

# Infineon drive systems solutions

Explore Infineon's variety of innovative power semiconductors which enable designers to develop highly reliable and efficient solutions for all kinds of drive applications.



[www.infineon.com](http://www.infineon.com)



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# 1.0 Introduction

We live in a mobile world filled with electrical devices. From the mobile phone in our pocket to the new EV car in our garage, our environment is becoming more and more automated and power hungry by the day. Innovations in consumer-grade robots are giving us robots that can mow our lawns or clean our homes. Highly efficient electric motors are replacing the traditional motors in home appliances, automobiles, and industry. The demand for light electric vehicles such as e-scooters and pedelecs is increasing exponentially. Multicopter technology is evolving at an incredible pace. Behind all of this innovation, a wireless charging revolution is changing how we power these devices and motors that surround us.

As these products evolve and improve, there is an increasing need for designers and engineers to find solutions that are more efficient, smaller, and less costly than ever before. Infineon's broad portfolio of semiconductor solutions including MOSFETs, drivers, microcontrollers, sensors, intelligent power modules, transistors, and security are exactly what is needed for the compact, cost effective designs of today, and for the innovative designs of tomorrow.






## 2.0 Battery powered drives

Superb performance for battery powered motor drives

Infineon's wide variety of high quality state-of-the-art high quality power semiconductors are built upon industry-leading technologies and manufacturing expertise. The comprehensive portfolio of power semiconductors enables engineers and designers to develop highly reliable and efficient solutions for a wide range of battery powered motor drive applications such as multicopters, service robotics, power tools, forklifts, and various light electric vehicles including e-skateboards, e-scooters, pedelecs, and low speed cars.

Infineon offers an excellent selection of devices for power management and power consumption, as well as voltage regulation – such as power MOSFETs (e.g. OptiMOS™ and CoolMOS™), XMC™ microcontrollers, gate driver ICs and more. To find the right fit for your application, take a look at Infineon's solution matrix!

	Consumer robotics 	Home and professional 	Light electric vehicles 
MOSFETs	StrongIRFET™ 20 V-300 V		
	OptiMOS™ 25 V-80 V		OptiMOS™ 80 V-300 V
	CoolMOS™ P7 (standard grade) <sup>1</sup>		CoolMOS™ P7 (industrial grade) <sup>1</sup>
Gate driver ICs	EiceDriver™/Half-bridge and three-phase gate driver ICs		
	200 V to 600 V gate driver ICs		
IPM	CIPOS™ Nano		
Microcontrollers	XMC1300/XMC1400		
	iMOTION™	XMC4500/XMC4400	
Microcontroller & driver support	Linear voltage and DC-DC switching regulators		
CAN transceivers	IFX1050, IFX1051		
Magnetic sensors	Hall and xMR sensors		
Authentication	OPTIGA™ Trust B		

<sup>1</sup> If the necessary package/ $R_{DS(on)}$  combination is not available in the new CoolMOS™ P7 series yet, the previous CoolMOS™ CE and P6 series are the preferred series

## 2.1 Consumer robotics

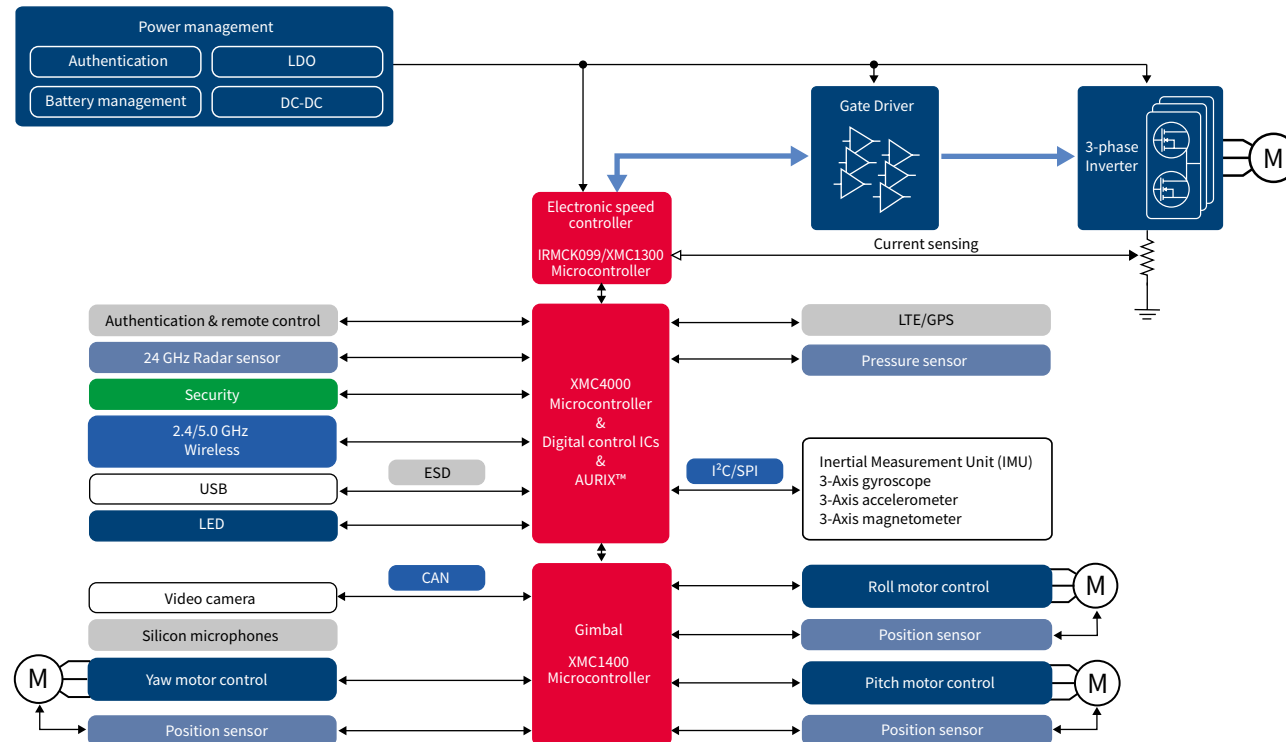
The fastest growing segment of the whole robotics market

### 2.1.1 Multicopters

Cost-effective system solutions

One of the largest growth segments of the consumer robotics marketplace is in multicopters. Core multicopter features such as camera applications, autonomous flight, and sophisticated on-board equipment is pushing the limits of performance, efficiency, and control. From XMC™ microcontrollers and iMOTION™ motor control ICs to magnetic sensors, Infineon offers a comprehensive system solution portfolio of high quality products well suited for multicopter designs.

