Renesas Synergy™ Platform

Segment LCD Display on DK-S3A7

Introduction

This application note describes how to use the Segment LCD Panel (DK-S3LCD v2.0), that is part of the Renesas DK-S3A7 Synergy™ MCU Group Development Kit.

Goals and Objectives

The goal of this application note is to install, build, and run the example application.

The example application includes a segment display library that provides support for initialization, icon control, and numerical digit display.

Required Resources

To build and run the application, you will need:

- Renesas DK-S3A7 Synergy MCU Development Kit,
- PC running Microsoft® Windows® 7 with the following Renesas software installed:
  - e² studio ISDE v7.3.0 or later
  - Synergy Software Package (SSP) v1.6.0 or later
  - IAR Embedded Workbench® for Renesas Synergy™ v8.23.3 or later
  - Synergy Standalone Configurator (SSC) v7.3.0 or later

You can download the required Renesas Synergy software from the Renesas Synergy Gallery (https://synergygallery.renesas.com).

Time Required

You can install, build, and run the example application in under 30 minutes.

The high-level steps involved are as follows:

1. Connect to the target board.
2. Import, build, and debug the project.
3. Observe the example application program output.

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1. Connecting to the Board

Follow the procedure in your target board's *Quick Start Guide* to set up the J-Link® debugger connection from your PC to the JTAG connector on the target board and power-up the board.

2. Importing and Building the Project

Follow the procedure in the *Importing a Renesas Synergy Project* (r11an0023eu0121-synergy-ssp-import-guide.pdf) to import the project into the e² studio ISDE, and to build, and debug the project. When prompted to select the debug configuration, select **DK-S3LCD_v2 Debug** (under **Renesas GDB Hardware Debugging**).

3. Synergy Project Settings for Segment LCD

This application note comes with an example Synergy project and the required project settings pre-configured, that can be imported. The Renesas Synergy Software Package (SSP) includes a driver for controlling the Segment LCD. In the example project, the SLDC Driver has already been added to your Synergy project, using the **Threads** tab of the Synergy project editor.

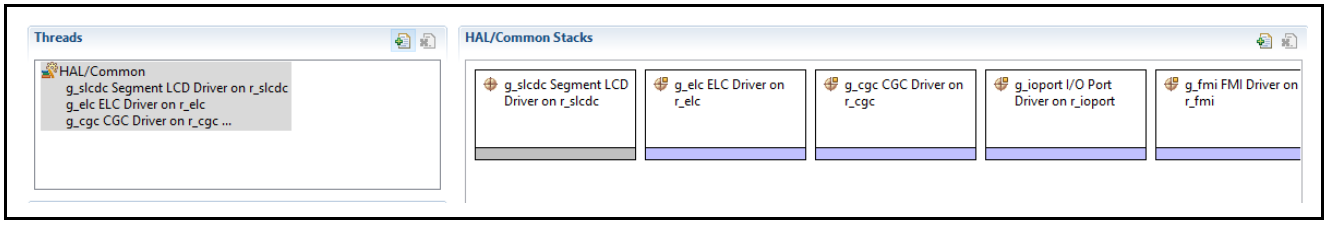

Figure 1. Threads tab

The SLDC Driver is configured for the Segment LCD, using the **Properties** dialog of the `g_slcdc` **Segment LCD Driver** on `r_slcdc`.

