

Service robots

Powerful. Smart. Secure.





Ushering Infineon's solutions for service robotics and AGVs that enable everyday life and work simplification

Disruptive technologies have significantly changed our lifestyle in the past few decades. Computers, the internet, mobile devices rapidly affected the way we work and live. Now a new era is on the horizon – the age of robots. Robotics will definitely revolutionize our habits, way of living, work processes and the environment that surrounds us.

A technology that is changing the future of humankind

Robotics can generally be categorized into four general types such as <u>industrial robots</u>, <u>collaborative robots</u> (<u>cobots</u>), <u>service robots</u> and <u>AGVs</u>; and further divided into subcategories based on activity fields, functionality and market demands. The industry segment employs static robots and mobile robots, AGVs – including warehouse and delivery robots - amongst them. Service robots simplify human's life and work with a special focus on one's personal physical and data protection. In professional environments, many robots are already integrated today in various areas such as hospitality, agriculture, medicine or surgery. In domestic environments, on the one hand, service robots significantly improved our quality of life by reducing the household work (e.g. vacuuming, lawn mowing, mopping and pool cleaning). Furthermore, they can be deployed as personal service robots for nursing elderly people, supporting parents entertaining and educating their kids, and even for securing. Another use case is in health applications, for example for therapeutic purposes.

We are sensing the trends

<u>Service robotics</u> applications and AGVs are affected by many emerging trends and challenges like artificial intelligence (AI), the Internet of Things (IoT), smart environments, increased connectivity, human machine interface (HMI) and wireless power. We, at Infineon - with our unique capabilities, outstanding robotics expertise and dedicated development support – offer a comprehensive portfolio of robotics solutions that meets and exceeds even your most rigorous requirements.

Infineon's solutions and their benefits for emerging trends affecting service robotics and AGVs

Artificial intelligence



Algorithms are key to this technology, but the computer power system demands are stretching the boundaries of the existing power delivery technology.

- > Infineon offers an excellent selection of components for power management and consumption, as well as for voltage regulation, including low-voltage <u>MOSFETs</u> <u>OptiMOS[™]/StrongIRFET[™]</u>, high-voltage MOSFETs <u>CoolMOS[™]</u>, <u>XMC microcontrollers</u>, <u>EiceDRIVER[™] gate driver ICs</u>, and iMOTION[™] motion control ICs.
- > All our products guarantee the highest possible energy efficiency along with top precision for increasingly efficient devices resulting in power loss reduction and superior power density.

Security and connectivity for the Internet of things, smart home, and cloud-based services



Connectivity level and the need of data security correlate, so security must be integrated into all existing and new systems.

Wireless power



Flexible movement and long operating time are key to optimize effectiveness. Cut the cables and charge without wires!

- > Security solutions like the <u>OPTIGA[™] Trust M</u> combine certified hardware security and state-of-the-art encryption technologies. They provide an anchor of trust for connected devices, giving every IoT device its own unique identity and enabling zero-touch onboarding with leading cloud providers.
- > Our customers enjoy full protection from attackers, malevolent manipulation, espionage, and data theft.
- Infineon has the most reliable and widely deployed family of Wi-Fi and Bluetooth/BLE devices in the industry. They deliver maximum RF performance, interoperability, and security.
- > We at Infineon have sophisticated inductive and resonant <u>wireless charging</u> solutions and reference designs ready for your robotics applications that use electromagnetic fields to transfer power from a transmitter to a receiver application.
- > Make the end users benefit from innovative high performance wireless charging. No more struggles with plug compatibility issues and limited movement. No contact with exposed electrical connectors increases the user's safety. Reliability in harsher environments, seamless on-the-go charging, and the charging of multiple devices in parallel are additional advantages.



Human machine interface and sensing



Safety is key when robots interact with their environment with a special focus on human safety, work safety, routing accuracy and collision avoidance. Smooth communication between people and machines requires interfacing (e.g. voice user interfaces) and accurate sensing. > A wealth of <u>sensors</u> can be fused into a robot to allow it to better understand its environment. Radar or laser sensors for collision avoidance, pressure or 3D sensors to extend the robot's capabilities. Get to know Infineon's XENSIV[™] portfolio designed for HMI features:

- XENSIV[™] radar ICs (e.g. 24 GHz radar technology)
- XENSIV[™] MEMS microphones
- XENSIV[™] 3D image sensors (REAL3[™])
- Environmental sensors such as XENSIV[™] barometric pressure sensors (e.g. <u>DPS310</u>)

Beside many more components, they support industrial and consumer robotics applications together with the XENSIV[™] family's magnetic speed, Hall and angle sensors.

