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
- Automation
  - Factory Automation
  - Industrial Robotics & Cobots
  - Motion Control & Servo-Drive
  - HVAC (Air Conditioning)
  - Forklift
  - Fluid Pumps
  - Professional Power Tools
- Building & Home
  - Elevator, Escalators & Moving Walkway
  - 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
- Medical
  - Medical Instruments
  - Medical Imaging
  - Wearable & Personal Portable Electronics

**Industrial**
- Powertrain
- Automation
- Building & Home
- Lighting
- Other Industrial
- Medical

**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
- Motor Control Topologies
  - Brushed Motor Control
  - Brushless (3Φ) Motor Control
  - Stepper Motor Control
- AC/DC Topologies
  - Non-Isolated AC/DC
  - Linear power supply
  - Power Factor Corrector – PFC
  - Vienna Rectifier for Three phase-isolated
Automotive

ADAS
- Radar Sensor Module
- Rear and front view cameras

Body Control
Chassis safety
Connectivity & Telematics
Powertrain
Infotainment
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

Applications

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

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

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

* Coming soon
Automotive

ADAS

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

Chassis Safety

Connectivity & Telematics

Powertrain

Infotainment
HVAC Blower Motor

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

Applications

**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

* Coming soon
Adaptive Front Led Lighting

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.

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

* Coming soon
Constant current source for interior LED lighting

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

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

- Connectivity & Telematics
- Powertrain
- Infotainment
Air Bag Controller

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 DPAK solutions
- 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)

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)**

**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

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**Applications**

**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

* Coming soon
Automotive

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

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

Battery Protection
- PN or SiGe diode
- DC/DC power supply
  - Buck or Boost topologies: 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

* Coming soon
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)

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

* Coming soon
Automotive

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

**ADAS**

**Body Control**

**Chassis Safety**

**Connectivity & Telematics**

**Infotainment**
Electronic Fuel Injection

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 m\( \Omega \), 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.

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 *

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

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 *

* Coming soon
**Traction inverter**

**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.

**Applications**

**DC/DC conversion**
- MOSFET: 40 to 100 V, R\textsubscript{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\textsubscript{DSon} 60 to 14mΩ CCPAK1212 (R\textsubscript{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/\textsuperscript{2}PAK/TO247 in dual pin
  - Gate Driver: New NGD7xxx family of HS/LS driver

**Battery management**
- Charge balancing MOSFETs: 20 to 40 V R\textsubscript{DSon} < 20mΩ
- Battery protection MOSFETs: 80 to 100 V R\textsubscript{DSon} 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

* Coming soon
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, \(R_{D_{\text{Son}}}\) 5 to 10 mΩ LFPAK & MLPALK 33/56

Cell monitoring and balancing
- Charge balancing MOSFET: 20 to 40 V \(R_{D_{\text{Son}}} < 20\)mΩ
- Battery protection MOSFET: 80 to 100 V \(R_{D_{\text{Son}}} 0,55\) 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

Nexperia value Proposition

- **LFPACK, 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**

DC/DC conversion

- **MOSFET**: 40 to 100 V, $R_{Dson}$ 5 to 10 mΩ LFP & 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 LFP
- **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

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

**Isolated function**

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

**Integrated solutions**

- Battery booster: SMB family
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 Rth(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

48V BSG (Belt Starter Generator)

Applications

- DC/DC conversion
  - MOSFET: 40 to 100 V, RDSon 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, RDSon 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

* Coming soon

Nexperia • External presentation
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\textsubscript{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
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 $R_{DS(on)}$ (0.003 to 0.021Ω) in LFPAK33/56
- Diodes: 60–100 V, Low $V_f$ in CFP3/5/15

INV interface

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

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)

AC/DC (PFC)

- MOSFETs: 25 to 100 V, $R_{DS(on)}$ 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, $R_{DS(on)}$ < 3mΩ LFPak88 or LFPak56 (R_{th} < 0,4K/W)
- Actuator control MOSFETs 40 V, 3 mΩ < $R_{DS(on)}$ < 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, $R_{DS(on)}$ 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

* Coming soon
Industrial Robotics and Robots

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)

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

Motor control
- Motor Control MOSFETs: 40 to 150 V, $R_{DSon}$ < 3 mΩ LFPAK88 or LFPAK56E ($R_{th}$ < 0.4 K/W)
- GaN FETs: 650 V, $R_{DSon}$ 12 to 90 mΩ, 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 5 A, 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, 600 mA Synchronous Buck Converter *

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

* Coming soon

1/3 Phase

Circuit breaker

Power Management

PFC, DC/DC

DC Bus

(48V to 120V)

Motor Drive

(logic-gates, FETs)

Robot/Motion Controller

Serve Drive Control Module

Electrical brake

(DC/DC)

Environment Sensing (Temp)

Robot Sensing

(current, speed, position)

PMSM

M

* Coming soon
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)

**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

**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

* Coming soon
**HVAC (Air Conditioning)**

### 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

### Applications

**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

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* Coming soon
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)

