System Solution Guide - Preview

Smart and Mobile Robotics

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Table of Contents

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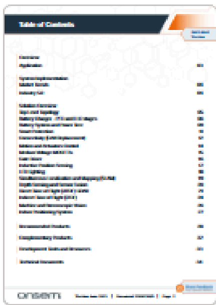
1

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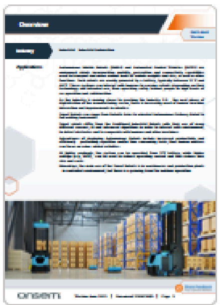
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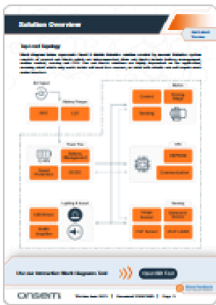
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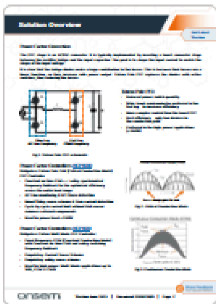
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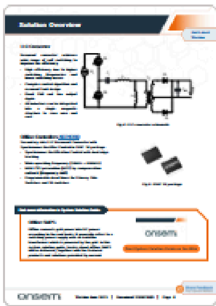
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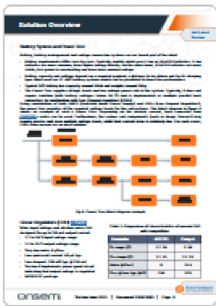
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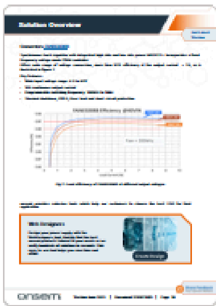
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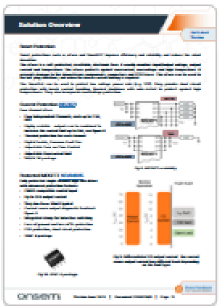
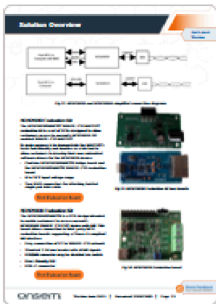

11

12

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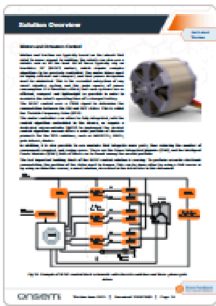
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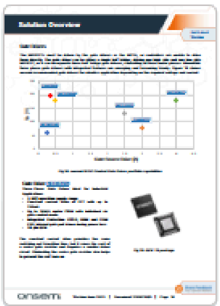
15

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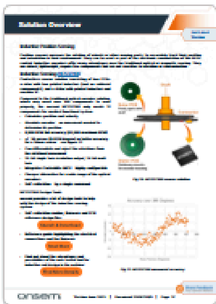
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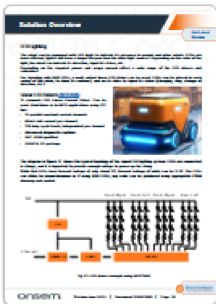
18

