Application Note 1-6-11-B

ConnectCore™ for i.MX51

Final Release Design Guidance
for
Early Availability Development Kit Customers
Hardware and Software

Date: March 1, 2011

This application note is intended for customers using the EA development kits of the ConnectCore for i.MX51 (Digi P/N CC-WMX51-CE6-EA, CC-WMX51-LX-EA, and CC-WMX51-LL-EA)

The document outlines the relevant design aspects of EA and GA versions of the module, development board, and related software. Including guidance on migration related aspects when moving to GA software releases.

GA modules maintain backwards-compatibility for customer hardware designs based on EA modules.

Contents

Overview

The information in this document applies to users of the Early Availability (EA) development kits for ConnectCore for i.MX51 only (Digi P/N CC-WMX51-CE6-EA, CC-WMX51-LX-EA, CC-WMX51-LL-EA).

This document outlines the relevant design aspects of EA and General Availability (GA) versions of the module, development board, and related software.

Software

This section covers all relevant software related aspects, including U-Boot and operating system platform support for Linux and Microsoft Windows Embedded CE.

GA module hardware maintains backwards-compatibility with all customer designs based on EA modules and development kits. Consequently, the Digi GA software releases for Digi Embedded Linux and Microsoft Windows Embedded CE 6.0 R3 allow customers to build images based on the development board (EA vs. GA).

The specific module variant (EA vs. GA) in use is not relevant for platform software builds unless new features provided by the GA module hardware are used, which does not directly affect EA customers.

U-Boot

All EA modules using U-Boot version DUB-1.0-3P.1 (or earlier) must be upgraded to the final release version DUB-1.0.14 (or greater). Please also refer to the U-Boot Reference Manual for detailed information on how to use U-Boot.

Upgrading U-Boot

Download the *uboot-ccwmxjs.bin.nandrfmt* and *u-boot-ccwmx51js_EAK.bin* images and make them available through the Digi tftp utility on your PC:

http://ftp1.digi.com/support/patches/i.MX51/CC_i.MX51_EA_Updates.htm

Follow the steps outlined below to properly set up the NAND flash layout of the module and upgrade to a final release version of U-Boot.

In order to access the U-Boot command prompt (#), you need to interrupt the module's boot process by pressing a key on the serial console connected to UART2 [X27] on the development board.

1. Disable automatic boot of OS images from flash by entering the following commands

```
# setenv bootcmd
# saveenv
```

2. Then execute the following command to check for bad sectors

```
# nand bad
```

Please write down any bad block information that may be displayed. The information is required later on to verify the successful completion of the upgrade process.

3. Update the module by writing the *u-boot-ccwmx51js.bin.nandrfmt* image

```
# update uboot tftp u-boot-ccwmx51js.bin.nandrfmt
```

4. Reset the module by entering the following command

```
# reset
```

5. Interrupt the boot process to access the command prompt, then enter the following command

```
# nandrfmt
```

Confirm when asked to proceed and wait until the flash reformatting is completed

6. Reset the module again by entering the following command

```
# reset
```

After this step you may see warnings related to the NVRAM environment.
These are expected and will disappear after the next step is completed.

7. Interrupt the boot process to access the command prompt, then reset the module once again to ensure the environment is properly updated

```
# reset
```

You should no longer see any NVRAM environment related warnings (step 6).
In the unexpected case that you still see those warnings, please contact Digi technical support.

8. Replace the *uboot-ccwmxjs.bin.nandrfmt* image (step 3) with the final U-Boot release version for your EA development board

```
# update uboot tftp u-boot-ccwmx51js_EAK.bin
```

Digi strongly recommends replacing the U-Boot uboot-ccwmxjs.bin.nandrfmt image with a version not providing the `nandrfmt` command to avoid accidental use and potential loss of data. Please complete this step!

9. Reset the module once again by entering the following command

```
# reset
```

10. Finally, interrupt the boot process to access the command prompt one more time, and execute the following command to verify the bad sector information recorded in step 2

```
# nand bad
```

Please verify that the bad block information shown matches the information you wrote down in step 1. In the unexpected case that the bad block information is not matching, please contact Digi technical support.

