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AN204896

F²MC-8FX Family MB95310/370 Series LCD Hardware Design API

Associated Part Family: MB95310/370 Series

This document describes the LCD module hardware design and protocol.

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1 Introduction

This document introduces API for LCD hardware design.

MCU LCD module drives LCD panel by connecting SEG and COM to LCD panel. In following chapters we will describe the LCD module hardware design and protocol.

2 Background

This chapter introduces the background of LCD.

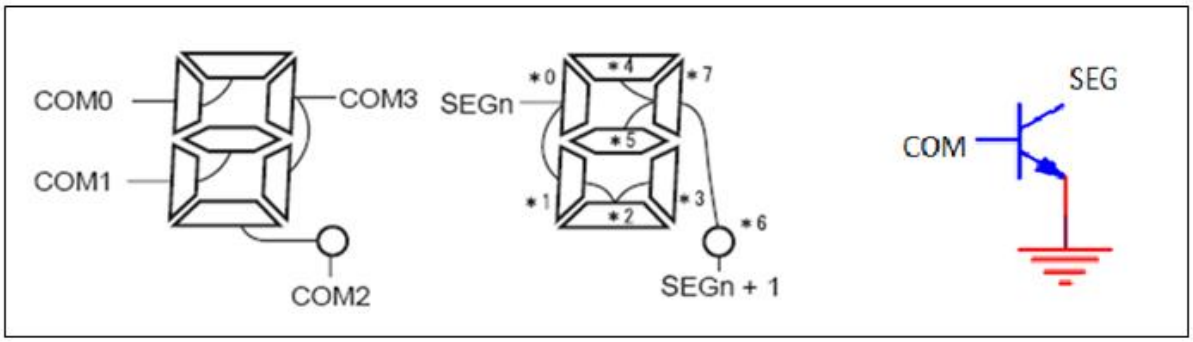
Liquid Crystal Display (LCD) is driven by COM and SEG, and be lighted on by voltage bias between COM and SEG.

There are two LCD driving voltage split resistors. They are internal split resistor and external split resistor. And bias can be selected between 1/2 bias and 1/3 bias.

How many COMs used will decide the duty number. When 4 COMs are used, the duty is 1/4.

LCD is normally used with internal LED cell. Figure 1 describes the LED and defines LCD work theory.

