



MICROCHIP

**MTD6505
3-Phase BLDC
Sensorless Fan Controller
Demonstration Board
User's Guide**

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC³² logo, rPIC and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.


FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniscient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICkit, PICtail, REAL ICE, rLAB, Select Mode, Total Endurance, TSHARC, UniWinDriver, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2011, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

ISBN: 978-1-61341-886-4

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949:2009 ==

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.



MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMO BOARD USER'S GUIDE

Table of Contents

Preface	5
Introduction.....	5
Document Layout	5
Conventions Used in this Guide	6
Recommended Reading.....	7
The Microchip Web Site	7
Customer Support	7
Document Revision History	7
Chapter 1. Product Overview	
1.1 Introduction	9
1.2 MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Hardware Description	10
1.3 What the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Kit Includes	10
Chapter 2. Installation and Operation	
2.1 Getting Started	11
2.1.1 Software Installation	11
2.1.2 Board Installation	11
2.2 MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Software Description	13
2.2.1 Controlling and Monitoring Tab	13
2.2.2 Measurement Tab	15
2.3 How to Define the Correct R_{PROG} Value	18
2.3.1 Operation	18
Appendix A. Schematics and Layouts	
A.1 Introduction	19
A.2 Board – Schematic: Power Management Part and Resistor for Programming Part	20
A.3 Board – Schematic: Direction Pin Management Part, PIC Reserves Part, and MTD6505 Voltage and Current Monitoring Part	21
A.4 Board – Schematic: PIC24FJ256GB106 Part	22
A.5 Board – Schematic: ICPart/MTD6505 Plug-in Module Socket Part, USB Connection Part, LED Part, and Reset Switch Part	23
A.6 Board – Top Silk and Pads	24
A.7 Board – Top Trace and Pads	25
A.8 Board – Bottom Trace and Pads	26
Appendix B. Bill of Materials	
Worldwide Sales and Service	30



MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMO BOARD USER'S GUIDE

Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXA”, where “XXXX” is the document number and “A” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – Important information about the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.
- **Chapter 2. “Installation and Operation”** – Includes instructions on how to get started with MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.
- **Appendix A. “Schematics and Layouts”** – Shows the schematic and layout diagrams for the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.
- **Appendix B. “Bill of Materials”** – Lists the parts used to build the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB[®] IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u><i>File>Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-Opa+, -Opa-
	Bit values	0, 1
	Constants	0xFF, 'A'
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [options]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	errorlevel {0 1}
Ellipses...	Replaces repeated text	var_name [, var_name...]
	Represents code supplied by user	void main (void) { ... }

RECOMMENDED READING

This user's guide describes how to use MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- **MTD6505 Data Sheet**, “3-Phase BLDC Sinusoidal Sensorless Fan Motor Drive” (DS22281)

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: <http://www.microchip.com/support>.

DOCUMENT REVISION HISTORY

Revision A (December 2011)

- Initial Release of this Document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

The MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board allows the control and monitoring of the MTD6505 device, using a PC software connected to the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board via a USB connection.

The MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Software provides several features, such as V_{DD} control and monitoring, pulse-width modulation (PWM) control, speed and current consumption monitoring. It also allows controlling the R_{PROG} resistor value for fan fitting.

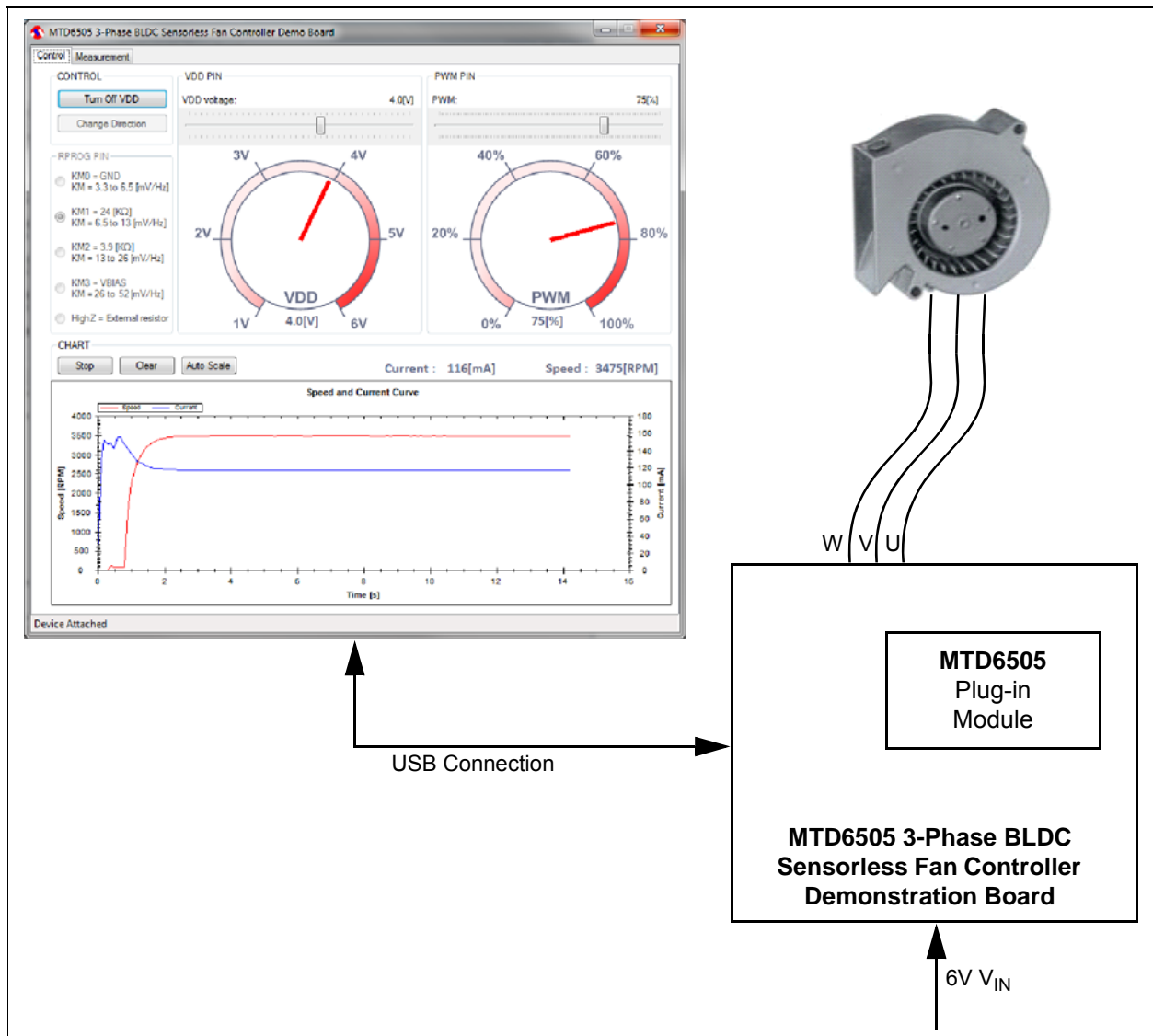


FIGURE 1-1: System Overview.