11. Enable the automatic boot action of your choice again. See examples below.

Boot Microsoft Windows Embedded CE image from flash

```
# setenv bootcmd dboot wce flash
# saveenv
```

Boot Microsoft Windows Embedded CE image from network via TFTP

```
# setenv bootcmd dboot wce tftp
# saveenv
```

Boot Digi Embedded Linux image from flash

```
# setenv bootcmd dboot linux flash
# saveenv
```

Boot Digi Embedded Linux image from network via TFTP

```
# setenv bootcmd dboot linux tftp
# saveenv
```

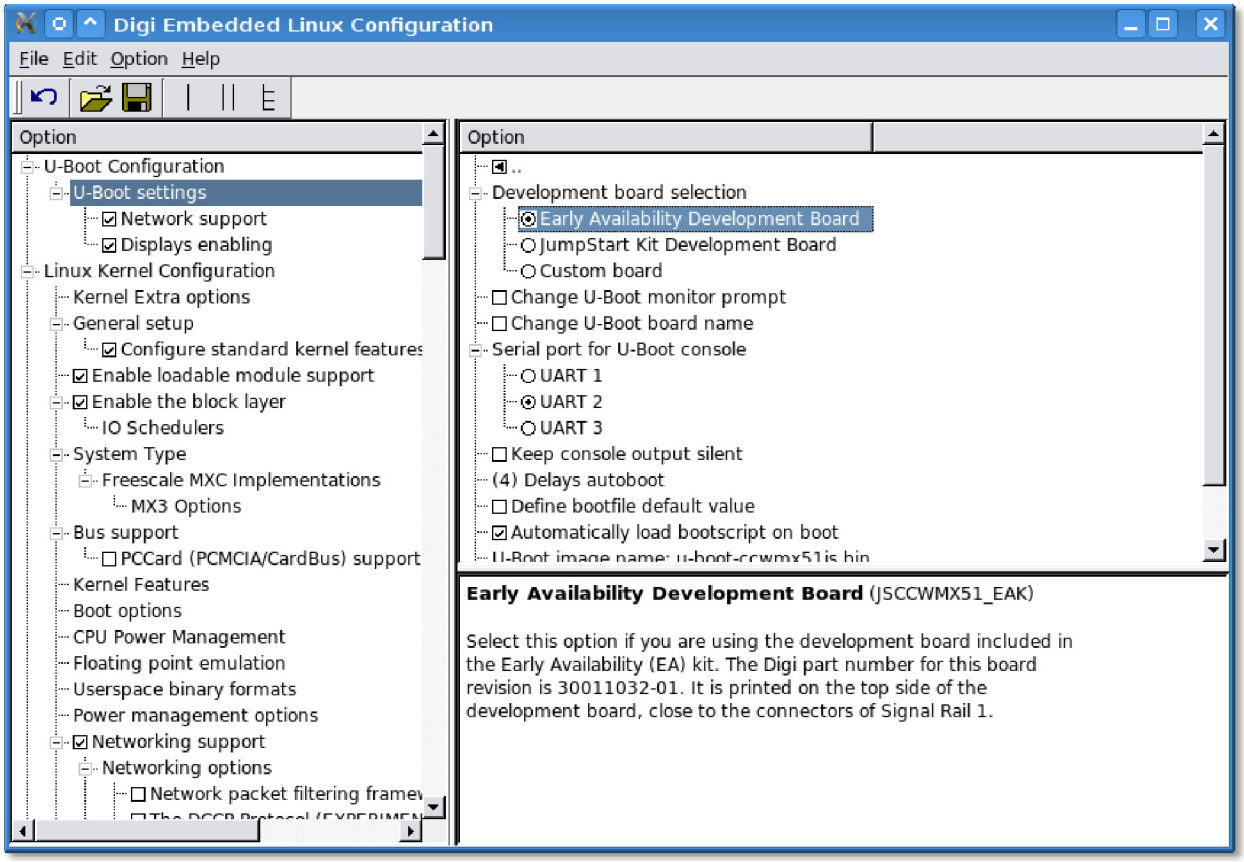
The U-Boot update process is now complete. Please repeat steps 1 to 11 for all modules that require the update.

Important Note for Microsoft Windows Embedded CE 6.0 Users:
The final U-Boot release supports only the GA release of the Microsoft Windows Embedded CE BSP. Image files are validated through their header information. Previous images will no longer boot.

Selecting the Development Board

The U-Boot bootloader can be set up for the specific version of the development board (EA/GA) in use by simply selecting the development board variant in the U-Boot configuration menu.

In Digi Embedded Linux, this can be configured as part of the Digi ESP project configuration with the U-Boot component added to the project. See screenshot below for reference.



In Microsoft Windows Embedded CE, the configuration is available in Visual Studio, if the U-Boot SDK is installed. Please refer to your Digi software platform documentation for more detailed information.

In addition, the Digi Embedded Linux DVD and the Digi support CD for Microsoft Windows Embedded CE include prebuilt images of the latest U-Boot version. These prebuilt images are also available on the Digi support website.

