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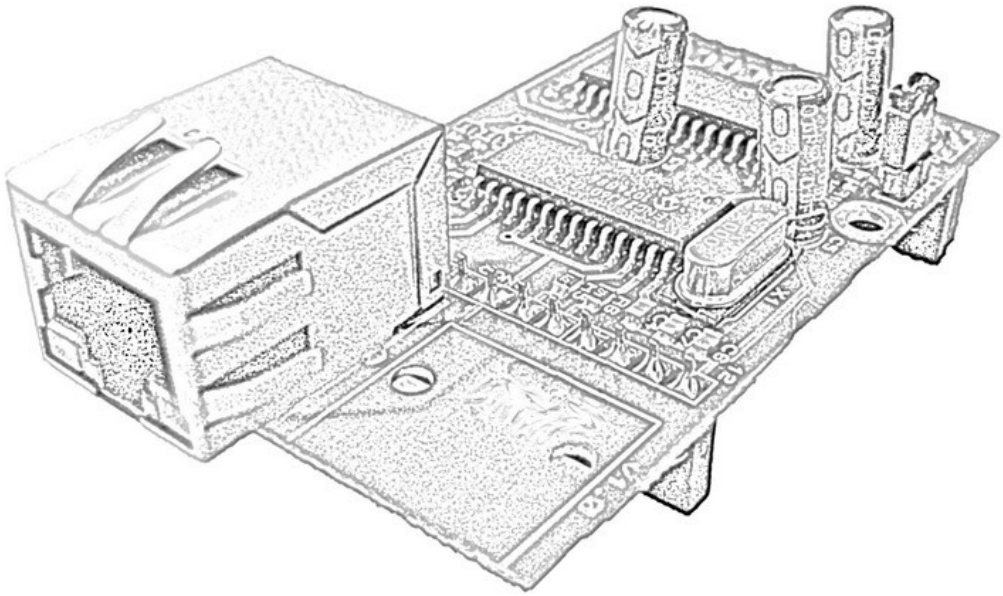
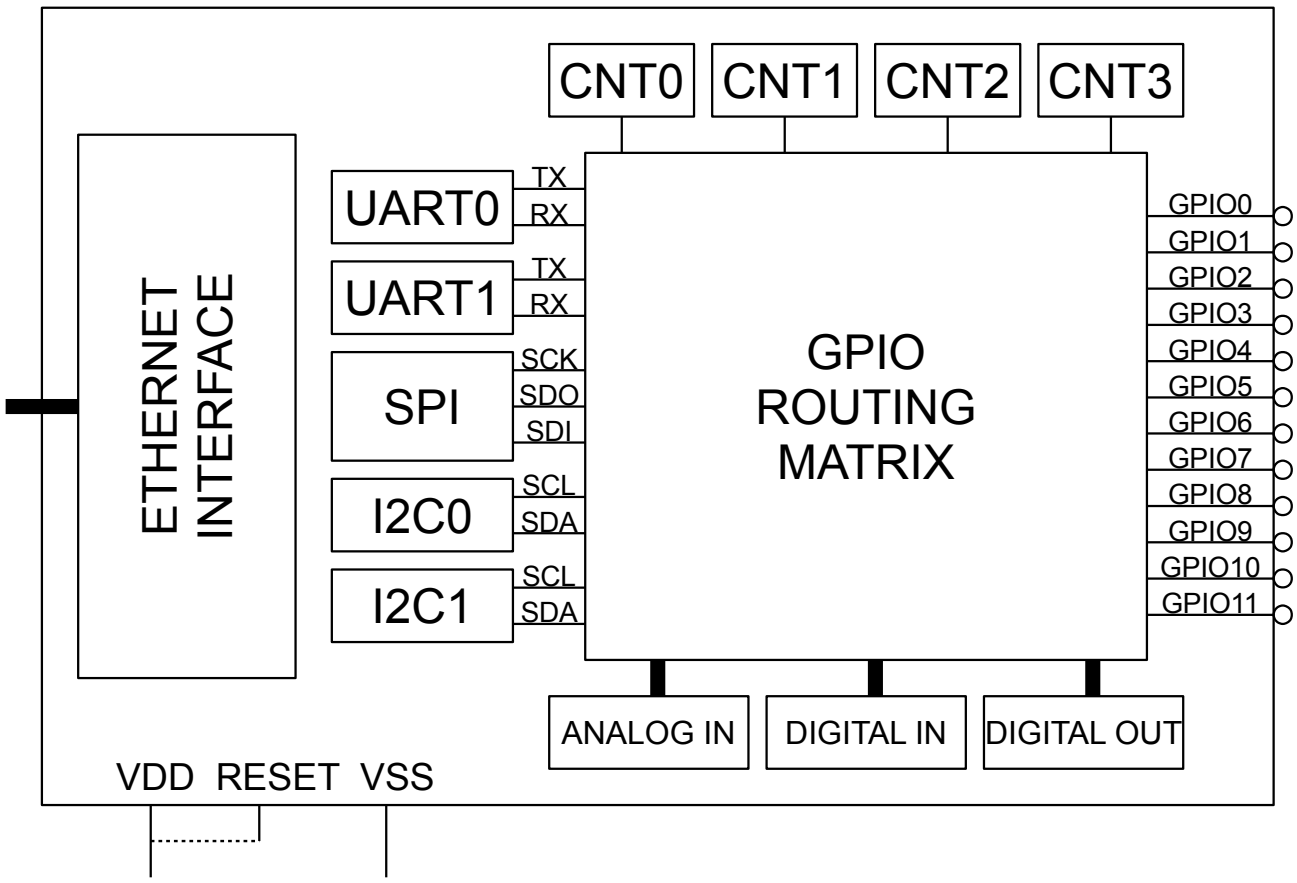
SR01E12
Data Sheet



