



## The flexible, programmable Controller for building intelligent, highly secure and Network Ready Devices



### OC8-V AT A GLANCE

#### Architecture

**CPU:** Arm9-based 200 MHz processor AT91SAM9263  
**Memory:** 64 MB SDRAM, 1Gb Flash, 32kB onchip caches

#### Network Interface

**Ethernet:** RJ45: 10/100 Base, auto-sensing, auto-MDIX  
**Protocols:** Profibus, CANopen, Modbus, Devicenet, (open) Powerlink, TCP, UDP, IP, XML, ARP, ICMP, DNS, DHCP  
**Security:** software encryption engine SHA, MD5, 3DES, AES

#### Interface

- 3 RS232 / 2 RS485 (software selectable) serial ports 921 kbps up to 12Mbps. ESD protection
- 66 General purpose I/O
- 1 12bit ADC (Analog Digital Converters) + Touchscreen
- 2 12bit DAC voltage out, 2 MSPS
- 1 12bit DAC current output (0, 4 – 20 mA)
- 1 13 bit A-grade temperature sensor
- 1 Can 2.0a/2.0b
- 1 I<sup>2</sup>C
- 1 SSC
- 2 SPI up to 66 MHz
- 1 AC-97
- 1 USB 2.0 device (12 Mbps)
- 2 USB 2.0 host (480 Mbps)
- 1 Voltage reference 4.7V, 0.5%
- 1 Realtime clock
- 1 LCD (STN TFT 1280x860) 24 bit @3v3
- 1 JTAG

#### Expansion

**Internal bus (20pin):** SPI, I2C to add-on cards like Wireless

#### Energy

**Input voltage:** 5VDC  
**Input PoE:** Power over Ethernet (class 1, isolated)  
**Power:** 1mW standby, 420 mW max @ TX on  
**PoE external circuit supply:**  
 - 5V, limited to 200mA continuous (short circuit proof)  
 - Separate rectified 48V (10 Watts additional power)

#### Operating system

**OS:** Safe free-RTOS (realtime OS), Linux® v2.6.31  
**Drivers:** bus drivers  
**Toolchain:** license free toolchain (gcc, openocd, IBM eclipse)

#### Software stack and support

Royalty free software stack.  
 Commercial project support available

#### Environment

**Industrial Temperature range:** -45 to 85°C

#### Packaging

**Dimensions (h\*b\*d):** 16 \* 21 \* 47 mm **Weight:** 22g RevB

The size of a few sugar cubes, OC8 is the first device server solution that goes beyond simple network connectivity to deliver an enterprise grade, service oriented, programmable device computing and networking platform.

This embedded processor module builds on our proven ethernet control technology.

It enables device manufacturers and IT system integrators to add the highest versatile and agile IT control component into their projects



#### Wireless

Zigbee add-on 12 €



#### Benefits

The benefits of integrating networked devices into traditional corporate or enterprise network are tremendous. A unified corporate network reduces operations costs by more effectively leveraging IT investments. Additionally, this integration differentiates a company's product or service with increased or added value and helps facilitate opportunities such as:

- Asset tracking
- Workflow improvement/monitoring/reporting
- Pro-active maintenance services and pre-emptive diagnosis
- Building automation
- Industrial automation

#### Enterprise-grade Security

The OC8 provides the highest level of security possible using state of the art crypto technology. With a wide variety of advanced cipher technologies including AES, 3DES and RC4 this 'data center grade' protection ensures secure network operations

#### Example applications

- ➔ Realtime asset tracking
  - Integration with enterprise systems like SAP, Microsoft Dynamics
- ➔ Secure remote metering
  - Networked PoE Access Control
    - Save power supply and installation costs
- ➔ POS Transaction Automation Terminal
  - Central processing management
- ➔ Industrial Automation
  - Seamless integration with today's control systems like Allen Bradley, Siemens and devices, sensors and activators

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## CONTROLLER CONCEPT

In using open controller technology there is no longer a need to switch boards, types and technology while going from one project to another. A wide variety in industrial communication methods and protocols is handled in a truly modular high performance design.

