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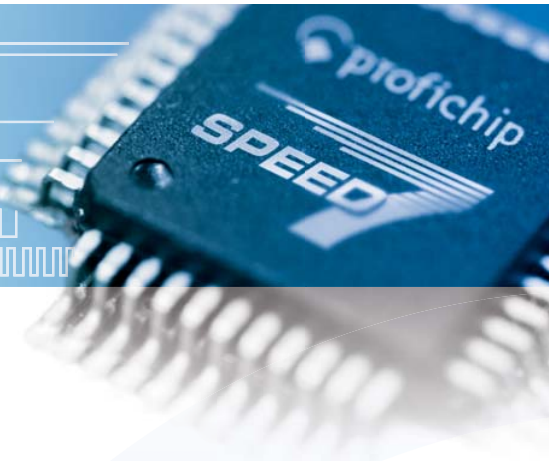
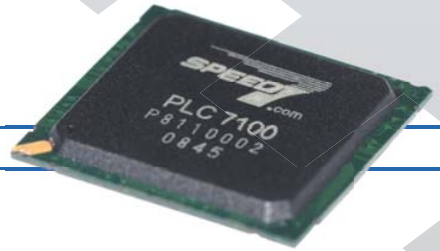


Single-chip PLC for STEP7 from Siemens

PLC7100



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PLC7100
Single-chip PLC for STEP7 from Siemens

The PLC7100 is the latest member of profichip's successful SPEED7 PLC processor family. Though based on its well-known predecessors the PLC7100 goes one step ahead: apart from an external DRAM and a non-volatile boot media it combines all the necessary system components to build a STEP7 programmable PLC CPU on a single piece of silicon. Equipped with a rich set of direct IO and communication features the PLC7100 is suited perfectly well to replace proprietary solutions by a new generation of single-chip PLCs supporting a popular and widely-used PLC programming language, tool chain and service capabilities.

Direct I/O Functions

The PLC7100 provides a maximum number of 24 digital inputs and 16 digital outputs. Besides the standard I/O functionality versatile interface features are available: the inputs can be configured to trigger an alarm with very low latency or to carry out various hardware counter functions like up/down, A/B for rotary encoders or frequency and pulse measurement. Functions like 4 channel Pulse-Width-Modulation or Stepper Motor Control and an SSI interface round up the very flexible I/O capabilities. Due to sharing common interface pins some restrictions apply which I/O functions can be used simultaneously but no matter which I/O functions are selected all inputs and outputs are mapped directly into the PLC process image resulting in very low latency and fast access times.