Figure 1. LCD Work Theory

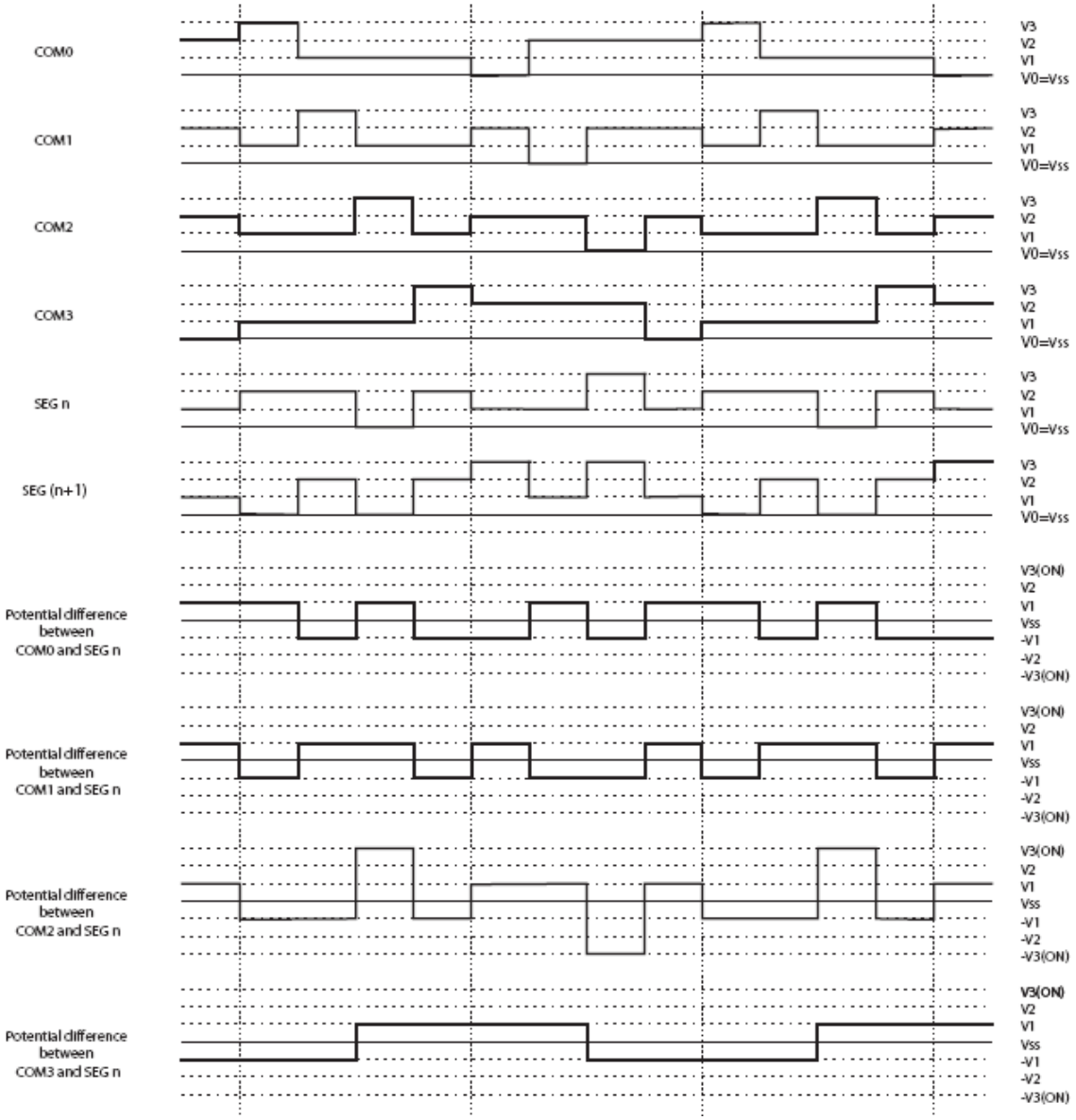


3 Description of LCD Protocol

This chapter describes the protocol of LCD module.

Those liquid crystal elements are turned ON for displaying which has the maximum potential difference between the common and segment outputs. Figure 2 simply describes LCD drive protocol.

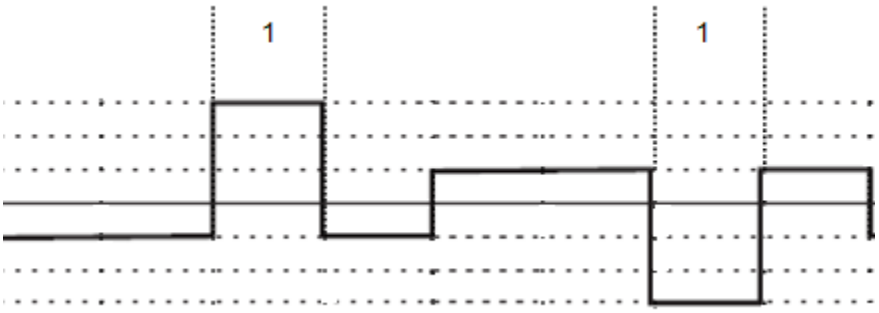
Figure 2. 1/4 Duty 1/3 Bias Output Waveform Example



3.1 LED On Condition

When the V_{COM} is V3 (highest voltage) and the V_{SEG} is V0 (lowest voltage), the potential is the highest voltage V3. So the LED will be lighted on.