Ethernet to UART / SPI / I2C / IO controller

Features

- Single 3.3V power supply
- 12 GPIO pins
- Analog inputs
- 5V tolerant inputs
- Selectable individual pullups
- 2 UART modules
- 1 SPI module
- 2 I2C modules
- 4 counter modules
- Nonvolatile configuration
- Static IP address or DHCP client



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Pins descriptions

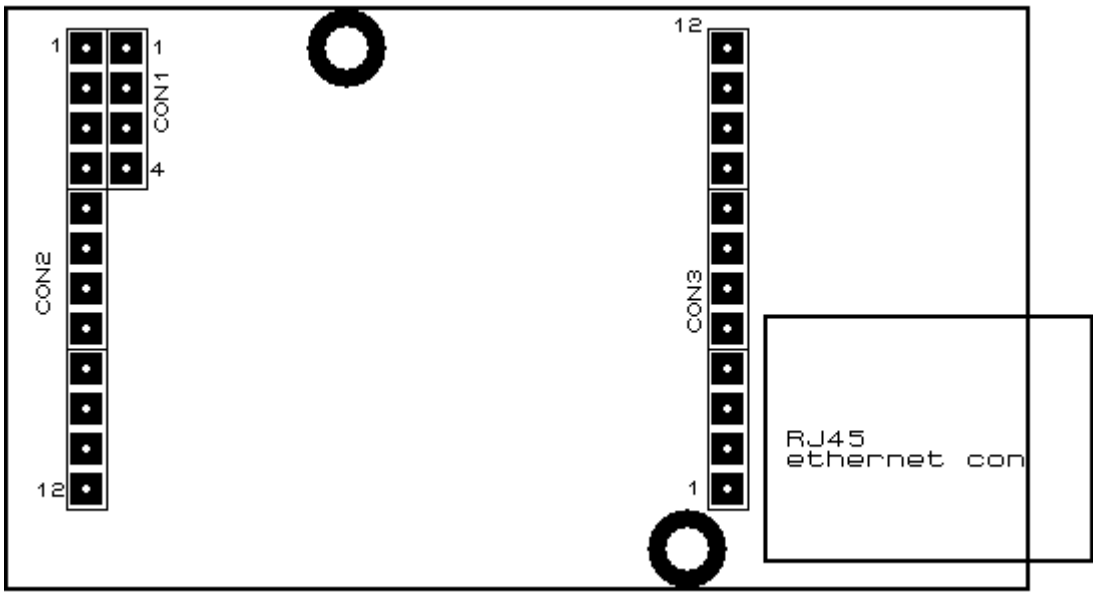


Figure 1: Pinouts (top view)

