



## QUICK START GUIDE

S12ZVM 3-PHASE MOTOR CONTROL  
EVALUATION BOARD

# MCSXR1CS12ZVM



## S12ZVM 3-PHASE MOTOR CONTROL EVALUATION BOARD



Figure 1: S12ZVM 3-phase motor control evaluation board

## GET TO KNOW THE MCSXSR1CS12ZVM

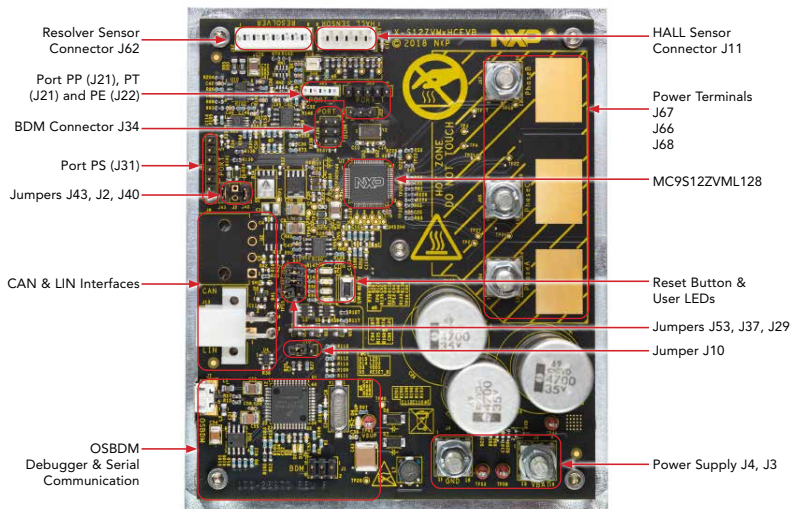


Figure 2: S12ZVM 3-phase motor control evaluation board description

## HEADER/PINOUT

MCSXSR1CS12ZVM is designed to control 3-phase AC motors up to 1 kW. Several configuration jumpers have to be set prior to the application

| FUNCTION | S12ZVM PIN | PIN   |
|----------|------------|-------|
| VBAT     | -          | J3    |
| GND      | -          | J4    |
| VCC      | EVDD       | J11-1 |
| GND      | -          | J11-2 |
| HALL_A   | PT1        | J11-3 |
| HALL_B   | PT2        | J11-4 |
| HALL_C   | PT3        | J11-5 |
| NC       | NC         | J11-6 |
| GPIO     | PP0        | J21-1 |
| GPIO     | PP1        | J21-2 |
| GPIO     | PP2        | J21-3 |
| GND      | -          | J21-4 |
| GPIO     | PE0        | J22-1 |
| GPIO     | PE1        | J22-2 |
| GND      | -          | J22-3 |
| GPIO     | PS0        | J31-1 |
| GPIO     | PS1        | J31-2 |
| GPIO     | PS2        | J31-3 |
| GPIO     | PS3        | J31-4 |
| GPIO     | PS4        | J31-5 |
| GPIO     | PS5        | J31-6 |
| GND      | -          | J31-7 |

| FUNCTION    | S12ZVM PIN | PIN   |
|-------------|------------|-------|
| BKGD        | BKGD       | J34-1 |
| GND         | -          | J34-2 |
| NC          | NC         | J34-3 |
| U_RESET     | RST        | J34-4 |
| NC          | NC         | J34-5 |
| +5VU        | -          | J34-6 |
| RES_GENP    | -          | J62-1 |
| RES_GENM    | -          | J62-2 |
| RES_SIN     | -          | J62-3 |
| RES_SIN_REF | -          | J62-4 |
| RES_COS     | -          | J62-5 |
| RES_COS_REF | -          | J62-6 |
| GND         | -          | J62-7 |
| +5VA        | -          | J62-8 |
| PHASE_A     | -          | J66   |
| PHASE_B     | -          | J67   |
| PHASE_C     | -          | J68   |

## MCSXSR1CS12ZVM FEATURES

### HARDWARE

- **MCSXSR1CS12ZVM** —S12ZVM  
Evaluation board for high power/high performance 3-phase motor control
- **Single PCB hardware design** up to 1 kW of power with optimized switching performance
- **Single-shunt current sensing** design for cost-sensitive applications
- **Resolver hardware** interface
- **Integrated LIN** & optional CAN connectivity support
- **OSBDM** programming/debugging with USB-to-SCI transceiver
- **USB cable**

### SOFTWARE

- **Automotive Motor Control Algorithm**
  - Sensorless control of the 3-phase PMSM motor based on Field Oriented Control (FOC) allowing independent control of the magnetic field and torque/speed
- **Evaluation version of the Automotive Math and Motor Control Library Set**
  - control algorithm built on blocks of precompiled software library
- **FreeMASTER and MCAT** application tuning and variables tracking at different levels of the FOC cascade structure
- **CodeWarrior 11.x**—Example software created in CodeWarrior 11.0 or higher

## STEP-BY-STEP INSTRUCTIONS

### 1 Download Software



Download installation software and documentation at [nxp.com/MCSXSR1CS12ZVM](http://nxp.com/MCSXSR1CS12ZVM).