19

20

Block Diagram

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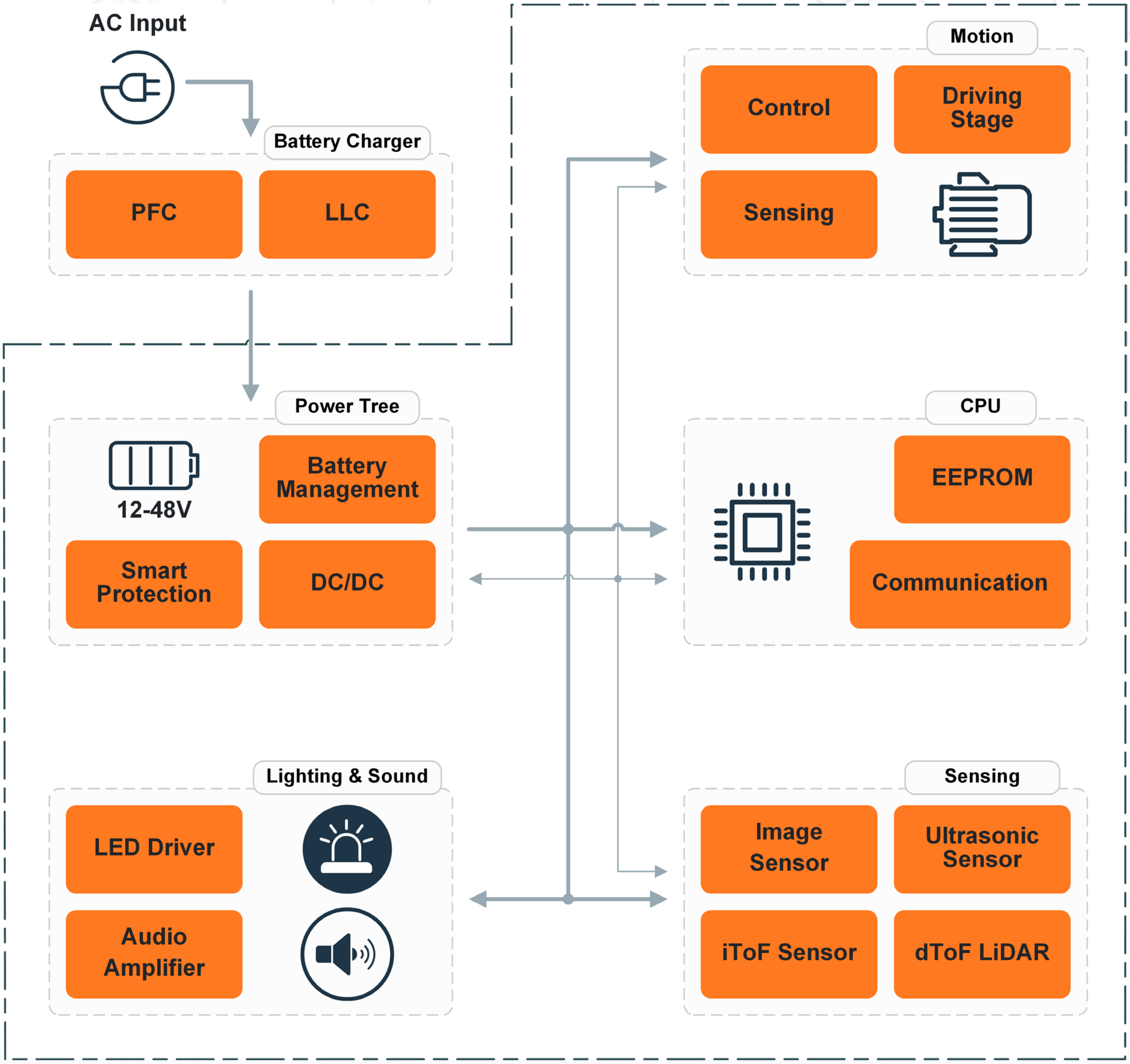
Top Level Topology

Block diagram below represents Smart & Mobile Robotics solution created by onsemi. Robotics system consists of several sub-blocks which are interconnected. Main sub-blocks include battery management, motion control, sensing and CPU. The sub-blocks solutions are highly dependent on the application, meaning robot which only works inside will need less sensors, or robot with robotic arm will require more motor inverters.



Use our Interactive Block Diagrams Tool

Open IBD Tool

Solution Overview

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Connectivity (CAN Replacement)

The CPU and all the building blocks in AMR need to communicate with each other. There are many means of communication available. Traditionally CAN, LIN, RS-485, RS232 and many others have been used. All of these can be replaced by **10Base-T1S**.

