MIKROE

EasyPIC v8
for dsPIC30
DEVELOPMENT BOARD

It's time to rethink the way you approach rapid prototyping

Let us introduce you to the latest generation of Mikroe development boards – **EasyPIC v8 for dsPIC30**

MIKROE
Time-saving embedded tools

All images shown in the manual are for illustration purpose only.

Table of contents

EasyPIC v8 for dsPIC30

8th Generation of EasyPIC Development Board

ON BOARD DEBUGGER UNIT

POWER SUPPLY UNIT

POWER CHARGER

CODEGRIP
USB WIFI

POWER
USB-LINK
NET-LINK
ACTIVE
DATA

POWER/DEBUG
BATTERY
POWER 12VDC

EXTERNAL

DBG SEL

LIN COMM.

POWER

RESET

MIKROE

GRAPHICAL DISPLAY

1 mikroBUS
WIRELESS CONNECTIVITY INTERFACES WITH FEATURES MOTOR DRIVERS INPUT DEVICES INPUT DISPLAYS

2 mikroBUS

3 mikroBUS

4 mikroBUS

5 mikroBUS

USB TO UART

CAN COMM.

VREF

LCD 2X16 CHARACTERS

BOARD SETUP

DEVICE SETUP

TOUCH PANEL CONTROLLER

BACKLIGHT

B
B/C
D/A
E
E/F

DIP40A

DIP28A

DIP28B

DIP40B

DIP18

DIP28C

Development board for 16-bit PIC microcontrollers

The EasyPIC v8 for dsPIC30 is a development board designed for the rapid development of embedded applications, based on 16-bit dsPIC30 microcontrollers (MCUs). Redesigned from the ground up, EasyPIC v8 for dsPIC30 offers a familiar set of standard features, as well as some new and unique features, common for the 8th generation of development boards: programming and debugging over the WiFi network, connectivity provided by USB-C connectors, support for a wide range of different MCUs, and more.
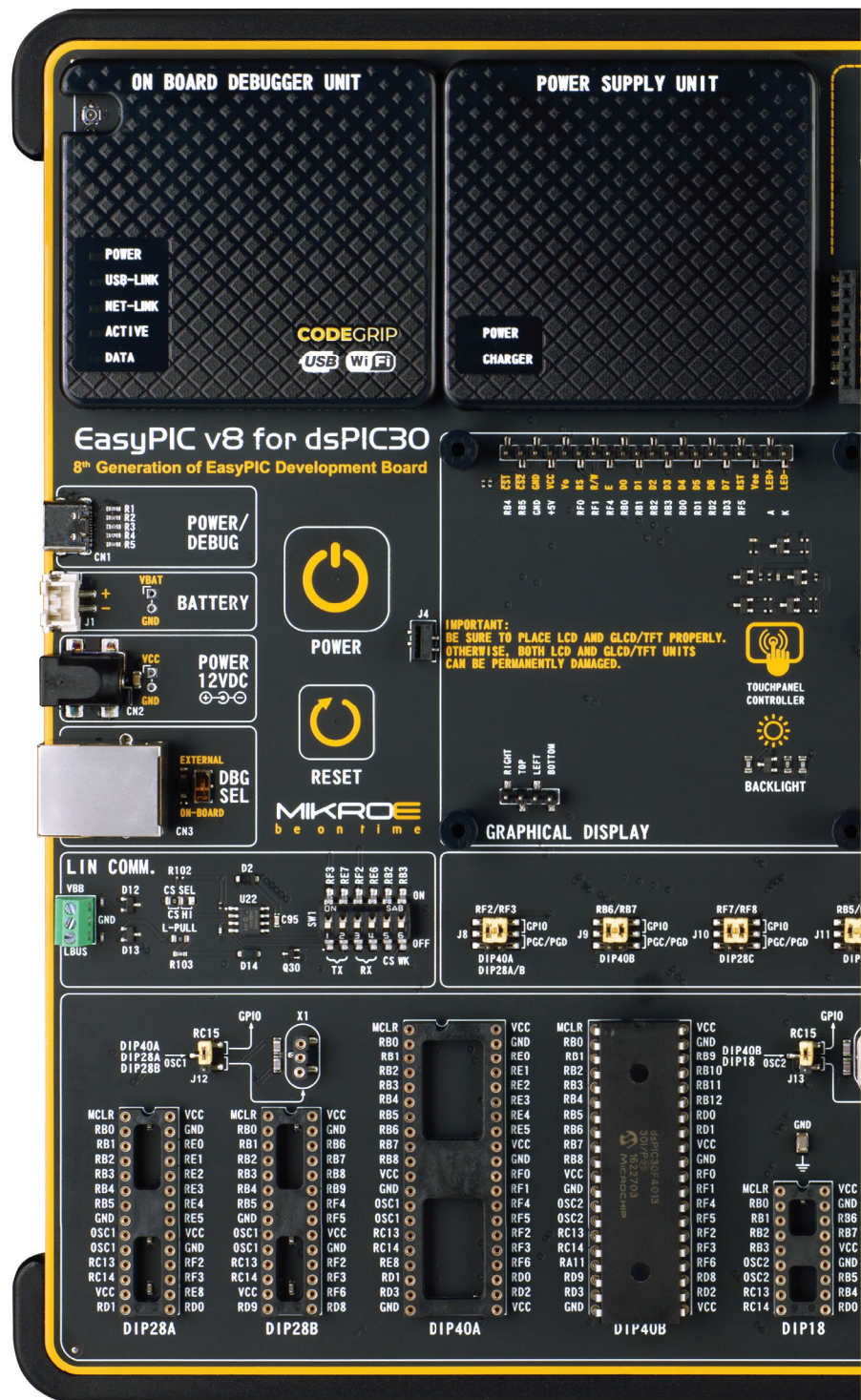
The development board is designed so that the developer has everything that might be needed for the application development, following the Swiss Army knife concept: a highly advanced programmer/debugger module, a reliable power supply module, a huge set of connectivity options including USB to UART, CAN, LIN etc.

EasyPIC v8 for dsPIC30 board offers a number of different DIP sockets, covering a wide range of 16-bit dsPIC30 MCUs, from the smallest dsPIC30 MCU devices with only 18 pins, all the way up to 40-pin "giants".

The development board supports the well-established mikroBUS™ connectivity standard, offering five mikroBUS™ sockets, allowing access to a huge base of Click boards™.

EasyPIC v8 for dsPIC30 offers two display options, allowing even the basic 16-bit dsPIC30 MCU devices to utilize them and display graphical or textual content. One of them is the 1x20 graphical display connector, compatible with the familiar Graphical Liquid Crystal Display (GLCD) based on the KS108 (or compatible) display driver, and EasyTFT board that contains TFT Color Display MI0283QT-9A, which is driven by ILI9341 display controller, capable of showing advanced graphical content. The other option is the 2x16 character LCD module, a four-bit display module with the embedded character-based display controller, which requires minimal processing power from the host MCU for its operation.

There is a wide range of useful interactive options at the disposal: high-quality buttons with selectable press levels, LEDs, pull-up/pull-down DIP switches, and more. All these features are packed on a single development board, which itself uses innovative manufacturing technologies, delivering fluid and immersive working experience. The EasyPIC v8 for dsPIC30 development board is also an integral part of the Mikroe rapid development ecosystem. Natively supported by the Mikroe Software toolchain, backed up by hundreds of different Click board™ designs with their number growing on a daily basis, it covers many different prototyping and development aspects, thus saving precious development time.

Development board overview

The EasyPIC v8 for dsPIC30 development board features a clean and intuitive layout, allowing the user to instantly understand how to set it up and how to easily tune it according to needs. The development board is divided into several sections, arranged so that all the related interactive components such as switches, buttons, indicators, and connectors, are logically positioned and grouped together.

Each section of the development board contains components important for reliable operation of the board itself. The Power Supply Unit (PSU), the CODEGRIP programmer/debugger module, and five mikroBUS™ sockets are located at the upper section of the development board. This is where the MCU is powered from, programmed, and interfaced with various Click boards™.

The **PSU module** provides a clean and well-regulated voltage for the development board. It can use a wide range of external power sources, including a battery, an external 12V power supply, and a power source over the USB-C connector. It supports the power supply redundancy function (power ORing) for uninterrupted operation. The onboard PSU module regulates, filters, and distributes the power across all the connected peripherals. The development board is equipped with two touch-sensitive buttons labeled as POWER and RESET. These buttons are used to power up the board and reset the MCU. Their sleek design and flawless responsiveness add up to the whole experience. These touch-sensitive buttons are resistant to wear over time and do not exhibit any bouncing effect, unlike mechanical switches.

The powerful **CODEGRIP module**, an integrated programmer/debugger module supports a wide range of different 16-bit dsPIC30 MCUs, produced by Microchip. It allows in-place programming and debugging of all the supported MCUs, offering many useful programming/debugging options and seamless integration with the Mikroe software environment. It also offers some powerful and unique features such as the programming/debugging over WiFi; a feature that will revolutionize the way that the embedded applications are developed.

The CODEGRIP module uses the USB-C connector for a reliable and secure connection with the personal computer (host PC). It does not require any additional drivers because it utilizes a HID driver model, natively supported by the computer's operating

system (OS). The USB-C connector is also used to power the development board, simplifying the cable management.
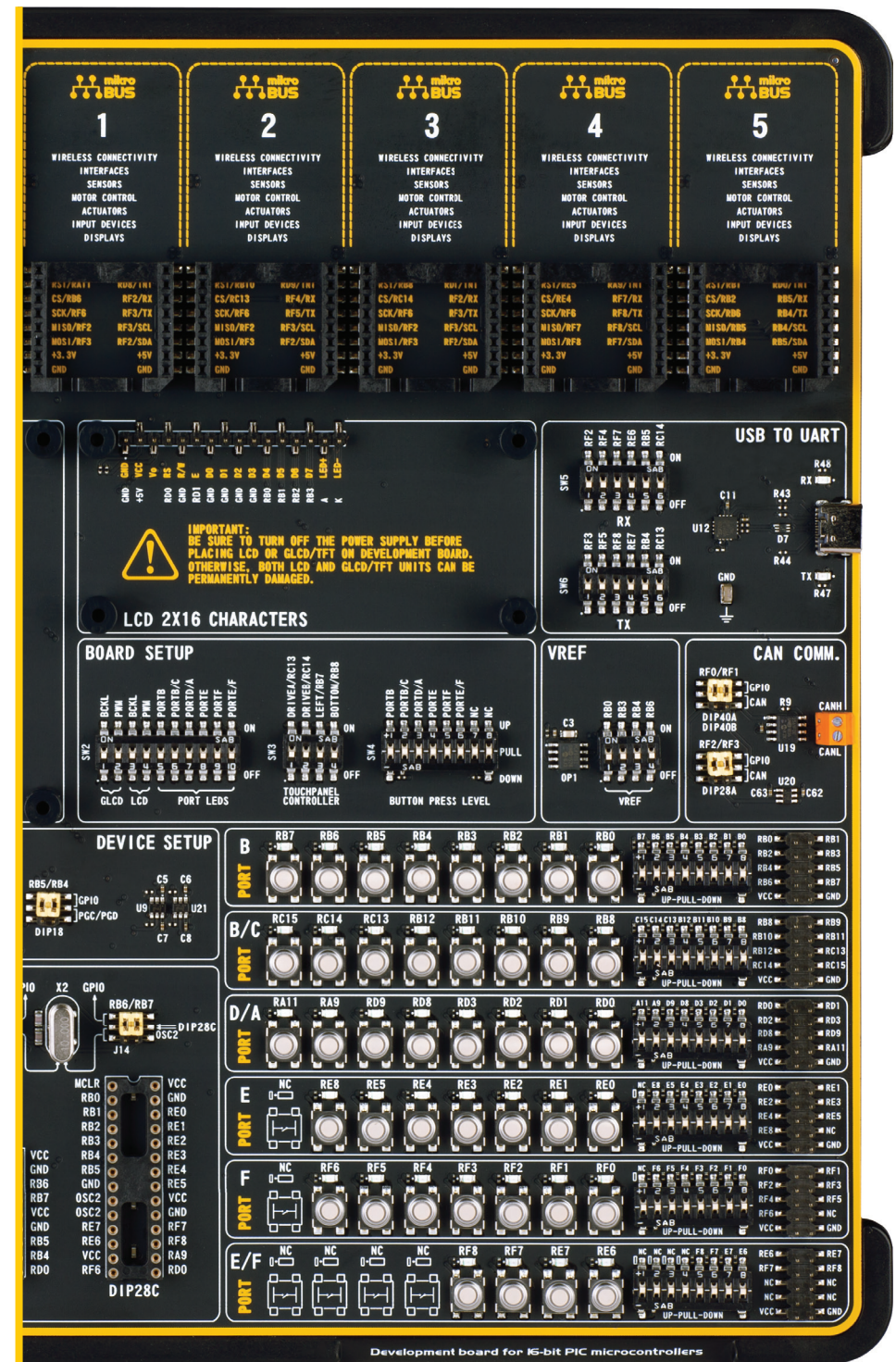
The EasyPIC v8 for dsPIC30 development board offers **five improved mikroBUS™ sockets**, allowing interfacing with a vast amount of electronic circuits and reference designs, standardized under the Click board trademark. Click boards™ are simple to use, require no additional hardware configuration and can be easily connected to the development board by inserting them into any of the available mikroBUS™ sockets. A new design of the mikroBUS™ socket allows even easier interfacing with the Click board™ line of products: it has a sturdier design which helps to align the Click board™ correctly. To read more about development improvements and huge benefits offered by the mikroBUS™ and Click board™ line of products, visit the official Mikroe web page at **www.mikroe.com**

The EasyPIC v8 for dsPIC30 development board is equipped with two display connectors, located in the middle section of the board. One connector is a **1x16 pin header** used for connecting a character-based LCD in 4-bit mode. The second display connector is a single row 20 pin header, which supports monochromatic GLCD and EasyTFT board. The **1x20 pin graphical display connector** is accompanied by two 4-pin connectors (4-pin FFC connector and 1x4 pin header), which are used for the touch panel connection. The development board also provides the required circuitry, allowing the resistive touch panel to be interfaced with the installed MCU. Both the LCD and GLCD display connectors support a PWM-driven (dimmable) or fixed backlight functionality.