Operating System Platform Support

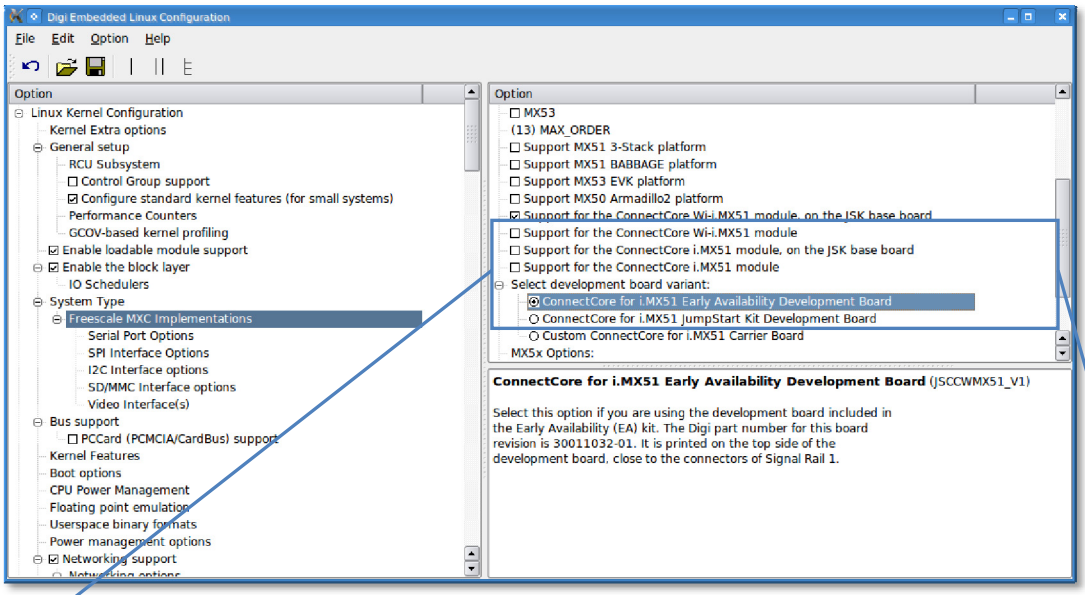
The information provided in this section refers to Digi Embedded Linux 5.6 and Digi support for Microsoft Windows Embedded CE 6.0 R3 v2.0.29.

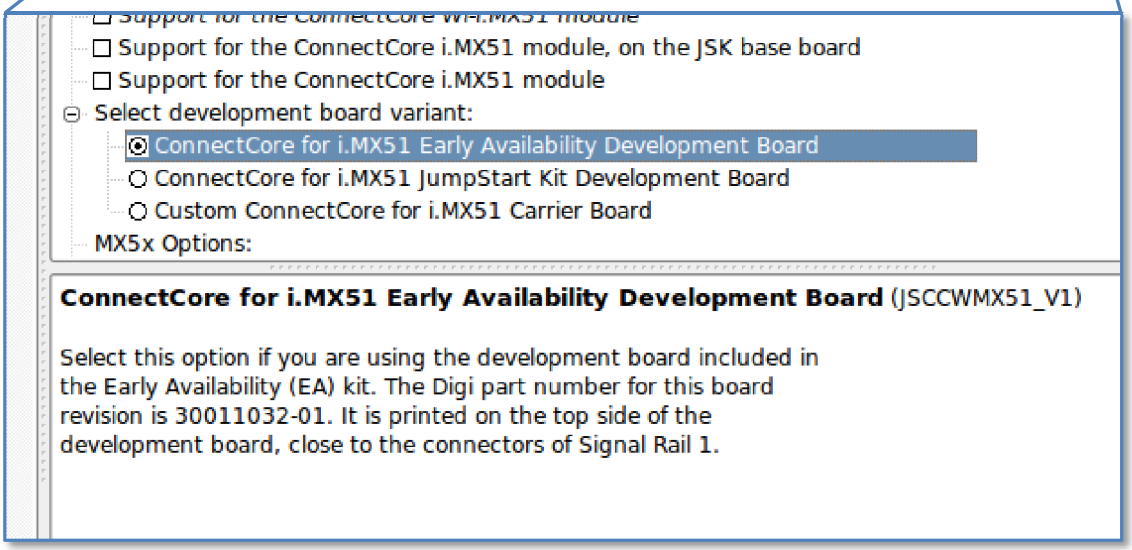
Please download and install the most recent Digi software platform support releases available online at http://ftp1.digi.com/support/patches/i.MX51/CC_i.MX51_EA_Updates.htm.

Digi Embedded Linux

When using Digi Embedded Linux 5.6 (or greater), you need to make sure that your project is configured properly to use the EA variant of the Digi JumpStart Kit development board.

