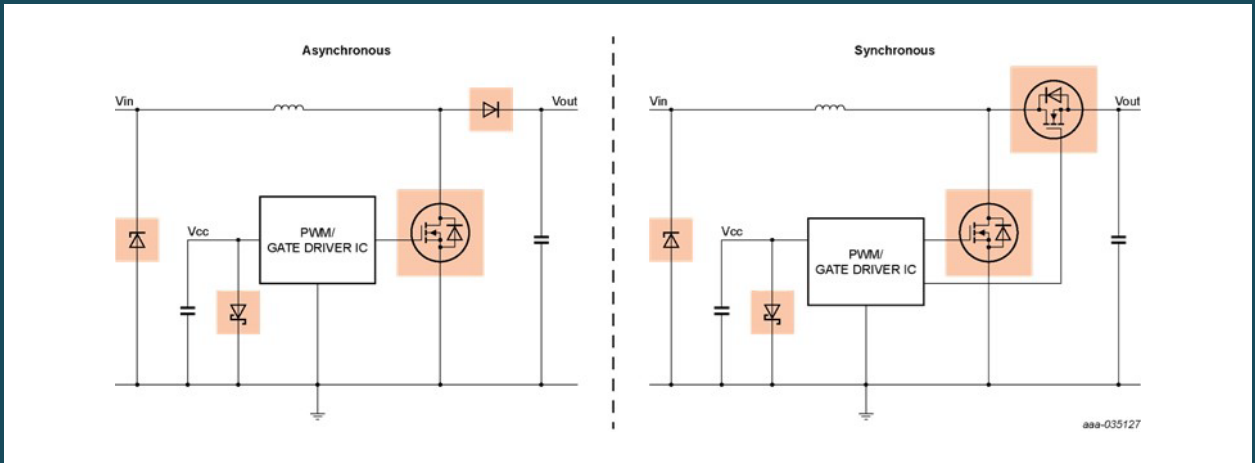
- MOSFETs – 30 V to 100 V, **Q_{GD} 1,7 – 13,5 nC**, LFPAK/MLPAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- ssMOSFET – 12 to 40 V, **compact package DFN1010D-3** P_{tot} > 0.3W, DFN2020MD-6, **P_{tot} up to 19W**
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- SiGe diodes, 120 V to 200 V, PMEGxxxGxx
- Buck: 40 V, 600mA Synchronous Buck Converter *

DC/DC Topologies
DC/DC Boost

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions, while reducing costs (less heating to dissipate)
- **Standard Packages MLPAK33 and MLPAK56** also available
- Therefore, the possibility to go to **higher switching frequency (F_{SW})**, which leads to smaller inductances and smaller capacities
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition



* Coming soon

Design considerations

- Point of load non-isolated DC-to-DC synchronous buck converter circuit
- Economical, two-MOSFET design - low Q_G(tot) & low FOM for best efficiency
- Step-down of voltage while stepping up current

Products Power

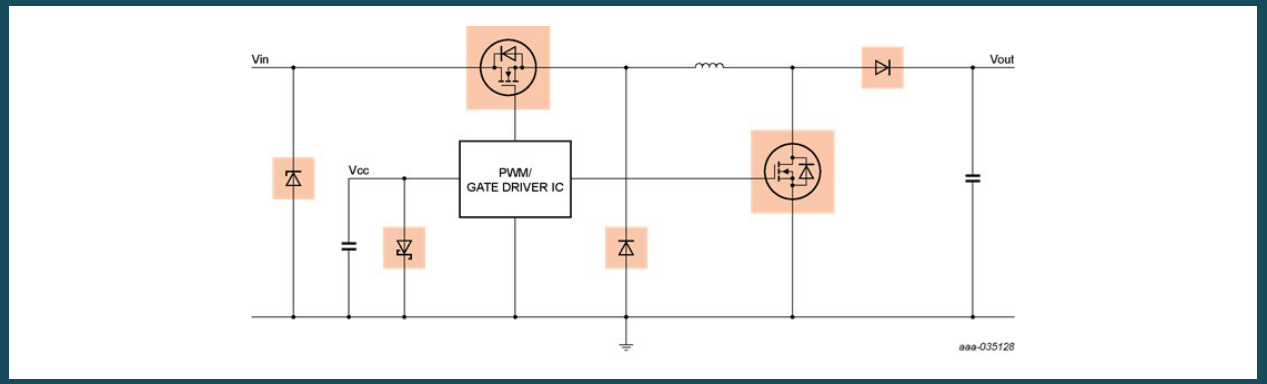
- MOSFETs – 30 to 100 V, **Q_{GD} 1,7 to 13,5 nC**, LFPAK/MLPAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- ssMOSFET – 12 to 40 V, **compact package DFN1010D-3** P_{tot} > 0.3W, DFN2020MD-6 **P_{tot} up to 19W**
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- TVS, DFN2020 compact for low medium power and CFP for higher power
- Zener diodes

DC/DC Topologies
DC/DC Buck-Boost

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions, while reducing costs (less heating to dissipate)
- **Standard Packages MLPAK33** and MLPAK56 also available
- Therefore, the possibility to go to **higher switching frequency (F_{sw})**, which leads to smaller inductances and smaller capacities
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- SiGe Diodes solve thermal runaway in **high temperature** environment and reduces **leakage current**



D1 and D2 can be replaced by 2 switch for higher efficiency

Design considerations

- Economical, two-MOSFET design - low Q_G(tot) & low FOM for best efficiency
- Step-down of voltage while stepping up current

Products Power

- MOSFETs – 30 to 100 V, QGD 1.7 to 13.5nC, LFPAK/MLPAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- ssMOSFET – 12 to 40 V, **compact package DFN1010D-3** P_{tot} > 0,3W, DFN2020MD-6 **P_{tot} up to 19W**
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- P/N switching diodes in various packages DFN1006-2 up to SOD123F
- Silicon Germanium (SiGe) rectifier encapsulated in a CFP3 (SOD123W) or CFP5 (SOD128) small and flat lead Surface-Mounted Device (SMD) plastic package
- TVS with CFP package

Integrated solution

- Battery Booster, SMB family with input supply done by a cell battery.

* Coming soon

DC/DC Topologies
DC/DC Flyback

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions, while reducing costs (less heating to dissipate)
- **Standard Packages MLPAK33 and MLPAK56** also available
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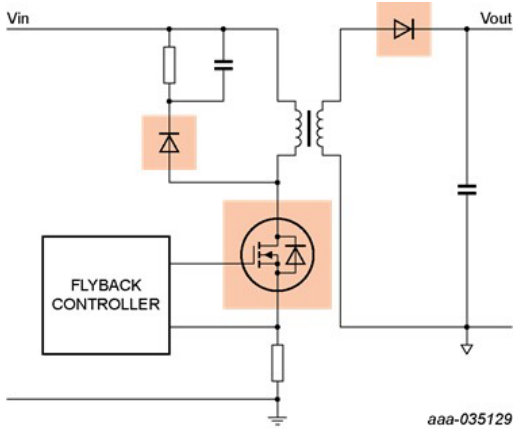

Products Power

- MOSFETs – 30 to 100 V, Q_{GD} 1,7 to 13,5 nC, LFPAK/MLPAK
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3 P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- P/N switching diodes in various packages DFN1006-2 up to SOD123F

DC/DC Topologies
DC/DC Resonant LLC

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK, CCPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions, while reducing costs (less heating to dissipate)
- Therefore, the possibility to go to **higher switching frequency (F_{sw})**, which leads to smaller inductances and smaller capacities
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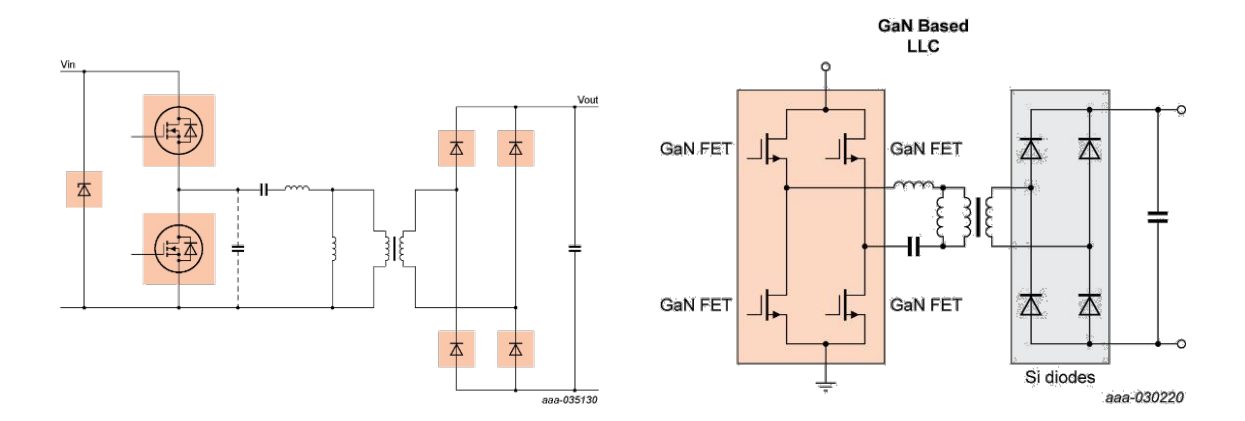
- SiGe Diodes solve thermal runaway in **high temperature** environment and reduces **leakage current**



* Coming soon

Products Power

- GaN FET: 650 V, R_{DSon} 70 to 12mΩ, TO247 or CCPAK1212 (R_{th} < 0,5K/W) *
- SiC diode: 650 V to 1200 V, DPAK/ D²PAK/TO247 true dual pin *
- LLC SR MOSFET's: 40 V–100 V from 1mW to 10W, LFPAK88
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/ drivers/Schmitt triggers/Translator
- P/N rectifier diodes: up to 650 V in CFP package