**Motor control**
- Motor Control MOSFETs: 60 to 150 V, $R_{D\text{son}} < 3\text{mΩ}$, LFPAK88 or LFPAK56E ($R_{th} < 0.4\text{K/W}$)
- Actuator control MOSFETs 40 V, 3 mΩ < $R_{D\text{son}}$ < 7 mΩ, LFPAK33 ($R_{th} < 2\text{K/W}$)
- Gate Driver: New NGD73xx family of HS/LS driver *

**DC/DC conversion**
- MOSFETs: 40 to 100 V, $R_{D\text{son}}$ 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, $R_{D\text{son}} < 20\text{mΩ}$
- Battery protection **MOSFETs**: 25 to 100 V $R_{D\text{son}}$ 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

* Coming soon
Fluid Pumps

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

AC/DC (PFC)

• 40–100 V MOSFET, R\text{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\text{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\text{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

* Coming soon
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)

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

* Coming soon
AC EV Wallbox/Bi-directional AC Wallbox

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

AC/DC (PFC)/Inverter

- GaN FET: 650 V, $R_{\text{DSon}}$ 60 to 14mΩ TO247 or CCPAK1212 ($R_{\text{th}} < 0,5K/W$) *
- 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, $R_{\text{DSon}}$ 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 $R_{\text{DSon}} < 20m\Omega$
- Battery protection MOSFETs: 80 to 100 V $R_{\text{DSon}}$ 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

* Coming soon
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.

**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 DC/DC/ 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

* Coming soon
AC/DC Power Supply

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)

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

Non-Isoalted Linear Supply

- Rectifier Diodes PNE family
- Zener Diodes
- Bipolar transistor

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 *

* Coming soon
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, $P_{out} \geq 20$ W
- **DC/DC Buck asynch.:** $V_{IN} = 3$ V–200 V, $V_{out} = 0.9$ V–100 V, $P_{out} \leq 50$ W
- **DC/DC Boost synch.:** $V_{IN} = 3$ V–150 V, $V_{out} = 5$ V–500 V, $P_{out} \geq 10$ W
- **DC/DC Boost asynch.:** $V_{IN} = 3$ V–24 V, $V_{out} = 5$ V–100 V, $P_{out} \leq 100$ W
- **DC/DC Buck-Boost:** $V_{IN} = 5$ V–150 V, $V_{out} = 3$ V–500 V, $P_{out} \leq 500$ W
- **DC/DC SEPIC:** $V_{IN} = 3$ V–150 V, $V_{out} = 5$ V–500 V, $P_{out} = 5$ W to 150 W

### Isolated function

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

### Integrated solutions

- Battery booster: SMB family
Grid powered battery charger

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)

AC/DC: (See ACDC Power Supply)

- IGBTs: 650 V and 1200 V (up to 75A), TO247 *
- GaN FET: 650 V, $R_{DS(on)}$ 60 to 14mΩ, TO-247 or CCPAK1212 ($R_{th}<0.5K/W$) *
- MOSFETs: 80 to 100 V, $R_{DS(on)}$ 1 to 3.5 mΩ, LFPAK56E or LFPAK88

DC/DC: (See DCDC Power Supply)

- GaN FET: 650 V, $R_{DS(on)}$ 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, $R_{DS(on)}$ 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, $R_{DS(on)}<20mΩ$
- Battery protection MOSFETs: 25 to 100 V, $R_{DS(on)}$ 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

* Coming soon

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**Applications**

- Input Rectifier
- Power Factor Correction (PFC)
- DC/DC
- Controller and Gate Drivers
- Gate Driver IC For Discrete Driver Designs
- BJT, RETs, Diodes Zeners (protection)
- HV Recovery Rectifiers
- Boost Diode- SiC Switch(MOSFET, IGBT, GaN)
- GaNFETs IGBTs SiC MOSFETS

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Nexperia • External presentation
**PV Inverter**

**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, \( R_{D\text{son}} \) 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, \( R_{D\text{son}} \) 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, \( R_{D\text{son}} < 20\text{mΩ} \)
- Battery protection MOSFETs: 80 to 100 V \( R_{D\text{son}} 0.55 \) 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

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 PMF 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 *
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, $R_{DSon} < 3$mΩ 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

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

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 *

* Coming soon
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
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

AC/DC: (See ACDC Power Supply)
- GaN FET: 650 V, $R_{DS(on)}$ 60 to 14mΩ, TO-247 or CCPAK1212 ($R_{th}<0,5K/W$) *
- MOSFETs: 80 to 100 V, $R_{DS(on)}$ 1 to 3,5 mΩ, LFPAK56E or LFPAK88

DC/DC: (See DCDC Power Supply)
- MOSFETs: 40 to 100 V, $R_{DS(on)}$ 5 to 10 mΩ LFPAPK33/LFPAK56E
- Schottky diodes: 40 to 100 V, $I_F > 1$ to $5A$, CFP 3, 5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Motor control
- GaN FET *, MOSFET, Diodes PN and SiC *, MOSFET driver *

* Coming soon
E-metering

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

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

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)

**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

* Coming soon
Security & Access Control

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

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 $I_q$ *
- Boost converter NEX2080x: 5.5 V Output Sync Boost with < 300nA Ultra-Low $I_q$ *
- 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

* Coming soon

* Ultra-Low $I_q$ is a feature that ensures extremely low current consumption, which is essential for applications requiring minimal power usage over extended periods.
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**