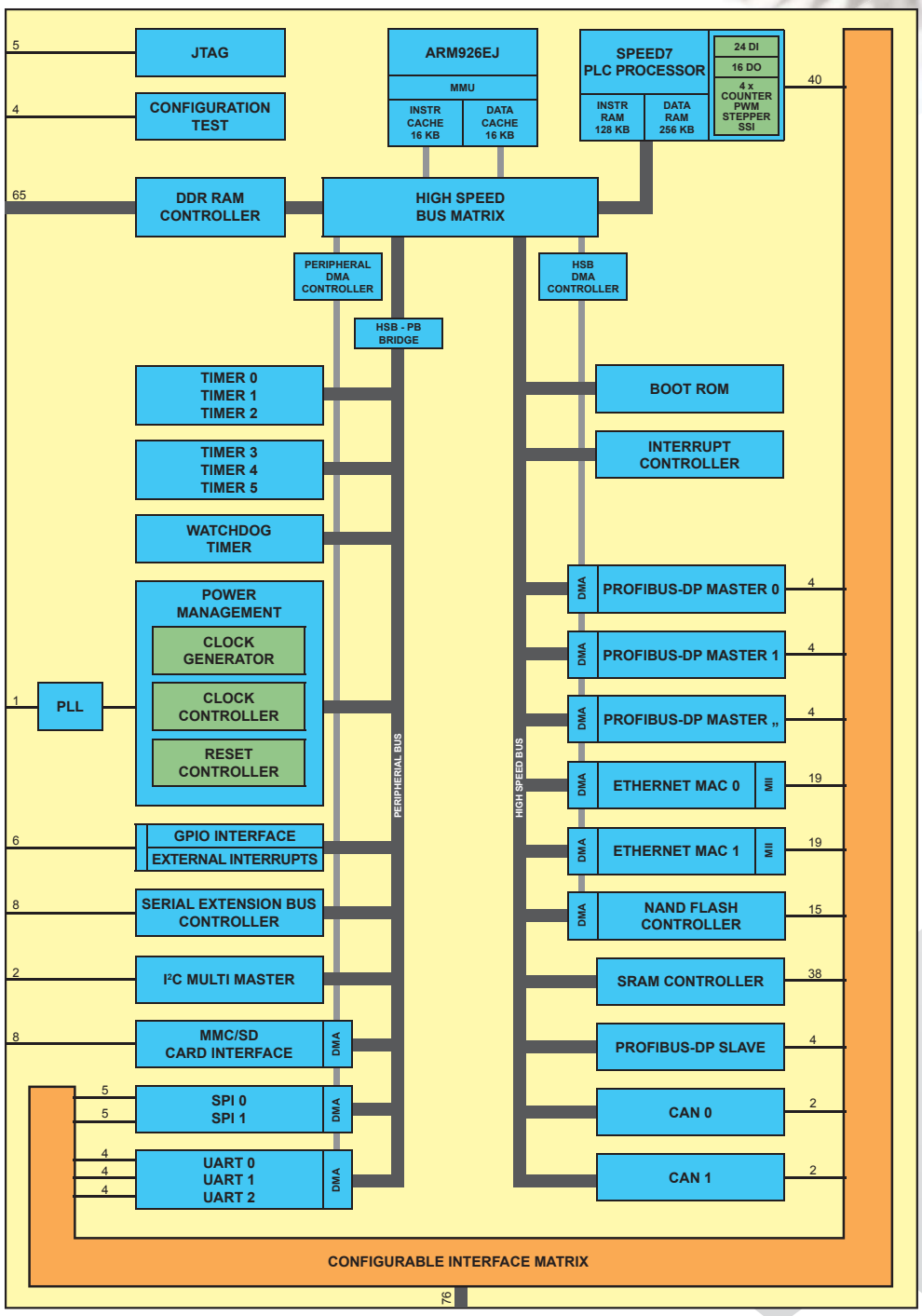
Communication Interfaces

The PLC7100 leaves almost nothing to be desired with respect to industrial communication. Three Profibus-DP masters are tailor-made for the PLC7100 system architecture and can be additionally used for MPI communication, profichip's well-known VPC3+C Profibus slave supporting all DPV0, DPV1 and DPV2 services and two CAN interfaces with flexible message box and FIFO modes ensure a seamless connectivity to the most important fieldbus protocols worldwide. The two 10/100 Ethernet-MACs can be used for PG/OP communication, standard Ethernet protocols or Ethernet-based industrial communication protocols. Numerous serial standard interfaces like three UARTs, two SPI channels, an I2C Multi-Master-Interface along with an SD/MMC and a NAND-Flash interface to connect non-volatile boot and backup memories complete the broad range of communication features. The communication concept is very flexible and there are few restrictions on using several interfaces simultaneously due to shared pins.

Software Support

The S7 operating system and the communication stacks are running on the integrated ARM926EJ Processor with 16kB/16kB cache. Together with cooperation partners profichip will offer different software packages for the chip. Depending on their requirements customers can choose from a set of pre-configured software bundles which are then licensed with the chip. User applications are recommended to be written in STEP7; directly programming the ARM processor is not supported.

For writing and debugging the STEP7 program all the available standard tools can be used. Debug features like single-stepping, setting breakpoints and real-time watching are supported by the PLC7100. Download of the MC7 code as well as using online functions is possible via MPI interface or by using an Ethernet Port in PG/OP mode. Alternatively the PLC program can be stored on a non-volatile media (SD/MMC or NAND-Flash) for initial download or backup.


