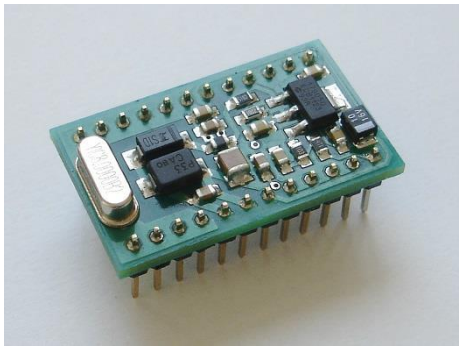
HAPCAN
HOME AUTOMATION

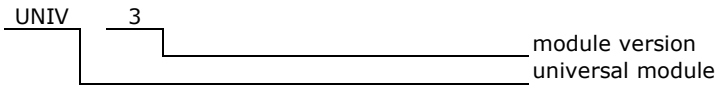
UNIVERSAL MODULE
UNIV 3

1. Feature



- The base to build HAPCAN home automation system devices.
  - Built with UNIV 3 CPU (PIC18F26K80) microcontroller
  - MCP2551 CAN transceiver
  - Pin raster compatible with the DIL-24
  - Implements ISO-11898 standard physical layer requirements
  - Conforms to CAN 2.0B
  - 125kbps bus speed
  - Up to 112 modules can be connected on the same bus
  - High noise immunity due to differential bus implementation
  - An unpowered node will not disturb the CAN bus
  - HAPCAN UART/CAN bootloader programmed which enables module firmware uploading
  - Implements XLP (extreme low power)
  - Operating voltage 8-24V
  - Clock speed 8MHz or 32MHz with PLL
- Non-volatile program and data memories
  - 64 kB FLASH (endurance 10,000 Write/Erase Cycles)
  - 1024 B EEPROM (endurance 100,000 Write/Erase Cycles)
  - 3.6 kB SRAM
- Peripherals
  - 18 general purpose inputs/outputs
  - 5 PWM output
  - 2 USART
  - Supporting SPI, I^2C
  - 6 available channels of 12-bit A/D converter

2. Module symbol



3. Overview

This is a universal module of HAPCAN system. The module processor comes with programmed HAPCAN UART/CAN bootloader, which allows firmware to be loaded through the serial port or system bus.
It can be used to build one of the system nodes. It needs a few external components to create sensor, actuator or interface of HAPCAN system. Functionality of device built with UNIV 3 module depends on firmware uploaded into it. All schematics, firmware and Windows software files can be found at hapcan.com.

4. Technical data

Parameter	Symbol	Value	Unit
Supply voltage	U_{CC}	8 - 24	V
Supply current - in bootloader CAN mode - in bootloader UART/CAN mode	I_{CC}	 6 8	 mA mA
Maximum current sourced by one port	$I_{SoOnemax}$	20	mA
Maximum current sourced by all ports	$I_{SoAllmax}$	20	mA

Table 1. Basic technical data of UNIV 3 module
For other and detailed data refer to PIC18F26K80 and MCP2551 datasheets.

5. Hardware

5.1. Module outputs

The UNIV 3 CPU processor is used to build UNIV 3 module. Detailed information about processor can be found at hapcan.com website.