The **I/O section** occupies the lower part of the development board and contains available MCU pins routed to 2x5 pin headers for easy access. There are configurable pull-up or pull-down resistors and buttons for applying logic states to MCU pins. LED indicators provide visual feedback of logic states for each pin. The MCU pins are divided into groups, following the grouping concept used on the MCU itself (PORTB, PORTB/C, PORTD/A, PORTE, PORTF and PORTE/F). The I/O section is where the most interaction with the MCU takes place.

Communication options such as USB-UART, CAN and LIN are also included. All the connectors are positioned at the edges of the development board, so they can be easily accessed. This is also true for the power connectors, as well as for an external RJ45 ICD connector. This allows clean and clutter-free cable management.

The EasyPIC v8 for dsPIC30 development board is equipped with the onboard **CODEGRIP module and supported by a powerful CODEGRIP Suite**, enabling complete control over the programming and debugging tasks. It is also used to configure various other options and settings, providing visual feedback through its clean and comprehensive Graphical User Interface (GUI). Detailed explanation on how to configure and use the CODEGRIP module find at the following link: **www.mikroe.com/debuggers/codegrip**
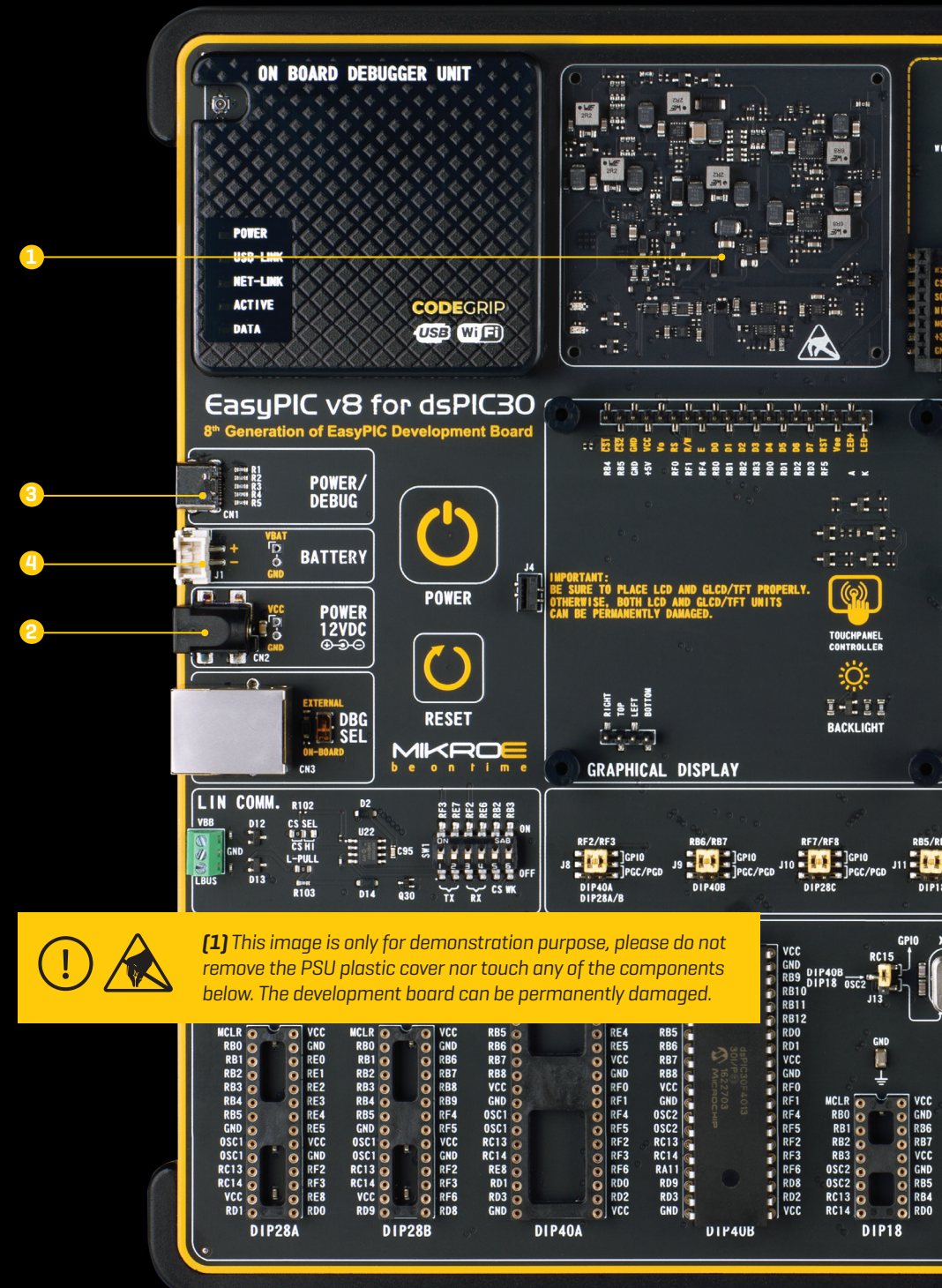
Power supply unit

The power supply unit (PSU) **[1]** provides clean and regulated power, necessary for proper operation of the development board. The host MCU, along with the rest of the peripherals, demands regulated and noise-free power supply. Therefore, the PSU is carefully designed to regulate, filter, and distribute the power to all parts of the development board. It is equipped with three different power supply inputs, offering all the flexibility that EasyPIC v8 for dsPIC30 needs, especially when used on the field. In the case when multiple power sources are used, an automatic power switching circuit with predefined priorities ensures that the most appropriate will be used.

The PSU also contains a reliable and safe battery charging circuit, which allows a single-cell Li-Po/Li-Ion battery to be charged. Power OR-ing option is also supported, providing uninterrupted power supply (UPS) functionality when an external or USB power source is used in combination with the battery.

Detailed description

The PSU has a very demanding task of providing power for the host MCU and all the peripherals onboard, as well as for the externally connected peripherals. One of the key requirements is to provide enough current, avoiding the voltage drop at the output. Also, the PSU must be able to support multiple power sources with different nominal voltages, allowing switching between them by priority. The PSU design, based on a set of high-performance integrated devices produced by Microchip, ensures a very good quality of the output voltage, high current rating, and reduced electromagnetic radiation.

At the input stage of the PSU, the MIC2253, a high-efficiency boost regulator IC with overvoltage protection ensures that the voltage input at the next stage is well-regulated and stable. It is used to boost the voltage of low-voltage power sources (a Li-Po/Li-Ion battery and USB), allowing the next stage to deliver well-regulated 3.3V and 5V to the development board. A set of discrete components are used to determine if the input power source requires a voltage boost. When multiple power sources are connected at once, this circuitry is also used to determine the input priority level: externally connected 12V PSU **[2]**, power over USB **[3]**, and the Li-Po/Li-Ion battery **[4]**. The transition between available power sources is seamless, providing uninterrupted operation of the development board.
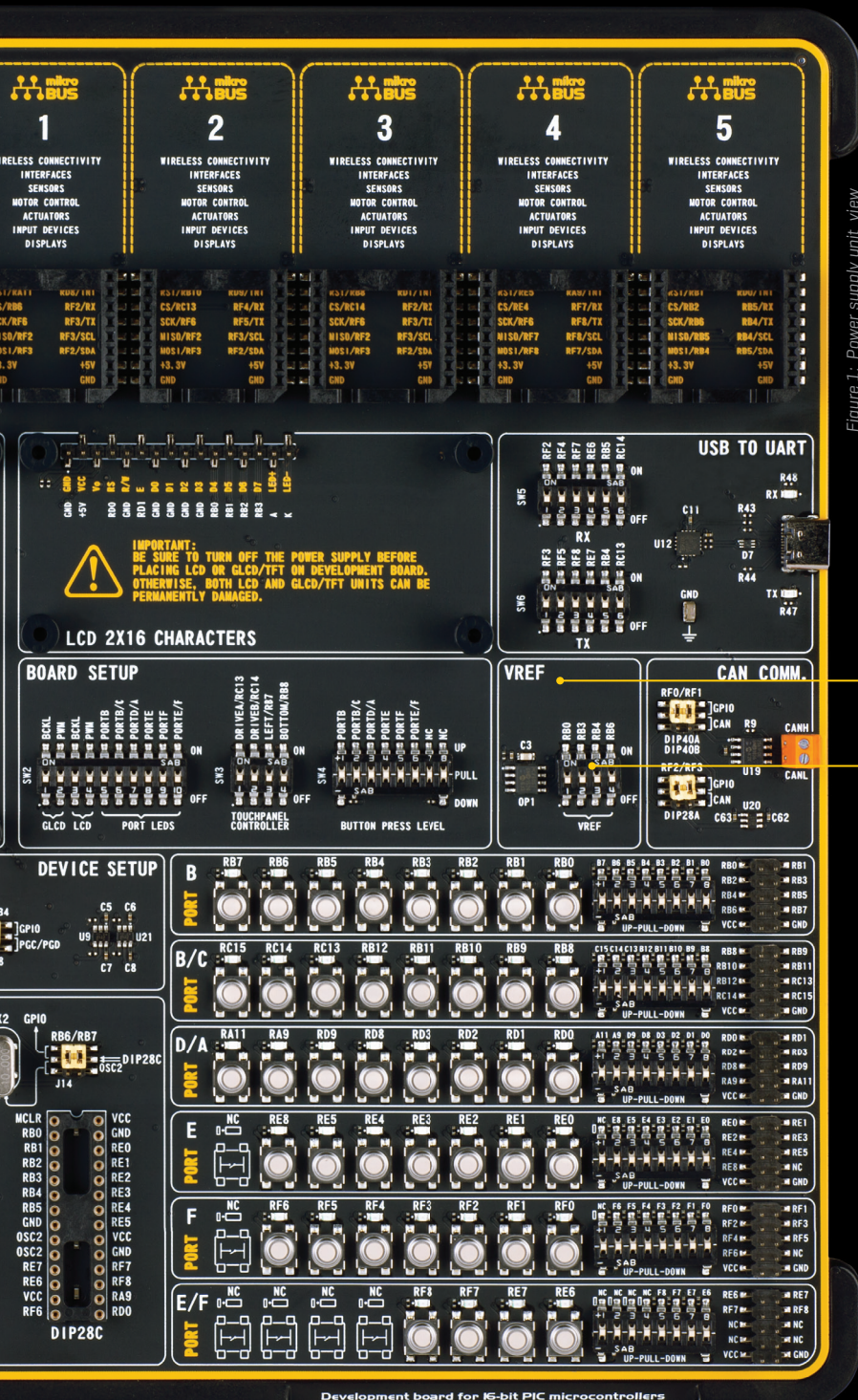

[1] This image is only for demonstration purpose, please do not remove the PSU plastic cover nor touch any of the components below. The development board can be permanently damaged.

The next PSU stage uses two MIC28511, synchronous step-down (buck) regulators, capable of providing up to 3A at their output. The MIC28511 IC utilizes the HyperSpeed Control® and HyperLight Load® architectures, providing an ultra-fast transient response and high efficiency for light loads. Each of the two buck regulators is used to supply power to the corresponding power supply rail (3.3V and 5V), throughout the entire development board and connected peripherals.

Voltage reference

The PSU is able to provide a very accurate, programmable voltage reference (VREF) **(5)** in the range from 0V to 4.096V. VREF is very useful for many different applications including A/D and D/A converters, comparators, etc.

The programmable VREF design is based on several different ICs produced by Microchip: the MCP1501, a high-precision buffered voltage reference IC is used to provide a very precise VREF of 4.096V for the MCP4726, a 12-bit D/A converter (DAC) with integrated EEPROM. The MCP4726 DAC is controlled and programmed by the CODEGRIP module, over the I2C interface. Finally, the MCP606, a single rail-to-rail operational amplifier is used to provide an additional buffering at the output. By using a 4-pole DIP switch **(6)** located in the VREF section of the development board, it is possible to route **VREF** to four different MCU pins:

> **ON (up):** connects VREF to the MCU pins (RB0, RB3, RB4, and RB6)
> **OFF (down):** disconnects VREF from the MCU pins (RB0, RB3, RB4, and RB6)

Programming voltage

Not all dsPIC30 MCU devices support low voltage programming. Therefore, the PSU module has to provide the required high voltage (VPP) for the programming of such devices. The VPP is controlled by the CODEGRIP module automatically, it depends on the programmed MCU and can't be modified by the user. To provide a sufficient voltage level, the MIC2250, a high-efficiency, low EMI boost regulator is used. It is used to provide 14V for the operational amplifier circuit composed of a dual operational amplifier, labeled as MCP6H02T, and produced by Microchip. This circuit has a fixed gain, allowing the CODEGRIP programmer/debugger module to reach up to 14V for the high-voltage programming of various dsPIC30 MCU devices.

In order to protect host MCU and development board, VREF values higher then 3.3V can only be set if the board voltage is previously set to 5V. **NOTE**

PSU connectors

As explained, the advanced design of the PSU allows several types of power sources to be used, offering unprecedented flexibility: when powered by a Li-Po/Li-ION battery, it offers an ultimate degree of autonomy. For situations where the power is an issue, it can be powered by an external 12VDC power supply, connected over the 5.5mm barrel connector. Power is not an issue even if it is powered over the USB cable. It can be powered over the USB-C connector, using power supply delivered by the USB HOST (e.g. personal computer), USB wall adapter, or a battery power bank.

