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***«NPF Mechatronica-Pro» LTD***

***MChip80-28035 – Developer's module  
for processors TMS320F2803x with ZIF-panel***

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Technical manual

Rev. 1.11

This technical manual corresponds to developer's module MChip80-28035 rev. 1.1. Correspondence of this manual to other versions of the module should be specified on website of developer – «NPF Mechatronica-Pro» LTD – [www.mechatronica-pro.com](http://www.mechatronica-pro.com).

## 1. Purpose

Developer's module MChip80-28035 is a debugging board with ZIF-panel and integrated USB-programmer for microcontrollers TMS320F28030, TMS320F28031, TMS320F28032, TMS320F28033, TMS320F28034, TMS320F28035 manufactured by Texas Instruments. In base case system the module is supplied with the most advanced microcontroller of line - TMS320F28035.

The module is intended for developing and debugging software that is developed for microcontrollers TMS320F2803x, as well as for programming and testing chips built on their basis.

The module can be used as a processor board for various laboratory and debugging kits, for example, from MCB line manufactured by «NPF Mechatronica-Pro» LTD.

The module is delivered with real-time operational environment MexBIOS™ and graphical programming environment MexBIOS™ Development Studio pre-installed into Flash-memory of the processor, and the environments use essentially accelerates the development of the software.

Mounting holes and location of main input-output connectors of module MChip80-28035 correspond to debugging board eZdsp™2812 manufactured by Spectrum Digital that in many cases makes them interchangeable.

Physical configuration of the module is shown in fig. 1.

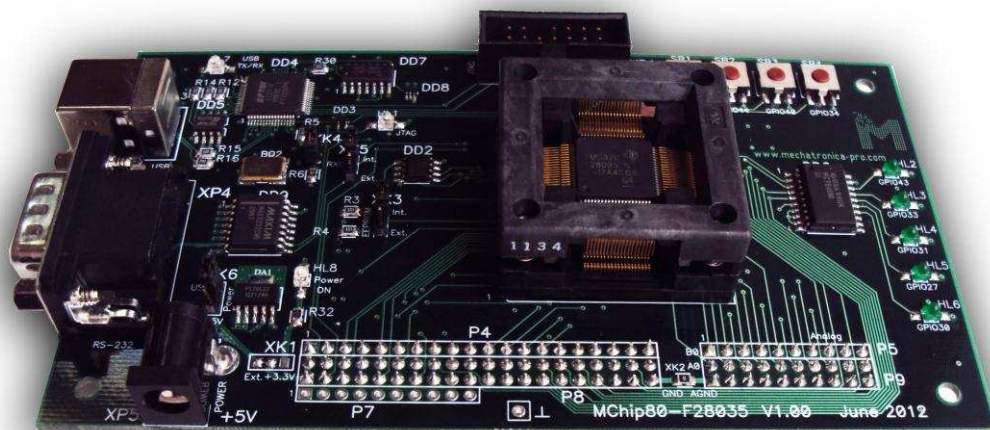


Fig. 1. Physical configuration of the developer's module MChip80-28035

## 2. Specification

Main specification of module MChip80-28035 is shown in table 1.

Table 1. Specification of module MChip80-28035		
Processor mounting method	ZIF-panel with zero insertion force	
Processor package	LQFP 80 (PN)	
Processor	TMS320F28035	
Mountable processors	TMS320F28030, TMS320F28031, TMS320F28032, TMS320F28033, TMS320F28034, TMS320F28035	
Clock frequency	Up to 60 MHz	
Floating point module FPU	No	
Memory on processor chip	For TMS320F28035	
RAM		10K x 16
Flash		64K x 16
Digital input/output lines, total	45	
EEPROM on board	64 kB (8k x 8)	
To external connections are led:		
analog inputs of the microcontroller	2 x 8 (12-bit ADC)	
digital inputs/outputs of the microcontroller	40 (3,3 V logic)	
Buttons for testing input	4	
LEDs for testing output	7	
Programming	Integrated USB-programmer (XDS100 driver) Connector IEEE 1149.1 JTAG	
Interface facilities of the board	USB 2.0 (VCP) and RS-232 connected to SCI MK interface	
Embedded software	Pre-installed OE MexBIOS™	
Power supply	From external power source 5 V 0,5 A From USB	
Board dimensions, mm	136,1 x 76,5	

### 3. Structure of the module

#### 3.1. Functional diagram

Functional diagram of the module is shown in fig. 2.

