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Application Note

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Stepper Motor Motion Control Driver for MC9S08LG32

by: Saurabh Jhamb
Reference Design and Applications Engineering
Microcontroller Solutions Group

1 Introduction

The MC9S08LG32 is a member of the Freescale HCS08 family of MCUs. It uses the S08 core and integrates abundant peripherals, such as LCD, TPM, SPI, I^2C, SCI, and ADC. This application note describes the stepper motor motion control driver using TPM (Timer/PWM) in software that allows you to control the stepper motor motion.

In a typical setup, the PC communicates with the MC9S08LG32 target system via a USB (BDM) interface. With BDM protocol, the PC can update the MC9S08LG32 firmware.

Figure 1 shows the sample stepper motor setup.

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Figure 1. Sample Stepper Motor Setup

In this document, the driver interfaces are explained. Various applications for MC9S08LG32 can make use of this driver. The next sections of this document describe the details and the steps for creating an application using it.

2 Driver Framework Overview

The motion control driver is provided in the form of multiple C code files. You can add these files to your applications. Some low level functions in the driver files are specific to the stepper motor being used. The next sub-sections describe these functions in detail.

With the integration of a motion control driver, you can call driver APIs to control the stepper motor motion in your application.

Figure 2 illustrates the project for the MC9S08LG32 motion control driver.

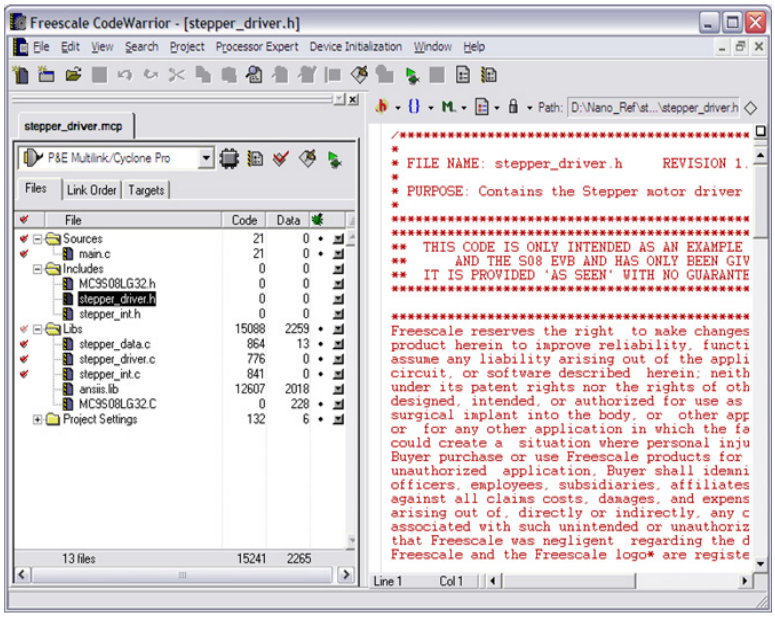

Figure 2. MC9S08LG32 Stepper Motor Motion Control Driver

2.1 Files Introduction

These five files are associated with the driver.

- **stepper_driver.c** — It is the main file for the driver, and contains the various high level API definitions exposed to the applications for motion control.
- **stepper_driver.h** — Contains the high level API declarations and the configuration macros intended for use by the application. It is included in the applications that intend to use the stepper motor driver.
- **stepper_int.c** — Contains the internal structures and APIs.
- **stepper_int.h** — Declares the internal APIs that are used to give motion control capabilities to the application.
- **stepper_data.c** — Contains the read-write data and global variables used by the driver.

2.2 External Interfaces

2.2.1 Data Structures

2.2.1.1 Configuration Macros

#define MODE_2TPM_2GPIO

This macro defines the mode for stepper motor pins to be driven by two TPM pins and two GPIOs.

NOTE

You must connect the stepper motor accordingly.

#define STEPPER_MOVE_CLKWISE

This macro defines the direction of the stepper motor motion as clockwise.

#define STEPPER_MOVE_ANTICLKWISE

This macro defines the direction of the stepper motor motion as anti-clockwise.

#define CURRENT_DRIVER_IC_ON

This macro activates the current driver IC that is used to drive the stepper motor.

#define CURRENT_DRIVER_IC_OFF

This macro deactivates the current driver IC that is used to drive the stepper motor.

2.2.2 API Descriptions

Here are the detailed descriptions for all the APIs exported to the application by the motion control driver. These interfaces are used by the application to access various stepper motor operation modes.

2.2.2.1 InitStepper

Prototype

void InitStepper(void)

Description:

Initializes the working mode of the stepper motor as:

- PIN1 — TPM1CH0
- PIN2 — PTI0
- PIN3 — PTI1
- PIN4 — TPM1CH1

It initializes all the required TPM and GPIO registers, but does not enable the TPM clock.

2.2.2.2 MotorCurrentDriverCE_Toggle

Prototype

void MotorCurrentDriverCE_Toggle(unsigned char currentdriver)

Description:

Toggles the ChipSelect signal (active low) for the current driver IC that is required to operate the stepper motor. Argument passed is CURRENT_DRIVER_IC_ON or CURRENT_DRIVER_IC_OFF.

2.2.2.3 DriveStepper_to_zero

Prototype

void DriveStepper_to_zero(void)

Description:

Uses a specified process to move stepper to initial zero position. This function might be different for different stepper motors. It basically programs a predefined movement that is designed to avoid jitter and noisy motions as it moves to the initial zero position.

2.2.2.4 move_motor_microstep

Prototype

void move_motor_microstep(unsigned int num_of_steps, unsigned char direction)

Description:

Provides movement of stepper motor in micro-steps. Each micro-step equals 1/12 degree.

2.2.2.5 move_motor_partialstep

Prototype

void move_motor_partialstep(unsigned int num_of_steps, unsigned char direction)

Description:

Provides movement of stepper motor in partial steps. Each partial step equals 1/3 degree.

2.2.2.6 move_motor_fullstep

Prototype

void move_motor_fullstep(unsigned int num_of_steps, unsigned char direction)

Description:

Provides movement of stepper motor in full steps. Each full step equals 1 degree.

2.3 Assumptions

The descriptions in this document assume that the person reading it has full knowledge of all the configuration registers of all the blocks in the MC9S08LG32, especially TPM and PORTs.

2.4 Design Decisions

- Provided all the types of steps supported in the stepper motor through the TPM block of the MC9S08LG32.
- Provided mechanism for initial driving of stepper motor to zero without audible jitter.

3 References

See S08LG Product Summary Page for more information and the documents released for MC9S08LG32.

How to Reach Us:

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USA/Europe or Locations Not Listed:
Freescale Semiconductor, Inc.
Technical Information Center, EL516
2100 East Elliot Road
Tempe, Arizona 85284
+1-800-521-6274 or +1-480-768-2130
www.freescale.com/support

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
www.freescale.com/support

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor China Ltd.
Exchange Building 23F
No. 118 Jianguo Road
Chaoyang District
Beijing 100022
China
+86 10 5879 8000
support.asia@freescale.com

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