DC/DC Topologies
SEPIC

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DCDC converter solutions, while reducing costs (less heating to dissipate)
- **Standard Packages MLPAK33 and MLPAK56** also available
- Therefore, the possibility to go to **higher switching frequency (F_{sw})**, which leads to smaller inductances and smaller capacities
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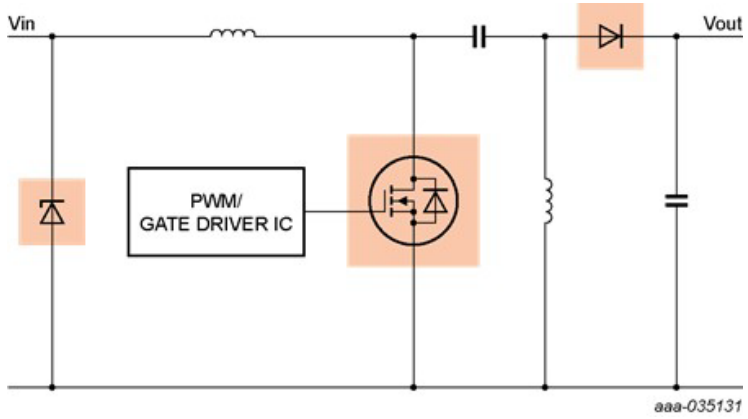


Design considerations

- Economical, single MOSFET design – low QG(tot) & low FOM for best efficiency

Products Power

- MOSFETs – 30 to 100 V, Q_{GD} 1,7 – 13,5 nC, LFPAK/MLPAK
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3 P_{tot} > 0.3W, DFN2020MD-6 P_{tot} up to 19W
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- TVS

Sub-System Functions

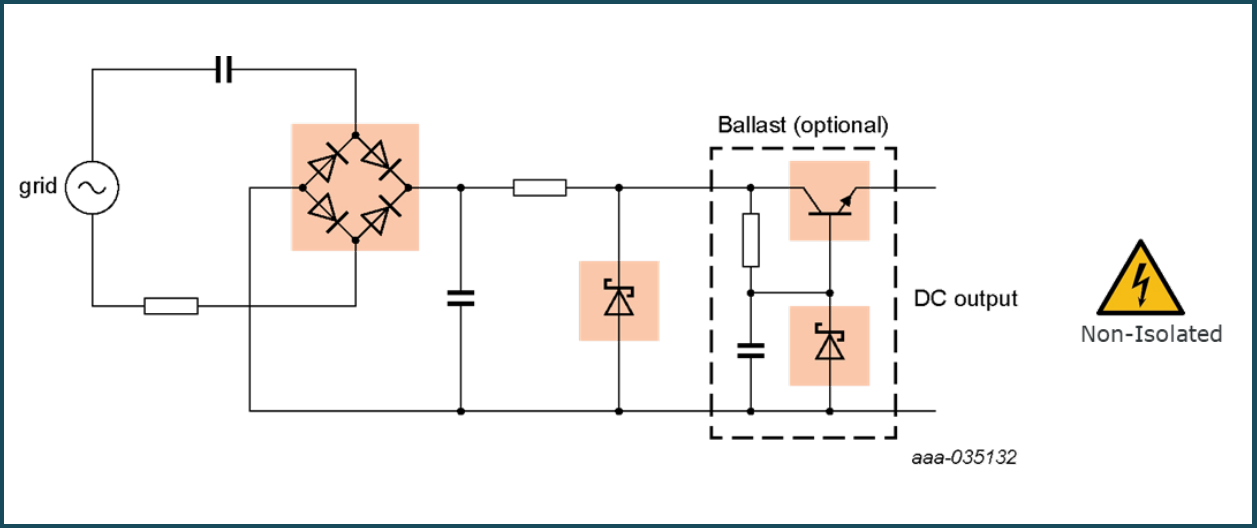
- DC/DC Topologies
- AC/DC Topologies
  - Non-Isolated AC/DC Linear power supply
  - Power Factor Corrector – PFC
  - Vienna Rectifier for Three phase–isolated
- Motor Control Topologies

AC/DC Topologies
Non-Isolated AC/DC Linear power supply

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition. No heatsink or copper surface to dissipate power
- Wide range of Zener diodes more than 2000 references
- Max V_{drop} can be controlled by adding a Zener before the ballast. This give as well a second output (24 V as example for the relay). You can so adjust the voltage of the relays to have the best price compromis
- Power to dissipate in the ballast Vdrop x 50mA (24-5)*50mA= 0,95W **SOT223 to LFPAK56 which won't require any heat spreader**



Design considerations

- Rectifier Diodes need to be able to drive 20mA to 50mA, from 100 V to 200 V
- Schottky rectifier BAT46GW (100 V, 250mA)
- PNE20010ER, CFP3 200 V 1A

Zener as voltage regulator

- From 1.8 V to 100 V (1% to 5% precision)

Ballast voltage regulator

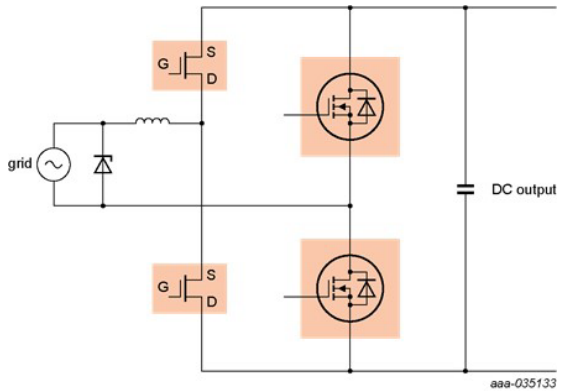
- Bipolar transistor PNP or NPN working in linear mode
- Zener diodes

AC/DC Topologies
Power Factor Corrector – PFC (Totem Pole)

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Reliable Clip-bonding package technology for **High anti stall Robustness**
- Nexperia GaN FET offer
  - **Efficiency above 99%**
  - **Low ripple current** (continuous conduction mode)
  - **Higher Power** from 2kW to 11kW (in single phase)



* Coming soon

Design considerations

- T1 and T2 could either be replaced by a diode PN or SiC (depending on voltage output), to be more cost effective. Or be replaced by GaN FET for more efficient and less switching losses. Lower thermal dissipation.

Power Stage

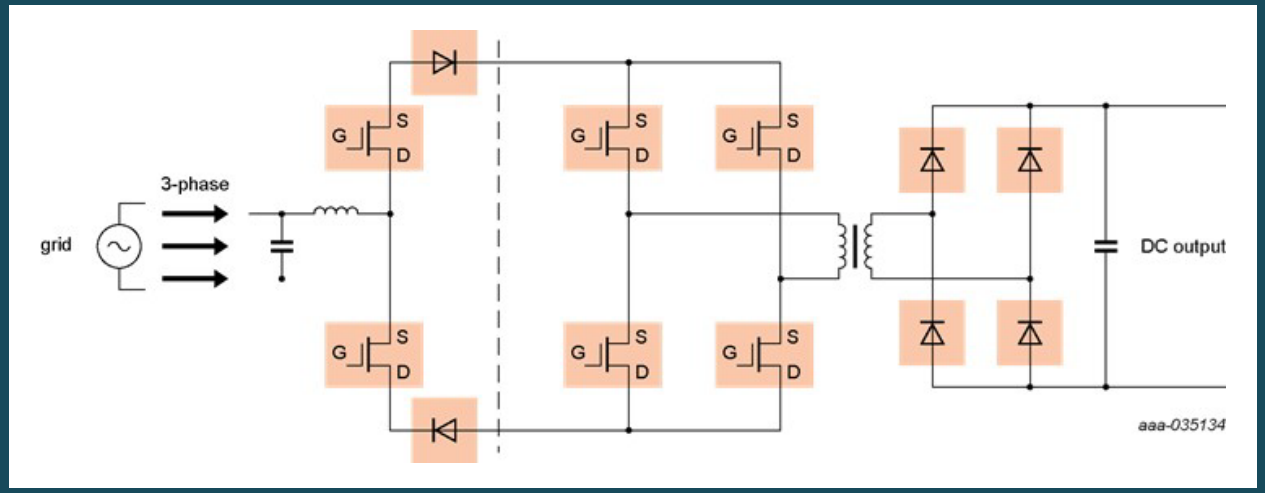
- GaN FET: 650 V, R_{DSon} 70 to 12mΩ, TO-247 or CCPAK1212 (R_{th} < 0,5K/W) *
  - IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator
- P/N rectifier diodes: up to 650 V in CFP package
- SiC diodes

AC/DC Topologies
Vienna Rectifier for Three phase–isolated

Applications

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- **Lower switch losses** improve even more the thermal behavior
- Nexperia GaN FET offer
  - **Efficiency above 99%**
  - **Low ripple current** (continuous conduction mode)
  - **Higher Power** from 2kW to 11kW (in single phase)



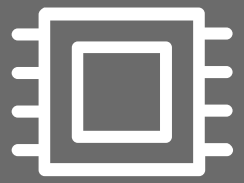
* Coming soon

Design considerations

- S1 to S4 could either be replaced by MOSFET (depending on voltage output), to be more cost effective. Or be replaced by GaN FET for more efficient and less switching losses. Lower thermal dissipation.
- G1, G2 could be GaN, SIC, IGBT (if IGBT need parallel diode)

Power Stage

- GaN FET: 650 V, R_{DSon} 70 to 12mΩ, TO-247 or CCPAK1212 (R_{th} < 0,5K/W) *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Gate Driver: New NGD73xx family of HS/LS driver *
- Gate Driver: Bipolar transistors ≤ 100 V, MOSFET ≤ 60 V, HC(T) buffer/drivers/Schmitt triggers/Translator
- P/N rectifier diodes: up to 650 V in CFP package
- SiC diodes