1.2 MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMONSTRATION BOARD HARDWARE DESCRIPTION

The MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board contains several components, such as:

- A microcontroller (PIC24FJ256GB) for USB connection, PWM generation, FG frequency measurement, V_{DD} measurement, other's signal's activations and component's communication.
- An adjustable LDO (MCP1827) combined to a digital potentiometer (MCP42050) to provide the V_{DD} to the MTD6505 device. The LDO can be enabled or disabled by the microcontroller.
- The digital potentiometer is also used to set the MTD6505 R_{PROG} external resistor value.
- A Delta-Sigma (MCP3421) combined to a shunt resistor for sensing the MTD6505 current consumption on the V_{DD} pin.

More details of the schematic are available in [Appendix A. "Schematics and Layouts"](#).

1.3 WHAT THE MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMONSTRATION BOARD KIT INCLUDES

The MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board includes:

- MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board (ADM00345)
- 3 x MTD6505 plug-in modules with soldered on MTD6505 (3x3 UDFN-10L)
- A mini-USB cable
- A 3-Phase BLDC fan (use with $K_M=1$)
- Important Information Sheet

Chapter 2. Installation and Operation

2.1 GETTING STARTED

The following sections describe how to use the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.

2.1.1 Software Installation

Download the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board software installer from the Microchip web site at <http://www.microchip.com>. From the web site, search for the evaluation board by part number ADM00345. The GUI can be downloaded from this web page.

Note: This application requires Microsoft .NET Framework 2.0 or later.

2.1.2 Board installation

Figure 2-1 identifies the required points for using the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.

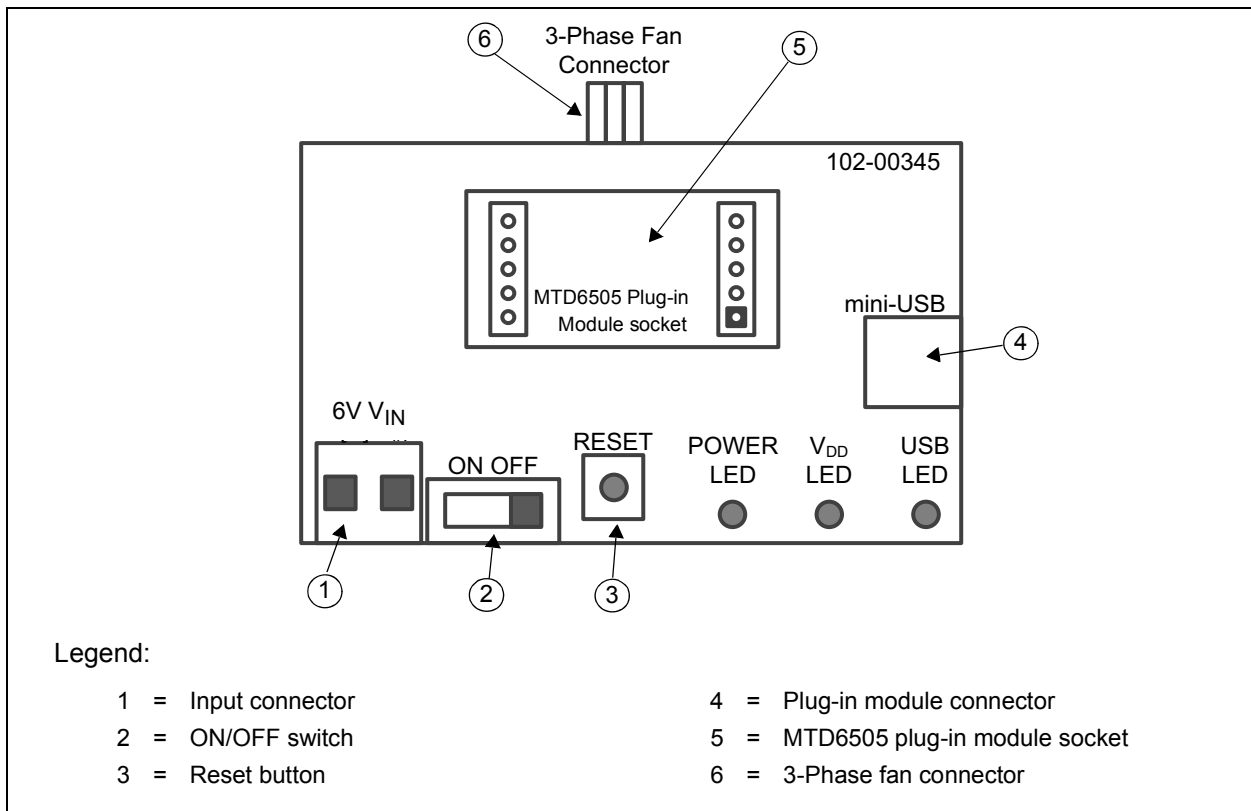


FIGURE 2-1: Top View - Hardware Components.

To use the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board, follow the next steps:

1. Plug in the MTD6505 plug-in module (with an MTD6505 soldered on it) on its socket (see [Figure 2-1](#)).
2. To plug in a 3-Phase BLDC sensorless fan, choose one of these connections:
 - 3-Phase fan connector from the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board (J5)
 - On the MTD6505 plug-in module fan connector.
3. Connect the Power Supply to the V_{IN} test point. V_{IN} value is +6V \pm 5%. The Power Supply should be able to deliver up to 1.0A.
4. Turn on the power switch. The POWER LED should be activated.
5. Plug the mini-USB cable from the USB port of a computer to the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board connector.
6. If required, let the computer identify the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.
7. Restart the computer, if required.
8. Start the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Software.

Note: Once the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Software is installed, it will automatically detect if the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board is attached and its configuration. This means it is possible to start the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Software before or after enabling the board.

2.2 MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMONSTRATION BOARD SOFTWARE DESCRIPTION

The MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board Software window contains two tabs. The first tab is for controlling and monitoring the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board; the second tab is the Measurement tab.

2.2.1 Controlling and Monitoring Tab

Figure 2-2 shows the options and functions available to control and monitor the board.

