

## 1 Subject

<b>Affected Products</b>	conga-QMX6		
<b>Subject</b>	Quick Start Guide		
<b>Date (dd.mm.yy)</b>	17.05.13	<b>Author</b>	MSW

## 2 Affected Article Numbers

Article Number(s)	Product
Numerous	conga-QMX6 (hardware revision B.1)

## 3 Information

The conga-QMX6 Starter Kit (pn 077500) includes:

Item Number	Item Name	Qty
007005	conga-QEVAL/Qseven 2.0	1 each
	QMX6 Heatsink	1 each
011115-	conga-LDVI/EPI (LVDS-to-DVI adapter) with an XGA EDID data set	1 each
016103	conga-QMX6/QC-1G eMMC4	1 each
016150	conga-ACC/I2S	1 each
016160	conga-QMX6/HSP1	1 each
033331	cab-LVDV-DAT-34-15; cable set LVDS	1 each
052147-	cab-LVDV-PWR-10-15	1 each
10000101	MicroSDHC-Card 8GB with Ubuntu boot Image	1 each
48000023	RS232 console adapter cable for conga-ARM modules	1 each
48000024	HDMI to DVI-D adapter	1 each
500016-	ATX Power Supply FSP180-50LE_MOD	1 each
500025	conga-HDMI ADD2 Card (connector card for the PEG connector (HGCA))	1 each

### Note

*The  $\mu$ SD card is already installed in the  $\mu$ SD card socket of the conga-QMX6 module.*

The connector layout picture below shows the various connectors available on the conga-QMX6:

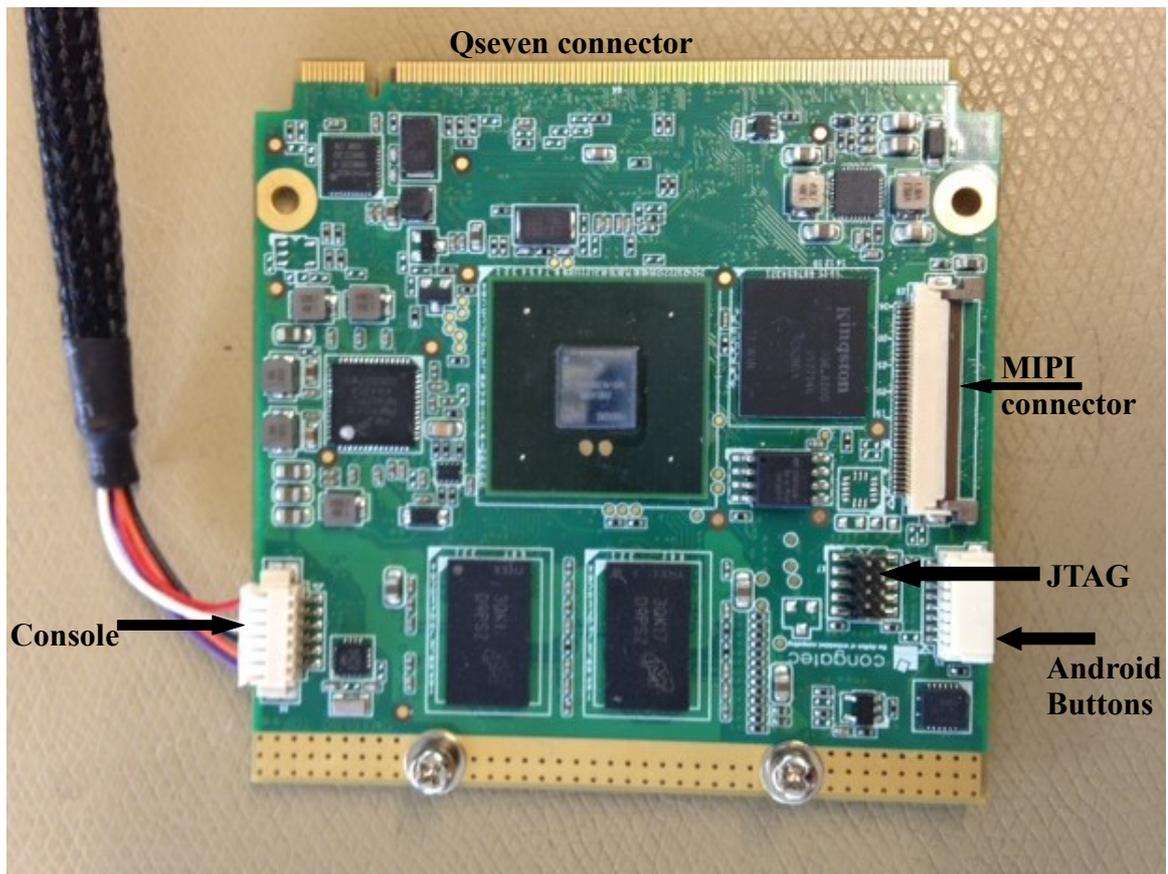


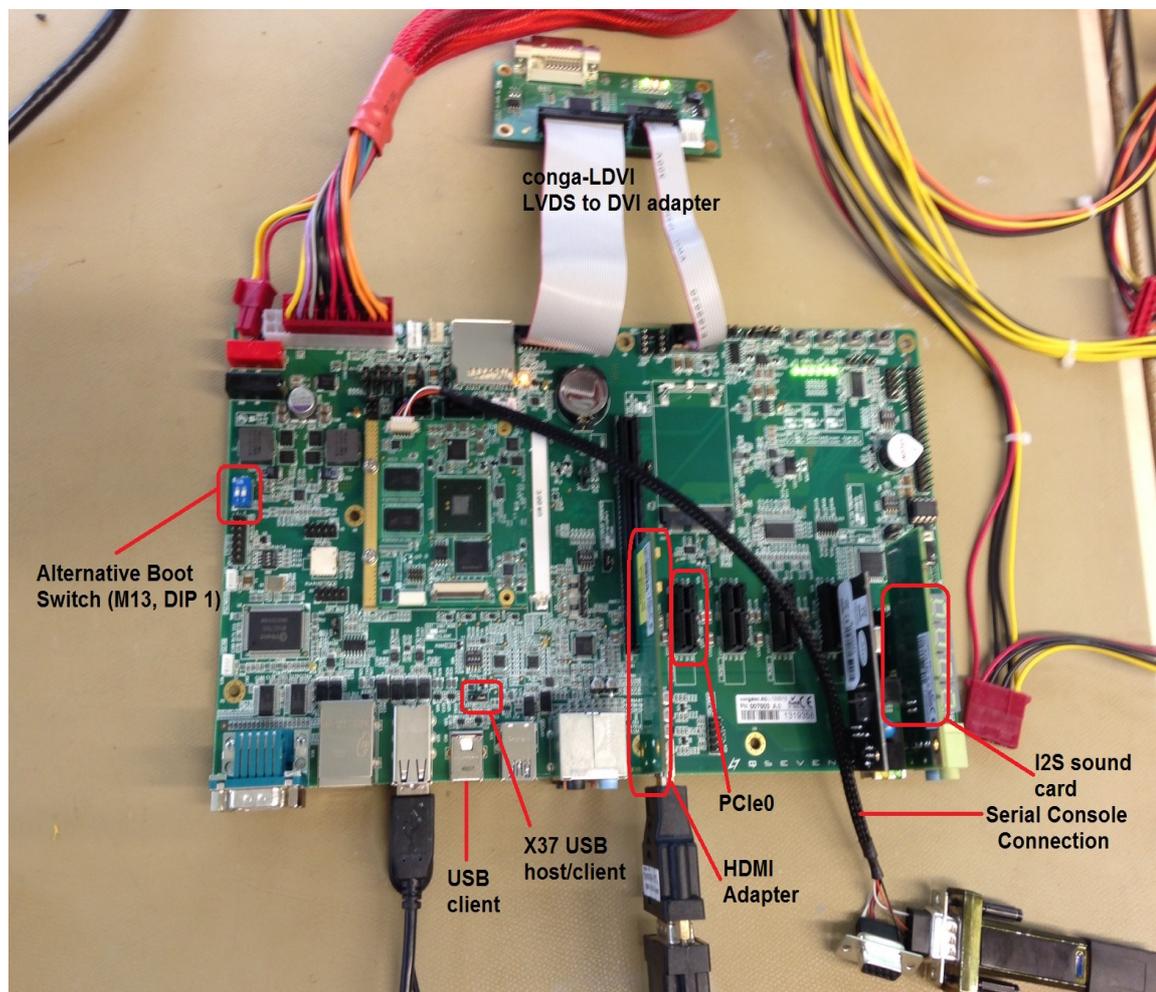
Figure 1- Onboard connectors

 **Note**

*Currently, at the bootloader level, only a few i.MX6 onchip devices are enabled by default. This leads to a low power consumption. However, power consumption may increase significantly depending on the application and the workload of the CPU.*