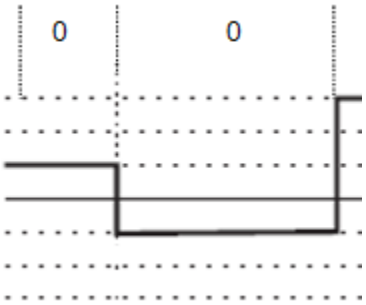
Figure 3. LED On Wave



3.2 LED Off Condition

When the V_{COM} is V3 (highest voltage) and the V_{SEG} is V1 (lower voltage), the potential is the lower voltage V2. So the LED will be lighted off.

Figure 4. LED Off Wave

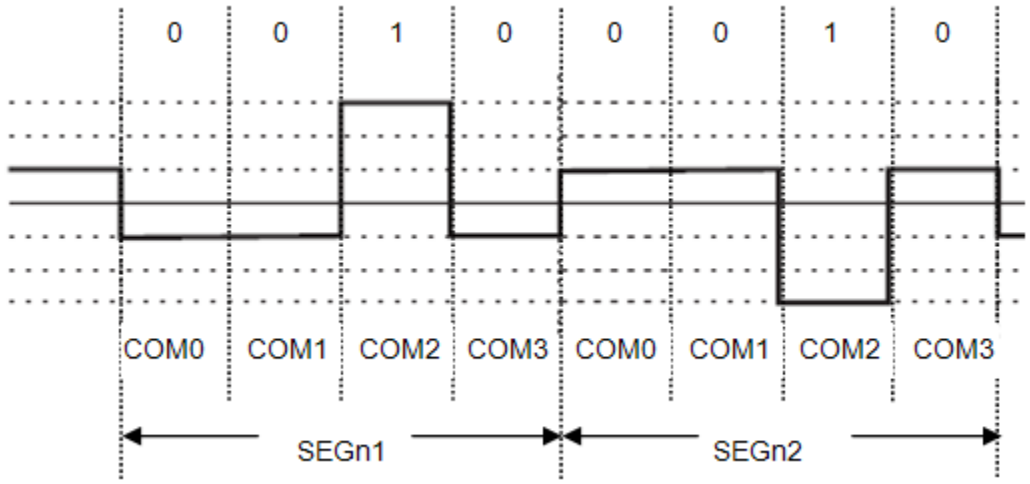


3.3 LCD Code

Writing data to LCD RAM will set potential to COM and SEG. When the potential is highest, the correlative LED will be lighted on, or the correlative LED will off.

Figure 5 describes the potential between COM and SEG.

Figure 5. LCD Code

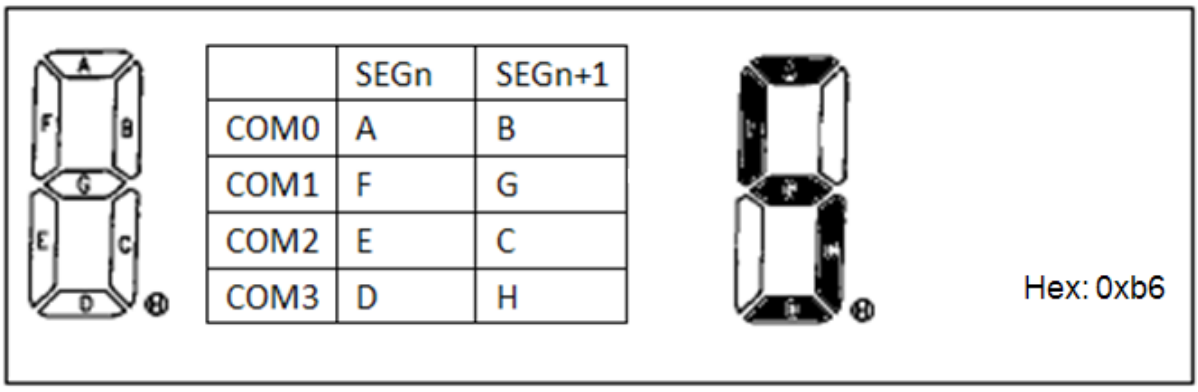


3.4 LCD RAM

LCD RAM is used to save data written to COM and SEG. If user wants to display different numbers, it only writes different data to LCD RAM. Following figure describes how to define LCD RAM.