JTAG
CONFIGURATION TEST
ARM926EJ
MMU
INSTR CACHE 16 KB
DATA CACHE 16 KB
SPEED7 PLC PROCESSOR
INSTR RAM 128 KB
DATA RAM 256 KB
24 DI
16 DO
4 x COUNTER PWM STEPPER SSI
DDR RAM CONTROLLER
HIGH SPEED BUS MATRIX
PERIPHERAL DMA CONTROLLER
HSB DMA CONTROLLER
HSB - PB BRIDGE
TIMER 0 TIMER 1 TIMER 2
TIMER 3 TIMER 4 TIMER 5
WATCHDOG TIMER
POWER MANAGEMENT
CLOCK GENERATOR
CLOCK CONTROLLER
RESET CONTROLLER
PLL
GPIO INTERFACE
EXTERNAL INTERRUPTS
SERIAL EXTENSION BUS CONTROLLER
I²C MULTI MASTER
MMC/SD CARD INTERFACE
SPI 0 SPI 1
UART 0 UART 1 UART 2
BOOT ROM
INTERRUPT CONTROLLER
PROFIBUS-DP MASTER 0
PROFIBUS-DP MASTER 1
PROFIBUS-DP MASTER „
ETHERNET MAC 0
ETHERNET MAC 1
NAND FLASH CONTROLLER
SRAM CONTROLLER
PROFIBUS-DP SLAVE
CAN 0
CAN 1
DMA
MII
PERIPHERAL BUS
HIGH SPEED BUS
CONFIGURABLE INTERFACE MATRIX
76

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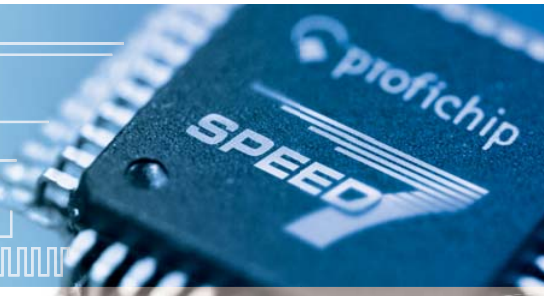

Features:

Features	PLC7100	PLC7200
PLC Assembler Code	MC7	MC7
PLC Memory (Data/Instruction)	256kB / 128kB	16MByte [3]
System Interfaces [1]		
SRAM Interface	8/16Bit x 64k	8/16Bit x 64k
On-Chip I/Os	24DI / 16DO	24DI / 16DO [3]
Alarms (e.g. OB 40)	16	16 [3]
Counter (Up, Down, A/B, etc.)	4 x 32Bit	4 x 32Bit [3]
PWM , Stepper Control	4	4 [3]
SSI In/Out-Master	1/1	1/1 [3]
General Purpose I/Os	6	6
ser. Extension Bus P-Bus/HSB	✓/✓	✓/✓
Communication Interfaces [1]		
PROFIBUS-DP master / MPI (12MBit/s)	1	3
PROFIBUS-DP slave (12MBit/s)	1	1
CAN 2.0 A/B	2	2
Ethernet 10/100	1	2
Standard Serial (UART)	2	3
Serial Peripheral Interface (SPI)	2	2
I²C Multi-Master	1	1
SD / MMC Interface	1	1
NAND-Flash Controller	1	1
PLC System Counter and Timer		
Instruction Cycle Time	20nsec	5nsec
Counter	2048	2048
Timer 10 msec. min	2048	2048
High-Resolution Timer 1µsec.	n [2]	n [2]
IEC Timer	max [2]	max [2]
RTC (no backup)	✓	✓
Technical Data		
Core Supply Voltage	1,2V	1,2V
I/O Voltage	3,3V / 2,5V	3,3V / 2,5V
Clock Supply (Crystal Oscillator)	48MHz	48MHz
Max. Power Consumption	< 1,3W	~ 1,5W
Temperature Range	-40°C - +85°C	-40°C - +85°C
Package	BGA 256, Pitch 1,0 mm	BGA, Pitch 1,0 mm

1) The listed values represent the total number of integrated interfaces. Depending on the system configuration not all interfaces can be used simultaneously.
2) Limited by available memory only.
3) Depending on external interface

