How to Use AM57x/DRA7x DFU Boot Mode with Linux Host

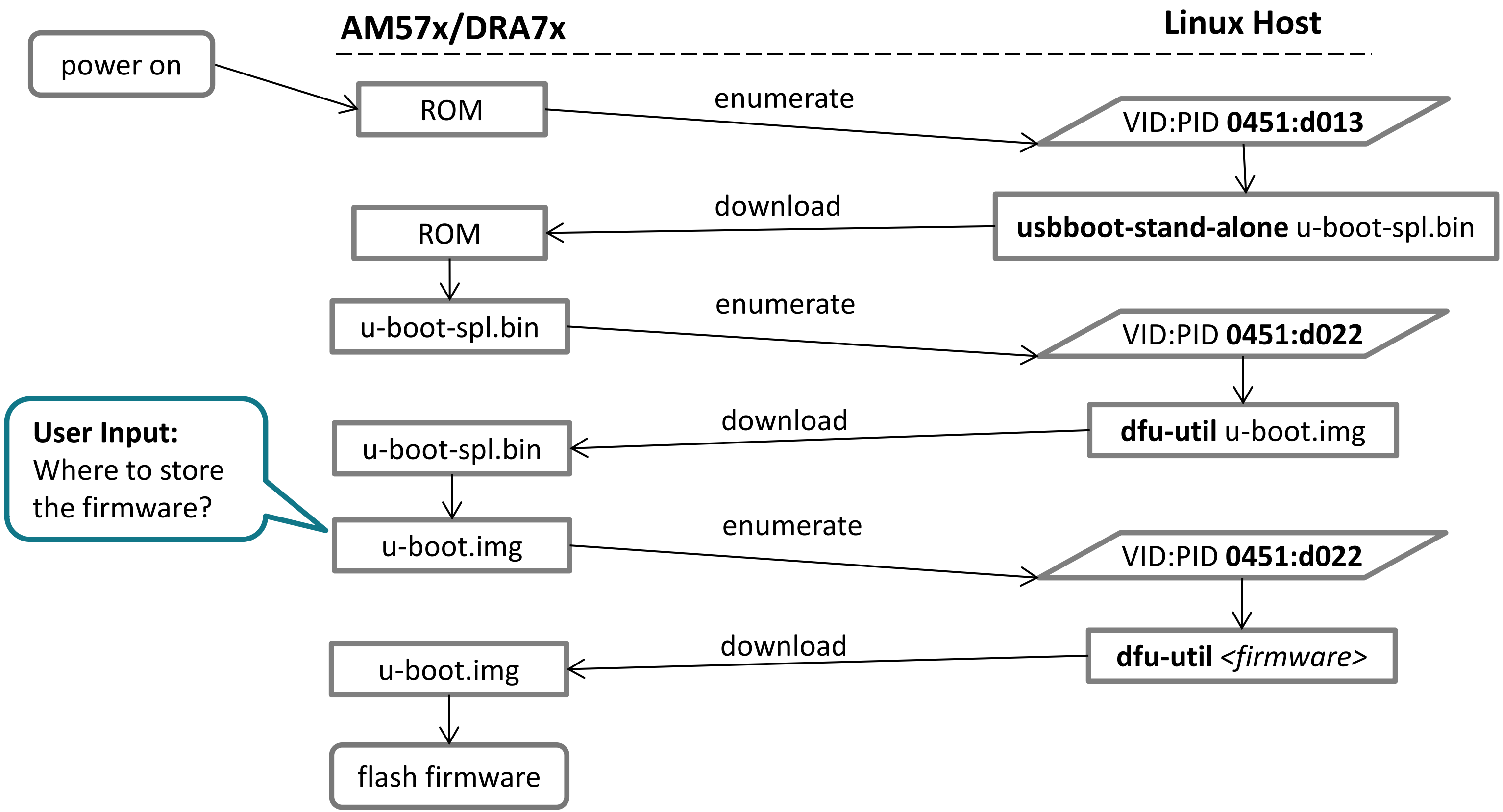
Flashing an image on AM57x/DRA7x with U-boot DFU using USB peripheral boot mode