Table 1: CON1

Pin	Description
1	Reserved for future use. Have internal direct connection to CON3.9
2	VDD
3	RESET - when low the device is in reset state. Can be connected to VDD
4	VSS

Table 2: CON2

Pin	Description
1	General purpose input/output GPIO0
2	General purpose input/output GPIO1
3	General purpose input/output GPIO2
4	General purpose input/output GPIO3
5	General purpose input/output GPIO4
6	General purpose input/output GPIO5
7	General purpose input/output GPIO6
8	General purpose input/output GPIO7
9	General purpose input/output GPIO8
10	General purpose input/output GPIO9
11	General purpose input/output GPIO10
12	General purpose input/output GPIO11

Table 3: CON3

Pin	Description
1	Reserved. Optional external RJ45 TPOUT+
2	Reserved. Optional external RJ45 TPOUT-
3	Reserved. Optional external RJ45 TPOUT0
4	Reserved. Optional external RJ45 TPIN+
5	Reserved. Optional external RJ45 TPIN-
6	Reserved. Optional external RJ45 LED A (internal connection to VDD)
7	Reserved. Optional external RJ45 LED K GREN
8	Reserved. Optional external RJ45 LED K YELLOW
9	Reserved. Have internal direct connection to CON1.1
10	Reserved
11	Reserved
12	Reserved. Internal connection to VSS

Table 4: Pins features

Pin	Digital IN	5V Tolerant	Analog IN	Digital OUT	UART / SPI / CNT port	I2C
GPIO0	●	●		●	●	SDA0
GPIO1	●	●		●	●	SCL0
GPIO2	●	●		●	●	
GPIO3	●	●		●		
GPIO4	●		●	●	●	
GPIO5	●		●	●	●	
GPIO6	●		●	●	●	
GPIO7	●		●	●	●	
GPIO8	●		●	●	●	SDA1
GPIO9	●		●	●	●	SCL1
GPIO10	●			●	●	
GPIO11	●			●		

Ethernet interface

Built in Ethernet interface is 10BASE T, IEEE 802.3i compatible and work at 10 Mbit/s half duplex. Device has built in DHCP client, reply to ICMP ping requests and communicate with the control library by TCP/UDP protocols.

Default network settings are:
IP address: 192.168.1.99
Netmask: 255.255.255.0
Gateway: 192.168.1.254
DHCP client: enabled
TCP/UDP port: 3101

With **sr_store_ip** function from the control library can be stored different IP address, Netamask, Gateway and enabled/disabled DHCP client. New settings will be active after device reset. Using **sr_read_ip** can be retrieved last stored settings.

At power up and after reset, the device performs following startup steps:

- If RESET jumper present, load last stored configuration. If the jumper is open, default configuration is used.
- Load static configuration data.
- If the DHCP client is enabled, send DHCP request to server.
- If DHCP server reply to request, provided configuration is used, overriding static one.

If the device is misconfiguired and cannot be reached by network, the following procedure is recommended to store new data:

- Remove the RESET jumper.
- Power up device.
- Now device uses default settings and can be reached by them.
- Plug RESET jumper.
- Use **sr_store_ip** function to save new configuration.
- Reset the device to load the new settings.

Note: With the RESET jumper removed, all store operations are disabled.

Analog inputs

Board have 6 analog inputs, assigned from GPIO4 to GPIO9. Each input has 10 bits resolution: 0 correspond to 0V and 1023 to V_{DD}. To setup a pin as analog, use **sr_pin_setup** or **sr_pins_setup** function form control library with **sr_pt_analog_in** type. To read analog value, use **sr_pin_get_analog** function.

