



User Guide

MP6570 Evaluation Kit (EVKT-MP6570)

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Overview

Introduction

The EVKT-MP6570 is an evaluation kit for the MP6570, a high-performance motor controller that incorporates field-oriented control (FOC) algorithms, SVPWM modulation technology, and an accurate embedded angle sensor. It is used for applications with three-phase permanent magnet synchronous motors (PMSMs) and brushless DC (BLDC) motors.

Kit Contents

EVKT-MP6570 kit contents (items below can be ordered separately, and the GUI installation file and supplemental documents can be downloaded from the MPS website):

#	Part Number	Item	Quantity
1	EV6570-R-00B	MP6570 evaluation board	1
2	eMotion System Communication Kit	Includes one USB to SPI/I ² C/RS485 communication interface, one USB cable, and one ribbon cable	1

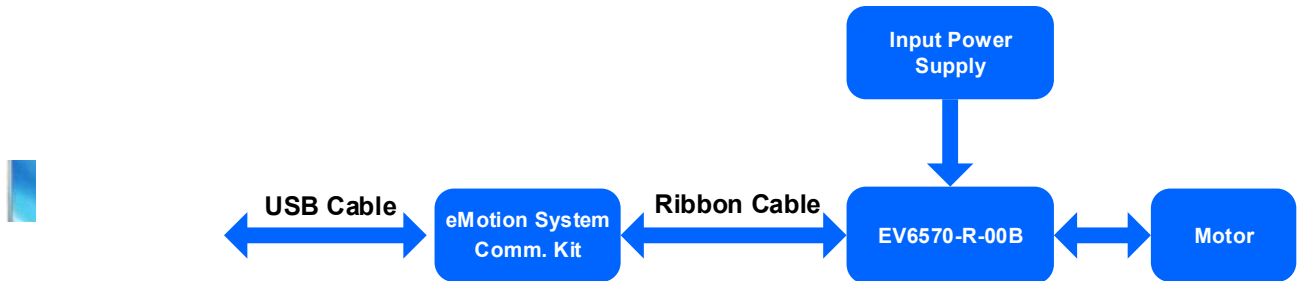


Figure 1: EVKT-MP6570 Evaluation Kit Set-Up

Features and Benefits

- Flexible Parameter Configuration via:
 - Non-Volatile Memory (NVM)
 - Selectable SPI/I²C/RS485 Interface
- Embedded Accurate Angle Sensor with Up to 14-Bit Resolution
- Field-Oriented Control (FOC)
- Supports Position Mode, Speed Mode, and Torque Mode
- Pulse-Width Modulation (PWM)/Clock/Digital Interface Reference Input
- Energy Regeneration Brake Mode
- 10-Bit Analog-to-Digital Converter (ADC) with Configurable Gain
- Up to 80kHz Configurable Switching Frequency (f_{sw})
- Up to 32 Configurable Slave Addresses
- Selectable Oscillator Source:
 - Integrated Internal Oscillator
 - External Passive Crystal Input
- Input Bus Over-Current Protection (OCP) and Over-Voltage Protection (OVP)
- Low-Power Standby Mode
- Locked-Rotor Detection and Restart
- Configurable Current Limit Threshold

Kit Specifications

Feature	Specification
Supply for Board	8V to 55V
Output Phase Current	20A (peak), 10A (continuous)
Communication Support	I ² C, SPI, RS485, default I ² C
Operating Systems Supported	Windows XP, 7, or later
System Requirement	Minimum 100MB free
GUI Software	eMotion Virtual Bench
EVB Size (LxW)	50.4cmx30cm

Section 1. Hardware Specifications

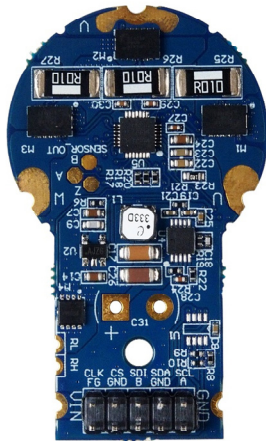
1.1 Personal Computer Requirements

The following minimum conditions must be met to use the EVKT-MP6570:

- Operating System of Windows XP, 7, or later
- Net Framework 4.0
- PC with a minimum of one available USB port
- At least 100MB of free space

1.2 EV6570-R-00B Specifications

The EV6570-R-00B is an evaluation board for the MP6570.



Feature	Specification
Supply for the Evaluation Board	8V to 55V
Operating Input Voltage	8V to 55V
EVB Size (LxW)	50.4cmx30cm

Figure 2: EV6570-R-00B Evaluation Board

1.3 eMotion System Communication Kit Specifications

The eMotion system communication kit refers to the USB to SPI/I²C/RS485 communication interface device, which connects the EVB, the PC, and its supporting accessories. Together with MPS’s eMotion Virtual Bench tool, it provides a quick and easy way to evaluate the performance of MPS digital products.

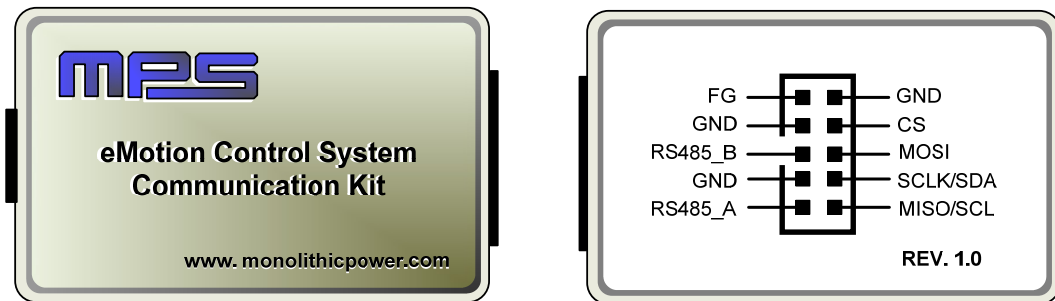


Figure 3: eMotion System Communication Kit

Section 2. Software Requirements

2.1 Software Installation Procedure

Programming occurs through the MPS eMotion Virtual Bench GUI. Follow the instructions below to install the software:

Note: This software can be downloaded from the MPS website.