Sub-System Functions

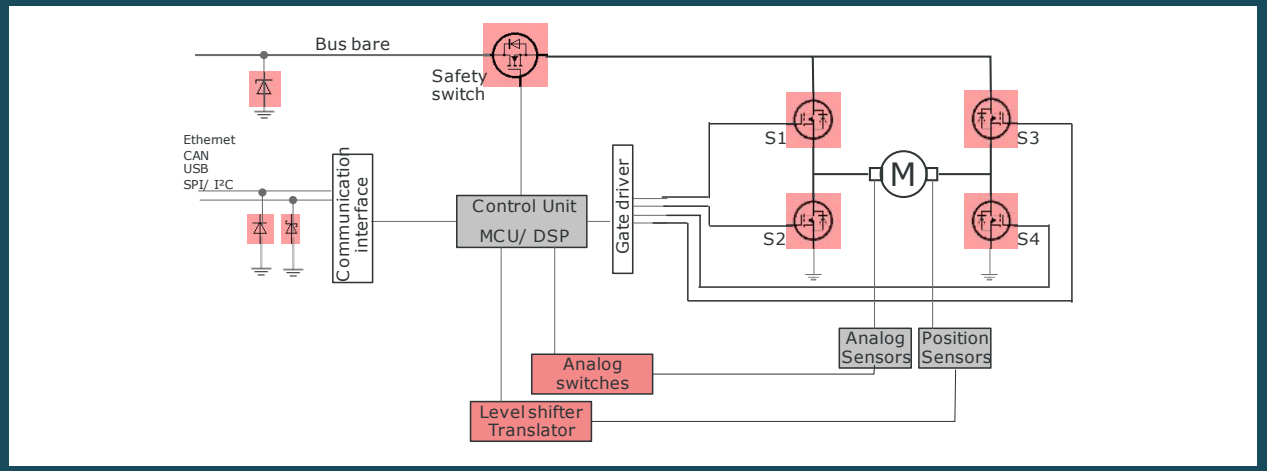
- DC/DC Topologies
- AC/DC Topologies
- **Motor Control Topologies**
  - Brushed Motor Control
  - Brushless (3Φ) Motor Control
  - Stepper Motor Control

Motor Control Topologies
Brushed Motor Control

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- LFPAK, CCPAK and CFP (both clip-bond package) allow a **high-efficiency** while reducing costs (less heating to dissipate)
- **Standard Packages MLPAK33 and MLPAK56** also available
- Therefore, the possibility to go to **higher switching frequency (F_{sw}),** which allow better accuracy for motor efficiency



Design considerations

- Wide range of switches from low voltage up to 650 V
- S switches can be MOSFET, Bipolar or IGBT

Power Stage

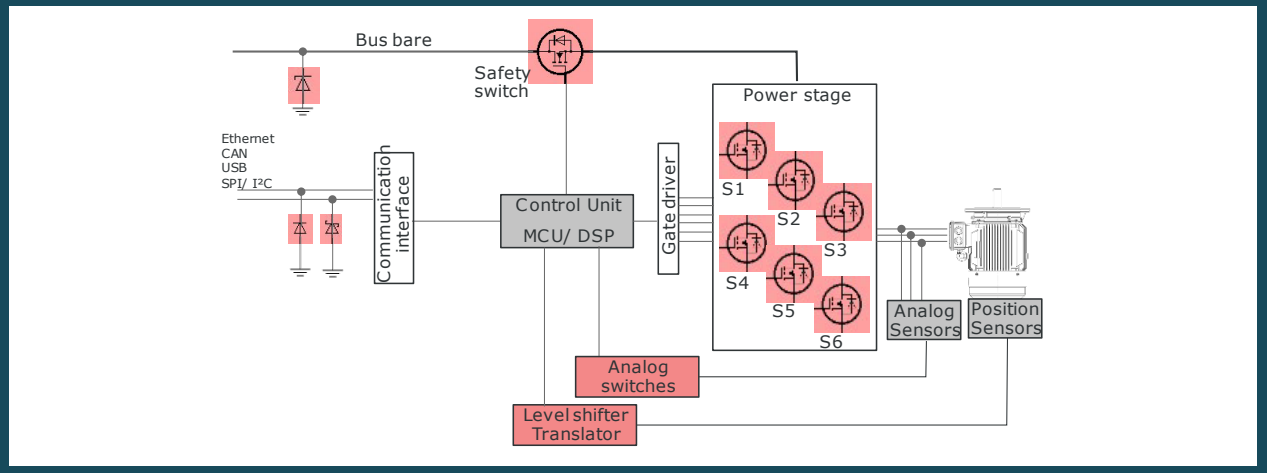
- GaN 650 V, R_{DSon} 7mW to 61mW, CCPAK1212 *
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- MOSFETs – 12V to 150 V, QGD 1.7 to 13.5nC, LFPAK/MLPAK
- Gate Driver: New NGD73xx family of HS/LS driver *
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3 P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- P/N switching and SiC diodes in various packages
- TVS with CFP package
- Analog switches HC(T), LV, LVC
- Level shifter and translator, 74AUP and 74AVC families

Motor Control Topologies
Brushless (3Φ) Motor Control

Applications

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- **Best thermal performance** thanks to Clip-bonding package, R_{th} 3x better than competition, allowing temperature twice smaller than competition
- LFPAK, CCPAK and CFP (both clip-bond package) allow a **high-efficiency** while reducing costs (less heating to dissipate)
- **Standard Packages MLPAK33 and MLPAK56** also available
- Therefore, the possibility to go to **higher switching frequency (F_{sw}),** which allow better accuracy for motor efficiency



Design considerations

- Wide range of switches from low voltage up to 650 V

Power Stage

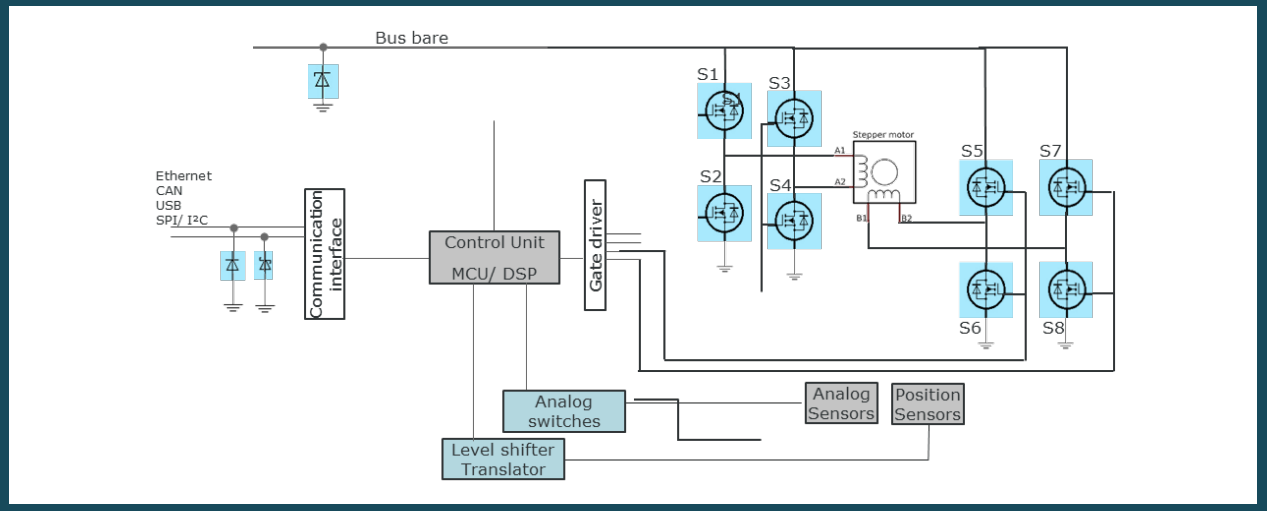
- MOSFETs – 12 V to 150 V, Q_{GD} 1.7 to 13.5nC, LFPAK/MLPAK
- Gate Driver: New NGD73xx family of HS/LS driver
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3 P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- GaN 650 V, R_{DSon} 7mW to 61mW, CCPAK1212
- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- P/N switching and SiC diodes in various packages
- TVS with CFP package
- Analog switches HC(T), LV, LVC
- Level shifter and translator, 74AUP and 74AVC families

Motor Control Topologies
Stepper Motor Control

Applications

Nexperia value proposition

- **Reduce ringing and spiking** improve EMC behavior
- **Low Q_G, Fast reverse recovery, Low C_{oss}, Logic Level** allow direct drive from an MCU
- **Standard Packages MLPAK33 and MLPAK56** also available
- **Small DFN, WLCSP (Wafer Level) or dual DFN** for miniaturization and high integration
- Therefore, the possibility to go to **higher switching frequency (F_{sw})**, which allow better accuracy for motor efficiency and precision



Design considerations

- Wide range of switches from low voltage up to 100 V

Power Stage

- MOSFETs – 12 V to 100 V, MLPAK and DFN
- Gate Driver: New NGD73xx family of HS/LS driver
- ssMOSFET – 12 to 40 V, compact package DFN1010D-3 P_{tot} > 0,3W, DFN2020MD-6 P_{tot} up to 19W
- Schottky diodes: ≤ 250 mA, SOD523/DFN1006-2
- TVS with compact package DFN1010 or XSON
- Analog switches HC(T), LV, LVC
- Level shifter and translator, 74AUP and 74AVC families

Sub-System Functions

- DC/DC Topologies
- AC/DC Topologies
- Motor Control Topologies

Small Signal Bipolar in DFN packages

Design Benefits

- Same electrical performance at smaller size
- Reduced parasitic inductance and capacitance
- Improve thermal behavior – enables higher reliability

