Introducing Poplar: First 96Boards TV Platform

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Overview

- General Information
- Poplar Hardware
  - High level overview of Hisilicon Poplar platform
  - 96Boards TV Platform Specification
- Poplar Software
- Poplar in LHG
- Target Google Supported Community Board
- Demos
General Information

● The Poplar board is manufactured by Tocoding Technologies Ltd.
  ○ 96Boards Poplar Hardware User Manual available [here](http://en.tocoding.com/index.php/96boards-poplar/)
  ○ Data sheet for Hi3798C V200 is [here](http://en.tocoding.com/index.php/96boards-poplar/)
  ○ Poplar board schematics are [here](http://en.tocoding.com/index.php/96boards-poplar/)

● Currently on sale for $79 + Shipping on Aliexpress

● Currently Tocoding has plans to release the accompanying Tuner cards (DVB-C/T2/S2) mid-October
Poplar Hardware
HiSilicon Poplar TV Platform
96Boards Enterprise Edition (TV Platform)

96Boards TV Platform Specification:
http://www.96boards.org/specifications/
## Poplar High Level Board Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Processor</strong></td>
<td>HiSilicon Hi3798CV200 Soc including Quad-core 64-bit ARM Cortex-A53</td>
</tr>
<tr>
<td><strong>Graphics processor</strong></td>
<td>Multi-core Mali T720 supporting OpenGL ES 3.1/2.0, OpenVG1.1, EGL, and Imprem 2.0 PQ engine</td>
</tr>
<tr>
<td><strong>Multimedia Support</strong></td>
<td>H.265/HEVC 4K @60fps and VP9 video decoding at 3840×2160 resolution at 60fps</td>
</tr>
<tr>
<td><strong>Security support</strong></td>
<td>ARM TrustZone, trusted execution environment, secure boot, secure storage, secure video path, DRM, DCAS</td>
</tr>
<tr>
<td><strong>Memory and Storage</strong></td>
<td>- 2GB DDR3</td>
</tr>
<tr>
<td></td>
<td>- 5GB eMMC on board</td>
</tr>
<tr>
<td></td>
<td>- MicroSD card slot (SD3.0)</td>
</tr>
<tr>
<td><strong>Display interface</strong></td>
<td>HDMI 2.0a with HDCP 2.2, maximum 4K x 2K @60fps</td>
</tr>
<tr>
<td><strong>Wireless</strong></td>
<td>802.11AC 2×2 WIFI with Bluetooth</td>
</tr>
<tr>
<td><strong>USB Interface</strong></td>
<td>- Two USB 2.0 ports</td>
</tr>
<tr>
<td></td>
<td>- One USB 3.0 ports</td>
</tr>
<tr>
<td></td>
<td>- One USB-KICP port for console support</td>
</tr>
<tr>
<td><strong>I/O extended interface</strong></td>
<td>- One 40-pin Low Speed (LS) expansion connector: UART, SPI, I2C, I2C-Q, GPIO×12, 12C power</td>
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<tr>
<td></td>
<td>- 1Gb Ethernet</td>
</tr>
<tr>
<td></td>
<td>- One PCIe 2.0 interace†</td>
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<tr>
<td></td>
<td>- One 9-Pt JTAG port</td>
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<tr>
<td></td>
<td>- One UART connector</td>
</tr>
<tr>
<td></td>
<td>- One IR receiver</td>
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<td></td>
<td>- Smart Card 12-pin connector open pin holes</td>
</tr>
<tr>
<td></td>
<td>- Tuner 24-pin connector open pin holes</td>
</tr>
<tr>
<td><strong>Operating System</strong></td>
<td>Android 5.1.1</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Standard 160×120 mm 968Boards Enterprise Edition form factor</td>
</tr>
<tr>
<td><strong>Options</strong></td>
<td>- DVB-C/T2/82 Tuner card</td>
</tr>
<tr>
<td></td>
<td>- Remote control</td>
</tr>
<tr>
<td></td>
<td>- Smart card module</td>
</tr>
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Block Diagram of Hi3798C V200 Block Diagram

- **TS in x 6 or TS in x 2+TS in/out x 2**
- **SD card**
- **SDIO 3.0 x 2 (optional)**
- **IR**
- **I²C**
- **UART x 2**
- **JTAG**
- **DDR3/3L/4 32-bit**
- **NAND flash/ eMMC**
- **SPI NOR/SPI NAND flash**
- **PLL**
- **OSCH**