Digital inputs

All GPIO pins can be used as digital inputs. For each one can be activated a pull-up resistor. To setup a pin use **sr_pin_setup** or **sr_pins_setup** function with **sr_pt_din** or **sr_pt_din_pullup** type. State of the pin is read with **sr_pin_get** and **sr_pins_get** functions. GPIO pins 0 to 3 accept input levels of up to 5.5V while others up to V_{DD}.

Digital outputs

All GPIO pins can be used as digital outputs. They can operate in a normal CMOS mode or in open drain mode. To setup a pin use **sr_pin_setup** or **sr_pins_setup** function with **sr_pt_dout_low**,

sr_pt_dout_high, **sr_pt_dout_opendrain_open** or **sr_pt_dout_opendrain_short** type. That call turns the pin into output with the specified signal level. This state can be used for the default level at power up - see Gpio default settings. To change the state use **sr_pin_set** and **sr_pins_set** functions. Current state is read with **sr_pin_get** and **sr_pins_get** functions.

Note: Change of the type of any pin set all digital output pins to their default state.

Note: Default state is not changed by calling **sr_pin_set** and **sr_pins_set** functions.

UART

Board have 2 independent UART modules with receive and transmit lines. Each module supports odd, even and no parity with one or two stop bits. The supported baud rate is from 16 to 4 000 000 bps. The exact baud rate at which device operates can be obtained by following formulas: *baudrate = 1 000 000 / (X+1)*, where X in 0 .. 65535 for a baud rates up to 1 000 000 bps and *baudrate = 4 000 000 / (X+1)*, where X in 0 .. 3 for baud rates between 1 000 000 bps and 4 000 000 bps. The typical communication during transmit and receive is shown in following figure.

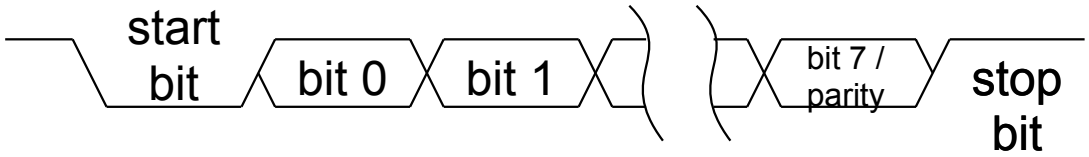


Figure 2: UART communication

Every transmit and receive line have a 256 bytes FIFO buffer which allow asynchronous operation without lack of throughput. To setup UART module use **sr_uart_enable** function from communication library. Receive and transmit lines can be assigned to GPIO pins 0, 1, 2, 4, 5, 6, 7, 8, 9, 10, GPIO3 and GPIO11 cannot be used in UART. For transmitting use **sr_uart_write** and **sr_uart_write_arr** functions. To receive use **sr_uart_read** and **sr_uart_read_arr** functions.

SPI

Serial peripheral interface operates as master and have 3 lines: clock, data input and data output. They can be assigned to following GPIO pins: 0, 1, 2, 4, 5, 6, 7, 8, 9, 10, GPIO3 and GPIO11 cannot be used. Four clock modes and two input sampling modes are supported (see Figure 3: SPI Modes) and 25 fixed clock rates from 31 250 to 8 000 000 bps (see Table 5: SPI baud rates).

Table 5: SPI baud rates

31 250	83 333	250 000	800 000	2 666 667
35 714	125 000	333 333	1 000 000	3 200 000
41 667	142 857	500 000	1 333 333	4 000 000
50 000	166 667	571 429	2 000 000	5 333 333
62 500	200 000	666 667	2 285 714	8 000 000