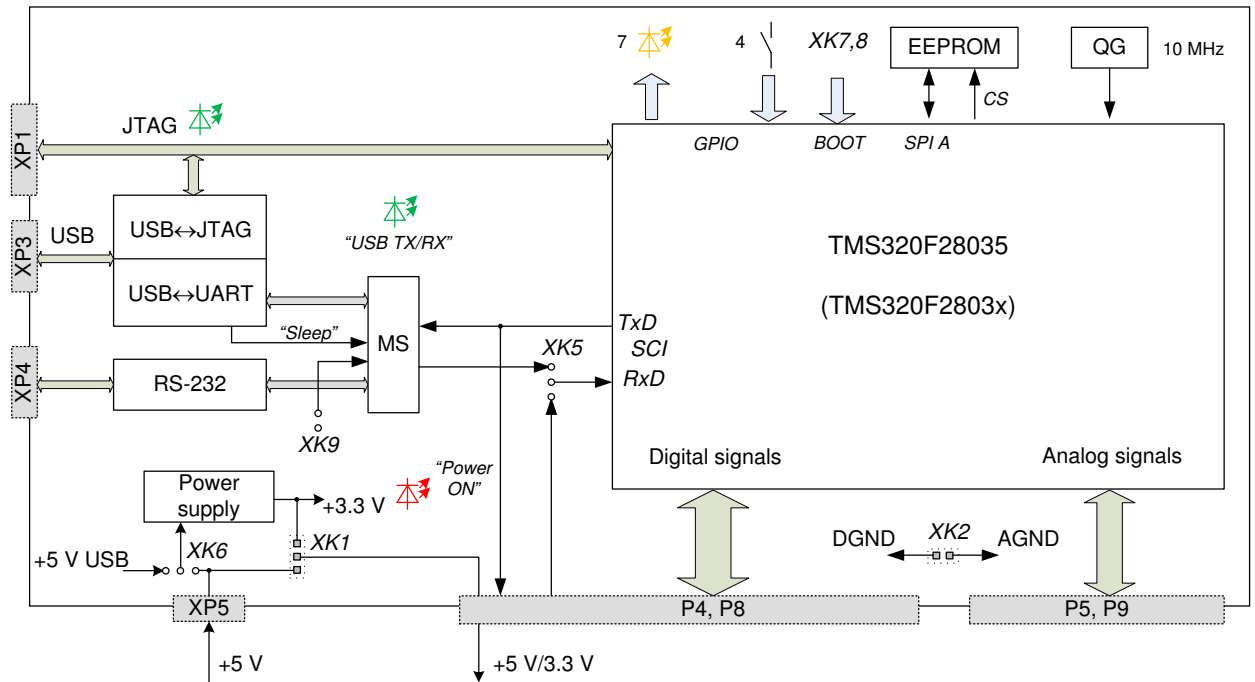


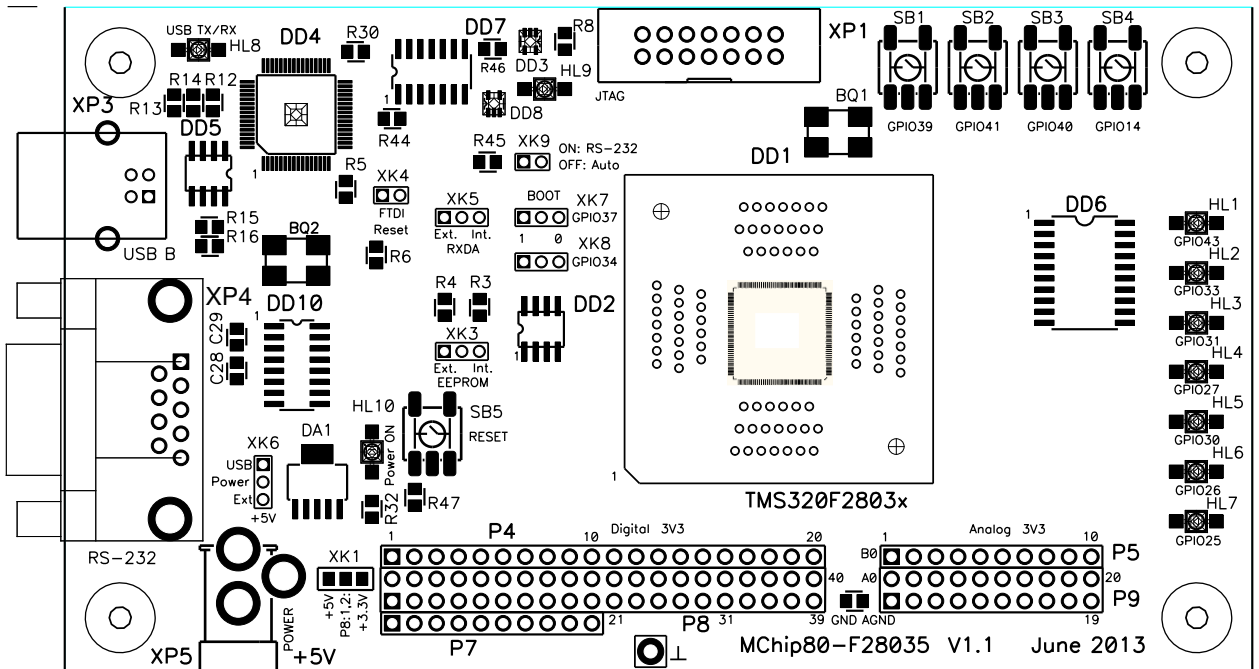
Fig. 2. Functional diagram of the module MChip80-28035

Components of the module are:

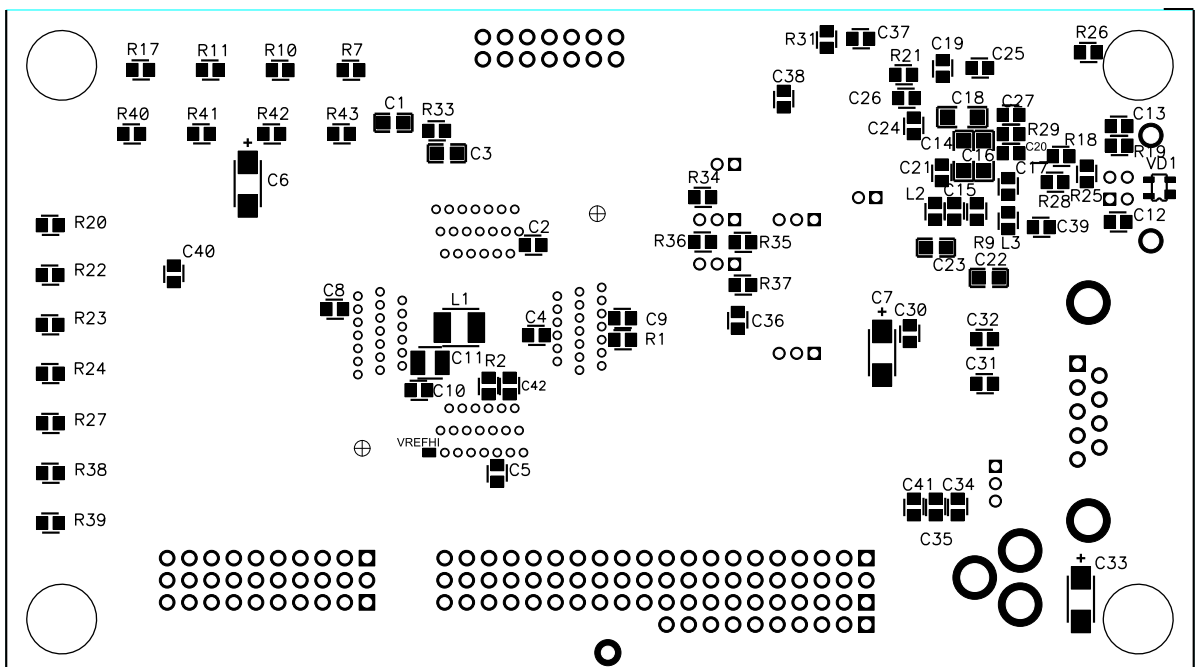
- DSP-microcontroller TMS320F28035 (DD1), mounted in ZIF-panel, or another from the supported line;
- EEPROM memory chip (ROM 8K x 8, DD2);
- clock 10 MHz (BQ1);
- USB interface (DD4);
- RS-232 interface (DD10);
- LED driver (DD6);
- Power supply (DA1);
- Buttons for testing digital input (SB1...SB4);
- LEDs of service indication;
- LEDs for testing digital output (HL1...HL7);
- connectors and jumpers.