Linux Core U-Boot User's Guide:
http://processors.wiki.ti.com/index.php/Linux_Core_U-Boot_User%27s_Guide

Introduction

- What is DFU?
  - Device Firmware Upgrade
  - Mechanism for upgrading device firmware via USB
    - The USB device informs the host of its DFU capability
    - The host transfers the firmware to the device
    - The device flashes the firmware to target storage, such as eMMC or NAND
  - Specifications defined by USB-IF
  - Supported in U-Boot
- AM57x/DRA7x devices support Peripheral booting via USB1 interface
  - Support USB High- and Full-speed
- Jacinto6 EVM
  - Uses DRA7x device
  - Supports USB1 interface in device mode
- Demo
  - using DFU to flash zImage to SD card first partition from a Linux host

AM57x/DRA7x DFU flow



DFU on AM57x: U-Boot User's Guide

http://processors.wiki.ti.com/index.php/Linux_Core_U-Boot_User's_Guide

- #Using_USB_Device_Firmware_Upgrade (DFU)
- #Updating_an_SD_card_or_eMMC_using_DFU
- #Writing_to_NAND_via_DFU
- #Writing_to_QSPI_using_DFU

Preparation outline

- Linux Host
  - Tools
    - usbboot-stand-alone
    - dfu-utils
  - Images
    - uboot spl/u-boot.img
    - firmware to be flashed
- Device
  - USB connection
  - Sysboot mode
  - SD card

Preparation: Compile usbboot

- Fetch and build *usbboot* tool on the Ubuntu host PC:

```
host$ git clone git://git.omapzoom.org/repo/omapboot.git
host$ cd omapboot
host$ checkout 609ac271d9f89b51c133fd829dc77e8af4e7b67e
host$ make -C host/tools
```

- This generates host side tool called *usbboot-stand-alone*
- Copy *usbboot-stand-alone* into your executable $PAT
  so that you don’t have to type in the full path when you execute it.

Preparation: Install dfu-util

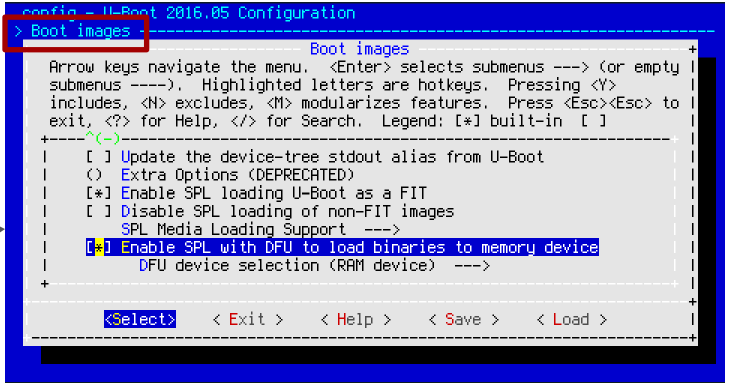
Install *dfu-util* on the Ubuntu host PC:

```
host$ sudo apt-get install dfu-util
```

Preparation: Compile U-Boot with DFU enabled

- Enable SPL_DFU support in U-Boot

```
host$ export ARCH=arm
host$ export CROSS_COMPILE=<toolchain_path>
host$ make dra7xx_evm_defconfig
host$ make menuconfig
```



```
config - U-Boot 2016.05 Configuration
> Boot images ----------------------------------------------------------------
  +------------------------------- Boot images -------------------------------+
  | Arrow keys navigate the menu.  <Enter> selects submenus ---> (or empty    |
  | submenus ----).  Highlighted letters are hotkeys.  Pressing <Y>           |
  | includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc> to    |
  | exit, <?> for Help, </> for Search.  Legend: [*] built-in  [ ]            |
  | +----^(-)--------------------------------------------------------------+  |
  | |      [ ] Update the device-tree stdout alias from U-Boot              |  |
  | |      ()  Extra Options (DEPRECATED)                                  |  |
  | |      [*] Enable SPL loading U-Boot as a FIT                          |  |
  | |      [ ] Disable SPL loading of non-FIT images                       |  |
  | |          SPL Media Loading Support  --->                             |  |
  | |      [*] Enable SPL with DFU to load binaries to memory device       |  |
  | |            DFU device selection (RAM device)  --->                   |  |
  | +----------------------------------------------------------------------+  |
  +---------------------------------------------------------------------------+
  |        <Select>    < Exit >    < Help >    < Save >    < Load >           |
  +---------------------------------------------------------------------------+
```