1. Download and extract the zip package titled “eMotion Virtual Bench.zip”.
2. Double-click the “eMotion Virtual Bench.exe” file to open the set-up guide (see Figure 4 and Figure 5). If a protection window comes up, click “More info,” then click “Run anyway.”
3. Follow the prompts in the set-up guide.
4. Wait for the status screen to verify that the installation is complete.



Figure 4: eMotion Virtual Bench Icon

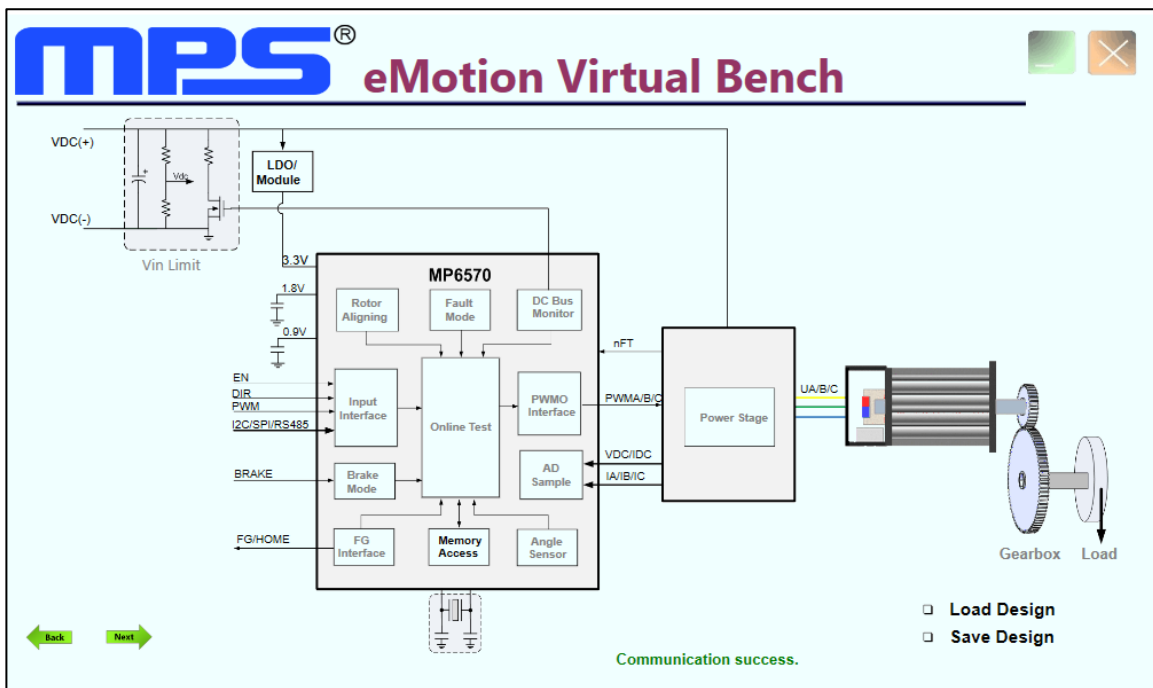


Figure 5: eMotion Virtual Bench

Section 3. Evaluation Kit Test Set-Up

3.1 Hardware Set-Up

The hardware must be properly configured prior to use. Follow the instructions below to set up the EVB:

1. Install the evaluation board at the back of the motor by connecting the three-phase motor windings to the board. Note that the center of the board should be aligned with the center of the magnet attached to the motor shaft. The distance between the magnet surface and the MP6570 surface should be between 1mm and 2mm (see Figure 6).
2. Connect the EVB to the eMotion system communication interface with the ribbon cable.
3. Connect the eMotion system communication kit to the PC with the USB cable.

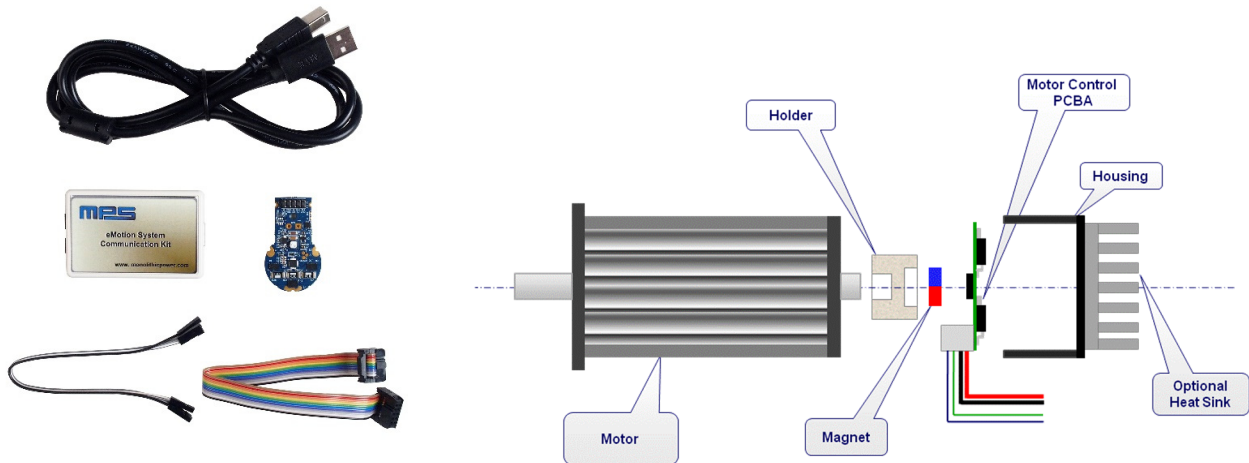


Figure 6: EVKT-MP6570 Evaluation Kit Set-up

3.2 Powering Up the EVB

1. Connect the power supply terminals to:
 - a. Positive (+): VIN
 - b. Negative (-): GND
2. Preset the power supply output between 8V and 55V. The power supply should be fused or current-limited, and be capable of supplying current up to the motor's set current limit.