### 3.2. Location of components on the board

Location of components on the board can be seen in fig. 3.



a) top view



b) bottom view

Fig. 3. Location of components on board of module MChip80-28035

### 3.3. Connectors functions

Functions of the module connectors are shown in table 2.

Table 2. Functions of connectors of the module				
Designation	Function		Type of on-board connector	Type of complementary connector
XP1	JTAG	Programming and debugging	BH-14	PBD-14, IDC-14F
XP3	USB	a) virtual COM-port (VCP), b) programming interface JTAG	Socket USBB-1J	Plug USB type B (M)
XP4	RS-232	Serial interface	DRB-9MB	DB-9F, DI(C)-9F
XP5	+5 B	External power supply	DJK-02A	DJK-10A
P4,P7,P8		Logic signal interface	PBD, PBS	PLT, PLD, PLS
P5, P9		Analog signals	PBD, PBS	PLT, PLD, PLS

### 3.4. Jumpers functions

Functions of the module jumpers are shown in table 3.

Table 3. Functions of jumpers of the module	
Designation	Function
XK1	Selection of power supply of external circuits via connectors P4, P8
XK2	Interconnection of analog and digital grounds
XK3	Selection of the GPIO13 use
XK4	Reset of USB driver
XK5	Selection of the SCIRXDA signal source
XK6	Selection of the module power source
XK7	Selection of BOOT-sector (GPIO34)
XK8	Selection of BOOT-sector (GPIO37)
XK9	Selection of communications interface for module SCI A

### 3.5. LEDs functions

Functions of the module LEDs are shown in table 4.

Table 4. Functions of LEDs of the module			
Designation		Color	Function
HL1	GPIO43	yellow	Testing digital output, active level is high
HL2	GPIO33		
HL3	GPIO31		
HL4	GPIO27		
HL5	GPIO30		
HL6	GPIO26		
HL7	GPIO25		
HL8	USB TX/RX	green	Indication of the data exchange via VCP USB
HL9	JTAG	green	Indication of JTAG operation
HL10	Power ON	red	Indication of power supply +3,3 V

### 3.6. Buttons functions

Functions of the module buttons are shown in table 5.

Table 5. Functions of buttons of the module		
Designation		Function
SB1	GPIO39	Testing digital input. If the button is pushed, the input gets logic zero state
SB2	GPIO41	
SB3	GPIO40	
SB4	GPIO14	

### 3.7. EEPROM memory usage

#### 3.7.1. EEPROM memory

For long-term data storage a nonvolatile memory chip CAT25640 (DD2) with capacity of 64K and feature (8192 x 8) is mounted on the module.

The memory communicates data with microcontroller via SPI interface, by using SPI A module of the microcontroller (see lines in table 7). The crystal selection signal is generated by GPIO13 line (the active level is low).

#### 3.7.2. Jumper XK3 function

GPIO13 line is connected to the output of CS memory chip only in right position («Int») of the XK3 jumper.

When jumper XK3 is in left position («Ext»), the GPIO13 line is connected to pin 4 of connector P4. In this case the data exchange with memory chip mounted on the module is disabled.

Table 6. Jumper XK3 settings		
Jumper	Setting	EEPROM chip in use
XK3	«Int» (right)*	Mounted on the module
	«Ext» (left)	External

#### 3.7.3. SPI external bus of the module

SPI external bus can be arranged as it is shown in table 7.

Table 7. Signals of SPI bus of the module			
Microcontroller pin	GPIO	Signal	External connector
46	GPIO16	SPISIMOA	P8: 23
42	GPIO17	SPISOMIA	P8: 24
41	GPIO18	SPICLKA	P8: 25
55	GPIO19	~SPISTEA*	P8: 26
74	GPIO34	SPI_CS0*	P4: 3
76	GPIO13	SPI_CS1*	P4: 4 (via XK3)
75	GPIO15	SPI_CS2*	P4: 5

\* - optionally

### 3.8. Selection of the load mode, jumpers XK7, XK8

The load mode is determined by setting the jumpers XK7, XK8.

Left setting of the jumper corresponds to logic «1», the right one – to logic «0».