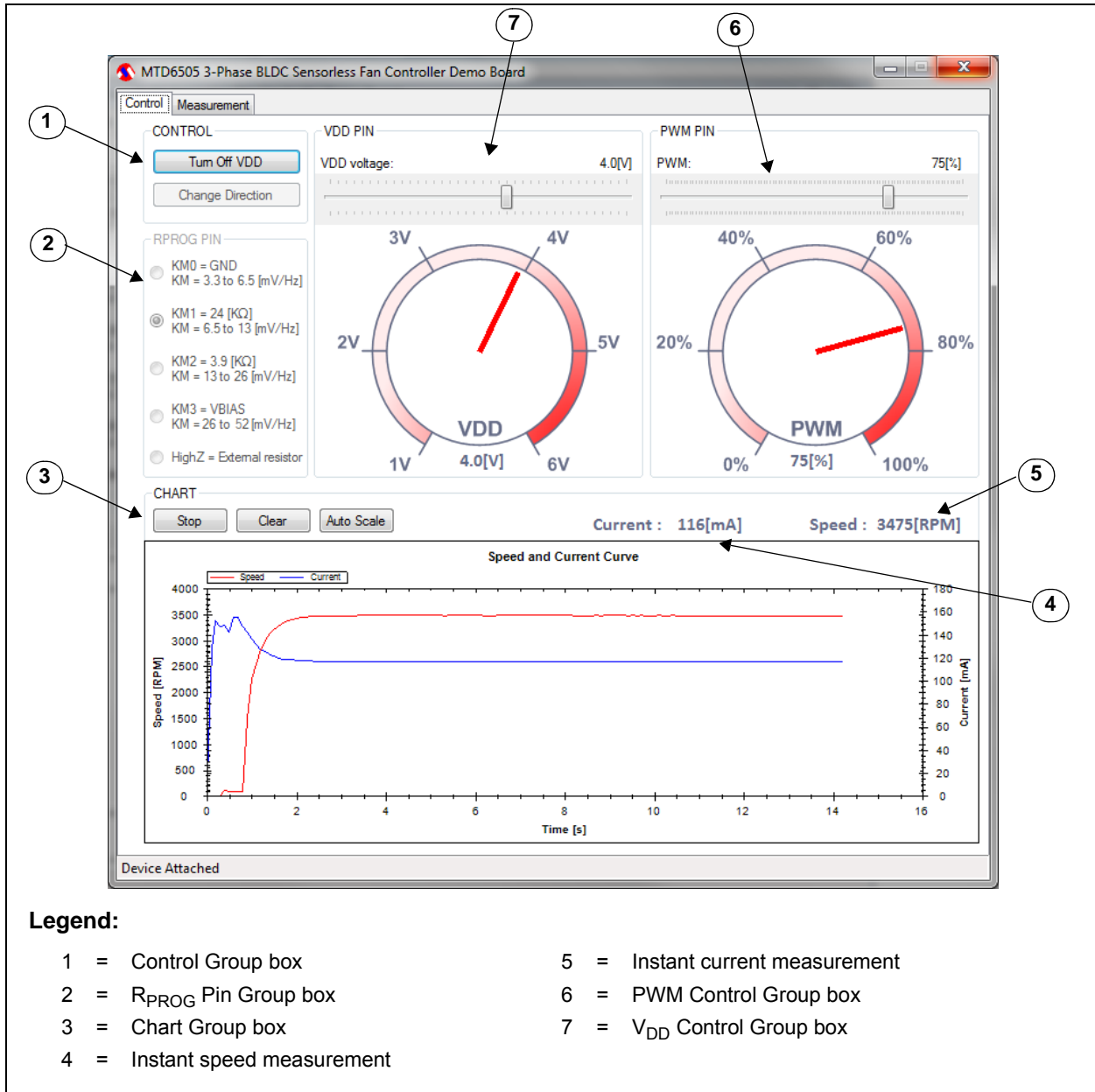


FIGURE 2-2: GUI - Controlling and Monitoring Tab.

All functions presented in Figure 2-2 are enabled only when the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board is connected to the PC via a USB connection.

2.2.1.1 CONTROL/MONITORING

The Control/Monitoring Group box contains two buttons:

- **Turn On/Off VDD** button enables/disables the power supply on the V_{DD} pin of the MTD6505 device.
- **Change Direction** is used to inverse the sense of the fan rotation. The **Change Direction** button is available only when V_{DD} is turned off.

2.2.1.2 R_{PROG} PIN

The R_{PROG} Pin Group box allows the selection of the desired R_{PROG} resistor value. This value depends on the K_M (mV/Hz) of the fan. See the section [Section 2.3 “How to define the correct \$R_{PROG}\$ Value”](#) for more information on the R_{PROG} selection.

One particular mode, HighZ, allows the setting of an external R_{PROG} resistor value directly on the plug-in module.

In order to use the MTD6502B with the MTD6505 3-Phase BLDC Sensorless Fan Controller Demo Board, use $K_M = 0$.

2.2.1.3 CHART

This part of the GUI displays a chart of the MTD6505 current consumption (mA) on the V_{DD} pin, and the fan speed (Revolutions Per Minute - RPM) by measuring the FG frequency. The chart adds 10 values per second. The three buttons have the following functions:

- **Start/Stop** – allows the values acquisition to start or stop
- **Clear** – removes all the values added to the chart
- **Auto Scale** – allows the restoration of the default scaling. In the default scaling mode, the chart will automatically adjust the scaling to ensure the complete view of the whole added values. In addition, when selecting a part of the chart with the mouse, it is possible to zoom in the selection. The mouse wheel zoom in/out is also enabled.

2.2.1.4 PWM PIN

The PWM Group box provides a slide bar to set the PWM ratio on the MTD6505 PWM pin. The gauge below indicates the current PWM applied.

2.2.1.5 V_{DD} PIN

The V_{DD} Group box also provides a slide bar to set the desired V_{DD} value. The gauge below indicates the instant V_{DD} value measured by the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board.

2.2.1.6 CURRENT/SPEED FIELDS

Current field shows the instant current measure (mA). Speed field shows the instant speed measure (RPM).

2.2.2 Measurement Tab

The **Measurement** tab is used to check if the fan is correctly adapted to the MTD6505 by testing the fan several times in different conditions. This tab contains two more tabs, for settings and results.

2.2.2.1 SETTINGS TAB

Figure 2-3 shows the **Setting** tab.

Legend:

- 1 = Measurement Settings Group box
- 2 = Startup measurement
- 3 = PWM Change Measurement Group box
- 4 = Speed Curve and Stability Measurement Group box
- 5 = Measurement Control Group box

FIGURE 2-3: GUI - Measurement tab – Settings.

2.2.2.1.1 Measurement Settings

The **Measurement Settings** Group box is used to specify the measurement corners required:

- **Number of iterations** – for one corner
- **PWM Corners Measurement** – requires the PWM Max (%), PWM Step (%) and PWM Min (%) values setting. The software will start with the maximum value entered, and will decrease the PWM by the step value until reaches the minimum entered PWM value.
- **V_{DD} corners** are similar to the PWM corners. A V_{DD} corner includes all PWM corners. This means that for one V_{DD} corner, all PWM corners are measured.
- **Startup max delay** – if the speed of the fan is measured as 0 RPM after this delay, the startup is considered a fail. The recommended value for this field is 3s.
- **Inter test delay** – specifies how many seconds are allocated to stop the fan between two tests. This value will depend on the fan lag.

2.2.2.1.2 Startup

When the **Startup** box is checked, the startup measurements are enabled, measuring every corner for this test. If **Startup** is not enabled, the Startup test is skipped. The other tests will be executed if they are enabled.

2.2.2.1.3 PWM Change

The PWM Change Measurement starts up with a PWM value of 100%. After the specified startup delay (entered in the Startup max delay field), the PWM changes depending on the PWM corner specified. The software will then verify if the fan is still running. This last check will occur after a delay value is specified in the **Braking Delay (s)** field.

2.2.2.1.4 Speed Curve and Stability

This measurement requires a specified number of samples in a specified condition to check speed stability. If the **Do every percent PWM** and/or **Do every 0.1(V) for V_{DD}** are not checked, the corners are measured. For this test, the iterations numbering will always be 1. When the **Do every percent PWM** option is enabled, the software will override the specified settings, and the measurement will occur for every PWM; the same procedure will happen for V_{DD}, if the check box **Do every 0.1[V] for V_{DD}** is checked.