Highlights and key feature's are:

- One technology to master all your projects from control, industrial control, tunneling, cross protocol bridging and wireless
- Modular design
- Including all hardware drivers and protocols under GPL license
- Ethernet bootloader and firmware update
- LUA logic engine ([www.lua.org](http://www.lua.org))
- IO Cards have a 16kb eeprom for storing configuration details.
- Easy to extend. Add or integrate your own design as well on a extension board
- Two of the same IO Cards can be installed in one controller
- Multiple controllers can share their controls in a network using ethernet (10/100 Mbit)
- Every controller has a OLED display (128 \* 64 white pixels).
- Industrial protocol support for profibus, CANopen, Modbus, Devicenet, (open) Powerlink
- **Opensource License and royalty free. Closed source versions available on request.**



## SOFTWARE ARCHITECTURE

LICENSE	<b>Free open source GPL license (a)</b>				<b>Professional Pro Pack (c)</b>
	For proprietary end user solutions a closed source license is available (b)				Requires commercial license
APPLICATIONS	Command & Control Protocol Bridging	Sensing	XML parser Tunneling	3rd party Chess	Web Manager Pro
MANAGEMENT	Web manager Remote support	GPIO manager Config manager	File system Serial manager	Logging XML	Remote Configuration Utility Serial to ethernet
SECURITY	IPsec	MD5 SHA	AES SSL	3DES PAP/CHAP	
NETWORK	DNS UDP DHCP	TCP NTP + dst Auto-IP	PPP SMTP ARP	CGI HTTP FTP	SNMP
PROTOCOL	CAN MODBUS		IP USB 2.0 EtherNet	http-XML SOAP 1.1	Profibus CANopen Profinet DeviceNet
DRIVERS	CAN USB Ethernet	GPIO DAC Current Control	SPI I2C OLED	RS232/485 Flash, Fat32 EEPROM	
KERNEL	Realtime Safe OS Preemptive scheduler	Threading Memory Guard	Semaphores Brownout detect	Timers Counters	

(a) GPL3 open source royalty free license. Free to use, modify and redistribute under GPL license model

(b) Closed source commercial license for integration in internal or resellable solutions/products at a one-time cost

(c) Additional protocol en utility pack is available at a one time cost for system integrators, check the webstore for pricing details