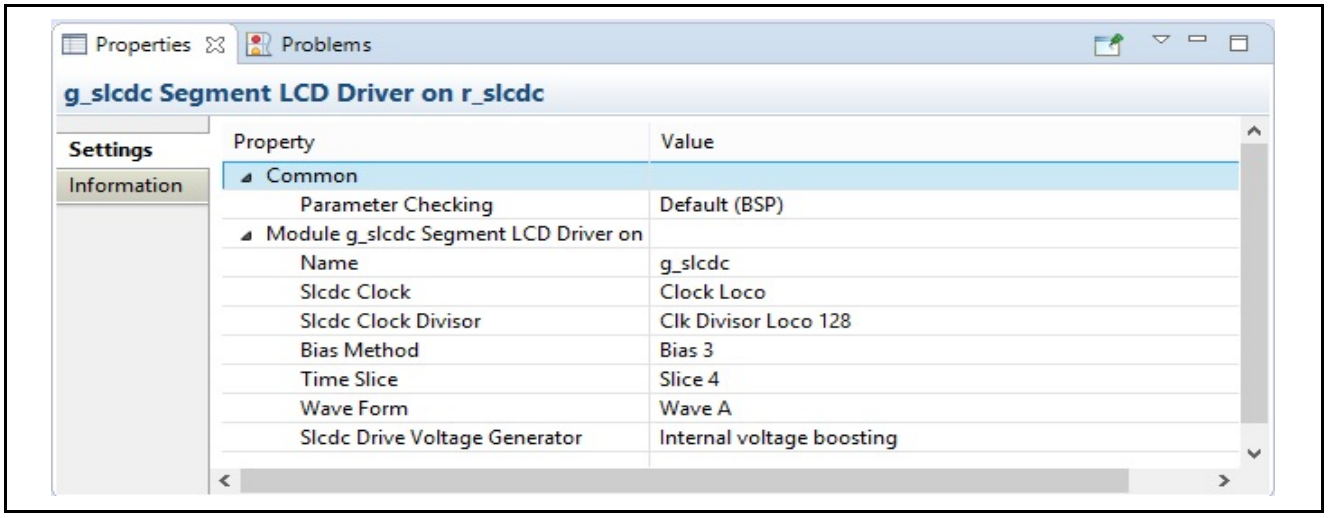

Figure 2. r_slcdc properties

Use the following example code to open and configure the driver:

```
ssp_err_t ssp_err;

ssp_err_t slcd_init(void)
{
    ssp_err = g_slcdc.p_api->open(g_slcdc.p_ctrl, g_slcdc.p_cfg);
    ssp_err = g_slcdc.p_api->start(g_slcdc.p_ctrl);
    ssp_err = g_slcdc.p_api->setdisplayArea(g_slcdc.p_ctrl, SLCDC_DISP_A);

    return ssp_err;
}
```

Write to the LCD Display Data Registers by using either of the following functions:

```
g_slcdc.p_api->write()
```

or

```
g_slcdc.p_api->modify()
```

4. LCD Segment Map

Figure 3 shows the LCD segments available on the DK-S3A7 MCU Segment LCD Panel. The number next to each segment is a reference to the associated LCD Display Data Register of the Segment LCD Controller and the data value that must be written to that register to enable that LCD segment. For example, the battery indicator consists of five segments.

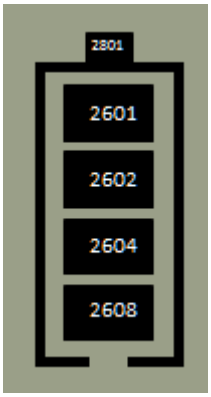

Figure 3. LCD segments

The outer case of the battery is marked 2801, which indicates the LCD Display Data Register SEG28, with write value 0x01. The four battery cell symbols are accessed through LCD Display Data Register SEG26, with write values 0x08, 0x04, 0x02, and 0x01.

