conga-SKIT/ARM i.MX8

Starter Kit for congatec SMARC 2.0 Development

Quick Start Guide

Revision 1.1

Preface

This quick start guide provides information on the contents of the conga-SKIT/ARM i.MX8 and how to set it up.

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1 Hardware

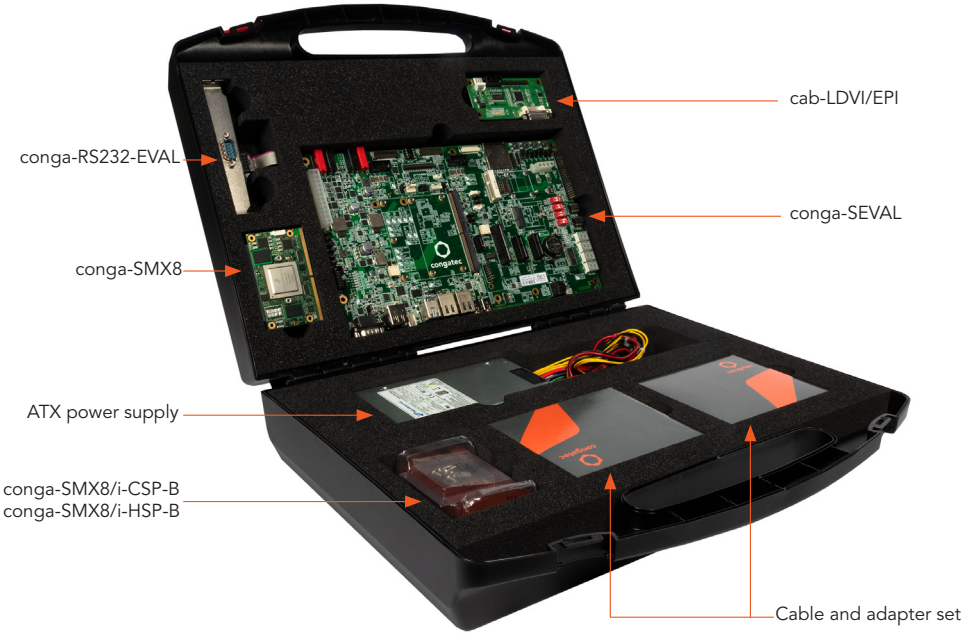
1.1 conga-SMX8 and conga-SEVAL

The conga-SMX8 features application processors from the NXP i.MX8 product family with up to 8 GB LPDDR4 onboard RAM and 16 GB onboard HS400 eMMC. It is available in commercial and industrial temperature range.

The conga-SEVAL evaluation carrier board provides 1x PCIe x1, 1x mPCIe, 1x M.2 Key E, 1x USB 2.0 OTG Micro AB, 1x USB Type A, 1x USB 2.0 Type A, 1x USB 3.1 Type-C, 1x USB 2.0 on M.2, and 1x USB 2.0 on mPCIe. It also provides 2x RJ45 for Gigabit Ethernet, 4x COM, 2x CAN bus, 12x GPIO, Digital and analog audio I/Os for I2S and HDA. Displays can be connected via dual channel LVDS, eDP, DP and HDMI. Additional storage media are available via a SD/MMC socket and 1x SATA 6 Gbps port.