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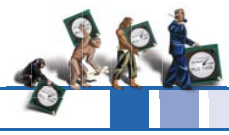

Date of Issue: 02|2010

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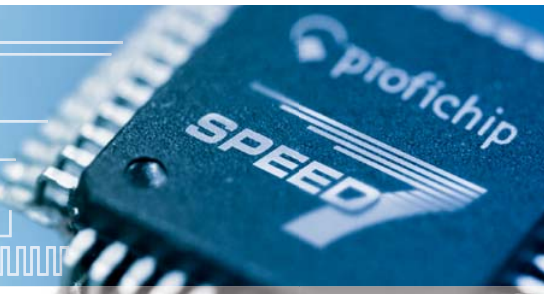


Embedded PLC module for STEP7 from Siemens

SODIMM-PLC 7001

Powerful, tiny and easy-to-use these are the attributes of profichip's SODIMM-PLC module. Equipped with a rich set of direct IO and communication features, programmable in Step7 from Siemens and up to 512kB of PLC user memory this module is the ideal extension to various types of applications where fast, deterministic and reliable hardware PLC control in a small form factor is required. Board Controllers, HMIs and a broad range of machinery can benefit from new control capabilities and direct IO- and communication functions. Supporting a very popular programming language, a well-known tool chain and extensive maintenance features will further increase the market acceptance and success of the final product.

I/O Functions

The SODIMM-PLC module is build around profichip's PLC 7001 chip. Based on the core of the PLC 7000 which has been in use for almost four years in over 10.000 applications worldwide, the PLC 7001 offers extended IO features with up to 32 digital inputs and 24 digital outputs directly on-chip. The IO interface is configurable to provide high level user functions like numerous hardware counter modes.
16 digital inputs can be employed with on-chip alarm functionality which results in low latency and fast response times upon critical system conditions and provides the capability to capture time critical events very accurately. The build-in Real-Time-Clock which can be buffered by an external battery allows precise timestamping and clock synchronized control tasks. SSI interface for rotary encoders, 4-channel Pulse-Width-Modulation and Stepper-Motor-Control are to be supported in future firmware updates.
If more than 56 digital I/O bits or analog functions are needed a serial I/O bus is provided which can be operated with up to 32 peripheral modules compatible with System 200V from VIPA.