**Table 8. XK3... XK6 jumpers settings**

Mode	XK7 (GPIO37/TDO)	XK8 (GPIO34)	~TRST	MODE
3	1	1	0	GetMode
2	1	0	0	Wait
1	0	1	0	SCI
0	0	0	0	Parallel IO
EMU	x	x	1	Emulation Boot

### 3.9. Power supply of the module

For operation the module needs a power supply with 5 V voltage.

#### 3.9.1. Methods of powering the module

The module power supply can be carried out by three methods:

- via power connector XP5 of type DJK-02A with internal pin with diameter 2 mm, when jumper XK6 is set into «+5 V Ext»;
- via pins 1 (1, 2) of connector P4 (P8), when XK1 jumper is set to 2-3;
- from USB when jumper XK6 is set to «+5 V USB».

#### 3.9.2. Function of jumper XK1

Setting of planar jumper XK1 determines connection of pin 1 of connector P4 and pins 1, 2 of connector P8 to bus +5 V of the module or to bus +3,3 V. In the former case it is possible to power the module both from an external power source via connectors P4, P8, and powering the boards that are connected to these connectors. In the latter case – the connectors are powered by voltage +3,3 V from the module power supply.

**Table 9. Jumper XK1 setting**

Jumper	Setting	Power supply to P4, P8
XK1	«3.3 V» (right)	+3,3 V
	«5V» (left)*	+5 V
	No jumper	is not applied

#### 3.9.3. Function of jumper XK6

Setting of XK6 jumper determines selection of the module power supply +5 V.

When set to 1-2 «+5 V USB» the module is supplied from USB bus.

When set to 2-3 «+5 V Ext» the module is powered from pin power supply connector XP5 or via pins 1 (1, 2) of connector P4 (P8).

**Table 10. Jumper XK6 setting**

Jumper	Setting	Power supply to the module
XK6	«+5 V USB» (upper)	USB bus
	«+5 V Ext» (lower)*	External supply source +5 V
	No jumper	The module is not powered

### 3.10. Serial interfaces of the module

The module communication with external devices can be carried out by one of two serial interfaces: USB and RS-232.

#### 3.10.1. USB interface

As USB driver a FT2232H chip is used, whose *B* converter converts the signals of USB 2.0 HS into UART with data communication speed up to 12 Mbaud.

The process of data communication is indicated by green LED HL8 «USB TX/RX».

The module can be powered from USB bus up to 500 mA.

On the module an USB connector of type B (XP3) is mounted. Functions of the connector pins are shown in table 11.

**Table 11. Functions of pins of connector XP3**

Connector	Pin	Circuit
XP3 Connector USBB-1J B type	1	+ 5 V
	2	DP
	3	DM
	4	GND

#### 3.10.2. RS-232 interface

As a driver for RS-232 interface a chip MAX3232WE is used with data communication speed up to 1 Mbaud.

For cable connection a connector of type DB-9 (XP4) is used. The connector pins functions are shown in table 12.

**Table 12. Functions of pins of connector XP4**

Connector	Pin	Circuit
XP4 DRB-9MB	1	is not used
	2	RxD
	3	TxD
	4	is not used
	5	GND
	6...9	is not used

#### 3.10.3. Multiplexing signals. Function of jumper XK9

Signals of interfaces are connected to SCI lines of the microcontroller via multiplexor. The operation mode of the multiplexor is determined by jumper XK9.

When there is no jumper XK9, the multiplexor is controlled by signal “~Suspend” of USB driver. If there is no device connected to USB, the USB driver switches over to sleep mode and enables the data

communication via RS-232 interface. And vice-versa, activation of USB driver disables the communication via RS-232 interface.

When jumper XK9 is shorted, then the RS-232 interface is enabled regardless of the master-device that is connected to USB port. This mode can be useful, for instance, in the following cases:

- the module is powered from USB bus, but because of high level of noise it is reasonable to use RS-232 interface;
- USB port is used for debugging via JTAG, and RS-232 – for serial communication.

**Table 13. Jumper XK9 settings**

Jumper	Setting	Mode
XK9	Shorted	RS-232
	No jumper*	Automatic selection

#### 3.10.4. Function of jumper XK5

By means of jumper XK5 you can select the source of signal that comes to input SCIRXDA/GPIO28 of microcontroller: from pin 4 of connector P8 or from active driver of serial interface of the module.