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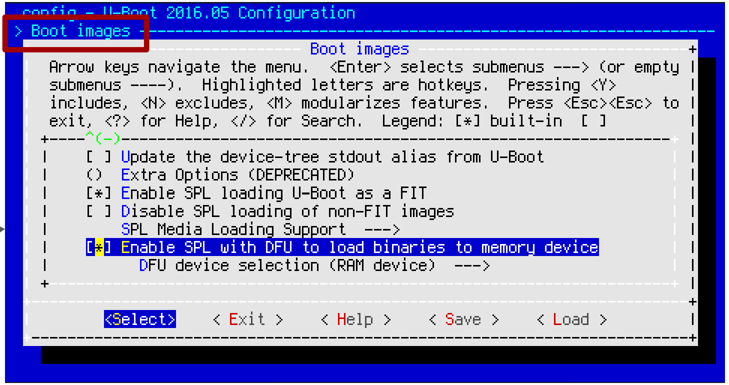
- Disable Hush Shell in U-Boot
  - To reduce the memory footprint



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  | +------------------------------------------------------------------+   |
  +------------------------------------------------------------------------+
  |         <Select>    < Exit >    < Help >    < Save >    < Load >       |
  +------------------------------------------------------------------------+
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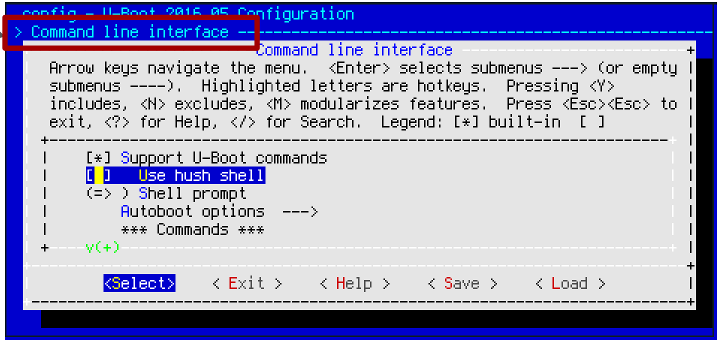