Application example block diagram - multicopter



## Solution tree for multicopters

Flight control					ESC		
Microcontrollers	Sensors	DC-DC modules	LDO	Low noise amplifier (LNA)	Microcontrollers	Sensors	Intelligent power modules
<ul style="list-style-type: none"><li>› XMC4000 family</li><li>› XMC1000 family</li><li>› AURIX™</li></ul>	<ul style="list-style-type: none"><li>› Pressure sensor: DPS310</li><li>› 24 GHz radar sensor: BGT24MTR11, BGT24MTR12</li><li>› Current sensor: TLI4970</li><li>› ToF imager: IRS1645C</li></ul>	<ul style="list-style-type: none"><li>› IFX90121ELV50</li><li>› IFX91041EJV33</li><li>› IFX91041EJV50</li></ul>	<ul style="list-style-type: none"><li>› IFX1117ME</li><li>› IFX54441EJV</li><li>› IFX1763XEJV33</li></ul>	<ul style="list-style-type: none"><li>› LTE: BGA7H, BGA7M, BGA7L</li><li>› GPS: BGA524N6, BGA824N6</li><li>› Wi-Fi: BFP842ESD, BFR840L3RHESD, BFR843L3, etc.</li></ul>	<ul style="list-style-type: none"><li>› XMC1300 family</li><li>› iMOTION™ IRMCK099</li><li>› ePOWER: TLE9879QXA40</li></ul>	<ul style="list-style-type: none"><li>› Hall sensor: TLI4961, TLV4961</li><li>› Angle sensor: TLI5012B, TLE5009</li></ul>	<ul style="list-style-type: none"><li>› IRSM005-800MH</li><li>› IRSM836-084MA</li></ul>
Security	Accessory authentication	Joystick	Interface protection diodes	LED drivers	MOSFET gate drivers	Dual n-channel power MOSFETs	Low voltage MOSFETs
<ul style="list-style-type: none"><li>› OPTIGA™ Trust E SLS32AIA</li><li>› OPTIGA™ Trust P SLJ52ACA</li><li>› OPTIGA™ TPM SLB96XX</li></ul>	<ul style="list-style-type: none"><li>› OPTIGA™ Trust SLS10ERE</li><li>› OPTIGA™ Trust B SLE95250</li></ul>	<ul style="list-style-type: none"><li>› 3D magnetic sensor: TLV493D</li></ul>	<ul style="list-style-type: none"><li>› ESD102 series</li></ul>	<ul style="list-style-type: none"><li>› BCR450</li><li>› BCR321U</li><li>› BCR421U</li></ul>	<ul style="list-style-type: none"><li>› 6EDL04N02PR</li><li>› 2EDL05N06PF</li><li>› IRS2005/7/8</li><li>› IRS2301</li><li>› IRS2136</li><li>› IRS21867</li><li>› IRS2334</li></ul>	<ul style="list-style-type: none"><li>› IR3742, etc.</li><li>› BSC0925ND, etc.</li></ul>	<ul style="list-style-type: none"><li>› OptiMOS™ 5 series</li><li>› StrongIRFET™ series</li></ul>
Charger				Battery management			
High voltage MOSFETs	Low voltage MOSFETs	Stand alone PWM controllers	Authentication ICs		Cell balancing		Low voltage MOSFETs
<ul style="list-style-type: none"><li>› 600 V-650 V CoolMOS™ CE</li><li>› 600 V CoolMOS™ P7 (standard grade)</li></ul>	<ul style="list-style-type: none"><li>› OptiMOS™ 5 40 V-80 V in TO-220, SuperSO8</li><li>› StrongIRFET™ 40 V-75 V</li></ul>	<ul style="list-style-type: none"><li>› ICE2QS03G</li></ul>	<ul style="list-style-type: none"><li>› OPTIGA™ Trust B SLE95250</li></ul>		<ul style="list-style-type: none"><li>› OptiMOS™ 30 V in SSO8, S308, DirectFET™</li><li>› StrongIRFET™ 30 V</li></ul>		<ul style="list-style-type: none"><li>› OptiMOS™ 5 in SuperSO8, S308, DirectFET™</li><li>› StrongIRFET™ 40 V-80 V</li><li>› OptiMOS™ LinearFET</li></ul>
Gimbal control							
Microcontrollers	Angle sensors	LDO	CAN transceiver	Silicon microphones	Low voltage MOSFETs	Dual n-channel power MOSFETs	MOSFET gate drivers
<ul style="list-style-type: none"><li>› XMC1400 family</li></ul>	<ul style="list-style-type: none"><li>› TLI5012B</li><li>› TLE5009</li></ul>	<ul style="list-style-type: none"><li>› IFX1117ME</li><li>› IFX54441EJV</li><li>› IFX1763XEJV33</li></ul>	<ul style="list-style-type: none"><li>› HS CAN IFX1050G</li><li>› IFX1050GVIO</li></ul>	<ul style="list-style-type: none"><li>› XENSIV™ IM69D family</li></ul>	<ul style="list-style-type: none"><li>› OptiMOS™ 5 25 V-30 V</li><li>› StrongIRFET™ 25 V-30 V</li><li>› P-channel MOSFETs</li></ul>	<ul style="list-style-type: none"><li>› IRFHM8363TRPBF, etc.</li></ul>	<ul style="list-style-type: none"><li>› 6EDL04N02PR</li><li>› 2EDL05N06PF</li><li>› IRS2005/7/8</li><li>› IRS2301</li><li>› IRS2136</li><li>› IRS21867</li><li>› IRS2334</li></ul>