Functions and applications

- General switching function
- Voltage regulation and conversion
- Signal inversion
- Load switching
- Reverse polarity protection, etc

Key technical features and portfolio

- Smallest form factor– about 75% less board space allows more design flexibility
- Lowest thermal resistance R_{th} j-a
- Optional side wettable flanks (SWF) allows automated optical inspection (AOI)

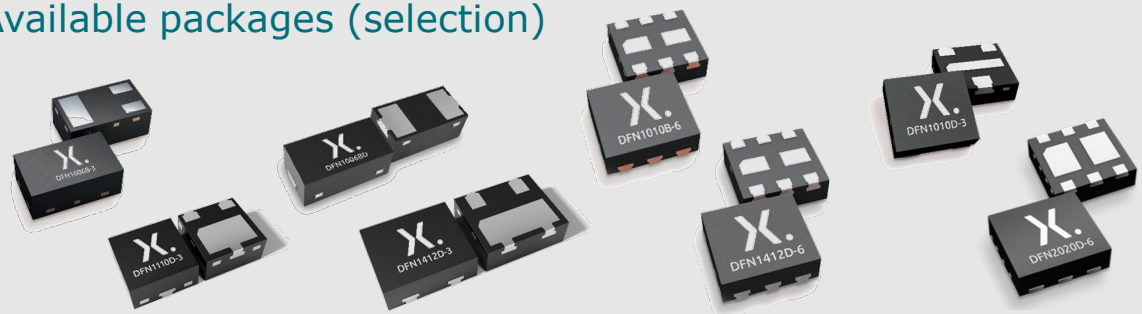
Discovery questions

- Is space a concern in your application? (Determine if component size is critical for the customer)
- Do you use automated optical inspection (AOI) for solder quality control? (Determine if side wettable flanks (SWF) are a plus for the application)

Products

- Currently we offer ca 600 small signal bipolar products in DFN packages covering all kind of diodes and transistors like:
  - Zener diodes
  - Switching diodes
  - Schottky diodes
  - Single and double bipolar transistors (BJT) in NPN and PNP polarity
  - Resistor-Equipped-Transistors (RETs)
  - Matched pair transistors

Available packages (selection)



Products

DC/DC Topologies

AC/DC Topologies

Motor Control Topologies

Power Bipolar Diodes & Transistors MFP topic overview

MFP Overview

Schottky's in CFP	Recovery Rectifiers in CFP	SiGe Rectifiers in CFP	BJT – MJD Series
Trench and Planar rectifier series dedicated to low V_F, low I_R and low Q_{rr}	Hyperfast/ Ultrafast rectifiers with soft and reliable switching	Rectifiers with extraordinary safe operation area and increased efficiency	High quality transistors with supply chain security and footprint compatibility

Schottky's in CFP Packages

Trench and Planar rectifier series dedicated to low V_F, low I_R and low Q_{rr}

Bipolar Diodes & Transistors

Design Benefits

- Excellent efficiency, very low switching losses
- High thermal stability
- Minimized PCB space due to compact package design

Functions and applications

- Rectification in power supply (e.g. USB/PD)
- DCDC conversion
- Reverse battery protection
- Or-ing (several supply sources)
- Free wheeling diode

Key technical features and portfolio

- Low forward voltage
- Low Q_{rr} and low I_{RM}
- High power dissipation capability
- AEC-Q101 qualified

Discovery questions

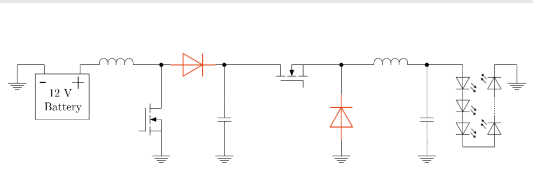
- Do you require a low V_F Schottky diode with improved thermal stability to avoid a thermal runaway?
- Do you see high losses in your application due to the switching behavior of your diode?
- Do you require a 100 V low V_F Schottky diode for your lighting applications ?

Products

Type	Key Feature	V_R max [V]	I_F(av) [A]	Package
Planar	Low V_F	20–60	1–15	CFP3, CFP5, CFP15(B)
Planar	Ultra-low I_R	60–100	1–10	CFP3, CFP5, CFP15(B)
Trench	Low Q_{rr}	40–100	1–20	CFP2-HP, CFP3, CFP5, CFP15(B)

Application diagram

e.g. LED driver – Boost/Buck stage



Available packages

CFP2-HP (SOD323HP)	CFP3 (SOD123W)	CFP5 (SOD128)	CFP15B (SOT1289B)
			
2.2 x 1.3 x 0.68	2.6 x 1.7 x 1.0	3.8 x 2.6 x 1.0	5.8 x 4.3 x 0.95

Hyperfast/Ultrafast Recovery Rectifiers in CFP Packages

Rectifiers with soft and reliable switching

Bipolar Diodes & Transistors

Design Benefits

- Hyperfast, Ultrafast, soft and reliable switching
- Small and thin SMD plastic package
- High power capability due to clip bond technology

Functions and applications

- Reverse voltage:
  VR max = 200 V/650 V
- Forward current:
  IF(av) ≤ 1A–10A, 2x2A–2x5A
- Hyperfast recovery trr typ ≤ 20ns
- Ultrafast recovery trr typ ≤ 50ns
- Low forward voltage drop
- Low reverse current
- Automotive qualified: AEC-Q101

Key technical features and portfolio

- General rectification
- High frequency converters
- Solenoid control
- LED Lighting
- Polarity protection
- Freewheeling applications
- Piezo injection
- OBCs

Discovery questions

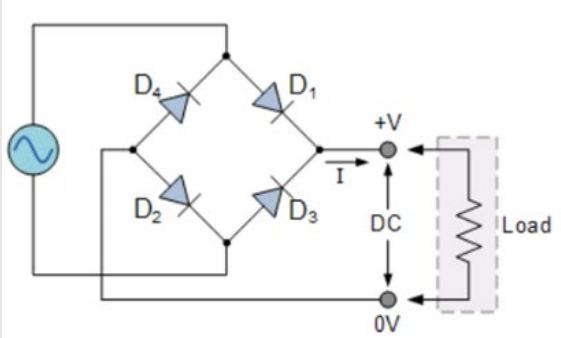
- Do you require a hyperfast, soft and reliable switching within your application?
- Do you require an ultrafast, soft and reliable switching within your 650 V applications?
- Do you plan to miniaturize your system size with CFP packages?

Products

Portfolio	V_R max [V]	I_F(av) [A]	t_{rr} max [ns]	Package
PNE20010EXD/–Q	200	1	25	CFP2-HP
PNE200x0ER/-Q	200	1/2	25	CFP3
PNE200x0EP/–Q	200	2/3	25/30	CFP5
PNE200x0EPE/–Q	200	4/6/8/10	30	CFP15B
PNE200x0CPE/–Q	200	2 x 2/3/4/5 (dual, cc)	30	CFP15B
PNU65010ER/–Q	650	1	60	CFP3
PNU65010EP/–Q	650	1	60	CFP5
PNU650x0EP/–Q	650	2/3	60	CFP5

Application diagram

e.g. Rectification



Available packages

CFP2-HP (SOD323HP)

2.2 x 1.3 x 0.68

CFP3 (SOD123W)

2.6 x 1.7 x 1.0

CFP5 (SOD128)

3.8 x 2.6 x 1.0

CFP15B (SOT1289B)

5.8 x 4.3 x 0.95

SiGe Rectifiers in CFP Packages

SiGe rectifiers with extraordinary safe operation area and increased efficiency

Bipolar Diodes & Transistors

Design Benefits

- Excellent efficiency (trade off between IR and VF)
- Extraordinary safe operation area up to 175°C
- Space saving and rugged CFP packages

Functions and applications

- High-efficiency power conversion
  - Automotive LED lighting
  - Engine control unit
  - Solenoid Drive
  - Power supply units
  - DCDC Converters
- Reverse polarity protection
- OR-ing

Key technical features and portfolio

- Low forward voltage and low Qrr
- Extremely low leakage current
- Thermal stability up to 175°C junction temperature
- Fast and smooth switching
- Low parasitic capacitance
- 2x AEC-Q101 qualified

Discovery questions

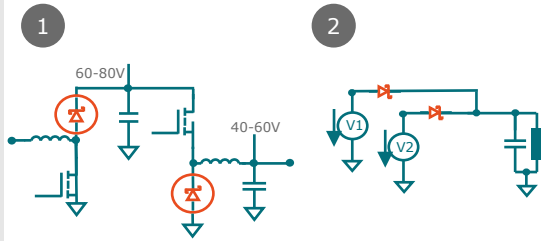
- Is your design sensitive to thermal runaway of the Schottky rectifier?
- Do you require a Schottky Rectifier with extremely low leakage currents at high temperatures?
- Do you use a Fast Recovery Rectifier in your design and require a lower VF?
- Do you have EMI issues because of overswing and ringing of the Rectifiers?

Products

Portfolio	Voltage [V]	Current [A]	Package
PMEGxxxG10ELR/-Q	120/150/200	1	CFP3 (SOD123W)
PMEGxxxG20ELR/-Q	120/150/200	1	CFP3 (SOD123W)
PMEGxxxG20ELP/-Q	120/150/200	2	CFP5 (SOD128)
PMEGxxxG30ELP/-Q	120/150/200	3	CFP5 (SOD128)

Application diagram

e.g. 1) Freewheeling diode in converter
2) OR-ing



Available packages

CFP2-HP (SOD323HP)	CFP3 (SOD123W)
	
2.6 x 1.7 x 1.0	3.8 x 2.6 x 1.0

Bipolar Transistors – MJD Series

High quality with supply chain security and footprint compatibility

Bipolar Diodes & Transistors

Design Benefits

- High thermal power dissipation capability
- High energy efficiency due to less heat generation
- Compatible to industry standard MJD series

Functions and applications

- LED automotive lighting
- Backlight dimming LCD displays
- Linear voltage regulator
- Motor drive
- Battery Management System
- Laser printer
- MOSFET driver

Key technical features and portfolio

- Low collector emitter saturation voltage
- Fast switching speeds
- Electrical performance similar to well known MJD series
- AEC-Q101 qualified (-Q)

Discovery questions

- Is delamination a critical topic for you ?
- Are you looking for a 2nd source supplier or supply security ?