*Please install the provided heatsink with the use of the enclosed self adhesive thermal tape.*

## 4 Hardware Setup



**Figure 2-Hardware Setup**

In order to setup the hardware, the following components should be connected to the conga-QEVAL/Qseven 2.0:

- install the conga-QMX6 (already assembled in the conga-QEVAL backplane when the Starter Kit is delivered)
- plug in the HDMI adapter card (HGCA) onto the PEG slot (X15)
- plug in the sound card adapter (ACC1) in HDA/AC97 slot (CN10)
- attach the conga-LDVI (optional) on the LVDS interface (CN12)
- attach the console adapter cable (conga-QMX6, X6)
- attach the power supply (either a standard ATX power supply via CN38 or a 12V power supply via M5/M6 can be used)
- connect the serial console with a terminal PC using a standard 9-pin D-Sub serial

cable (not included in the starter kit)

- attach a HDMI to the HDMI adapter card
- attach speakers to the sound adapter card (the green jack)
- connect PCIe card to PCIe0 connector.

#### 4.1 Required DIP Switch Settings When Using conga-QMX6 On conga-QEVAL/Qseven 2.0 Carrier Board

The jumpers on conga-QEVAL/Qseven 2.0 must be set in the following way to work with the conga-QMX6:

Switches	DIP 1	DIP2	DIP3	DIP4	Comment
SW1	OFF	OFF	OFF	OFF	I2C EEPROM is not needed, better leave if off because it could conflict with I2S soundcard
SW2	OFF	OFF	OFF	OFF	There is no support for LPC bus on QMX6
SW3	ON	OFF	OFF	OFF	FAN_PWMOUT/SPKR/FAN_TACHOIN are GPIOs on the QMX6, must be first implemented in kernel before using them.
SW4	ON	ON	ON	ON	
SW9	OFF	OFF	OFF	OFF	
M13	OFF (BOOT_ ALT# Jumper)	OFF			Dip 1 of Switch M13 must be set to 'ON' when updating the conga-QMX6 bootloader. Jumper on X37 connector has to be changed to position 2-3 to enable USB client

#### 4.2 Default Jumper and DIP Switch Settings for conga-QEVAL/Qseven 2.0

The default jumper configuration of conga-QEVAL/Qseven 2.0 looks like this:

Jumper	Default	Jumper	Default	Switches	DIP 1	DIP2	DIP3	DIP4
X9	2-3	X44	1-2	SW1	ON	ON	ON	ON
X17	1-2	X46	1-2	SW2	ON	ON	OFF	ON
X22	1-2	X47	2-3	SW3	ON	ON	ON	ON
X28	1-2	X48	1-2	SW4	ON	ON	ON	ON
X29	1-2	X49	1-2	SW9	OFF	OFF	OFF	OFF
X32	1-2	X50	1-2	M13	OFF	OFF		
X33	1-2	X51	1-2					
X37	1-2	X52	1-2					
X43	1-2							

## 5 Starting Up

The conga-QMX6 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 behaviour. The boot behaviour is controlled via environment variables.

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

Use the following communication parameters:

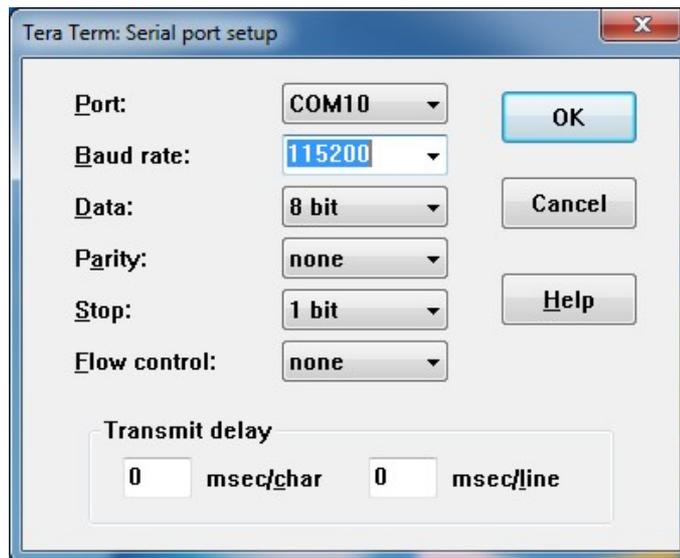


Figure 2. Terminal communication parameters

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

```
COM10:115200baud - Tera Term VT
File Edit Setup Control Window Help
U-Boot 2009.08 QMX6R001 (Sep 21 2012 - 08:13:50)
CPU: Freescale i.MX6 family T01.1 at 792 MHz
Temperature: 35 C, calibration data 0x5964f37d
mx6q p111: 792MHz
mx6q p112: 528MHz
mx6q p113: 480MHz
mx6q p118: 50MHz
ipg clock : 660000000Hz
ipg per clock : 660000000Hz
uart clock : 800000000Hz
cspi clock : 600000000Hz
ahb clock : 1320000000Hz
axi clock : 2640000000Hz
emi_slow clock : 293333333Hz
ddr clock : 5280000000Hz
usdhc1 clock : 1980000000Hz
usdhc2 clock : 1980000000Hz
usdhc3 clock : 1980000000Hz
usdhc4 clock : 1980000000Hz
nfc clock : 240000000Hz
Board: i.MX6Q-QMX6; V.0 Board: 0x63011 (POR 1)
Boot Device: SPI NOR
I2C: ready
DRAM: 2 GB
MMC: FSL_USDHC: 0,FSL_USDHC: 1,FSL_USDHC: 2
JEDEC ID: 0xbf:0x25:0x4a
Reading SPI NOR flash 0xc0000 [0x2000 bytes] -> ram 0x27600b20
SUCCESS
In: serial
Out: serial
Err: serial
Found PFUZE100! device id=10
Net: got MAC address from IIM: 00:13:95:0b:e8:9d
FEC0 [PRIME]
Hit any key to stop autoboot: 0
conga-QMX6 U-Boot >
```

## 5.1 Boot process

The conga-QMX6 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. In normal operation (in contrast to the alternative boot mode, that is selected via conga-QEVAL, CN31), the Boot ROM uses the state of the BOOT\_MODE register and eFUSES of the processor to determine the boot device.

The i.MX6 bootfuses on conga-QMX6 are preconfigured to fetch the bootloader from the onboard SPI flash. 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 µSD card.

By default, the environment variables are set up to search for the boot script “6q\_bootscript” on any of the mass storage device (µSD card, external SD card and onboard eMMC card). If this script is found, it will be sourced and executed. Thereafter, the “6q\_bootscript” script will load and execute the Linux kernel.

### 5.1.1 Environment variables

One of the benefits of the u-boot bootloader is the possibility to specify its run time configuration using environment variables. Also the u-boot environment is located in SPI Flash, particularly at the offset position 0xC0000. The size of the environment is 0x2000 bytes.

The environment variables of u-boot can be displayed using the *printenv* (or the *print*) command.

The following environment variables are predefined for conga-QMX6:

```
bootdelay=3
baudrate=115200
ipaddr=192.168.1.103
serverip=_SERVER_IP_ADDR_
netmask=255.255.255.0
loadaddr=0x10800000
rd_loadaddr=0x11000000
netdev=eth0
ethprime=FEC0
ethaddr=00:00:00:00:00:00
uboot=u-boot.bin
kernel=ulmage
vid_dev0=hdmi,1920x1080M@60,if=RGB24
vid_dev1=ldb,LDB-XGA,if=RGB666
bootargs=console=ttymx1,115200
bootargs_base=setenv bootargs ${bootargs} video=mxcb0:dev=${vid_dev0} video=mxcb1:dev=${vid_dev1}
bootargs_mmc=setenv bootargs ${bootargs} rootwait enable_wait_mode=on
bootargs_nfs=setenv bootargs ${bootargs} root=/dev/nfs ip=dhcp nfsroot=${serverip}:${nfsroot},v3,tcp
enable_wait_mode=off
bootcmd_net=dhcp; run bootargs_base bootargs_nfs; bootm
bootcmd_mmc=run bootargs_base bootargs_mmc; for disk in 0 1 2; do mmc dev ${disk}; for fs in fat ext2 ; do ${fs}load
mmc ${disk}:1 10008000 /6q_bootscript && source 10008000 ; done ; done
```

```
bootcmd=run bootcmd_mmc
clearenv=sf probe 1 && sf erase 0xc0000 0x2000 && echo restored environment to factory default
upgradeu=for disk in 0 1 2; do mmc dev ${disk} ;for fs in fat ext2 ; do ${fs}load mmc ${disk}:1 10008000 /6q_upgrade &&
    source 10008000 ; done ; done
bootfile=_BOOT_FILE_PATH_IN_TFTP_
nfsroot=_ROOTFS_PATH_IN_NFS_
stdin=serial
stdout=serial
stderr=serial
ethact=FEC0
```