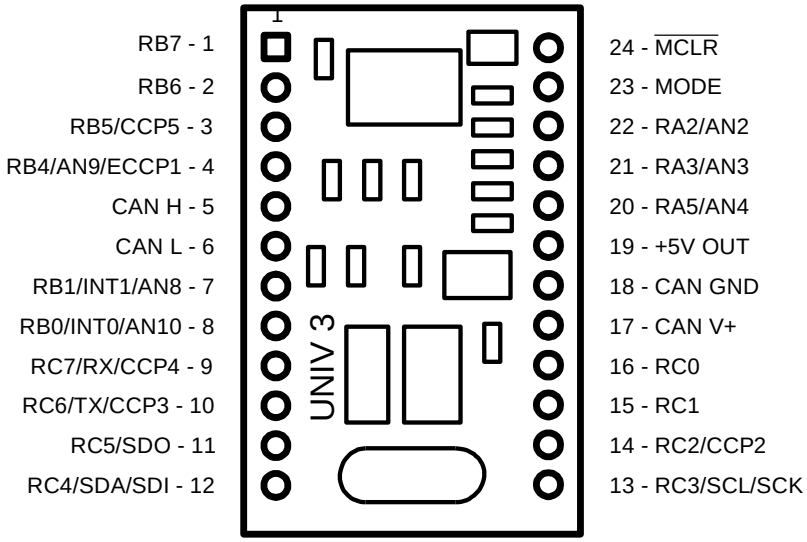


Figure 1. Pinout of UNIV 3 module

Pin number	Symbol	Description	Pin number	Symbol	Description
1	RB7	Port B <7> data input/output	13	RC3 SCK SCL	Port C <3> data input/output SPI clock input/output I^2C clock input/output
2	RB6	Port B <6> data input/output	14	RC2 CCP2	Port C <2> data input/output PWM output
3	RB5 CCP5	Port B <5> data input/output PWM output	15	RC1	Port C <1> data input/output
4	RB4 AN9 ECCP1	Port B <4> data input/output Analogue input PWM output	16	RC0	Port C <0> data input/output
5	CAN H	CAN High-Level Voltage I/O	17	CAN V+	Power supply voltage
6	CAN L	CAN Low-Level Voltage I/O	18	CAN GND	Ground
7	RB1 INT1 AN8	Port B <1> data input/output External interrupt 1 Analogue input	19	+5V OUT	+5V output, max 20mA source
8	RB0 INT0 AN10	Port B <0> data input/output External interrupt 0 Analogue input	20	RA5 AN4	Port A <5> data input/output Analogue input
9	RC7 RX CCP4	Port C <7> data input/output UART data input PWM output	21	RA3 AN3	Port A <3> data input/output Analogue input
10	RC6 TX CCP3	Port C <6> data input/output UART data output PWM output	22	RA2 AN2	Port A <2> data input/output Analogue input
11	RC5 SDO	Port C <5> data input/output SPI data output	23	MODE	Bootloader working mode
12	RC4 SDI SDA	Port C <4> data input/output SPI data input I^2C data input/output	24	MCLR	Reset

Table 2. Pin description

5.2. Bootloader working mode

Processor pin 23 (MODE) connected to the negative power switches bootloader to CAN mode, while connected to positive power switches to UART/CAN mode and increases the clock from 8MHz to 32MHz.