2.2.2.1.5 Measurement Control

This group box contains three buttons that allows the user to control the work flow:

- **Stop Measuring** – starts and stops the required measuring
- **Clear Result** – clears the current result from the screen
- **Save Results** – stores the current measurement in an Excel file

2.2.2.2 MEASUREMENT RESULTS TAB

Figure 2-4 shows the Measurement Results sub-tab:

Test Name	Item Number	PWM [%]	VDD [V]	FG [rpm]	Current [mA]	Startup Success	PWM Ch Success
Startup	1	100	5	0	0	True	True
Startup	2	100	5	0	0	True	True
Startup	3	100	5	0	0	True	True
Startup	4	100	5	0	0	True	True
Startup	5	100	5	0	0	True	True
Startup	6	100	5	0	0	True	True
Startup	7	100	5	0	0	True	True
Startup	8	100	5	0	0	True	True
Startup	9	100	5	0	0	True	True
Startup	10	100	5	0	0	True	True
PWM Change	1	50	5	0	0	True	True
PWM Change	2	50	5	0	0	True	True
PWM Change	3	50	5	0	0	True	True
PWM Change	4	50	5	0	0	True	True
PWM Change	5	50	5	0	0	True	True
PWM Change	6	50	5	0	0	True	True
PWM Change	7	50	5	0	0	True	True
PWM Change	8	50	5	0	0	True	True
PWM Change	9	50	5	0	0	True	True
PWM Change	10	50	5	0	0	True	True

Measurement Control

Stop Measuring Clear Results Save Results Current Test : Startup, 5[V], 100[%], item n°2

Device AttachedState

Legend:

- 1 = Measurement Results table
- 2 = Measurement Control Group box

FIGURE 2-4: GUI - Measurement – Results Tab.

The results are stored in this table. All the tests have the first six columns in common, with the other columns being significant only for a specific test. Settings' control buttons are also visible in this tab (see description in [Section 2.2.2.1.5 “Measurement Control”](#)).

2.3 HOW TO DEFINE THE CORRECT R_{PROG} VALUE

This section explains how to define the correct K_M value for a specific fan. The K_M is linked to the R_{PROG} (see [Table 2-1](#)). An incorrect K_M selection can create issues, or reduce the efficiency.

2.3.1 Operation

Follow the next steps to define the right R_{PROG} value:

1. Apply a constant stream of air to a fan that is not connected.
2. Using an oscilloscope, measure the waveform between two phases, when the fan is rotating.
3. Measure the generated peak-to-peak voltage (V_{p-p}) value and the frequency (f).
4. Compute K_M based on the measured V_{p-p} and f (in mV/Hz):

EQUATION 2-1: K_M COMPUTE

$$K_m = \frac{V_{p-p}}{2f}$$

K_M should be constant, for all fan rotation speeds, but for the K_M measurement, the fan rotation speed due to the air stream, should be close to the nominal fan rotation speed.

[Table 2-1](#) shows the corresponding K_M for different R_{PROG} values.

TABLE 2-1: R_{PROG} VALUE

R _{PROG}	K _M	K _M Range (mV/Hz)
V _{BIAS} (0Ω)	3	26 - 52
3.9 kΩ	2	13 - 26
24 kΩ	1	6.5 - 13
GND	0	3.25 - 6.5



MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMO BOARD USER'S GUIDE

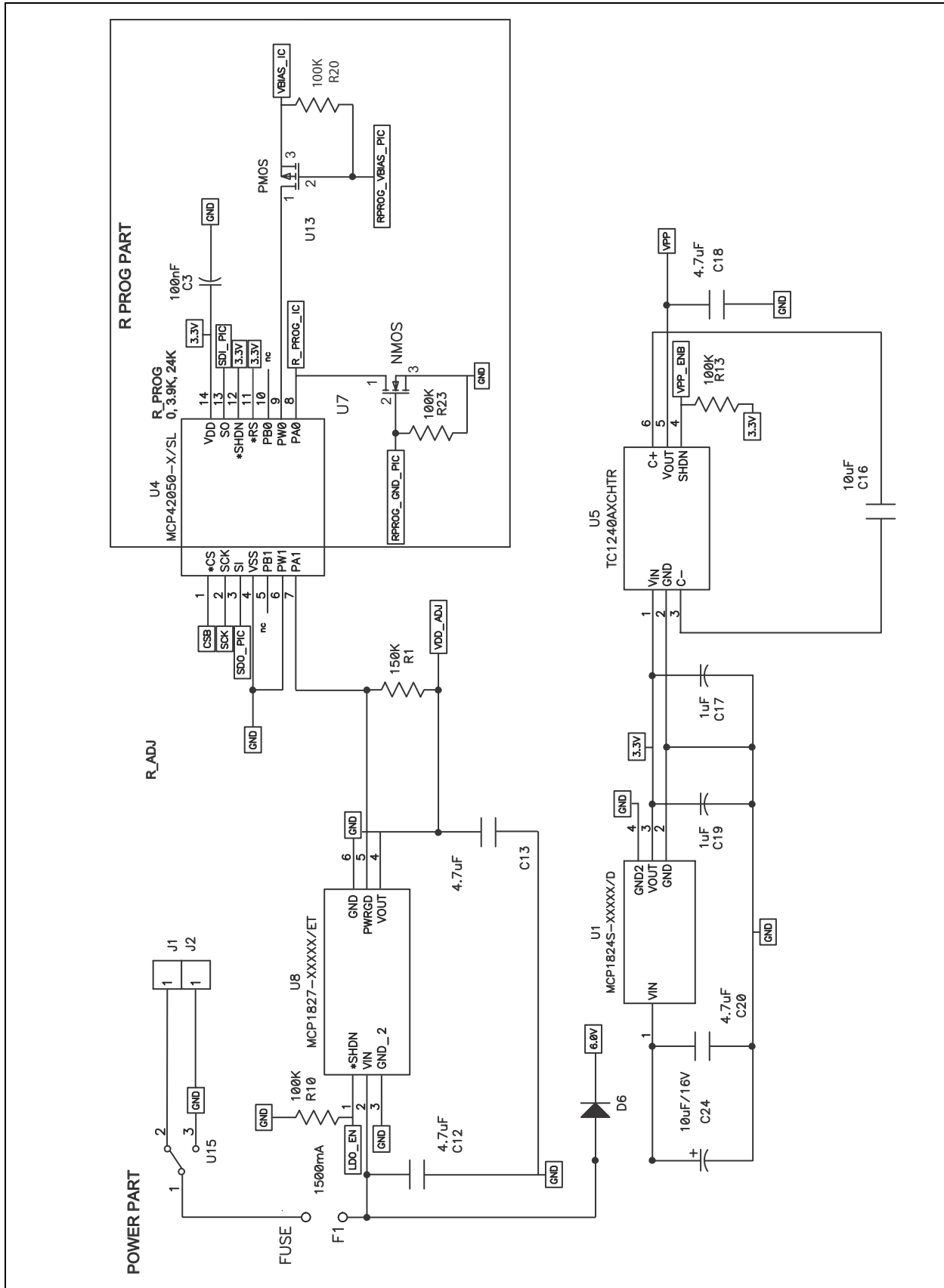
Appendix A. Schematics and Layouts

A.1 INTRODUCTION

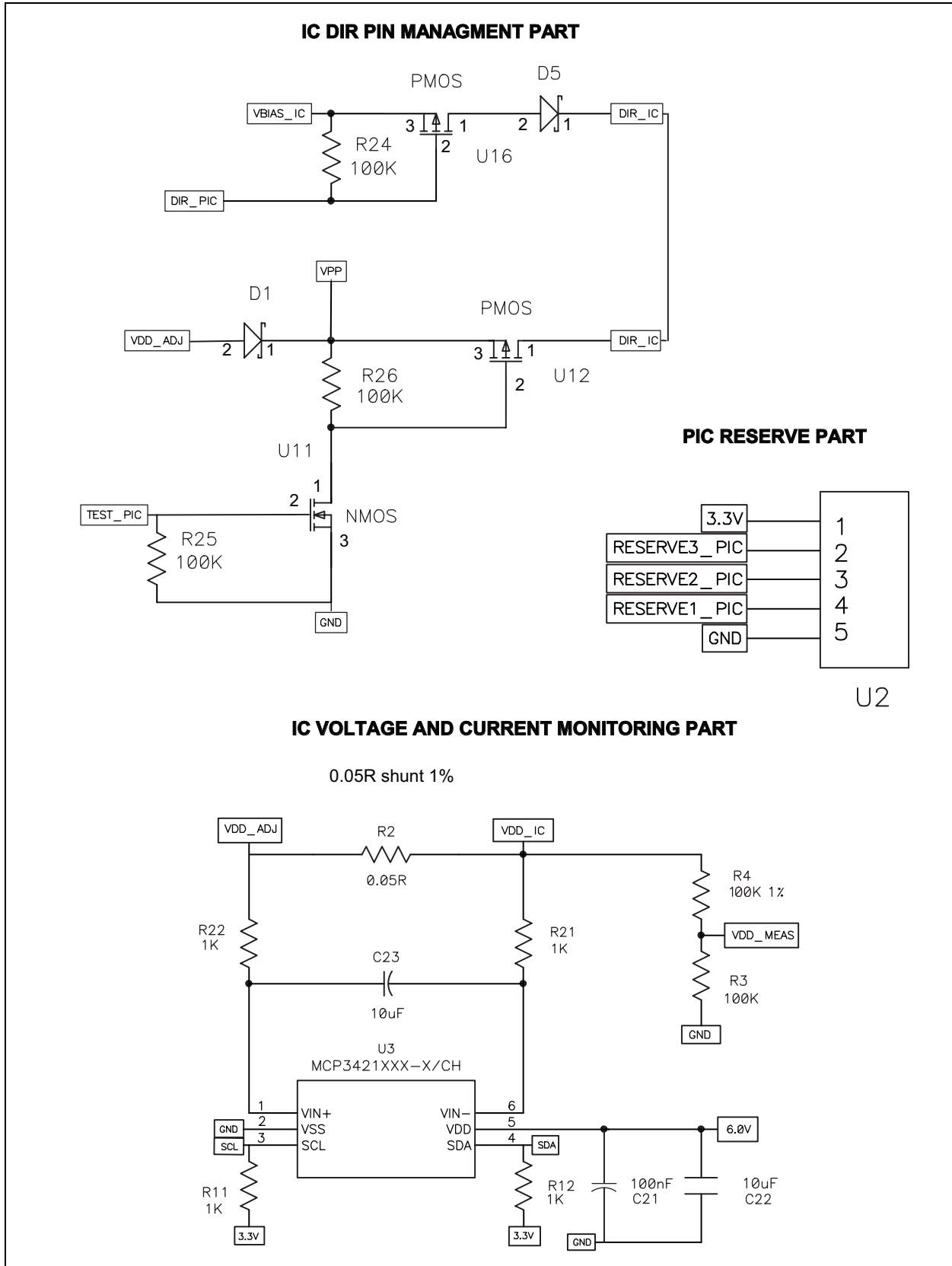
This appendix contains the following schematics and layouts for the MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board:

- Board - Schematic: Power Management Part and Resistor for Programming Part
- Board – Schematic: Direction Pin Management Part, PIC Reserves Part and MTD6505 Voltage and Current Monitoring Part
- Board – Schematic: PIC24FJ256GB106 Part
- Board – Schematic: IC Part/MTD6505 Plug-in Module Socket Part, USB Connection Part, LED Part and Reset Switch Part
- Board – Top Silk and Pads
- Board – Top Trace and Pads
- Board – Bottom Trace and Pads