To do that, create a new Digi Embedded Linux kernel/rootfs/U-Boot project in Digi ESP, click on the *Configure Project* icon, and select "ConnectCore for i.MX51 Early Availability Development Board" under *Linux Kernel Configuration -> System type -> Freescale MXC implementations*. See screenshots below for guidance.





After saving the configuration, simply build and install your project as usual.

Additional information about how to configure your projects can be found in the Digi Embedded Linux documentation, section “Devices and their hardware resources”.

Microsoft Windows Embedded CE 6.0 R3

When using Microsoft Windows Embedded CE 6.0, you need to ensure your project is configured properly to use the EA variant of the Digi JumpStart Kit development board.

Existing Project

First, open the existing project in Visual Studio that you created with the previous Digi EA software support for Microsoft Windows Embedded CE 6.0 R3.

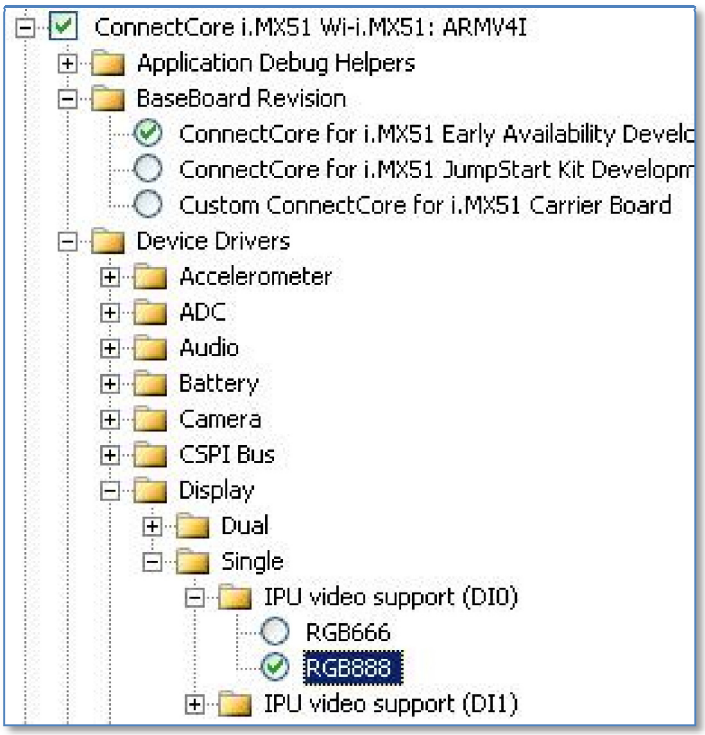
If you see any error messages regarding components that have be renamed or disappeared, just select the components and click on *OK*. This will update the project catalog configuration.

Then change to the *Catalog View* in Visual Studio 2005 and apply the following changes to the settings of *ConnectCore i.MX51 Wi-i.MX51: ARMV4I*:

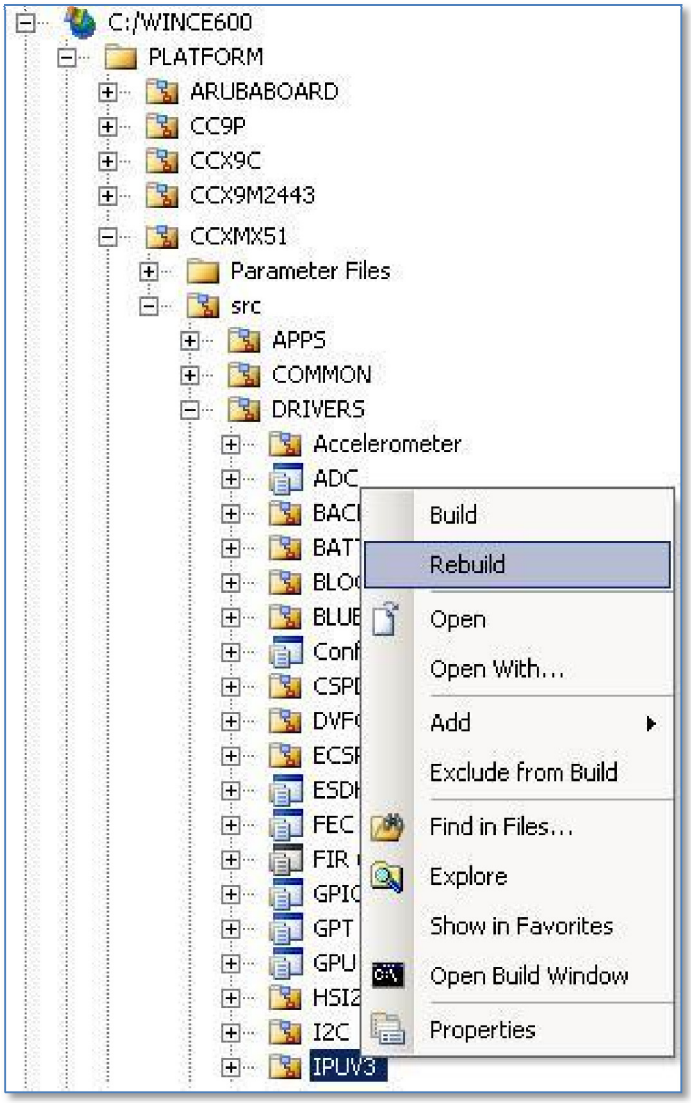
- *Device Drivers -> Display -> Single -> IPU video support (DI0)*
  Select color configuration mode “RGB888”