There are three power connectors available, each with its unique purpose:

POWER/DEBUG, USB-C connector

BATTERY, standard 2.5mm pitch XH battery connector

POWER 12VDC, barrel type male 2mm x 6.5mm power connector

Power/debug, USB-C connector

The development board can be powered over the USB-C connector, labeled as POWER/DEBUG. This connector provides power from the USB host, USB power bank, or USB wall adapter. When powered over the USB connector, the available power will depend on the USB power source capabilities.

Maximum power ratings, along with the allowed input voltage range in the case when the USB power supply is used, are given in the table below:

USB Power Supply				
Input Voltage [V]		Output Voltage [V]	Max Current [A]	Max Power [W]
MIN	MAX	3.3	1.8	6
4.4	5.5	5	1.4	7
		3.3 & 5	0.8 & 0.8	6.64

Figure 2: USB power supply table

When using a PC as a power source, the maximum power can be obtained if the host PC supports the USB 3.2 interface and is equipped with USB-C connectors. If the host PC has a USB 2.0 interface, it will be able to provide the least power, since only up to 500 mA (2.5W at 5V) is available from the host in that case. Note that when using long USB cables or USB cables of low quality, the voltage may drop outside the rated operating voltage range, causing unpredictable behavior of the development board.

Power 12VDC, external power supply

An external 12V power supply can be connected over the 12VDC barrel connector. When using an external power supply, it is possible to obtain an optimal amount of power, since one external power supply unit can be easily exchanged with another, while its power and operating characteristics can be decided per application. The development board allows a maximum current of 2.8A per power rail (3.3V and 5V) when using an external 12V power supply. The barrel-type connector is useful for connecting wall-adapters.

Maximum power ratings, along with the allowed input voltage range in the case when the external power supply is used, are given in the table below:

External Power Supply				
Input Voltage [V]		Output Voltage [V]	Max Current [A]	Max Power [W]
MIN	MAX	3.3	2.8	9.24
10.6	14	5	2.8	14
		3.3 & 5	2.8 & 2.8	23.24

Figure 3: External Power supply table

Battery power supply

When powered by a single-cell Li-Po/Li-Ion battery, the development board offers an option to be operated remotely. Combined with the fact that the board can be remotely programmed and debugged over the WiFi network, the EasyPIC v8 for dsPIC30 development board allows complete autonomy, allowing it to be used in some very specific situations: hazardous environments, agricultural applications, etc.

The development board uses a 2.5mm pitch XH battery connector. It allows a range of Li-Po and Li-Ion batteries to be connected. The development board offers battery charging functionality from both the USB connector and the external power supply. The battery charging circuitry of the PSU module manages the battery charging process, ensuring optimal charging conditions and longer battery life. The charging process is indicated by a CHARGER LED indicator.

The battery charging current can be configured by using the CODEGRIP Suite, which offers a choice between 100mA and 500mA when the USB power supply is used, or between 100mA and 200mA when the external 12V power supply is used. In the case when the development board is powered OFF, the charging current will be set to 500mA by default (200mA with the external power supply).

If both the external 12V power supply and the USB cable are connected to the development board, the battery will be charged from the external 12V power supply, thus minimizing the USB power consumption.

Maximum power ratings at a fully charged battery, along with the allowed input voltage range when the battery power supply is used, are given in the following table:

Battery Power Supply				
Input Voltage [V]		Output Voltage [V]	Max Current [A]	Max Power [W]
MIN	MAX	3.3	1.6	5.28
3.5	4.2	5	1.2	6
		3.3 & 5	0.7 & 0.7	5.81

Figure 4: Battery Power Supply table

Using USB hubs, long USB cables, and low-quality USB cables, may cause a significant USB voltage drop, which can obstruct the battery charging process.

Power redundancy and uninterrupted power supply (UPS)

The PSU module supports power supply redundancy: it will automatically switch to the most appropriate power source if one of the connected power sources fails or becomes disconnected. The power supply redundancy also allows for an uninterrupted operation (e.g. UPS functionality, the battery will still provide power if the USB cable is removed, without resetting the MCU during the transition period).

Powering up the development board

Two touch-sensitive buttons are used to power up and reset the EasyPIC v8 for dsPIC30 development board. These capacitive buttons are processed by two AT42QT1011, digital burst mode charge-transfer sensors, specifically designed for human-machine interfaces (HMI), from Microchip. The AT42QT1011 allows very responsive and reliable touch detection for the connected button pad.

As soon as a valid power source is connected, the development board will enter the Stand-By mode. When the capacitive POWER button is pressed, the PSU module will start distributing the power to the rest of the development board. This is indicated by the POWER LED indicator, located on the PSU module itself.

Right under the POWER LED, there is a CHARGE LED, indicating the charging status of the Li-Po/Li-Ion single cell battery, if connected. The complete battery power supply section, including the battery charger circuit, is explained in the respective chapter of this manual.

Below the POWER capacitive button **[1]**, there is a RESET capacitive button **[2]** which is not entirely power-related, but it has a similar function: it is routed to the MCLR pin of the MCU, allowing the RESET function to be performed.

Dual power supply

EasyPIC v8 for dsPIC30 development board supports both 3.3V and 5V power supply on a single board. Advanced PSU module provides the possibility to chose power supply for board and host MCU, between 3.3V (default) and 5V. This setting can be easily configured from CODEGRIP Suite, and this feature greatly increases the number of supported MCUs.

To easily indicate the power supply configuration, the previously mentioned POWER LED will also have a dual function. It lights up GREEN when 3.3V power supply is configured, and lights up BLUE when 5V power supply is chosen.
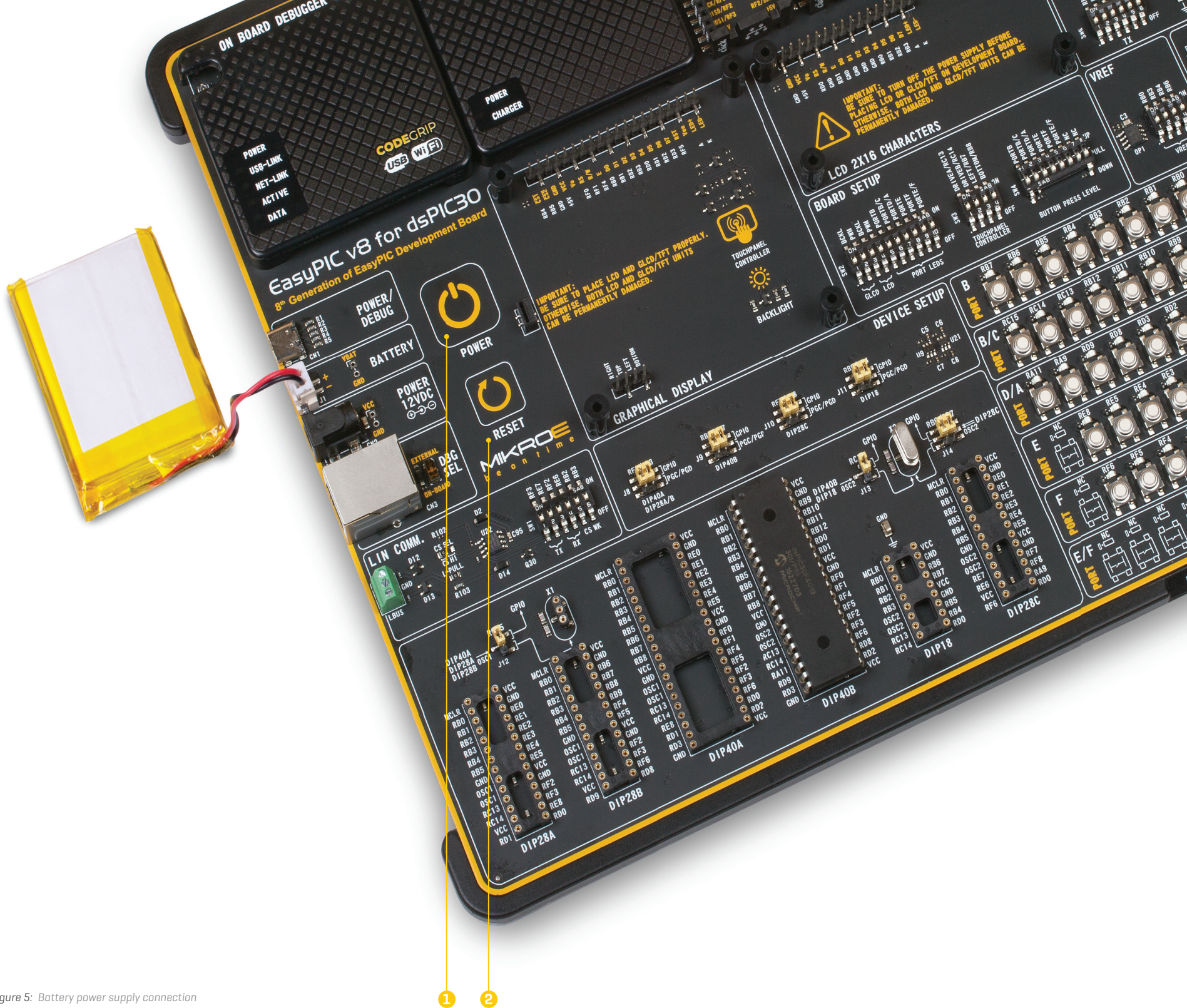
Figure 5: Battery power supply connection

CODEGRIP programmer/debugger module

Envisioned as the unified development platform for all the 16-bit dsPIC30 MCUs in DIP package, the EasyPIC v8 for dsPIC30 development board is equipped with the onboard CODEGRIP programming/debugging module, to support programming/debugging feature. The CODEGRIP module can be interfaced with the host computer over the USB-C connector.

Besides the USB cable, the CODEGRIP module **[1]** can be accessed over the WiFi network. This is a revolutionary new feature, which allows some unique usage scenarios, currently not available on any other programming/debugging solution in the world. The WiFi connectivity option of the CODEGRIP module offers a complete autonomy of the development board. Running in the hazardous environment while debugging the software in real time, programming the MCU with a new software during exposure, having the sensor responses collected and logged remotely from several different base points, debugging a drone firmware while it is in mid-air... These are just simple examples of what EasyPIC v8 for dsPIC30 development board can offer.

CODEGRIP module is equipped with LED indicators that provide visual feedback about its status:

POWER (GREEN) Indicates that the development board is powered on

USB-LINK (YELLOW) After the host OS completes the USB enumeration of the CODEGRIP module, this LED will indicate that the connection has been established
NET-LINK (AMBER) When the CODEGRIP module is connected to the WiFi network, this LED will indicate that the connection has been established

ACTIVE (RED) Indicates the operational state of the CODEGRIP module: when CODEGRIP module is in the bootloader mode, this indicator will blink. Normal operation of the CODEGRIP module is indicated by the ACTIVE LED being constantly turned ON

DATA (BLUE) Indicates that there is a data transfer ongoing between the MCU and the CODEGRIP module

The onboard CODEGRIP module requires no additional drivers, as it utilizes a HID driver model, which is natively supported by the computer OS. This makes its installation very easy and straightforward in the case when the USB cable is used. As soon as the USB cable is connected to the host PC, the CODEGRIP module is enumerated and the development board is ready to be used.

CODEGRIP programmer/debugger module is supported by CODEGRIP Suite. Detailed explanation on how to configure and use the CODEGRIP module on the EasyPIC v8 for dsPIC30 development board find at the following link:
www.mikroe.com/debuggers/codegrip

CODEGRIP device setup

Since the development board supports many different MCUs with a different number of pins and functionalities, it is necessary to connect the CODEGRIP programmer/debugger to the correct programming lines (PGC, PGD) of the particular MCU. The development board allows easy selection of the programming lines by offering a set of high-quality jumpers, which ensure reliable operation. For more information about MCU DIP sockets and how to use them, please refer to the **MCU sockets** chapter.

All jumpers required to set up the programming and reset lines for each DIP socket, are grouped under the DEVICE SETUP label, in a section located in the middle of the EasyPIC v8 for dsPIC30 development board.

PGC/PGD jumpers

There are four jumpers located in the DEVICE SETUP section, labeled as PGC/PGD. These jumpers allow to redirect the programming lines of the CODEGRIP onboard module to the corresponding programming pins of the MCU. These jumpers have an MCU DIP socket name printed next to it, so it is very easy to know which one should be used for which socket.

If using **DIP40A**, or **DIP28A/B MCU sockets**, a jumper with the J8 label should be used to configure the programming lines:
    J8 (DIP40A, DIP28A/B)
    GPIO (up): allows the RF2 and RF3 pins to be used as GPIO lines
    PGC/PGD (down): connects the RF2 and RF3 pins to the CODEGRIP programmer/debugger module or external device

If using **DIP40B socket**, a jumper with the J9 label should be used to configure the programming lines:

J9 (DIP40B)
GPIO (up): allows the RB6 and RB7 pins to be used as GPIO lines
PGC/PGD (down): connects the RB6 and RB7 pins to the CODEGRIP programmer/debugger module or external device

If using **DIP28C socket**, a jumper with the J10 label should be used to configure the programming lines:

J10 (DIP28C)
GPIO (up): allows the RF7 and RF8 pins to be used as GPIO lines
PGC/PGD (down): connects the RF7 and RF8 pins to the CODEGRIP programmer/debugger module or external device

If using **DIP18 socket**, a jumper with the J11 label should be used to configure the programming lines:
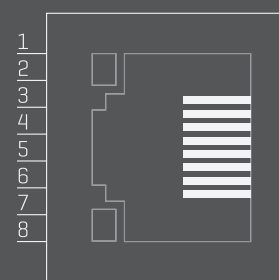
J11 (DIP18)
GPIO (up): allows the RB5 and RB4 pins to be used as GPIO lines
PGC/PGD (down): connects the RB5 and RB4 pins to the CODEGRIP programmer/debugger module or external device
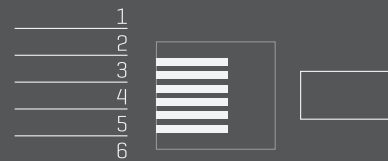
EXT PROG/DBG PINOUT

RJ-45	RJ-12	ICSP (MHCP)
1		
2	1	MCLR
3	2	VDD
4	3	GND
5	4	PGD
6	5	PGC
7	6	
8		

RJ-45 JACK

RJ-12 CONNECTOR/CABLE

Figure 6: Programmer/debugger view

DBG selection

The EasyPIC v8 for dsPIC30 development board is equipped with the RJ-45 connector **(2)**, allowing an external programmer/debugger to be connected. The connector supports a wiring pinout compatible with Microchip® ICD external programmers/debuggers. This connector also supports connection of the RJ-12 cable, connect the RJ-12 cable by simply inserting it into the center of the RJ-45 connector.