Figure 6 describes the LCD RAM data in 8-seg LED.

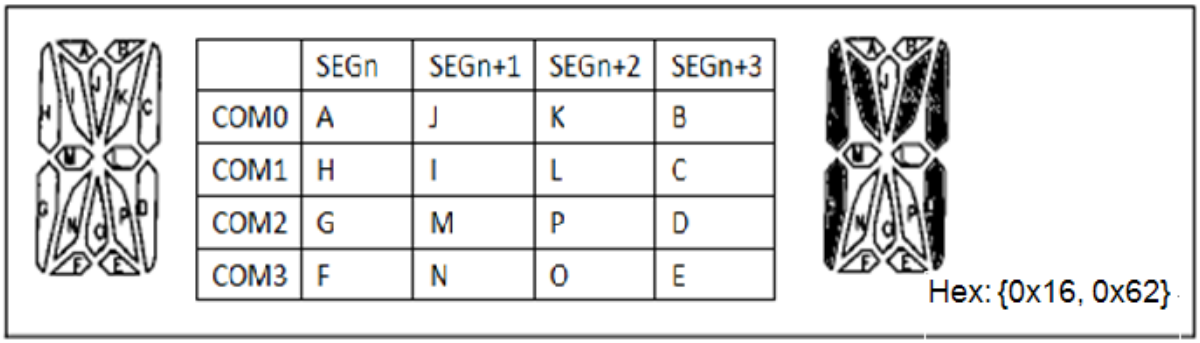
Figure 6. LCD RAM 8_seg Hex



	SEGn	SEGn+1
COM0	A	B
COM1	F	G
COM2	E	C
COM3	D	H

Figure 7 describes the LCD RAM data in 16-seg LED.

Figure 7. LCD RAM 16_seg Hex



	SEGn	SEGn+1	SEGn+2	SEGn+3
COM0	A	J	K	B
COM1	H	I	L	C
COM2	G	M	P	D
COM3	F	N	O	E

4 LCD Hardware Design

This chapter describes the hardware design of LCD module.

4.1 Hardware Design

For LCD hardware design, user only needs to connect MCU COM to LCD panel COM and connect MCU SEG to LCD panel SEG. If user wants to use external voltage, user must supply V0~V3 voltage outside the MCU.

Figure 8 is a sample hardware design for COM and SEG.