1.2 Kit Content

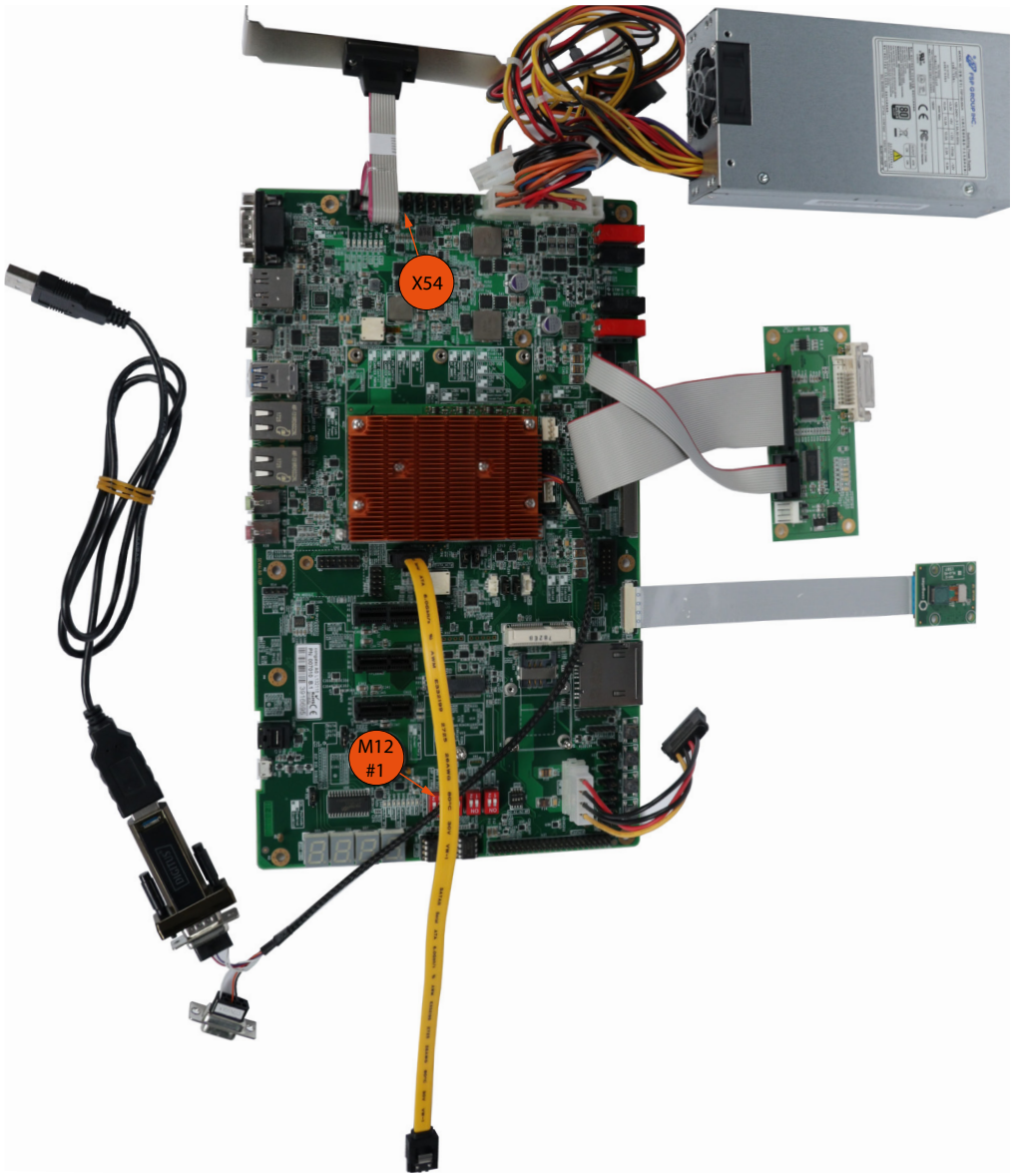
Part #	Name	Description	Qty
007010	conga-SEVAL	Evaluation carrier board for standard SMARC modules based on SMARC Specification 2.0	1
051020	conga-SMX8/i-QCM-6GB eMMC16	SMARC 2.0 module with NXP i.MX8 QuadMax application processor, 1 MB L2 cache, 6 GB LPDDR4 onboard memory and 16 GB onboard HS400 eMMC.	1
10000285	MicroSDHC-Card UHS-I	8GB - Kingston industrial SDCIT/EU Class 10 with preinstalled image.	1
051050	conga-SMX8/i-CSP-B	Passive cooling solution. All stand-offs are bore hole 2.7mm	1
051051	conga-SMX/i-HSP-B	Standard heatspreader. All stand-offs are bore hole 2.7mm	1
011115	conga-LDVI/EPI	LVDS to DVI converter board for digital flat panels with onboard EEPROM	1
016153	conga-ACAM/JAL-2721	MIPI camera module adapter with camera JAL-2721. Image sensor OV5640. MIPI CSI-2.	1
48000026	Flat Foil Cable	FFC for conga-ACAM/JAL-2721. 36 pins, pitch 0.5mm, length 150mm, opposite side contact.	1
033331	cab-LVDV-DAT-34-15	15cm data cable LVDS to DVI adapter	1
052147	cab-LVDV-PWR-10-15	15cm power cable LVDS to DVI adapter	1
10000116	USB 2.0 to Serial Adapter	USB 2.0 to Serial Adapter DSUB9 based on FTDI FT232	1
14000200	cab-RS232-EVAL	20cm 2x5pin female to D-Sub 9P male	1
14000202	SATA power cable 12cm	12cm SATA HDD 15pin SATA to 4pin ATX	1
48000023	RS232 adapter cable	MOLEX 6-Pin PicoBlade to two D-SUB 9	1
48000029	SATA III cable 30 cm	30cm SATA III cable, straight / straight	1
500016	ATX Power Supply	FSP180-50L max. 180 W (150 x 81.5 x 40.5 mm)	1
85500014	Quick Start Guide	Quick Start Guide	1
91500002	Safety and Regulatory Information	Safety and Regulatory Information	1
91500003	Wireless Content Information	Wireless Content Information	1