- > Test and evaluate our best-in-class pressure sensors for highly sensitive airflow and pressure measurement, indoor navigation and temperature measurement. Get to know our radar solutions for collision avoidance, gesture sensing and motion/presence detection, outperforming by far alternatives like infrared or cameras. Consider our 3D imager chips for face recognition and navigation for taking your robotics project to the next level, together with our MEMS microphone technology for predictive maintenance and voice-user interface connection.
- Infineon PSoC 6 and PSoC 4 MCU families enable best-in-class HMI capabilities in robotics applications. Integrating elegant UI such as sleek buttons, sliders, and more via CapSense® capacitive-sensing is made easy with PSoC MCUs. With PSoC 6, you can even power small, rich graphical displays and perform local audio-voice processing.
- > Service robots' and AGVs' communication capabilities are very dependent on the area in which they are deployed. CAN, Wi-Fi or location services with GPS or mobile communication like LTE modules can be implemented.



Our experience, your benefits

Unique application insight	As a user and an enabler, our unique application insight adds value to every robotic system.
Real functional safety	Certified safety products combined with advanced security solutions ensure that your robotic system is actually functionally safe.
Broadest product portfolio	Our broadest portfolio features leading products with a proven track record, for the entire control loop, and accelerate your time to market.

Drawing on our insight into all facets of the robotics field, and with a comprehensive portfolio of power products and sensors as well as security solutions on offer, we are able to provide reliable system solutions that address the latest trends in robotics, and add value to nearly every robot design.

This translates directly into economic and technical benefits for our customers. When choosing Infineon's high-quality components and system solutions, you can be certain they will work together seamlessly and error free. Furthermore, our ready-to-use robotic hardware building blocks let you bring a project to market quickly by reducing the effort required for the design-in. The valuable time you save in that way can be spent developing algorithms to differentiate from competitors.

How our offering enhances your project?

Infineon can help you in multiple ways to overcome your design, construction, sensing, energy efficiency and information processing challenges.



Decrease the control box size using IGBTs, IPMs, MOSFETS, and gate drivers



Protect confidentiality, integrity and authenticity of information and devices



Misc. topologies and control functions in power modules and microcontrollers

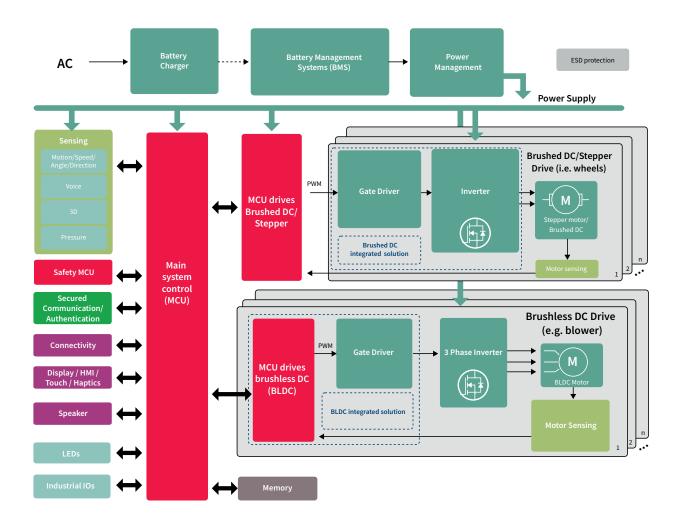


Sensors and safety controllers: torque, position, pressure, 3D image

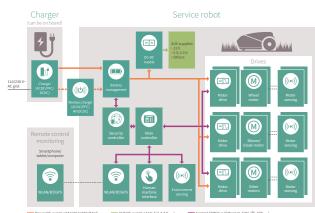


Infineon – Your one-stop-shop for a broad service robotics and AGV portfolio

The block diagram below visualizes what we mean when we call ourselves a one-stop-shop for your service robotics and AGVs projects. We are prepared to make your applications go-to-market ready, are you too?



Domestic robots - simplifying everyday life and work



Structural system overview: domestic robots

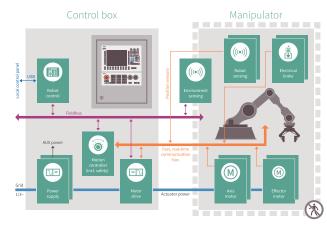
The latest generation of domestic robots is ushering in a new level of assistance and simplicity in homes and professional environments.