User Data Interface

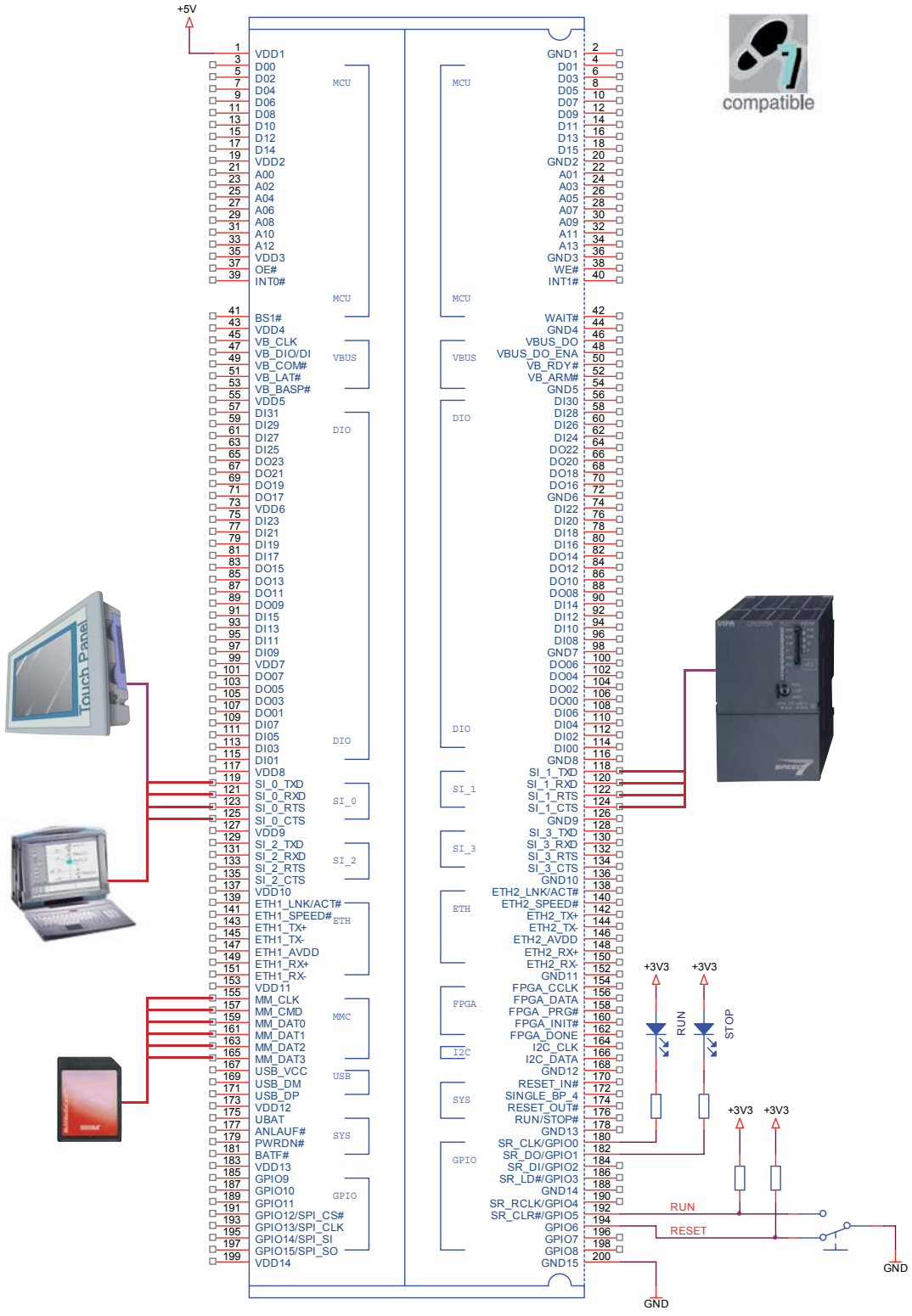
For maximum flexibility and convenient adaption the SODIMM-PLC module is equipped with a 16 bit SRAM interface to an external FPGA or Dual-Port-RAM with up to 1024 bytes address space mapped into the PLC I/O area. This interface can be used to easily share data of external communication interfaces like PROFIBUS- or CAN-Master with the integrated PLC memory as well.

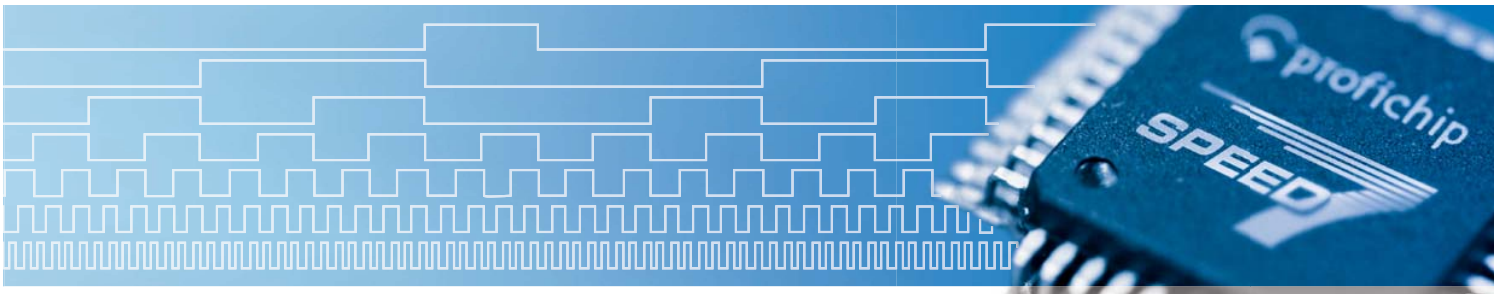
Communication Interfaces

Currently there are three serial interfaces and one Ethernet port available on the SODIMM-PLC module. The serial interfaces are dedicated to MPI communication, PROFIBUS-DP Slave interface (both supporting transmission rates up to 12 MBit/s) and a serial standard interface (e.g. for establishing a Point-To-Point (PtP) communication). The Ethernet port is restricted to PU/OP functionality like hardware configuration, PLC program download and online functions. Alternatively the MPI interface can be used for system setup, program update, debugging and online functions.