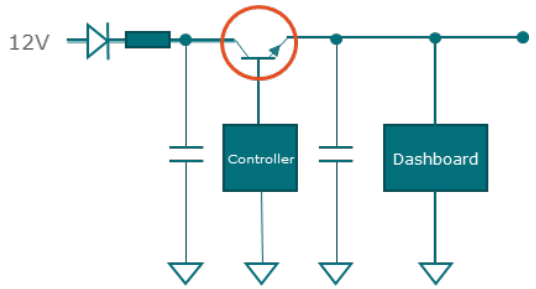
Products

Portfolio	Vceo [V]	I_c[A]	Type	Package
MJD148/-Q	45	4	NPN	DPAK
MJD2873/-Q	50	2	NPN	DPAK
MJD44H11/A	80	8	NPN	DPAK
MJD45H11/A	80	8	PNP	DPAK
MJD31C/A	100	3	NPN	DPAK
MJD31CH-Q (high gain)	100	3	NPN	DPAK
MJD32C/A	100	3	PNP	DPAK
MJD41C/-Q	100	6	NPN	DPAK
MJD42C/-Q	100	6	PNP	DPAK

Automotive Qualified
- xxxA
- xxx-Q

Application diagram

e.g. Voltage stabilization for vehicle dashboard



Available packages

DPAK (SOT-428C)

10 x 6.6 x 2.3 mm

Products

DC/DC Topologies

AC/DC Topologies

Motor Control Topologies

SiC Schottky Diodes

Ultra-high performance and high efficiency diodes with low energy losses

SiC Discretes

Design Benefits

- Ultra-high performance
- High efficiency with low energy loss
- Temperature independent fast and smooth switching performance
- Reduced system cost
- System miniaturization
- Reduced EMI

Functions and applications

- Switch Mode Power Supplies (SMPS)
- AC-DC and DC-DC Converters
- Battery Charging Infrastructure
- Uninterruptible Power Supply (UPS)
- Photovoltaic inverters

Key technical features and portfolio

- Low forward voltage drop (V_F)
- Zero recovery switching behavior
- Outstanding figure-of-merit (Q_C x V_F)
- High I_{FSM} capability
- High-voltage compliant Real-2-Pin (R2P) packages

Discovery questions

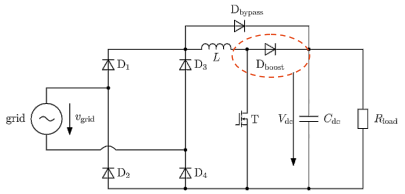
- Do you require ultra-high performance for your high voltage switching applications?
- Do you see high losses in your application due to the switching behavior of your diode?
- Are you looking for a robust SiC diode with low forward voltage drop and an excellent I_{FSM} capability?
- Is creepage/clearance distance a concern for your designs?

Products

Portfolio	V_R max [V]	I_F(av) [A]	Package
PSC1065H	650	10	DPAK R2P
PSC1065J	650	10	D2PAK R2P
PSC1065K	650	10	TO-220-2
PSC1065L	650	10	TO-247-2

Application diagram

e.g. Bootstrap diode in Boost PFC section



Available packages

SMD		Through-Hole	
DPAK (SOT8017)	D2PAK (SOT8018)	TO-220-2 (SOT8021)	TO-247-2 (SOT8022)
			
6.1 x 6.5 x 2.3	8.8 x 10.3 x 4.4	15.3 x 10 x 4.4	20.9 x 15.9 x 5.0

Products

DC/DC Topologies

AC/DC Topologies

Motor Control Topologies

ESD & TVS
MFP Overview

TrEOS high speed ESD protection	Superior RF Common mode filter	Automotive IVN Protection
Best-in class High-Speed ESD Protection for up to ~20Gbps per line pair	2 in 1 solution with improved RF performance up to 12Gbps FRL per line pair	ESD Protection for In-Vehicle-Network (IVN), Ethernet, ADAS, Multi-media & Infotainment in the automotive domain

TrEOS High-Speed ESD Protection

Ideal combination of low capacitance, low clamping voltage and high surge robustness to protect sensitive high-speed interfaces

ESD & TVS

Design Benefits

- Optimizing the three pillars of ESD protection
  - Low capacitance for highest signal integrity
  - Low clamping & trigger for enhanced system protection
  - High robustness against ESD & surge transients
- Snap-back technology allows for lowest clamping voltage
- Highest RF performance for lowest harmonic distortion as well as lowest insertion loss and return loss

Functions and applications

- Suitable for up to ~20Gbps per line pair
  - USB Type-C (USB 2.0/3.2/4)
  - Thunderbolt (up 40 Gbps) and HDMI 2.1
  - All other sensitive I/Os

Key technical features and portfolio

- Extremely low capacitance down to 0.085 pF
- Extremely low clamping down to 0.07 Ω (Rdyn)
- High ESD and surge robustness up to 22 A at 8/20 µs
- Extremely fast switching time under 1 ns

Discovery questions

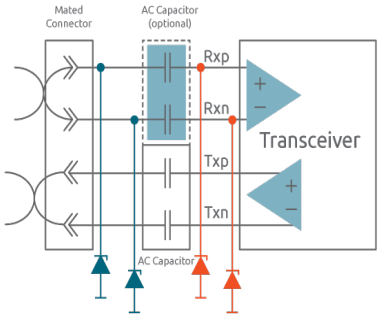
- Do you need to safeguard high-speed data-lines with up to ~20Gbps per line?
- Do you need to protect very sensitive transceiver SoCs against peak pulses?

Products

Portfolio (Excerpt)	Capacitance	Clamping @ 16 A TLP	Trigger	Surge	Package
PESD**1V2**Y1BSF	0.26 pF	6.4 V	3.4 V	4 A	SOD962
PESD**2V8**Y1BSF	0.16 pF	8 V	6.9 V	5.5 A	SOD962
PESD**3V3**Z1BSF	0.28 pF	5.7 V	9 V	9.5 A	SOD962
PESD3USB3S ($5V_{RWM}$)	0.45 pF	4 V	14.2 V	8 A	WLCSP15
PUSB3BB2DF ($4V_{RWM}$)	0.26 pF	6.2 V	9 V	8 A	SOT8013
PESD**4V0**X2UM	0.82 pF	4 V	8 V	11 A	SOT883
PESD**5V0**R1BDSF	0.1 pF@10 GHz	9 V	11.5 V	4.8 A	SOD962
PESD**9V0**W1BDSF	0.49 pF	3.8 V	12.2 V	20 A	SOD962
PESD**15V**W1BCSF	0.45 pF	3.9 V	26 V	20 A	SOD962

Application diagram

USB4 Rx/Tx Protection



Available packages

SOD992B (DSN0402)	SOD962-2 (DSN0603-2)	SOT8013 (DFN0603-3)	WLCSP 5/10/15
			
0.4 x 0.2 x 0.2	0.6 x 0.3 x 0.3	0.6 x 0.3 x 0.3	0.8*n x 1.2 x 0.6, n=1,2,3

Small-footprint package with low-inductance & extreme-robustness; WLCSP footprint compatible to Common Mode Filter portfolio

Superior RF Common Mode Filter in WLCSP

2 in 1 solution combining common-mode suppression with Nexperia's best-in-class TrEOS ESD protection with up to 12Gbps FRL per line pair

ESD & TVS

Design Benefits

- Common-Mode Filter & ESD protection on one footprint
  - Best CM suppression at all GHz data-line signal fundamentals
  - Widest differential passband to keep signal integrity
  - Uncompromising TrEOS High-Speed ESD protection
- Reduces part count and accelerates PCB placement
- Portfolio of ESD-only devices with identical footprint

Functions and applications

- You are not sure whether your design requires a common-mode filter or ESD protection?
- Are you using a discrete ferrite in combination with an ESD protection and you want to increase your protection and data rate?
- Your design uses high data rates and you need to reduce space or accelerate PCB placement?