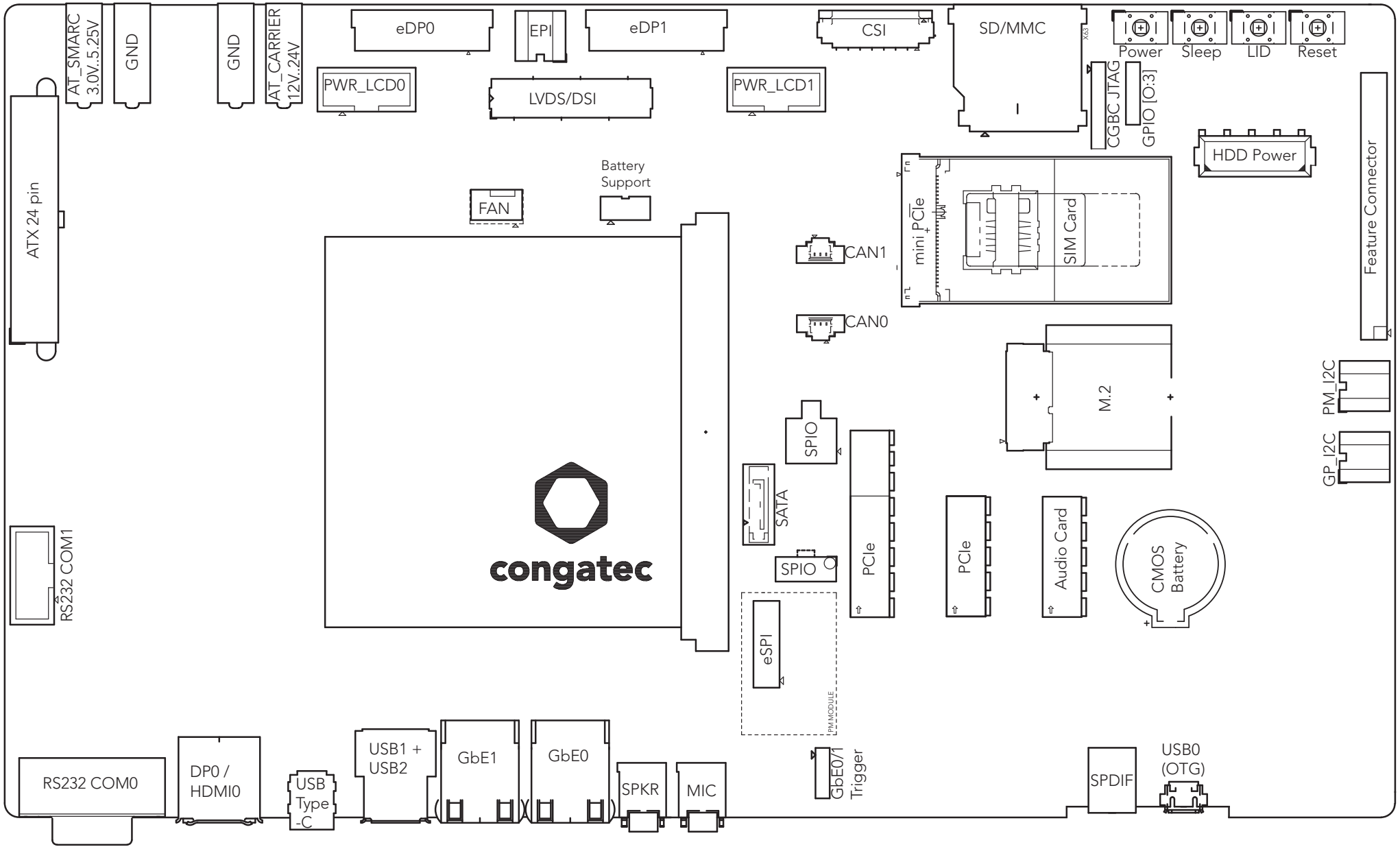
1.3 Connecting the Hardware

1. Ensure the hardware is protected from the effects of electrostatic discharge (ESD).
2. On the conga-SEVAL carrier board, set DIP switch M12 #1 to OFF (I²S). See picture on the right for the location of M12 #1.
3. On the conga-SEVAL carrier board, set jumper X54 to position 2-3 (CARRIER_PWRON). See picture on the right for the location of X54.
4. Ensure the included microSD card is inserted into the slot of the module.
5. Attach the RS232 adapter cable to the connector on the module.
6. Attach the conga-SMX8 module to the carrier board.
7. Mount the conga-SMX8/i-CSP-B passive cooling solution.
8. If required, connect the MIPI camera module or skip to step 9:
   a. Pull the black slider until you feel a resistance.
   b. Fully slide the flat-foil cable inside the slot above the black slider. The exposed conductive traces of the flat-foil cable must face up.