During the boot process, the bootloader evaluates the “bootcmd” variable and executes it. In particular, the script that is stored in “bootcmd\_mmc” variable will be executed. It is used to setup the kernel command line parameters (via “run bootargs\_base bootargs\_mmc”) and to enumerate through the disks in order to find and to execute the “6q\_bootscrip”

Very often, an environment variable does not just contain an ordinary value, but a complete small script that can be executed using the 'run' command (see also variable “bootcmd\_mmc” and variable “clearenv”).

Detailed description of the environment variables:

- **bootdelay=3**

This is the number of seconds that u-boot waits before it executes the contents of the bootcmd variable. During this time, the boot can be interrupted by pressing any key.

- **baudrate=115200**

The baudrate of the console in bps.

- **ipaddr=192.168.1.103**

IP address, when using tftp to fetch the bootfile.

- **serverip=\_SERVER\_IP\_ADDR\_**

The server IP address, when using tftp to fetch the bootfile.

- **netmask=255.255.255.0**

The subnet mask,when using tftp to fetch the bootfile.

- **loadaddr=0x10800000**

The memory location where the bootfile is loaded to

- **rd\_loadaddr=0x11000000**

The memory location where the initial RAMDisk is loaded to

- **netdev=eth0**

The ethernet interface.

- **ethprime=FEC0**  
The primary Ethernet interface
- **ethaddr=00:00:00:00:00:00**  
Ethernet MAC address for the ethernet interface. The MAC address is usually provided from the i.MX6 OTP configuration. In general, there is no need to modify this value.
- **uboot=u-boot.bin**  
The name of the u-boot binary
- **kernel=ulmage**  
The name of the kernel image
- **nfsroot=\_ROOTFS\_PATH\_IN\_NFS\_**  
Specifies the path to the NFS root filesystem, when booting from network/NFS.
- **bootargs=console=ttymx1,115200**
- **bootargs\_base=setenv bootargs \${bootargs} video=mxcfb0:dev=\${vid\_dev0}  
video=mxcfb1:dev=\${vid\_dev1}**  
The basic boot arguments that are passed to the Linux kernel. Usually, these arguments are expanded during the boot process in order to establish different boot behaviour (e.g. for standard boot or boot via NFS)
- **bootargs\_nfs=setenv bootargs \${bootargs} root=/dev/nfs ip=dhcp nfsroot=\${serverip}:\${nfsroot},v3,tcp**  
The boot arguments that are passed to the Linux kernel when booting from network. Please notice, that the default bootargs will be expanded by executing 'run bootargs\_nfs'.
- **bootcmd\_net=dhcp; run bootargs\_base bootargs\_nfs;bootm.**  
This variable/script is used to boot from network. DHCP address resolution is performed and the file specified by 'bootfile' will be loaded. Afterwards, the 'bootfile' will be executed using the 'bootm' command.
- **bootargs\_mmc=run bootargs\_base bootargs\_mmc;for disk in 0 1 2; do mmc dev \$ {disk};for fs in fat ext2 ; do \${fs}load mmc \${disk}:1 10008000 /6q\_bootscript && source 10008000 ; done ; done**  
This variable/script is used to perform standard boot from SD card or eMMC.
- **bootcmd=run bootcmd\_mmc**  
The start-point of the boot process.
- **clearenv=sf probe 1 && sf erase 0xc0000 0x2000 && echo restored environment to factory default**

This variable/script is used to erase the current environment and to restore default values.