3.3 Software Set-Up

After connecting the hardware according to the steps above, follow the steps below to use the GUI software:

1. Start the software. It should check the EVB connection automatically.
 - If the connection is successful, the connection status will be listed as “Communication Success” in green (see Figure 5).

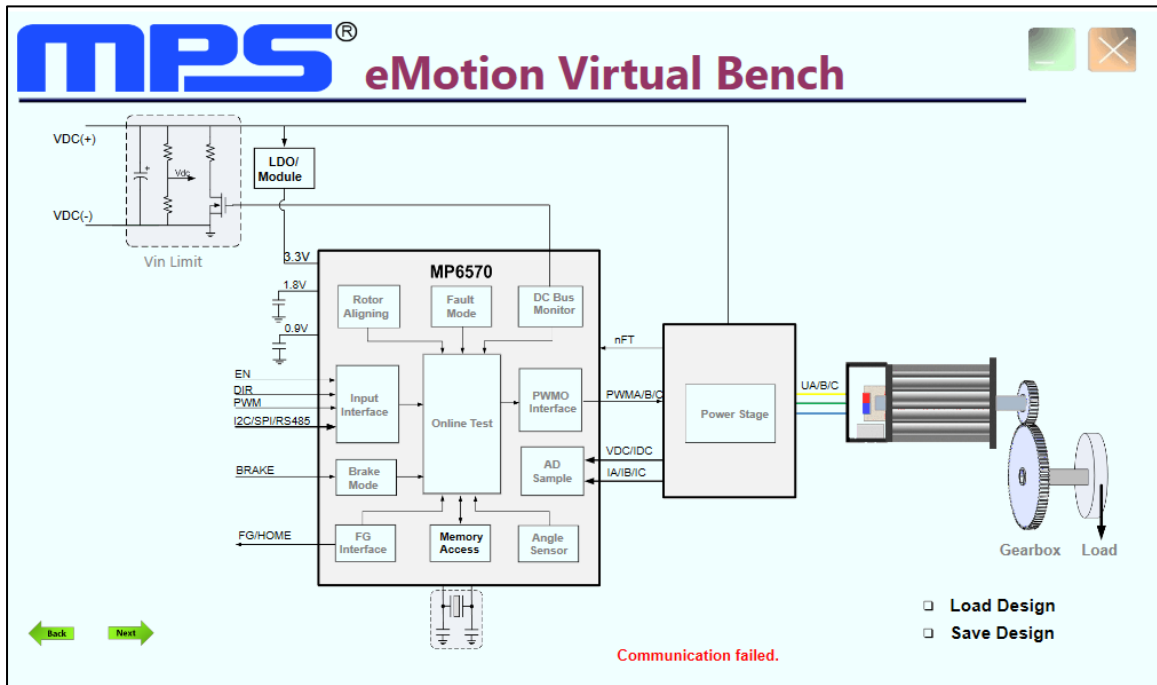


Figure 7: Connection Status

- If the connection is unsuccessful, the connection status will be listed as “USB device unconnected” or “Communication failed” in red (see Figure 7). Check the connections between the EVB, communication interface, and PC or re-plug the USB into the computer.
 - If the MP6570 demo board is listed as “USB device unconnected,” this means that the eMotion system communication kit is not connected correctly or the USB driver is not installed.
 - If the USB is listed as “Communication failed,” this means that the EVB is not connected correctly.

3.4 Run the Motor

1. Click the “Load Design” button (see Figure 8).
2. Select the *EV6570-R-00B demo design.xls* design file in the *DesignList* folder and load it to the eMotion Virtual Bench software.

