

An Introduction to HT56R2x SCOM LCD Driving Applications

D/N : HA0214E

Introduction

The HT56R2x contains an internal R-Type LCD driving function with 1/2 bias and four COM driving capability. The following provides a description of 1/2 bias 1/4 duty LCD driving with the HT56R2x.

Operating Principle

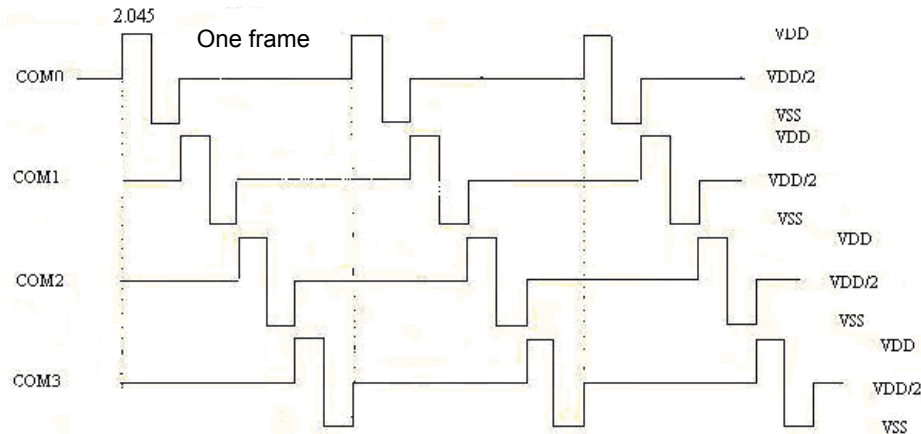
According to LCD driving principles, the LCD pixels can only be used with AC voltages. The contrast of the LCD displayer is determined by the voltage value on the COM pin minus that on the SEG pin. When the differential voltage is larger than the LCD saturation voltage, the pixels will be turned on, or else be turned off if the differential voltage is smaller than the threshold voltage of the LCD. The HT56R2x is able to generate a VDD/2 voltage interface (COM0~COM3), as long as the I/O port can simulate the LCD driving output signals.

For the best operation the LCD frame frequency should be within 25Hz ~ 250Hz. The system clock of the HT56R24 HIRC is 4MHz. The internal clock source of Timer1 can be selected to be the internal LXT oscillator (32kHz). Set the initial value TMR1H=0xFF, TMR1L=0xBC and an overflow interrupt will be generated every $(0xFF-0xBC) / 32$ which is about 2.093ms. Taking this as the time base, the 1/4 duty frame period is:

$2.093 \text{ ms} * 8 = 16.744 \text{ ms}$, that is, $1 / 16.744 = 59.7\text{Hz}$

This matches the requirements.

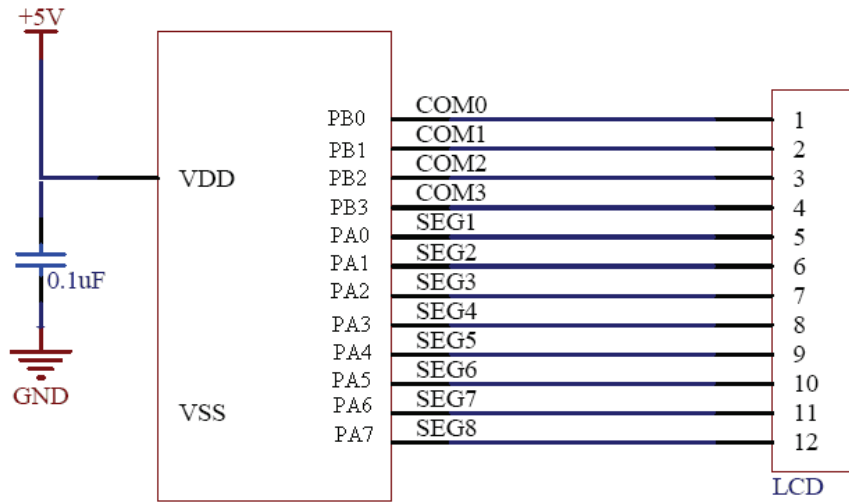
The COM0~COM3 driving waveform of the 1/2 bias LCD is shown below.