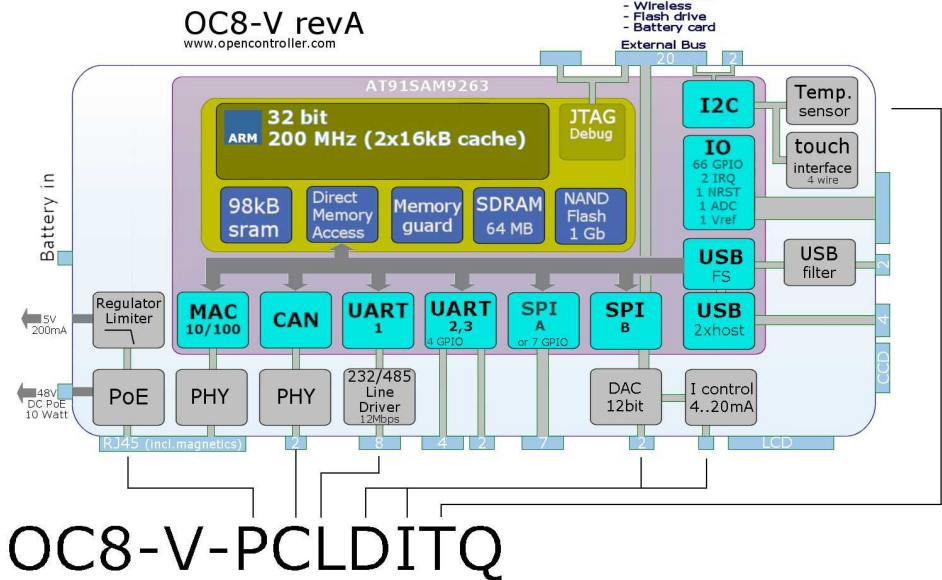
## OC8-V FUNCTIONS



Function	Specs	Comments
PoE Power over Ethernet	Integrated 2 Watts <b>isolated</b> switching power supply. Including 5V short-circuit proof supply to power other logic (current-limited to 200 mA continuous)	Rectified POE lines (48V) are also available for up to 10 Watts of external power requiring an additional external switching power supply.
DAC	2 ports 12 bit DAC	2 Mega Sample/sec, full output swing on highest sample rate
I2C	Serial bus	2 pins, not shared with other pins
SPI	Serial bus, max 66MHz, 4 chipselect lines	7 pins, not shared with other functions
CAN	2.0 A & B	Including PHY (transceiver chip)
SSC	Synchronous Serial Interface	6 pins
AC-97	Audio	4 pins
USART RS232/485	Serial synchronous/asynchronous port with linedriver. RS232, 422 and 485 RX, TX, RTS, CTS, DTR, DSR, RI	Software selectable protocols, 232, 422,485 RS232 650 kbps [+7V, -7V] RS485 up to <b>12Mbps</b> [+7V, -7V] Without linedriver chip selection 3v3 logic
USART RS232/485	RX, TX, RTS, CTS	Standard USART (921 kbps) 3v3 logic level
USART RS232/485	2 RX, TX ports	USART ( 921 kbps) 3v3 logic level
USART RS232	1 RX, TX port	Extra USART (115 kbps) 3v3 logic level
IO	66 IO pins	12 dedicated 54 are shared on UART, ADC, SSC, SPI, LCD, IRQ
I-controller	Current output [0, 4-20mA] max 230 ohm	1 Industrial current output control port
Voltage reference	Class A 4,7V 0.5%	1 pin for external use
ADC	1 12 bit ADC + touchscreen interface	5 pin (X+,X-,Y+,Y-,ADC-in)
USB	1 USB-device 12Mbit/s	EMC filtered
USB	2 USB-host 12Mbit/s	
Temperature Sensor	Class A	13 bit, 0.03 C resolution on I2C-bus
RTC	Realtime clock	<1 ppm
LED	RGB (red, green, blue) LED	LED controlled by 3 dedicated GPIO
IRQ	Interrupt lines	2 interrupt lines (not shared with other pins)
NRST	Reset line	External reset line (1 pin) [input/output]
LCD	1 LCD controller STN TFT 1280x860 24 bit	3v3 logic level
Touchscreen	4 wire resistive touch	Via I2C
JTAG	JTAG programming interface	5 pins, including jtag-select

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# HARDWARE ARCHITECTURE



CPU: Arm9-based 200 MHz processor, 32kB onchip caches (AT91SAM9263)	POE	SI3401	Silicon Labs
Memory: 64MB SDRAM, 1Gb NAND Flash	Linedriver	ISL41334	Intersil
Motion Sensor ADXL345 Analog devices	DAC	DAC122S085	National
V-ref AP431ARG-7 Diodes	RTC	onboard	Atmel
Current-limiter FPF2140 Fairchild	T-sensor	SE95DP-T	NXP

## OC8-V rev.B

## OC8-V rev.A



### Production status: Q2 2010

The OC8-V rev.b (AT91SAM9G35 128MB Ram 2Gb FLASH) with stack connector (S)

### Production status: production

Rev.a (AT91SAM9263-CU 64MB Ram 1Gb FLASH) does not have 20 pin board to board stack connector (S)

## PRICING and ORDER INFORMATION: OC8-V series

System: 200MHz, 64MB DDR, 1Gb Flash Realtime-OS, Linux

Order number	Type	66 GPIO	5 USART	2 SPI	1 SSC	1 I2C	2 IRQ	1 RTC	1 NRST	1 LCD	1 AC-97	1 JTAG	1 Ethernet	USB Device	USB host	USB EMI filter	Voltage ref.	PoE	CAN	LINEDRIVER:uart1	DAC	Temp. -sensor	ADC [1 Channel 12bit]	Touchinterface [4-wire]	NAND-Flash [Gb]	Headerboard [USB-JTAG,PSU]	€/pc* moq 1	€/pc* moq 5	€/pc* oq 50
81A-606	OC8-V-AF-PCLDTQ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		99	96	
81A-094	OC8-V-AF-PCLDT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		90	88	
81A-514	OC8-V-AF-PQ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		81	79	
81A-078	OC8-V-AF-PCLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		79	77	
81A-066	OC8-V-AF-PT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		74	72	
81A-012	OC8-V-AF-CL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		72	71	
81A-008	OC8-V-AF-L	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		70	69	
81A-001	OC8-V-AF	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		63	62	
81A-606-H	OC8-V-AF-PCLDTQ-H	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	125			