Key technical features and portfolio

- Leading common-mode suppression up to -36 dB
- Extremely wide differential pass-band up to 10 GHz
- High ESD ruggedness 15-20 kV, exceeding IEC 61000-4-2
- TrEOS ESD protection up to 15 kV contact discharge

Discovery questions

- USB Type-C (USB 2.0/3.2)
- HDMI 2.1
- MIPI CSI camera interface & MIPI DSI display interface

Products

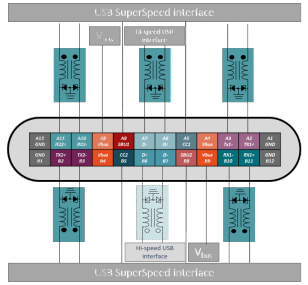
Portfolio (Excerpt)	Passband[1)]	Rejection	V_{ESD}	Package
PCMFxUSB3B/C	8 GHz	-36 dB	20 kV	WLCSP5/10/15
PCMFxUSB3BA/C	10 GHz	-35 dB	15 kV	WLCSP5/10/15
PCMFxHDMI2BA-C	10 GHz	-35 dB	15 kV	WLCSP5/10/15

1) S21dd f3dB

Application diagram

USB Type-C Dongle

Tx/Rx Common-Mode Filter



Available packages

- Smallest footprint & lowest inductive path to ground due to wafer level chip scale package
- Package design allows for optimal RF routing

Automotive In-Vehicle Network Protection

for IVN, Ethernet, ADAS, Multimedia & Infotainment

ESD & TVS

Design Benefits

- New generation of protection technology, optimized for the latest generation of transceiver
- Same silicon in discrete SMD and DFN packages – easy adaption of latest technology
- Approved or in-approval by major automotive OEM

Functions and applications

- Family of products for automotive Ethernet according to OPEN alliance
- Automotive TrEOS products for ADAS, Multimedia & Infotainement protection
- Protection of transceiver devices with CAN, CAN-FD LIN, FlexRay, et al. interfaces

Key technical features and portfolio

- new portfolio for CAN-FD, automotive Ethernet and ADAS/ Mutimedia/ Infotainment
- Higher ESD robustness - withstands higher failure voltage
- Lower (=better) ESD clamping voltage with TrEOS technology offers improved system level protection)

Discovery questions

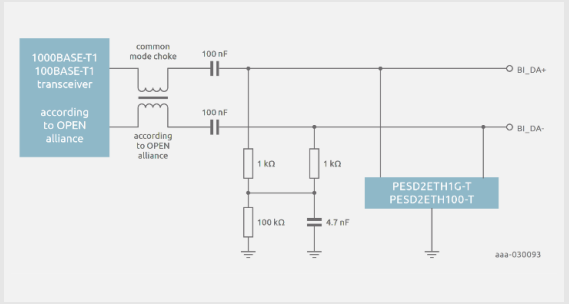
- Is there a chance of electrical discharge in your network? (if the answer is „YES" - ESD protection diodes offer a solution)
- Which in-vehicle network do you use? (narrow down the choice of protection diodes)
- Which OEM is behind the project? (make use of OEM approval to secure the print position)

Products

Portfolio	V_{RWM}	lines	$C_{D\ max}$	Application
PESD1IVN2x-A/U	24/ 27	1	17 pF	LIN/ CAN/ FlexRay
PESD2IVN2x-T/U	24/ 27	2	17 pF	LIN/ CAN/ FlexRay
PESD2CANFDU/V/Lx-x	24/ 27	2	3.5/ 6/ 10 pF	CAN FD
PESD2ETHxxx-T/LS	24	1	1/ 2/ 3 pF	Automotive Ethernet (OA)
PESD2USB3/5UV/X-T	3.3/ 5	2	0.5…0.9 pF	ADAS, Multimedia, Infotainment
PESD4USB3/5R/U-TBR	3.3/ 5	4	0.34/ 0.6 pF	ADAS, Multimedia, Infotainment

Application diagram

Automotive Ethernet 100BASE-T1/ 1000BASE-T1 protection, single channel (according to OPEN alliance)



Available packages

Products

DC/DC Topologies

AC/DC Topologies

Motor Control Topologies

Analog and Logic ICS
MFP Overview

Voltage Translators

Resolve input/output Voltage difference with our Voltage Translator ICs

Precision Analog Switches

Simplify signal switching with our new Low Ohmic Analog Switches

Voltage translators (level-shifters)

Design Benefits

- Industry leading portfolio
- Different types of translators:
  - Unidirectional translators
  - Bidirectional translators:
    - Direction-controlled translators
    - Autosense translators
    - Translator gates
  - Application-specific translators (e.g. SIM/SD -card)
- Wide supply voltage range; different voltage families
- Multiple package options
- AEC-Q100 grade 1 options

Functions and applications

- Portable consumer applications
- I2C, TV, computing and telecom infrastructure
- Industrial applications
- Automotive applications
- NXS010x (Open-drain applications)
- NXB010x (Push-pull applications)
- LSF010x (Open-drain and Push-pull applications)
- NXS0506 (SD Card applications)
- NXT45xx (Sim Card applications)
- NCA9xxx (I2C applications)

Key technical features and portfolio

- Our translators serve as an interface between different supply and input/output voltage levels. These translators include a range from single-bit to 20-bit widths.

Discovery questions

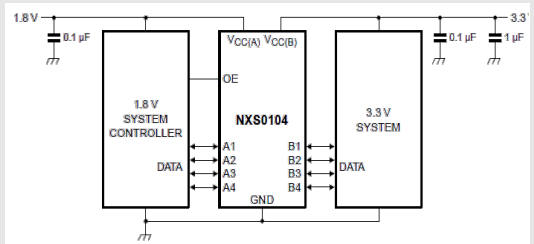
- What voltage is used by system controller and system rails?
- Do you need data transmission in one way or also data reception?
- Do you need a translator without the need for direction pin?
- Do you need push-pull or open-drain based translators?

Products

Product name	Channels	Portfolio size	Packages
NXSx	1,2,4,8	10	GW, GT, GS, GM, DC, PW, GU12, BQ, UN, UM
NXBx	1,2,4,8	11	GW, GT, GS, GM, DC, PW, GU12, BQ, UN
LSFx	1,2,4,8	15	GW, GS, GM, GX, DP, DC, PW, GU12, BQ
74AVCx	1,2,4,8,16	67	GM, GS, GT, GW, GX, D, DP, GU, GU12, DC, PW, BQ, BZ, DGG, DGV

Application diagram

Example of voltage translation between 1.8 V MCU and 3.3 V system rail



Available packages

Package name	XSON6	X2SON8	XQFN12	DHVQFN20
				
Pin count	6	8	12	20
Version	SOT886	SOT1233	SOT1174-1	SOT764
Suffix	GM	GX	GU12	BQ
Pitch (mm)	0.50	0.4	0.40	0.5
W x L x H (mm)	1.0 x 1.45 x 0.50	1.35 x 0.8 x 0.35	2.0 x 1.7 x 0.50	4.5 x 2.5 x 1.0

Precision Analog Switches

Design Benefits

- Wide supply voltage range from 1.4 V to 5.5 V
- Rail to rail switching
- Very low RON (up to 0.5Ω) for low signal attenuation
- Low RON(flat) (up to 0.2Ω) for low signal distortion
- High current handling capability (350 mA continuous)
- High noise immunity
- 1.8 V logic compatible
- Break before make
- Fail safe logic
- Very low supply current and low power consumption
- Over-voltage tolerant control inputs
- Small footprint packages

Key technical features and portfolio

- Low attenuation – eliminates post switching amplification
- Suitable for mixed-voltage switch applications

Functions and applications

Low Ohmic analog switches suitable for:

Portable consumer applications, like

- Mobile phones
- Tablet/Notebook
- Wearables

Automotive applications, like:

- ECU, BCM, TCU

Telecom and Industrial applications:

- Active antenna unit
- Security system

Discovery questions

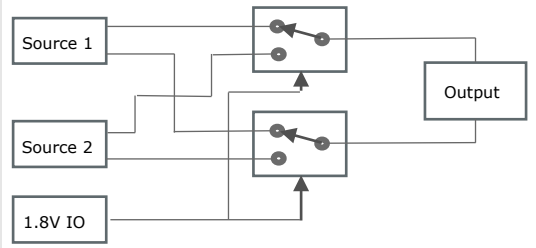
- What kind of switch configuration is needed SPST, SPDT, SP8T or Quad SPDT?
- What voltage levels are present on the board?
- What is the amplitude of the signal levels to be passed and is level translation required?
- What is the RON requirement for your application? Do your signals with high accuracy requiring low ohmic switching, such as sensors?

Products

Product name	Packages
XS3A1Tx157	GM,GS
XS3A405x	PW
XS3A2467	PW
XS5A1T4157	GW

Application diagram

- Example of Low Ohmic Analog Switching between signals with level translation functions



Available packages

Package name	XSON6	XSON6	TSSOP6	TSSOP16
				
Pin count	6	6	6	16
Version	SOT886	SOT1202	SOT363	SOT403
Suffix	GM	GS	GW	PW
Pitch (mm)	0.50	0.4	0.65	0.65
W x L x H (mm)	1.0 x 1.45 x 0.50	1.0 x 1.0 x 0.35	2.1 x 1.25 x 0.95	5.0 x 4.4 x 1.1

Products

DC/DC Topologies

AC/DC Topologies

Motor Control Topologies

MOSFETs
MFP Overview

ssMOS for Auto	ssMOS for Mobile	NextPowerS3	NextPower 80/100 V	Trench 9
AEC-Q101 qualified MOSFETs in small leaded SMD and leadless DFN packages	Small-signal MOSFETs for mobile and portables in WLCSP and leadless packages	Award winning portfolio in 25 V, 30 V, 40 V, 50 V & 55 V products	Including new 80/100 V products for high performance switching and hotswap	Enhanced value proposition focused on robustness

MOSFETs
MFP Overview

LFPAK88 for Auto

8x8mm replacement for larger wire-bond packages (D^2PAK/TOLL).

Copper clip package gives low $R_{DS(on)}$, low R_{th} and high I_D max

LFPAK88 for Industrial

8x8mm replacement for larger wire-bond packages (D^2PAK/TOLL).

Copper clip package gives low $R_{DS(on)}$, low R_{th} and high I_D max

Trench 9

Including avalanche rugged, half-bridge, and upcoming airbag ASFETs

Small-signal MOSFETs for Automotive

MOSFETs

Design Benefits

- Broad range of packages for optimum choice
- Side-wettable flanks for automatic optical inspection (AOI) and improved solder joint quality
- Automotive compliant (AEC-Q101)
- Most types with 2 kV ESD protection
- 'BUK' devices qualified to 175°C T_j max
- Replacement of larger packages

Functions and applications

- Load switches in power management functions like
- Body control units: doors, window lift, seat control
- Infotainment systems: car radio, navigation
- Safety and control systems: air bag, LED lighting, et al.