**Table 14. Jumper XK5 settings**

Jumper	Setting	Signal source for input SCIRXDA
XK5	«Int» (right)*	From driver of serial interface of the board
	«Ext» (left)	From pin 4 of connector P8
	No jumper	Signal is not applied to the input

#### 3.10.5. SCI bus of the module

SCI bus of the module is connected to pins of microcontroller according to table 15.

**Table 15. Signals of the module SCI bus**

Microcontroller pin	GPIO	Signal	External connector
34	GPIO29	SCITXDA	P8: 3
40	GPIO28	SCIRXDA	P8: 4 (via XK5)

### 3.11. Programming via JTAG

Programming and debugging of the software can be fulfilled by means of JTAG interface via connector XP1 and via USB converter.

#### 3.11.1. Programming via USB

Converter A of the USB driver - chip FT2232H converts signals of USB 2.0 HS into JTAG interface, if XDS100 driver is used on the computer (by Code Composer or C2Prog for example).

The process of data communication is indicated by green LED HL9 «JTAG».

#### 3.11.2. Programming via connector XP1

Functions of the connector pins are shown in table 16.

**Table 16. Functions of pins of connectors XP1, XS1**

Connector	Pin	Circuit	MC pin	GPIO
XP1, PBD-14	1	TMS	60	GPIO36
	2	~TRST	10	
	3	TDI	59	GPIO35
	4, 6, 8, 10, 12	GND		
	5	+3.3 V		
	7	TDO	58	GPIO37
	9	TCK	57	GPIO38
	11	TCK		
	13, 14	<i>not used</i>		

### 3.12. Connectors of inputting/outputting logic signals

Inputting/outputting logic signals from microcontroller to external expansion boards is carried out via connectors P4, P7, P8.

Almost all outputs of the connectors are connected directly to microcontroller and allow operation with 3,3 V.

Functions of the connectors pins are shown in table 17.

**Table 17. Functions of pins of connectors P4, P7, P8**

Connector	Pin	Microcontroller pin			Function in module
		№	Functions	GPIO	
P4, PBS-20	1	+5V			+5V
	2	<i>is not used</i>			
	3	74	~TZ3/LINTXA/SPICLKB	GPIO34	
	4	76	~TZ2/SPISOMIB	GPIO13	CS_EEPROM (via XK3)
	5	75	~TZ1/LINRXA/~SPISTEB	GPIO15	
	6	<i>is not used</i>			
	7	<i>is not used</i>			
	8	56		GPIO39	SB1
	9	<i>is not used</i>			
	10	GND			GND
	11	80	ECAP1/SPISIMOB	GPIO24	
	12	1	EQEP1S/LINTXA	GPIO22	
	13	6	COMP2OUT	GPIO43	HL1
	14	5	COMP1OUT	GPIO42	
	15	3	SDAA/EPWMSYNCO/ADCSOCBO	GPIO33	HL2
	16	64	EPWM7A	GPIO40	SB3
	17	48	EPWM7B	GPIO41	SB2
	18	<i>is not used</i>			
	19	77	TZ3/LINTXA/SPICLKB	GPIO14	SB4
20	GND			GND	
P7, PBS-10	1...9	<i>are not used</i>			
	10	GND			GND