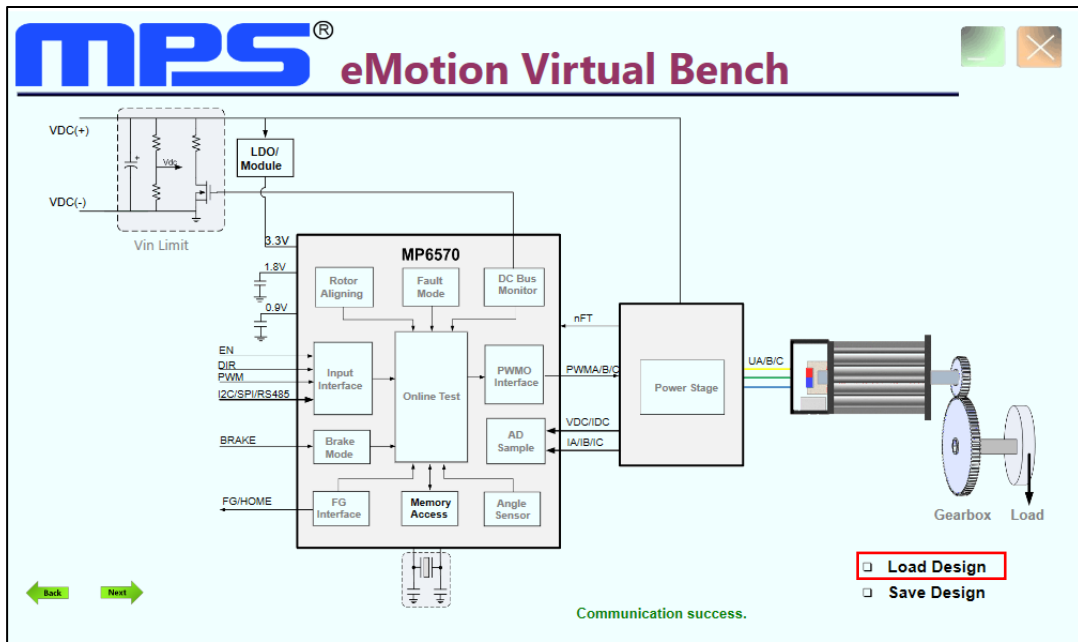


Figure 8: Load the Design File

3. Click the motor picture and change the motor parameters according to the motor datasheet (see Figure 9).

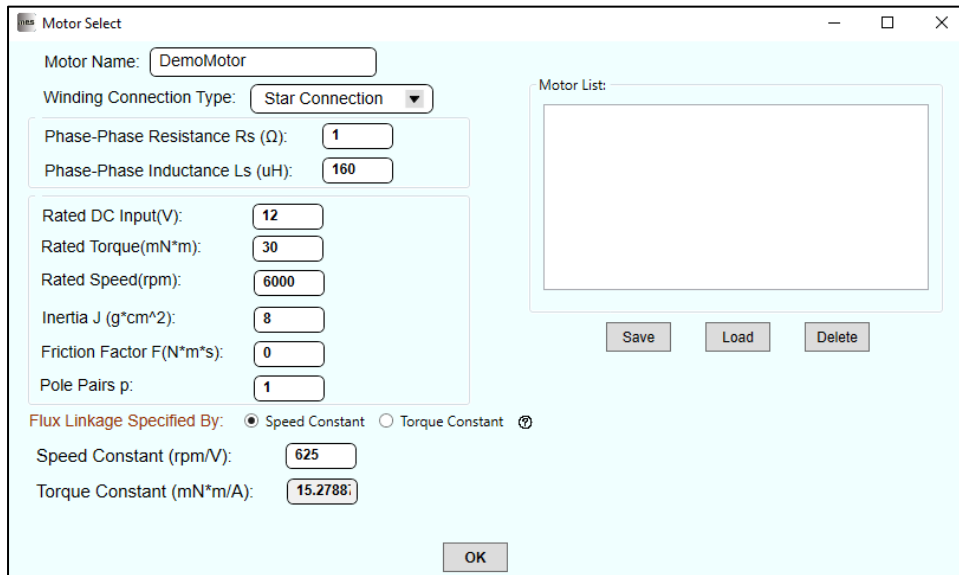


Figure 9: Change the Motor Parameters

4. Follow the steps below to determine the theta bias (if the theta bias is saved to the design file, skip this step and proceed to step 5):
 - a. Navigate to the “Rotor Aligning” window from the home page (see Figure 10). Turn on the auto theta bias function.
 - b. Set the interval time and bias current, then click the “Start” button. The auto-theta bias function should turn off automatically.
 - c. Click the “OK” button to return to the home page.

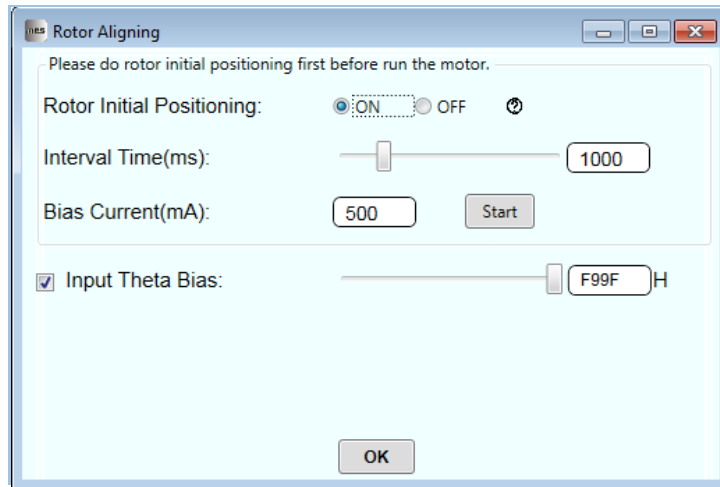


Figure 10: Rotor Aligning Window

5. Follow the steps below to run the motor:
 - a. Navigate to the “Online Test” window from the home page.
 - b. Click the “Load to RAM” button to load the design parameters to the MP6570 RAM.
 - c. Click the “Start/Stop” button to turn on the MP6570.
 - d. Click the “Update” button to set the motor speed. Monitor the speed curve in the scope.
 - e. Change and update the speed. Monitor the motor speed in the scope (see Figure 11).

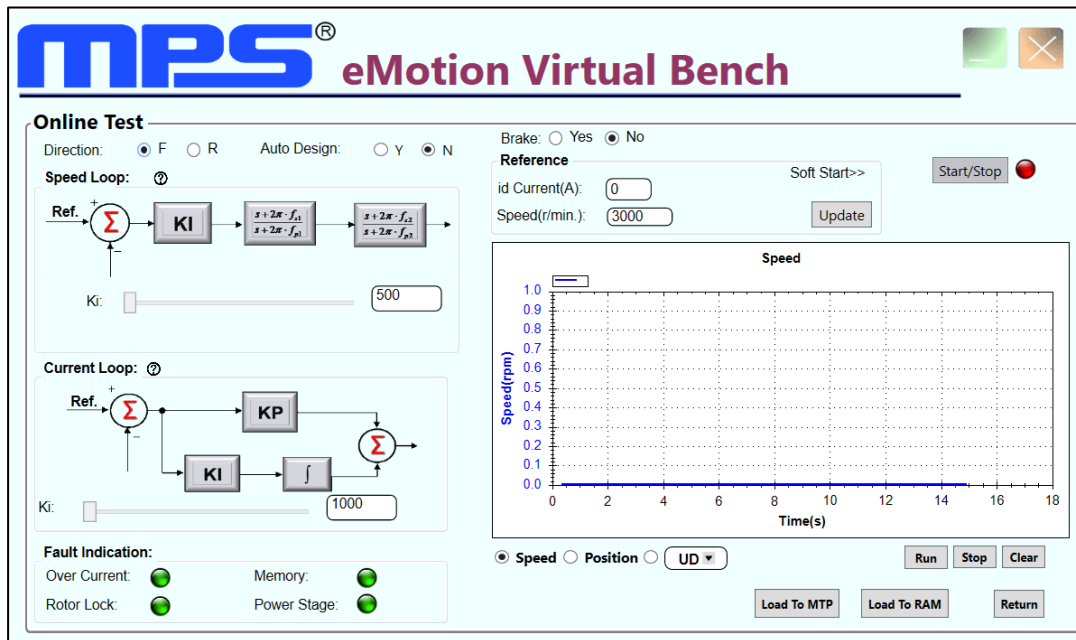


Figure 11: eMotion Virtual Bench Software

6. Adjust the speed loop and current loop parameters for better performance.

3.5 Device Programming Instructions

The MP6570 is a multiple-time programmable (MTP) part. Follow the steps below to create and export customized configurations:

1. Using a computer, open the eMotion Virtual Bench software and load a design file to the GUI.
2. Enter the Online Test window, then click the “Load to MTP” button (see Figure 12).