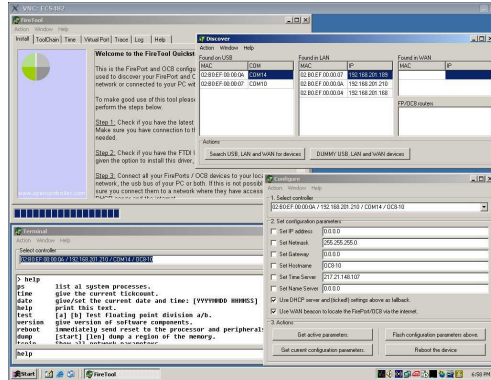
moq: minimum order quantity 1 pack of 5 modules. Pricing excl VAT. Contact Open Controller for other option and feature sets. Small quantities can be purchased online. Single units (OC8-V-AF-PCLDTQ-H) include a OC8-V-AF-PCLDTQ and a headerboard containing a powersupply (9..34VDC to 5V@400mA) and onboard USB/(JTAG & debug) adapter.

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## CERTIFIED Embedded system codebase (SIL, MISRA)



## Comprehensive network control tools



## Quality

EMI: Compliant with CISPR22 Class B  
EMC: Compliant with EN55022

## RoHS Compliance

OC8 devices meet the requirements of Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of Hazardous Substance (RoHS) and of the China RoHS (SJ/T11363 - 2006) requirements which came into force on 1st March 2007.

## Environment

Open controller is committed to being a leader in the device networking industry in protecting the environment. Open controller is committed to comply with the requirements of all applicable environmental legislation and regulations, including the restriction of hazardous substances in our products.

## CONTACT

### International sales

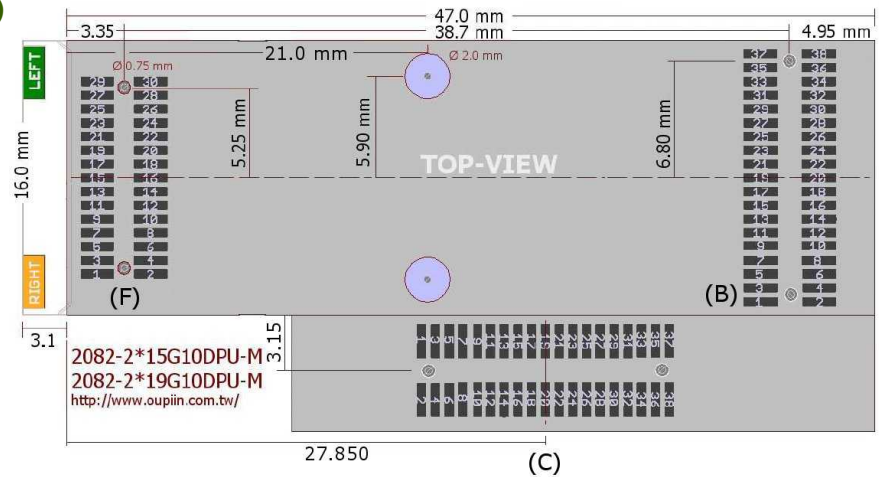
sales@opencontroller.com  
Telephone +31 (0)73-6449992

### Benelux sales

Nijkerk Electronics, Amsterdam, The Netherlands  
Tel: +31 20 504.14.24 Email: ne@nijkerk.nl

Nijkerk Electronics, Antwerpen, Belgium  
Tel: +32 (0)3 544.70.66 Email: ne@nijkerk.be

# PINOUT (topview OC8-V rev.A)



Name	Pin #	OC8-V	Name	Pin #	OC8-V
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## BACK (B) CONNECTOR (OUPIIN 2082-2x19G15DP 0.8mm on the module. Suitable mating PCB header OUPIIN 2081-1x19G15DP series)