Table 17 (Continuation). Functions of pins of connectors P4, P7, P8

Connector	Pin	Microcontroller pin			Function in module
		№	Functions	GPIO	
P8, PBD-40	1, 2	+5V			+5V
	3	34	SCITXDA/SCLA/~TZ3	GPIO29	SCITXDA
	4	40	SCIRXDA/SDAA/~TZ2	GPIO28	SCIRXDA (via XK5)
	5	<i>is not used</i>			
	6	78	EQEP1A/COMP1OUT	GPIO20	
	7	79	EQEP1B/COMP2OUT	GPIO21	
	8	4	EQEP1I/LINRXA	GPIO23	
	9	69	EPWM1A	GPIO0	
	10	68	EPWM1B/COMP1OUT	GPIO1	
	11	67	EPWM2A	GPIO2	
	12	66	EPWM2B/SPISOMIA/COMP2OUT	GPIO3	
	13	63	EPWM3A	GPIO4	
	14	62	EPWM3B/SPISIMOA/ECAP1	GPIO5	
	15	31	HRCAP2/~SPISTEB	<b>GPIO27</b>	HL4
	16	32	CANTXA	<b>GPIO31</b>	HL3
	17, 18	<i>are not used</i>			
	19, 20	GND			GND
	21	33	CANRXA	<b>GPIO30</b>	HL5
	22	<i>is not used</i>			
	23	46	SPISIMOA/~TZ2	GPIO16	SPISIMOA
	24	42	SPISOMIA/~TZ3	GPIO17	SPISOMIA
	25	41	SPICLKA/LINTXA/XCLKOUT	GPIO18	SPICLKA
	26	55	XCLKIN/SPISTEA / LINRXA/ECAP1	GPIO19	
	27	37	HRCAP1/SPICLKB	<b>GPIO26</b>	HL6
	28	44	SPISOMIB	<b>GPIO25</b>	HL7
	29	<i>is not used</i>			
	30	50	EPWM4A/EPWMSYNCI/EPWMSYNCO	GPIO6	
	31	49	EPWM4B/SCIRXDA	GPIO7	
	32	43	EPWM5A/ADCSOAO	GPIO8	
	33	39	EPWM5B/LINTXA/HRCAP1	GPIO9	
	34	65	EPWM6A/ADCSOCBO	GPIO10	
	35	61	EPWM6B/LINRXA/HRCAP2	GPIO11	
	36	2	SDAA/EPWMSYNCI/ADCSOAO	<b>GPIO32</b>	
	37	45		<b>GPIO44</b>	
	38	47	TZ1/SCITXDA/SPISIMOB	<b>GPIO12</b>	
	39	GND			GND
	40	GND			GND

### 3.13. Inputting analog signals

#### 3.13.1. Connectors for inputting analog signals

Inputting analog signals from external expansion boards is carried out via connectors P5, P9. Functions of the connectors pins are shown in table 18.

Table 18. Functions of pins of connectors P5, P9					
Connector	Pin	Microcontroller pin		Function in MCB kit	
		№	Function		Assignment
P5, PBS-10	1	23	ADCINB0	Analog inputs ADC B	VREF
	2	24	ADCINB1		V_DC
	3	25	ADCINB2		CUR_W1
	4	26	ADCINB3		CUR_U1
	5	27	ADCINB4		
	6	28	ADCINB5		
	7	29	ADCINB6		CUR_U2
	8	30	ADCINB7		CUR_W2
	9	<i>is not used</i>			
	10	<i>is not used</i>			
P9, PBD-20	1	AGND		AGND	
	2	18	ADCINA0	Analog input ADC A0	
	3	AGND		AGND	
	4	17	ADCINA1	Analog input ADC A1	
	5	AGND		AGND	
	6	16	ADCINA2	Analog input ADC A2	
	7	AGND		AGND	
	8	15	ADCINA3	Analog input ADC A3	
	9	AGND		AGND	
	10	14	ADCINA4	Analog input ADC A4	
	11	AGND		AGND	
	12	13	ADCINA5	Analog input ADC A5	
	13	AGND		AGND	
	14	12	ADCINA6	Analog input ADC A6	
	15	AGND		AGND	
	16	11	ADCINA7	Analog input ADC A7	
	17	AGND		AGND	
	18	<i>is not used</i>			
	19	AGND		AGND	
	20	<i>is not used</i>			

#### 3.13.2. Function of jumper XK2

Planar jumper XK2 interconnects analog and digital grounds of the module. In delivery set it is mounted.

## 4. Delivery set

The module is delivered as a set of following components:

- Debugging board MChip80-28035;
- Power supply source ~220 V / + 5 V, 3 A;
- Null-modem cable DB9F-DB9F 3.0m;
- cable USB 2.0 A -->B 1.8m with ferrite rings;
- connectors (for P4, P5, P8, P9, by agreement)
- technical manual;
- pre-installed MexBIOS™Kernel.

Note:

- 1) for configuring MexBIOS™Kernel you need to contact the developer or download MexBIOS™Development Studio from the website of the developer;
- 2) the circuit scheme of the module is granted on demand.

## 5. Contacts

"NPF Mechatronica-Pro" LTD  
str. Usova 7 office 232  
Tomsk 634034 Russia  
Phone.: +7 (3822) 252-842  
E-Mail: support@mechatronica-pro.com  
<http://mechatronica-pro.com>