MCSXR1CS12ZVM 3-PHASE MOTOR CONTROL EVALUATION BOARD

The MCSXR1CS12ZVM evaluation board demonstrates the advantages of the NXP® S12ZVM MCU for 3-phase brushless DC motor (BLDC) and permanent magnet synchronous motor (PMSM) control in high-current applications.

OVERVIEW

The MCSXR1CS12ZVM evaluation board serves as an example of a high-current motor control design using the S12ZVM family of automotive mixed-signal MCUs based on the 16-bit S12 MagniV® S12Z core and integrates an automotive voltage regulator, a LIN physical interface, and a gate driver unit able to drive up to six external MOSFETs.

KEY FEATURES

- **S12ZVM MCU** – 16-bit S12Z-based MCUs with integrated high-voltage capabilities targeted for automotive and high-reliability industrial motor control applications
- **Integrated solution** – Integrated 6-channel gate driver unit to control six power MOSFETs, a 12 V to 5 V voltage regulator and a LIN physical layer
- **Automotive motor control algorithm** – Sensorless control of the PMSM motor based on field-oriented control (FOC) and sensorless control of the BLDC motor based on a six-step commutation control technique that allows torque/speed control with low CPU load
- **Automotive Math and Motor Control Library Set** – control algorithm built on blocks of precompiled software library
- **FreeMASTER and Motor Control Application Tuning (MCAT) support** – application tuning and variables tracking

S12ZVML128 SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash</td>
<td>128 KB</td>
<td>Temp</td>
<td>+150 °C TA/+175 °C TJ</td>
</tr>
<tr>
<td>RAM</td>
<td>8 KB</td>
<td>PMF</td>
<td>6-ch., 15-bit PWM</td>
</tr>
<tr>
<td>EEPROM</td>
<td>S12 B</td>
<td>12 V VREG</td>
<td>12 V/70 mA, 170 mA with ballast, 3.5–20 V capable</td>
</tr>
<tr>
<td>Core</td>
<td>S12Z</td>
<td>ADC</td>
<td>2 x 16-ch., 12-bit</td>
</tr>
<tr>
<td>Package</td>
<td>LQFP-64</td>
<td>Trigger Unit</td>
<td>2 x PTU</td>
</tr>
<tr>
<td>LIN-Phy</td>
<td>1</td>
<td>GDU</td>
<td>3/3</td>
</tr>
<tr>
<td>Comms</td>
<td>2 x SCI, 1 x SPI</td>
<td>EVDD</td>
<td>1-ch. 5 V/20 mA (source)</td>
</tr>
</tbody>
</table>

EVB SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (*boost option enabled)</td>
<td>3.5*/8 V</td>
<td>12 V</td>
<td>18 V</td>
</tr>
<tr>
<td>Phase current</td>
<td>-</td>
<td>75 A(rms)</td>
<td>120 A(peak)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 °C</td>
<td>20 °C</td>
<td>45 °C</td>
</tr>
<tr>
<td>Board temperature (passive heat sink)</td>
<td>-</td>
<td>-</td>
<td>150 °C</td>
</tr>
<tr>
<td>Communication (<strong>S12ZVMC used</strong>)</td>
<td>LIN/CAN**, USB, SCI, SPI, BDM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotor speed or position sensors</td>
<td>3 Hall switches, resolver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital I/O, debugging</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TARGET AUTOMOTIVE APPLICATIONS

- Actuators and valve controls
- Electric fuel, water and oil pumps
- Engine cooling fans
- Windshield wipers
- Heating, ventilation and air conditioning (HVAC)
- Doors, window lift and seat control

ENABLEMENT TOOLS

Development Hardware:

- 3-phase low-voltage high-current power stage up to 18 V/75 A(rms)
- Single-shunt (DC-link) current sensing
- High-efficiency design up to 75 A(rms) phase current/120 A(peak)
- Onboard OSBDM with USB and virtual RS232 port emulation

Runtime Software:

- Sensorless and Hall-based six-step control of the PM motor
- Software example created in the CodeWarrior® for MCUs (Eclipse IDE) - 11.x
- FreeMASTER 3.x project part of software package
- Motor Control Application Tuning (MCAT) tool support

RESOURCES

MCSXSR1CS12ZVM Evaluation Board
nxp.com/MCSXSR1CS12ZVM

S12ZVM Mixed-Signal MCUs
nxp.com/s12zvm

S12ZVM Community
community.nxp.com

MOTOR CONTROL ALGORITHM CONCEPT

AMMCLib Functions

www.nxp.com/MCSXSR1CS12ZVM

NXP, the NXP logo, CodeWarrior and MagiV are trademarks of NXP B.V. All other product or service names are the property of their respective owners.
© 2020 NXP B.V.

Document Number: MCSXSR1CS12ZVMFS  REV 0