TX1+	B38	TX0+RS422/485	CNL	B37	CAN L GPIO
TX1	B36	TX0 GPIO	CNH	B35	CAN H GPIO
RX1+	B35	RX0+RS422/485	POUT	B33	5V@200mA output
RX1	B32	RX0 GPIO	VREF	B31	4,7 V
CTS1	B30	CTS0 GPIO	GND	B29	Ground
RTS1	B28	RTS0 GPIO	VA	B27	DAC chA [0 - 4,7V]
DTR1	B26	LCDDEN GPIO	VB	B25	DAC chB [0 - 4,7V]
DSR1	B24	DSR0 GPIO	V+	B23	5V DC in
GP05	B22	LCDCC [PB9] GPIO	GPIO	B21	AC-97 FS GPIO
GP08	B20	PWM GPIO	GP12	B19	TCLK0 GPIO
IRQ1	B18	IRQ1	GP06	B17	TF1 GPIO
VBAT	B16	3v3 in RTC battery	OMISO	B15	SPI0-MISO GPIO
GP02	B14	TIOB5 GPIO	OMOSI	B13	SPI0-MOSI GPIO
GP01	B12	PCK3 GPIO	OCLK	B11	SPI0-CLK GPIO
GP07	B10	PCK1 GPIO	OCS3	B9	SPI0-CS3 GPIO
SDA	B8	I2C data GPIO	OCS1	B7	SPI0-CS1 GPIO
SCL	B6	I2C clock GPIO	OCS0	B5	SPI0-CS0 GPIO
AC4	B4	Reserved for ADC-4 AT91SAM9G35 (OC8-V RevB.)	AC2	B3	Reserved for ADC-2 AT91SAM9G35 (OC8-V RevB.)
AC3	B2	ADC-12bit [0-3,3V]	AC1	B1	Reserved for ADC-1 AT91SAM9G35 (OC8-V RevB.)

## FRONT (F) CONNECTOR (OUPIIN 2082-2x15G15DP 0.8mm on the module. Suitable mating PCB header OUPIIN 2081-2x15G15DP series)

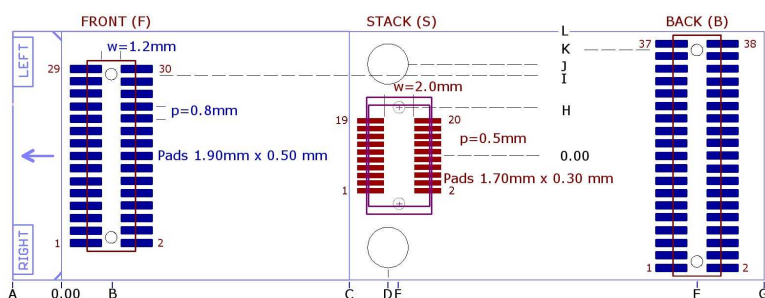
USBH1-	F29	USB host 1 - GPIO	USBH1+	F30	USB host 1 + GPIO
POE+	F27	POE rectified high volts+	CTS0	F28	CTS1 GPIO
POE-	F25	POE rectified high Volts-	RTS0	F26	RTS1 GPIO
USBH2+	F23	USB host 2 + GPIO	TX0	F24	TX1 GPIO
USBH2-	F21	USB host 2 - GPIO	RX0	F22	RX1 GPIO
GPIO	F19		NRST	F20	Reset-line [in & out]
GPIO	F17	TK GPIO	GND	F18	Ground
GPIO	F15	AC-97 RX	GP09	F16	ISI HSync GPIO
GPIO	F13	SPI0-CS2 GPIO	GP11	F14	TX2 GPIO
TDI	F11	JTAG	GP03	F12	RX2 GPIO
TMS	F9	JTAG	GP04	F10	RTS2 GPIO
TCK	F7	JTAG	GP10	F8	CTS2 GPIO
TDO	F5	JTAG	IRQ0	F6	FIQ GPIO
DRXD	F3	RX4 + debug	DDP	F4	USB device +
DTXD	F1	TX4 + debug	DDM	F2	USB device -