- **bootfile**=\_BOOT\_FILE\_PATH\_IN\_TFTP\_

Specifies the file that is loaded using the tftp command. Needs to be specified properly in order to be used with a TFTP server.

- **ethact**=FEC0

Specifies the Ethernet interface when booting via network (TFTP/NFS). Usually, this value does not need to be changed.

- **vid\_dev0**=hdmi,[1920x1080@60](#),if=RGB24

The configuration for the first frame buffer device. In the default configuration, this device maps to the HDMI port, provides Full high definition resolution and provides a RGB24 color mapping.

**vid\_dev1**=ldb,LDB-XGA,if=RGB666

The configuration for the second frame buffer device. In the default configuration, this device maps to the LVDS port (ldb), provides XGA resolution and a RGB666 (18-bit) color mapping.

- **stdin**=serial
- **stdout**=serial
- **stderr**=serial

Maps all standard text input/output/error consoles to the serial port.

### 5.1.2 Changing the u-boot environment.

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.

Below is a list of the most useful commands:

- **help**: prints a help text for each command
- **print**: prints a list of the current environment variables
- **setenv**: sets the value of an environment variable
- **save**: saves the current u-boot environment to SPI Flash
- **bootm**: boots an application image that is stored in memory. If booting a linux image, this command accepts arguments.
- **dhcp**: invokes a DHCP request in order to obtain IP/boot parameters, and boots an image via network

- **run**: runs a script stored in an environment variable.
- **spi**: used to manage the SPI subsystem, e.g. to select, read and program devices.
- **mmc**: used to manage the MMC subsystem
- **sata**: used to manage the SATA interface and connected devices
- **i2c**: used to manage the I2C interface and connected devices

### 5.1.2.1 Example: Setting the display to LVDS:

To change the display configuration on u-boot for LVDS, and use the LVDS to DVI converter card included in the kit, we could do it in this way:

```
setenv bootargs_base 'setenv bootargs ${bootargs} video=mxcfb0:dev=${vid_dev0}  
video=mxcfb2:dev=${vid_dev1}'
```

```
setenv vid_dev0 'ldb,LDB-XGA,if=RGB24'
```

```
setenv vid_dev1 'hdmi,800x480@60,if=RGB24'
```

```
save
```

This defines a XGA resolution for the LVDS panel. We define the lvds on vid\_dev0 because we configured this video device for framebuffer 0 (mxcfb0); that is the framebuffer active by default on software.

## 5.2 Linux operating system

By default, the system boots the Linux operating system that is stored on the  $\mu$ SD card. The operating system image is based on Ubuntu 11.10 "Oneiric".

Booting to the Linux desktop may take some time. This is because the complete system initialization occurs from a  $\mu$ SD card (which is connected via a 4bit 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 shutdown the system cleanly by issuing the command "shutdown -h now" or "poweroff" in the console terminal.*

## 6 Additional Information

---

The software that is installed on the Starter Kit is based on the Freescale toolchain 3.0.35-4.1.0. In order to rebuild the kernel and the bootloader for conga-QMX6, software patches are required. These patches, or the complete kernel and bootloader source, can be obtained from our git server: <https://git.congatec.com/public>

## 7 Revision History

---

Revision	Date (dd.mm.yy)	Author	Changes
1.0	09.07.12	MSW	Initial release.
1.1	08.11.12	GEL	Added additional information to the "Note" in section 4 about the use of X86 based Qseven modules. Added information to section 5 about editing u-boot.
1.2	17.12.12	SML	Reworked throughout.
1.3	16.05.13	GEL	Revised for revision A.0 of the module.
1.4	28.08.13	GEL	Document adapted to the new BOM: Removed references to the hardware revision of the components of the kit. Added HSP and information about the MIPI camera module
1.5	23.10.2013	GEL	Added an example of how to configure the system for an LVDS panel
1.6	06.03.2014	GEL	Removed MIPI camera , revised to match rev B.x of the module
1.7	07.03.2014	GEL	Corrected typo, changed LVDS parameters on section 5.1.2.1 to match the LVDS to DVI converter card.
1.8	11.04.2014	GEL	Document adapted to conga-QEV2/Qseven 2.0
1.9	16.04.2014	GEL	Corrected p.n. For conga-QEVAL/Qseven 2.0 for ARM
1.10	30.04.2014	GEL	Corrected typo