**Quad-core Cortex A53**
- 32 KB I/D L1 cache
- 512 KB L2 cache

**Video decoder**
- (4K x 2Kp60, 10-bit)

**3D GPU**
- Mali T720MP
- OpenGL ES 3.1
- OpenVG 1.1
- OpenCL 1.1

**Video processor engine**

**JPEG/PNG decoder**

**Video encoder**
- (1080p30 x 1 or 720p30 x 2)
- H.264

**BootROM/OTP BootRAM**

**Cipher**
- DES/3DES/AES

**Low-power processor**

**VDAC x 1**
- CVBS

**HDMI 2.0a TX**
- HDMI out

**Audio DAC**
- Audio output

**i²S x 1**
- Audio CODEC

**S/PDIF x 1**
- S/PDIF

**USB 2.0 x 1**
- USB 2.0 device

**USB 3.0 x 1**
- USB 3.0 device

**USB 3.0 SATA 3.0 PCIe 2.0 device**

**GMAC x 2**

**TDE and HWC**

**BootROM**

**PCIe 2.0**

**NAND/eMMC/ SPI**
Mali-T720 Functional Block Diagram

ARM® Mali™-T720

Inter-Core Task Management

Shader Core
Shader Core
Shader Core
Shader Core
Shader Core
Shader Core

MMU
MMU

Level 2 Cache
Level 2 Cache

AMBA®4 ACE-Lite
AMBA®4 ACE-Lite
Transport Stream connector and DVB T2 Tuner Card

Side View: TS Interface to Tuner Card

Tocoding DVR/T2 Tuner Card
Pre-Production Poplar with Terrestrial Tuner Card
Poplar Software
Poplar Software

- Poplar board ships with Android 5.1.1 and kernel 3.18
- PCIe support coming
- Work to upstream Poplar kernel/drivers to recent kernel (targeting 4.9)
  - Upstream mainline support is a 96Boards program goal
  - HiSilicon and Linaro providing patches against a kernel.org mainline, LTS kernels used in Android
- Unlocked bootloader
  - Currently U-Boot supported
  - Later work planned for UEFI/FDT
- Support for a secure execution environment (OP-TEE)
- Support for ARM Trusted Firmware (ARMv8)
Poplar in LHG (1/2)

- LHG will work closely with HiSilicon throughout the process of upstreaming Poplar kernel and driver support to the Linux kernel and Android Open Source Project (AOSP)
  - Ensure that the latest kernel features can be used by LHG and the larger community for development.
- Poplar board target for development work in Android/AOSP TV, RDK, TVOS
- LHG Reference Platform Build (RPB) target
  - Linux and Android-based builds containing features defined by LHG Steering Committee
  - LHG RPBs help our members accelerate their product development through collaborative development of essential open source components and interfaces. The RPBs will be tested on Poplar via Continuous Integration (CI) loops using Jenkins servers.
  - Optimized media frameworks and commercial DRM integrations (e.g., Widevine and PlayReady DRMs)
  - ARM TF, ARM TrustZone with OPTEE
  - Linux OpenEmbedded/Yocto - initial target of Yocto 2.1 (Krogoth)
Poplar in LHG (2/2)

- **AOSP TV**
  - AOSP TV + AndroidTV Components with device support + Security (OPTEE & WV) + Android HAL device support + device kernel/drivers + Media & Graphics Acceleration + TV Applications
  - Open source reference AOSP TV platform on selected target devices
  - Must pass Google’s Compatibility Test Suite (CTS) and meet Android hardware/software compatibility definition
  - Poplar will be target board for LHG Member LCR builds (M-LCRs)

- **Exercise TV Input Framework use cases**
  - Hybrid scenario with linear services delivered via cable/satellite/terrestrial combined with broadband IP services (IPTV, OTT)
  - Android TV TV Input Framework (TIF)
  - Linux-based Hybrid Broadcast/Broadband TV
Target Google Supported Community Board

- Desirable to get Poplar (and subsequent TV Platform boards) SW platform stack accepted into AOSP master tree (as was done with HiKey)
  - Target AOSP builds + relevant Poplar hardware-specific binaries
  - AOSP kernel source and Poplar board support will enable developers to easily create and debug new and existing peripheral drivers and perform kernel development
- Android TV requirements outlined in Android Compatibility Definition [document](#)
- Upstreaming Poplar kernel to AOSP mainline, including upstreamed ARM TF and UEFI runtime environment support
- General compatibility requirements for Hardware, Display & Graphics, Multimedia Capability, Core Media Codecs, Network, Security (SELinux), Memory Storage + TV Input Framework, TV Apps, EPG, Remote Control, etc.
Poplar Demos

- ‘Speed’ game - uses smartphone as controller
- DTV Capability w/ T2 card demo
- H265-4K video decoding with test streams
  - Adaptive bit-rate streams played with ExoPlayer
  - Content from YouTube server - 4K video streams
  - Different ABR packaging/delivery: HLS and MPEG DASH
Thank You

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For further information: www.linaro.org
LAS16 keynotes and videos on: connect.linaro.org