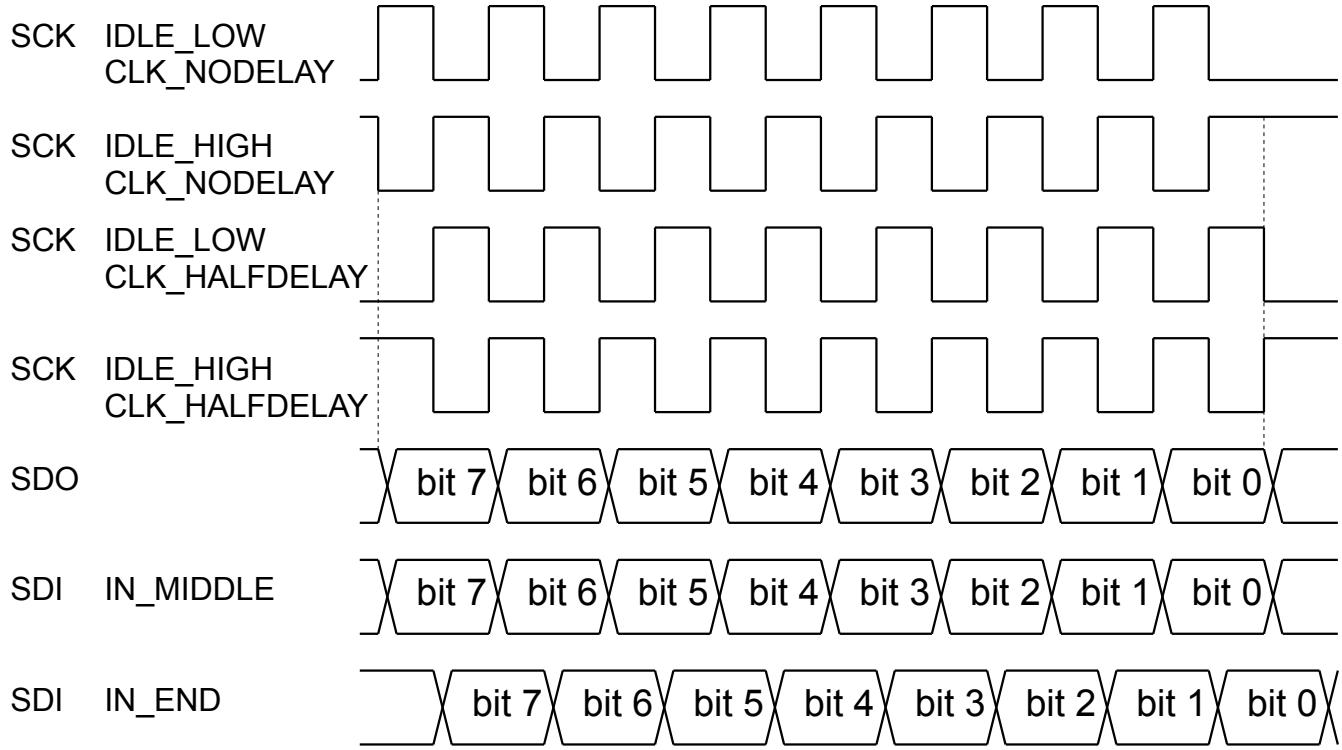


Figure 3: SPI Modes

Typically, the SPI communication requires a chip select (CS) signal, which can be delivered from any of the free GPIO pins. To maintain correct order GPIO and SPI commands, there is not a standalone SPI buffer and all commands are queered in common buffer. To setup SPI interface, use **sr_spi_enable** command. To send data, use **sr_spi_write** and **sr_spi_write_arr** commands, to receive: **sr_spi_read** and **sr_spi_read_arr**.

I2C

There are two I2C modules, operating as masters at fixed GPIO pins. First one has SDA at GPIO0 and SCL at GPIO1 and second module is as SDA at GPIO8 and SCL at GPIO9. The supported baud rate is in a rage of 62 112 to 2 857 143 bps. The target baud rate at which device operates can be obtained by following formula: *baudrate = 16 000 000 / (X+2.6)*, where X in 3 .. 255. Baud rate depends on used pull up resistors and the total load on the SCL line. I2C communication is shown on following figure.