SODIMM-PLC 7001	SO-313SC-2DP	max. config.
PLC Core CPU	PLC 7001	
PLC Assembler Code	MC7	
PLC Memory (Data/Code)	32kB / 32kB	256kB / 256kB
PLC Memory Extension up to	256kB / 256kB	-
System Frequency	48MHz	
Internal Cycle Time	20 nsec.	
System Interface		
User Data / Extension Port	DPR Interface (16Bit / 1024Bytes)	
On-Board I/Os	16DI / 16DO	32DI / 24DO
Alarms (e.g. OB 40)	16	
Counter (Up, Down, A/B, etc.)	3 x 32Bit	4 x 32Bit
SSI In/Out-Master	-/-	1/1
Backplane-Bus, ser. I/O-Bus	✓	
Communication Interfaces		
Ethernet 10/100 (PU/OP)	1x	
MPI	1 x 187,5kBit/s	1 x 12MBit/s
PROFIBUS-Slave, 12 MBit/s	1x	
Standard Serial	1x	
SD / MMC	1x	
PLC System Counter and Timer		
Counter	512	
Timer 10 msec.	512	
High Resolution Timer 1µsec.	max *	
IEC Timer	max *	
RTC (+ext. Battery for Backup)	✓	
Operation Conditions		
Core Supply Voltage	5,0 V	
I/O Voltage	3,3 V	
Power Consumption	2,0 W	
Temperature Range	- 25°C - + 60°C	