Figure 8. LCD Hardware Design

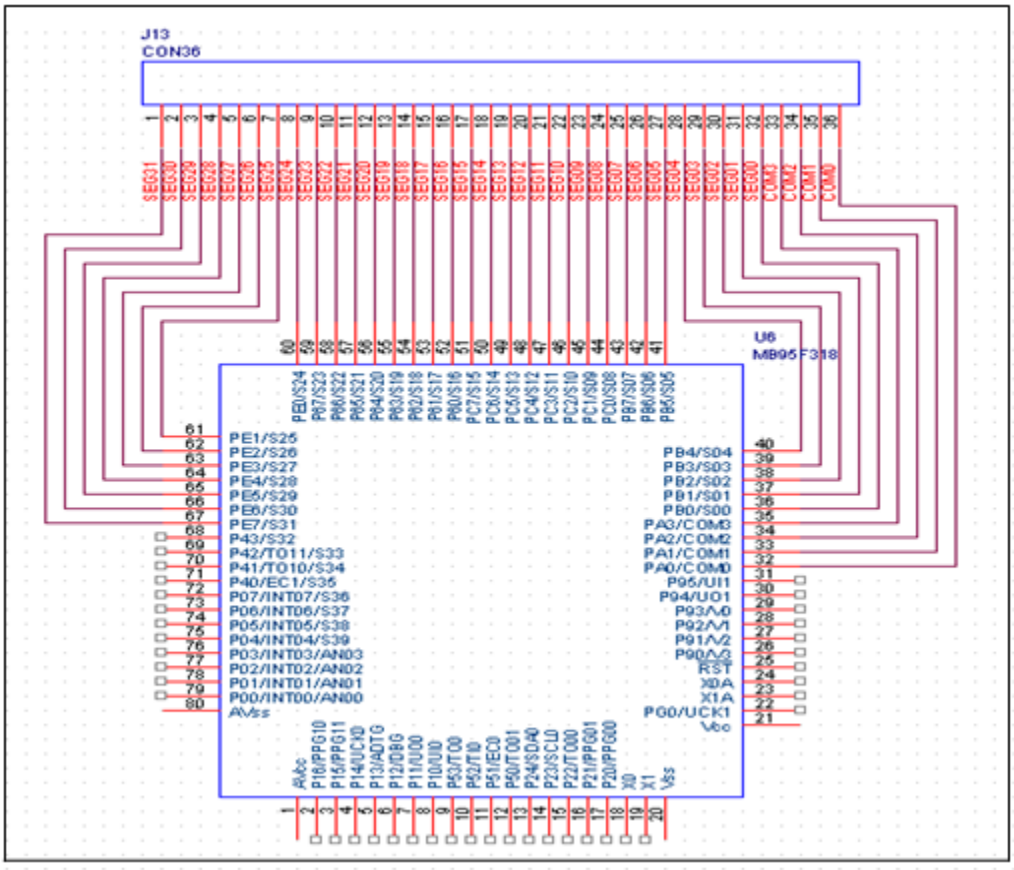
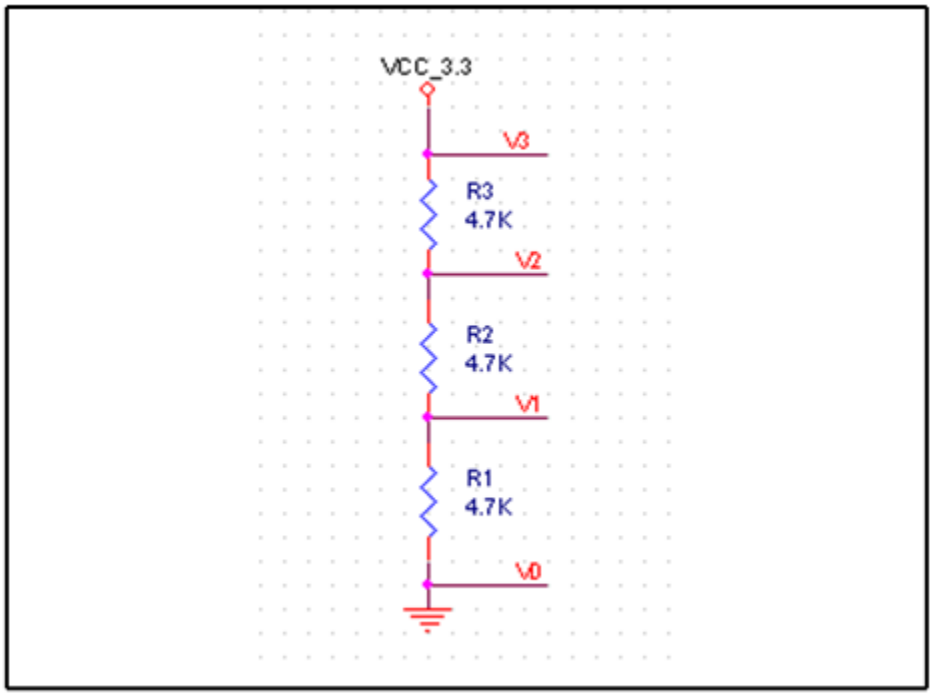


Figure 9 is a sample hardware design for V0~V3.