They directly interact with humans, which introduces unique challenges from a design perspective, especially in domestic environments. Energy efficiency, long battery life, security aspects and sensing capabilities are key to user-friendly and safe designs.

By choosing Infineon, you get a one-stop semiconductor shop for all your service-robot design needs.

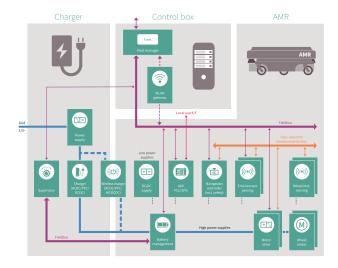
Cobots - advance through collaboration

Cobots, or collaborative robots, work outside the limitation of a safety cell, directly interacting with real people. This setup requires a precise set of design features, especially for workplace safety. With Infineon's semiconductors for cobot systems, you benefit from the expertise of an experienced and reliable partner. Our XENSIV[™] radar and sensor solutions provide the tools to uphold even the highest safety standards and allow the robots to leave their formerly fenced working environment.



Structural system overview: domestic robots

Mobile robots – driving production and logistics forward



Autonomous mobile robots (AMRs) are a self-driving force behind automated manufacturing processes. Battery-powered systems offer the highest degree of flexibility within working environments. Covering the entire product portfolio for robotic applications – from the power supply to motor drives and sensors for navigation and environment scanning as well as security – Infineon is equipped to ensure AMRs can find their way through nearly all production environments.

Structural system overview: domestic robots

Infineon's offering for service robots

We at Infineon always welcome innovative ideas and challenging projects. Turn us into your robotics partner and we will assist you in realizing them. Refer to the following portfolio table and convince yourself of our broad offering. Listed are our key enabling parts for reliable chargers, efficient power/battery management, compact <u>motor control</u>, indispensable sensors, security and more.¹⁾

Charger

Product family	Voltage class [V _{DS} max]	Package	Part number	$ \begin{array}{c} \textbf{R}_{\text{DS(on),max.}} \\ @\textbf{V}_{\text{GS}} = \textbf{10} \textbf{ V} \\ [\textbf{m} \Omega] \end{array} $
<u>CoolMOS™</u>	600	DPAK	IPD60R600P7S	600
SJ MOSFET P7			IPD60R360P7S	360
			IPD60R280P7S	280
			IPD60R180P7S	180
		SOT-223	IPN60R600P7S	600
			IPN60R360P7S	360
		TO-220FP	IPA60R280P7S	280
			IPA60R180P7S	180
	700	DPAK	IPD70R360P7S	360
			IPD70R600P7S	600
		SOT-223	IPN70R600P7S	600
			IPN70R360P7S	360
		TO-220FP	IPA70R600P7S	600
			IPA70R360P7S	360
	800	DPAK	IPD80R600P7	600
			IPD80R360P7	360
		TO-220FP	IPA80R600P7	600
			IPA80R360P7	360
<u>OptiMOS™</u>	100	TO-220	IPP045N10N3 G	4.5
	150	D2PAK	IPB048N15N5	4.8
		TO-220	IPP051N15N5	5.1
<u>StrongIRFET™</u>	100	TO-220	IRFB4110PBF	4.5
	150	TO-247	IRFP4568	5.9
<u>CoolSET™</u>	800	DSO-12	ICE5QR0680AG	800
			ICE5AR0680AG	800
<u>PWM flyback</u> <u>controller</u>	ICE5QSAG, ICE5ASAG, ICE5GSAG, ICE2QS03G			
Gate Driver ICs	EiceDRIVER™: 2	EiceDRIVER™: 2EDS8265H, 2EDN852x		
	Low Side Drivers: IR44273L			
Wireless charging	Find wireless charging portfolios for inductive and resonant solutions at: www.infineon.com/wirelesscharging			

