conga-SMX8-X (Prototype Revision Y.1)

Sample Distribution Set for congatec SMARC 2.0 Development

Quick Start Guide

Revision 1.1

Preface

This quick start guide provides information about the contents of the conga-SMX8-X (Prototype Revision Y.1) sample distribution set and how to set it up.

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Revision History

Revision	Date (yyyy-mm-dd)	Author	Changes
0.1	2019-02-19	BEU	Preliminary release for X.0
1.0	2019-04-10	BEU	Final release for X.0
1.1	2019-11-15	BEU	Update for Y.1

1 Hardware

1.1 Sample Distribution Set Contents

The contents of the conga-SMX8-X (Prototype Revision Y.1) sample distribution set are listed below:

Part #	Rev.	Name	Description	Qty
007010	C.0	conga-SEVAL	Evaluation carrier board for standard SMARC modules based on SMARC Specification 2.0	1
051100 or 051103	Y.1	conga-SMX8-X/QXP-4G eMMC16 (Prototype) or conga-SMX8-X/QXP-2G eMMC16 (Prototype)	SMARC 2.0 prototype module with NXP i.MX 8QuadXPlus applications processor, 16 GB onboard HS400 eMMC, and 4 GB or 2 GB LPDDR4 onboard memory.	1
051050	X.0	conga-SMX8/i-CSP-B	Passive cooling for SMARC 2.0 module conga-SMX8. All stand-offs are bore hole 2.7 mm.	1
011115	B.0	conga-LDVI/EPI	LVDS to DVI converter board for digital flat panels with onboard EEPROM.	1
033331	A	cab-LVDV-DAT-34-15	15 cm data cable LVDS to DVI adapter	1
052147	A	cab-LVDV-PWR-10-15	15 cm power cable LVDS to DVI adapter	1
48000023	A	RS232 adapter cable	MOLEX 6-pin PicoBlade to 2x D-SUB 9 adapter	1
10000285	A	MicroSDHC-Card UHS-I	Kingston industrial SDCIT/EU Class 10 8 GB microSD card with SD card adapter and preinstalled image.	1
N/A	1.1	Quick Start Guide	conga-SMX8-X Sample Distribution Set Quick Start Guide	1

1.2 conga-SMX8-X

The conga-SMX8-X (Prototype Revision Y.1) included in this sample distribution set is a SMARC 2.0 prototype module featuring the NXP i.MX 8QuadXPlus applications processor, 16 GB HS400 onboard eMMC, and 4 GB or 2 GB LPDDR4 onboard memory.

For information about the Mass Production (MP) variants, refer to the datasheet available at www.congatec.com.

1.2.1 Pinout Description

The conga-SMX8-X (Prototype Revision Y.1) pinout description is available at the link below. The pinout description lists which signals of the NXP i.MX 8QuadXPlus applications processor are routed to the SMARC connector.

https://git.congatec.com/imx8x_early_access/imx8x_sx8x_pinlist

Note

Contact congatec technical support to get access to this folder.

1.3 conga-SEVAL

The conga-SEVAL (Revision C.0) included in this sample distribution set is an evaluation carrier board based on the SMARC Specification 2.0.

For information about the conga-SEVAL, refer to the User's Guide available at www.congatec.com.

1.4   Hardware Setup

Follow the steps below to assemble the hardware:

1. Ensure the hardware is protected from the effects of electrostatic discharge (ESD).

2. On the carrier board, select the boot source via the DIP switches[1,2]:

M18	M17		Selected Boot Source[1,2]
#1	#2	#1	
ON	ON	OFF	SPI flash (default)
OFF	ON	ON	SD card