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, CFP15

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

* Coming soon
Smoke and Fire detector

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

Battery Management and DCDC

- **Battery Booster**: Buck-Boost NBM family
- **ssMOSFET** – 12 to 40 V, compact package DFN1010D-3, P\textsubscript{tot} > 0.3W, DFN2020MD-6 P\textsubscript{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**

* Coming soon
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)

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

HPS Ballast
- MOSFETs: 40 to 150 V, $R_{DSon}$ < 3 mΩ
  - LFPAK88 or LFPAK56E ($R_{th}$ < 0.4 K/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 5 A, CFP3,5
- Buck: 40 V, 600 mA Synchronous Buck Converter *

Control Panel/Wifi.
- **ESD protection** (CAN-FD, Ethernet)
- Control logic: LVC family
- Antenna protection

* Coming soon
Industrial

- Automation
- Power & Energy
- Medical
- Building & Home
- Lighting

**Other Industrial**

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

**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: BIT, 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 charger** (see link here)
- 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)

* Coming soon
Power Tools – Battery powered

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 $t_{ON}$, $t_{OFF}$ 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

Motor control

- Motor Control MOSFETs: 20 to 80 V, $R_{DSon} < 2m\Omega$
  LFPAK88 or LFPAK56E ($R_{th} < 0,4K/W$)
- Actuator control MOSFETs 40 V, $3 \text{ m}\Omega < R_{DSon} < 7 \text{ m}\Omega$
  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 $10 \text{ m}\Omega$
  LFPAK33/LFPAK56
- Schottky diodes: 40 to 100 V, $IF > 1$ to $5\text{A}$
  CFP 3, 5
- Buck: 40 V, 600mA Synchronous Buck Converter *

Control Panel/Display

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

* Coming soon
Professional Audio Amplifier

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, $R_h$, 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 $R_h$ (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)

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)

* Coming soon
Smart Watch

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

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 *

* Coming soon
Consumer

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

Small Appliances
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**

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**Applications**

**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 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*

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* Coming soon
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)
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**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 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 *

* Coming soon

**Fridge & Freezer**
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**

**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 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

* Coming soon
Cooking Hob

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)

<table>
<thead>
<tr>
<th>AC/DC (PFC)/DC/DC</th>
<th>Motor Control DC</th>
</tr>
</thead>
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<tr>
<td>• MOSFETs: 25 to 100 V, R\text{DSon} 2 to 10mΩ, LFPAK33/LFPAK56/LFPAK88</td>
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</tr>
<tr>
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</tr>
</tbody>
</table>

**Actuator Control (Half bridge or single switch)**

- **MOSFETs**: 60 to 100 V, R\text{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)

<table>
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<td>• LED drivers, NCR family for backlighting and signaling</td>
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<td>• ESD protection (standard capacitance and high-speed): PESD family</td>
</tr>
<tr>
<td>• I/O expander</td>
</tr>
</tbody>
</table>

* Coming soon
Home Appliances

Small Appliances

- Vacuum cleaner
- Vacuum robot

Consumer
Vacuum cleaner

Nexperia value proposition

- **Best thermal performance** thanks to Clip-bonding package, **lower switch losses** improve even more the thermal behavior. This allows 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**

**Applications**

**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 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

**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)

**Display/Control panel/Sensors**

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

Nexperia • External presentation
Vacuum robots

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**

### 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*

* Coming soon
Sub-System Functions

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

AC/DC Topologies

Motor Control Topologies
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**.

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, **\(Q_{GD} 1,7 – 13,5 \, \text{nC}\)**, 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, \(P_{tot} \, \text{up to} \, 19W\)
- **Schottky diodes**: \(\leq 250 \, \text{mA}\), SOD523/DFN1006-2
- **SiGe diodes**, 120 V to 200 V, PMEGxxxGxx
- **Buck**: 40 V, 600mA Synchronous Buck Converter *
**DC/DC Topologies**

**DC/DC Boost**

Nexperia value proposition

- **Lower switch losses** improve even more the thermal behavior
- LFPAK and CFP (both clip-bond package) allow a **high-efficiency** DC-DC 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

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 $13,5 \text{ nC}$, 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

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**

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.

*D Coming soon*
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

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**: \( \leq 250 \) mA, SOD523/DFN1006-2
- P/N switching diodes in various packages DFN1006-2 up to SOD123F
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
- **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**

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/ $D^2$PAK/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

* Coming soon
DC/DC Topologies

SEPIC

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

Design considerations

- Economical, single MOSFET design – low \( Q_{G(tot)} \) & 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

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

DC/DC Topologies

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

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 $V_{drop} \times 50mA$ $(24-5)*50mA = 0.95W$
  **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)

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)

**Power Stage**

- GaN FET: 650 V, $R_{DSon}$ 70 to 12mΩ, TO-247 or CCPAK1212 ($R_{th} < 0.5 K/W$)
- 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**

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.