The HT56R24 offers 4 * COM outputs, pin-shared with the PB0~PB3 I/O ports that needs to be setup using the LCDC register for the COM0~COM3 to output VDD/2 voltage levels. Therefore, the waveform on COM0~COM3 can be acquired by setting respectively the corresponding voltage of the COM0~COM3 outputs within one COM period. In other words, set COM0 as a VDD output at the first overflow interrupt of Timer1 and the other COMs as VDD/2 outputs. Set COM0 as a VSS output at the second Timer1 overflow interrupt and COM1~COM3 as VDD/2 outputs. Set COM1 as a VDD output at the third Timer1 overflow interrupt, and the other COMs as VDD/2 outputs. Set COM1 as a VSS output at the fourth Timer1 overflow interrupt and the other COMs as VDD/2 outputs, and so on. Then set COM3 as a VSS output at the eighth interrupt and the other COMs as VDD/2 outputs.

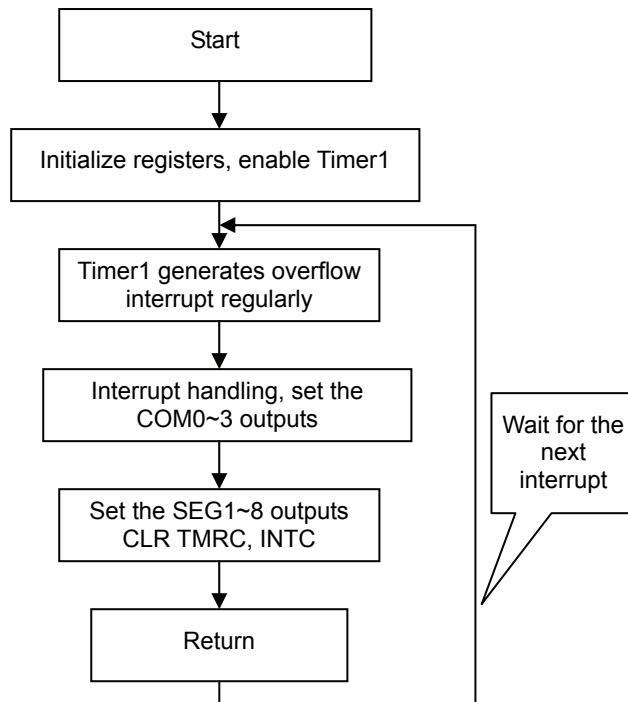
To light up the LCD pixels, the differential voltage of COM and SEG must be larger than the saturation voltage, that is, +VDD or -VDD. Accordingly, to light up a pixel, simply output an opposing voltage on COM and SEG. For example, when COM0 = VDD, the corresponding pixel will be lit up if SEG = VSS. The same is for the condition when COM0 = VSS and SEG = VDD. It should be noted that by first applying +VDD then -VDD to illuminate the LCD pixels will extend the life of the LCD panel.

Application Circuit Diagram



For the actual application circuit, refer to the HT56R2x datasheet.

S/W Flowchart



Program Description

The example program uses a 4x8 segment LCD, to cycle a number from 000 to 999 on the display at an interval of $250 * 2.093 = 0.511$ seconds. It uses eleven bytes of RAM in total. In the program display_1, display_2, display_3, and display_4 are used to store the corresponding LCD font codes of the number to be displayed. Users may decide the COM and SEG according to actual demands. If the LCD is 1/2 duty, for example if only two COMs are needed to be reserved, then the SEGs may be expanded according to the example program.

From the description above, set the COM0~COM3 outputs respectively to have 8 intervals. Whether the SEG outputs are VDD or VSS depends upon the number to be displayed. For detailed voltage levels of the I/O ports refer to the table below.

	COM0	COM1	COM2	COM3	SEGx (on)	SEGx (off)
1 st Interrupt	VDD	VDD/2	VDD/2	VDD/2	VSS	VDD
2 nd Interrupt	VSS	VDD/2	VDD/2	VDD/2	VDD	VSS
3 rd Interrupt	VDD/2	VDD	VDD/2	VDD/2	VSS	VDD
4 th Interrupt	VDD/2	VSS	VDD/2	VDD/2	VDD	VSS
5 th Interrupt	VDD/2	VDD/2	VDD	VDD/2	VSS	VDD
6 th Interrupt	VDD/2	VDD/2	VSS	VDD/2	VDD	VSS
7 th Interrupt	VDD/2	VDD/2	VDD/2	VDD	VSS	VDD
8th Interrupt	VDD/2	VDD/2	VDD/2	VSS	VDD	VSS

Conclusion

This example has shown how to drive a 4 * 8 LCD . Users only need a little modification before applying the example to their selected 1/2 bias LCD applications.

Revision History

Revision: V1.10

Updated Date: January 2, 2012

Modified Contents: The Operating Principle section was modified and the application software was modified.