4. On the carrier board, set DIP switch M12 #1 to OFF (Audio: I²S)

5. Insert the included SD card into the SD card slot of the carrier board.

6. Connect the RS232 adapter cable to the connector on the module.

7. Connect the USB 2.0 to Serial Adapter to the RS232 adapter cable port labeled "CONSOLE".

8. Mount the cooling solution onto the module. (Final torque: 0.4 Nm)

9. Mount the module onto the carrier board. (Final torque: 0.4 Nm)

10. Connect the conga-LDVI/EPI as shown in the image on the right.

11. Connect a Power Supply Unit (PSU)[3] to the carrier board.

12. To start the system, switch the PSU on[4].

Note

1   Boot source selection via DIP switches will not be implemented on Mass Production (MP) variants.

2   To enable serial downloader mode, set jumper X45 to position 2-3. Fastboot is currently not supported.

3   An AT PSU is recommended.

4   If an ATX PSU is used in combination with a modified U-Boot, it may be necessary to push the reset button several times to start the system.
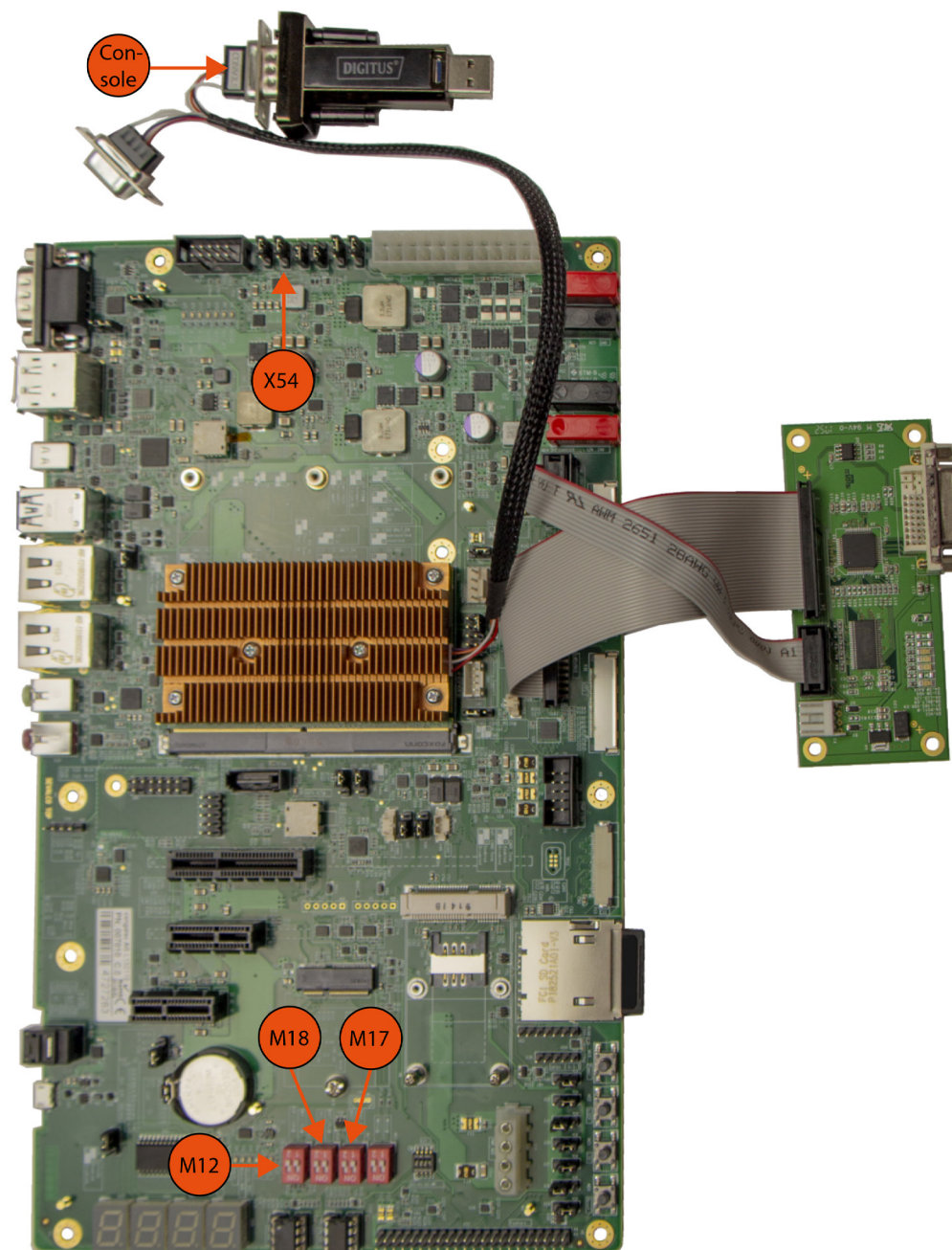
2   Software