* Coming soon
AC/DC Topologies
Vienna Rectifier for Three phase–isolated

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)

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

* Coming soon
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

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 $P_{tot} > 0.3$W, 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

![Control Unit Diagram](image-url)
Motor Control Topologies
Brushless (3Φ) Motor Control

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

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 $R_{th,ja}$
- 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

Full product list is within the MFP zip pack

### Available packages (selection)
- Single and double bipolar transistors (BJT) in NPN and PNP polarity
- Resistor-Equipped-Transistors (RETs)
- Matched pair transistors
Products

- DC/DC Topologies
- AC/DC Topologies
- Motor Control Topologies
## Power Bipolar Diodes & Transistors MFP topic overview

### MFP Overview

<table>
<thead>
<tr>
<th>Schottky's in CFP</th>
<th>Recovery Rectifiers in CFP</th>
<th>SiGe Rectifiers in CFP</th>
<th>BJT – MJD Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trench and Planar rectifier series dedicated to low $V_F$, low $I_R$ and low $Q_{rr}$</td>
<td>Hyperfast/ Ultrafast rectifiers with soft and reliable switching</td>
<td>Rectifiers with extraordinary safe operation area and increased efficiency</td>
<td>High quality transistors with supply chain security and footprint compatibility</td>
</tr>
</tbody>
</table>
Schottky's in CFP Packages
Trench and Planar rectifier series dedicated to low \( V_F \), low \( I_R \) and low \( Q_{rr} \)

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Key Feature</th>
<th>( V_{R \ max} ) [( \text{V} )]</th>
<th>( I_\text{(av)} ) [( \text{A} )]</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planar</td>
<td>Low ( V_F )</td>
<td>20–60</td>
<td>1–15</td>
<td>CFP3, CFP5, CFP15(B)</td>
</tr>
<tr>
<td>Planar</td>
<td>Ultra-low ( I_R )</td>
<td>60–100</td>
<td>1–10</td>
<td>CFP3, CFP5, CFP15(B)</td>
</tr>
<tr>
<td>Trench</td>
<td>Low ( Q_{rr} )</td>
<td>40–100</td>
<td>1–20</td>
<td>CFP2-HP, CFP3, CFP5, CFP15(B)</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack.

Application diagram
e.g. LED driver – Boost/Buck stage

Available packages

<table>
<thead>
<tr>
<th>CFP2-HP (SOD323HP)</th>
<th>CFP3 (SOD123W)</th>
<th>CFP5 (SOD128)</th>
<th>CFP15B (SOD1289B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 x 1.3 x 0.68</td>
<td>2.6 x 1.7 x 1.0</td>
<td>3.8 x 2.6 x 1.0</td>
<td>5.8 x 4.3 x 0.95</td>
</tr>
</tbody>
</table>
Hyperfast/Ultrafast Recovery Rectifiers in CFP Packages

Rectifiers with soft and reliable switching

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

Key technical features and portfolio
- General rectification
- High frequency converters
- Solenoid control
- LED Lighting
- Polarity protection
- Freewheeling applications
- Piezo injection
- OBCs

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

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

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Vr max [V]</th>
<th>I_F(av) [A]</th>
<th>t_rr max [ns]</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNE20010EXD/~Q</td>
<td>200</td>
<td>1</td>
<td>25</td>
<td>CFP2-HP</td>
</tr>
<tr>
<td>PNE200x0ER/~Q</td>
<td>200</td>
<td>1/2</td>
<td>25</td>
<td>CFP3</td>
</tr>
<tr>
<td>PNE200x0EP/~Q</td>
<td>200</td>
<td>2/3</td>
<td>25/30</td>
<td>CFP5</td>
</tr>
<tr>
<td>PNE200x0EPE/~Q</td>
<td>200</td>
<td>4/6/8/10</td>
<td>30</td>
<td>CFP15B</td>
</tr>
<tr>
<td>PNE200x0CPPE/~Q</td>
<td>200</td>
<td>2 x 2/3/4/5 (dual, cc)</td>
<td>30</td>
<td>CFP15B</td>
</tr>
<tr>
<td>PNU65010ER/~Q</td>
<td>650</td>
<td>1</td>
<td>60</td>
<td>CFP3</td>
</tr>
<tr>
<td>PNU65010EP/~Q</td>
<td>650</td>
<td>1</td>
<td>60</td>
<td>CFP5</td>
</tr>
<tr>
<td>PNU650x0EP/~Q</td>
<td>650</td>
<td>2/3</td>
<td>60</td>
<td>CFP5</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

Application diagram

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

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

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Voltage [V]</th>
<th>Current [A]</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMEGxxxG10ELR/-Q</td>
<td>120/150/200</td>
<td>1</td>
<td>CFP3 (SOD123W)</td>
</tr>
<tr>
<td>PMEGxxxG20ELR/-Q</td>
<td>120/150/200</td>
<td>1</td>
<td>CFP3 (SOD123W)</td>
</tr>
<tr>
<td>PMEGxxxG20ELP/-Q</td>
<td>120/150/200</td>
<td>2</td>
<td>CFP5 (SOD128)</td>
</tr>
<tr>
<td>PMEGxxxG30ELP/-Q</td>
<td>120/150/200</td>
<td>3</td>
<td>CFP5 (SOD128)</td>
</tr>
</tbody>
</table>

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

Full product list is within the MFP zip pack
Bipolar Transistors – MJD Series
High quality with supply chain security and footprint compatibility

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

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)