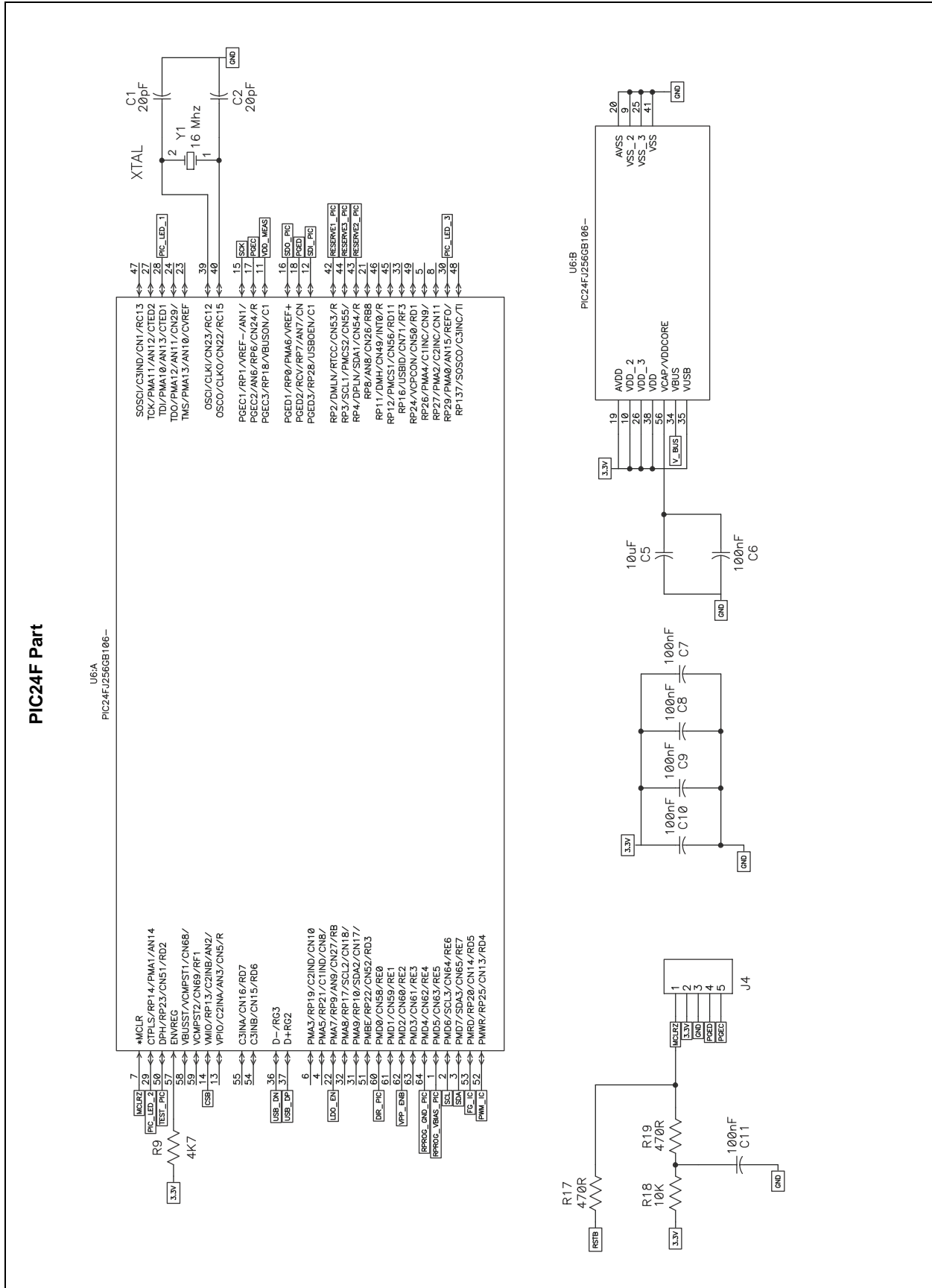
A.2 BOARD – SCHEMATIC: POWER MANAGEMENT PART AND RESISTOR FOR PROGRAMMING PART



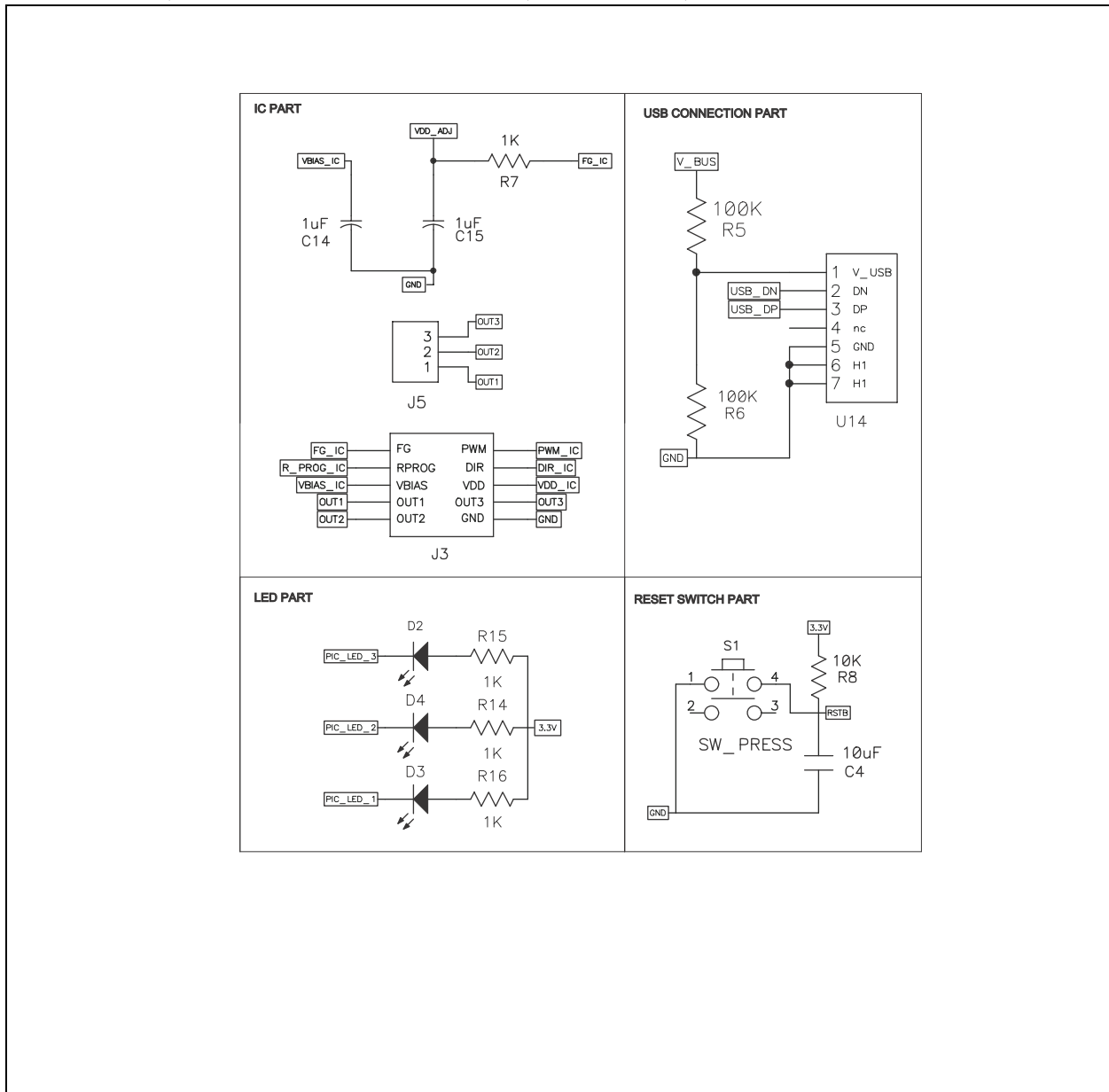
A.3 BOARD – SCHEMATIC: DIRECTION PIN MANAGEMENT PART, PIC RESERVES PART, AND MTD6505 VOLTAGE AND CURRENT MONITORING PART



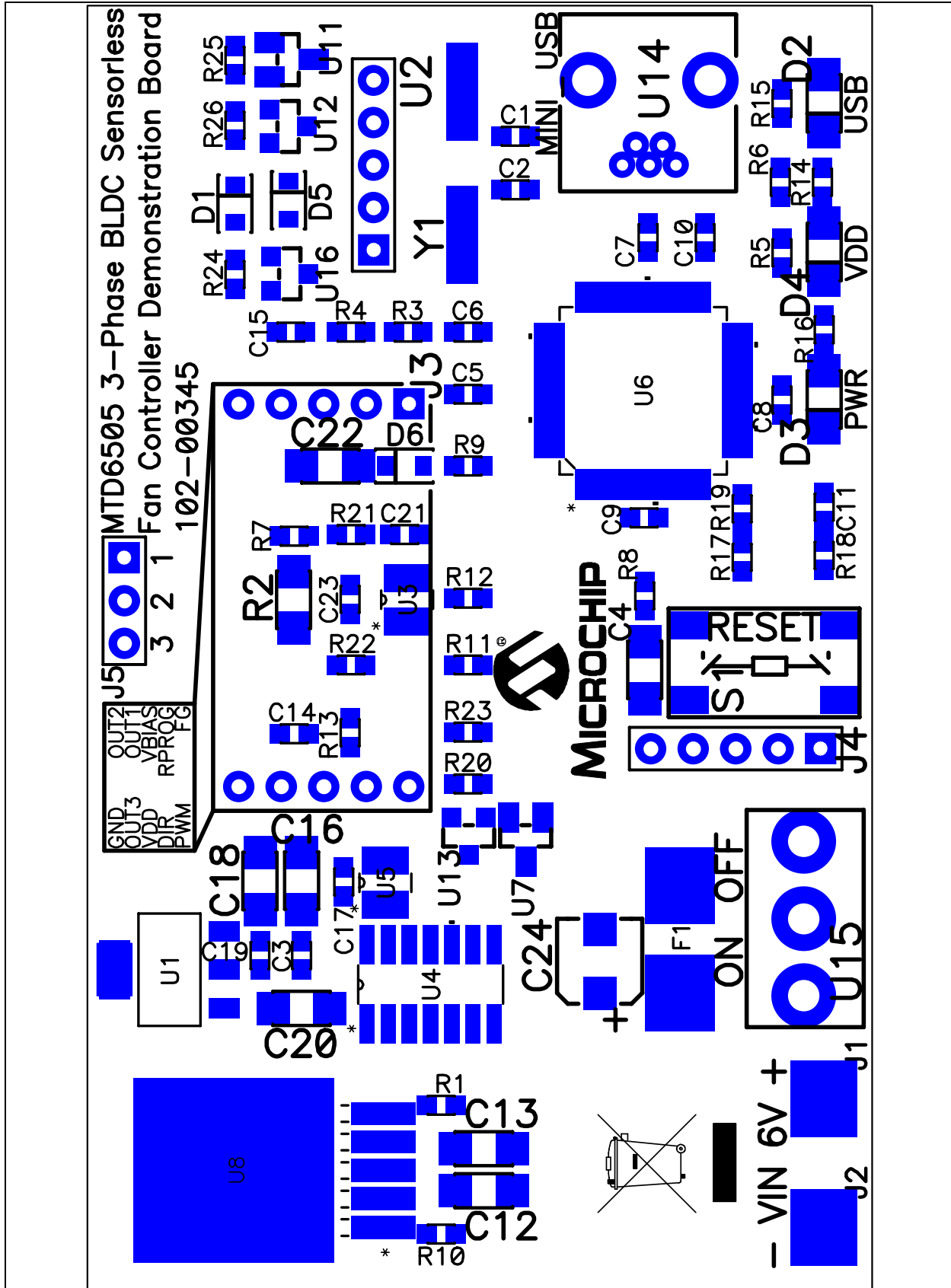
A.4 BOARD – SCHEMATIC: PIC24FJ256GB106 PART