2.1   Starting Up

The conga-SMX8-X uses U-Boot as standard bootloader. The bootloader is GNU GPL open source software. A serial terminal connection is required in order to display the boot process and to modify the boot behavior. The boot behavior is controlled via environment variables.

The included RS232 adapter cable has two connectors. The RX/TX signals are already crossed. Therefore, do NOT use a crossover-cable. Use the connector labeled "Console" for the U-Boot console output. Use the unlabeled connector for the System Controller Unit Firmware (SCFW) debug output.

To establish a terminal connection, a terminal program such as TeraTerm or Putty can be used.

Use the following communication parameters:

Baud rate:	115200
Data:	8 bit
Parity:	none
Stop:	1 bit
Flow control:	none

The following console output will be displayed when the system is powered on:

```
U-Boot 2017.03-atp__imx_v2017.03_4.9.123_imx8mm_ga+ga426519 (Dec 05 2018 - 11:48:59 +0000)

CPU:   Freescale i.MX8QXP revB A35 at 1200 MHz at 25C
Model: congatec SMX8-X aka SX8X
Board: conga-SMX8-X aka SX8X
Boot:  SD1
DRAM:  3 GiB
setup_typec lookup gpio@1a_7 failed ret = -22
MMC:   FSL_SDHC: 0, FSL_SDHC: 1
Run CMD11 1.8V switch
*** Warning - bad CRC, using default environment

TX PLL is not locked.
In:    serial
Out:   serial
Err:   serial

 BuildInfo:
  - SCFW 07a6cccf, SECO-FW 31fabbff, IMX-MKIMAGE 7f7b5b25, ATF 30d73be
  - U-Boot 2017.03-atp__imx_v2017.03_4.9.123_imx8mm_ga+ga426519

switch to partitions #0, OK
mmc1 is current device
flash target is MMC:1
bad ssr
Net:   No ethernet found.
Fastboot: Normal
Normal Boot
Hit any key to stop autoboot:  0
=>
```

2.2   Boot Process

The conga-SMX8-X boot process starts at Power On Reset (POR), where the hardware reset logic forces the ARM core to begin execution. The on-chip boot ROM loads the boot container which usually consists of SCFW, Security Controller (SECO) firmware, ARM Trusted Firmware (ATF) and the bootloader binary (U-Boot).

After SCFW loading, the bootloader is executed and performs basic system initialization (serial console, etc.). Afterwards, the environment settings are parsed and the system boot continues as specified.

Press any key during startup to stop autoboot and to get to U-Boot console. At the U-Boot console, the environment settings can be displayed using the "print" command. In addition, useful functionality is available (such as memory dump, access to the SPI and the I2C system, etc.). The "help" command will display any command supported by the U-Boot.

If autoboot is not interrupted by pressing a key, the boot process goes ahead and the module boots the Linux operating system installed on the SD card.

2.3   U-Boot Environment Variables

The U-Boot environment is located in SPI flash. One of the benefits of the U-Boot bootloader is the possibility to specify its run time configuration using environment variables.

The environment variables of U-Boot can be displayed using the printenv (or the print) command.

During the boot process, the bootloader evaluates the "bootcmd" variable and executes it. The boot command tries to load a bootscript or a kernel from the boot device. If this is successful, the script or kernel will be started, otherwise a fallback to network boot is performed. The variable "mmcdev" specifies the mmc boot device. Furthermore, the variable "mmcroot" is passed to the kernel in order to specify the location of the root filesystem.