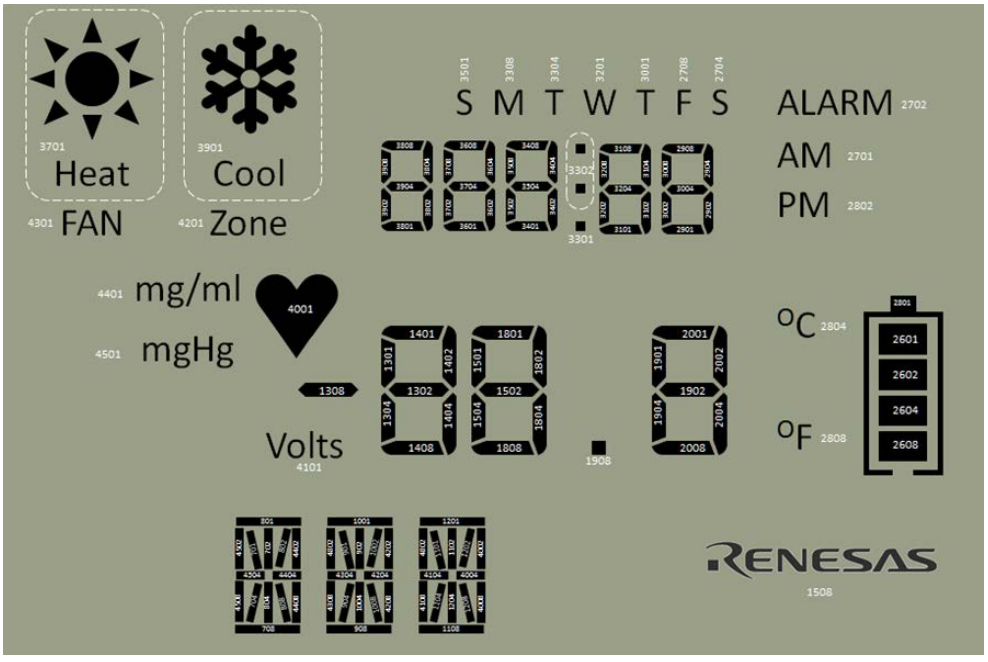

Figure 4. Segment LCD panel – segment numbering

5. SLCDC Drawing Functions

This section details some simple drawing functions that can be used to write to the SLCD.

The available functions are:

```
ssp_err_t set_segments_medium_digits( uint32_t value, medium_dp_or_colon_t
point_or_colon );
ssp_err_t set_segments_icon_medium_dp_colon( medium_dp_or_colon_t setting );
ssp_err_t set_segments_big_digits( int16_t value, big_digit_dp_t dp_setting );
ssp_err_t set_segments_small_digits(small_number_t setting);
ssp_err_t set_segments_icon_dow( day_of_week_t day_of_week );
ssp_err_t set_segments_icon_battery( battery_level_t level );
ssp_err_t set_segments_icon_am_pm( am_or_pm_t setting );
ssp_err_t set_segments_icon_degC_degF( degc_or_degf_t setting );
ssp_err_t set_segment_icon_named( uint16_t segment_name, on_or_off_t
setting );
```

Function descriptions:

```
ssp_err_t set_segments_medium_digits( uint32_t value, medium_dp_or_colon_t
point_or_colon );
```

The `set_segments_medium_digits()` function displays a value in the range of 0 to 99999 to the top row of digits. If a value greater than 99999 is passed, “E r r o r” is displayed on the top row of digits.

When calling the function, you can specify whether to display the colon segment or decimal point segment.

Examples:

```
set_segments_medium_digits( 12345, SET_COLON );
set_segments_medium_digits( 99999, SET_DP );
set_segments_medium_digits( 99999, DP_COLON_OFF );
ssp_err_t set_segments_icon_medium_dp_colon( medium_dp_or_colon_t setting );
```

The `set_segments_icon_medium_dp_colon()` function draws the colon segment or decimal point segment to the top row of digits. It is typically called by the function `set_segments_medium_digits()`, but it can also be called in isolation.

Example:

```
set_segments_icon_medium_dp_colon( DP_COLON_OFF );
ssp_err_t set_segments_big_digits( int16_t value, big_digit_dp_t dp_setting );
```

The `set_segments_big_digits()` function displays a value in the range of -999 to 999 to the center row of digits. If a value greater the 999 or less than -999 is passed, “E r r o r” is displayed on the center row of digits.

When calling the function, you can specify whether to display the decimal point segment.

Examples:

```
set_segments_big_digits( 123, WITH_DP );
set_segments_big_digits( -356, NO_DP );
ssp_err_t set_segments_small_digits(small_number_t setting);
```

The `set_segments_small_digits()` function displays or clears the small digits on the segment LCD screen according to the parameter passed to the function.

Examples:

```
set_segments_small_digits(DISPLAY_ON);
set_segments_small_digits(DISPLAY_OFF);
ssp_err_t set_segments_icon_dow( day_of_week_t day_of_week );
```

The `set_segments_icon_dow()` function displays the specified day of the week: S M T W T F S. The function can display as many days as required by OR-ing the days of the week passed into the function.

Examples:

```
set_segments_icon_dow( DOW_SUNDAY );
set_segments_icon_dow( DOW_MONDAY );
set_segments_icon_dow( DOW_TUESDAY );
set_segments_icon_dow( DOW_OFF );// Clear all days
set_segments_icon_dow( DOW_SUNDAY | DOW_SATURDAY );
set_segments_icon_dow( DOW_MONDAY| DOW_TUESDAY| DOW_WEDNESDAY| DOW_THURSDAY|
DOW_FRIDAY );
ssp_err_t set_segments_icon_battery( battery_level_t level );
```

The `set_segments_icon_battery()` function displays the battery symbol with the specified number of battery cell segments.