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 > Command line interface ------------------------------------------------
  +----------------------- Command line interface -----------------------+
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  | +------------------------------------------------------------------+   |
  | |    [*] Support U-Boot commands                                   |   |
  | |    [ ]   Use hush shell                                          |   |
  | |    (=> ) Shell prompt                                            |   |
  | |        Autoboot options  --->                                    |   |
  | |        *** Commands ***                                          |   |
  | +----v(+)----------------------------------------------------------+   |
  +------------------------------------------------------------------------+
  |         <Select>    < Exit >    < Help >    < Save >    < Load >       |
  +------------------------------------------------------------------------+
```

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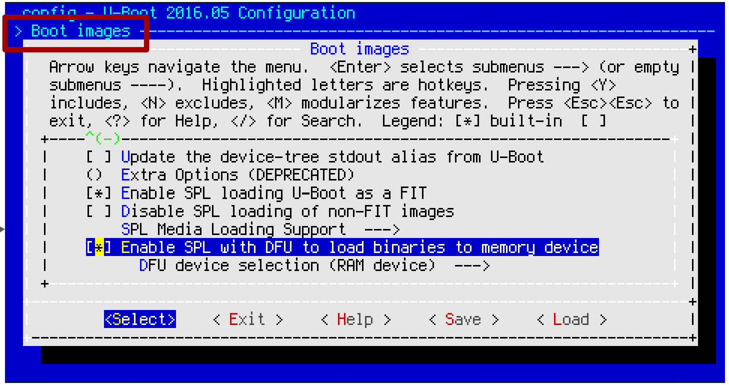

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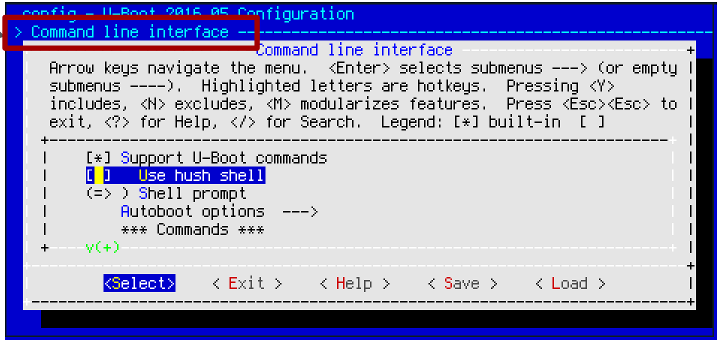

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 |    (=> ) Shell prompt
 |        Autoboot options  --->
 |        *** Commands ***
 +----v(+)
      <Select>    < Exit >    < Help >    < Save >    < Load >
```
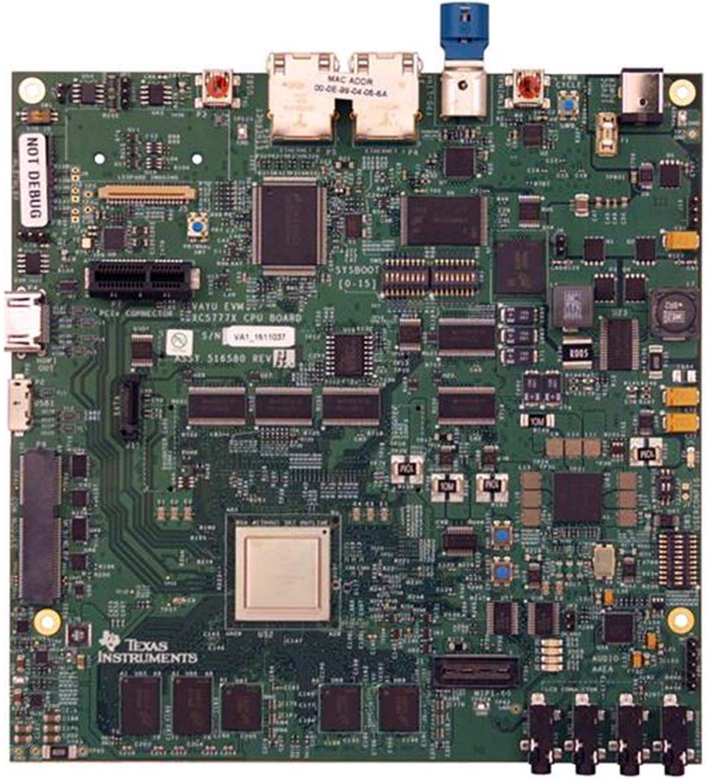
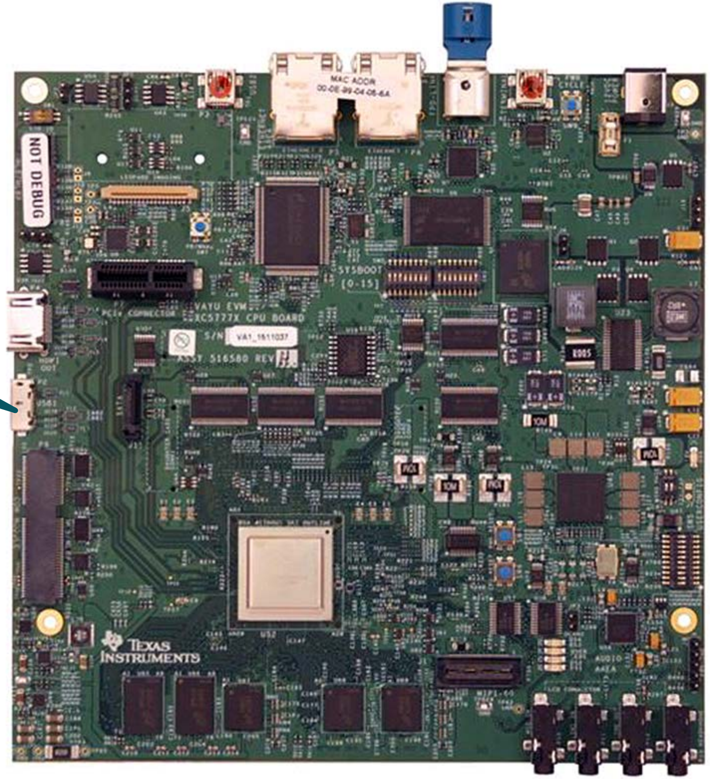