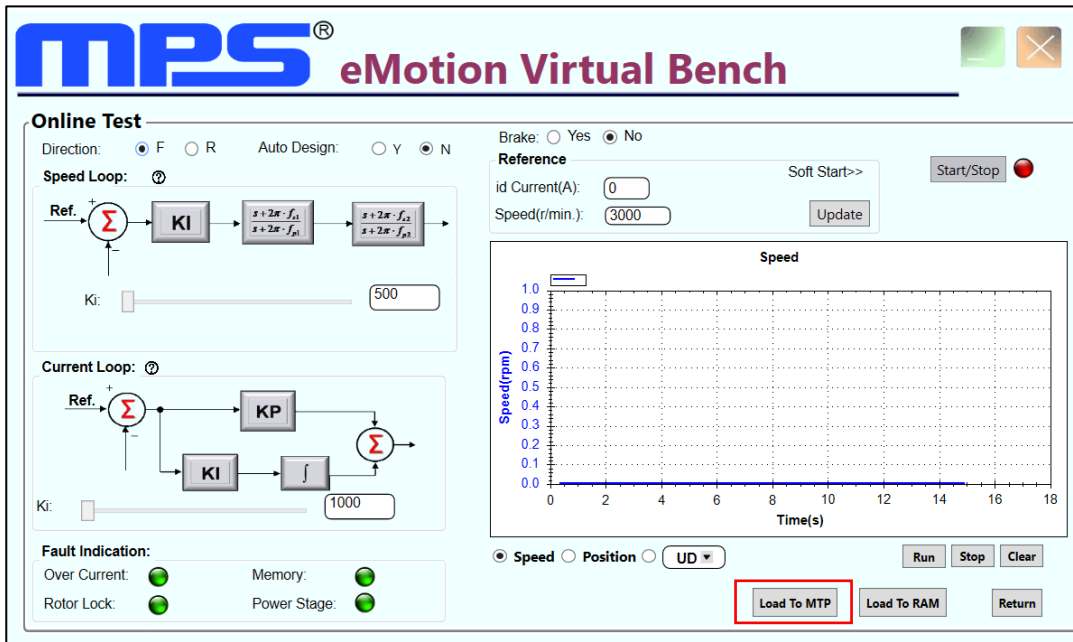


Figure 12: Write MTP

3. Changes can be made to the parameters outlined in red (see Figure 13).

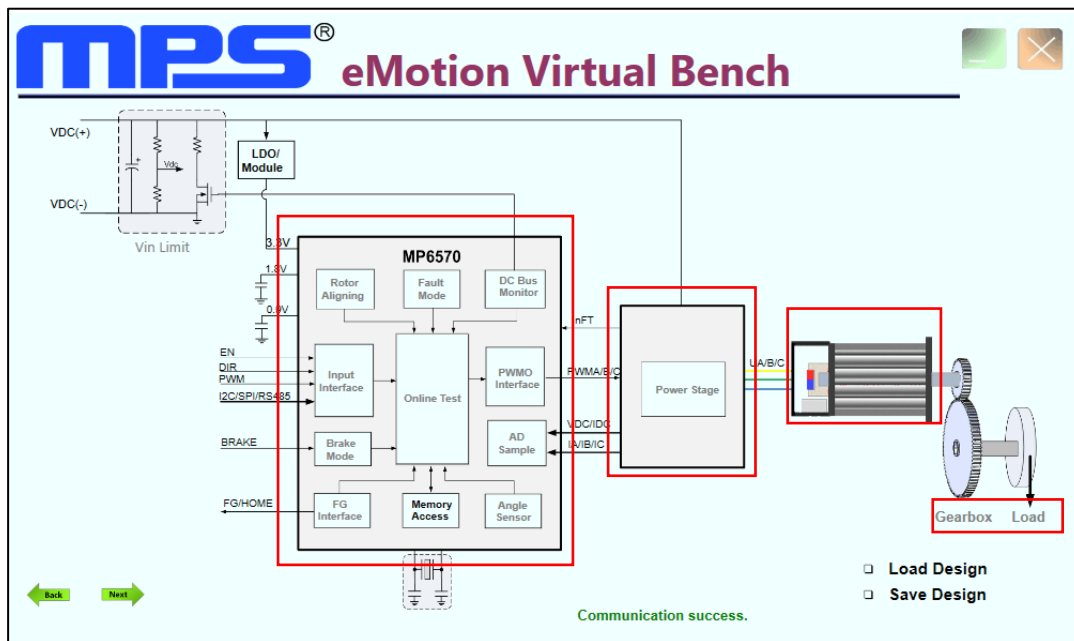


Figure 13: Configurable Parameters

4. Click the “Save Design” button to save the parameters (see Figure 14).

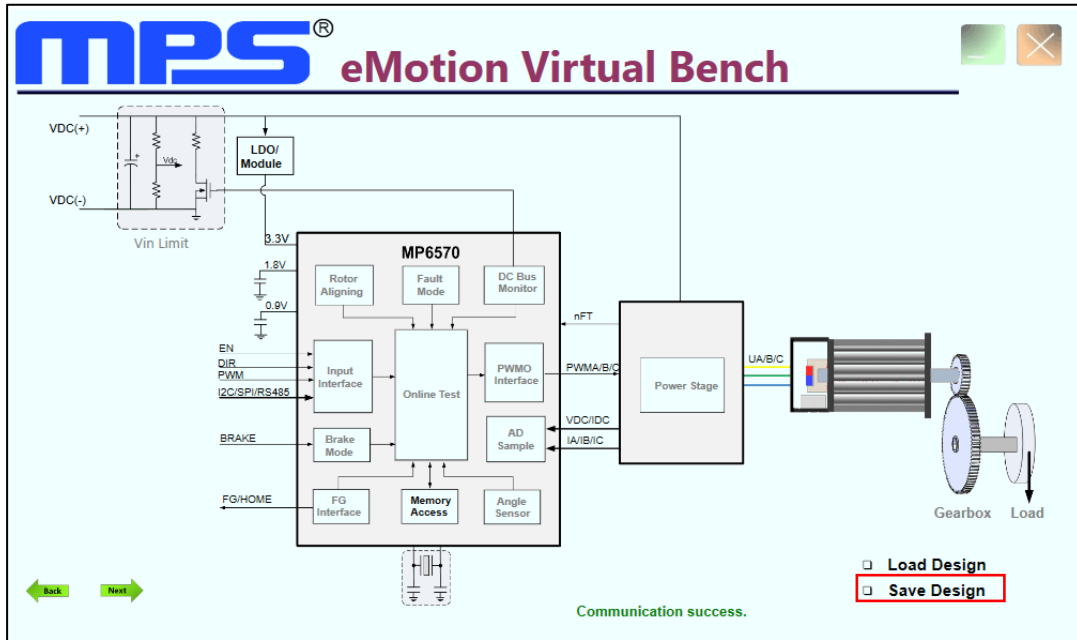


Figure 14: Save the Parameters with “Save Design”

5. Select a location for the exported file, then click the “Save” button. The new configuration should save as a “.xls” file, a .txt file which has the same file name will also be saved with all register values (see Figure 15).

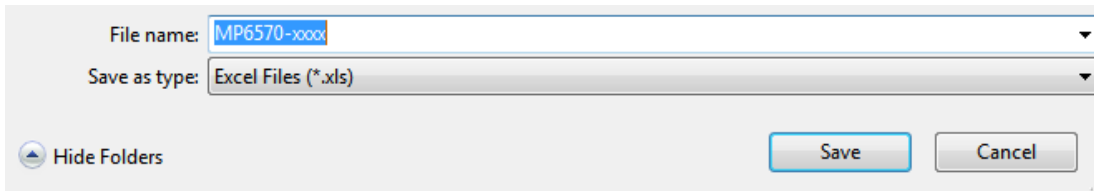


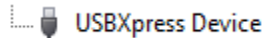
Figure 15: New Configuration Saved as a “.txt” File

3.6 Troubleshooting Tips

eMotion System Communication Kit Driver Installation Problem

If the eMotion system communication kit driver is not properly installed, manual installation is required. Follow the steps below to manually install the eMotion system communication kit driver:

Note: Check the driver version. Find “USBXpress Device” in the Device Manager under USB controllers.



Right-click and view properties. Ensure the driver version matches the newest version. If the PC is running Windows 10, Windows 10 may automatically install the older USB driver, which is not compatible. The correct driver version should be newer than 4.0.0.0 (see Figure 16 on page 14).

1. Install the correct “.exe” file.

Choose either the 32-bit or 64-bit operating system.