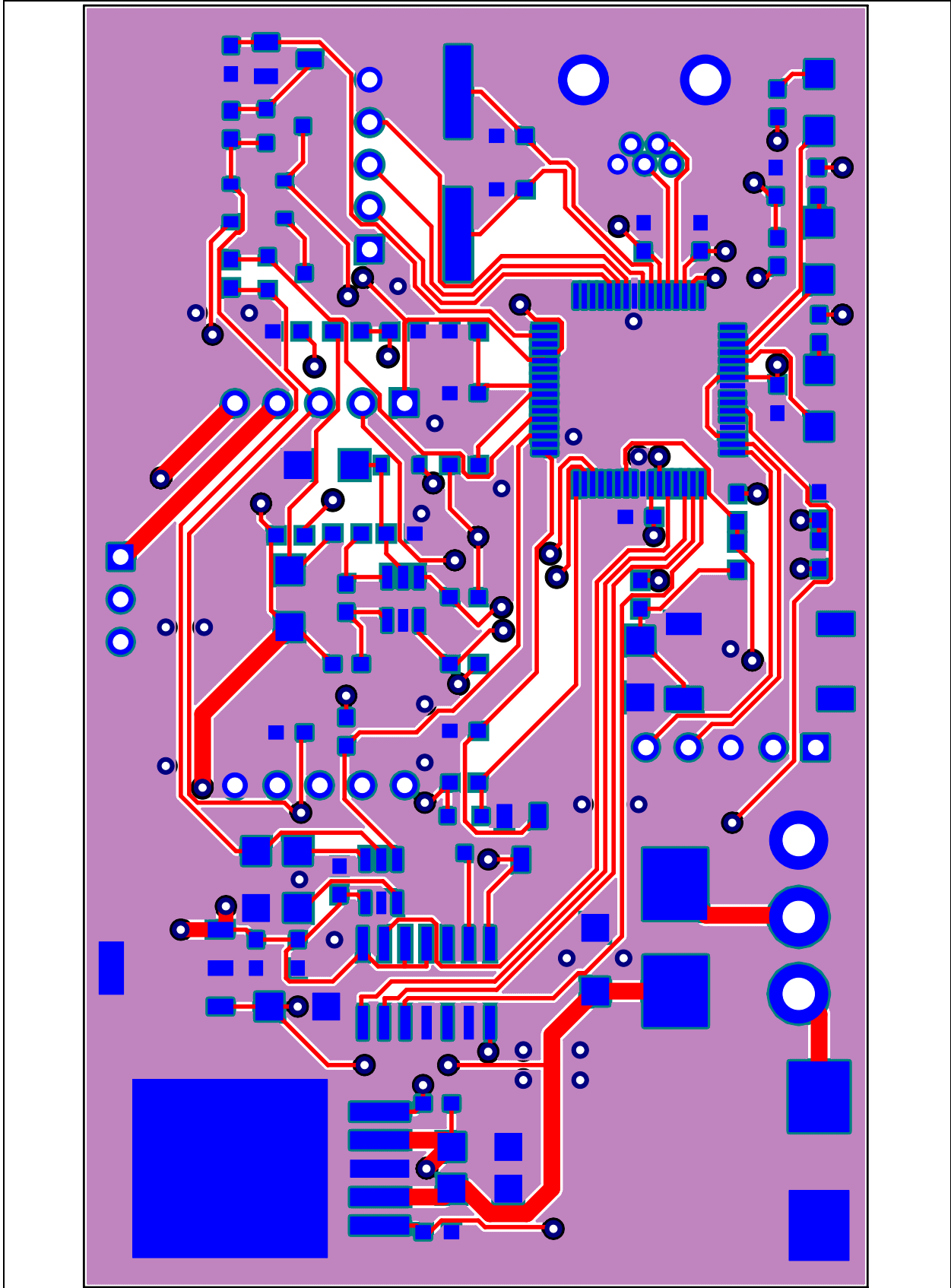
A.5 BOARD – SCHEMATIC: IC PART/MTD6505 PLUG-IN MODULE SOCKET PART, USB CONNECTION PART, LED PART, AND RESET SWITCH PART