- Build spl/uboot-spl.bin and u-boot.img

```
host$ make
```

Jacinto6 EVM

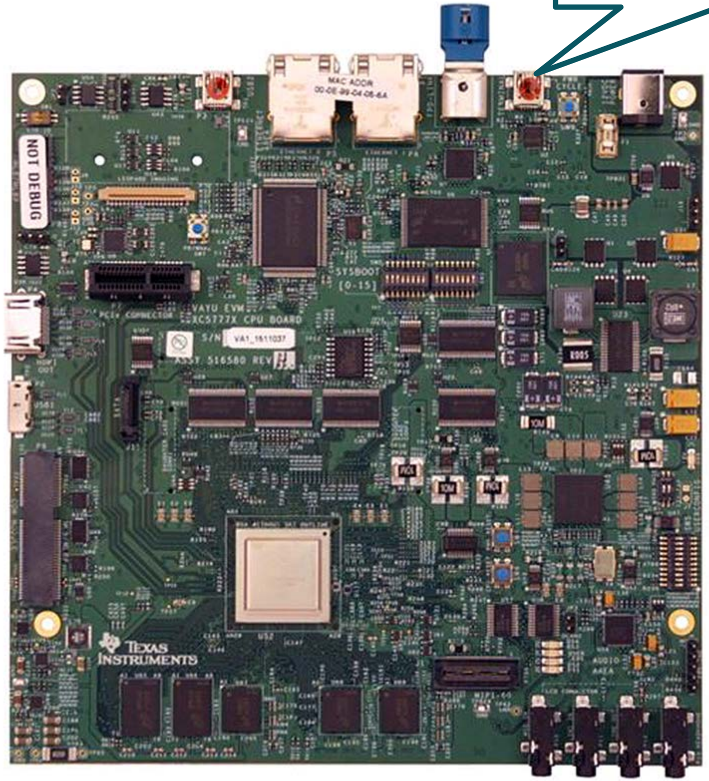


Jacinto6 EVM



USB1 port:
- For DFU in this demo