32-bit: \USB Driver\USBXpressInstaller_x86.exe

64-bit: \USB Driver\USBXpressInstaller_x64.exe

2. Connect the communication interface to the PC with a USB cable.

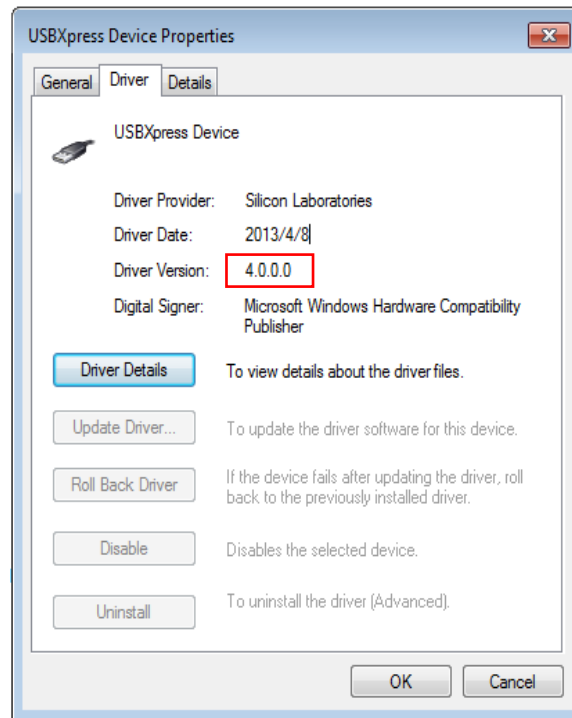


Figure 16: Determining the Driver Software

Section 4. Evaluation Board Schematic, Bill of Materials, and PCB Layout

4.1 Evaluation Board Schematic

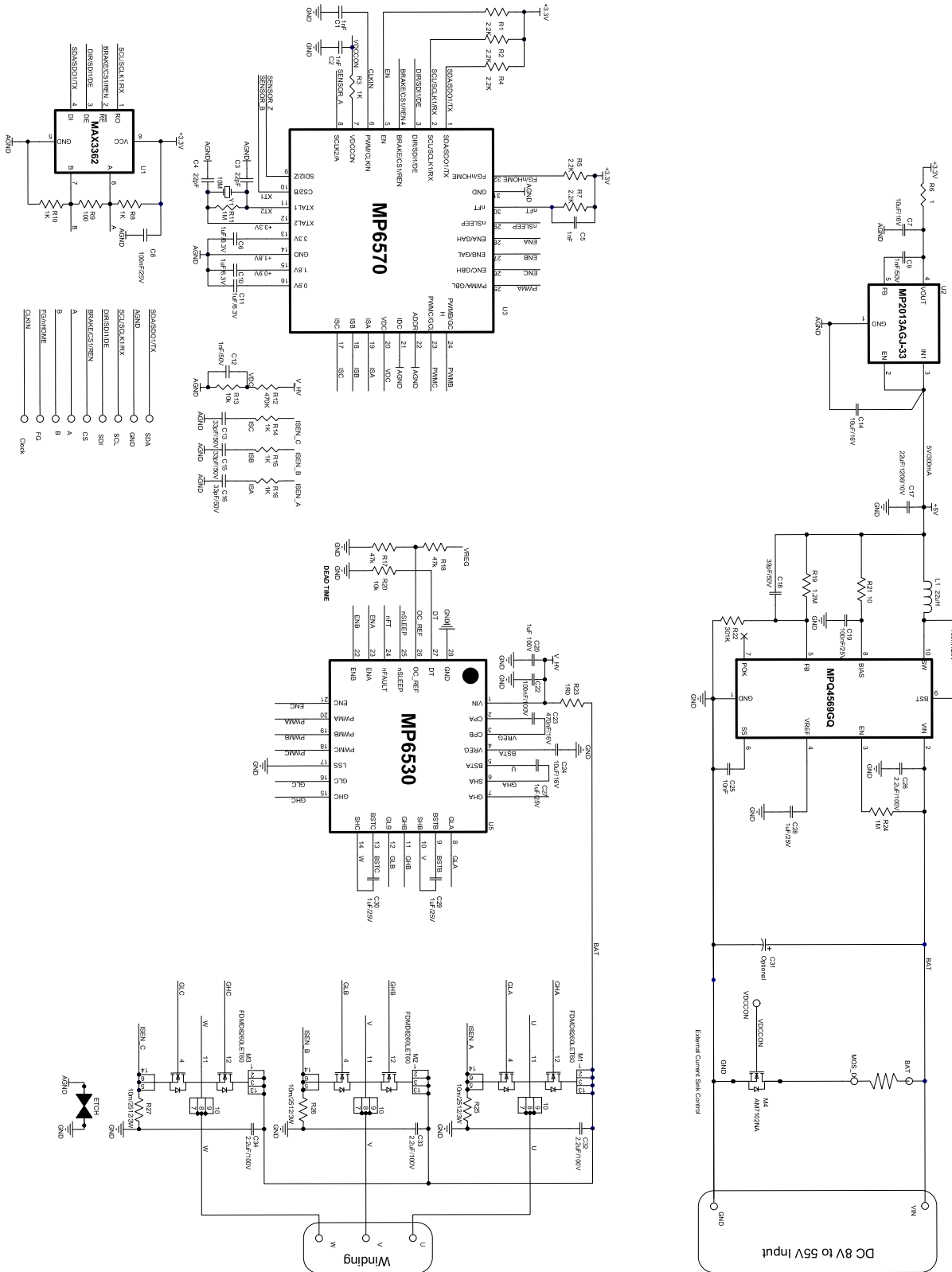


Figure 17: Evaluation Board Schematic

4.2 EV6570-R-00B Bill of Materials

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
4	C1, C2, C5, C12	1nF	Ceramic capacitor, 50V, X7R	0402	Murata	GRM155R71H102KA01
5	C3, C4, C13, C15, C16, C18	33pF	Ceramic capacitor, 50V, C0G	0402	Murata	GRM1555C1H330JA01D
3	C6, C10, C11	1μF	Ceramic capacitor, 6.3V, X7R	0402	Murata	GRM155R70J105KA12D
3	C7, C14, C24	10μF	Ceramic capacitor, 16V, X5R	0603	Murata	GRM188C81C106MA73D
3	C8, C19, C21	100nF	Ceramic capacitor, 25V, X7R	0402	Murata	GRM155R71E104KE14D
1	C9	1nF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM188R71H102KA01D
1	C17	22μF	Ceramic capacitor, 10V, X5R	1206	Murata	GRM31CR71A226KE15L
1	C20	1μF	Ceramic capacitor, 100V, X7R	1206	Murata	GRM31CR72A105KA01L
1	C22	100nF	Ceramic capacitor, 100V, X7R	0603	Murata	GRM188R72A104KA35D
1	C23	470nF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R61E474KA12D
1	C25	10nF	Ceramic capacitor, 50V, X7R	0402	Murata	GRM155R71H103KA88D
