Quick Start Guide

3-Phase Sensorless BLDC Motor Control Development Kit with S12 MagniV MC9S12ZVML128 MCU

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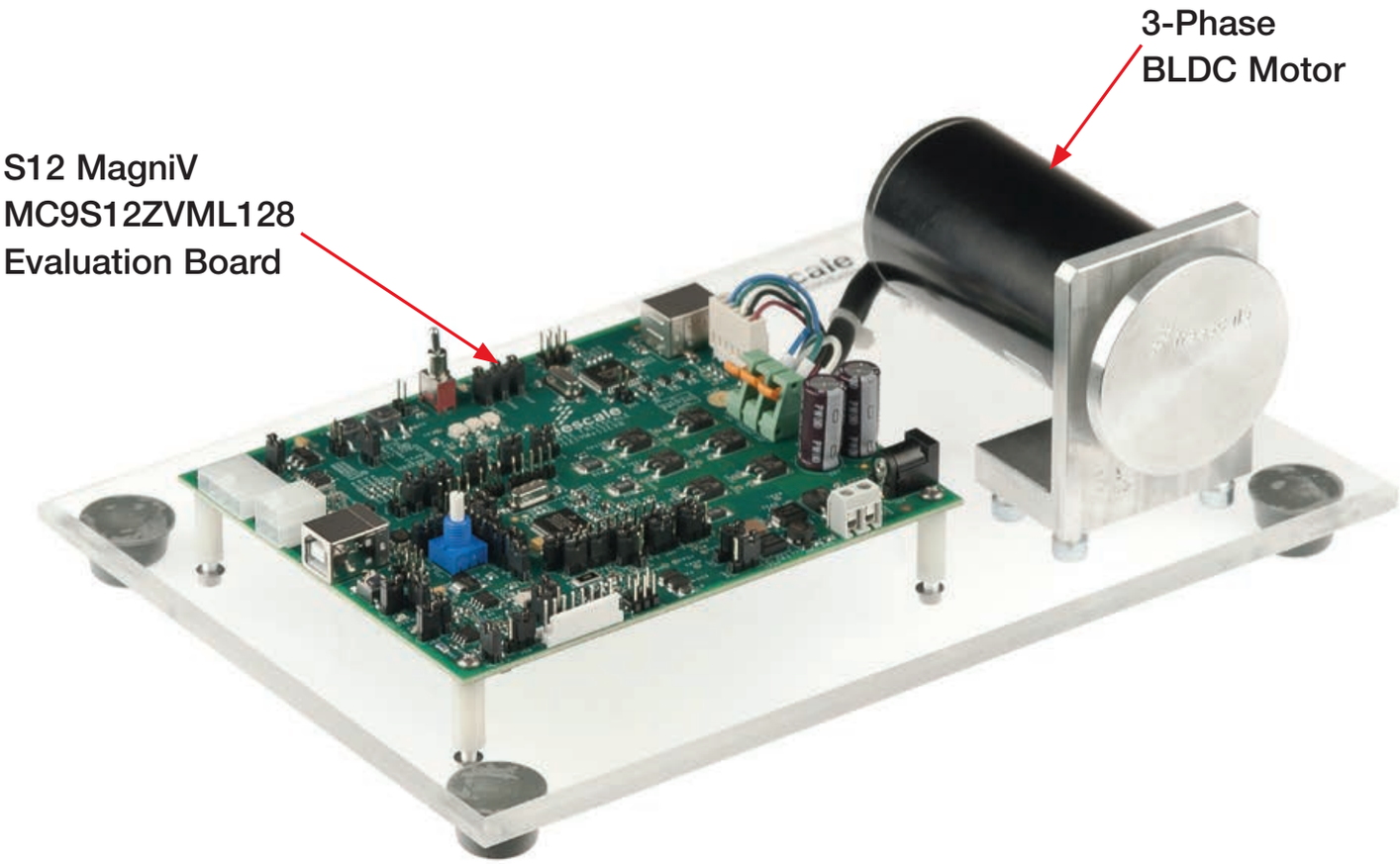