The DIP switch located next to the RJ-45 connector allows control of the interface between onboard CODEGRIP module and target MCU:

ONBOARD (down): Interface is enabled. If an external debugger probe-device is connected, there is a possible collision in communication.

EXTERNAL (up): Interface is disabled. External debugger probe-device can reliably communicate with target MCU.
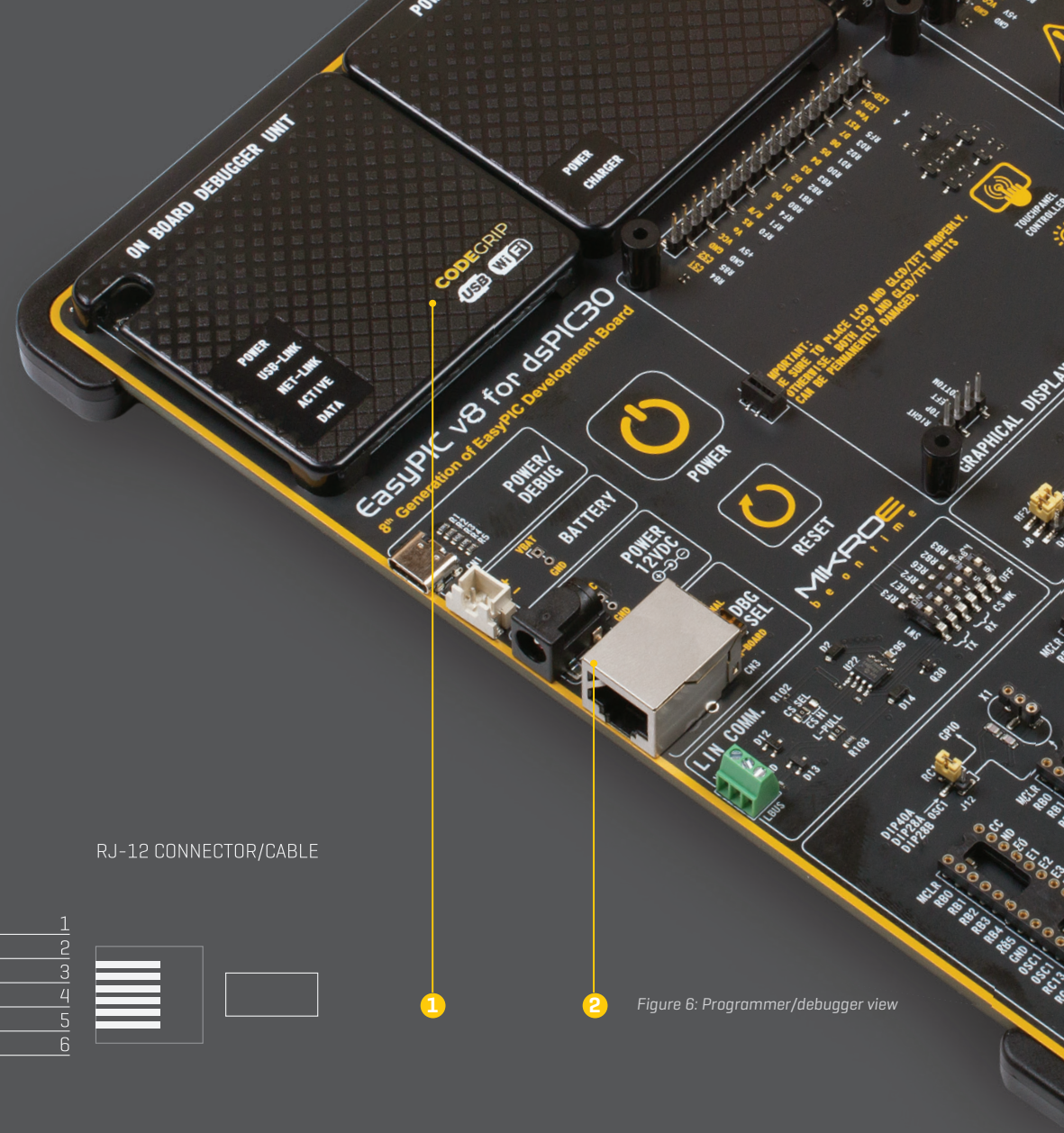
Connectivity

One of the key features of the EasyPIC v8 for dsPIC30 development board is its connectivity.

It features a diversity of connecting options making the board very versatile, adaptable to any situation, and very easy to work with.

The EasyPIC v8 for dsPIC30 development board supports all 16-bit dsPIC30 MCUs in DIP package type. To allow this, the development board offers a total of six DIP socket sizes: DIP18, DIP28 [A, B, C] and DIP40 [A, B].

The development board also features two display connectors [1x16 character display connector and 1x20 graphical display connector], USB-UART, an external ICD compatible programmer/debugger connector and more. The PORT I/O section is the most distinctive connectivity option. It allows direct interfacing with the MCU pins. This section also contains LEDs for visual indication of pin states, BUTTONs for applying the desired logic states to the pins, and DIP switches for configuring pull-up or pull-down resistors.

All LEDs, buttons, and headers are logically organized and grouped as PORTs, following the pin organization topology of the MCU itself.
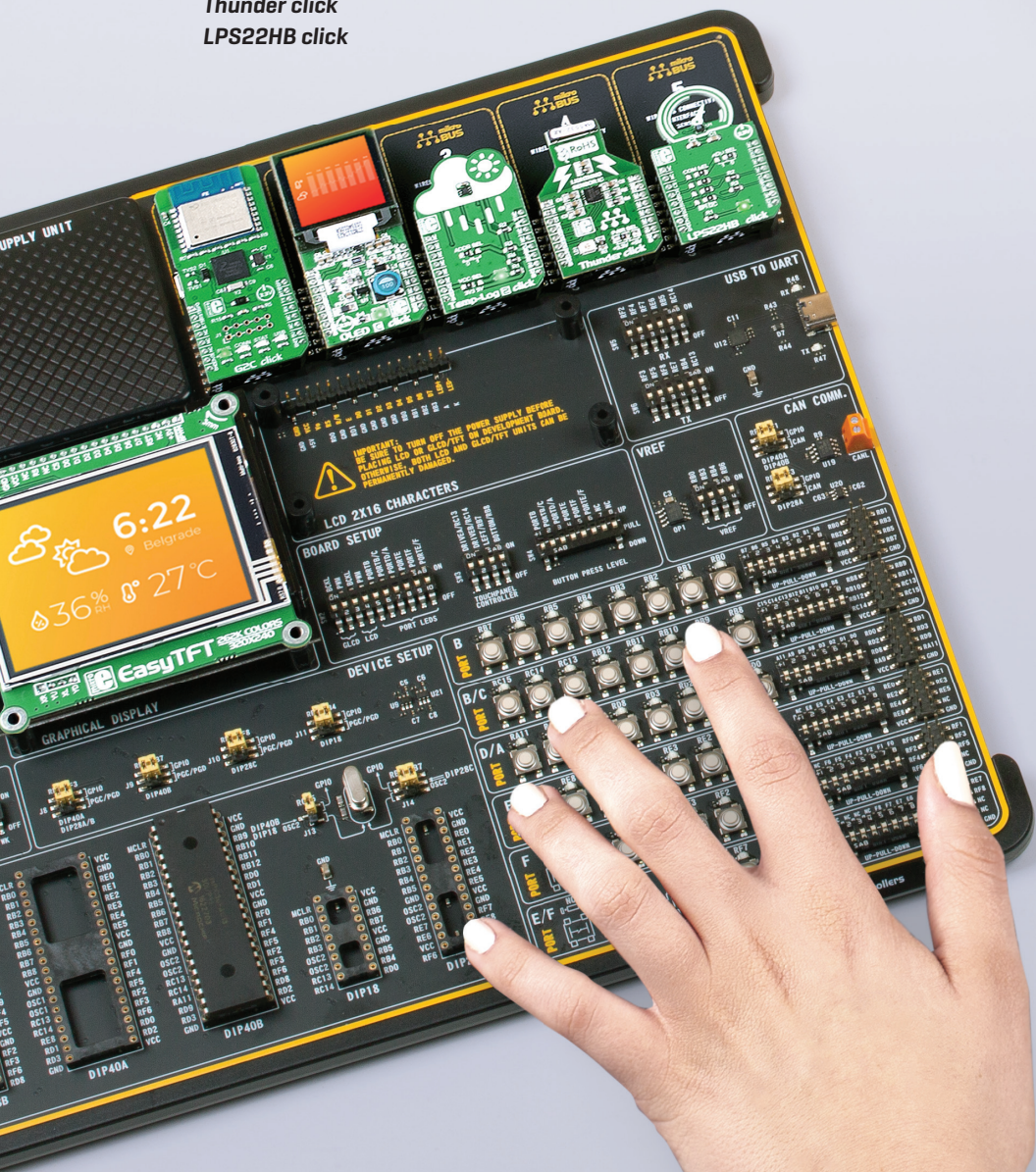
Availability of five standardized mikroBUS™ sockets is something that makes the EasyPIC v8 for dsPIC30 development board very special: the world of Click boards™ is now just under your fingertips. By combining up to 5 different Click boards™, virtually an unlimited number of combinations is possible, considering the fact that the Click board™ repository already has several hundreds of various Click boards™, with more added on a daily basis. Tight integration of the EasyPIC v8 for dsPIC30 development board with the whole Mikroe ecosystem, allows seamless and effortless prototyping, and truly rapid embedded application development. For more info about the mikroBUS™ standard and the Click board™ line of products, please visit the official Mikroe web page at: *www.mikroe.com*

Easily create an IoT Weather Station with the EasyPIC v8 for dsPIC30 development board.
Use the following tools:

EasyPIC v8 for dsPIC30 development board
EasyTFT board

G2C click
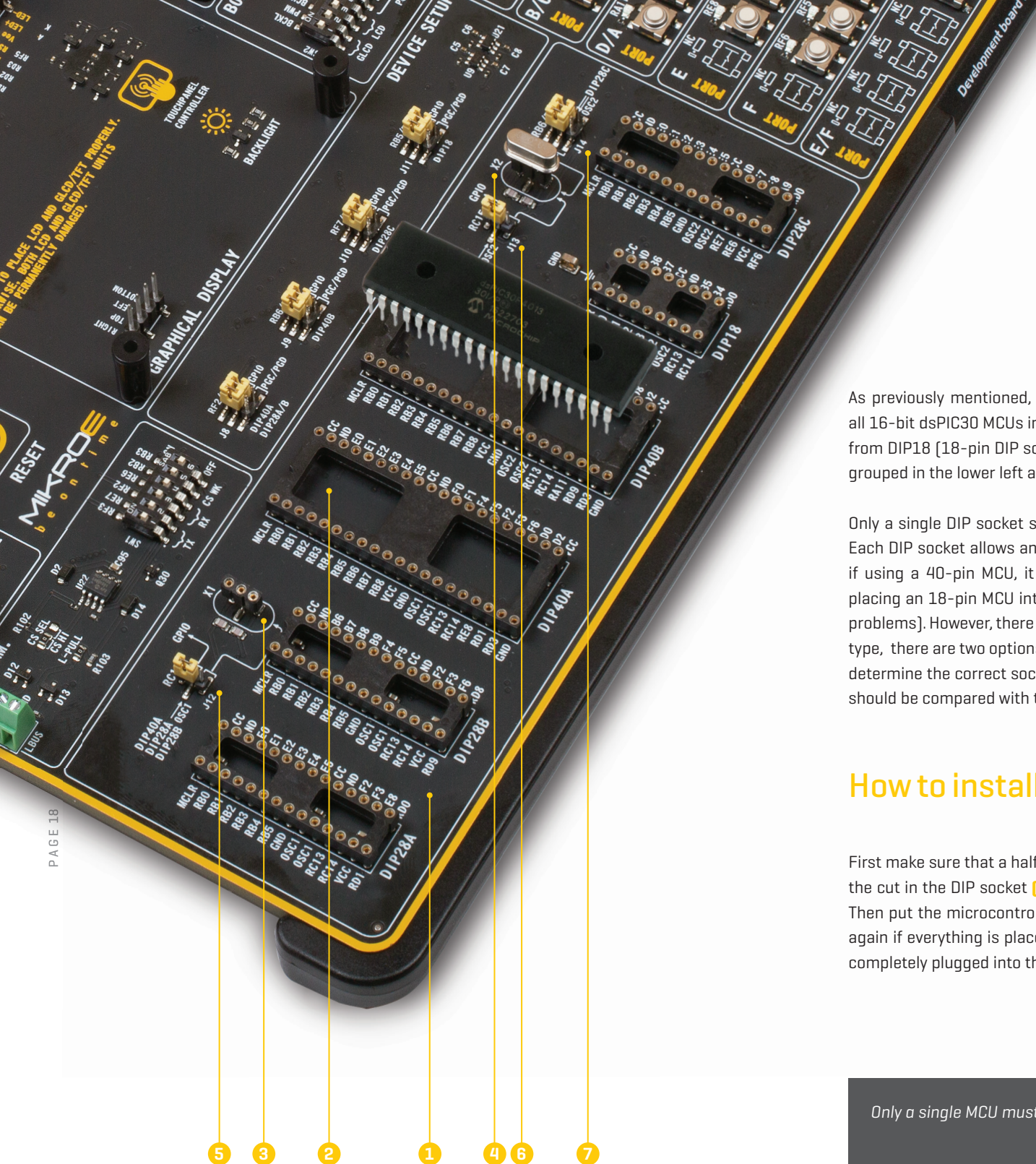**OLED C click**
Temp-Log 2 click
Thunder click
LPS22HB click

MCU sockets

As previously mentioned, the EasyPIC v8 for dsPIC30 development board supports all 16-bit dsPIC30 MCUs in DIP package type. There are six different sockets, ranging from DIP18 (18-pin DIP socket), up to DIP40 (40-pin DIP socket). All DIP sockets are grouped in the lower left area of the board **[1]**.