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

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

Products

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Vceo [V]</th>
<th>Ic[A]</th>
<th>Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJD148/-Q</td>
<td>45</td>
<td>4</td>
<td>NPN</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD2873/-Q</td>
<td>50</td>
<td>2</td>
<td>NPN</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD44H11/A</td>
<td>80</td>
<td>8</td>
<td>NPN</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD45H11/A</td>
<td>80</td>
<td>8</td>
<td>PNP</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD31C/A</td>
<td>100</td>
<td>3</td>
<td>NPN</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD31CH-Q (high gain)</td>
<td>100</td>
<td>3</td>
<td>NPN</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD32C/A</td>
<td>100</td>
<td>3</td>
<td>PNP</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD41C/-Q</td>
<td>100</td>
<td>6</td>
<td>NPN</td>
<td>DPAK</td>
</tr>
<tr>
<td>MJD42C/-Q</td>
<td>100</td>
<td>6</td>
<td>PNP</td>
<td>DPAK</td>
</tr>
</tbody>
</table>

Automotive Qualified
- xxxA
- xxx-Q

Full product list is within the MFP zip pack

Available packages
DPAK (SOT-428C)
10 x 6.6 x 2.3 mm

e.g. Voltage stabilization for vehicle dashboard

Application diagram
SiC Schottky Diodes
Ultra-high performance and high efficiency diodes with low energy losses

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

Key technical features and portfolio
- Low forward voltage drop ($V_F$)
- Zero recovery switching behavior
- Outstanding figure-of-merit ($Q_C \times V_F$)
- High $I_{FSM}$ capability
- High-voltage compliant Real-2-Pin (R2P) packages

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

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

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>$V_R$ max [V]</th>
<th>$I_C$ (av) [A]</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSC1065H</td>
<td>650</td>
<td>10</td>
<td>DPAK R2P</td>
</tr>
<tr>
<td>PSC1065J</td>
<td>650</td>
<td>10</td>
<td>D2PAK R2P</td>
</tr>
<tr>
<td>PSC1065K</td>
<td>650</td>
<td>10</td>
<td>TO-220-2</td>
</tr>
<tr>
<td>PSC1065L</td>
<td>650</td>
<td>10</td>
<td>TO-247-2</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

Application diagram

Available packages

SMD
- DPAK (SOT8017)
- D2PAK (SOT8018)

Through-Hole
- TO-220-2 (SOT8021)
- TO-247-2 (SOT8022)
<table>
<thead>
<tr>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC/DC Topologies</td>
</tr>
<tr>
<td>AC/DC Topologies</td>
</tr>
<tr>
<td>Motor Control Topologies</td>
</tr>
</tbody>
</table>
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
Nexperia
• External presentation

TrEOS High-Speed ESD Protection
Ideal combination of low capacitance, low clamping voltage and high surge robustness to protect sensitive high-speed interfaces

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

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

Design Benefits
• 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

Functions and applications

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

<table>
<thead>
<tr>
<th>Portfolio (Excerpt)</th>
<th>Capacitance</th>
<th>Clamping @ 16 A TLP</th>
<th>Trigger</th>
<th>Surge</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>PESD12V11BSF</td>
<td>0.26 pF</td>
<td>6.4 V</td>
<td>3.4 V</td>
<td>4 A</td>
<td>SOD962</td>
</tr>
<tr>
<td>PESD28V11BSF</td>
<td>0.16 pF</td>
<td>8 V</td>
<td>6.9 V</td>
<td>5.5 A</td>
<td>SOD962</td>
</tr>
<tr>
<td>PESD33V31BSF</td>
<td>0.28 pF</td>
<td>5.7 V</td>
<td>9 V</td>
<td>9.5 A</td>
<td>SOD962</td>
</tr>
<tr>
<td>PESD3USB3S (Pmax)</td>
<td>0.45 pF</td>
<td>4 V</td>
<td>14.2 V</td>
<td>8 A</td>
<td>WLCSP15</td>
</tr>
<tr>
<td>PUSB3BB2DF (Pmax)</td>
<td>0.26 pF</td>
<td>6.2 V</td>
<td>9 V</td>
<td>8 A</td>
<td>SOT8013</td>
</tr>
<tr>
<td>PESD4VX2UM</td>
<td>0.82 pF</td>
<td>4 V</td>
<td>8 V</td>
<td>11 A</td>
<td>SOT883</td>
</tr>
<tr>
<td>PESD5BV11BSF</td>
<td>0.1 pF@10 GHz</td>
<td>9 V</td>
<td>11.5 V</td>
<td>4.8 A</td>
<td>SOD962</td>
</tr>
<tr>
<td>PESD9BV11BSF</td>
<td>0.49 pF</td>
<td>3.8 V</td>
<td>12.2 V</td>
<td>20 A</td>
<td>SOD962</td>
</tr>
<tr>
<td>PESD15VW1BCSF</td>
<td>0.45 pF</td>
<td>3.9 V</td>
<td>26 V</td>
<td>20 A</td>
<td>SOD962</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

Application diagram

USB4 Rx/Tx Protection

Available packages

<table>
<thead>
<tr>
<th>SOD992B (DSN0402)</th>
<th>SOD962-2 (DSN0603-2)</th>
<th>SOT8013 (DFN0603-3)</th>
<th>WLCSP 5/10/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4 x 0.2 x 0.2</td>
<td>0.6 x 0.3 x 0.3</td>
<td>0.6 x 0.3 x 0.3</td>
<td>0.8*n x 1.2 x 0.6, n=1,2,3</td>
</tr>
</tbody>
</table>

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

Extensive product portfolio

Portfolio (Excerpt)

Capacitance

Clamping @ 16 A TLP

Trigger

Surge

External presentation
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

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

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

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?