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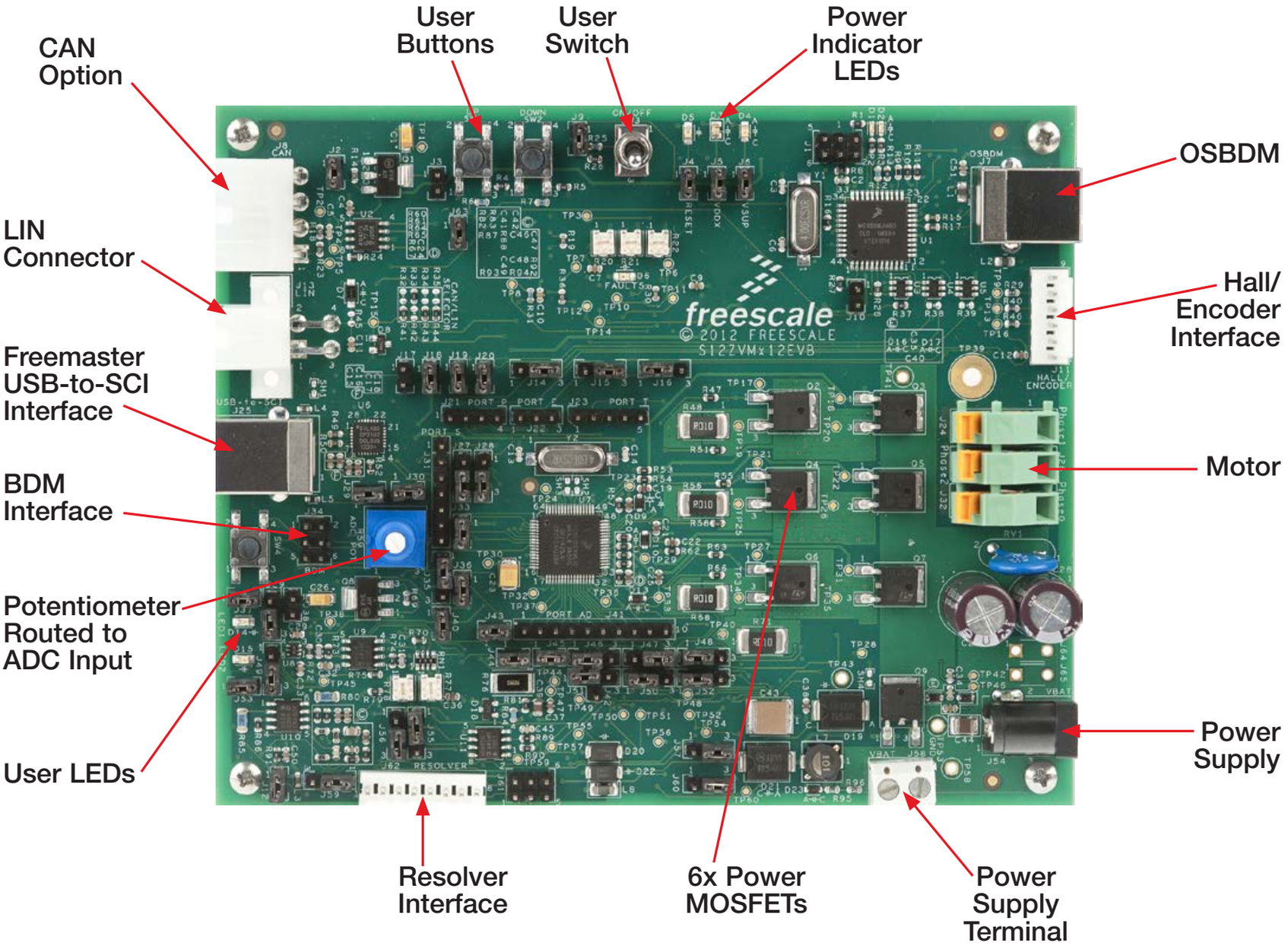
Hardware

- S12 MagniV MC9S12ZVML128 evaluation board with integrated 3-phase 12 V/10 A power stage
- 3-phase BLDC motor with Hall sensor, 24 VDC, 9350 RPM, 90 W, 45ZWN24-90-B
- USB cable
- 12 VDC power supply

Resources

- Sensorless control using back EMF zero-crossing detection application source code
- Automotive math and motor control library set for MC9S12ZVM installation package
- FreeMASTER installation pack
- FreeMASTER project
- 3-phase sensorless BLDC kit with MC9S12ZVML128 MCU quick start guide
- 3-phase sensorless BLDC kit with MC9S12ZVML128 MCU fact sheet
- 3-phase sensorless BLDC kit with MC9S12ZVML128 MCU application note AN4704
- MC9S12ZVML128 evaluation board user guide

S12 MagniV MC9S12ZVML128 Evaluation Board



Software Tools Installation

1. Install the FreeMASTER debugging tool. Download the application at **freescale.com/freemaster**.

2. Install the CP210x virtual COM port driver. The CP210x virtual COM port driver installation file is available in the “Downloads” section at **freescale.com/automcdevkits**.