   c. Press against the black slider until it is locked.
9. Connect the cables and adapters as shown in the picture on the right.
10. Plug a power cable (not included) into the ATX power supply.
11. To power on the system, plug the power cable into a power outlet (110V-240V) and switch on the PSU.

NOTE: The power, sleep, and LID buttons currently have no function.

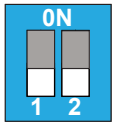


1.4 Interfaces



1.5 DIP Switch Settings

M11 - DIP Switch (Wireless Disable Signal 1, 2)



Switch #	Switch ON	Switch OFF
1	W_DISABLE1# ON	W_DISABLE1# OFF*
2	W_DISABLE2# ON	W_DISABLE2# OFF*

M12 - DIP Switch (Audio and Display)

Switch #	Switch ON	Switch OFF
1	HDA*	I²S
2	eDP	LVDS / DSI*

M18 - DIP Switch (SPI_HOLD#)

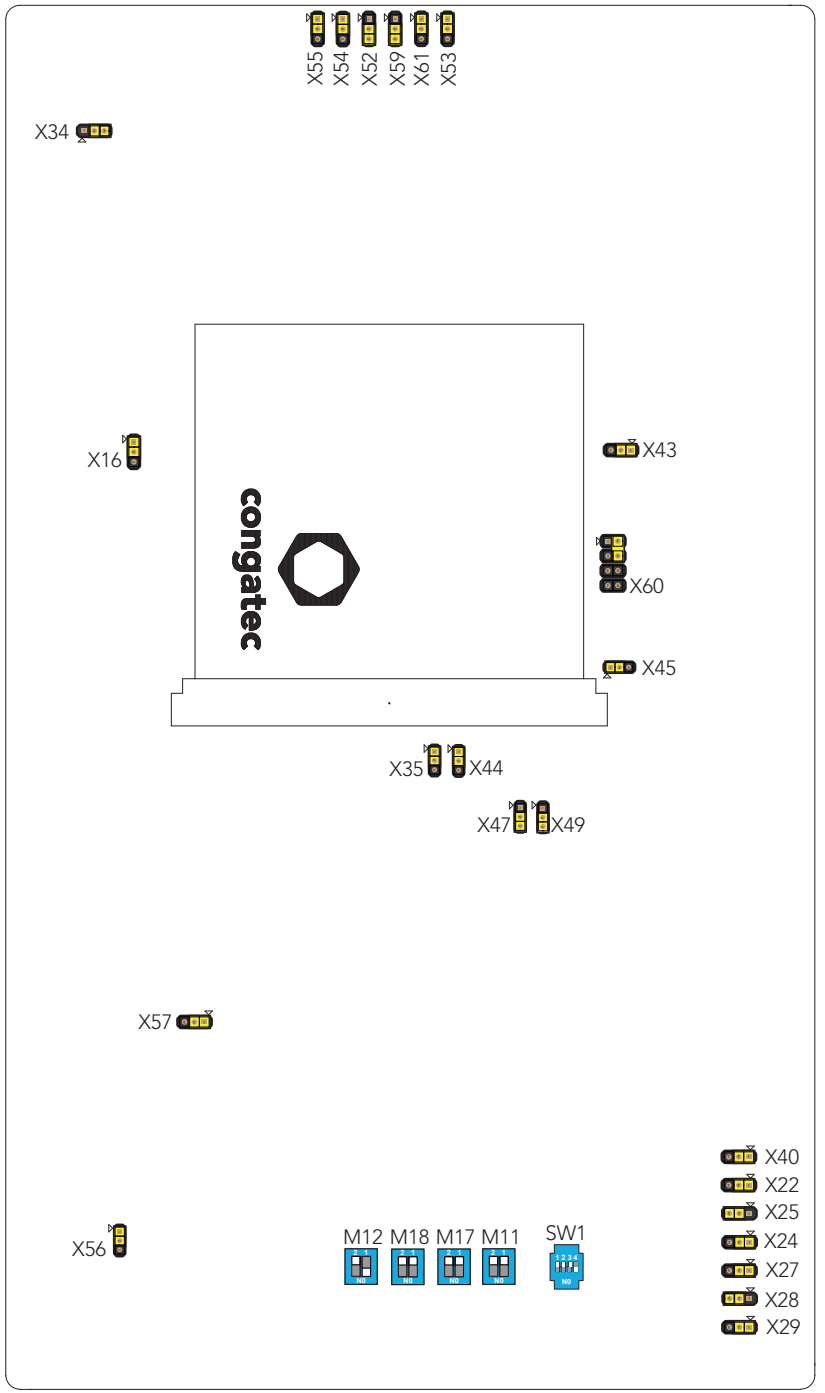
Switch #	Switch ON	Switch OFF
2	SPI_HOLD# ON	SPI_HOLD# OFF*