Products

<table>
<thead>
<tr>
<th>Portfolio (Excerpt)</th>
<th>Passband(^1)</th>
<th>Rejection</th>
<th>(V_{ESD})</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCMFxUSB3B/C</td>
<td>8 GHz</td>
<td>-36 dB</td>
<td>20 kV</td>
<td>WLCSP5/10/15</td>
</tr>
<tr>
<td>PCMFxUSB3BA/C</td>
<td>10 GHz</td>
<td>-35 dB</td>
<td>15 kV</td>
<td>WLCSP5/10/15</td>
</tr>
<tr>
<td>PCMFxHDMI2BA-C</td>
<td>10 GHz</td>
<td>-35 dB</td>
<td>15 kV</td>
<td>WLCSP5/10/15</td>
</tr>
</tbody>
</table>

\(^1\) S21dd f3dB
Full product list is within the MFP zip pack

Functions and applications

- USB Type-C (USB 2.0/3.2)
- HDMI 2.1

Discovery questions

- MIPI CSI camera interface & MIPI DSI display interface

Available packages

<table>
<thead>
<tr>
<th></th>
<th>WLCSP5</th>
<th>WLCSP10</th>
<th>WLCSP15</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Type-C Dongle</td>
<td><img src="image" alt="Diagram" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Nexperia • External presentation
Automotive In-Vehicle Network Protection
for IVN, Ethernet, ADAS, Multimedia & Infotainment

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 & Infotainment 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/ Multimedia/ Infotainment
• Higher ESD robustness - withstands higher failure voltage
• Lower (=better) ESD clamping voltage with TrEOS technology offers improved system level protection

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

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

Full product list is within the MFP zip pack

Application diagram
Automotive Ethernet 100BASE-T1/ 1000BASE-T1 protection, single channel (according to OPEN alliance)
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
- NX5010x (Open-drain applications)
- NX80506 (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.

Products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Channels</th>
<th>Portfolio size</th>
<th>Packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX5x</td>
<td>1,2,4,8</td>
<td>10</td>
<td>GW, GT, GS, GM, DC, PW, GU12, BQ, UN, UM</td>
</tr>
<tr>
<td>NXBx</td>
<td>1,2,4,8</td>
<td>11</td>
<td>GW, GT, GS, GM, DC, PW, GU12, BQ, UN</td>
</tr>
<tr>
<td>LSFx</td>
<td>1,2,4,8</td>
<td>15</td>
<td>GW, GS, GM, GX, DP, DC, PW, GU12, BQ</td>
</tr>
<tr>
<td>74AVCx</td>
<td>1,2,4,8,16</td>
<td>67</td>
<td>GM, GS, GT, GW, GX, D, DP, GU, GU12, DC, PW, BQ, BZ, DGG, DGV</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

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?

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

Available packages

<table>
<thead>
<tr>
<th>Package name</th>
</tr>
</thead>
<tbody>
<tr>
<td>XSON6</td>
</tr>
<tr>
<td>X2SON8</td>
</tr>
<tr>
<td>XQFN12</td>
</tr>
<tr>
<td>DHQFN20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin count</th>
<th>6</th>
<th>8</th>
<th>12</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>SOT886</td>
<td>SOT1233</td>
<td>SOT1174-1</td>
<td>SOT764</td>
</tr>
<tr>
<td>Suffix</td>
<td>GM</td>
<td>GX</td>
<td>GU12</td>
<td>BQ</td>
</tr>
<tr>
<td>Pitch (mm)</td>
<td>0.50</td>
<td>0.4</td>
<td>0.40</td>
<td>0.5</td>
</tr>
<tr>
<td>W x L x H (mm)</td>
<td>1.0 x 1.45 x 0.50</td>
<td>1.35 x 0.8 x 0.35</td>
<td>2.0 x 1.7 x 0.50</td>
<td>4.5 x 2.5 x 1.0</td>
</tr>
</tbody>
</table>

Nexperia • External presentation
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

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?