3. Run “Device Manager” on your system and check which COM port was assigned to the CP210x COM port driver.

4. Connect the MC9S12ZVML128 evaluation board and the host PC via the supplied USB cable.

5. Connect the power supply to the MC9S12ZVML128 evaluation board.

   Please ensure the development kit is updated with the latest available application software found at **freescale.com/automcdevkits** before proceeding to step 6.

6. Start the FreeMASTER project MC9S12ZVML128_BLDC_Sensorless.pmp located in MTRCKTSBNZVM128\SW\MC9S12ZVML128_BLDC_Sensorless project directory.

7. Enable communication by pressing the “STOP” button in the FreeMASTER, or by pressing “CTRL+K.”

8. Successful communication is signalized in the status bar. If the communication is not established, check the USB connection between the PC and MC9S12ZVML128 evaluation board, communication port and speed. The communication port and speed can be set in the Project\Options menu (or pressing “CTRL+T”). The communication speed must be set at 9600 Bd.

Application Control

1. When the power supply is connected to EVB board, the BLDC motor is in stop mode. The user switch starts the motor.

2. The application is controlled by user controls built into MC9S12ZVML128 evaluation board or by the FreeMASTER interface.

3. Enter the required speed by changing the value of the “Required Speed RPM” variable in the variables watch window or by double clicking the speed gauge in the “Control Page.” The “Required Speed RPM” variable is scaled in revolutions per minute.

4. Analyze behavior of BLDC motor during transients by opening “Speed Scope.” Speed Scope displays scope of “Actual Speed RPM” and “Required Speed RPM” variables.

5. Change the maximum allowed value of DC bus current by modifying “DC bus Current Limit” in the variables watch window.

S12 MagniV MC9S12ZVML128 Evaluation Board Jumper Options

The following is a list of all jumper options. The default installed jumper settings are shown in white text within the blue boxes.

Jumper	Option	Setting	Description
J2	CAN Transceiver 5 V supply option	**Open**	VDDC ballast transistor is not supplied from VSUP
		Close	VDDC ballast transistor is supplied from VSUP
J3	VDDC supplied from USB option	**Open**	VDDC node is not supplied from the USB-to-SCI interface
		Close	VDDC node is supplied from the USB-to-SCI interface
J4	RESET LED indicator option	**Open**	RESET LED indicator disabled
		Close	RESET LED indicator enabled
J5	VDDX LED indicator option	**Open**	VDD LED indicator disabled
		Close	VDD LED indicator enabled
J6	VSUP LED indicator option	**Open**	VSUP LED indicator disabled
		Close	VSUP LED indicator enabled

Jumper Options

Continued

Jumper	Option	Setting	Description
J9	ON/OFF switch option	**Open**	ON/OFF switch disabled
		Close	ON/OFF switch enabled
J10	OSBDM boot-loader option	**Open**	OSBDM boot loader disabled
		Close	OSBDM boot loader enabled
J12	Resolver circuit 5 V supply option	**Open**	Resolver input circuitry (+5VDC) supply disabled
		Close	Resolver input circuitry (+5VDC) supply enabled
J14	EVDD or FAULT selector	**1-2**	FAULT input is connected to port PP0
		2-3	Port PP0 is connected to EVDD at Hall sensor interface
J15	Resolver or Hall/encoder phase A selector	**1-2**	Phase A from resolver is connected to port PT1
		2-3	Phase A from Hall/encoder interface is connected to port PT1
J16	Resolver or Hall/encoder phase B selector	**1-2**	Phase B from Hall/encoder interface is connected to port PT2
		2-3	Phase B from resolver is connected to port PT2

Jumper Options

Continued

Jumper	Option	Setting	Description
J18	USB-to-SCI interface supply option	**Open**	USB-to-SCI isolator supply disable
		Close	USB-to-SCI isolator supply enable
J19	“UP” push-button option	**Open**	“UP” push button disabled
		Close	“UP” push button enabled
J20	“DOWN” push-button option	**Open**	“DOWN” push button disabled
		Close	“DOWN” push button enabled
J27	SCI RXD selector	**1-2**	RXD from OSBDM is connected to port PS2
		2-3	RXD from USB-to-SCI is connected to port PS2
J28	SCI TXD selector	**1-2**	TXD from OSBDM is connected to port PS3
		2-3	TXD from USB-to-SCI is connected to port PS3
J29	BDM interface supply option	**Open**	BDM supply disabled
		Close	BDM supply enabled