The following environment variables are predefined for conga-SMX8-X (Prototype Revision Y.1):

Name	Default value	Description
bootcmd		Defines the startup command of the bootloader, i.e. how the system performs the boot process
fdt_file	imx8qxp-cgtsx8x.dtb	The device tree blob, might be exchanged in order to enhance functionality
image	Image	The name of the kernel image file that is loaded during boot process
ipaddr	not specified	Address of the system (used for network boot)
serverip	not specified	Address of the remote host (used for network boot)
netmask	not specified	Netmask of the network (used for network boot)
nfsroot	not specified	The location where the NFS root filesystem is stored (used for network boot)
mmcdev	"1" (external SD card)	The boot device number (used for mmcboot)
mmcpart	"1" (first partition)	The number of the bootpartiton on the bootdevice (used for mmcboot)
mmcroot	"/dev/mmcblk1p2 rootwait rw" (2nd partition on device 1)	The root filesystem (used for mmcboot), might also be used to extend the kernel command line

Following, some frequently used scripts:

Name	Description
mmcboot	Boots the system from mmc (with the specified parameters for mmcboot), i.e. eMMC, SD card
mmcargs	Configures the bootargs for mmcboot
netboot	Boots the system from network (with the specified parameters for network boot)
netargs	Configures the bootargs for network boot
loadbootscript	Used during boot, loads an eventually existing boot script
loadimage	Used during boot, loads the kernel
loadfdt	Used during boot, loads the device tree blob file

There are several commands to change the behavior of the bootloader and to customize the boot process. The help command can be used to display a list of all available commands.

2.4 Updating or Fixing the Boot Container

The boot container of the conga-SMX8-X (Prototype Revision Y.1) is stored in SPI flash. To update or fix a corrupted boot container, boot from a recovery SD card instead of SPI flash. Follow the steps below to create a recovery SD card and update or fix the boot container:

1. Flash your root filesystem image to an SD card[1] ("recovery SD card"):

    ```
    dd if=your_rootfs.sdcard of=/dev/sdX
    ```

2. Write your boot container (SD) to the recovery SD card:

    ```
    dd if=your_bootcontainer_sd.bin of=/dev/sdX bs=1k seek=32
    ```

3. Copy your boot container (SPI flash) to the recovery SD card:

    ```
    mkdir -p /mnt/sd
    mount /dev/sdX1 /mnt/sd
    cp -avr your_bootcontainer_fspi.bin /mnt/sd/.
    sync; umount /mnt/sd
    ```

4. Insert the recovery SD card into the SD card slot of the carrier board

5. Set the DIP switches to boot from SD card (see step 2 of section 1.4)

6. Start the system (see step 12 of section 1.4)

7. Log in as root and enter the following commands:

    ```
    cd /run/media/mmcblk1p1
    flash_eraseall /dev/mtd0
    dd if=xyz_bootcontainer_fspi.bin of=/dev/mtd0
    poweroff
    ```

8. Switch the PSU off

The boot container is updated. The recovery SD card can be removed and the DIP switches set back to boot from SPI flash (see step 2 of section 1.4).

▭▷ **Note**

1   *Do not use the SD card included in the sample distribution set for this purpose.*

2.5 Linux

By default, the bootloader loads the Linux operating system stored on the SD card. The operating system image is built by Yocto.

Booting to the Linux desktop may take some time. To speed up the boot process significantly, install the root filesystem onto the onboard eMMC device.

Note

In order to maintain the integrity of the filesystem, it is recommended to always shut down the system by issuing the command "poweroff" in the console terminal.

2.6 Additional Information

The software provided on the included SD card is based on the Yocto Project (www.yoctoproject.org) and i.MX 8QuadXPlus specific add-on layers provided by NXP and congatec.

The conga-SMX8-X software documentation is available at:
https://git.congatec.com/imx8x_early_access/meta-fsl-bsp-release

The conga-SMX8-X sources required to build the root filesystem image, kernel and bootloader are available at:
https://git.congatec.com/imx8x_early_access

Caution

Using the wrong source can cause damage to the hardware and/or loss of data. For the conga-SMX8-X Prototype Revision Y.1, only use sources from branches ending with "_cgtsx8x-Y1".

Note

Contact congatec technical support to get access to the repositories.