M18 - DIP	M17 - DIP		Selected Boot Source*1
Switch 1	Switch 2	Switch 1	
ON	ON	ON	Boot from Fuses
ON	OFF	ON	USB Serial Downloader
OFF	ON	ON	eMMC0 Boot
OFF	OFF	ON	Carrier Board SD
OFF*	OFF*	OFF*	Module microSD

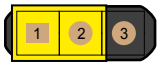
SW1 - DIP				Selected I2C Address
Switch 1	Switch 2	Switch 3	Switch 4	
ON	OFF	OFF	OFF	A0
OFF	ON	OFF	OFF	A1
OFF	OFF	ON	OFF	A2
OFF*	OFF*	OFF*	ON*	WP

*Default setting. Change to the setting highlighted in red for conga-SMX8 module.

*1 Boot source selection does not conform to the SMARC specification.



1.6 Jumper Settings



X16 - LAN LEDs

Pin	Configuration
1-2	Standby powered*
2-3	Main powered

X22 - LCD0 VDD

Pin	Configuration
1-2	3.3 V panel power*
2-3	5 V panel power

X24 - LCD0 BKLT_EN

Pin	Configuration
1-2	Non-inverted*
2-3	Inverted

X25 - LCD0 BKLT

Pin	Configuration
1-2	Backlight power 12 V
2-3	Backlight power 5 V*

X27 - LCD1 Panel Power

Pin	Configuration
1-2	3.3 V*
2-3	5 V

X28 - LCD1 BKLT1

Pin	Configuration
1-2	12 V
2-3	5 V*

X29 - LCD1 BKLT_EN1

Pin	Configuration
1-2	Non-inverted*
2-3	Inverted

X34 - HDMI/DP1*1

Pin	Configuration
1-2	DP1 @ USB Type-C
2-3	HDMI*

X35 - DP1 AUX_SEL*1

Pin	Configuration
1-2	Pull-down*
2-3	Pull-up

X40 - GPIO [0:7]

Pin	Configuration
1-2	Enabled*
2-3	Disabled

X43 - FAN Power

Pin	Configuration
1-2	12V*
2-3	5V

X44 - JTAG/Camera*3

Pin	Configuration
1-2	JTAG*
2-3	Camera

X45 - FORCE_RECOV#*3

Pin	Configuration
1-2	Normal operation*
2-3	Serial Downloader

X47 - CAN0 Term

Pin	Configuration
1-2	Enabled
2-3	Disabled*

X49 - CAN1 Term

Pin	Configuration
1-2	Enabled
2-3	Disabled*

X52 - SBM3

Pin	Configuration
1-2	Present
2-3	Not present*

X53 - ATX PSON#

Pin	Configuration
1-2	ATX Mode*
2-3	AT Mode / Always ON

X54 - ATX Control

Pin	Configuration
1-2	CARRIER_SBY#*
2-3	CARRIER_PWRON

X55 - SBY Control

Pin	Configuration
1-2	CARRIER_PWRON*
2-3	Always ON

X56 - Postcode

Pin	Configuration
1-2	Enabled*
2-3	Disabled

X57 - RTC Battery

Pin	Configuration
1-2	Normal operation*
2-3	RTC battery disconnected

X59 - Module Power

Pin	Configuration
1-2	3.3 V
2-3	5 V*

X60 - VIN PWRBAD#

Pin	Configuration
1-2	ATX_PG (only for debug)
3-4	AT_CARRIER PG
5-6	+3.3V_ATX PG
7-8	AT_SMARC PG
2-4	No control*

X61 - Power Path

Pin	Configuration
1-2	Automatic* *2
2-3	AT_SMARC

* Default setting. Change to the setting highlighted in red for conga-SMX8 module.

