
**Using Display Module TM7000 on
SAMA5D4 Xplained Ultra Board**

Atmel | SMART SAMA5D4 Series

Introduction

The Atmel® SAMA5D4 Xplained Ultra evaluation kit (SAMA5D4-XULT) is a fully-featured evaluation platform for the Atmel | SMART SAMA5D4 series ARM®-based embedded microprocessor units (eMPU). It allows users to extensively evaluate, prototype and create application-specific designs.

This application note aims at introducing how to adapt the display module TM7000 to work with the SAMA5D4 Xplained Ultra board.

This AN should be used in conjunction with the SAMA5D4 Xplained Ultra User Guide available on www.atmel.com.

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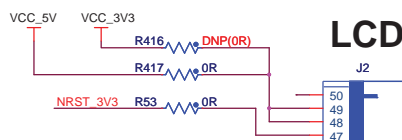
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1. LCD TFT Interface on SAMA5D4-XULT Board

The SAMA5D4 provides 24 bits of data and control signals to the LCD interface. Other signals are used to control the LCD and are available on 50-pin LCD expansion connector J2: TWI, SPI, 2 GPIOs for interrupt, 1-Wire and power supply lines.

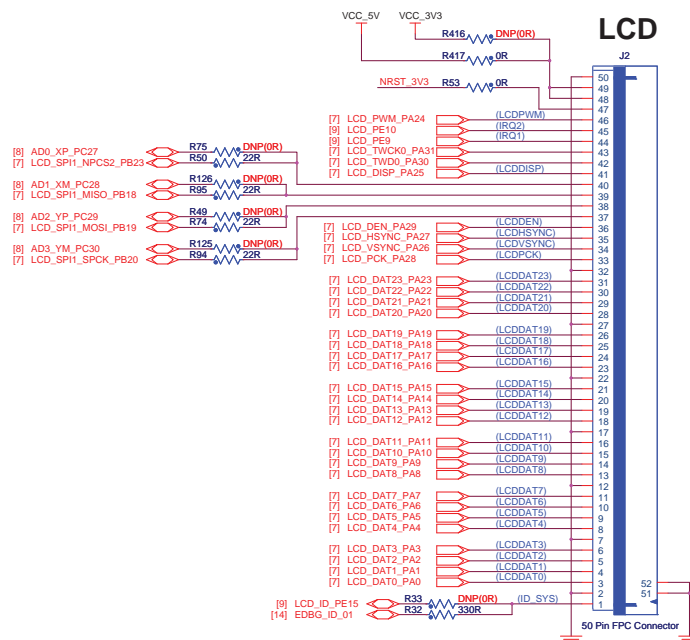
In order to adapt to various LCD modules, two voltage lines are available: 3.3 V and 5 V (by default), both selected by 0R resistors R416 and R417, as shown in Figure 1-1.

Figure 1-1. LCD Power



By default, the SAMA5D4-XULT board is configured to operate with display module TM4301 which has a 24-bit RGB parallel data interface and needs a 5 Vcc supply applied on J2 pins 48 and 49. Figure 1-2 shows the default connection between the LCD expansion connector and the TM4301 module.

Figure 1-2. LCD Expansion Connector Interface



2. TM7000 Display Module Overview

The TM7000 display module is a touchscreen module combined with a 7-inch TFT LCD panel. This module was designed to interface with a variety of Atmel ARM-based EKs including the SAMA5D3x-EK and the SAMA5D3 Xplained. It requires a power supply of 3.3 V on J2 pins 48 and 49 and has an 18-bit RGB parallel data interface.

Figure 2-1 shows the top and bottom views of the TM7000 display module.

Figure 2-1. Top and Bottom Views of TM7000



For more details on the TM7000 display module, please refer to the TM7000 Datasheet available on <http://www.pdaatl.com>.

3. Using TM7000 on SAMA5D4-XULT Board

To adapt the TM7000 module to work with the SAMA5D4-XULT board, some hardware modifications need to be made both on the SAMA5D4-XULT board and on the TM7000 display module.

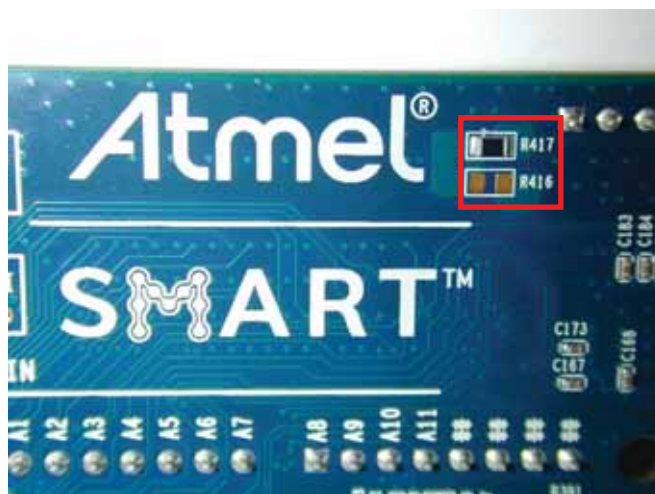
3.1 Power Supply

As explained, the TM7000 module requires a power supply of 3.3 V, while by default only 5 V is available on the SAMA5D4-XULT board for the LCD display module.