- Connect micro-B cable

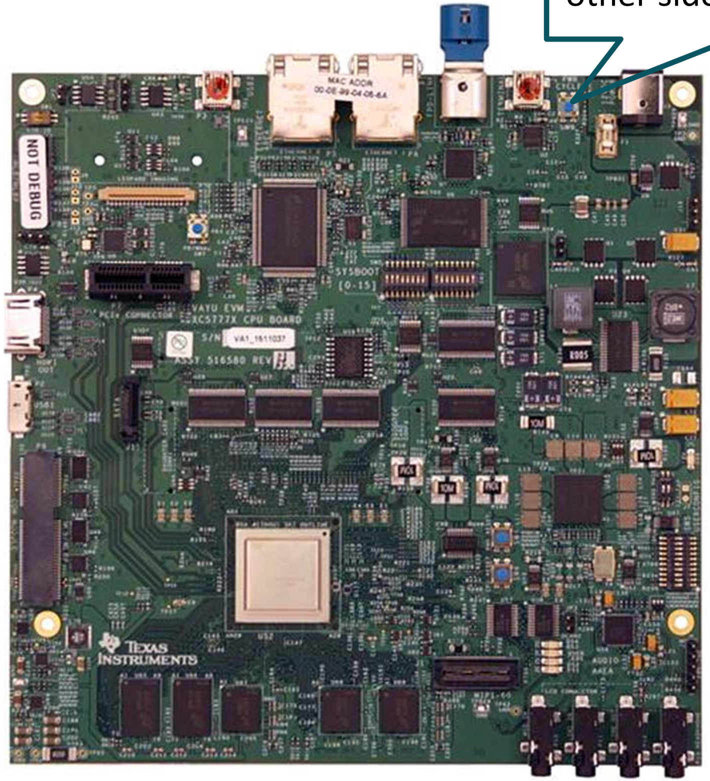
Jacinto6 EVM



TERMINAL port:

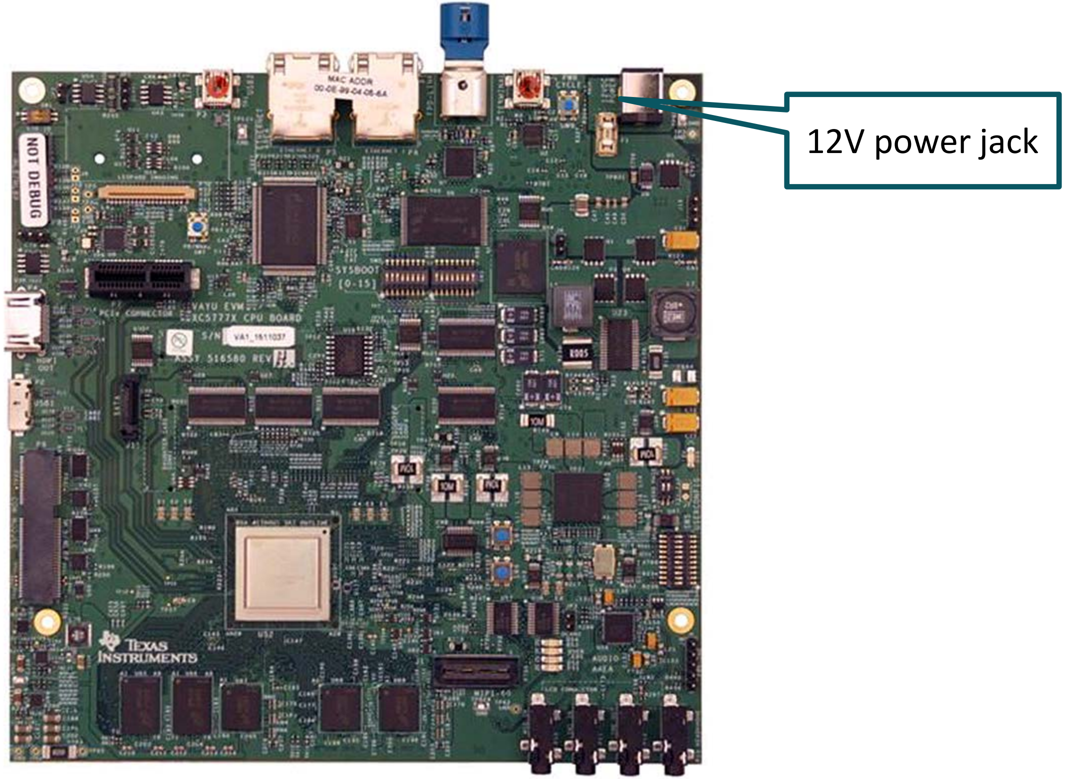
- For UART console
- Connect mini-B cable

