Quick Start Guide

3-Phase Sensorless BLDC Motor Control Development Kit with MC9S12G128 MCU
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3-Phase Sensorless BLDC Motor Control Development Kit Features

- MC9S12G128 MCU (100-pin LQFP)
- MC33905S system basis chip
- MC33937A FET pre-driver
- Sensorless BLDC motor control support
- Hardware support for Hall sensor-based motor control
- DC-bus overvoltage, overcurrent and undervoltage detection
- FreeMASTER instrumentation/visualization
Quick Start Guide

3-Phase Low-Voltage Power Stage

- Brake Resistor
- Motor Connector
- MC33937A Overcurrent Threshold Setup
- UNI-3 Interface
- Power Supply Connector
- Power Supply Terminal
- MC33937A Interface
MC9S12G128 Controller Board

- Hall Sensor Interface Connector
- PWM LED Indicators
- UNI-3 Interface
- LIN Connector
- CAN Connector
- MC33937A Interface
- Fault and Hall/Zero-Cross LED Indicators
- USB Connector
- Rotary Switch
- BDM Connector
- I/O Ring to Allow Access to All MCU Pin Signals
- Power Supply Connector
Quick Start Guide

Step-by-Step Installation Instructions

Learn how to set up and use the development kit with the FreeMASTER tool.

1 Install Tools and Drivers

- Install FreeMASTER runtime debugging tool
- Install FTDI virtual COM port driver

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

For FreeMASTER application download, please visit freescale.com/freemaster.

2 Connect the USB Cable

Connect the MC9S12G128 controller board to the PC using the USB cable. Allow the PC to automatically configure the USB drivers if needed.

3 Connect the Power Supply

Connect 24 V/3 A power supply to the power connector on the 3-phase low-voltage power stage.

Power supply operation range is 8 to 24 V. The BLDC motor used is designed for 24 V phase voltage.
Using the FreeMASTER Project

- Download and unzip the application software for the MTRCKTSBNG128 available at freescale.com/automcdevkits.
- Open the FreeMASTER project MTRCKTSBNG128/SW/MC9S12G128_BLD_C_Sensorless/MC9S12G128_BLD_C_Sensorless.pmp.
- Set up the RS232 communication port and speed in the menu Project/Options. Set the communication speed to 19200 Bd.

The COM port number can be found using Windows Device Manager under “Ports (COM & LPT)” section as “USB Serial Port (COMn).”

- Press the red STOP button in the FreeMASTER toolbar to enable the communication.

Successful communication is signalized in the status bar.

- To start the motor, set the ON/OFF flip-flop switch ON or short press the rotary switch on the MC9S12G128 controller board.
- Enter the required speed by changing the value of the “requiredSpeed” variable in the variables watch window, by double clicking the speed gauge, or by rotating rotary switch clockwise (speed up) or counterclockwise (speed down) on the MC9S12G128 controller board. The variable value is in revolutions per minute.
- To stop the motor, set the ON/OFF flip-flop OFF or short press the rotary switch on the MC9S12G128 controller board.
- To clear pending faults, click the green Fault Clear button or long press the rotary switch on the MC9S12G128 controller board.

Faults present in the system are signalized by the fault indicators, pending faults by small red LED-like indicator next to the respective fault indicator.
### Jumper Options

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

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Selector</th>
<th>Functions</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>J3</td>
<td>SBC Debug Mode Enable</td>
<td>MC33905S Debug mode enabled</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MC33905S Debug mode disabled</td>
<td>Off</td>
</tr>
<tr>
<td>J4</td>
<td>SBC Fail-Safe Mode Enable</td>
<td>MC33905S Fail-safe mode enabled</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MC33905S Fail-safe mode disabled</td>
<td>Off</td>
</tr>
<tr>
<td>J6</td>
<td>CAN - L Termination</td>
<td>CAN - L termination</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No CAN - L termination</td>
<td>Off</td>
</tr>
<tr>
<td>J7</td>
<td>CAN - H Termination</td>
<td>CAN - H termination</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No CAN - H termination</td>
<td>Off</td>
</tr>
<tr>
<td>J8</td>
<td>LIN Master Termination</td>
<td>LIN Master Mode</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LIN Slave Mode</td>
<td>Off</td>
</tr>
<tr>
<td>J18</td>
<td>Reset Interconnection</td>
<td>MCU and SBC resets are connected</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCU and SBC resets are not connected</td>
<td>Off</td>
</tr>
<tr>
<td>J20, J22</td>
<td>Phase A Dead Time Insertion</td>
<td>Phase A dead time controlled by MC33937A</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>~2 µs phase A dead time generated by on-board HW</td>
<td>2-3</td>
</tr>
</tbody>
</table>
## MC9S12G128 Controller Board

### Jumper Options (continued)

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Selector</th>
<th>Functions</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>J21, J23</td>
<td>Phase C Dead Time Insertion</td>
<td>Phase C dead time controlled by MC33937A&lt;br&gt;~2 μs phase C dead time generated by onboard HW</td>
<td>1-2&lt;br&gt;2-3</td>
</tr>
<tr>
<td>J24, J25</td>
<td>Phase B Dead Time Insertion</td>
<td>Phase B dead time controlled by MC33937A&lt;br&gt;~2 μs phase B dead time generated by onboard HW</td>
<td>1-2&lt;br&gt;2-3</td>
</tr>
<tr>
<td>J26</td>
<td>Fault Processing Select 0</td>
<td>Faults processed by onboard HW&lt;br&gt;Faults processed by MCU software (IRQ)</td>
<td>1-2&lt;br&gt;2-3</td>
</tr>
<tr>
<td>J27</td>
<td>Fault Action Select</td>
<td>Onboard flip-flops disable PWM driving signals&lt;br&gt;Onboard HW drives MC33937A EN pin low&lt;br&gt;Faults processed by MCU software</td>
<td>1-2&lt;br&gt;2-3&lt;br&gt;Off</td>
</tr>
<tr>
<td>J28</td>
<td>Fault Processing Select 1</td>
<td>Faults processed by onboard HW&lt;br&gt;Faults processed by MCU software (IRQ)</td>
<td>1-2&lt;br&gt;Off</td>
</tr>
<tr>
<td>J29</td>
<td>Overcurrent Detection Select</td>
<td>Overcurrent detected by onboard comparator&lt;br&gt;Overcurrent detected by MC33937A int. comparator</td>
<td>1-2&lt;br&gt;2-3</td>
</tr>
<tr>
<td>J32, J33, J35</td>
<td>Control Signal Selection</td>
<td>Hall sensor signals&lt;br&gt;MC33937A zero cross signals</td>
<td>1-2&lt;br&gt;2-3</td>
</tr>
</tbody>
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Support
Visit freescale.com/support for a list of phone numbers within your region.

Warranty
Visit freescale.com/warranty for complete warranty information.

For more information, visit freescale.com/automcdevkits

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