Table 1: Back and Front connector

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Name	Pin #	OC8-V	Name	Pin #	OC8-V
<b>SIDE (C) CONNECTOR</b> (OUPIIN 2082-2x19G15DP 0.8mm on the module. Suitable mating PCB header OUPIIN 2081-1x19G15DP series)					
ADC	C38	ADC X- [Touchscreen]	ADC	C37	ADC Y+ [Touchscreen]
ADC	C36	ADC Y- [Touchscreen]	ADC	C35	ADC X+ [Touchscreen]
GPIO	C34	AC-97 TX GPIO	GPIO	C33	AC-97 CK GPIO
LCD_15	C32	LCD 16-bit BLUE 5 GPIO	GND	C31	Ground
LCD_14	C30	LCD 16-bit BLUE 4 GPIO	ISID00	C29	Reserved for CCD 12-bit (not connected)
LCD_13	C28	LCD 16-bit BLUE 3 GPIO	ISID01	C27	Reserved for CCD 12-bit (not connected)
LCD_12	C26	LCD 16-bit BLUE 2 GPIO	ISID02	C25	Reserved for CCD 12-bit (not connected)
LCD_11	C24	LCD 16-bit BLUE 1 GPIO	ISID03	C23	Reserved for CCD 12-bit (not connected)
LCD_10	C22	LCD 16-bit GREEN 5 GPIO	ISID04	C21	Reserved for CCD 12-bit (not connected)
LCD_09	C20	LCD 16-bit GREEN 4 GPIO	ISID05	C19	Reserved for CCD 12-bit (not connected)
LCD_08	C18	LCD 16-bit GREEN 3 GPIO	ISID06	C17	Reserved for CCD 12-bit (not connected)
LCD_07	C16	LCD 16-bit GREEN 2 GPIO	ISID07	C15	Reserved for CCD 12-bit (not connected)
LCD_06	C14	LCD 16-bit GREEN 1 GPIO	ISID08	C13	Reserved for CCD 12-bit (not connected)
LCD_05	C12	LCD 16-bit GREEN 0 (LSB) GPIO	ISID09	C11	Reserved for CCD 12-bit (not connected)
LCD_04	C10	LCD 16-bit RED 5 GPIO	ISID10	C9	Reserved for CCD 12-bit (not connected)
LCD_03	C8	LCD 16-bit RED 4 GPIO	ISID11	C7	Reserved for CCD 12-bit (not connected)
LCD_02	C6	LCD 16-bit RED 3 GPIO	LCDHSYNC	C5	LCD HSYNC GPIO
LCD_01	C4	LCD 16-bit RED 2 GPIO	LCDVSYNC	C3	LCD VSYNC GPIO
LCD_00	C2	LCD 16-bit RED 1 GPIO	DOTCK	C1	LCD DOTCK GPIO

