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Application Note

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Using the S12ZVC Device for Industrial Applications

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1. Introduction

The S12ZVC family offers smart and optimized integration of high voltage components, with a high reliability certification from its automotive context. This provides a number of advantages that can be leveraged in the industrial sector.

Built upon LL18UHV technology, the S12ZVC combines highly reliable 180 nm non-volatile memory with high voltage analog components capable of excellent performance even in the harshest industrial environments.

The S12ZVC integrates a CAN physical layer, ESD protected 12 V input pins capable of ADC measurement, 12-bit resolution ADC with internal VSUP monitoring, 16 ns resolution PWM and Timer, and a voltage regulator operating between 3.5 V and 40 V to supply power to on and off chip functions.

2. Industrial application examples

Factory automation equipment is ruggedly constructed for fanless operation in a harsh industrial environment. The S12ZVC provides the following advantages integrated for industrial applications:

- Zero PPM, high temperature, and high reliability
- Integrated CAN PHY for industrial device communication
- High voltage analog and digital inputs
- 16 ns resolution, 16-bit PWM, and Timer
- Integrated voltage regulator

The following sections illustrate some industrial applications that can be implemented using the S12ZVC features.

2.1. Human Machine Interface (HMI)

HMI's are used to monitor and control a wide range of electronic systems, such as our home thermostats, building elevators, bank kiosks, gas pumps, manufacturing operator panels, and data access terminals.

A human machine interface implemented with the S12ZVC can implement (among others) the following features using the on chip features:

- CAN communication for sending/receiving information from other industrial devices
- Status LEDs and keypads
- A serial diagnostic interface to communicate over RS232 or RS485 with other industrial devices
- Analog and digital inputs up to 12 V
- Analog and digital outputs up to 5 V
- Audible feedback or sound for the user, using PWM and a buzzer or speaker.

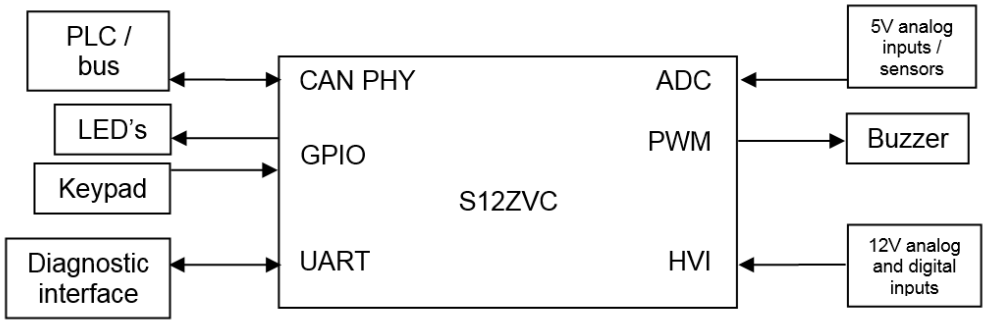

Figure 1. HMI block diagram

2.2. Input output control

An input output (I/O) controller connects to sensors and controls actuators in a factory or process environment. It communicates with multiple end nodes using multiple binary and analog input outputs such as voltage loops, and/or fieldbus. Intrinsically safe systems connect via level translation and optical isolation.

The following block diagram illustrates an example of such an application using the S12ZVC device.

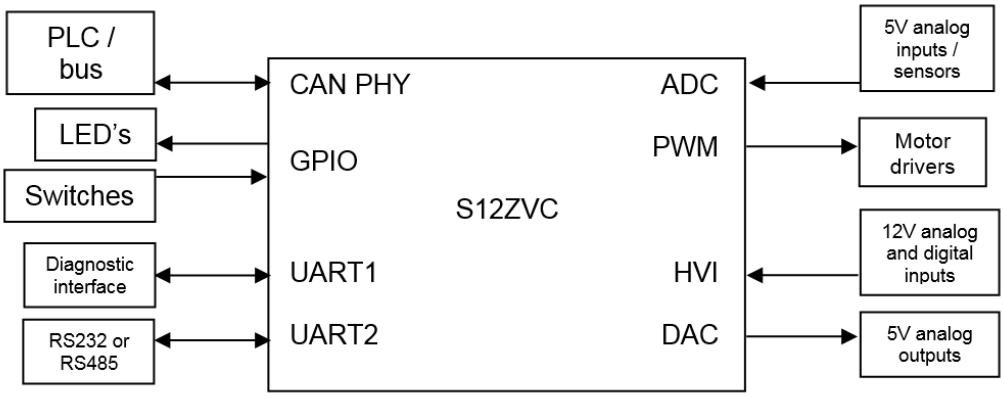

Figure 2. Input output control block diagram

2.3. Process and/or temperature control

A process controller or temperature controller connects to sensors, actuators, and switches to control industrial processing parameters such as temperature, pressure, flow, and fluid level. It communicates with multiple end nodes using binary and analog input/outputs such as voltage loops. Intrinsically safe systems connect via level translation and optical isolation to avoid spark.

Process and/or temperature controller systems share a similar block diagram with input output controllers. The following S12ZVC features stand out when the S12ZVC is used as a process or temperature controller:

- **CANPHY**: Integrated high speed CAN interface for baud rates of up to 1 Mbit/s. No need for external physical interface chip. ISO 11898-2 and ISO 11898-5 compliant.
- **HVI**: 2x High voltage digital inputs up to 12 V with integrated voltage divider. Can be routed to ADC for monitoring 12 V range analog signals.
- **DAC**: Integrated 8-bit resolution analog output. Usable as standalone operational amplifier for analog outputs from 0 V to 5 V.
- **ACMP**: integrated analog comparator with rail to rail inputs, selectable internal and external inputs, selectable hysteresis, and support for triggering input capture events for directly measuring and handling analog compare events.
- **PWM & Timer**: 16 ns resolution PWM and Timer channels for high speed digital control and measurement.

2.4. Programmable logic control

A programmable logic controller (PLC) controls machines and processes with fast, deterministic operation to manage functions such as logic sequencing, timing, counting, and arithmetic algorithms. It communicates with end nodes using voltage loops, field bus communication protocol. Factory automation equipment is ruggedly constructed for fanless operation in a harsh industrial environment.

3. Summary

Using the S12ZVC device in industrial application can enable lowering the system part count and the PCB size. This can bring the following added value advantages:

- Reduced PCB due to integration
- Reduced system cost
- Less points of failure due to reduced part count
- Integrates analog functions such as:
  - Digital to Analog Converter (DAC)
  - Analog comparator
  - Operational Amplifier
  - High voltage inputs
  - Voltage regulator
  - CAN physical layer
- High temperature operation
- High reliability (zero PPM defects)
- ISO26262 compliant under the Freescale Safe Assure Program for safety applications

4. Reference material

For more information about the S12ZVC, visit www.freescale.com/S12ZVC.

The following application notes (with accompanying software) are available at freescale.com:

- AN4975: Using MSCAN on the MagniV Family.
- AN4851: Using the high resolution timer and PWM in the S12ZVC.
- AN4852: Using the SENT Transmitter module in S12ZVC devices.

For more information about MagniV automotive and industrial mixed signal microcontrollers, visit www.freescale.com/MagniV.

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