Battery Management

Product family	Voltage class [V _{DS} max]	Package	Part number	R _{DS(on),max.} @V _{GS} =10 V [mΩ]
<u>OptiMOS™</u>	40	SuperSO8	BSC026N04LS	2.6
	60	TD-SON-8	BSC028N06NS	2.8
		HSOF-8-1	IPT007N06N	0.75
	100	TO-220-3	IPP045N10N3 G	4.5
		D²PAK 7pin	IPB017N10N5LF	1.7
		D ² PAK	IPB020N10N5LF	2.0
			IPB033N10N5LF	3.3
<u>StrongIRFET™</u>	30	DPAK	IRLR8726	5.8
		PQFN	IRFH8311	2.1
	40	DirectFET	IRL7472L1	0.45
		PQFN	IRFH7440	2.4
		TO-220	IRF1404Z	3.7
			IRFB7437	2.0
			IRFB7434	1.6
		DirectFET2	IRF7739L1	0.7
		TO-220	IRFB7440	2.5
	75	TO-220	IRFB7730	2.2
Small Signal	20	SOT-23	IRLML6244	21
MOSFETs		TSOP-6	BSL202SN	22
		SC59	BSR802N	23
	60	SOT-89	<u>BSS606N</u>	60
	100	SOT-223	<u>BSP373N</u>	240
	-20	TSOP-6	BSL207SP	41
		SOT-23	IRLML2244	54
	-30	SOT-23	BSS308PE	80
	-60	SOT-223	BSP612P	130
Gate Driver ICs	EiceDRIVER™: 2	EDN752x, 1EI	<u>DN751x</u>	
	High voltage gate drivers 200 V - 600 V: <u>6ED003L02-F2</u> , <u>6ED003L06-F2</u> , <u>6EDL04N02PR</u> , <u>6EDL04N06PT</u> , <u>2EDL05N06PF</u> , <u>2ED2304S06F</u> , <u>IRS2005S</u> , <u>IRS2005M</u> , <u>IRS2007S</u> , <u>IRS2008S</u> , <u>IRS2011S</u>			
Microcontroller XMC1000 family	XMC1100			
<u>Voltage regula-</u> <u>tors:</u> LDO and <u>DCDC switching</u> <u>regulators</u>	IFX1763, IFX54441, IFX54211, IFX30081, IFX90121, IFX91041			

Motor control

Product family	Voltage class [V _{DS} max]	Package	Part number	R _{DS(on),max.} @V _{GS} =10 V [mΩ]
<u>OptiMOS™</u>	25	PQFN 3.3x3.3 Source-Down	BSC010N04LSI	0.65
	30	PQFN 3.3x3.3	ISZ040N03L5IS	4.0
		SuperSO8	ISC019N03L5S	1.9
			ISC045N03L5S	4.5
	40	SuperSO8	ISC015N04NM5	1.5
			ISC019N04NM5	1.9
			ISC028N04NM5	2.8
			ISC036N04NM5	3.6
		PQFN 3.3x3.3	BSZ025N04LS	2.5
		PQFN 3.3x3.3 Source-Down	IQE013N04LM6	1.35
		sTOLL	IST007N04NM6	0.7
	60	SuperSO8	BSC014N06NS	1.45
			BSC027N06LS5	2.7
	80	PQFN 3.3x3.3	BSZ110N08NS5	11
		Super SO8	IPB017N08N5	2.6
		D ² PAK	IPT012N08N5	1.7
		TOLL	IPB017N08N5	1.2
	100	TOLL	IPT015N10N5	1.5
		D ² PAK	IPB020N10N5	2
	120	SuperSO8	BSC080N12LS G	8.0
	150	SuperSO8	BSC074N15NS5	7.4
		PQFN 3.3x3.3	BSZ300N15NS5	30
	200	TOLL	IPT111N20NFD	11.1
	-30	DPAK	IPD042P03L3 G	4.2
		SO8	BSO200P03S H	20
	-60	D ² PAK	IPB110P06LM	11
		DPAK	IPD380P06NM	38
<u>StrongIRFET™</u>	30	PQFN 3.3x3.3	IRLHM630	3.2
	40	PQFN 3.3x3.3	BSZ063N04LS6	6.3
		DPAK	IRFR7446PbF	3.9
		DirectFET ME	IRF7480M	1.2
		DirectFET MF	<u>IRF7483M</u>	2.3
		SuperSO8	IRFH7084	1.25
			IRFH7004	1.4
			IRFH7440	2.4
	60	SuperSO8	IRFH7085	3.2
	-30	PQFN 2x2	IRFHS9301	37
		SO8	IRF9321	7.2
		SuperSO8	IRFH9310	4.6
	40/40	SuperSO8	IRF40H210	1.7
	30/-30	S08	<u>IRF9389</u>	N27, P64
	-30/-30	SO8	IRF9362	P21, P21