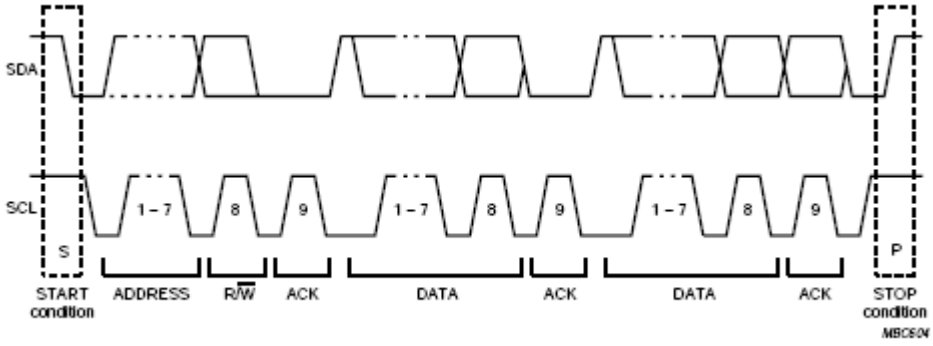


Figure 4: I2C communication

Three types of commands are supported. Write data commands: **sr_i2c_write** and **sr_i2c_write_arr**. They operate as sending a start condition, address, write flag, one or many data bytes and stop condition.

Read data commands: **sr_i2c_read** and **sr_i2c_read_arr**. A message is composed of: start condition, address, read flag, one or many data bytes read and stop condition. Third command types are combined write followed by read operation. Library functions are: **sr_i2c_write_read** and **sr_i2c_write_read_arr**. The message is: start condition, address, write flag, one or many data bytes restart condition, address, read flag, one or many data bytes read and stop condition.

Counters

Device have 4 counters, enumerated as CNT0, CNT1, CNT2, CNT3. They can be assigned to GPIO pins 0, 1, 2, 4, 5, 6, 7, 8, 9, 10. GPIO3 and GPIO11 cannot be used for source. Assignment is done by **sr_cnt_enable** function from control library. Count increment is done on low to high transaction of the input and count register is 16 bits. It rollover from 65535 to 0. Current count value is read with **sr_cnt_read** function, also current count can be reset by **sr_cnt_reset** function.

Gpio default settings

All settings of GPIO pins type, UART, SPI, I2C, CNT modules can be remembered in nonvolatile memory and loaded at next power up. After the device is configured, call **sr_store_config** function from the control library to remember that configuration.

Note: With the RESET jumper removed, all store operations are disabled.