*1 Only for modules with support for DP++ at HDMI0/DP1.

*2 Every time +V3.3A gets enabled, the status of +AT_SMARC is used to select the power path (AT vs. 3.3 V / 5 V). This means once activated, the AT_SMARC path is kept active until a full power cycle is performed.

*3 Jumper function differs from the default conga-SEVAL carrier board function.

2 Software

2.1 Starting Up

The conga-SMX8 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.

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 2017.03-00964-g9871af2-dirty (Aug 03 2018 - 08:34:55 +0200)

CPU:   Freescale i.MX8QM revA A53 at 1200 MHz at 28C
Model: congatec SMX8
Board: conga-SMX8
Boot:  SD2
DRAM:  6 GiB
MMC:   FSL_SDHC: 0, FSL_SDHC: 1, FSL_SDHC: 2
Run CMD11 1.8V switch
In:    serial
Out:   serial
Err:   serial

 BuildInfo:
  - SCFW 8ab8f982, SECO-FW 8ab8f982, IMX-MKIMAGE 7bb91090, ATF 00b653e
  - U-Boot 2017.03-00964-g9871af2-dirty

Run CMD11 1.8V switch
switch to partitions #0, OK
mmc2 is current device
Loading hdp firmware from 0x0000000090000000 offset 0x0000000000002000
Loading hdp firmware Complete
SCSI:  Net:
Warning: ethernet@5b040000 (eth0) using random MAC address - 5a:3d:37:9b:cf:04
eth0: ethernet@5b040000 [PRIME]
Warning: ethernet@5b050000 (eth1) using random MAC address - a6:c5:a3:c4:91:22
, eth1: ethernet@5b050000
Normal Boot
Hit any key to stop autoboot:  0
=>
```

2.2 Boot Process

The conga-SMX8 boot process starts at Power On Reset (POR), where the hardware reset logic forces the ARM core to begin execution, starting from the on-chip boot ROM of the processor.

After loading, the bootloader will be executed and will perform basic system initialization (e.g. the system memory, serial console, etc.). Afterwards, the environment settings are parsed and the system boot will go ahead 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 will boot the Linux operating system that is installed on the microSD card.

2.3 U-Boot Environment Variables

The u-boot environment is located in SPI Flash (in microSD for prototypes). 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:

Name	Default value	Description
bootcmd		Defines the startup command of the bootloader, i.e. how the system performs the boot process
fdt_file	imx8qm-cgtsmx8.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
hdp_file	hdmitxfw.bin	The binary firmware file for enabling HDMI transmit, essential to load if video output to HDMI is desired
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	"2" (onboard microSD)	The boot device number (used for mmcboot)
mmcpart	"1" (first partition)	The number of the bootpartiton on the bootdevice (used for mmcboot)
mmcroot	"/dev/mmcblk2p2 rootwait rw" (2nd partition on device 2)	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, microSD-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
loadhpd	Used during boot, loads the hdmi firmware 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 Linux

By default, the system boots the Linux operating system that is stored on the microSD card. The operating system image is Yocto.

Booting to the Linux desktop may take some time. This is because the complete system initialization occurs from a microSD card connected via a 4-bit interface.

To speed up the boot process significantly, install the root filesystem onto the onboard eMMC device or an external SATA device.

Note

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

2.5 Additional Information

The software provided with the conga-SKIT/ARM i.MX8 is based on the Yocto Project (www.yoctoproject.org) and i.MX8 specific add-on layers provided by NXP and congatec.

In order to rebuild the root filesystem image, kernel and bootloader for conga-SMX8, the complete kernel source, bootloader source and individual patches can be obtained from the congatec source code repository:
https://git.congatec.com/imx8_early_access

Further software documentation can be found here:
https://git.congatec.com/imx8_early_access/meta-fsl-bsp-release

Note

Contact congatec technical support to get access to the repository.