Modification:

On the SAMA5D4-XULT board, remove R417 and populate R416 to switch the LCD supply power from 5 V to 3.3 V (Figure 3-1).

Figure 3-1. SAMA5D4-XULT PCB (Partial Bottom View)



3.2 LCD Data Bus Mapping

The LCD display device featured on the TM7000 display module has an 18-bit RGB parallel data interface. By default, this module is configured to interface with boards such as SAMA5D3x-EK and SAMA5D3 Xplained.

However, the pin assignment of the RGB bus as a function of the bus width (24-, 18-, 16- or 12-bit mode) differs between SAMA5D3 and SAMA5D4.

Table 3-1 and Table 3-2 show the LCD data bus mapping schemes of SAMA5D3 and SAMA5D4, respectively.

Table 3-1. Active Mode Output Pin Assignment with SAMA5D3

Pin ID	TFT 24 bits	TFT 18 bits	TFT 16 bits	TFT 12 bits
LCD_DAT[23]	R[7]	–	–	–
LCD_DAT[22]	R[6]	–	–	–
LCD_DAT[21]	R[5]	–	–	–
LCD_DAT[20]	R[4]	–	–	–
LCD_DAT[19]	R[3]	–	–	–
LCD_DAT[18]	R[2]	–	–	–
LCD_DAT[17]	R[1]	R[5]	–	–
LCD_DAT[16]	R[0]	R[4]	–	–
LCD_DAT[15]	G[7]	R[3]	R[4]	–
LCD_DAT[14]	G[6]	R[2]	R[3]	–
LCD_DAT[13]	G[5]	R[1]	R[2]	–
LCD_DAT[12]	G[4]	R[0]	R[1]	–
LCD_DAT[11]	G[3]	G[5]	R[0]	R[3]
LCD_DAT[10]	G[2]	G[4]	G[5]	R[2]
LCD_DAT[9]	G[1]	G[3]	G[4]	R[1]
LCD_DAT[8]	G[0]	G[2]	G[3]	R[0]
LCD_DAT[7]	B[7]	G[1]	G[2]	G[3]
LCD_DAT[6]	B[6]	G[0]	G[1]	G[2]
LCD_DAT[5]	B[5]	B[5]	G[0]	G[1]
LCD_DAT[4]	B[4]	B[4]	B[4]	G[0]
LCD_DAT[3]	B[3]	B[3]	B[3]	B[3]
LCD_DAT[2]	B[2]	B[2]	B[2]	B[2]
LCD_DAT[1]	B[1]	B[1]	B[1]	B[1]
LCD_DAT[0]	B[0]	B[0]	B[0]	B[0]

Table 3-2. Active Mode Output Pin Assignment with SAMA5D4

Pin ID	TFT 24 bits	TFT 18 bits	TFT 16 bits	TFT 12 bits
LCD_DAT[23]	R[7]	R[5]	R[4]	R[3]
LCD_DAT[22]	R[6]	R[4]	R[3]	R[2]
LCD_DAT[21]	R[5]	R[3]	R[2]	R[1]
LCD_DAT[20]	R[4]	R[2]	R[1]	R[0]
LCD_DAT[19]	R[3]	R[1]	R[0]	–
LCD_DAT[18]	R[2]	R[0]	–	–
LCD_DAT[17]	R[1]	–	–	–
LCD_DAT[16]	R[0]	–	–	–
LCD_DAT[15]	G[7]	G[5]	G[5]	G[3]
LCD_DAT[14]	G[6]	G[4]	G[4]	G[2]
LCD_DAT[13]	G[5]	G[3]	G[3]	G[1]
LCD_DAT[12]	G[4]	G[2]	G[2]	G[0]
LCD_DAT[11]	G[3]	G[1]	G[1]	–
LCD_DAT[10]	G[2]	G[0]	G[0]	–
LCD_DAT[9]	G[1]	–	–	–
LCD_DAT[8]	G[0]	–	–	–
LCD_DAT[7]	B[7]	B[5]	B[4]	B[3]
LCD_DAT[6]	B[6]	B[4]	B[3]	B[2]
LCD_DAT[5]	B[5]	B[3]	B[2]	B[1]
LCD_DAT[4]	B[4]	B[2]	B[1]	B[0]
LCD_DAT[3]	B[3]	B[1]	B[0]	–
LCD_DAT[2]	B[2]	B[0]	–	–
LCD_DAT[1]	B[1]	–	–	–
LCD_DAT[0]	B[0]	–	–	–

As shown in the above tables, in 18-bit mode (necessary to correctly drive the TM7000 LCD display) the SAMA5D3 routes the LCD RGB color bits to LCDDAT[0..17], whereas the SAMA5D4 routes them to LCDDAT[2..7, 10..15, 18..23]. Therefore, a rerouting needs to be done on the TM7000 module to ensure a correct LCD bus mapping to SAMA5D4.