Jacinto6 EVM



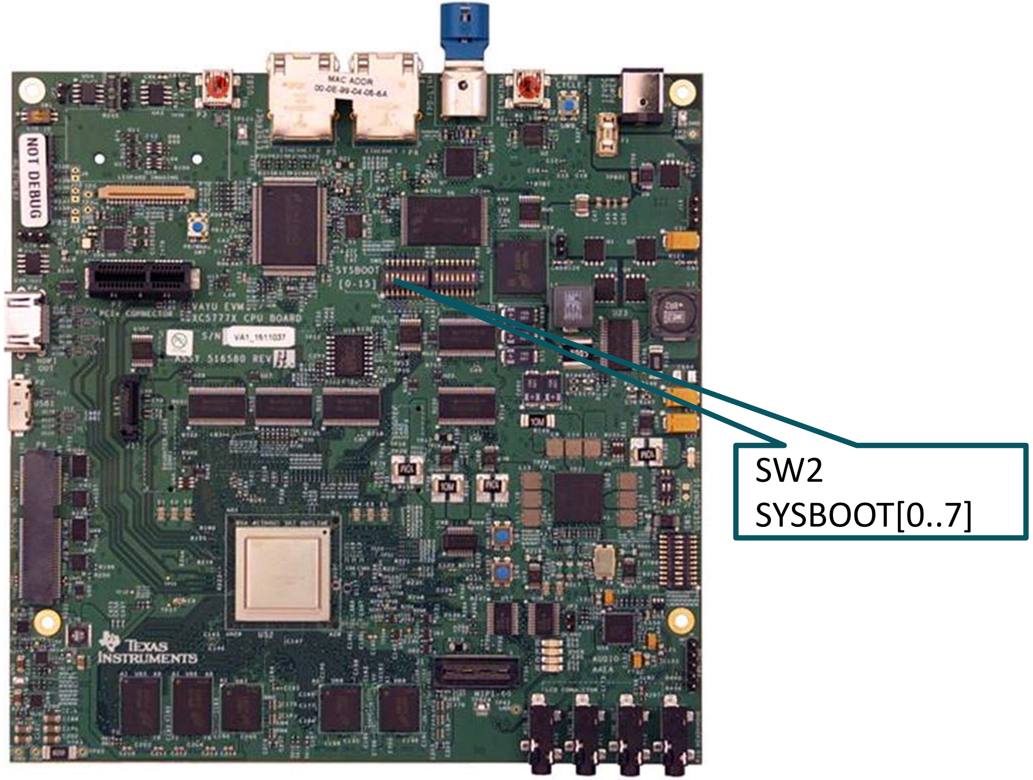
POWER-CYCLE button: MicroSD card slot is on the other side of the board

Jacinto6 EVM



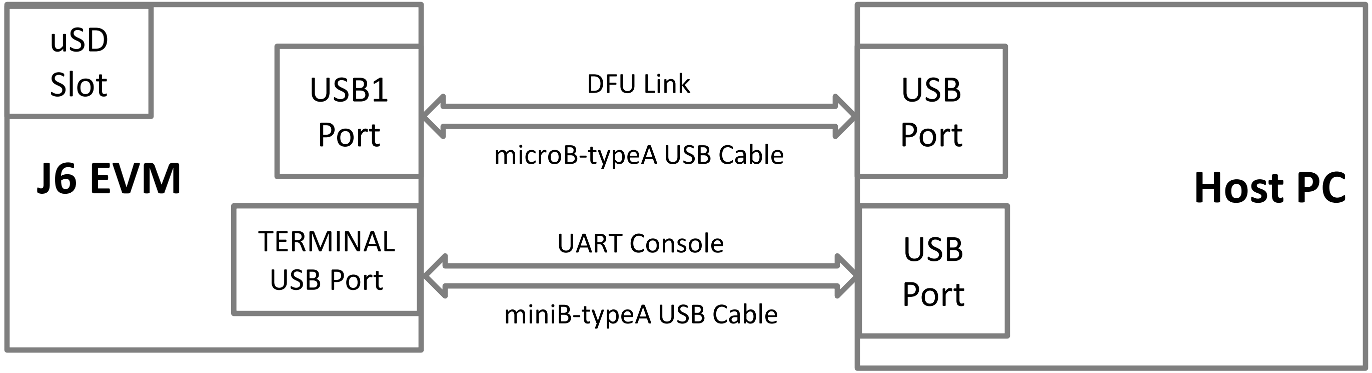
12V power jack

Jacinto6 EVM



SW2
SYSBOOT[0..7]