Table 2: (C) LCD and CCD connector



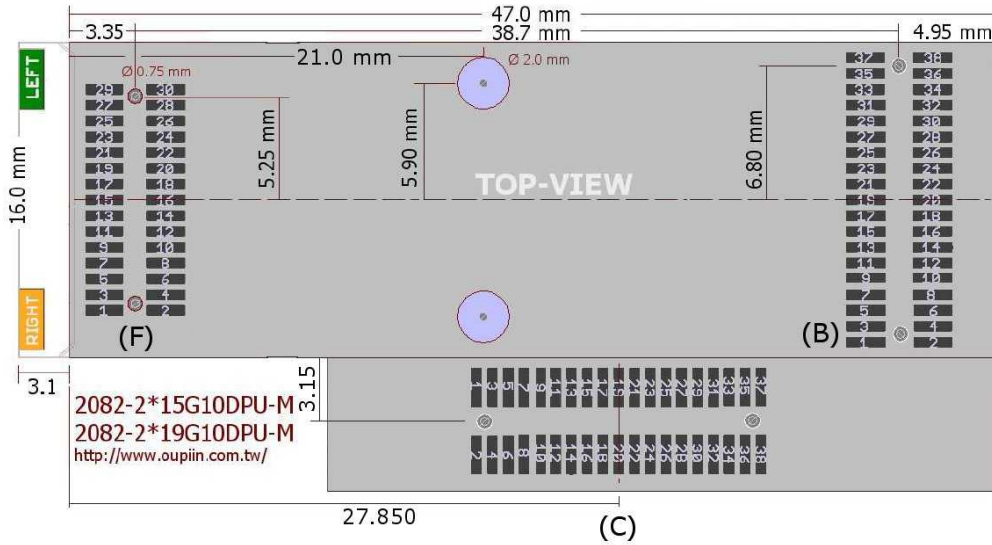
Name	Pin #	Function OC8-V	Name	Pin #	Function OC8-V
<b>STACK (S) CONNECTOR</b> (OUPIIN 2317-20G15DPT 0.5mm. Suitable PCB header OUPIIN 2342-20G15DP4 series 0.5mm pitch 5.0 mm stacking height)					
VBAT	S19	3V3 Vbat	DRXD	S20	TX4 + debug GPIO
NRST	S17	Reset-line [in & out]	DTXD	S18	RX4 + debug GPIO
GPIO	S15	USB host 2 + GPIO	GP27	S16	USB host 2 - GPIO
3V3	S13	3V3 power [150mA max]	IRQ1	S14	IRQ 1
TMS	S11	JTAG	GND	S12	Ground
TCK	S9	JTAG	1CS3	S10	SPI 1 CS3 GPIO
TDO	S7	JTAG	1CS0	S8	SPI 1 CS0 GPIO
TDI	S5	JTAG	1CLK	S6	SPI 1 CLK
SDA	S3	I2C clock	1MOSI	S4	SPI 1 MOSI
SCL	S1	I2C data	1MISO	S2	SPI 1 MISO

Table 3: Stack connector

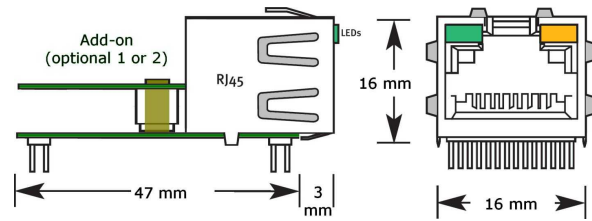
Table 1,2 and 3 notes:

- GPIO, LCD, SPI, I2C and ADC's operate on 3v3 unless otherwise noted.

## DIMENSIONS



Dimensions OC8-V rev.B  
OC8-V-AM-



## PRODUCTION INFORMATION

Part number example:

OC8-V-AF-PLDT

position	value
'OC8-'	
1	series identification [S,N,V,E,C,F,H]
-	
2	revision [A,B,C,D,E]
3	[F: oupiin female 2082 series (default)], [M reverse pinout oupiin 2081 male series]
-	
4-10	featureset [P,C,L,D,I,T,Q] see order information table for reference

Serial number example:

C51A0200A

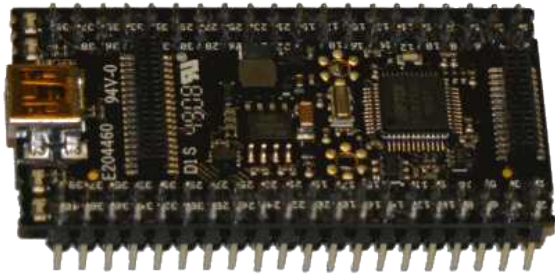
position	value
2	production year [C:2009] [D:2010] [E:2011]
3-4	production week
5-7	production location [A:Geel, Belgium] [B:Den Bosch, The Netherlands] [C:Seoul, S-Korea]
	part of the MAC address
7-9	serialnumber in production run, also the last group of the MAC address.

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## OTHER RELEVANT PRODUCTS

OC8-H (Headerboard for all OC8-Series)



USB to T/JAG 2 channel solution for programming and debugging. Includes 7 to 34 VDC input, 5V@1A output power supply, 1 USB and 4 GPIO status LED's. This board can also be used to evaluate the OC8-series modules. OC8-H revB provides additional LCD/CCD connector for OC8-V modules (available november 2009).

OC8-E (Evaluation kit)



Evaluation kit in the form of a ready to use controller. All I/O's and busses are available. Including GPRS/Zigbee SMA connector, navigation button, OLED display, USB JTAG/Debug, 7 to 34 VDC input, 5V@1A output power supply,