5.3. Schematic

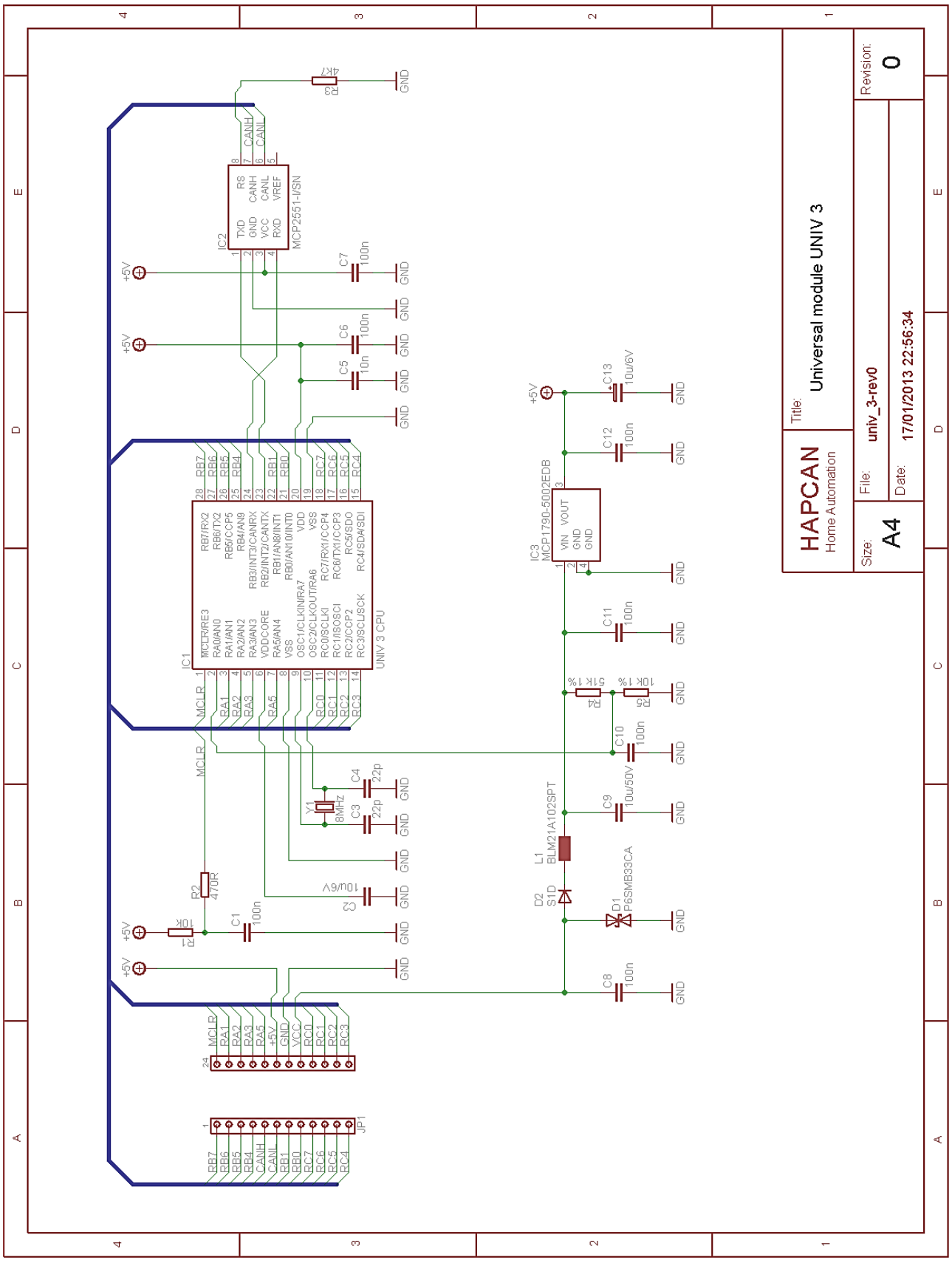
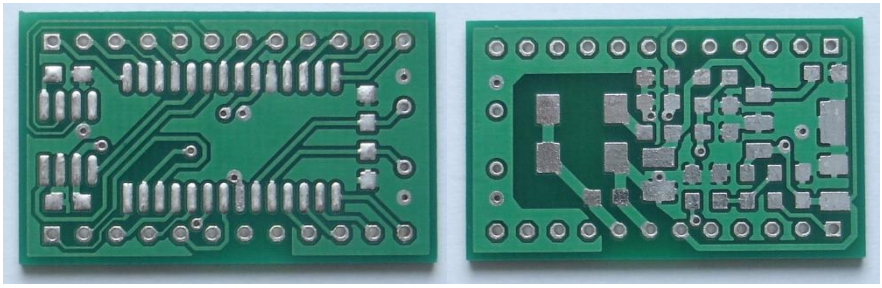


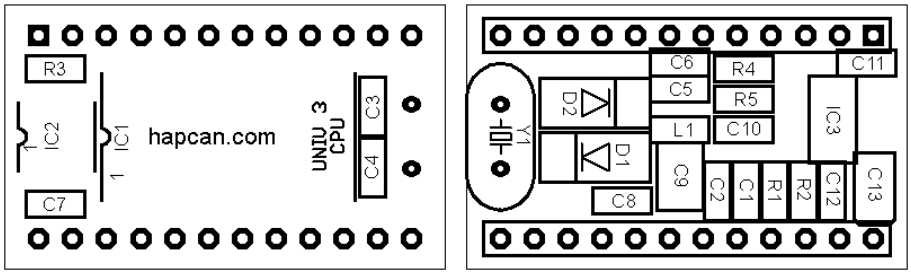
Figure 2. UNIV 3 module schematic

5.4. Printed circuit board

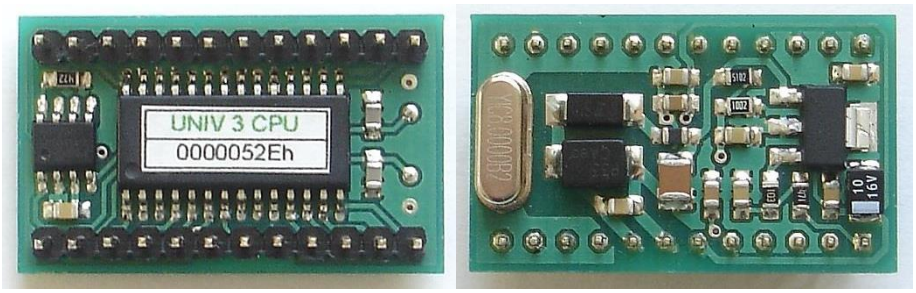
- PCB of UNIV 3 module
- PCB dimensions 33mm x 20mm