Only a single DIP socket should be populated at a time since their lines are shared. Each DIP socket allows an MCU with the specific pin-count to be used. For example, if using a 40-pin MCU, it should be placed into the DIP40 socket, exclusively (i.e. placing an 18-pin MCU into the DIP28 socket will cause pin misalignment and other problems). However, there are exceptions to this rule: if using an MCU in DIP40 package type, there are two options available, depending on its pinout: DIP40A and DIP40B. To determine the correct socket that should be used in this case, the pinout of the MCU should be compared with the pinout which is printed next to these sockets.

How to install the MCU into the DIP socket?

First make sure that a half circular cut in the microcontroller DIP packaging matches the cut in the DIP socket **[2]**. Align both ends of the microcontroller with the socket. Then put the microcontroller slowly down until all the pins match the socket. Check again if everything is placed correctly and gently press the microcontroller until it is completely plugged into the socket.

Only a single MCU must be installed into the development board at a time.

Crystal oscillator

Most of PIC MCU devices can use an external quartz-crystal oscillator. There are two sockets for installing the crystal oscillator, depending on which MCU socket will be used:

Crystal oscillator socket OSC1[X1] is routed to DIP40A, DIP28A, and DIP28B MCU sockets **[3]**
Crystal oscillator socket OSC2[X2] is routed to DIP40B, DIP28C and DIP18 MCU sockets **[4]**

Above the DIP28A MCU socket, there is a jumper J12 **[5]** used to specify whether the OSC1/RC15 will be used as GPIO on the corresponding MCU sockets, or connected to the OSC1 crystal oscillator socket:

J12 (OSC1)
UP position: allows the RC15 to be used as GPIO line
DOWN position: connects the RC15 to the crystal oscillator socket OSC1

Above the DIP18 MCU socket, there is a jumper J13 **[6]** used to specify whether the OSC2/RC15 will be used as GPIO on the corresponding MCU sockets, or connected to the OSC2 crystal oscillator socket:

J13 (OSC2)
UP position: allows the RC15 to be used as GPIO line
DOWN position: connects the RC15 to the crystal oscillator socket OSC2

Above the DIP28C MCU socket, there is a jumper J14 **[7]** used to specify whether the OSC2/RB6 and OSC2/RB7 will be used as GPIOs on the corresponding MCU sockets, or connected to the OSC2 crystal oscillator socket:

J14 (OSC2)
UP position: allows the RB6 and RB7 to be used as GPIO lines
DOWN position: connects the RB6 and RB7 to the crystal oscillator socket OSC2

INPUT/OUTPUT section

I/O pins of any MCU are internally grouped as PORTs. The same grouping concept is kept throughout the development board as well, offering a clean and organized user interface.

There are six PORTs [1] on the EasyPIC v8 for dsPIC30 development board, labeled from PORTB to PORTE/F. Depending on the pin-count of the MCU, not all PORTs will be used. However, the development board supports the highest pin-count MCUs in DIP package type (40 pins). The PORTs are located at the lower right side of the board, each containing a set of buttons, LEDs, an eight-pole DIP switch, and a single 2x5 pin header with the standard 2.54mm pitch. The PORTs are labeled according to the MCU PORT they are routed to.

PORT buttons

PORT buttons [2] can be used to apply an arbitrary logic state to the pins of the MCU. These buttons are small tactile SPST buttons that work in combination with a DIP switch (SW4), labeled as BUTTON PRESS LEVEL. This DIP switch is located in the BOARD SETUP section.
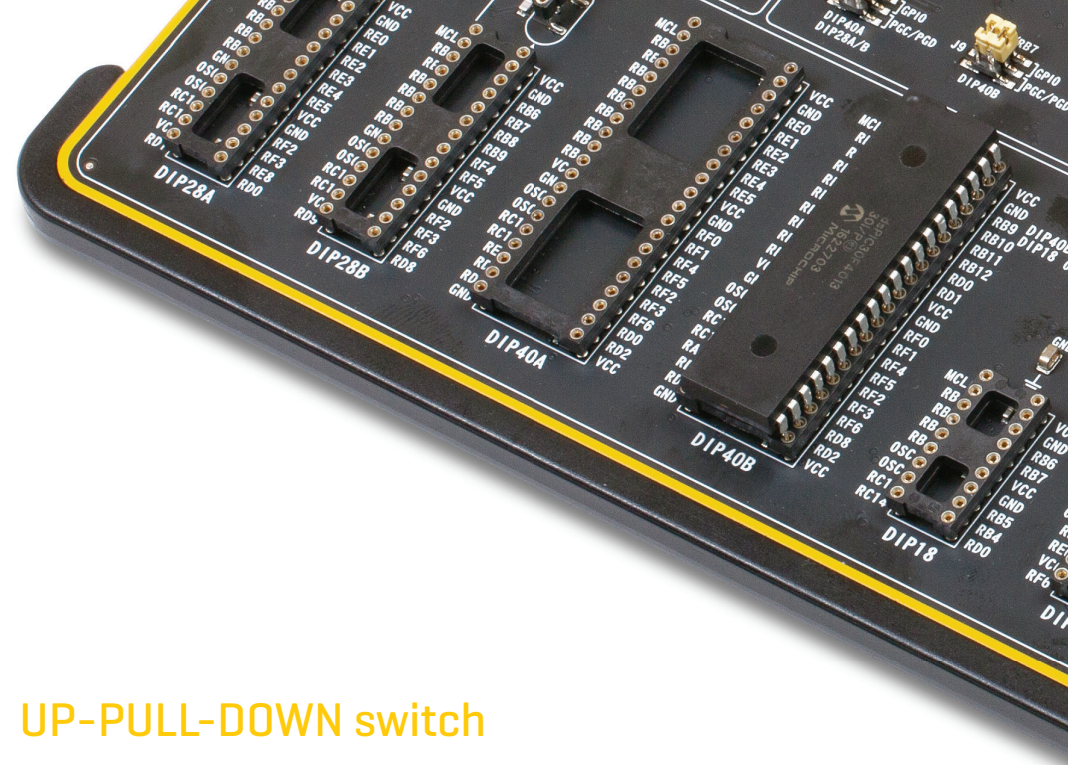
BUTTON PRESS LEVEL

This eight-pole, tri-state DIP switch allows the button to apply a LOW logic level to an MCU pin when pressed (connecting it to the GND), or to apply a HIGH logic level when pressed (connecting it to the power rail). It can also be used to completely disconnect the button, preventing accidental button presses. To limit the pin current and prevent the excessive inrush of currents when a button is pressed, a protective 220Ω resistor is used, connected in series with the switch. Each position of the BUTTON PRESS LEVEL [3] is used to determine the applied logic level of a button press for the entire PORT. As a result, only six poles of this DIP switch are used, allowing control of all six groups of buttons (unused poles are marked with the NC label - Not Connected).

> **BUTTON PRESS LEVEL:**
> **UP position:** a button press applies HIGH logic level to the corresponding PORT pins
> **MID position:** a button is completely disconnected
> **DOWN position:** a button applies LOW logic level to the corresponding PORT pins

UP-PULL-DOWN switch

Besides buttons, each of the six PORTs has an eight-pole DIP switch associated with it. It is labeled as UP-PULL-DOWN [4] and it is used to enable a pull-up or pull-down resistor for the specific pin or to leave the pin in a floating state:

> **UP-PULL-DOWN:**
> **UP position:** connects a 4.7kΩ resistor between the MCU power rail and the pin (the pin is pulled up)
> **MID position:** Disables both pull-up and pull-down resistor connections from the pin (the pin is in the floating state)
> **DOWN position:** Connects the 4.7kΩ resistor between the GND and pin associated with the DIP switch position (the pin is pulled down)

PORT LEDs

Each PORT contains a group of maximum eight LEDs [5] used to provide a visual indication of the logic state of the specific pin. The maximum current through a single LED is limited with the 4.7kΩ resistor. Each LED is connected to a PORT pin and it is labeled according to the name of the connected pin. LEDs on each PORT should be disconnected when not used. Having a LED on a communication line or an A/D converter input might alter expected results since LED represents an additional electrical load. There is a ten-pole DIP switch (SW2) [6] located in the BOARD SETUP section. Six poles of this DIP switch, labeled as PORT LEDs are used to enable or disable LEDs on each PORT:
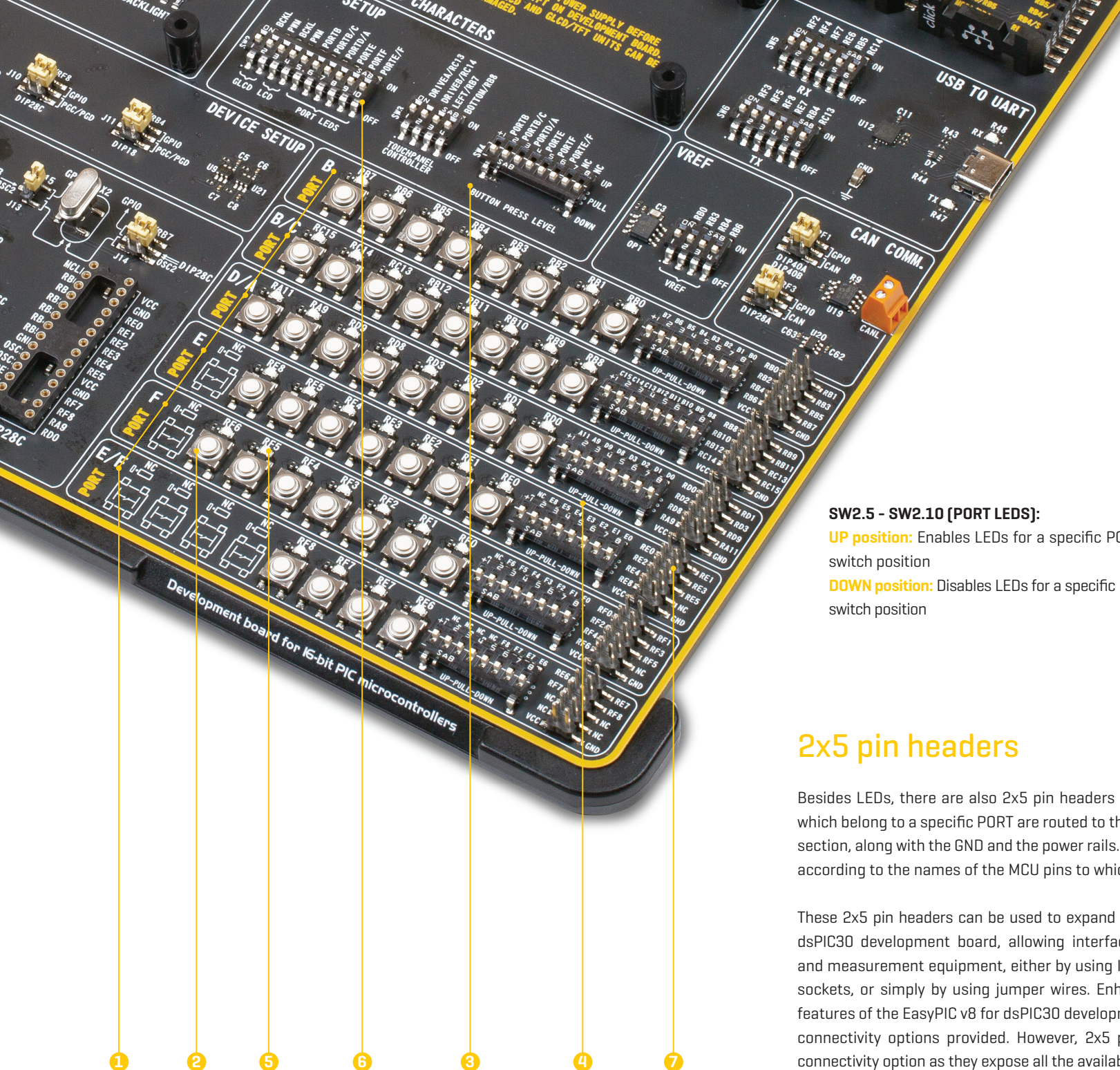
SW2.5 - SW2.10 (PORT LEDS):

UP position: Enables LEDs for a specific PORT, associated with the particular DIP switch position

DOWN position: Disables LEDs for a specific PORT, associated with the particular DIP switch position

2x5 pin headers

Besides LEDs, there are also 2x5 pin headers **(7)** in the PORT sections. All the pins which belong to a specific PORT are routed to the 2x5 pin header located in that PORT section, along with the GND and the power rails. The pins on these headers are labeled according to the names of the MCU pins to which they are routed.

These 2x5 pin headers can be used to expand the connectivity of the EasyPIC v8 for dsPIC30 development board, allowing interfacing with other devices, peripherals, and measurement equipment, either by using IDC10 extension cables, IDC10 female sockets, or simply by using jumper wires. Enhanced connectivity is one of the key features of the EasyPIC v8 for dsPIC30 development board, therefore, there are many connectivity options provided. However, 2x5 pin headers offer the most extensive connectivity option as they expose all the available MCU pins to the outside world.

1x20 graphical display connector

The EasyPIC v8 for dsPIC30 development board is equipped with the 1x20 graphical display connector [1], offering support for GLCDs with the resolution of 128x64 pixels, driven by the KS108 or compatible display controller.