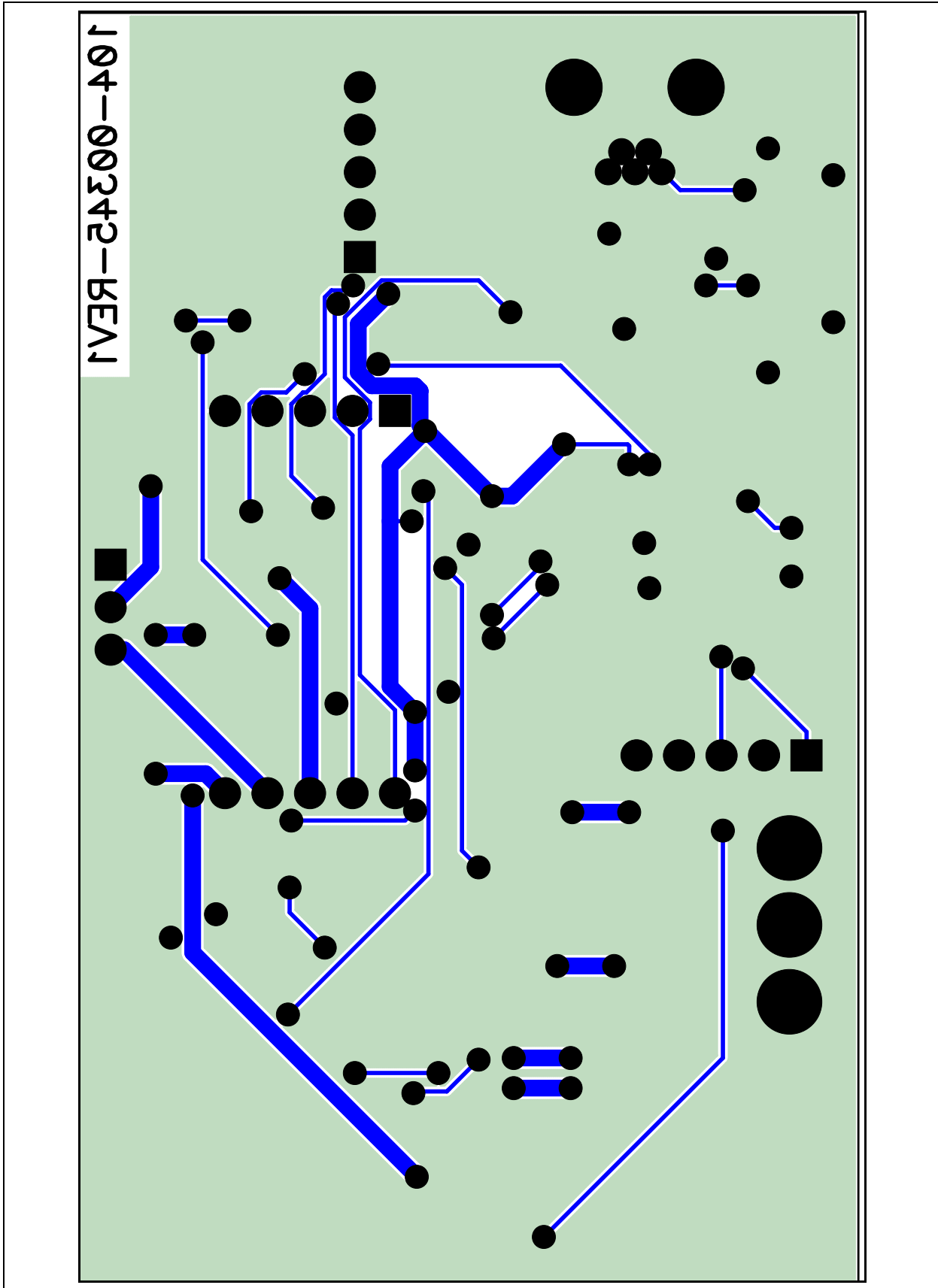
A.6 BOARD – TOP SILK AND PADS



A.7 BOARD – TOP TRACE AND PADS



A.8 BOARD – BOTTOM TRACE AND PADS





MTD6505 3-PHASE BLDC SENSORLESS FAN CONTROLLER DEMO BOARD USER'S GUIDE

Appendix B. Bill of Materials

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
2	C1, C2	CAP CER 20PF 50V C0G 0603	TDK [®] Corporation	C1608C0G1H200J
8	C3, C6, C7, C8, C9, C10, C11, C21	CAP CER .1UF 16V 10% X7R 0603	Murata Electronics [®]	GRM188R71C104KA01D
3	C4, C16, C22	CAP CERAMIC 10.0UF 16V X5R 1206	KEMET [®] Electronics Corp.	C1206C106K4PACTU
2	C5, C23	CAP CER 10UF 6.3V X5R 0603	KEMET Electronics Corp.	C0603C106M9PACTU
4	C12, C13, C18, C20	CAP CERAMIC 4.7UF 16V X7R 1206	KEMET Electronics Corp.	C1206C475K4RACTU
4	C14, C15, C17, C19	CAP CER 1.0UF 16V 10% X5R 0603	Murata Electronics	GRM188R61C105KA93D
1	C24	CAP ALUM 10UF 16V 20% SMD	Panasonic [®] - ECG	EEE-HC1C100R
2	D1, D5, D6	DIODE SCHOTTKY 30V 200MA SC-76	NXP Semiconductors	1PS76SB10,115
3	D2, D3, D4	LED INGAN BLUE CLEAR 1206 SMD	Dialight Corp.	598-8291-107F
1	D6	DIODE ZENER 12V 400MW SOD323	NXP Semiconductors	PDZ12B,115
1	F1 Fuse	044901.5MR - FUSE, SMD, 1.5A, TIME DELAY	Littelfuse [®]	044901.5MR
1	F1 Holder	0154007.DR - FUSE BLOCK W/ 7A FUSE, FAST ACTING	Littelfuse	R154007
1	J1, J2	PC TEST POINT COMPACT SMT	Keystone Electronics	5016
3	J3, J3, U2	CONN RCPT .100" 5POS SNGL TIN	Samtec, Inc.	SLW-105-01-T-S
1	J4	CONN HDR BRKWAY .100 05POS VERT	TE Connectivity	9-146282-0-05
1	J5	CONN HDR BRKWAY .100 03POS VERT	TE Connectivity	9-146282-0-03
1	R1	RES 150K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ154V
1	R2	RES .05 OHM 1W 1% 1206 SMD	Vishay [®] /Dale	WSLP1206R0500FEA
2	R3, R4	RES 100K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1003V
9	R5, R6, R10, R13, R20, R23, R24, R25, R26	RES 100K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ104V
8	R7, R11, R12, R14, R15, R16, R21, R22	RES 1.0K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ102V

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

MTD6505 3-Phase BLDC Sensorless Fan Controller Demonstration Board

TABLE B-1: BILL OF MATERIALS (BOM) (CONTINUED)

Qty	Reference	Description	Manufacturer	Part Number
2	R8, R18	RES 10K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ103V
1	R9	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ472V
2	R17, R19	RES 470 OHM 1/10W 5% 0603 SMD	Panasonic - ECG	ERJ-3GEYJ471V
1	S1	SWITCH, TACTILE SPST 50mA, SMD GULL WING	TE Connectivity Alcoswitch	FSM2JSMATR
1	U1	300 mA, Low Voltage, Low Quiescent Current LDO Regulator	Microchip Technology Inc.	MCP1824S-3302E/DB:3.3V
1	U3	18-Bit Analog-to-Digital Converter with I ² C Interface and On-Board Reference	Microchip Technology Inc.	MCP3421A0T-E/CH
1	U4	Single/Dual Digital Potentiometer with SPI Interface	Microchip Technology Inc.	MCP42050-E/SL
1	U5	Positive Doubling Charge Pumps with Shutdown	Microchip Technology Inc.	TC1240AXCHTR
1	U6	64-Pin, 16-Bit Flash Microcontroller with USB On-The-Go (OTG)	Microchip Technology Inc.	PIC24FJ256GB106-I/PT
2	U7, U11	MOSFET N-CH 20V 1.2A SC59-3	Diodes Incorporated [®]	DMN2112SN-7
1	U8	1.5A, Low Voltage, Low Quiescent Current LDO Regulator	Microchip Technology Inc.	MCP1827-ADJE/ET
3	U12, U13, U16	MOSFET P-CH 20V 1A SSOT3	Fairchild Semiconductor [®]	NDS332P
1	U14	Plug-in Module connector Type B (USB 2.0)	Hsuan Mao Technology Co., Ltd	C8320-05BFRSB0R
1	U15	SLIDE SWITCH, SPDT	Knitter-Switch	MFP106D
1	Y1	CRYSTAL, HC49/SMD, 16.000MHZ	Aker Technology	CAA-16.000-18-3050-X
1	FAN	3-Phase BLDC Fan	Kunshan Kipo Technology Co., LTD	FAKL600EPA

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

NOTES:



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Cleveland
Independence, OH
Tel: 216-447-0464
Fax: 216-447-0643

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Farmington Hills, MI
Tel: 248-538-2250
Fax: 248-538-2260

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

Santa Clara
Santa Clara, CA
Tel: 408-961-6444
Fax: 408-961-6445

Toronto
Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon
Hong Kong
Tel: 852-2401-1200
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Hangzhou
Tel: 86-571-2819-3187
Fax: 86-571-2819-3189

China - Hong Kong SAR
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-2566-1512
Fax: 91-20-2566-1513

Japan - Osaka
Tel: 81-66-152-7160
Fax: 81-66-152-9310

Japan - Yokohama
Tel: 81-45-471-6166
Fax: 81-45-471-6122

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung
Tel: 886-7-536-4818
Fax: 886-7-330-9305

Taiwan - Taipei
Tel: 886-2-2500-6610
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

UK - Wokingham
Tel: 44-118-921-5869
Fax: 44-118-921-5820

11/29/11



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.