Key technical features and portfolio

- Most parts with ESD robustness of 2kV
- $R_{DS(on)}$ down to 15 mΩ and up to 64 A max drain current
- Available V_{DS} voltages of 20, 30, 40, 60, 70, 80 Volt

Discovery questions

- What voltage do the system operate at? (determine MOSFET voltage)
- What is the current requirement of the loads? (determine MOSFET current)
- What is the ambient temperature of your application? (is 175°C T_j max a plus)

Products

Product name	Package	polarity
PMNxxx(x)EN(E)A	SOT457	N
PMNxxxP(E)A	SOT457	P
PMVxx(x)xN(E)A	SOT23	N
PMVxx(x)xP(E)A	SOT23	P
PMPBxxxN(E)A	DFN2020MD-6	N
PMPBxxxP(E)A	DFN2020MD-6	P
BUKxDxx-x0E	DFN2020MD-6	N
BUK6Dxx(x)-x0P	DFN2020MD-6	P
PMTxxxENEA	SOT223	N

Available packages (selection)

Small-signal MOSFETs for Mobile and Portable

MOSFETs

Design Benefits

- Including the ultra-small MOSFET DFN0606 package
- Replacement of larger packages - Performance improvements in wafer technology and in package technology enable higher electrical and thermal performance on a smaller footprint
- High power capability (WLCSP)

Functions and applications

- Relay driver
- Load switch
- Switching circuits
- Battery switch
- Charging switch for portables
- DC/DC converter
- Power management in battery driven portables and computing

Key technical features and portfolio

- Improved $R_{DS(on)}$ performance
- Most types with ESD protection up to 2 kV
- Broad portfolios for optimum choice
- R_{DS} voltage range of 12 V – 100 V

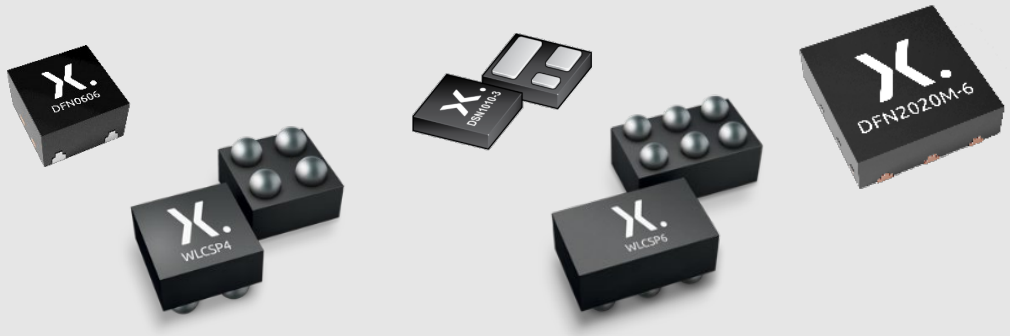
Discovery questions

- Is the board space limited in your application? (is space a concern)
- Can your production handle CSP products? (determine if DFN or CSP is preferred)
- Can sunlight reach the component on the board? ("NO" = no issue for CSP; "YES" = consider housed products)

Products

Product name	Package	polarity
PMCNxx0xxNE	WLCSP4/6/9	N
PMCNxx0xxPE	WLCSP4/6/9	P
NXxxxxxBKH	DFN0606	N
PMHxxxxUPE	DFN0606	P
PMHxxxUNE	DFN0606	N
PMPBxxRxxP	DFN2020M-6	P
PMPBxxRxxN	DFN2020M-6	N
PMCA14UN	DSN1010	N

Available packages (selection)



NextPowerS3

MOSFETs

Design Benefits

- Large portfolio of 'No Compromise' fast-switching superjunction MOSFETs in 25 V, 30 V, 40 V, 50 V & 55 V
- Ultra-low $R_{DS(on)}$, low Q_g, low spiking, low I_{DSS} leakage, high I_D max, high linear-mode (SOA) performance and qualified to 175°C

Functions and applications

- 12V server and computing ORing & hotswap
- Synchronous rectifier & fast-switching control FET
- Voltage regulator (VRM) and Point of Load (PoL) modules
- Brushed and BLDC motor control
- USB-PD V_{BUS} switch, load-switch, battery protection

Key technical features and portfolio

- Balanced $R_{DS(on)}$ and Qg for high-efficiency DC/DC
- Unique Schottky-Plus body-diode delivers low-spiking and low IDSS leakage
- Strong SOA advantage compared to leading competitors
- Logic-level & standard-level gate options available

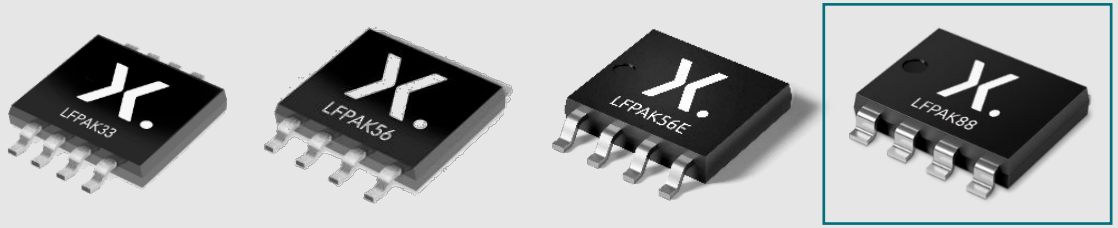
Discovery questions

- Are you worried about thermal performance? Nexperia's low $R_{DS(on)}$ MOSFETs generate less heat
- Do you use multiple low voltage MOSFETs in parallel? Nexperia's very low $R_{DS(on)}$ devices can reduce component count and save costs
- Do you require a MOSFET that can withstand high surge or fault current?

Products

Product name	Package	$R_{DS(on)}$ @ 10 V
PSMNR51-25YLH	LFPAK56E	0.57
PSMNR58-30YLH	LFPAK56E	0.67
PSMN1R5-50YLH	LFPAK56E	1.75
PSMN2R0-55YLH	LFPAK56E	2.1

Available packages (selection)



LFPAK88 products, listed under separate LFPAK88 category

NextPower 80/100 V

MOSFETs

Design Benefits

- Industry leading low Q_{rr} for high-efficiency and low-spiking
- Low $Q_G \times R_{DS(on)}$ FoM for high efficiency switching apps
- Optimised body diode V_{SD}=1V(max)
- Strong avalanche energy rating (E_{AS}) & 100% tested
- Qualified to T_j (max)=175°C, meets IPC9592
- Ha-free and RoHS compliant LFPAK56 package
- Additional capacity – new 8" DMAN wafer line ramps in 2022

Functions and applications

- Synchronous rectifier in AC/DC & DC/DC
- Primary side switch – 48 V DC/DC
- BLDC motor control
- USB-PD adapters & chargers
- Full-bridge and half-bridge applications
- Flyback and resonant topologies
- 48 V OR-ing & hotswap (ASFET variant)

Key technical features and portfolio

- High-efficiency & lowest spiking compared to competitors
- 80 V & 100 V portfolio in LFPAK56 & LFPAK56E packages
- LFPAK88 types listed under "LFPAK88" MFP category
- ASFETs for hotswap & PoE included e.g PSMN4R8-100YSE

Discovery questions

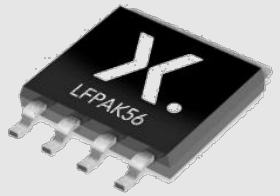
- Do you use 80 V or 100 V MOSFETs ?
- Is low-spiking & high-efficiency important to you?
- Do you need a MOSFET with strong SOA for hotswap
- apps?

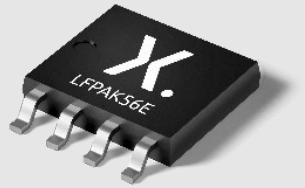
Products

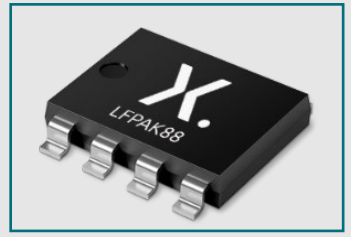
Product name	Package	$R_{DS(on)}$ @ 10 V
PSMN3R9-100YSF	LFPAK56E	4.3
PSMN3R5-80YSF	LFPAK56E	3.5
PSMN4R8-100YSE	LFPAK56E	4.8
PSMN012-100YSF	LFPAK56	11.2

Suffix "E" denotes ASFET with enhanced SOA

Available packages (selection)







LFPAK88 products, listed under separate LFPAK88 category

LFPAK88 for Industrial

MOSFETs

Design Benefits

- Ultra-low $R_{DS(on)}$ types in 40 V, 50 V, 55 V, 80 V & 100 V
- 8 mm x 8 mm footprint – 60% smaller than D2PAK
- Solid copper-clip gives low electrical & thermal resistance and high I_D max capability

Design Benefits

- Battery protection - Power tools, ebike, light EVs
- AC/DC & DC/DC Power supply equipment
- High-power BLDC motor control
- Telecom infrastructure – Hotswap & ORing
- Surge protection & eFuse

Key technical features and portfolio

- 52x power-density compared to wire-bonded D^2PAK
- Advanced package design - reliability exceeds 2x AEC-Q101
- ASFET types have best-in-class linear-mode (SOA) Recommended for hotswap, surge protection, BMS & eFuse applications

Discovery questions

- Do you require a low $R_{DS(on)}$ and/or high-current (I_D) replacement for D^2PAK, D^2PAK-7 or TOLL
- Do you need the ultimate linear-mode (SOA) performance for advanced hotswap & eFuse applications

Products

Product name	V_{DS}	$R_{DS(on)}$ @ 10 V
PSMNR55-40SSH	40 V	0.55
PSMNR70-40SSH	40 V	0.7
PSMNR90-50SLH	50 V	0.90
PSMN1R8-80SSF	80 V	1.8
PSMN1R9-80SSE	80 V	1.9
PSMN2R3-100SSE	100 V	2.3

Suffix "E" denotes ASFET with enhanced SOA

Available packages

LFPAK88 for Automotive

MOSFETs

Design Benefits

- 8 mm x 8 mm footprint
- Copper clip technology gives low electrical and thermal resistance

Functions and applications

- Power steering
- ABS braking
- DC/DC conversion
- Reverse battery protection

Key technical features and portfolio

- 53 x power-density compared to wire bonded equivalents
- Advanced package design exceeds 2 x AEC-Q101
- Ultra low On-Resistance
- Best-in-class linear mode (SOA) performance in-rush and surge protection (ruggedness)

Discovery questions

- Do you require a rugged low $R_{DS(on)}$ high current (I_D) MOSFET in a highly reliable package for improved system power density?