Product family	Voltage class [V _{DS} max]	Package	Part number	R _{DS(on),max.} @V _{GS} =10 V [mΩ]
Small Signal	20	SOT-23	IRLML6244	21
MOSFETs		TSOP-6	BSL202SN	22
		SC59	BSR802N	23
	30	SOT-23	IRLML00130	27
		SOT-23	<u>BSS306N</u>	57
	40	SOT-23	IRLML0040	56
	60	SOT-89	BSS606N	60
		SOT-23	IRLML0060	92
	100	SOT-23	IRLML0010	220
		SOT-223	<u>BSP373N</u>	240
	-20	TSOP-6	BSL207SP	41
		SOT-23	IRLML2244	54
	-30	SOT-23	IRLML9301	64
		SOT-23	BSS308PE	80
Gate Driver ICs	EiceDRIVER™ 1EDN7550, 2EDL811x			
	High voltage gate drivers 200 V - 600 V: <u>6ED003L02-F2</u> , 6ED003L06-F2, 6EDL04N02PR, 6EDL04N06PT, 2EDL05N06PF, IRS2005S, IRS2005M, IRS2007S, IRS2008S, IRS2011S			
	Integrated gate drivers ICs: <u>IFX9201/2</u> , <u>NovalithIC™ BTN8982TA</u> , <u>Trilith IC BTM7752G</u>			
	Automotive Embedded Power ICs: TLE986x family. TLE987x family			
Microcontroller XMC1000/4000 families	<u>XMC1100, XMC1200, XMC1300, XMC1400, XMC4200, XMC4400, XMC4500, XMC4700, XMC4300, XMC4800</u>			
<u>iMOTION™</u>	IRMCK099M, IMC101T-T038, IMC101T-Q048, IMC101T-F064			
Hall switches	TLE496x: TLI4961-1M, TLI4963-1M			
Angle sensor	TLI5012B, TLE5501			
Current sensor	<u>TLI4971</u>			

Sensors and peripherals

Product family	Part number	
Hall switches	TLE496x: TLE4964-1M, TLI4965-5M	
Angle sensor	TLI5012B, TLE5501	
Interface	Industrial CAN transceiver IFX1050, IFX1051	
ISOFACE™ industrial interface ICs	ISO1H81xG family, ISO2H823V, ISO1I81xT family	
PROFET [™] Smart high side switches	BTT6200-4EMA, BTT6200-1EJA, BTT6100-2EKA, BTT6050-1EKA, BTT6050-2EKA, BTT6030-2EKA, BTT6030-1EKA, BTT6030-2EKB, BTT6020-1EKA, BTT6010-1EKA, BTT6010-1EKB	
XENSIV [™] <u>Pressure sensor</u>	DPS310, DPS422	
XENSIV™ 24GHz radar	BGT24M/L family	
XENSIV™ MEMS microphone	<u>IM69D130</u>	
Class D Audio Amplifier	IR43x1M, IR43x2M	
Security device authentication, data and IP protection	<u>OPTIGA™ family: OPTIGA™ Trust X SLS32AIAX4,</u> <u>OPTIGA™ Trust B SLE 95250, OPTIGA™ TPM</u>	
LNAs	BFP842ESD, BFR840L3RHESD, BFR843EL3	
LED drivers	Linear driver ICs: <u>BCR3xx family</u> , <u>BCR4xx family</u>	
	DCDC switch mode: <u>ILD4xxx family</u> , <u>ILD6xxx family</u>	

Connectivity and HMI

Product family	Part number
PSoC 6 Microcontrollers	PSoC 61: Programmable line (single Cortex-M4)
	PSoC 62: Performance line (dual-core Cortex-M4/M0+)
	PSoC 63: Connectivity line (integrated BLE 5 radio)
	PSoC 64: Security line (integrated application security)
PSoC 4 Microcontrollers	PSoC 4000: Entry-level (CapSense MCU)
	PSoC 4100: Intelligent analog (+programmable analog blocks)
	PSoC 4200: Programmable digital (+programmable digital blocks))
	PSoC 4700: Sense anything (+inductive-sensing)
<u>Wi-Fi + Bluetooth Radios</u>	CYW4373E: 1X1 DB 802.11ac + dual-mode Bluetooth
	CYW4343W: 1X1 802.11n + dual-mode Bluetooth
Wi-Fi MCU Platform	Explore PSoC 6 Wi-Fi Host MCU + CYW43x Solutions
Dual-Mode Bluetooth SoCS	<u>CYW20819</u> : Ultralow-power Cortex-M4. Bluetooth-Mesh-compliant
	CYW20735: Cortex-M4 with internal PA. Bluetooth-Mesh-compliant
	CYW20706: Cost-optimized Cortex-M3. Bluetooth-Mesh-compliant
Bluetooth LE only SoCs	PSoC 63 BLE: Dual-core Cortex-M4/M0+ with rich peripherals
	PSoC 4 BLE: Cortex-M0 with rich peripherals
	CYW20736: Cost-optimized Cortex-M3
OPTIGA™	OPTIGA [™] Trust M SLS32AIA: secured communication to the cloud or other devices
3D Magnetic sensor	TLx493D, TLI493D-A2B6, TLE493D-A2B6, TLE493D-W2B6 A0

¹⁾ Note that only key enabling products are listed here. For complete portfolio, please visit <u>www.infineon.com/service-robotics.</u> Through this page, you will be linked to different product pages offering the full portfolio of the specific products you are interested in.