System setup

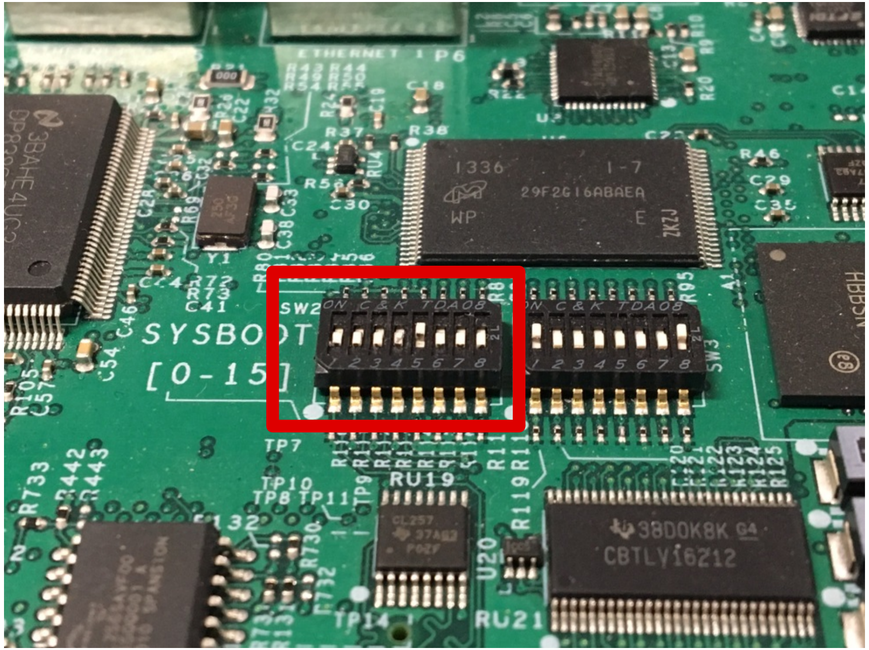


*J6 EVM USB1 port has a super-speed micro-AB receptacle

Jacinto6 EVM Sysboot Setting

Sysboot setting for USB boot:

- SW2[0..7] = 00001000
- 1 is *ON* on the DIP switch
- Refer TRM: Table 33-8



Partition/Format uSD card

- This demonstration shows flashing a file to the uSD card first partition.

- The uSD card should be partitioned to two partitions:
  - uboot env **`dfu_alt_info_mmc`** defines two partitions for mmc/SD.
  - The first partition should be formatted to FAT/VFAT format.
  - Processor Linux SDK has the script *bin/create-sdcard.sh*, which can be used to partition/format the uSD card.

Procedure outline for DFU flashing SD card

1. Download DFU-enabled spl

```
host$ sudo usbboot-stand-alone -S spl/u-boot-spl.bin
```

2. Download DFU-enabled u-boot.img

```
host$ sudo dfu-util -c1 -i0 -a0 -D u-boot.img –R
```

3. Set dfu target device, Example: to SD card

```
board=> setenv dfu_alt_info ${dfu_alt_info_mmc}
board=> dfu 0 mmc 0
```

4. Download firmware, Example: zImage to SD card first partition

```
host$ sudo dfu-util -c1 -i0 -a9 -D zImage
```

For More Information

- AM57x device home page: http://www.ti.com/lsds/ti/processors/sitara/arm_cortex-a15/am57x/overview.page

- Jacinto6 EVM: http://www.ti.com/tool/j6evm5777#1

- Processor SDK U-Boot User’s Guide: http://processors.wiki.ti.com/index.php/Linux_Core_U-Boot_User's_Guide

- DFU Specs v1.1: http://www.usb.org/developers/docs/devclass_docs/DFU_1.1.pdf

- For questions regarding topics covered in this training, visit the support forums at the TI E2E Community website: https://e2e.ti.com