Electrical characteristics

DC characteristics 0°C < Ta < 70 °C

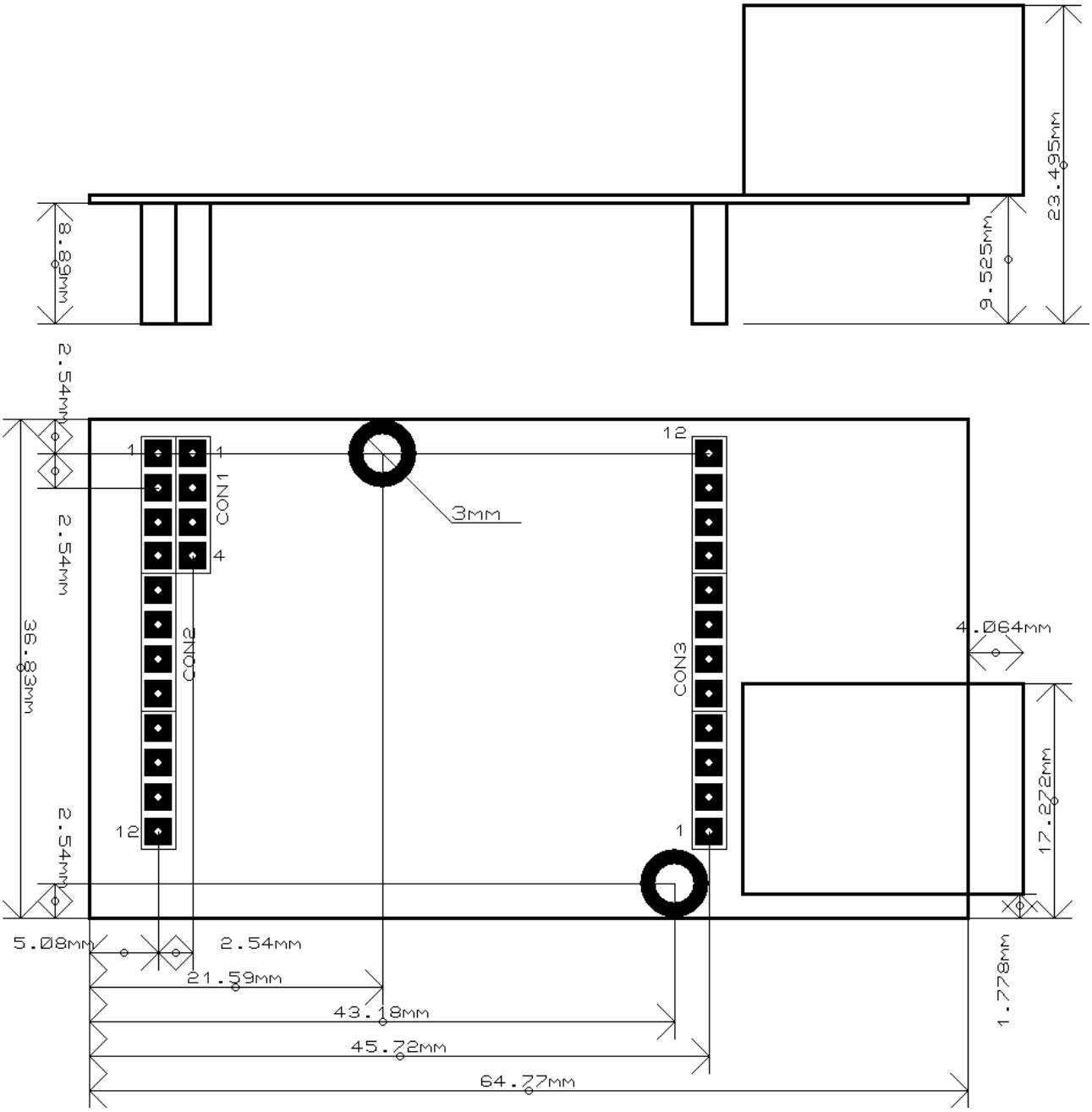
Symbol	Characteristic	Min	Typ	Max	Units	Conditions
V_{DD}	Supply Voltage	3.1	3.3	3.6	V	
I_{DD}	Operating Current		136 176	140 200	mA	Active Transmitting Ethernet packets
V_{IH}	Input High Voltage RESET GPIO 0, 1, 2, 3 GPIO 4, 5, 6, 7, 8, 9, 10, 11 I2C on IO Ports 0,1 I2C on IO Ports 8,9	 0.8 V_{DD} 0.8 V_{DD} 0.8 V_{DD} 0.7 V_{DD} 0.7 V_{DD}		 V_{DD} 5,5 V_{DD} 5,5 V_{DD}	V	
V_{IL}	Input Low Voltage RESET, GPIO Pins I2C Enabled pin	 V_{SS} V_{SS}		 0.2 V_{DD} 0.3 V_{DD}	V	
V_{PU}	Pull-up Current	50	250	400	µA	
I_{IL}	Input Leakage Current Digital IO Analog In			 ±50 ±610	nA	 Reccomended inpedance <2.5kΩ
V_{OH}	Output High Voltage	3			V	
V_{OL}	Output Low Voltage			0.4	V	
I_{OC}	Output Current			±15	mA	