- *BaseBoard Revision*
  Select “ConnectCore for i.MX51 Early Availability Development Board”

See screenshot below for guidance.



After applying this change to the catalog settings, switch to the *Solution Explorer* and rebuild the folder *IPUV3*. See screenshot below for guidance.

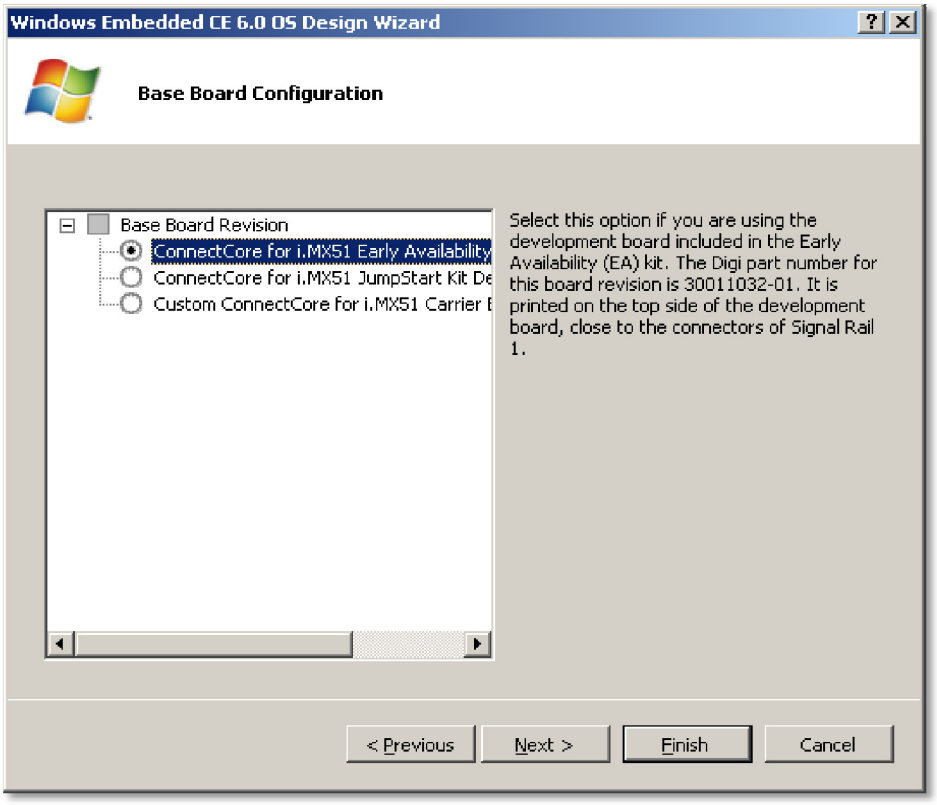


Finally, after rebuilding the video driver, create a run-time image of your project as usual and deploy it to the target.

Please refer to the Digi documentation for Microsoft Windows Embedded CE 6.0 R3 for additional information.

New Project

Use the Digi Design Template to create the new Windows Embedded CE project and select the EA development board under “Base Board Configuration” (step 12). See screenshot below.



Simply build your project as usual and deploy it to the target.

Please also refer to the Digi documentation for Microsoft Windows Embedded CE 6.0 R3 for additional information on how to create projects.

Hardware

This section outlines hardware related differences and particular design impacts.

The information provided should be used in conjunction with the most recent Hardware Reference Module and final development board schematics posted at http://ftp1.digi.com/support/patches/i.MX51/CC_i.MX51_EA_Updates.htm.