Examples:

```
set_segments_icon_battery( BATTERY_EMPTY ); // can use BATTERY_EMPTY or
BATTERY_0
set_segments_icon_battery( BATTERY_1 );
set_segments_icon_battery( BATTERY_2 );
set_segments_icon_battery( BATTERY_3 );
set_segments_icon_battery( BATTERY_FULL ); // can use BATTERY_FULL or
BATTERY_4
set_segments_icon_battery( BATTERY_OFF );  // turn off the battery symbol
ssp_err_t set_segments_icon_am_pm( am_or_pm_t setting );
```

The `set_segments_icon_am_pm()` function displays either the AM or PM segments, or turns the segments off. When using this function, it is not possible to have the AM and PM symbol showing at the same time.

Examples:

```
set_segments_icon_am_pm( AM_TIME );
set_segments_icon_am_pm( PM_TIME );
set_segments_icon_am_pm( AM_PM_OFF );
ssp_err_t set_segments_icon_degC_degF( degc_or_degf_t setting );
```

The `set_segments_icon_degC_degF()` function displays either the degC or degF segments, or turns the segments off. When using this function, it is not possible to have the degC and degF symbol showing at the same time.

Examples:

```
set_segments_icon_degC_degF( TEMP_DEG_C );
set_segments_icon_degC_degF( TEMP_DEG_F );
set_segments_icon_degC_degF( DEG_C_F_OFF );
ssp_err_t set_segment_icon_named( uint16_t segment_name, on_or_off_t
setting );
```

The `set_segment_icon_named( )` function displays or clears the specified segment. The segments that can be controlled by this function are:

```
HEAT_ICON
COOL_ICON
FAN_ICON
ZONE_ICON
MG_ML_ICON
MG_HG_ICON
HEART_ICON
VOLTS_ICON
RENESAS_ICON
ALARM_ICON
```

Examples:

```
set_segment_icon_named( HEAT_ICON, ICON_ON );
set_segment_icon_named( HEAT_ICON, ICON_OFF );

set_segment_icon_named( COOL_ICON, ICON_ON );
set_segment_icon_named( COOL_ICON, ICON_OFF );

set_segment_icon_named( FAN_ICON, ICON_ON );
set_segment_icon_named( FAN_ICON, ICON_OFF );

set_segment_icon_named( ZONE_ICON, ICON_ON );
set_segment_icon_named( ZONE_ICON, ICON_OFF );

set_segment_icon_named( MG_ML_ICON, ICON_ON );
set_segment_icon_named( MG_ML_ICON, ICON_OFF );

set_segment_icon_named( MG_HG_ICON, ICON_ON );
set_segment_icon_named( MG_HG_ICON, ICON_OFF );

set_segment_icon_named( HEART_ICON, ICON_ON );
set_segment_icon_named( HEART_ICON, ICON_OFF );

set_segment_icon_named( VOLTS_ICON, ICON_ON );
set_segment_icon_named( VOLTS_ICON, ICON_OFF );

set_segment_icon_named( RENESAS_ICON, ICON_ON );
set_segment_icon_named( RENESAS_ICON, ICON_OFF );

set_segment_icon_named( ALARM_ICON, ICON_ON );
set_segment_icon_named( ALARM_ICON, ICON_OFF );
```

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Visit the following vanity URLs to learn about key elements of the Synergy Platform, download components and related documentation, and get support.

Synergy Software	www.renesas.com/synergy/software
Synergy Software Package	www.renesas.com/synergy/ssp
Software add-ons	www.renesas.com/synergy/addons
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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jun.16.16	-	Initial version.
1.01	Nov.18.16	-	Minor format changes.
1.02	Jan.05.17	-	Updated for SSP v1.2.0.b.1 Added set_segments_small_digits (small_number_t setting) function to display small digits segments
1.03	Feb.22.17	-	Added support for v1.2.0
1.04	Aug.22.17	-	Upgraded to SSP v1.3.0
1.05	Sep.27.17	1	Required resources of SSP version changed
1.06	Jan.16.18	-	Updated for SSP v1.3.3
1.07	Feb.26.18	-	Updated for 1.4.0
1.08	Feb.28.19	-	Updated for 1.6.0

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