4	C26, C32, C33, C34	2.2μF	Ceramic capacitor, 100V, X7S	1206	TDK	C3216X7S2A225K
4	C27, C28, C29, C30	1μF	Ceramic capacitor, 25V, X6S	0402	Murata	GRM155C81E105KE11D
1	C31	NS				
5	R1, R2, R4, R5, R7	2.2kΩ	Film resistor, 1%	0402	Yageo	RC0402JR-072K2L
6	R8, R10, R14, R15, R16	1kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-071KL
1	R6	1Ω	Film resistor, 1%	0402	Yageo	RC0402FR-071RL
2	R3, R9	100Ω	Film resistor, 1%	0402	Yageo	RC0402FR-07100RL
2	R11, R24	1MΩ	Film resistor, 5%	0402	Yageo	RC0402JR-071ML
1	R12	470kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-07470KL
1	R13	10kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-0710KL
2	R17, R18	47kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-0747KL
1	R19	402kΩ	Film resistor, 1%	0402	Shenzhen Bangdayuan	0402-F4023TCE
1	R20, R22	100kΩ	Film resistor, 1%	0402	Yageo	RC0402FR-07100KL
1	R21	10Ω	Film resistor, 1%	0402	Yageo	RC0402FR-0710RL
1	R23	10Ω	Film resistor, 1%	0603	LIZ	CR0603JA01R0G
3	R25, R26, R27	10mΩ	Sense resistor, 1%, 2W	2512	Yageo	PF2512FKF7W0R01L
1	CON1	2.54mm	10-position, double-row, 2.54mm pitch header	DIP	Any	
1	L1	22μH	Inductor, 369mΩ, 0.49A	SMD	TDK	VLCF4018-220MR49-2
3	M1, M2, M3	60V	Dual N-channel MOSFET, 15A	PQFN-12	Fairchild (On Semiconductor)	FDMD8260LET60
1	M4	100V	N-channel MOSFET, 9.5A	DFN3x3	Analog Power	AM7102NA