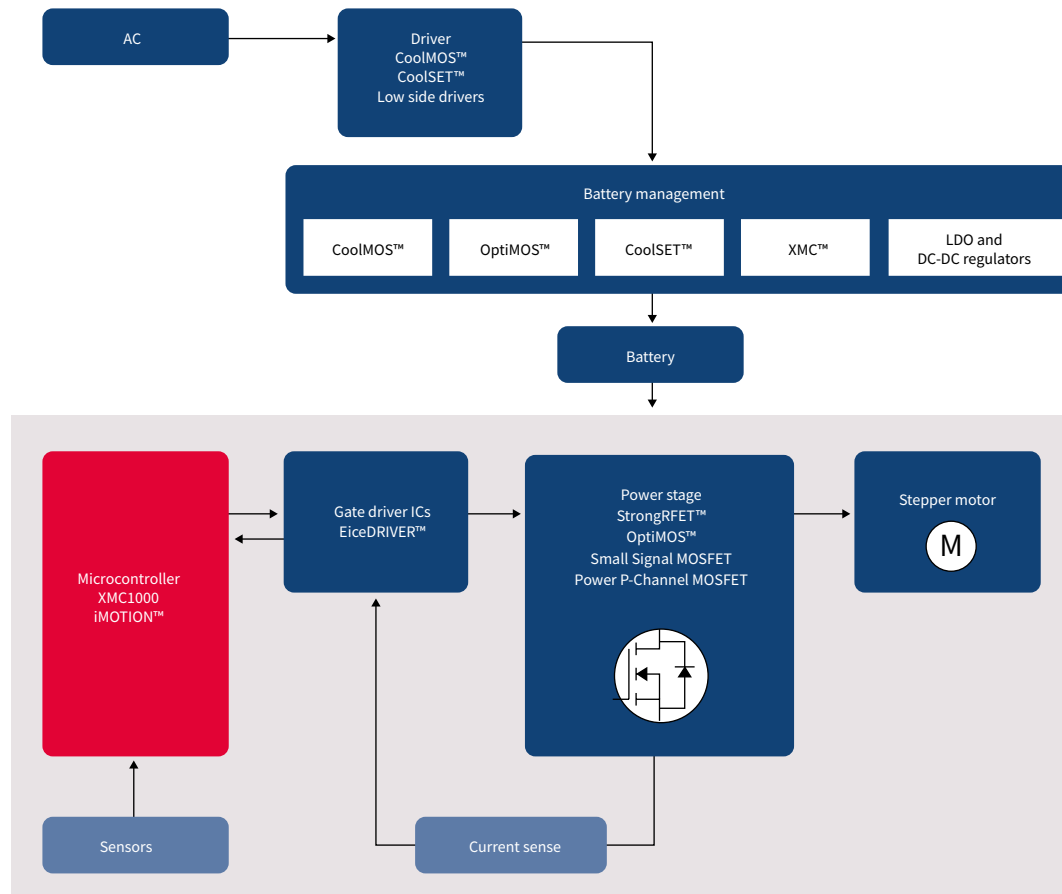


## 2.1.2 Service robotics

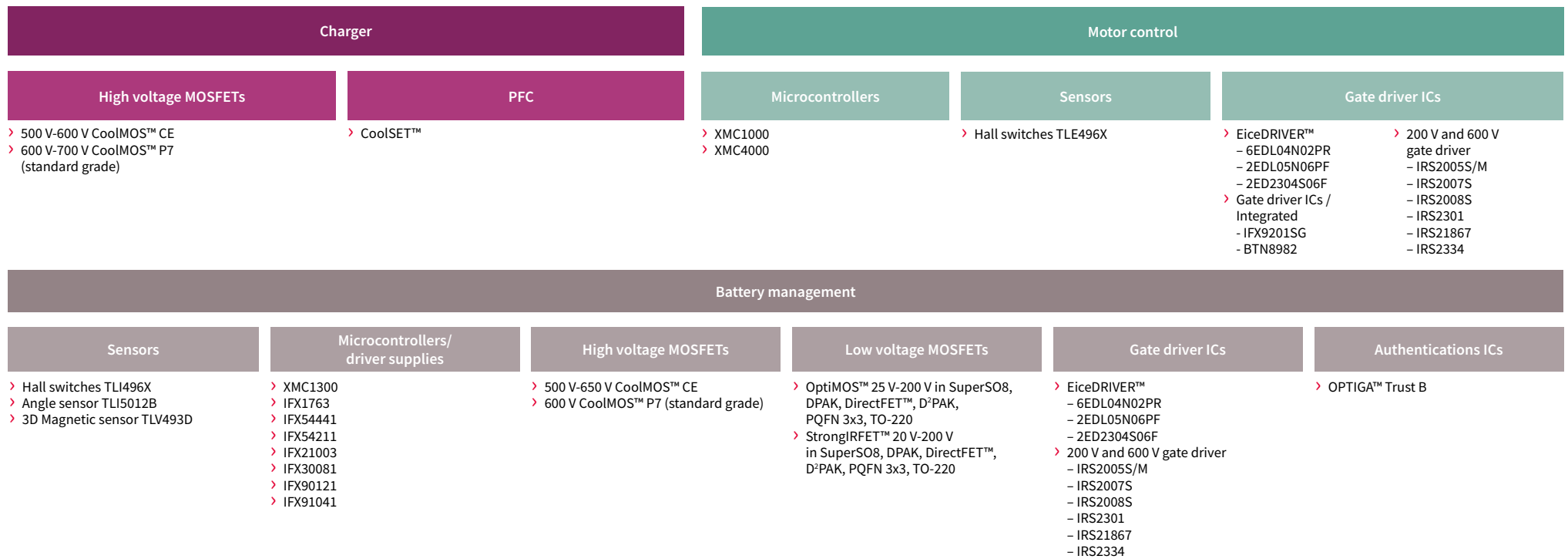
### Powerful and quiet solutions

Service robotics is a high growth market segment with an estimated 15 percent compound annual growth rate within the next 5 years. The primary focus of this growth is in two key areas, electric vacuum cleaners and lawn mowers. High performance Infineon components such as low  $R_{DS(on)}$  MOSFETs, powerful microcontrollers, and sensors can be used to develop solutions with high power density, reduced weight, and low noise.