It is an **Ethernet** protocol specified by **IEEE** in the 802.3cg clause 147 specification. With 10BASE-T1S, multiple PHYs can be connected to a common bus using only a single twisted pair. This reduces the number of switch ports required and eliminates the need for gateways. The fact that 10BASE-T1S requires only a single unshielded twisted pair also dramatically reduces cabling costs.

- What's more, 10BASE-T1S can communicate at up to 10Mbps, which is higher than many of the solutions used to date (e.g., LIN up to 20Kbps, CAN up to ~1Mbps).
- Any node can send and receive Ethernet frames to/from any other node, similar to traditional Ethernet LAN.
- Physical Layer Collision Avoidance (**PLCA**) allows packet collisions to be avoided when operating in a multidrop topology (as shown in figure 7). Based on their ID, nodes take their turn (one at a time) to transmit on the bus. The PLCA cycle is not fixed and depends on the pending data.

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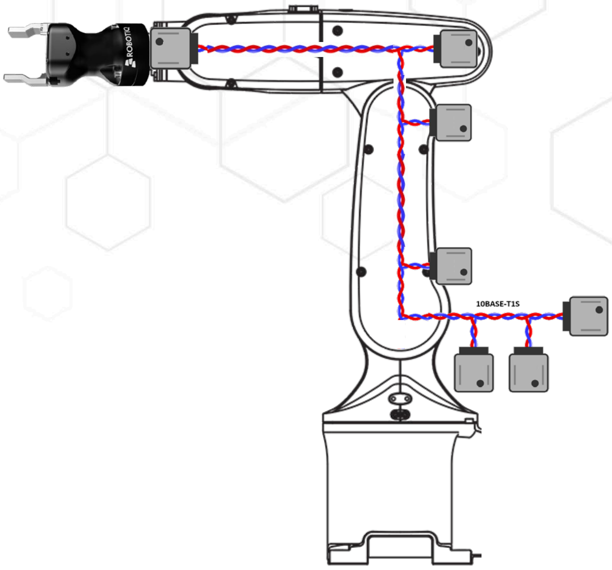

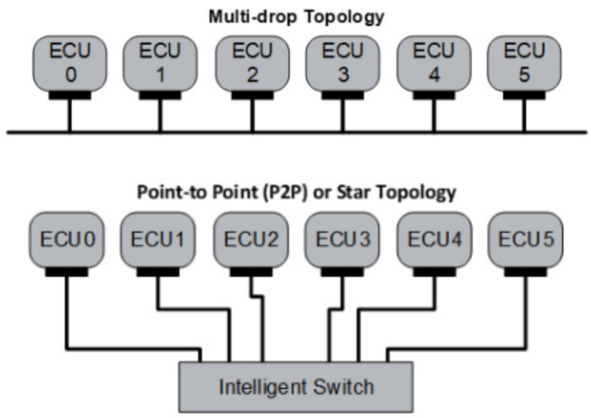

Fig.11: Multi-drop vs Point-to-Point network topology

Ethernet Controllers NCN26010

10Mb/s Industrial Ethernet MAC+PHY IC controller

- 10BASE–T1S – IEEE 802.3cg Compliant
- Integrated MAC and 10BASE-T1S PHY
- PLCA burst mode – if any node needs to send more data than all others, it is allowed more frames per PLCA transfer opportunity
- Supports >8 Nodes over >25m UTP cable
- Enhanced noise immunity
- Globally unique MAC address
- 32pin QFN package

Fig.13: 10BASE-T1S MACPHY Evaluation kit

Find Evaluation Board

Inductive Position Sensing

Position sensors measure the rotation of wheels or other moving parts, to accurately track their position and orientation in their environment. They can be used as part of the electronic commutation of the BLDC control. Inductive encoders offer many advantages over the traditional optical or magnetic sensing.

They are robust, lightweight, require few components and are not sensitive to vibration or contamination.

Inductive Sensing NCS32100

Contactless sensor solution consisting of two PCBs: a rotor with two printed inductors (and no soldered components), and a stator with printed inductors and encoder IC.