Jumper Options

Continued

Jumper	Option	Setting	Description
J30	ADC potentiometer pull-up option	**Open**	POT 1 (ADC potentiometer) supply disabled
		Close	POT 1 (ADC potentiometer) supply enabled
J33	MCU supply option	**Open**	MCU supply disabled
		Close	MCU supply enabled
J35	ADC mapping PAD0	**1-2**	Connects PAD0 to AMP0 external gain-setting resistors
		2-3	Connects PAD0 to POS_SIN resolver output
J36	VREF generation supply option	**Open**	Disconnects VSUP to supply a regulated voltage at VREF2
		Close	Connects VSUP to supply a regulated voltage at VREF2
J37	USER LED1 option	**Open**	“User LED1” disabled
		Close	“User LED1” enabled
J38	PDO-PDOCLK	**Open**	PDO-PDOCLK not shorted
		Close	PDO-PDOCLK shorted

Jumper Options

Continued

Jumper	Option	Setting	Description
J39	Resolver phase B selector	**1-2**	SINCOS I/O connector phase B connected to resolver phase B input
		2-3	POS_COS connected to resolver phase B input
J40	VDDX ballast supply option	**Open**	VDDX ballast is disconnected
		Close	VDDX ballast is connected
J43	Resolver circuit 12 V supply option	**Open**	Resolver generator circuit supply disconnected
		Close	Resolver generator circuit supply connected
J44	ADC mapping PAD1	**Open**	PAD1 is disconnected from the AMPM0 external gain-setting resistors
		Close	PAD1 is connected to the AMPM0 external gain-setting resistors
J45	ADC mapping PAD2	**Open**	PAD2 is disconnected from the AMPP0 external gain-setting resistors
		Close	PAD2 is connected to the AMPP0 external gain-setting resistors

Jumper Options

Continued

Jumper	Option	Setting	Description
J46	ADC mapping PAD3	**1-2**	Connects PAD3 to ADC_IA (phase A current sense from external opamp)
		2-3	Connects PAD3 to POS_SIN resolver output
J47	ADC mapping PAD4	**1-2**	Connects PAD4 to ADC_IB (phase B current sense from external opamp)
		2-3	Connects PAD4 to ADC potentiometer POT1
J48	ADC mapping PAD5	**1-2**	Connects PAD5 to AMP1 external gain setting resistors
		2-3	Connects PAD5 to ADC_IB (phase B current sense from external opamp)
J49	Resolver phase A selector	**1-2**	Resolver phase A connected to SINCOS I/O connector phase A input
		2-3	Resolver phase A connected to resolver POS_SIN Schmitt-Trigger
J50	ADC mapping PAD6	**1-2**	Connects PAD6 to AMPM1 external gain-setting resistors
		2-3	Connects PAD6 to POS_COS resolver output

Jumper Options

Continued

Jumper	Option	Setting	Description
J51/J42	ADC mapping PAD7	**J51(1-2)**	Connects PAD7 to AMPP1 external gain-setting resistors
		J51(2-3)	Connects PAD7 to POS_SIN resolver output
		J42(1)-J51(2)	Connects PAD7 to ADC potentiometer POT1
J52	ADC mapping PAD8	**1-2**	Connects PAD8 to ADC_IC (phase C current sense from external opamp)
		2-3	Connects PAD8 to POS_COS resolver output
J53	USER LED2 option	**Open**	“User LED 2” disabled
		Close	“User LED 2” enabled
J55	VREF selector	**1-2**	VREF supplied from VDDX
		2-3	VREF supplied from the VREF2 regulator
J56	Resolver COS reference	**1-2**	Input to POS_COS circuit is from OFFSET1
		2-3	Input to POS_COS circuit is from RES_COS_REF