Key technical features and portfolio
- Low attenuation – eliminates post switching amplification
- Suitable for mixed-voltage switch applications

Products
<table>
<thead>
<tr>
<th>Product name</th>
<th>Packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>XS3A1Tx157</td>
<td>GM, GS</td>
</tr>
<tr>
<td>XS3A405x</td>
<td>PW</td>
</tr>
<tr>
<td>XS3A2467</td>
<td>PW</td>
</tr>
<tr>
<td>XS5A1T4157</td>
<td>GW</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

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

Available packages
<table>
<thead>
<tr>
<th>Package name</th>
<th>XSON6</th>
<th>XSON6</th>
<th>TSSOP6</th>
<th>TSSOP16</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Version</td>
<td>SOT886</td>
<td>SOT1202</td>
<td>SOT363</td>
<td>SOT403</td>
</tr>
<tr>
<td>Suffix</td>
<td>GM</td>
<td>GS</td>
<td>GW</td>
<td>PW</td>
</tr>
<tr>
<td>Pitch (mm)</td>
<td>0.50</td>
<td>0.4</td>
<td>0.65</td>
<td>0.65</td>
</tr>
<tr>
<td>W x L x H (mm)</td>
<td>1.0 x 1.45 x 0.50</td>
<td>1.0 x 1.0 x 0.35</td>
<td>2.1 x 1.25 x 0.95</td>
<td>5.0 x 4.4 x 1.1</td>
</tr>
</tbody>
</table>
**MOSFETs**

**MFP Overview**

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

LFPAK88 for Auto

8x8mm replacement for larger wire-bond packages (D²PAK/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 (D²PAK/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

**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 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

**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

**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.

**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 $T_{j \text{ max}}$ a plus)

**Available packages (selection)**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMNxxx(x)EN(E)A</td>
<td>SOT457</td>
<td>N</td>
</tr>
<tr>
<td>PMNxxxP(E)A</td>
<td>SOT457</td>
<td>P</td>
</tr>
<tr>
<td>PMVxx(x)N(E)A</td>
<td>SOT23</td>
<td>N</td>
</tr>
<tr>
<td>PMVxx(x)P(E)A</td>
<td>SOT23</td>
<td>P</td>
</tr>
<tr>
<td>PMPBxxxN(E)A</td>
<td>DFN2020MD-6</td>
<td>N</td>
</tr>
<tr>
<td>PMPBxxxP(E)A</td>
<td>DFN2020MD-6</td>
<td>P</td>
</tr>
<tr>
<td>BUKxDxx-x0E</td>
<td>DFN2020MD-6</td>
<td>N</td>
</tr>
<tr>
<td>BUK6Dxx(x)-x0P</td>
<td>DFN2020MD-6</td>
<td>P</td>
</tr>
<tr>
<td>PMTxxxEN(E)A</td>
<td>SOT223</td>
<td>N</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

* Low $R_{DS(on)}$ MOSFETs for Automotive in DFN2020 in DFN2020
Small-signal MOSFETs for Mobile and Portable

Design Benefits
• Including the ultra-small MOSFET DFN0606 package
• Replacement of larger packages - Performance improvements in wafer technology and in package technology

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

enable higher electrical and thermal performance on a smaller footprint
• High power capability (WLCSP)

Key technical features and portfolio
• Improved $R_{DS(ON)}$ Performance
• Most types with ESD protection up to 2 kV

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)

Broad portfolios for optimum choice
• $R_{DS}$ voltage range of 12 V – 100 V

Products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMCNxx0xxNE</td>
<td>WLCSP4/6/9</td>
<td>N</td>
</tr>
<tr>
<td>PMCNxx0xxPE</td>
<td>WLCSP4/6/9</td>
<td>P</td>
</tr>
<tr>
<td>NXxxxxxBKH</td>
<td>DFN0606</td>
<td>N</td>
</tr>
<tr>
<td>PMHxxxxxUPE</td>
<td>DFN0606</td>
<td>P</td>
</tr>
<tr>
<td>PMHxxxxUNE</td>
<td>DFN0606</td>
<td>N</td>
</tr>
<tr>
<td>PMPBxxRxxP</td>
<td>DFN2020M-6</td>
<td>P</td>
</tr>
<tr>
<td>PMPBxxRxxN</td>
<td>DFN2020M-6</td>
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</tr>
<tr>
<td>PMCA14UN</td>
<td>DSN1010</td>
<td>N</td>
</tr>
</tbody>
</table>

Available packages (selection)

Full product list is within the MFP zip pack
**NextPowerS3**

**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

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

**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

**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**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>$R_{DS(on)}@10,V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSMNR51-25YLH</td>
<td>LFPAK56E</td>
<td>0.57</td>
</tr>
<tr>
<td>PSMNR58-30YLH</td>
<td>LFPAK56E</td>
<td>0.67</td>
</tr>
<tr>
<td>PSMN1R5-50YLH</td>
<td>LFPAK56E</td>
<td>1.75</td>
</tr>
<tr>
<td>PSMN2R0-55YLH</td>
<td>LFPAK56E</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

**Available packages (selection)**

LFPACK88 products, listed under separate LFPACK88 category
NextPower 80/100 V

Design Benefits
- Industry leading low Qrr for high-efficiency and low-spiking
- Low $Q_G \times R_{DS(on)}$ FoM for high efficiency switching apps
- Optimised body diode $V_{SD}=1\text{V}(\text{max})$
- Strong avalanche energy rating (EAS) & 100% tested

Functions and applications
- Qualified to $T_J(\text{max})=175\text{°C}$, meets IPC9592
- Ha-free and RoHS compliant LFPAK56 package
- Additional capacity – new 8” DMAN wafer line ramps in 2022

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?