* limited by available memory only


+5V
compatible
Touch Panel
VDD1 D00 D02 D04 D06 D08 D10 D12 D14 VDD2 A00 A02 A04 A06 A08 A10 A12 VDD3 OE# INT0#
BS1# VDD4 VB_CLK VB_DIO/DI VB_COM# VB_LAT# VB_BASP# VDD5
DI31 DI29 DI27 DI25 DO23 DO21 DO19 DO17 VDD6 DI23 DI21 DI19 DI17 DO15 DO13 DO11 DO09 DI15 DI13 DI11 DI09 VDD7 DO07 DO05 DO03 DO01 DI07 DI05 DI03 DI01 VDD8
SI_0_TXD SI_0_RXD SI_0_RTS SI_0_CTS VDD9 SI_2_TXD SI_2_RXD SI_2_RTS SI_2_CTS VDD10
ETH1_LNK/ACT# ETH1_SPEED# ETH1_TX+ ETH1_TX- ETH1_AVDD ETH1_RX+ ETH1_RX- VDD11
MM_CLK MM_CMD MM_DAT0 MM_DAT1 MM_DAT2 MM_DAT3 USB_VCC USB_DM USB_DP VDD12 UBAT ANLAUF# PWRDN# BATF# VDD13 GPIO9 GPIO10 GPIO11 GPIO12/SPI_CS# GPIO13/SPI_CLK GPIO14/SPI_SI GPIO15/SPI_SO VDD14
MCU VBUS DIO SI_0 SI_2 ETH MMC USB SYS GPIO
GND1 D01 D03 D05 D07 D09 D11 D13 D15 GND2 A01 A03 A05 A07 A09 A11 A13 GND3 WE# INT1#
WAIT# GND4 VBUS_DO VBUS_DO_ENA VB_RDY# VB_ARM# GND5 DI30 DI28 DI26 DI24 DO22 DO20 DO18 DO16 GND6 DI22 DI20 DI18 DI16 DO14 DO12 DO10 DO08 DI14 DI12 DI10 DI08 GND7 DO06 DO04 DO02 DO00 DI06 DI04 DI02 DI00 GND8
SI_1_TXD SI_1_RXD SI_1_RTS SI_1_CTS GND9 SI_3_TXD SI_3_RXD SI_3_RTS SI_3_CTS GND10
ETH2_LNK/ACT# ETH2_SPEED# ETH2_TX+ ETH2_TX- ETH2_AVDD ETH2_RX+ ETH2_RX- GND11
FPGA_CCLK FPGA_DATA FPGA_PRG# FPGA_INIT# FPGA_DONE
I2C_CLK I2C_DATA GND12
RESET_IN# SINGLE_BP_4 RESET_OUT# RUN/STOP# GND13
SR_CLK/GPIO0 SR_DO/GPIO1 SR_DI/GPIO2 SR_LD#/GPIO3 GND14 SR_RCLK/GPIO4 SR_CLR#/GPIO5 GPIO6 GPIO7 GPIO8 GND15
MCU VBUS DIO SI_1 SI_3 ETH FPGA I2C SYS GPIO
+3V3 +3V3 RUN STOP +3V3 +3V3 RUN RESET GND GND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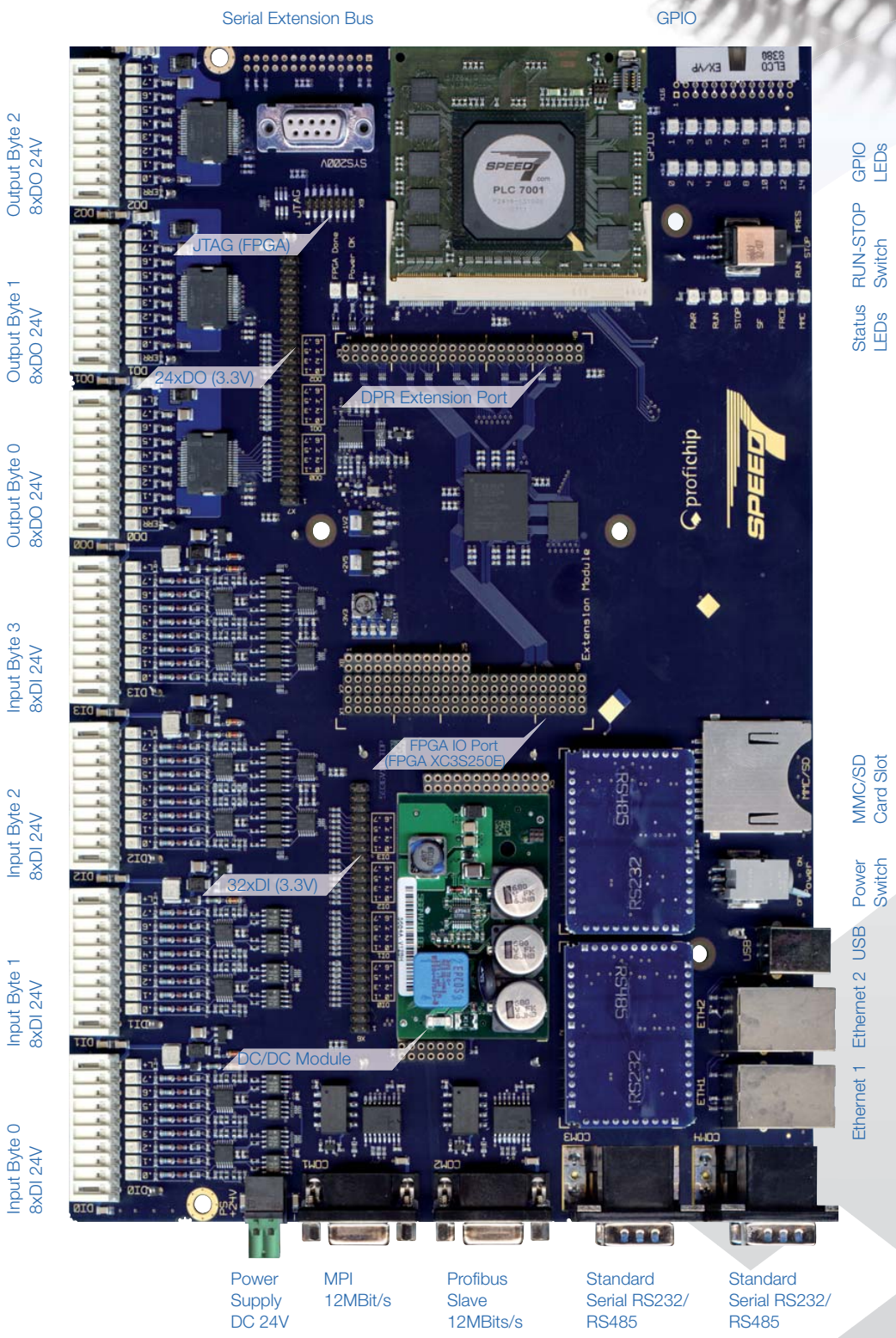
SPEED7