#### Application example block diagram - service robotics



## Solution tree for service robotics (vacuum cleaners and lawn mowers)



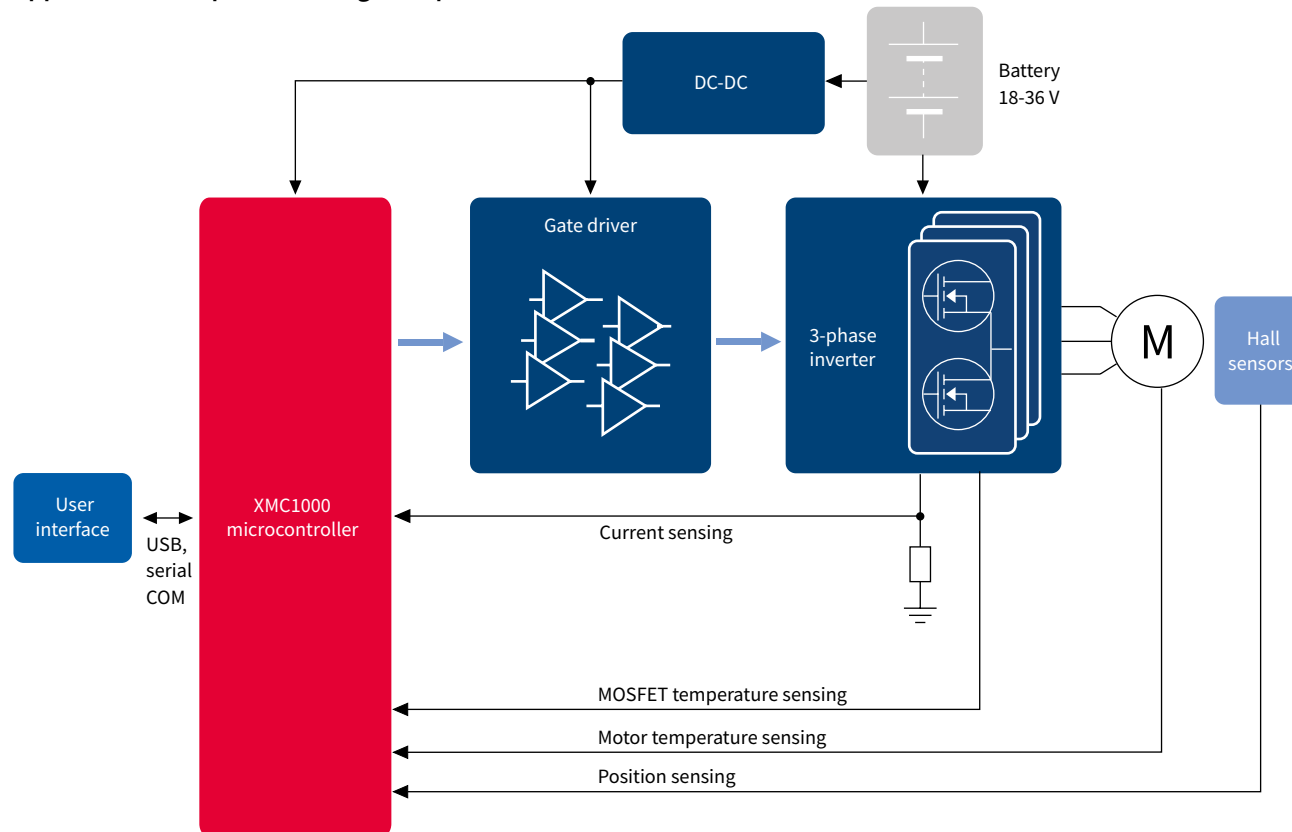


## 2.2 Home and professional use

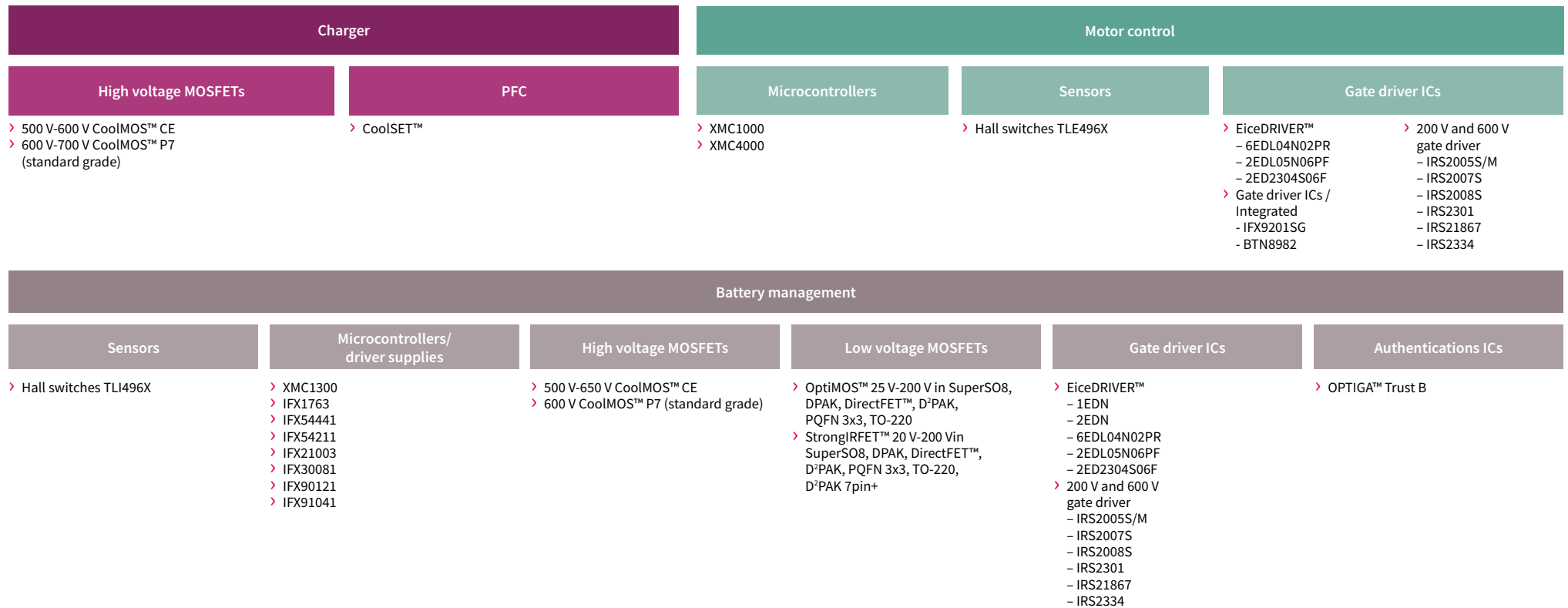
Highest power density and system efficiency

Cordless power tools are major part of the rapidly growing electric tool market. The convenience and safety of lightweight and low-voltage cordless power tools benefits both professional and private users. Depending on the topology, cordless power tools require either space-optimized designs or cost-optimized solutions. Infineon offers a complete portfolio of reliable, high performance MOSFETs, drivers, microcontrollers, and sensors which can be used for both space and cost optimized designs.