Available packages (selection)
- 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)

Products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>$R_{DS(on)}$ @ 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSMN3R9-100YSF</td>
<td>LFPAK56E</td>
<td>4.3</td>
</tr>
<tr>
<td>PSMN3R5-80YSF</td>
<td>LFPAK56E</td>
<td>3.5</td>
</tr>
<tr>
<td>PSMN4R8-100YSE</td>
<td>LFPAK56E</td>
<td>4.8</td>
</tr>
<tr>
<td>PSMN012-100YSF</td>
<td>LFPAK56</td>
<td>11.2</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack
Suffix "E" denotes ASFET with enhanced SOA

LFPAK88 products, listed under separate LFPAK88 category
LFPAK88 for Industrial

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 D²PAK
- 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 D²PAK, D²PAK-7 or TOLL
- Do you need the ultimate linear-mode (SOA) performance for advanced hotswap & eFuse applications

Available packages

<table>
<thead>
<tr>
<th>Product name</th>
<th>$V_{DS}$</th>
<th>$R_{DS(on)}$ @ 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSMNR55-40SSH</td>
<td>40 V</td>
<td>0.55</td>
</tr>
<tr>
<td>PSMNR70-40SSH</td>
<td>40 V</td>
<td>0.7</td>
</tr>
<tr>
<td>PSMNR90-50SLH</td>
<td>50 V</td>
<td>0.90</td>
</tr>
<tr>
<td>PSMN1R8-80SSE</td>
<td>80 V</td>
<td>1.8</td>
</tr>
<tr>
<td>PSMN1R9-80SSE</td>
<td>80 V</td>
<td>1.9</td>
</tr>
<tr>
<td>PSMN2R3-100SSE</td>
<td>100 V</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack
Suffix “E” denotes ASFET with enhanced SOA
LFPAK88 for Automotive

Design Benefits
• 8 mm x 8 mm footprint
• Copper clip technology gives low electrical and thermal resistance

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)

Functions and applications
• Power steering
• ABS braking
• DC/DC conversion
• Reverse battery protection

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

<table>
<thead>
<tr>
<th>Product name</th>
<th>$V_{DS}$</th>
<th>$R_{DS(on)}$ @ 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUK7S0R5-40H</td>
<td>40</td>
<td>0.5</td>
</tr>
<tr>
<td>BUK7S0R7-40H</td>
<td>40</td>
<td>0.7</td>
</tr>
<tr>
<td>BUK7S0R9-40H</td>
<td>40</td>
<td>0.9</td>
</tr>
<tr>
<td>BUK7S1R0-40H</td>
<td>40</td>
<td>1.0</td>
</tr>
<tr>
<td>BUK7S1R2-40H</td>
<td>40</td>
<td>1.2</td>
</tr>
<tr>
<td>BUK7S1R5-40H</td>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>BUK7S2R0-40H</td>
<td>40</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack
Suffix "E" denotes ASFET with enhanced SOA

Available packages

Application diagram
Trench 9 Automotive 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 enable easy paralleling of MOSFETs in high current applications
- Enhanced LFPAK56E design allows up to 30% improvement in $R_{DS(on)}$ and power density

**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

**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

**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?

**Available packages**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>$R_{DS(on)}$ @ 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUK7M3R3-40H</td>
<td>LFPAK33</td>
<td>3.3</td>
</tr>
<tr>
<td>BUK7Y1R4-40H</td>
<td>LFPAK56</td>
<td>1.4</td>
</tr>
<tr>
<td>BUK9K13-40H</td>
<td>LFPAK56D</td>
<td>13</td>
</tr>
<tr>
<td>BUK9J0R9-40H</td>
<td>LFPAK56E</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack

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

## Design Benefits

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

## Functions and applications

- 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

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

Full product list is within the MFP zip pack

## Available packages
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

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

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

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

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?

Available packages and application diagram

Products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>$R_{DS(on)}$ typ@ 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAN014-650NBBA</td>
<td>CCPAK1212</td>
<td>12</td>
</tr>
<tr>
<td>GAN014-650NTCA</td>
<td>CCPAK1212i</td>
<td>12</td>
</tr>
<tr>
<td>GAN039-650NBBA</td>
<td>CCPAK1212</td>
<td>33</td>
</tr>
<tr>
<td>GAN039-650NTBA</td>
<td>CCPAK1212i</td>
<td>33</td>
</tr>
</tbody>
</table>

Full product list is within the MFP zip pack.
GaN FETs for Industrial applications

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 target operating frequency?
- What is the power rating of the system?

Products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Package</th>
<th>$R_{DS(on)}$ typ @ 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAN041-650WSB</td>
<td>TO-247</td>
<td>35</td>
</tr>
<tr>
<td>GAN063-650WSA</td>
<td>TO-247</td>
<td>50</td>
</tr>
<tr>
<td>GAN039-650NBB</td>
<td>CCPAK1212i</td>
<td>33</td>
</tr>
<tr>
<td>GAN039-650NTB</td>
<td>CCPAK1212i</td>
<td>33</td>
</tr>
<tr>
<td>GAN014-650NBC</td>
<td>CCPAK1212</td>
<td>12</td>
</tr>
<tr>
<td>GAN014-650NTC</td>
<td>CCPAK1212i</td>
<td>12</td>
</tr>
</tbody>
</table>

Available packages and application diagram

Full product list is within the MFP zip pack