### 2 Install CodeWarrior for MCUs 11.x IDE

Download and install CodeWarrior for MCUs IDE version 11.0 or higher available at [nxp.com/codewarrior](http://nxp.com/codewarrior).

### 3 Install FreeMASTER

Download and install FreeMASTER runtime debugging tool available at [nxp.com/FreeMASTER](http://nxp.com/FreeMASTER).

### 4 Jumper Settings

Ensure default MCSXSR1CS12ZVM jumper options (see page 9)

### 5 Connect the Power Supply

Connect appropriate 12 V power supply (8-18 V range or 3.5-18 V range with boost option enabled) to the power supply terminals J3 and J4 using M5 ring-eye connector and proper wiring (10 A/mm<sup>2</sup> max).

### 6 Connect the USB Cable

Connect MCSXSR1CS12ZVM to the PC using the USB cable. Allow the PC to automatically configure the USB drivers if needed.

### 7 Connect the Motor

Connect your motor to the output terminals J66, J67 and J68 using M5 ring-eye connector and proper wiring (10 A/mm<sup>2</sup> max).

## STEP-BY-STEP INSTRUCTIONS CONTINUED

## 8 Re-program the MCU using CodeWarrior for MCUs

Import the installed application software project in the CodeWarrior for MCUs:

- Start CodeWarrior for MCUs application
- Click **File – Import**
- Select General – **Existing Projects into Workspace** and click **Next**
- Select root directory: Navigate to the installed application directory: **MC\_DevKits\MCSXSR1CS12ZVM\sw**
- Select either MCSXSR1CS12ZVM\_PMSM or MCSXSR1CS12ZVM\_BLDC
- Select **Copy project into workspace**. Click **Finish**
- Clear the project, click **Debug** to build and flash the software. Once flashed, **Run** the session and click **Disconnect** to release the USB resources.

## 9 FreeMASTER 3.0 Setup

- Start the FreeMASTER application
- Open FreeMASTER project **<selected project> FreeMASTER\_control\MCSXSR1CS12ZVM\_PMSM\_SW\_CW11.pmp** by clicking **File – Open Project**
- Click the green **GO** button in the FreeMASTER toolbar or press CTRL+G to enable the communication
- Successful communication is signaled in the status bar at the very bottom as “RS232 UART Communication;COMn; speed = 19200”

## APPLICATION CONTROL

1. Motor Control Application Tuning (MCAT) tool – tool menu to display the application control page. When the power supply is connected to the board, the application is in **READY** state indicated by a blue LED on the board. The LED diode also indicates:
  - **READY, INIT** states slowly flashing LED
  - **CALIB, ALIGN** states flashing LED
  - **RUN** state lighting LED
  - **FAULT** state fast-flashing LED
2. In case of pending faults, click the fault button **Clear FAULT** on the FreeMASTER MCAT Control Page.
3. Start the application by pressing **ON/OFF** button on the FreeMASTER MCAT control page.
4. Set required speed by changing the **Speed Required** variable value manually in the variable watch window, or by clicking **speed gauge** in the MCAT control tab.
5. To stop the application, click the **ON/OFF** button on the FreeMASTER MCAT control page.



## MCSXSR1CS12ZVM JUMPER OPTIONS

| JUMPER | OPTION           | SETTING | DESCRIPTION                                            |
|--------|------------------|---------|--------------------------------------------------------|
| J2     | CAN VREG         | Open    | CAN VREG disabled (default)                            |
|        |                  | Short   | CAN VREG enabled (S12ZVMC version has to be populated) |
| J10    | OSBDM Bootloader | Open    | OSBDM Bootloader update disabled (default)             |
|        |                  | Short   | OSBDM Bootloader update enable                         |
| J29    | VDDX to BDM      | Open    | Supply of the OSBDM from VDDX disabled (default)       |
|        |                  | Short   | Supply of the OSBDM from VDDX enabled                  |
| J37    | LED2 Enabled     | Open    | User LED2 (D14) on PS5 disabled                        |
|        |                  | Short   | User LED2 (D14) on PS5 enabled (default)               |
| J40    | VDDX Ballast     | Open    | VSUP ballast transistor on VDDX disabled               |
|        |                  | Short   | VSUP ballast transistor on VDDX enabled (default)      |
| J43    | VSUP to Resolver | Open    | VSUP to VSUP2 for resolver disabled                    |
|        |                  | Short   | VSUP to VSUP2 for resolver enabled (default)           |
| J53    | LED1 Enabled     | Open    | User LED1 (D15) on PS4 disabled                        |
|        |                  | Short   | User LED1 (D15) on PS4 enabled (default)               |



## GET STARTED

Download installation software  
and documentation at  
[nxp.com/MCSXSR1CS12ZVM](http://nxp.com/MCSXSR1CS12ZVM).

## SUPPORT

Visit [www.nxp.com/support](http://www.nxp.com/support) for a list of support resources.

## WARRANTY

Visit [www.nxp.com/warranty](http://www.nxp.com/warranty) for complete warranty information.

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[www.nxp.com/MCSXSR1CS12ZVM](http://www.nxp.com/MCSXSR1CS12ZVM)

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