Graphical Liquid Crystal Displays (GLCDs) [2] can be used to display monochromatic graphical content such as text, images, etc. Besides data lines, 1x20 GLCD connector also contains command lines, necessary power supply rails (GND, +5V for the backlight and for the display module), backlight PWM control, and contrast control voltage.

GLCDs usually come with a touch-sensitive panel, which allows them to be used as input devices. The EasyPIC v8 for dsPIC30 development board provides support for the resistive touch panel over two separate connectors: one 1x4-pin header and one 4-pin flat-cable connector (FFC) labeled as J4 [3], typically used for GLCDs. This connector is perfectly aligned with the GLCD modules which are available for purchase from the official Mikroe store. For more information about the GLCD displays, please visit our web page: *www.mikroe.com*

Two DIP switches (SW2 and SW3) located in the BOARD SETUP section of the development board are used to set up the configurable options for both the GLCD backlight and touch panel control.

Two poles of the SW2 DIP switch [4], grouped under the GLCD label, are used to control the backlight options of the GLCD:

> **SW2.1:**
> **ON (up):** GLCD backlight is ON
> **OFF (down):** GLCD backlight is OFF

> **SW2.2:**
> **ON (up):** PWM signal at the RB10 pin controls the GLCD backlight brightness
> **OFF (down):** Backlight brightness amount is fixed and can't be controlled by the MCU

NOTE *In order to use backlight PWM dimming, both SW2.1 and SW2.2 switches must be enabled at the same time.*

A four-pole DIP switch [8] labeled as SW3 allows to connect the pins RB7, RB8, RC13, and RC14 to the touch panel control circuit:

> **SW3:**
> **ON (up):** A specific touch panel control is connected to the respective MCU pin
> **OFF (down):** A specific touch panel control is disconnected from the respective MCU pin

If you want to upgrade your GLCD application with TFT display, **EasyTFT board** [5] is a perfect choice. It features connector compatible with 1x20 graphical display connector [1] on EasyPIC v8 for dsPIC30 development board, and a touch panel connector.

The EasyTFT board contains 2.83" TFT color display MI0283QT-9A with 320x240 pixel resolution, which is driven by ILI9341 display controller, capable of showing advanced graphical content. Each pixel can display 262K different colors. TFT display is covered with a resistive touch panel which can be used as input device, supported with 1x4 pin header [6] on EasyPIC v8 for dsPIC30 development board.

The board is primarily designed to be used as a display board on Mikroe Easy development boards. After testing and building the final program, this board can also be used in your final device. The board also contains mounting holes [7] for easier integration into your designs.

A four-pole DIP switch [8] labeled as SW3 located in the BOARD SETUP section of the development board is used to set up the configurable options for touch panel control.

It allows to connect the pins RB7, RB8, RC13, and RC14 to the touch panel control circuit:
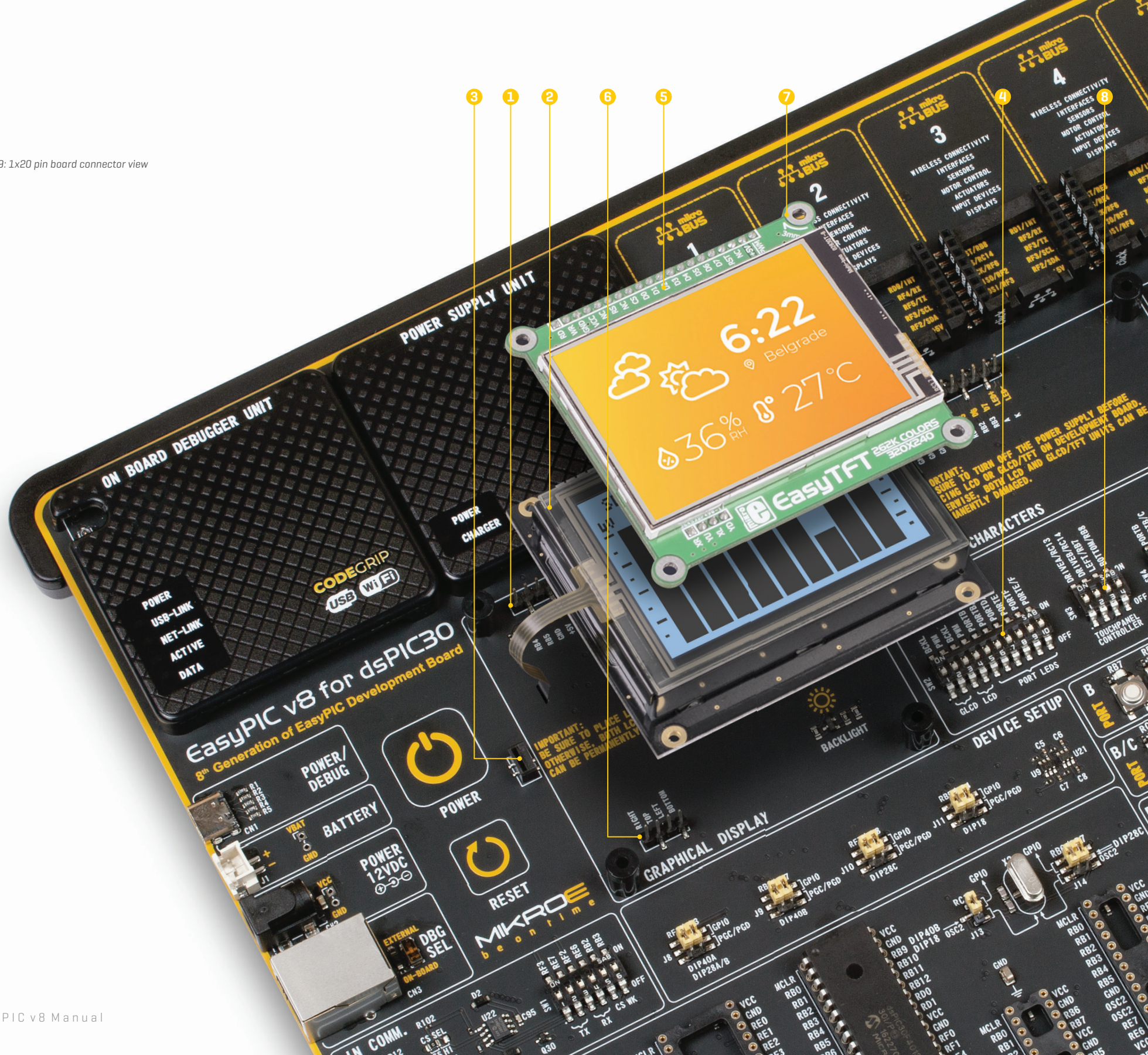
> **SW3:**
> **ON (up):** A specific touch panel control is connected to the respective MCU pin
> **OFF (down):** A specific touch panel control is disconnected from the respective MCU pin

The EasyTFT board and LCD use the same pins, thus are unable to operate if simultaneously plugged in.

Figure 9: 1x20 pin board connector view

2x16 LCD
Mikroe

micro BUS 1
micro BUS 2
micro BUS 3
micro BUS 4
micro BUS 5

WIRELESS CONNECTIVITY
INTERFACES
SENSORS
MOTOR CONTROL
ACTUATORS
INPUT DEVICES
DISPLAYS

BOARD SETUP

LCD 2x16 CHARACTERS

IMPORTANT: BE SURE TO TURN OFF THE POWER SUPPLY BEFORE
PLACING LCD OR GLCD/TFT ON DEVELOPMENT BOARD.
OTHERWISE, BOTH LCD, AND GLCD/TFT UNITS CAN BE
PERMANENTLY DAMAGED.

PLACE LCD AND GLCD/TFT PROPERLY.
BOTH LCD AND GLCD/TFT UNITS
MANENTLY DAMAGED.

TOUCHPANEL
CONTROLLER

BACKLIGHT

DEVICE SETUP

TOUCHPANEL
CONTROLLER

BUTTON PRESS LEVEL

VREF

USB TO UART

RX

TX

CAN COMM.

PORT B
PORT B/C
PORT D/A
PORT E
PORT F
PORT E/F

Figure 10: 1x16 display header view

1x16 character display connector

Character-based Liquid Crystal Display (LCD) **[1]** is a cheap and popular way of representing application results, short messages, or some other type of information to users. The EasyPIC v8 for dsPIC30 development board natively supports 2x16 character LCD module, connected in 4-bit mode. It offers a dedicated 1x16 pin header **[2]** that can host a compatible LCD module. Each pin of the connector is labeled on the development board and should be connected to the respective pin of the LCD module.

There are four plastic spacers [3] used to provide physical support for both types of connected displays (LCD and GLCD), ensuring a reliable connection and preventing bending of their pins.

The LCD and GLCD use the same pins, thus are unable to operate if simultaneously plugged in.

Two poles of the SW2 DIP switch **[4]**, grouped under the LCD label, are used to control the backlight options of the LCD:

SW2.3:
ON (up): LCD backlight is ON
OFF (down): LCD backlight is OFF

SW2.4:
ON (up): PWM signal at the RB10 pin controls the LCD backlight brightness
OFF (down): Backlight brightness amount is fixed and can't be controlled by the MCU

> **NOTE** *In order to use backlight PWM dimming, both SW2.3 and SW2.4 switches must be enabled at the same time.*

> (!) *Make sure to turn off the power supply before placing either of the display modules on the board. Otherwise, the display module or the development board can be permanently damaged.*
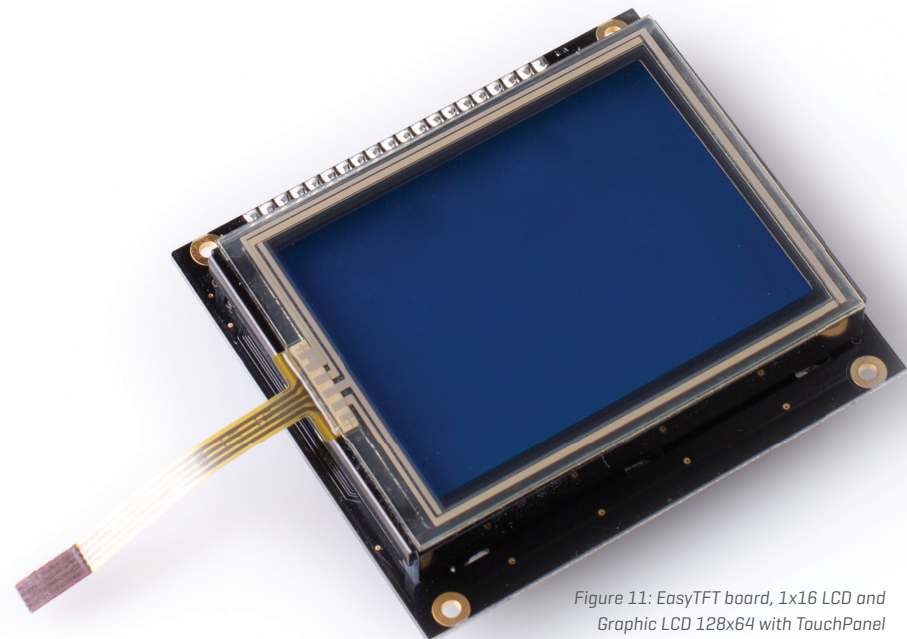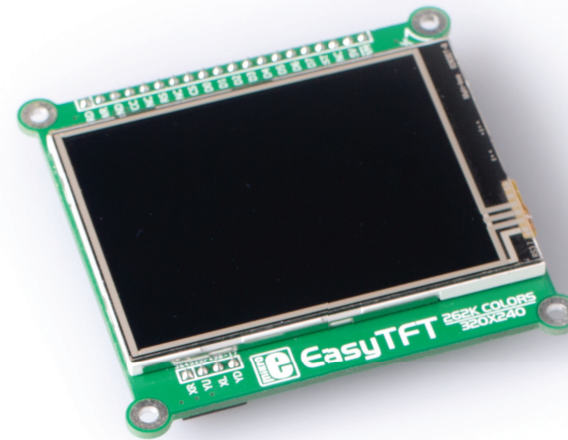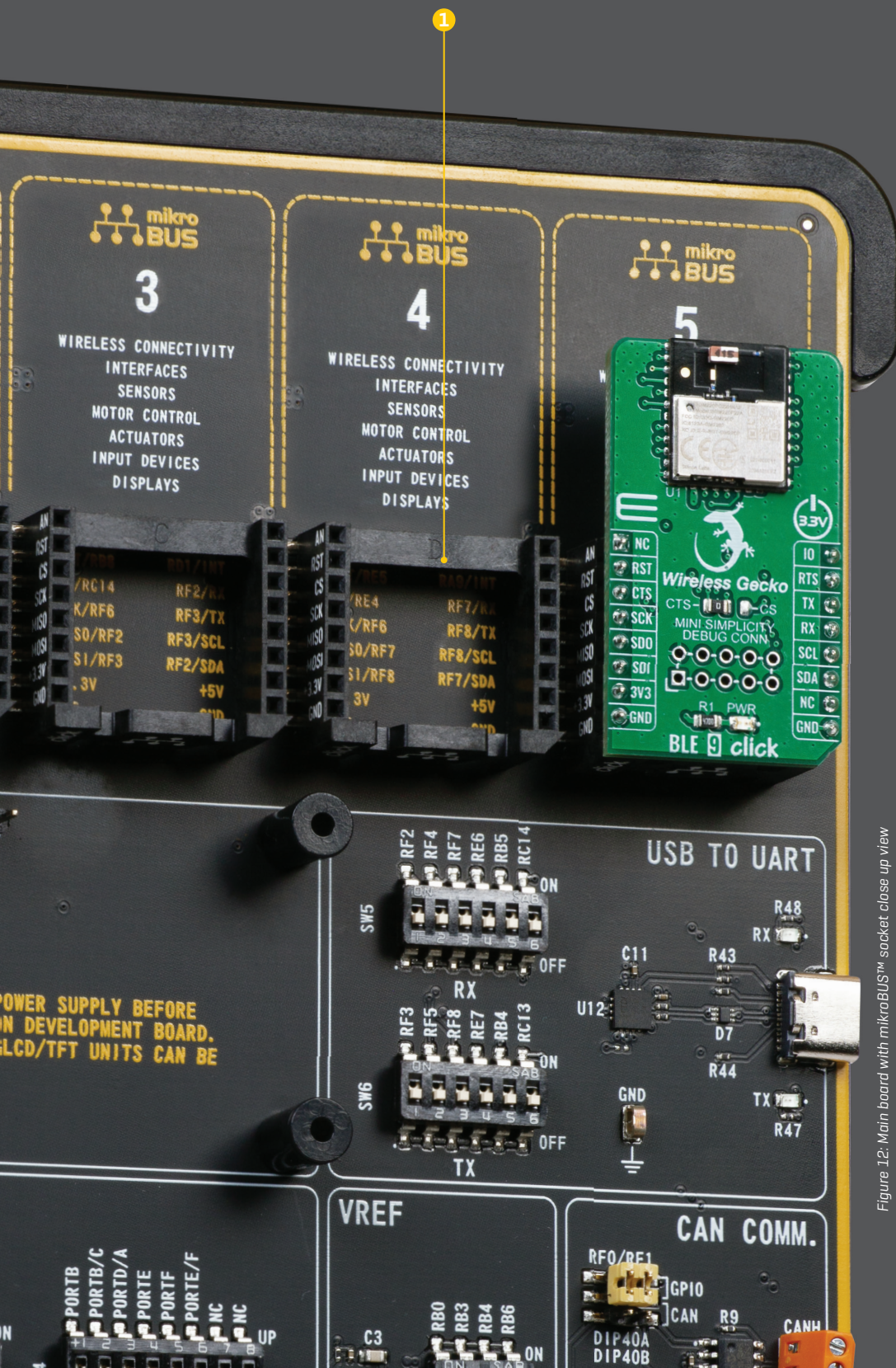