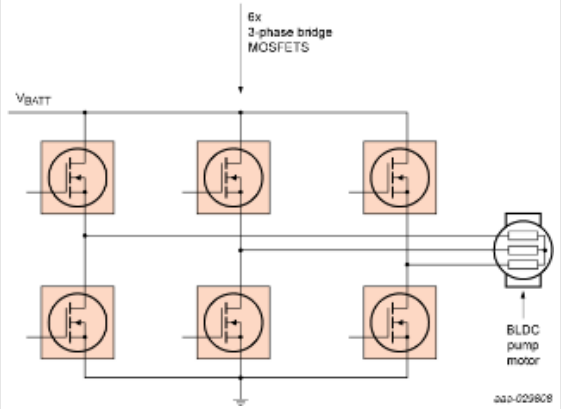
Products

Product name	V_{DS}	$R_{DS(on)}$ @ 10 V
BUK7S0R5-40H	40	0.5
BUK7S0R7-40H	40	0.7
BUK7S0R9-40H	40	0.9
BUK7S1R0-40H	40	1.0
BUK7S1R2-40H	40	1.2
BUK7S1R5-40H	40	1.5
BUK7S2R0-40H	40	2.0

Suffix "E" denotes ASFET with enhanced SOA

Available packages

Application diagram



Trench 9 Automotive MOSFETs

MOSFETs

Design Benefits

- Very robust superjunction technology with exceptional SOA and avalanche capability
- Improved efficiency and power density through lower $R_{DS(on)}$ and enhanced switching performance
- Tight V_{th} limits enables easy paralleling of MOSFETs in high current applications
- Enhanced LFPAK56E design allows up to 30% improvement in $R_{DS(on)}$ and power density

Functions and applications

- Engine management
- Reverse battery protection
- DC/DC Converters
- Motor control (Brushless and Brushed)
  - Power steering
  - Transmission control
  - Pumps; Water, oil and fuel

Key technical features and portfolio

- $R_{DS(on)}$ capability improved from 3 mΩ to 0.9 mΩ
- Standard level and Logic Level
- Improved DC current rating

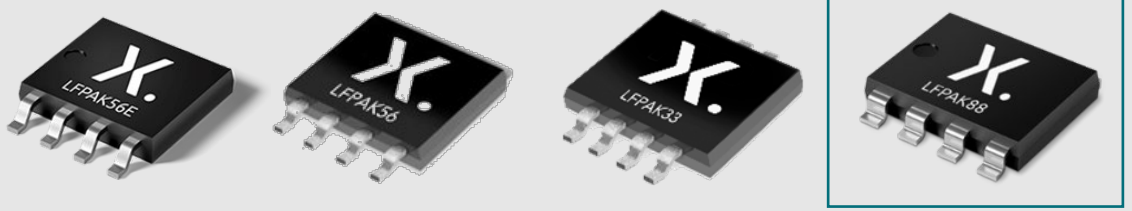
Discovery questions

- Do you require an MOSFET for an engine management system with low R_{th} and low switching losses?
- Do you require a low $R_{DS(on)}$ high current (I_D) MOSFET in a highly reliable package for improved system power density?

Products

Product name	Package	$R_{DS(on)}$ @ 10 V
BUK7M3R3-40H	LFPAK33	3.3
BUK7Y1R4-40H	LFPAK56	1.4
BUK9K13-40H	LFPAK56D	13
BUK9J0R9-40H	LFPAK56E	0.9

Available packages



Trench 9 offers also LFPAK88 products, featured in the LFPAK88 for Auto topic.

Automotive ASFETs

MOSFETs

Design Benefits

- Application specific MOSFETs – incl. Repetitive Avalanche, half-bridge and upcoming ASFETs for airbag

Functions and applications

- 3-phase motor control in automotive powertrain
- Motor control such as fuel, oil and water pumps
- DC/DC
- Repetitive avalanche topologies
- Engine control and transmission control
- Actuator and auxiliary loads
- Airbag topologies

Key technical features and portfolio

Repetitive avalanche

- Guaranteed repetitive avalanche performance, tested up to 1 billion cycles
- Modern trench alternative to older planar technologies

Half-bridge

- 60% lower parasitic inductance and 30% space saving due to internal clip connection (compared to LFPAK56D dual)

Airbag

- Enhanced SOA offering LFPAK56 or LFPAK33 alternatives to older generations of DPAK and D2PAK

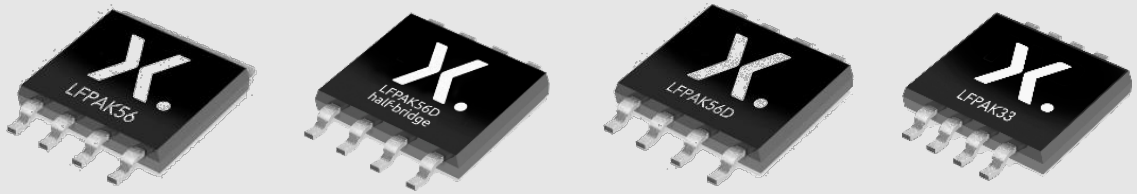
Discovery questions

- Do you need a cost-effective alternative to DPAK in your airbag application? (better quality and supply reliability)
- How do you drive your actuators/solenoids within your system design? Utilizing repetitive avalanche MOSFETs can significantly reduced your BOM count and PCB size.

Products

Product name	Package	$R_{DS(on)}$ @ 10 V	ASFET Family
BUK9K13-60RA	LFPAK56D	12.5	Repetitive Avalanche
BUK7V4R2-40H	LFPAK56D half-bridge	4.2	Half-bridge
BUK9Y7R0-60EL	LFPAK56	7.0	Enhanced SOA for airbags

Available packages



Products

DC/DC Topologies

AC/DC Topologies

Motor Control Topologies

GaN FETs
MFP Overview

GaN FETs for Auto applications

Including the new CCPAK and CCPAKi AEC-Q101 packages

GaN FETs for Industrial apps

Building on GaN traction in the key Power GaN markets

GaN FETs for Automotive applications

GaN FETs

Design Benefits

- >99% power conversion efficiency
- Up to 1 MHz in soft-switching (high power density)
- 175°C rated FETs
- Copper clip (x3 lower inductance for lower switching losses and EMI and higher reliability than wire-bond)
- Low thermal resistance

Functions and applications

- On-board charger (OBC) (4–25kW)
- DC/DC converter
- Traction inverter (25–250kW)

Key technical features and portfolio

- Two cooling options (top side/bottom side)
- Robust and reliable (transient over-voltage capability, robust gate oxide and safe against parasitic turn on)
- 0 to 12 V standard gate drive
- No bipolar body diode degradation

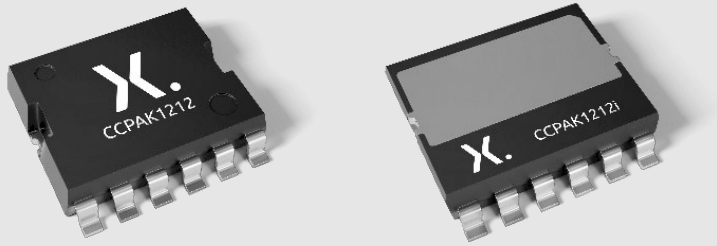
Discovery questions

- What's the topology used?
- What's the voltage rating of the device needed?
- What's the power rating of the system?
- What $R_{DS(on)}$ typ/max is required?
- What's the target system operating frequency?
- How many phases is the system?

Products

Product name	Package	$R_{DS(on)\ typ}$@ 10 V
GAN014-650NBCA	CCPAK1212	12
GAN014-650NTCA	CCPAK1212i	12
GAN039-650NBBA	CCPAK1212	33
GAN039-650NTBA	CCPAK1212i	33

Available packages and application diagram



GaN FETs for Industrial applications

GaN FETs

Design Benefits

- >99% power conversion efficiency
- Up to 1 MHz in soft-switching (high power density)
- Easy to design gate drive
- 175°C rated FETs

Functions and applications

- Solar inverters (Single phase)
- Server & telecom SMPS
- Industrial automation (Servo drives)
- Industrial SMPS
- Uninterrupted power supplies (UPS)
- Audio amplifier

Key technical features and portfolio

- Low & Linear E_{OSS}
- Virtually no Q_{rr}
- Lowest WBG FET losses in reverse condition
- 0 to 12 V standard gate drive
- No bipolar body diode degradation

Discovery questions

- What is the topology/converter type?
- What is the voltage rating of the device needed?
- What is the power rating of the system?
- What is the target operating frequency?

Products

Product name	Package	$R_{DS(on)\ typ}$ @ 10 V
GAN041-650WSB	TO-247	35
GAN063-650WSA	TO-247	50
GAN039-650NBB	CCPAK1212	33
GAN039-650NTB	CCPAK1212i	33
GAN014-650NBC	CCPAK1212	12
GAN014-650NTC	CCPAK1212i	12

Available packages and application diagram