Compared to the traditional optical encoder solution, which may need over 100 components to work properly, the **onsemi** NCS32100 only needs 12 components for smallest functional system.

- Calculates position and velocity
- **Absolute encoder** – no movement needed to determine its position
- 6,000 RPM full accuracy (45,000 maximum RPM)
- +/- 50 arcsec (0.0138 degree) or better accuracy for a 38mm sensor – see figure 16
- Can differentiate and reject the vibrations from the rotational movement
- 20-bit single-turn resolution output, 24-bit multi-turn
- Integrates CortexM0+ MCU – highly configurable
- Cheaper alternative for a wide range of the optical encoders
- Self-calibration – by a single command

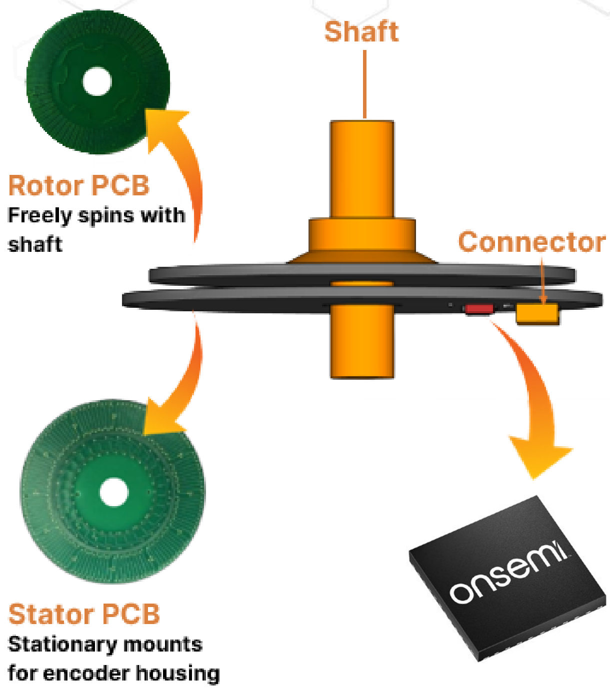

Fig.20: NCS32100 sensor solution

NCS32100 Design Tools

onsemi provides a lot of design tools to help with the design of the inductive sensing system

- Self-calibration routine, firmware and PCB reference design files

Search & Download

- Reference guide highlighting the electrical connections and the firmware

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- Find out about the advantages and possibilities of the web-based tool for inductive coil design in the webinar

Find More Details

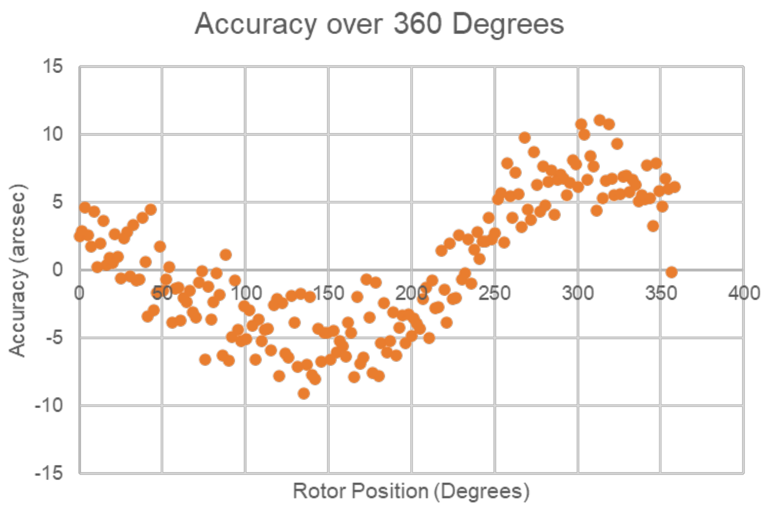

Fig.21: NCS32100 measured accuracy

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