Figure 11: EasyTFT board, 1x16 LCD and Graphic LCD 128x64 with TouchPanel

mikroBUS™ sockets

The superior connectivity features of the EasyPIC v8 for dsPIC30 development board are rounded up with five standardized mikroBUS™ host connectors **[1]**. It is a considerable upgrade for the board, as it allows interfacing with the vast amount of Click boards™.

mikroBUS™ is the add-on board standard that offers maximum expandability with the smallest number of pins. More information at **www.mikroe.com/mikrobus**

All the mikroBUS™ sockets are now redesigned and improved. They became much sturdier, allowing a better grip of the Click board™. In addition to added horizontal supports between two 8-pin connectors, the right lower edge is chamfered at the angle of 45°, the same as the Click board™, making it seamlessly fit into the mikroBUS™ socket. The new mikroBUS™ socket is now a fully-fledged, standardized monolithic component with all its pins clearly labeled, offering very good grip for the Click board™, preventing it to flip over or to be placed incorrectly.

The mikroBUS™ socket supports the following communication interfaces: SPI, UART, and I2C. There are also single pins reserved for PWM, Interrupt, Analog input, Reset, and SPI Chip Select. The mikroBUS™ socket also contains pins with the two power rails (3.3V and 5V), along with the GND pins.

Each MCU socket has the appropriate pins routed to the mikroBUS™ sockets. Therefore, each mikroBUS™ socket pin is clearly labeled on the development board. This helps users to identify to which MCU pin its routed to. Also, each mikroBUS™ socket is labeled on the development board with its ordinal number, by which the connector is referenced to in the Mikroe development environment, software applications, tutorials, etc.
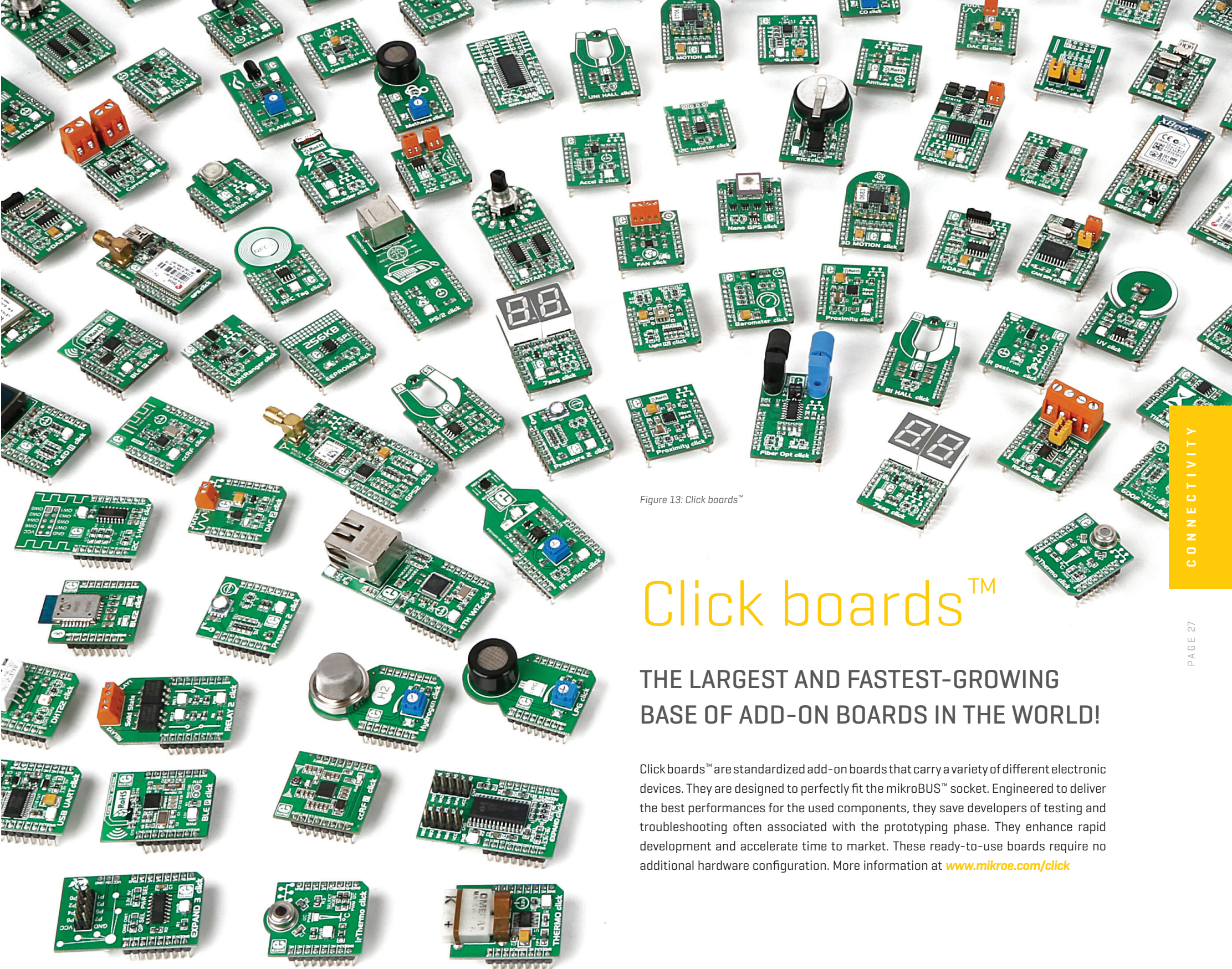
Figure 13: Click boards™

Click boards™

THE LARGEST AND FASTEST-GROWING BASE OF ADD-ON BOARDS IN THE WORLD!

Click boards™ are standardized add-on boards that carry a variety of different electronic devices. They are designed to perfectly fit the mikroBUS™ socket. Engineered to deliver the best performances for the used components, they save developers of testing and troubleshooting often associated with the prototyping phase. They enhance rapid development and accelerate time to market. These ready-to-use boards require no additional hardware configuration. More information at **www.mikroe.com/click**

Communication

Communication connectors allow the development board to be connected with many different devices that use high-layer communication protocols such as USB, CAN, etc. Also, there is a USB-UART converter, which enables simplified communication with the personal computer over the emulated serial interface. Each of these connectors will be described in more detail, in the following sections of the manual.

USB-UART

UART (Universal Asynchronous Receiver/Transmitter) interface **[1]** is one of the most common interfaces for data exchange between the MCU and other external devices. The EasyPIC v8 for dsPIC30 development board offers the UART connectivity over the USB-C connector **[2]** by utilizing the FT230XQ **[3]**, a popular USB-UART signal conversion IC, produced by FTDI Chip. This IC contains the complete USB stack necessary for the interface bridging between the UART peripheral of the MCU and the USB interface of the PC. FT230XQ drivers are available for download from the official FTDI drivers web page *www.ftdichip.com/Drivers/VCP.htm*

To enable UART data exchange via the USB-C connector, RX and TX lines of the MCU UART peripheral must be connected to the corresponding pins of the FT230XQ IC. Two six-pole DIP switches located in the USB TO UART section of the board, labeled as TX (SW6) **[4]** and RX (SW5) **[5]**, allow fully independent control of the UART RX and TX lines, offering complete freedom of pin selection. The TX DIP switch (SW6) connects the specific MCU pin (labeled next to the related switch) as the UART transmission line, while the RX DIP switch (SW5) connects the specific MCU pin (labeled next to the related switch) as the UART receiving line. This allows custom UART TX/RX pair configuration, allowing the development board to adapt to many different UART pin configurations, found on various PIC MCU devices:

SW6 (TX)
ON (up): connects the respective UART TX pin to the USB-UART conversion circuit
OFF (down): disconnects the respective UART TX pin from the USB-UART conversion circuit

SW5 (RX)
ON (up): connects the respective UART RX pin to the USB-UART conversion circuit
OFF (down): disconnects the respective UART RX pin from the USB-UART conversion circuit

UART traffic is indicated by two LED indicators, located in the USB TO UART section of the board, near the USB-C connector:

Yellow LED (TX) [6] indicates outgoing data transfer
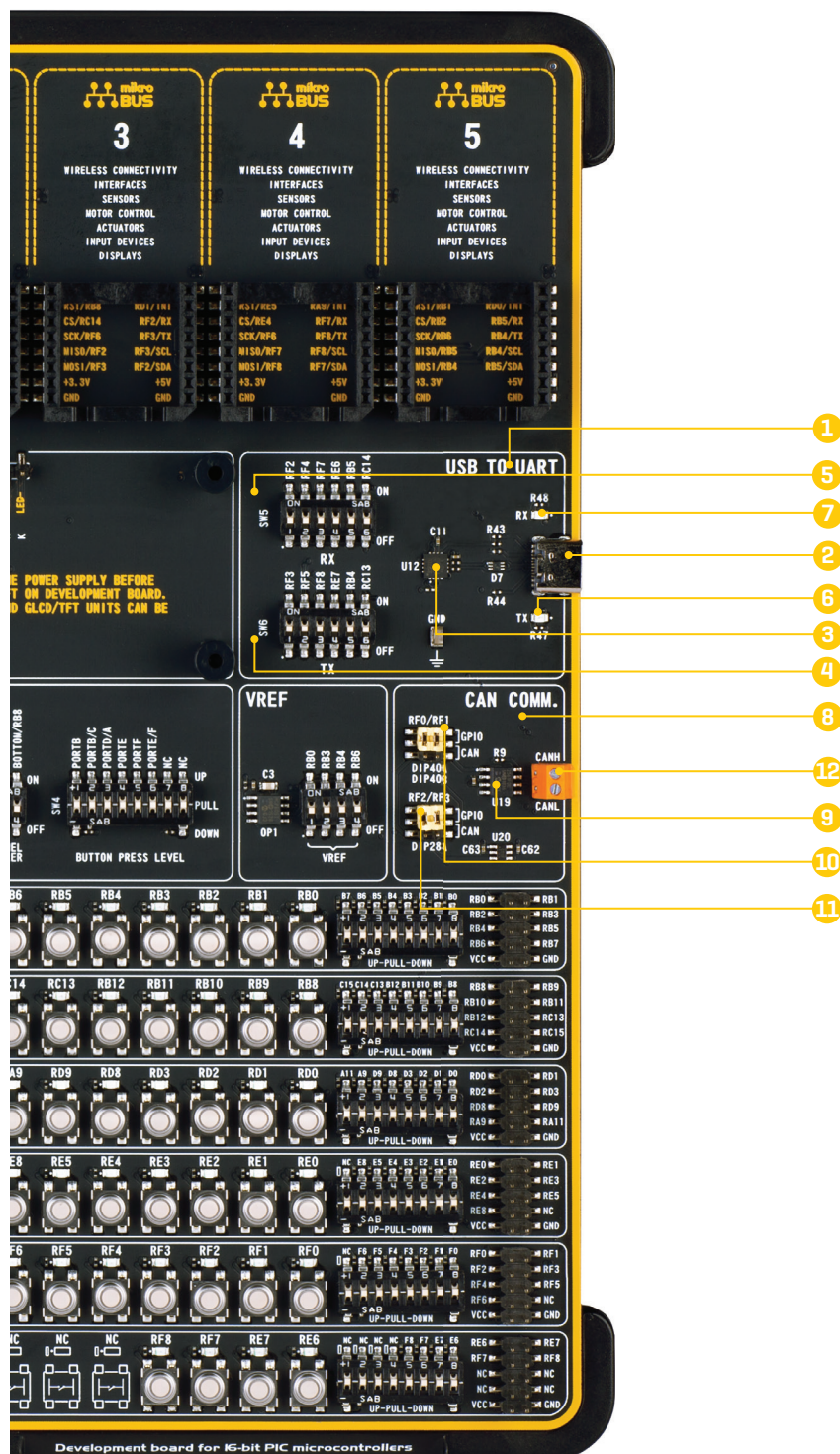**Red LED (RX) [7]** indicates incoming data transfer

CAN

Controller Area Network (CAN or CAN Bus) **[8]** is a serial network technology, originally designed for the automotive industry, but due to its robustness and noise immunity, it has become popular in many other applications. The CAN Bus is primarily used in embedded systems, allowing to establish fast communication between MCUs or other peripherals, eliminating the need for expensive and complex technology. The CAN Bus consists of only two wires, allowing both high data rates and message collision prevention.