Module

The GA modules maintain general backwards-compatibility with all existing customer hardware designs based on EA modules and development kits. The following provides an overview of the module improvements and their compatibility impact on existing customer carrier board designs:

M51-1-1: Mounting Holes

Category	Mechanical
EA Module	Two mounting holes
GA Module	Two *additional* mounting holes (all connected to GND)
Compatibility Impact	☐ Yes ☒ No
Comments	None

M51-2-1: BOOT_MODE

Category	Boot
EA Module	BOOT_MODE signals of i.MX51 not available on module connector
GA Module	BOOT_MODE signals of i.MX51 available on module connector BOOT_MODE0 available on J1.27, BOOT_MODE1 on J1.29
Compatibility Impact	☐ Yes ☒ No
Comments	Allows configuration of i.MX51 processor boot modes If not used, signals should be left disconnected

M51-3-1: On-Module +3.3V DC/DC Converter

Category	Power
EA Module	No capability to disable the on-module +3.3V DC/DC converter
GA Module	New capability to disable the on-module +3.3V DC/DC converter through PWRGTDRV2 signal of Freescale MC13892 PMIC PWRGTDRV2 is still available on the module connector J1.44
Compatibility Impact	☐ Yes ☒ No
Comments	None

M51-3-2: VLIO / 5V_IN

Category	Power
EA Module	Module powered through VLIO only 5V_IN (charger) not connected
GA Module	Module can be powered through VLIO and/or 5V_IN (charger input) Charger input available on module connector J1.48, J1.50, and J1.52
Compatibility Impact	☐ Yes ☒ No
Comments	Allows more efficient/flexible power circuitry design on carrier boards Example: Implementation of single +5V power supply on carrier board providing 5V_IN for module as well as separate voltage required for USB ports. Eliminates additional DC/DC converter.

M51-3-3: VSWLED (Backlight)

Category	Power
EA Module	Signal VSWLED (J2.54) connected to Freescale MC13892, but not working properly due to Freescale errata
GA Module	Signal VSWLED disconnected due to Freescale MC13892 errata
Compatibility Impact	☐ Yes ☒ No
Comments	See also Freescale errata document MC13892ER

M51-3-4: WLAN Power Management

Category	Power
EA Module	Supports hold-in-reset for internal WLAN power management purposes
GA Module	Supports hold-in-reset and disconnect of power through load switch integrated on module for WLAN power management purposes
Compatibility Impact	☐ Yes ☒ No
Comments	None

M51-3-5: WLAN_DISABLE#

Category	Power
EA Module	WLAN_DISABLE# signal (J1.28) not supported
GA Module	WLAN_DISABLE# signal (J1.28) supported
Compatibility Impact	☐ Yes ☒ No
Comments	None

M51-4-1: WDOG#/GPIO1_4

Category	GPIO
EA Module	Signal on J2.109 can be used as Watchdog output (WDOG#) or GPIO (GPIO1_4)
GA Module	Signal on J2.109 can be used as Watchdog output (WDOG#) *only* Signal connected to Watchdog input of Freescale MC13892 PMIC
Compatibility Impact	☒ Yes ☐ No
Comments	None

M51-5-1: WLAN Performance

Category	Other
EA Module	Maximum throughput in 802.11a mode (5 GHz) reduced by about 50%
GA Module	No throughput impact in 802.11a mode (5 GHz)
Compatibility Impact	☐ Yes ☒ No
Comments	None

Development Board

For general reference purposes, this section outlines the key differences between the final GA variant and the EA variant of the Digi JumpStart Kit development board.

The GA variant of the development board mainly provides new features, and supports the EA and GA variants of the ConnectCore for i.MX51 modules. Development board changes are handled in Digi software, as needed.

Schematics and related design files, including complete BOMs, are available on the Digi support website.

The GA variant of the development board, wall power supply included, is also available for purchase as a standard accessory item (Digi P/N CC-ACC-DBMX-51) for development and prototyping purposes.

D51-1-1: Mounting Holes

Category	Mechanical
EA Development Board	Provides two mounting holes for the module
GA Development Board	Provides three mounting holes with fasteners applied
Comments	None

D51-2-1: User Button 1

Category	User Interface
EA Development Board	Uses GPIO1_8/USB_PWR signal for User Button 1
GA Development Board	Uses DISPB2_SER_DIO/GPIO3_6 signal for User Button 1
Comments	Differences handled in Digi software, based on development board selected as part of build process

D51-2-2: 1-Wire

Category	User Interface
EA Development Board	Access to 1-Wire through signal rail 2 (J26.91) only
GA Development Board	Access to 1-Wire through signal rail 2 (J26.91) and new dedicated 2-position pin header (J21)
Comments	None