4.2 EV6570-R-00B Bill of Materials (continued)

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	U1	NS				
1	Y1	10MHz	Crystal oscillator	SMD-3225	NDK	NX3225GA-10MHz
1	U2	MPQ2013A	Linear regulator, low I _q , 40V, 150mA	QFN-8 (3mmx3mm)	MPS	MPQ2013AGQ
1	U3	MP6570	3-phase BLDC controller with high-accuracy angular sensor, 55V, 10A	QFN-32 (4mmx4mm)	MPS	MP6570GR
1	U4	MPQ4569	Synchronous buck converter, 75V, 0.3A	QFN-10 (3mmx3mm)	MPS	MP4569GQ
1	U5	MP6530	3-phase BLDC motor pre-driver, 60V	QFN-28 (4mmx4mm)	MPS	MP6530GR

4.3 PCB Layout

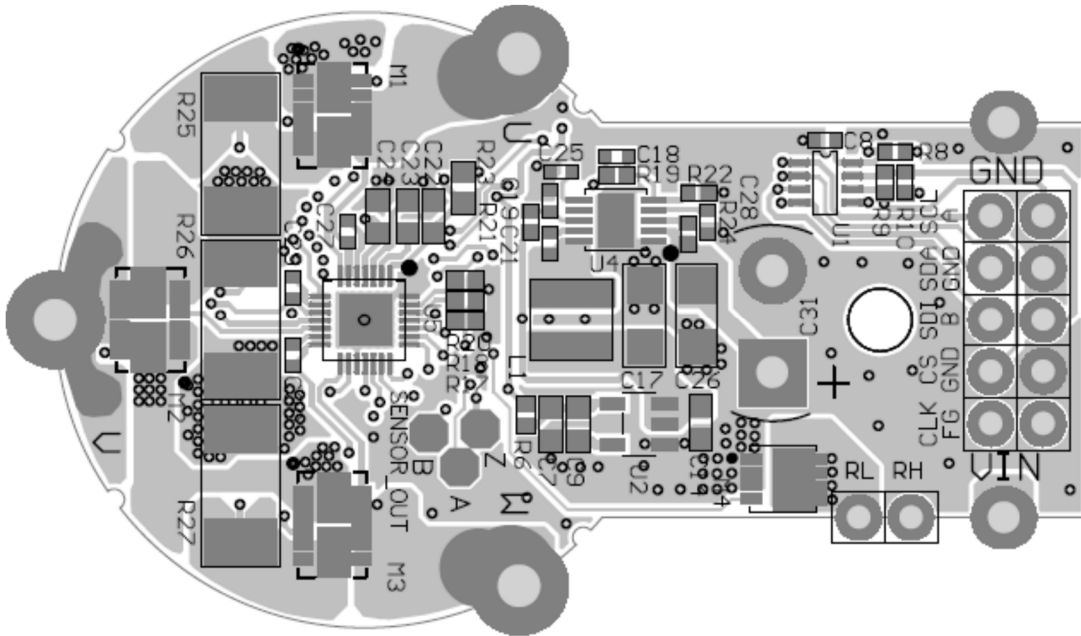


Figure 18: Top Silk and Top Layer

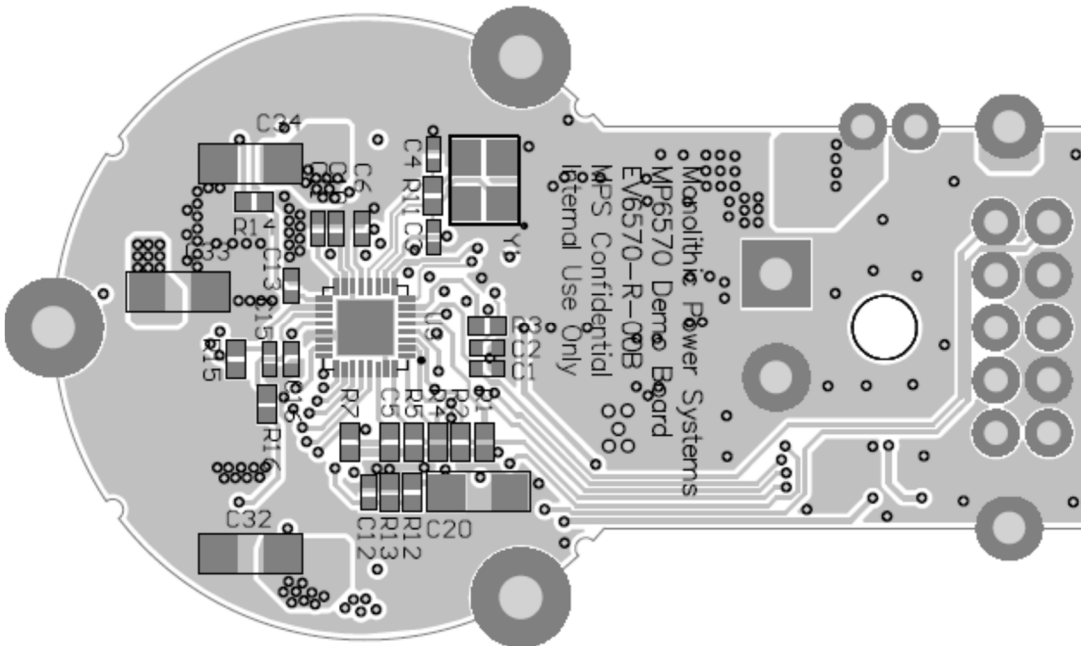


Figure 19: Bottom Layer and Bottom Silk

Section 5. Ordering Information

The components of the evaluation kit can be purchased separately, depending on user needs.

Part Number	Description
EVKT-MP6570	Complete evaluation kit
Contents of EVKT-MP6570	
EV6570-R-00B	MP6570 evaluation board
eMotion System Communication Kit	Includes one USB to SPI/I ² C/RS485 communication interface, one USB cable, and one ribbon cable

Order directly from MonolithicPower.com or our distributors.

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	1/12/2022	Initial Release	-

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