Application example block diagram - power tool



## Solution tree for power tools

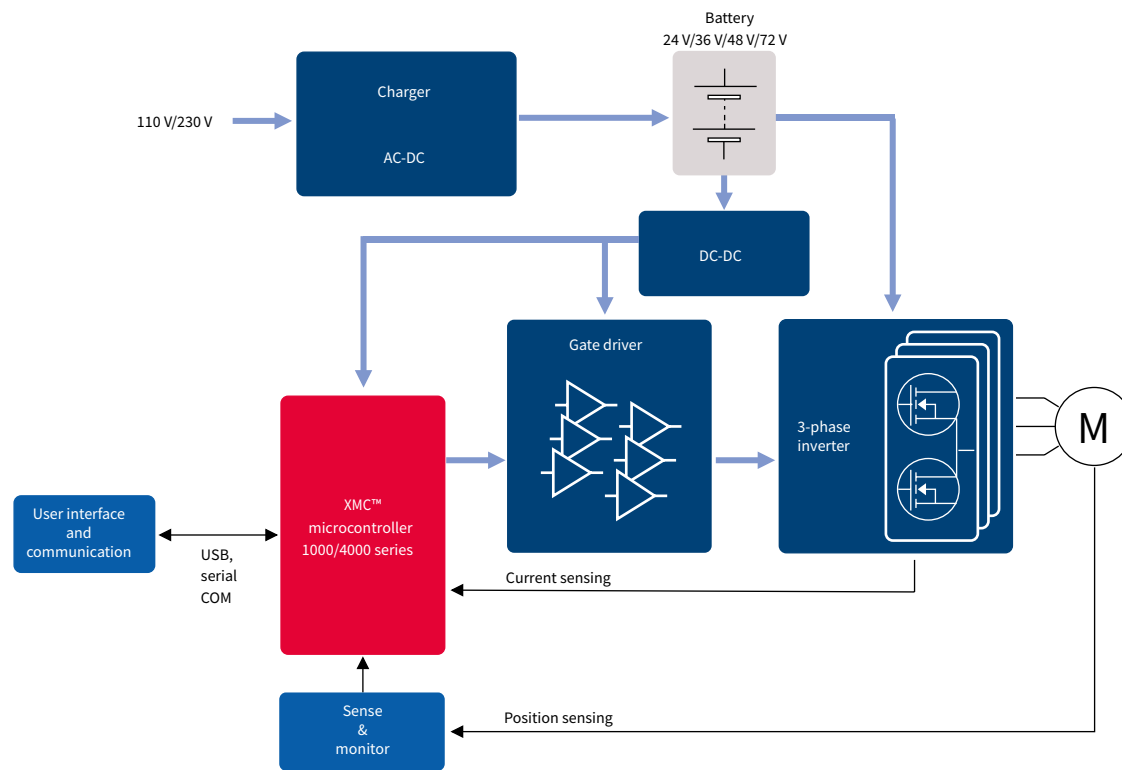


## 2.3 Light electric vehicles

### Performance leadership and system solution

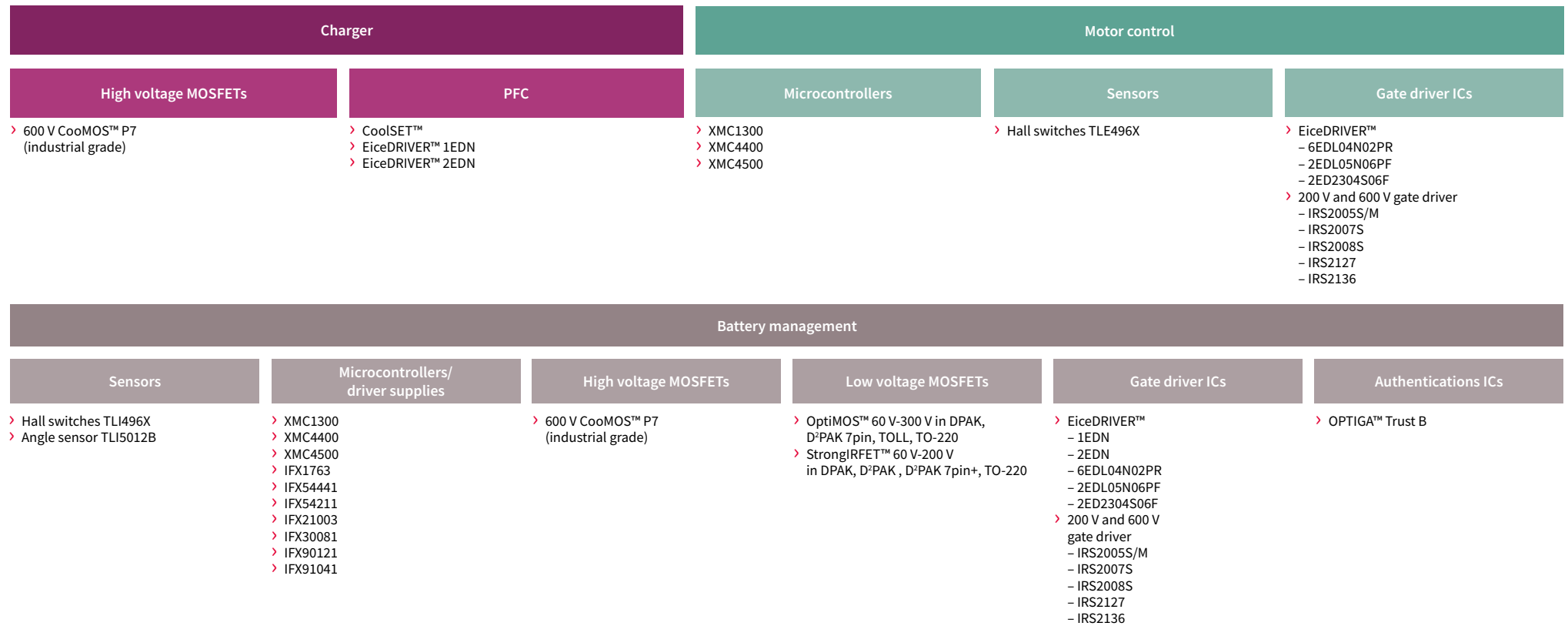
The need to reduce pollution in urban areas as part of improving our environment has resulted in a shift towards alternative means of transportation. The rise in popularity of e-mobility products such as e-bikes, e-scooters, and low speed electric cars has exposed the need for more efficient and higher performing electric motors. The efficiency and high performance must also be supported by increased battery life, operating range, and reduced charging time. With XMC™ microcontrollers, EiceDRIVER™ gate drivers and OptiMOS™ low voltage MOSFETs, Infineon provides solutions for all e-mobility applications.

#### Application example block diagram – e-bike





## Solution tree for light electric vehicles



## 3.0 Home and building automation

Once merely a vision, the smart home gain traction on an ever larger scale, home and building automation designs gets a whole new dimension. Motorized retractable shades, panels, projector screens, and door openers etc. are all sub-applications in the field of home and building automation. In the specific terms of security and the harsh exterior environment, including temperature extremes and humidity, present design challenges. Nevertheless reliability, robustness together with cost-effectiveness retain the leading parts in home automation solutions. As a proven leader in this field, Infineon's competence paired with a portfolio of high-quality components (CIPOS™ family) for home automation technology can help in a range of home systems

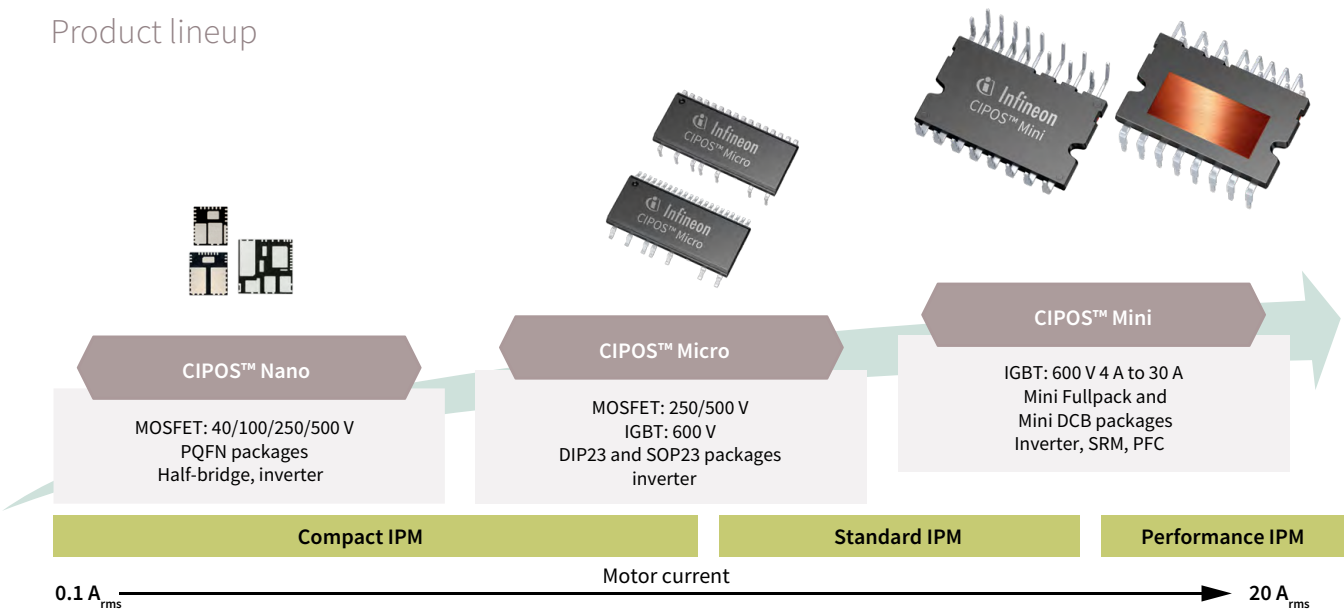
Like in most consumer and home applications, slick design, compact, reliable and efficient are key end-product features. These features translate to thin, small, integrated modules that provide higher efficiency, reliability and hardware protection. The CIPOS™ family provides such solutions in varying form factor and power applications of motor, drive, pump, and plunger.

### 3.1 CIPOS™ family

Control integrated power system- intelligent power modules (CIPOS™ IPMs) are a family of highly integrated, compact power modules designed into drive motors for applications ranging from building automation, home appliances, to fans, pumps and general purpose drives. Depending on the level of integration and power to be handled, Infineon offers a range of IPMs available in different packages and diverse voltage and current classes. These IPM portfolios include CIPOS™ Nano, CIPOS™ Micro and CIPOS™ Mini families.



Product lineup



3.1.1 CIPOS™ Nano  
3-phase or half-bridge with MOSFETs

CIPOS™ Nano is a family of ultra-compact, power modules for high efficiency and light industrial applications, including compressor drives for automation systems. By utilizing an innovative packaging solution, the CIPOS™ Nano family delivers a new benchmark in package size, offering up to a 60 percent smaller footprint compared to existing 3-phase motor control power IPMs and even eliminating the need for an external heat sink.