AC characteristics

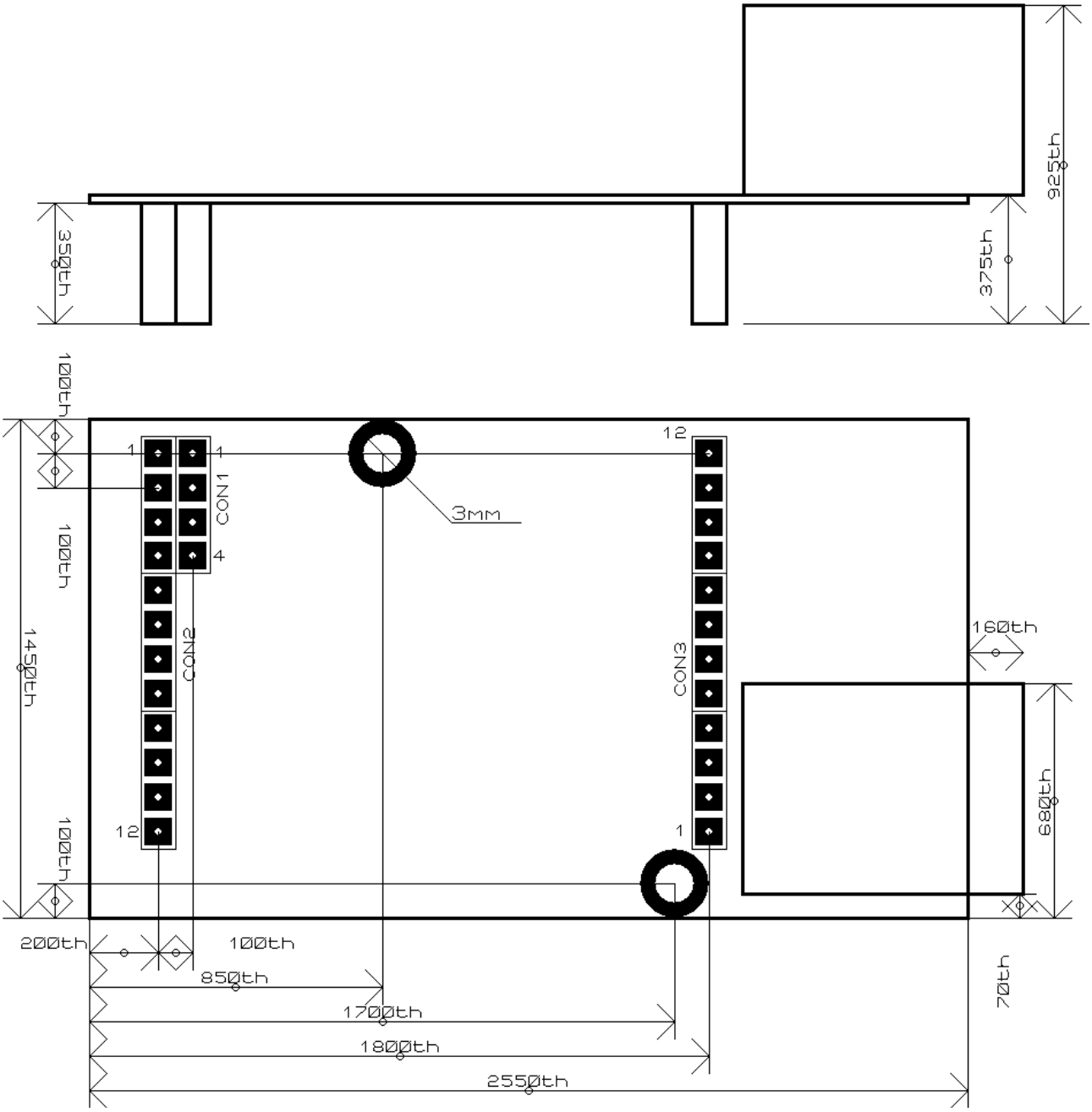
Symbol	Characteristic	Min	Typ	Max	Units	Conditions
T_{RSTL}	RESET Pulse Width (low)	2			µs	
T_{PWR}	Power-up period		100		ms	
F_{UART}	UART baud rate	0.016		4000	KHz	Setup by command
F_{SPI}	SPI Clock	31.25		8000	KHz	Setup by command
F_{I2C}	I2C Clock	62.112		2857	KHz	Setup by command
F_{TMR}	Counter Frequency	0		16000	KHz	

Mechanical characteristics

Millimeters



Inches


925th
350th
375th
100th
100th
100th
100th
145Øth
CON1
CON2
CON3
3MM
160th
680th
70th
200th
100th
850th
1700th
1800th
2550th