D51-2-3: UART RTS#/CTS# Signals

Category	User Interface
EA Development Board	Direction of RTS#/CTS# signals (UART1/2/3) reversed
GA Development Board	Direction of RTS#/CTS# signals corrected Level shifters (+2.775V) implemented (RXD/RTS#)
Comments	See also Digi Product Notice #8-4-10 for additional information

D51-2-4: UART3 Header

Category	User Interface
EA Development Board	RXD and RTS# signals connected directly to header (X19)
GA Development Board	RXD and RTS# signals connected to header (X19) through level shifters (+3.3V to +2.775V)
Comments	None

D51-2-5: UART3 Selection (XBee/Header)

Category	User Interface
EA Development Board	No UART3 selection available
GA Development Board	New 3-position headers (J30/J31) allow selection of UART3 for XBee module socket (X28/X29) or UART TTL header (X19)
Comments	None

D51-2-6: MicroSD Card Detect

Category	User Interface
EA Development Board	Card Detect signal connected to MicroSD card connector (X14.9)
GA Development Board	Card Detect signal not connected to MicroSD card connector (X14.9)
Comments	GPIO1_0/SD1_CD#/SPI_SS2 recommended for customer-specific carrier boards utilizing MicroSD card connectors with card detect support

D51-2-7: Digital I/O Terminal Block

Category	User Interface
EA Development Board	X45.1 – DISP2_SER_DIN/GPIO3_5 X45.2 – DISPB2_SER_DIO/GPIO3_6 X45.3 – DISPB2_SER_CLK/GPIO3_7 X45.4 – DISPB2_SER_RS/GPIO3_8/USB_RESET# X45.5 – NANDF_CS4#/PATA_DA0/MII_TXD1/GPIO3_20/SD4_DAT1 X45.6 – NANDF_CS5#/PATA_DA1/MII_TXD2/GPIO3_21/SD4_DAT2 X45.7 – NANDF_CS6#/PATA_DA2/MII_TXD3/GPIO3_22/SD4_DAT3 X45.8 – NANDF_CS7#/MII_TXEN/GPIO3_23/SD3_CLK X45.9 – GND
GA Development Board	*X45.1 – NANDF_RB3/MII_RX_CLK/SPI2_MISO/GPIO3_11* *X45.2 – NANDF_CS2#/PATA_CS0/GPIO3_18/SD4_CLK* *X45.3 – NANDF_RB1/PATA_IORDY/SPI2_RDY/GPIO3_9/USER_LED2* *X45.4 – NANDF_RB2/MII_COL/SPI2_SCLK/GPIO3_10/USER_LED1* X45.5 – NANDF_CS4#/PATA_DA0/MII_TXD1/GPIO3_20/SD4_DAT1 X45.6 – NANDF_CS5#/PATA_DA1/MII_TXD2/GPIO3_21/SD4_DAT2 X45.7 – NANDF_CS6#/PATA_DA2/MII_TXD3/GPIO3_22/SD4_DAT3 *X45.8 – X45.2 – DISPB2_SER_DIO/GPIO3_6/USER_KEY1* X45.9 – GND
Comments	Signal assignment changed

D51-2-8: HS-I2C Header

Category	User Interface
EA Development Board	HS-I2C signals available on dedicated header P23
GA Development Board	HS-I2C header removed
Comments	HS-I2C no longer a supported by Freescale on the i.MX51 due to numerous errata items related to the HS-I2C interface See Freescale document IMX51CE for additional information

D51-2-9: Peripheral Connector

Category	User Interface
EA Development Board	Wrong direction of EIM_CRE/GPIO3_2 (U33) when used as EIM_CRE
GA Development Board	EIM_CRE/GPIO3_2 (U13) with correct direction when used as EIM_CRE
Comments	Related to signal available on P21.44 (Peripheral Connector) only

D51-3-1: On-Board Power Supply

Category	Power
EA Development Board	9-30V is generating VLIO (U15 – LM2576) VLIO is connected to battery terminal header (J23) VLIO is generating +5V (U2 – LTC3125) VLIO voltage connect VLIO pins on module (J1.47/49/51) Charger pins are left unconnected (J1.48/50/52)
GA Development Board	9-30V is generating +5V (U15 – LM22676) VLIO is connected to battery terminal header (J23) VLIO is generating +5V (U2 – LTC3125) The common +5V is generating +3.3V on JumpStart board (U50) VLIO voltage connected to VLIO pins on module (J1.47/49/51) Charger pins (J1.48/50/52) are connected to +5V (output of U15)

Comments	When using an EA module on a GA development board, it is *required* to apply power through the battery terminal header (J23) in order to power the module, due to the revised development board supply path