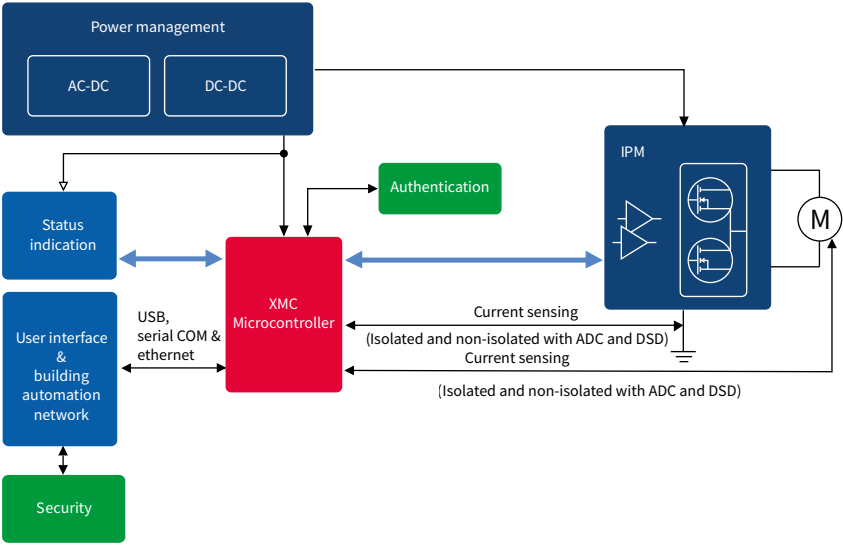
Selected CIPOS™ Nano products

Product	Voltage class [V]	R <sub>DS(on)</sub> (25°C) max. [Ω]	P <sub>mot</sub> (10 kHz) [W]	Built in NTC	Configuration	Package
3-phase						
IRSM836-045MA	500	1.7	80	no	3-phase open source	PQFN 12x12
IRSM836-084MA	250	0.45	85	no	3-phase open source	PQFN 12x12
Half-bridge						
IRSM807-045MH	500	1.7	130	no	Half-bridge	PQFN 8x9





Application example for brushed DC motor drive



3.1.2 CIPOS™ Micro

High performance solution for home and building automation motor drives

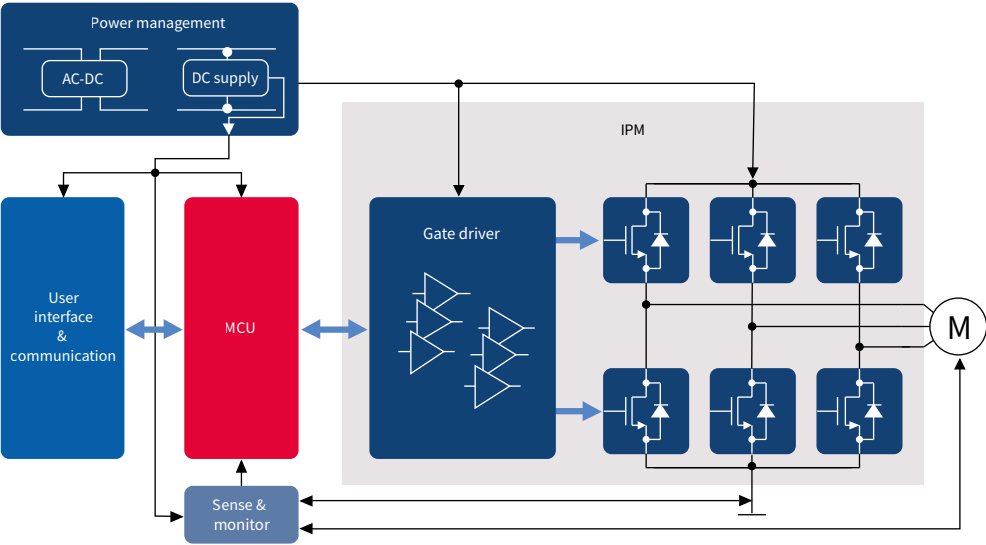
CIPOS™ Micro is a family of compact and efficient intelligent power modules (IPMs) for motor drives. Micro IPMs are the best choice for various drives used in motorized window blinds, shades, shutters, automatic curtain drawing systems, door openers and other applications. Wide range of voltage, current ratings and features helps the designer in making optimum IPM selection for various motor power and application conditions. They offer DC current ratings ranging up to 4.6 A to drive motors up to 90 W without heatsink and up to 250 W with heatsink. CIPOS™ Micro family products are available in both through-hole and surface mount packages.

Selected CIPOS™ Micro products

Product	Voltage class [V]	Rated current [A]	P <sub>mot</sub> (10 kHz) [W]	Built in NTC	Configuration	Package
IRSM506-076DA	600	4	105	yes	3-phase open source	DIP23
IRSM506-076PA	600	4	105	yes	3-phase open source	SOP23
IRSM516-076DA	600	4	105	no	3-phase open source	DIP23
IRSM516-076PA	600	4	105	no	3-phase open source	SOP23



Application example for brushless DC motor control and drives



3.1.3 CIPOS™ Mini

Broad range of application from PFC to inverter

CIPOS™ Mini modules integrate various power and control components to increase reliability, and to optimize PCB size and system costs. This simplifies the power design and reduces significantly time-to-market. These modules are designed to control AC motors in variable speed drives for applications from 4 A up to 30 A such as air conditioning, washing machines, refrigerators, vacuum cleaners, compressors and industrial drives.

Selected CIPOS™ Mini products

Product	Package	Voltage class [V]	P <sub>mot</sub> (10 kHz) [W]	Rated current [A]
3-phase open emitter				
IKCM10L60GA	MDIP-24 Fullpack	600	1200	10
IKCM10L60HA	MDIP-24 Fullpack	600	1200	10
IKCM15L60GA	MDIP-24 Fullpack	600	1600	15
IKCM15L60HA	MDIP-24 Fullpack	600	1600	15





# 4.0 Motor control and drives

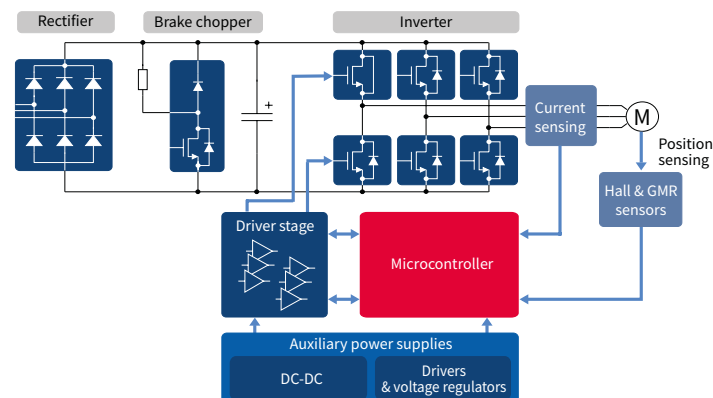
Nowadays motors are increasingly driven via electronics systems, which offer more precise control of speed, position, and torque, as well as higher efficiency, rather than via direct connection to their source of power. The motor control circuit has to control the current flowing in the motor's coils in the most efficient way. Leading semiconductor solutions from Infineon's wide portfolio offers high product quality and reliability, industry leading highly efficient technology and competitive price.

## 4.1 Industrial drives (IGBT discrete)

### 4.1.1 Automation, axis control and industrial robots

Applications like rotary printing press, textile machines, bottling plants, CNC machinery, automated manufacturing or industrial robotics require high-quality motors capable of top energy efficiency and reliable performance. Most common motor types used are DC-induction- and servo motors. Servo motors—more precisely called permanent magnet synchronous machines or referred to as brushless DC-motors offer higher torque/volume ratio and lower inertia, thus allow higher dynamics. A servo motor is often equipped with a sensor which gives feedback about the position. As a rotary actuator, it enables precise control of the position, velocity and acceleration. A unique characteristic of the servo motor is that it consumes power while rotating to the desired position and then rests upon arrival.