Figure 9. LCD Drive Power



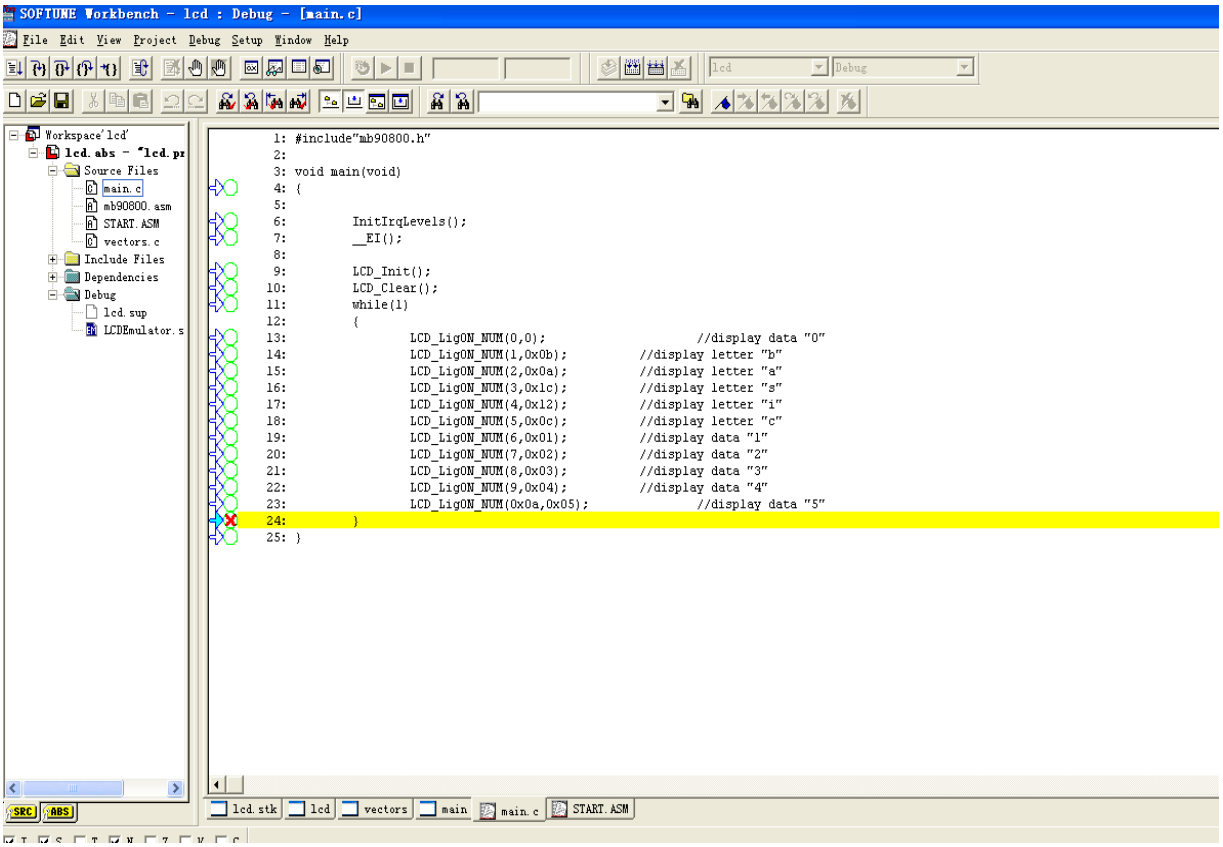
5 Usage Demo

This chapter describes how to debug the sample code on EV-Board and what will happen when the code is running.

There is a simple project LCD.prj to debug. This project is based on our EV-Board MB2146-450-E and the target MCU is MB95F310.

Figure 10 is debugging example.

Figure 10. Debugging Example



6 Additional Information

For more information about how to use MB95310 EV-board, BGM Adaptor and SOFTUNE, please refer to EV-Board MB2146-450-E User Manual.

http://www.cypress.com/documentation/application-notes/mb95310370-mb2146-450-e-lcd-evb-user-manual

Please contact your local support team for any technical question.

Document History

Document Title: AN204896 - F²MC-8FX Family MB95310/370 Series LCD Hardware Design API

Document Number: 002-04896

Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	—	HUAL	11/10/2009	Initial release
*A	5254122	HUAL	05/12/2016	Migrated Spansion Application Note “MCU-AN- 500063-E-10” to Cypress format

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