D51-3-2: Charger Signals

Category	Power
EA Development Board	CHRGSE1# and CHRGLED signals are not implemented
GA Development Board	CHRGSE#1 and CHRGLED signals are supported
Comments	None

D51-3-3: 9-30V DC/DC Converter

Category	Power
EA Development Board	Uses National LM2576 simple switcher component
GA Development Board	Uses National LM22676 simple switcher component
Comments	Both components can be used in carrier board designs Main advantage of LM22676 component is a higher switching frequency of 500 kHz (vs. 52 kHz for LM2576) allowing more efficient use of real estate by selecting smaller supporting components such as capacitors

D51-4-1: LCD1/LCD2

Category	Video
EA Development Board	LCD1 (P1) connector supports up to 24 bit color depth LCD2 (P2) connector supports up to 16 bit color depth 24-bit color depth via HDMI
GA Development Board	LCD1 and LCD2 connectors support up to 18 bit color depth 18-bit color depth via HDMI
Comments	Simplifies dual-screen setups on development board Changes affect connectors P1/P2 and U32/U45 connections Customer can implement other color mode configurations, including 24-bit mode, if needed, on own carrier boards

D51-4-2: Camera 1/Camera 2 Control

Category	Video
EA Development Board	I2C2 used as control interface for Camera 1 HS-I2C used as a control interface for Camera 2
GA Development Board	I2C2 used as control interface for Camera 1 and Camera 2
Comments	Due to Freescale i.MX51 errata related to HS-I2C interface

D51-4-3: Camera 2 Reset

Category	Video
EA Development Board	Camera 2 reset signal is CSI1_D8
GA Development Board	Camera 2 reset signal is DISPB2_SERCLK/GPIO3_7
Comments	None

D51-4-4: HDMI HDCP EEPROM

Category	Video
EA Development Board	HDCP EEPROM (U47) present
GA Development Board	HDCP EEPROM removed
Comments	None

D51-5-1: Bootstrapping (BOOT_MODE)

Category	Video
EA Development Board	Does not allow configuration of BOOT_MODE through user interface of development board (resistor population only)
GA Development Board	New configuration switches S8/S9 added to allow configuration of BOOT_MODE settings by user
Comments	BOOT_MODE signals only available on GA modules

D51-6-1: Audio Codec

Category	Audio
EA Development Board	Schematics show *incorrect* connection of U44.7 signals DACDAT to ~~AUD3_BB_RXD~~ and U44.6 ADCDAT to ~~AUD3_BB_TXD~~
GA Development Board	Schematics corrected by connecting U44.7 DACDAT to AUD3_BB_TXD and U44.6 ADCDAT to AUD3_BB_RXD
Comments	EA development board *operated properly* due to Gerber patch

Part Numbers

The tables below list relevant part numbers and revisions for reference purposes.

Development Kits (GA)

Digi Part Number	Description
CC-WMX51-LX	Digi Embedded Linux Development Kit
CC-WMX51-CE6	Microsoft Windows CE 6.0 R3 Development Kit
CC-WMX51-LL	Timesys LinuxLink Development Kit

Software (GA)

Digi Part Number	Description	Type
40002739_A	Microsoft Windows CE 6.0 R3 Support for ConnectCore for i.MX51 (v2.0.29)	ISO
40002742_A	Digi Embedded Linux 5.6 for ConnectCore for i.MX51	ISO

Part number and revision information included in the corresponding file name.

Documentation (GA)

Digi Part Number	Description	Type
90001129_A	U-Boot Reference Manual	PDF
90001128_C	Hardware Reference Manual for ConnectCore for i.MX51	PDF
55001488_A	Development Board Schematics	PDF

Part number and revision information included in the file name and the actual document.

Hardware (General)

Digi Part Number	Description
55001445-nn	ConnectCore Wi-i.MX51 module variants EA modules also carry the revision indicator “1P” or “2P
55001585-nn	ConnectCore i.MX51 module variants EA modules also carry the revision indicator “1P” or “2P
55001488-01	Early Availability Development Board
55001488-02	General Availability Development Board

Part number information is provided on the corresponding labels applied to the units.

Digi Information

Documentation Updates

Please always check the product specific section on the Digi support website for the most current revision of this document.

Customer support

For more information about Digi products and to contact customer service and technical support, please write us, give us a call, or visit us online.

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Please also visit http://www.digi.com/aboutus/locations.jsp for Digi locations in your country/region.

Document Change Log

Revision	Date	Comments
A	1-6-2011	Initial
B	3-1-2011	Title update, update of outdated chapter references, added accessory Digi P/N reference for GA dev board, updated U-Boot image file name (step 3), WLAN Performance item added (M51-5-1)