#### Application example for servo motor control and drives





Brake chopper

Inverter

Gate driver

MCU

Sensor

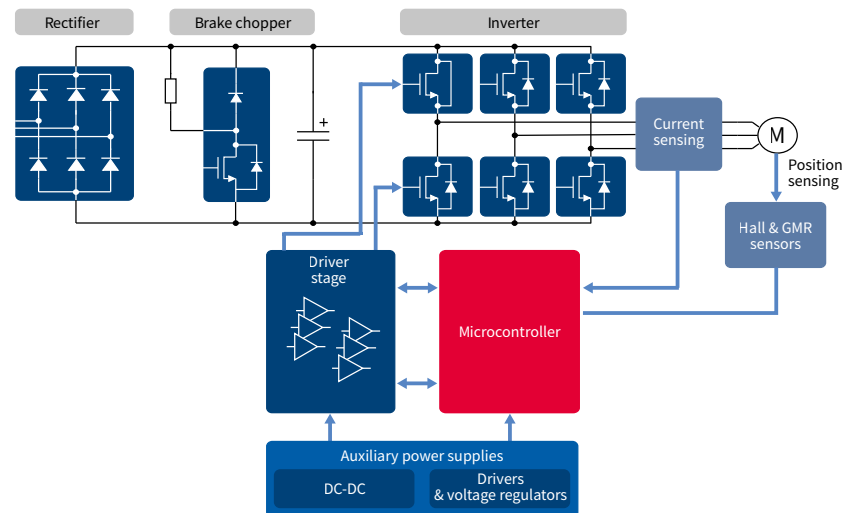
600 V TRENCHSTOP™ IGBT, 600 V TRENCHSTOP™ Performance IGBT  
6 A-120 A IGBT+diode in DPAK, D<sup>2</sup>PAK, TO-220, TO-220 FullPAK, TO-247-3, TO-247PLUS-3

1200 V TRENCHSTOP™2 IGBT 15 A, 25 A, 40 A, 50 A, 75 A  
IGBT+diode in TO-247-3, TO-247PLUS-3

## 4.1.2 Industrial power machines

Industrial power machines cover applications like forming machines, punching tools, cranes, conveyors, belts. The most common motor topologies for are induction motor, DC motor and brushless DC motor. Today growing numbers of applications rely on brushless DC (BLDC) motor. In each instance BLDC motor is chosen for its numerous advantages, such as highest efficiency, smaller motor size, light weight, longer lifetime and low cost of maintenance. Infineon's product offer for industrial power tools provides a wide product portfolio ranging from power switches to microcontrollers, dedicated motor control ICs, gate drivers and sensors to enable customers to design a more efficient brushless DC motor driven application.

### Application example for brushless DC motor (discrete)



Battery DC-DC

Inverter

Gate driver

MCU

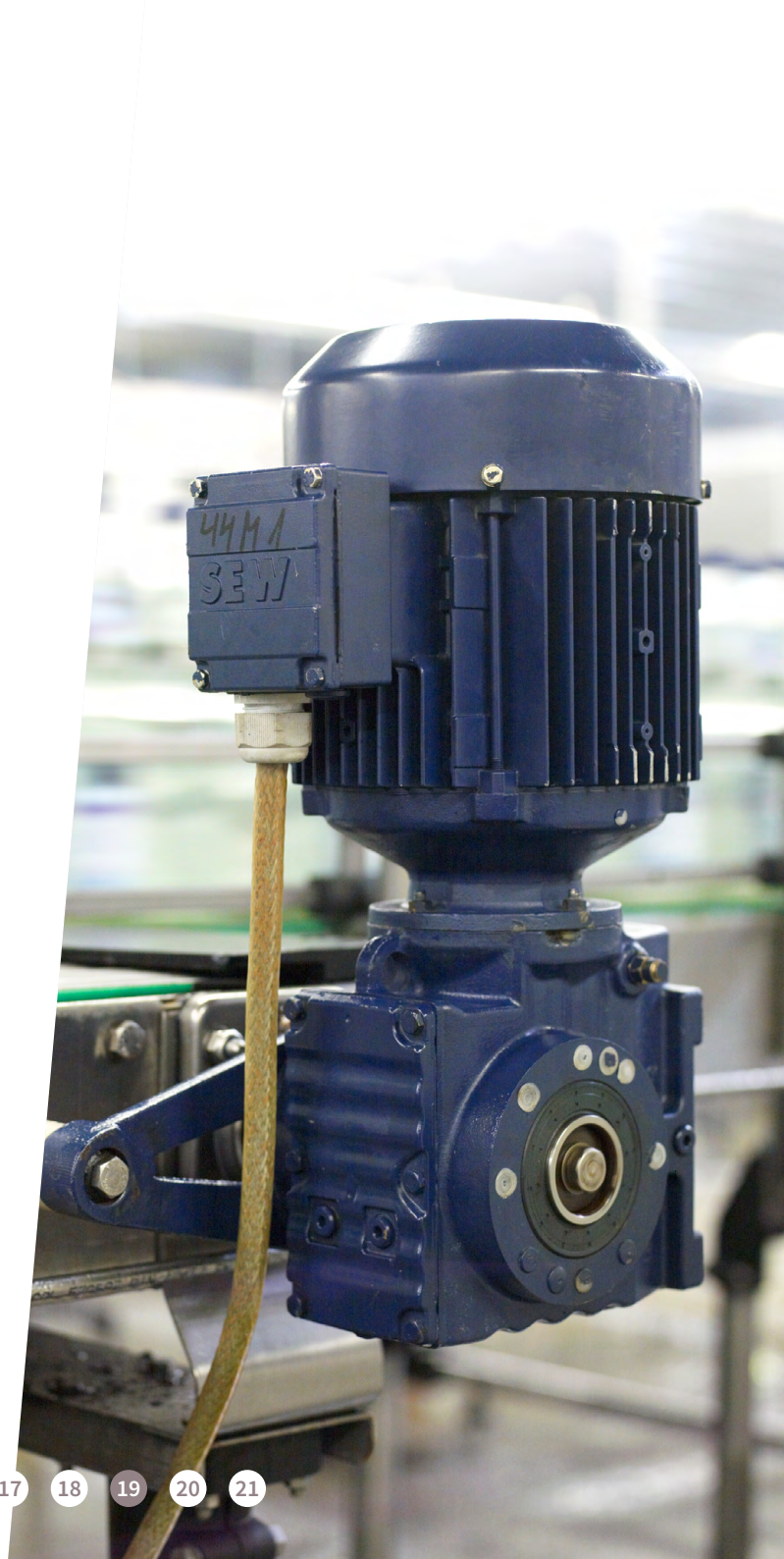
1200 V TRENCHSTOP™2 IGBT  
15 A, 25 A, 40 A, 50 A, 75 A IGBT+diode  
in TO-247-3, TO-247PLUS-3

600 V TRENCHSTOP™ IGBT  
600 V TRENCHSTOP™  
Performance IGBT  
6 A-120 A IGBT+diode in DPAK,  
D<sup>2</sup>PAK, TO-220, TO-220 FullPAK,  
TO-247-3, TO-247PLUS3

## 4.2 Industrial drives (module)

Electrical drive systems play a key role in energy savings. They account for two-thirds of electrical energy consumed in industry and they are a central component of automation systems. There are two distinct industrial drive technology groups. The first group includes electrically driven machines requiring position control. This group includes, for example, machine tools, measuring machines and packaging machines where precision in movement is required. The second group covers all applications where a fluid is moved by pumps and fans. Here variable speed drives allow the flow to be aligned with the needs of the process. Compared with traditional methods of flow control like throttling and bypassing, electronic speed control significantly increases overall efficiency. Furthermore, an inverter enables more efficient motor technologies, like permanent magnet synchronous motors and reluctance motors, to be used. Today, these drives can be implemented in a power range from watts up to megawatts.