The EasyPIC v8 for dsPIC30 utilizes the MCP2561FD **[9]**, a high-speed CAN flexible data rate transceiver from Microchip, offering support for both CAN and CAN FD (CAN Flexible Data Rate) for MCUs equipped with the CAN peripheral. The MCP2561FD transceiver meets all the automotive requirements for CAN FD, exceeding 2Mbps data rate, featuring low quiescent current, electromagnetic compatibility (EMC), and electrostatic discharge (ESD) immunity. Some features provided by the MCP2561FD include:

- Optimized for CAN FD at 2Mbps, 5Mbps, and 8 Mbps operation
- CAN Bus Pins are disconnected when the CAN transceiver is unpowered
- Detection of ground fault
- Protection against damage due to short-circuit conditions
- Protection against high-voltage transients in automotive environments
- Automatic thermal shutdown

Figure 14: Main board partial right side view

Development board for 16-bit PIC microcontrollers

The development board offers two jumpers located in the CAN COMM. section, which are used to specify whether the MCU pins should be used as GPIOs or they should be connected to the CAN transceiver circuit as CAN TX and CAN RX lines. CAN connectivity is provided only for MCUs installed in DIP28A, DIP40A and DIP40B MCU sockets:

J17 (DIP40A, DIP40B) [10]

GPIO (up): Allows the RF0 and RF1 pins to be used as GPIO lines
CAN (down): Connects the RF0 and RF1 pins to the CAN transceiver circuit

J18 (DIP28A) [11]

GPIO (up): Allows the RF2 and RF3 pins to be used as GPIO lines
CAN (down): Connects the RF2 and RF3 pins to the CAN transceiver circuitt

The development board can be connected to the CAN Bus by using the 2-pole screw terminal **[12]**, located in the CAN COMM section. Please note that the CAN H and CAN L differential signals need to be properly connected to the CAN Bus, else no CAN communication will be possible.

LIN COMMUNICATION

LIN [Local Interconnect Network] **[1]** is a inexpensive serial network protocol used for communication between components in vehicles, It effectively supports remote application within a car's network. The LIN Bus is particularly intended for mechatronic nodes in distributed automotive applications, but is equally suited to industrial applications.

The EasyPIC v8 for dsPIC30 utilizes the MCP2003B **[2]**, it provides a physical interface to automotive and industrial LIN systems, in accordance to the LIN Bus Specifications Revision 2.2, SAE J2602 and ISO 17987. It is short circuit and overtemperature protected by internal circuitry. MCP2003B communicates with the target board MCU through the UART interface [RXD, TXD], with additional functionality provided by the CS and WAKE pins. LIN connectivity is provided only for MCUs installed in DIP28C and DIP40B MCU sockets.

A six-pole DIP switch SW1 **[3]** located in the LIN COMM, section of the board, allow fully independent control of the UART RX and TX lines, and CS and WAKE lines.

SW1.1/SW1.2 [TX] [3]
ON [up]: connects the RF3 and RE7 pins to the transmit data input
OFF [down]: disconnects the RF3 and RE7 pins from the transmit data input

SW1.3/SW1.4 [RX] [3]
ON [up]: connects the RF2 and RE6 pins to receive data output
OFF [down]: disconnects the RF2 and RE6 pins from the receive data output
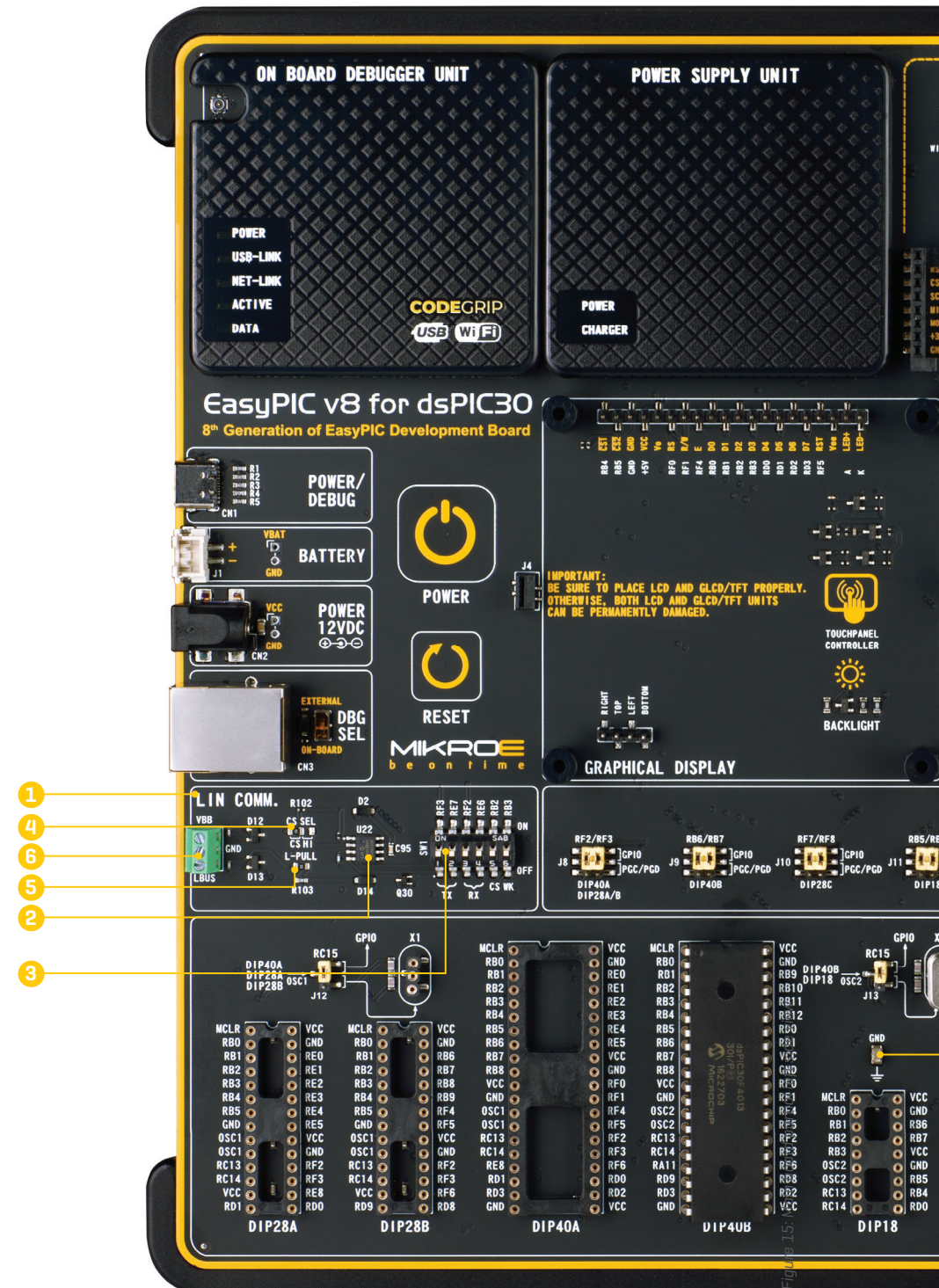
SW1.5 [CS] [3]
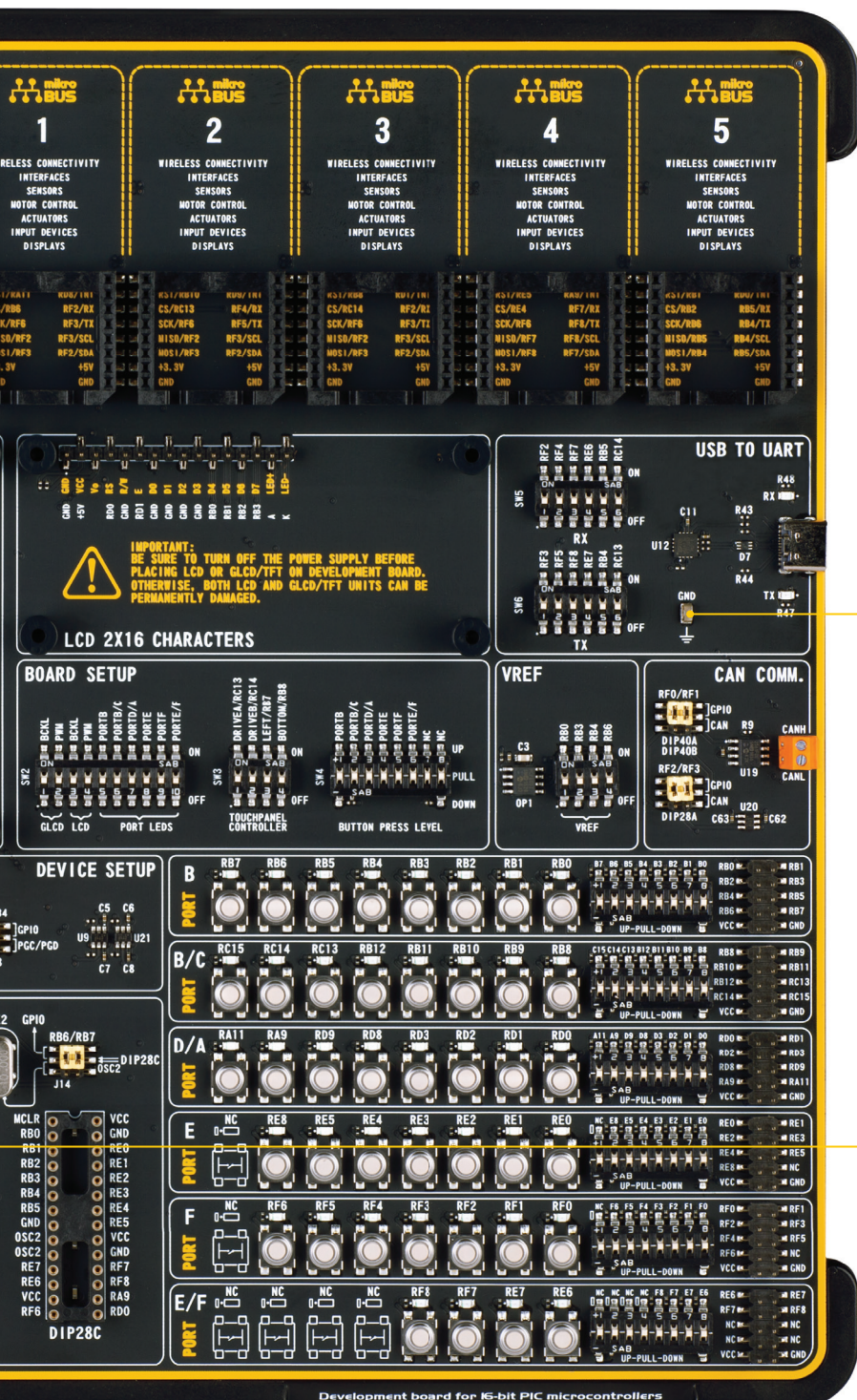**ON [up]:** connects the RB2 pin to the chip select input
OFF [down]: disconnects the RB2 pin from the chip select input

SW1.6 [WK] [3]
ON [up]: connects the RB3 pin to the wake up input
OFF [down]: disconnects the RB3 pin from the wake up input

A jumper resistor marked as CS SEL **(4)**, allows the connection of the CS pin to the dedicated MCU pin, or to a board power supply through a 4.7k pull-up resistor.

A jumper resistor marked as L-PULL **(5)**, allows the connection of external voltage supply to LIN Bus, or can be removed if external supply is not necessary.

On-board screw terminal CN5 **(6)** is used to provide an easy connection of the transceiver to a LIN network (three wires: LBUS, VBB and GND).

Additional GNDs

The EasyPIC v8 for dsPIC30 development board contains exposed GND **(7)** pins which can be used to connect measurement or testing equipment. These additional GND pins allow secure connection with the instrumentation probes, avoiding loose cables or unreliable contacts that might compromise the accuracy of the readings.

What makes you want to be an embedded developer? Is it the recognition of your skills, invention, or the development process? Whatever the reason is, we want to let you know that we are here for you every step of the way.
You can enjoy the process focused, yet relaxed – everything else is taken care of.

Enjoy premium.

What's Next?

You have now completed the journey through each and every feature of the EasyPIC v8 for dsPIC30 development board. You have become familiar with its modules, organization, and the programmer/debugger. Now you are ready to start using your new board. We suggest following steps which are highly recommended to begin with.

1 COMPILERS

Easy programming, clean interface, powerful debugging, great support - our compilers come in three different flavors: mikroC PRO for dsPIC, mikroBASIC PRO for dsPIC and mikroPASCAL PRO for dsPIC, offering a complete rapid embedded development solution for these 3 major programming languages.
www.mikroe.com/compilers/compilers-dspic-pic24

Fast, professional, multiplatform, and multi-architectural Necto Studio is already in the air. Support for dsPIC compiler inside the Necto studio is ready, for more information, please visit: *www.mikroe.com/necto*

2 PROJECTS

Once you have chosen your compiler, and since you already got the board, you are ready to start writing your first projects. We have equipped our compilers with dozens of examples that demonstrate the use of each and every feature of the EasyPIC v8 for dsPIC30 development board. This makes an excellent starting point for future custom projects. Just load the example, read well commented code, and see how it works on hardware.

3 COMMUNITY

We invite you to join thousands of users of Mikroe development tools. You will find useful projects and tutorials and get help from a large user community. If you want to download free projects and libraries, or share your own code, please visit the Libstock website. With user profiles, you can get to know other programmers, and subscribe to receive notifications on their code. *www.libstock.mikroe.com*

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