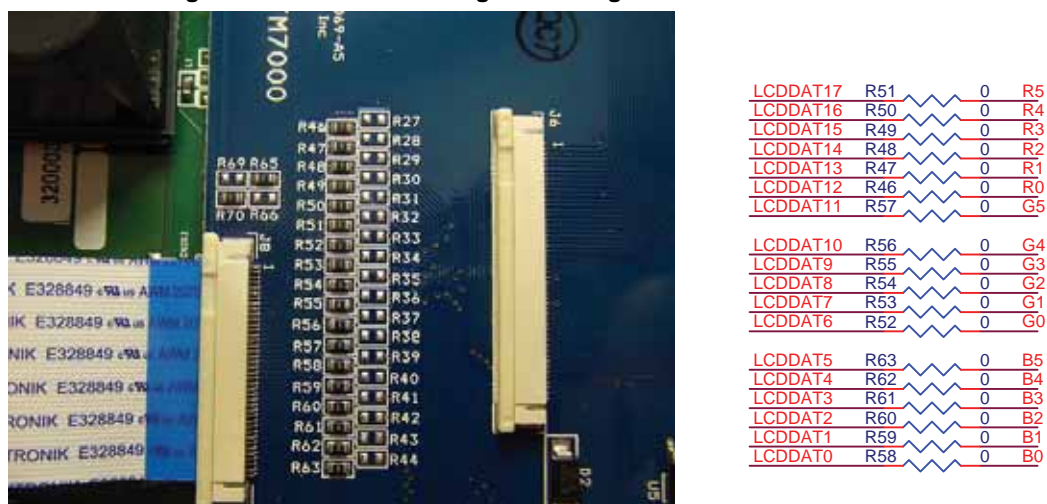
The TM7000 module provides two groups of 0R resistors that enable adaptation to either of the two LCD data bus mapping schemes:

- R46 to R63 (populated for SAMA5D3, default configuration)
- R27 to R44 (populated for SAMA5D4, alternative configuration)

Modification:

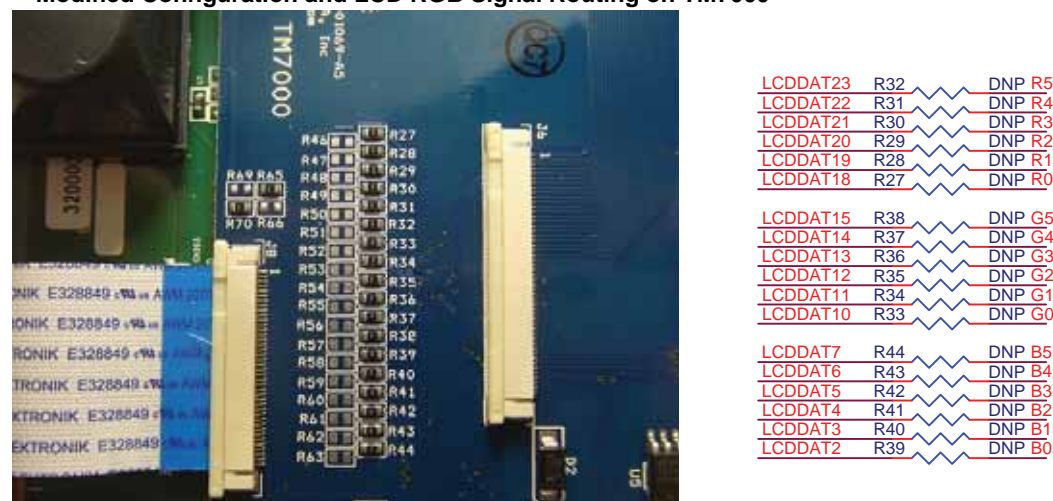
On the TM7000 display module, remove the 0R resistors R46 to R63 and solder them to positions R27 to R44. [Figure 3-2](#) shows the default configuration and LCD RGB signal routing (for SAMA5D3) on the TM7000 module (LCDDATxx = LCD data bus bits from driving board; Rx/Gx/Bx = LCD RGB color bits)

Figure 3-2. Default Configuration and LCD RGB Signal Routing on TM7000



[Figure 3-3](#) shows the configuration and the LCD RGB signal routing (for SAMA5D4) on the TM7000 module after modification.

Figure 3-3. Modified Configuration and LCD RGB Signal Routing on TM7000



4. Revision History

Table 4-1. Using TM7000 on SAMA5D4 Xplained Ultra Board 44019 Revision History

Doc. Rev.	Changes
A	First issue



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