Nearly all static converters for electrical drives used today employ a combination of input rectifier, DC link and output inverter. If no regeneration system is required for the electrical drive, the most competitive semiconductor components for the input rectifier are bipolar thyristors and/or diodes offered in various topologies, such as complete 6-pack modules, half-bridge modules or single modules. In high-power electrical drives, the input rectifier consists of thyristors and/or diodes in Presspack housings. If regeneration is required, an active front end can be designed using IGBT modules. In the low-power range, where power factor correction is mandatory in some applications, PFC (power factor correction) circuits can be designed using discrete IGBTs and diodes or dedicated modules. Infineon provides the latest chip technology embedded into innovative mechanical module designs. This enables our customers to develop highly reliable and efficient solutions. The Easy family was developed to offer a cost-efficient, compact design. These modules are an optimized product generation for low- and medium-power industrial drives.





### 4.2.1 Easy family

With EasyPIM™ and EasyPACK™ configurations, the Easy family portfolio covers the full power range from 10 A up to 50 A in 600 V with IGBT3. This series comes in the Easy1B and Easy2B housing. The screw clamp provides a fast, reliable mounting concept.

**Selected EasyPIM™ 3-phase products - 600 V**

Product	Package	Pin	Description
FP50R06W2E3	EasyPIM™ 2B	Solder contact	PIM 3-phase input rectifier
FP50R06W2E3_B11	EasyPIM™ 2B	PressFIT	PIM 3-phase input rectifier
FP30R06W1E3	EasyPIM™ 1B	Solder contact	PIM 3-phase input rectifier
FP30R06W1E3_B11	EasyPIM™ 1B	PressFIT	PIM 3-phase input rectifier
FP20R06W1E3	EasyPIM™ 1B	Solder contact	PIM 3-phase input rectifier
FP20R06W1E3_B11	EasyPIM™ 1B	PressFIT	PIM 3-phase input rectifier
FP15R06W1E3	EasyPIM™ 1B	Solder contact	PIM 3-phase input rectifier
FP15R06W1E3_B11	EasyPIM™ 1B	PressFIT	PIM 3-phase input rectifier
FP10R06W1E3	EasyPIM™ 1B	Solder contact	PIM 3-phase input rectifier
FP10R06W1E3_B11	EasyPIM™ 1B	PressFIT	PIM 3-phase input rectifier

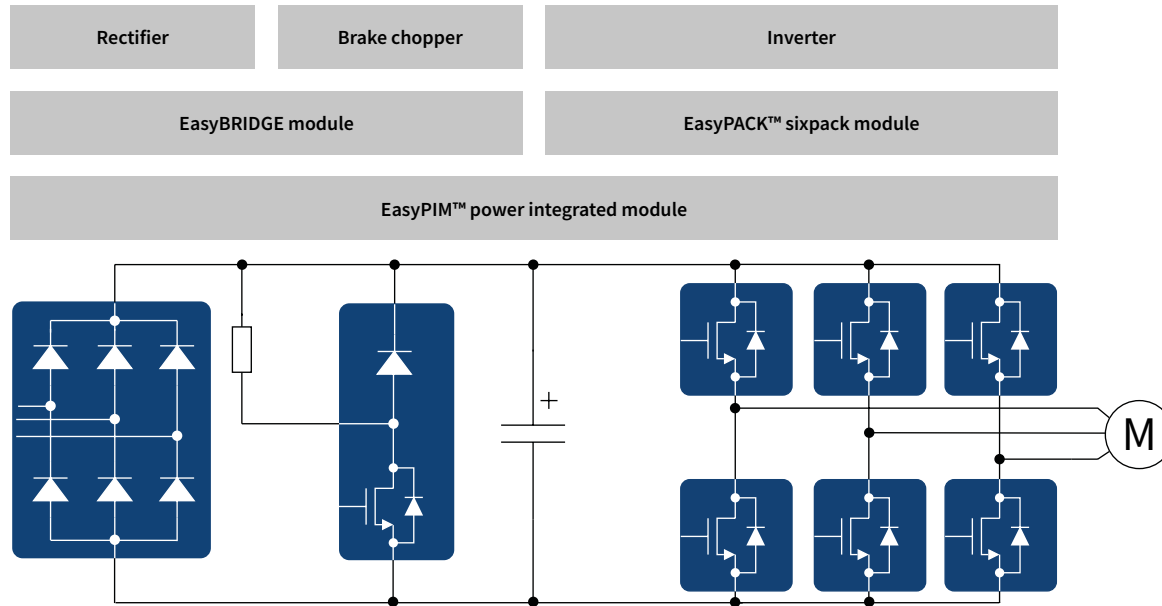
**Selected EasyPACK™ sixpack portfolio - 600 V**

Product	Package	Pin	Description
FS50R06W1E3	EasyPACK™ 1B	Solder contact	Sixpack
FS50R06W1E3_B11	EasyPACK™ 1B	PressFIT	Sixpack
FS30R06W1E3	EasyPACK™ 1B	Solder contact	Sixpack
FS30R06W1E3_B11	EasyPACK™ 1B	PressFIT	Sixpack
FS20R06W1E3	EasyPACK™ 1B	Solder contact	Sixpack
FS20R06W1E3_B11	EasyPACK™ 1B	PressFIT	Sixpack





## General purpose drive



## Thermal interface material (TIM)

With the ongoing increase of power densities in power electronics, the thermal interface between power module and heatsink becomes a larger challenge. Infineon's TIM does not only provide the lowest thermal resistance, but it also fulfils the highest quality standards given for power modules to achieve the longest lifetime and highest system reliability. TIM has been developed to fit to most of Infineon's existing power module packages as well as to upcoming future designs. Using modules with TIM applied results in highly reproducible thermal performance of power electronic applications.



# Where to buy

Infiniteon distribution partners and sales offices:  
[www.infineon.com/WhereToBuy](http://www.infineon.com/WhereToBuy)

## Service hotline

Infiniteon offers its toll-free 0800/4001 service hotline as one central number, available 24/7 in English, Mandarin and German.

- > Germany ..... 0800 951 951 951 (German/English)
- > China, mainland ..... 4001 200 951 (Mandarin/English)
- > India ..... 000 800 4402 951 (English)
- > USA ..... 1-866 951 9519 (English/German)
- > Other countries ..... 00\* 800 951 951 951 (English/German)
- > Direct access ..... +49 89 234-0 (interconnection fee, German/English)

\* Please note: Some countries may require you to dial a code other than "00" to access this international number.  
Please visit [www.infineon.com/service](http://www.infineon.com/service) for your country!



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Mobile app for iOS and Android.

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