Serial Extension Bus
GPIO
Output Byte 2
8xDO 24V
Output Byte 1
8xDO 24V
Output Byte 0
8xDO 24V
Input Byte 3
8xDI 24V
Input Byte 2
8xDI 24V
Input Byte 1
8xDI 24V
Input Byte 0
8xDI 24V
JTAG (FPGA)
24xDO (3.3V)
DPR Extension Port
FPGA IO Port
(FPGA XC3S250E)
32xDI (3.3V)
DC/DC Module
PLC 7001
GPIO LEDs
RUN-STOP Switch
Status LEDs
MMC/SD Card Slot
Power Switch
USB
Ethernet 2
Ethernet 1
Power Supply DC 24V
MPI 12MBit/s
Profibus Slave 12MBits/s
Standard Serial RS232/ RS485
Standard Serial RS232/ RS485

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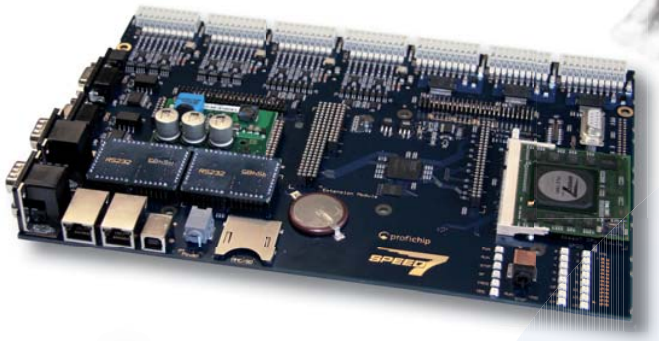

Evaluation Board for SODIMM-PLC Modules	
Sockets for SODIMM-PLC Modules	1
PLC System Interface	
Dual-Port-RAM Interface	16Bit / 1024Bytes
Digital Inputs (24V / 3,3V)	32
Digital Outputs (24V / 3,3V)	24
General Purpose I/Os	16
Backplane-Bus, serial Extension Bus	✓
Communication Interfaces	
MPI (RS485, 12MBit/s)	1
Profibus-DP Slave (RS485, 12MBit/s)	1
Ethernet 10/100 (PU/OP)	2
UART (RS485 / RS232)	2
SD / MMC Interface	1
USB	1
Miscellaneous	
FPGA for DPR / Extension Board Interface (XC3S250E)	1
JTAG Interface for FPGA Download / Debugging	1
Power Switch / Run-Stop-Reset Switch	✓/✓
LEDs DI / DO / GPIO	32/24/16
LEDs CPU / Power / FPGA	6/1/1
Plug-In Line Driver Module (RS485 / RS232)	2
Plug-In DC/DC Module	1
Backup Battery for RTC	✓
Technical Data	
Power Supply	DC 24V
I/O Voltage	24V / 3,3V
Dimensions: LxW (mm)	300 x 236

This board is the evaluation platform for profichip's SODIMM-PLC Module. All the interfaces of the PLC module can be accessed very easily in order to start right away with software implementation and test before a custom board is available. The entire kit contains all manuals and schematics to build a stand-alone PLC CPU based on the SODIMM-PLC Module or to integrate the module into an existing application.

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