5.4.1. Assembly schematic



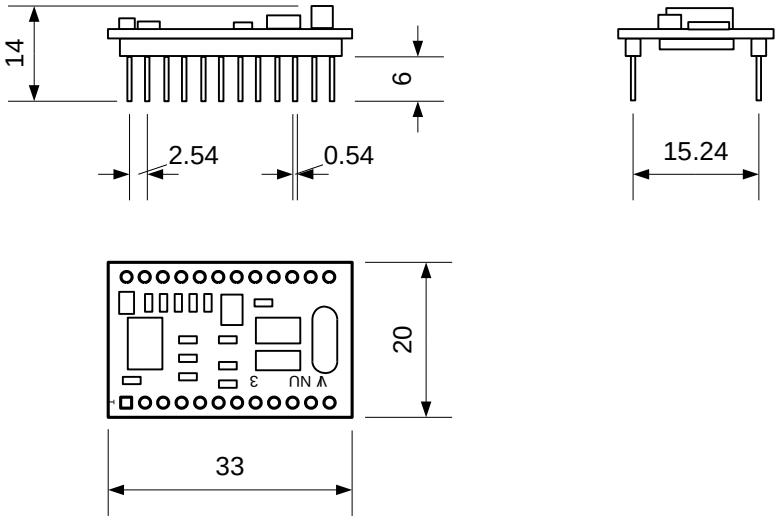
5.4.2. Assembled PCB



5.4.3. Components

Designator	Type	Footprint	Description
C1, C6, C7, C8, C10, C11, C12	100nF	0805	Capacitor
C2	10uF/6V	0805	Capacitor
C3, C4	22pF	0805	Capacitor
C5	10nF	0805	Capacitor
C9	10uF/50V	1210	Capacitor
C13	10uF/6V	SMB	Tantalum capacitor
R1	10k	0805	Resistor
R2	470 Ohm	0805	Resistor
R3	4k7	0805	Resistor
R4	51k 1%	0805	Resistor
R5	10k 1%	0805	Resistor
L1	BLM21A102SPT	0805	Choke
Y1	8MHz	HC49-S	Quartz crystal
D1	P6SMB33CA	DO-214	Transil diode
D2	S1D	DO-214	Diode
IC1	UNIV 3 CPU	SOIC-28	HAPCAN universal processor
IC2	MCP2551-SN	SOIC-8	CAN transceiver
IC3	MCP1790-5002EDB	SOT-23-6	Voltage regulator
JP1	2x12pin	Raster 2.54mm	Connector

5.5. Dimensions



6. Commissioning

6.1. CPU voltage measurement

After verifying the correctness and quality of the soldering, the bus voltage should be connected while measuring the processor voltage. To do this, connect a voltmeter to pins 18 and 19 (GND, +5V OUT) of the module. Processor supply voltage should be about 5V.

6.2. Checking the CPU clock

Proper operation of the CPU can be checked by temporarily connecting the LED to pins 2 and 18 (RB6 & GND) of the module. When device is powered, the LED should light up in one of the sequences shown in table below.

500ms 500ms 500ms 500ms 500ms 500ms 500ms	**Bootloader in UART/CAN mode (32 MHz)** – processor can be accessed through serial port UART (RS232C) or HAPCAN bus. The processor clock is 32 MHz.
1000ms 1000ms 1000ms	**Bootloader in CAN mode (8 MHz)** – processor can be accessed only through HAPCAN bus. The processor clock is 8 MHz.
50ms	**Bootloader is in the programming mode**
∞	**Bootloader error mode**

Table 3. Indication of processor working mode.

7. Firmware

7.1. Bootloader

The bootloader is the program that is executed immediately after processor power up. Thanks to bootloader, communication with processor is possible even if there is not uploaded any firmware or it is incorrect. To communicate with the processor there is a PC needed with HAPCAN Programmer and HAPCAN <-> PC interface. The UNIV 3 CPU processor has pre-uploaded bootloader version 3.x. A detailed description of the current version of the bootloader can be found at hapcan.com.

7.2. Functional firmware

Bootloader enables uploading of functional firmware that manages the operation of the device. The firmware must be dedicated to a specific device, otherwise the device may be damaged.

8. License

9. Document version

File	Note	Date
univ_3a.pdf	Original version	January 2013
univ_3b.pdf	Added missing figure in 5.4.1. section	August 2013