Jumper Options

Continued

Jumper	Option	Setting	Description
J57	Internal AMP0 input selector (inverting)	**1-2**	Connects DC bus to the internal AMP0 inverting input (phase A current sense)
		2-3	Connects ground to the internal AMP0 inverting input (DC bus current sense)
J59	Resolver SIN reference	**1-2**	Input to POS_SIN circuit is from RES_SIN_REF
		2-3	Input to POS_SIN circuit is from OFFSET1
J60	Internal AMP0 input selector (non-inverting)	**1-2**	Connects phase A to the internal AMP0 non-inverting input (phase A current sense)
		2-3	Connects DC bus as non-inverting input for internal AMP0 (DC bus current sense)
J63	FAULT comparators 5 V supply option	**Open**	FAULT circuit supply disconnected
		Close	FAULT circuit supply connected

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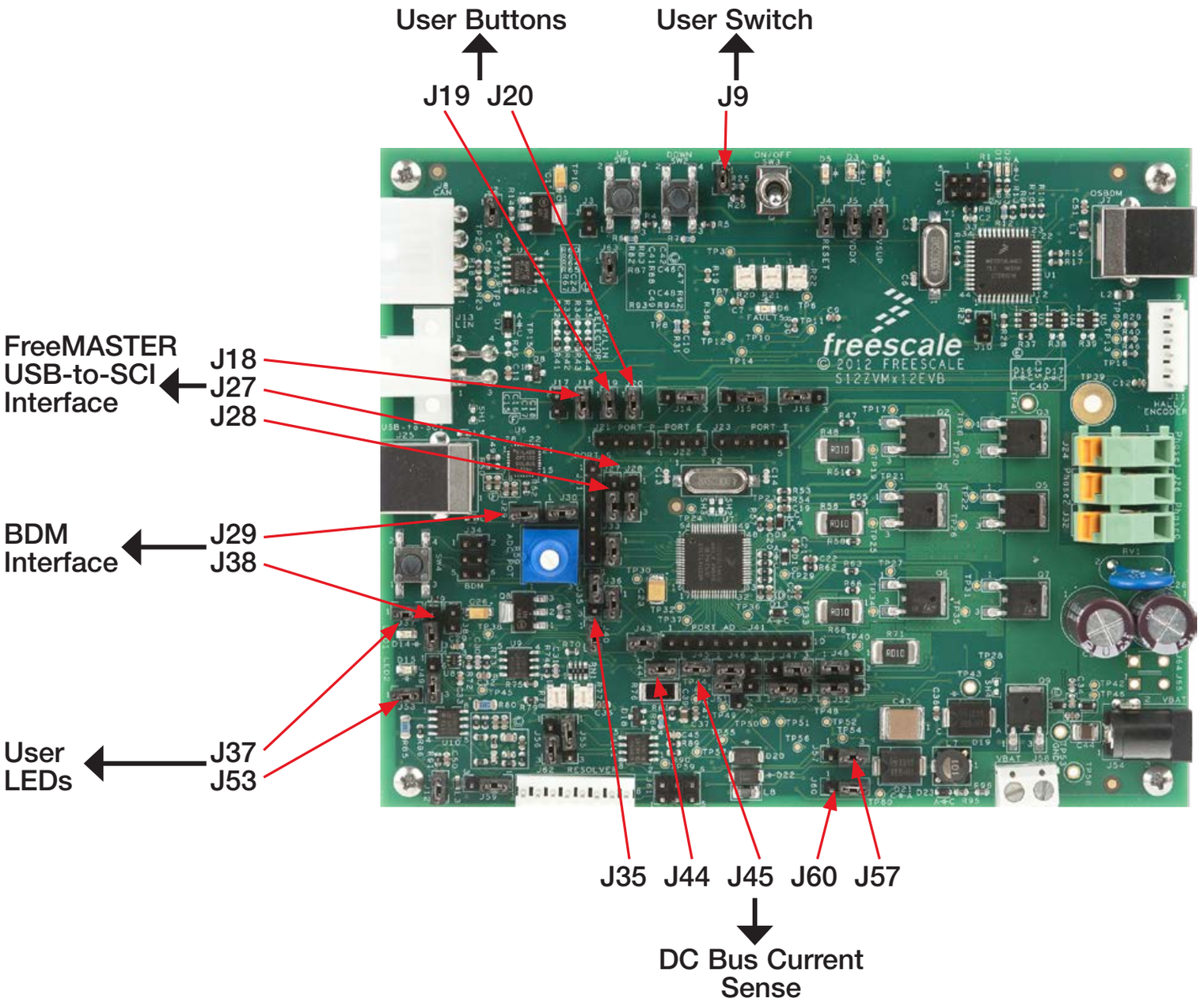

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Visit **freescale.com/support** for a list of phone numbers within your region.

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