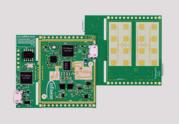
Demoboards and evaluation kits

Find the right board or evaluation kit for the development, prototyping and testing of your future service robotics and AGV applications.

Microcontrollers



XENSIV[™] radar sensor ICs



Demo Distance2Go

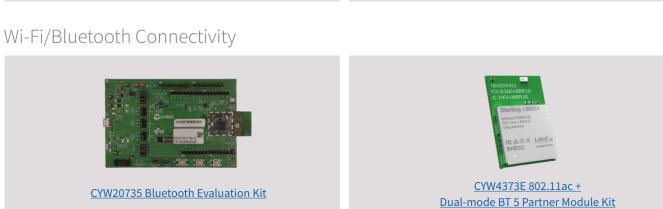


Demo Sense2GoL

Motor drive



40 V Medium Can ME/MF DirectFET™ three-phase BLDC board





XENSIV™ MEMS microphones





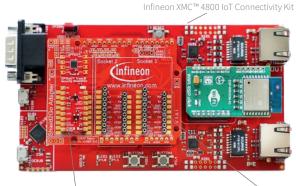
S2GO PRESSURE DPS310

XENSIV[™] pressure sensors



OPTIGA™ Trust M Evaluation Kit

Find the right board or evaluation kit for the development, prototyping, and testing of your future service robotics and AGV applications.



Infineon OPTIGATM Trust M Shield2Go

Infineon My IoT Adapter



Evaluation Kit

- > Showcasing application of OPTIGA[™] Trust M
- > Based on Infineon XMC[™] 4800, My IoT adapter and OPTIGA[™] Trust M Shield2Go
- > Wi-Fi connectivity
- > Software framework and application notes on GitHub
- > The OPTIGA[™] Trust Charge evaluation kit serves to demonstrate the OPTIGA[™] Trust Charge functionalities and typical applications such as power transmitter authentication for wireless charging
- > The evaluation kit allows users to connect and explore the OPTIGA[™] Trust Charge through the I2C interface
- > Customers can use the evaluation kit for design-in or to evaluate the features of the OPTIGA[™] Trust Charge and receive a reference system for their own wireless charging application
- > The evaluation kit combines our turnkey authentication solution with a powerful microcontroller: the evaluation kit is based on the XMC4700 Relax kit with extension board (My lot adapter)
- > OPTIGA[™] Trust Charge chip is included
- > Open source code makes integration easy and user friendly. Open source code and Getting Started Guide are hosted on GitHub:
 - https://github.com/Infineon/optiga-trust-charge
 - Includes an application note which shows a reference integration into a wireless charging system using Qi 1.3 protocol messages preparation
- > Ordering part number: TRUSTCHARGEEVALKITTOBO1
- > Website with more information: www.infineon.com/OPTIGA-Trust-Charge-kit

3D Sensors



Position Sensor 2-Go Kits



PSoC or 3rd party MCU: PSoC or 3rd-party MCU running RTOS 3rd-party SoC running Linux OS

Security



OPTIGA™ Trust M Evaluation kit based on Infineon's XMC™ 4800, MyIoT adapter and OPTIGA™ Trust M Shield2Go



PSoC[®] 64 Standard Secure - AWS Wi-Fi BT Pioneer Kit (CY8CKIT-064S0S2-4343W)4

For further information on our components for service robotics and AGVs visit: www.infineon.com www.infineon.com/robotics www.infineon.com/service-robotics www.infineon.com/cms/en/discoveries/fundamentals-robotics/ www.infineon.com/automatedguidedvehicles

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- > 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)

* Please note: Some countries may require you to dial a code other than "00" to access this international number. Please visit <u>www.infineon.com/service</u> for your country!

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Due to technical requirements, our products may contain dangerous substances. For information on the types in question, please contact your nearest Infineon Technologies office.

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