1   Introduction to SlimPort™

In recent years with the fast expanding wireless bandwidth after the 3G/4G network deployment, and the ever-increasing processing capability of the application processors used in mobile devices like smart phones or tablet computers, the need for high-definition audio/video content streaming grows rapidly. However there is a lack of industry standard to connect such mobile devices to HD displays.

SlimPort products, by Analogix Semiconductor Inc., address this need. It is based on the VESA DisplayPort[©] standard (www.vesa.org) except that it embeds the AUX channel (normally two wires) onto a single wire to make the whole interface fit into the 5-pin micro-USB connector, which is commonly used in today's mobile devices. That is, a SlimPort accessory (adapter, cable or docking station) connects to the mobile device's microUSB connector and to the HDMI connector of the TV. A live video can be found here:
http://www.youtube.com/watch?v=PG91rdPhReo&feature=player_embedded.

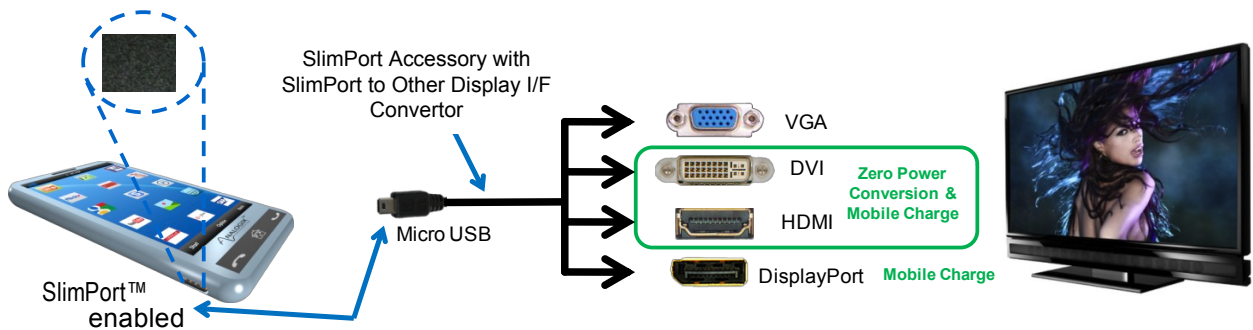Figure 1 shows a SlimPort accessory connecting a smart phone with a wide screen TV.

Figure 1 - System Diagram of a SlimPort Application Example

Mobility DisplayPort (MYDP) is a standard that has been proposed by ST to VESA that also embeds the AUX channel onto a single wire. Refer to http://www.youtube.com/watch?v=4gwfY_KNsMg&feature=player_embedded . SlimPort products are compatible with devices that comply with MYDP (proposed at the time of this writing).

Using SlimPort products, smart phone and tablet OEMs can make accessories that connect to any type of display, including HDMI TVs, VGA projectors and DisplayPort monitors. Examples of these are shown in the following figures.

Figure 2 - A SlimPort to HDMI Adaptor

Figure 3 - A SlimPort to DVI Adaptor

Figure 4 - A SlimPort to DisplayPort Adaptor

Figure 5 - A SlimPort to VGA Adaptor

2   What Is the Advantage of SlimPort Technology?

Some mobile devices have a separate micro HDMI connector to connect to the big screen as shown in Figure 6. Table 1 compares such a solution with SlimPort.

Figure 6 - A Mobile Device with Separate Micro HDMI Connector

Table 1 Comparison between SlimPort and HDMI Connector Solutions

Comparison Items	SlimPort Solution	HDMI Solution	Comments
Minimum Pin Count	5	19	
Needs Extra Connector	No	Yes	SlimPort can share the existing USB connector of the mobile device.
Licensing & Royalty Fees	No	Yes	SlimPort is based on VESA DP that has no licensing fee. HDMI comes from HDMI LLC that has strict licensing terms.
1080P Support	Yes	Yes	
Multi AV Stream Support	Yes	No	MST (Multi-Stream Transport) is supported in DP v1.2.
Cost	Low	High	Due to the incremental cost for the extra connector, extra tests, extra licensing fees, etc., separate HDMI connector solution has higher cost than SlimPort solution.
Mobile Device Battery Charge	Yes	No	SlimPort products minimize battery drain and, in some cases, charge the device.
EMI	Low	High	SlimPort main link signal has SSC (Spread Spectrum Clock) and low swing (as low as 400 mV differential peak to peak, or lower)[1]. HDMI TMDS signal has no SSC and its swing is minimum 800 mV differential peak to peak[2].
Max Bandwidth	20.16 Gbps (4 lanes)	10.2 Gbps	

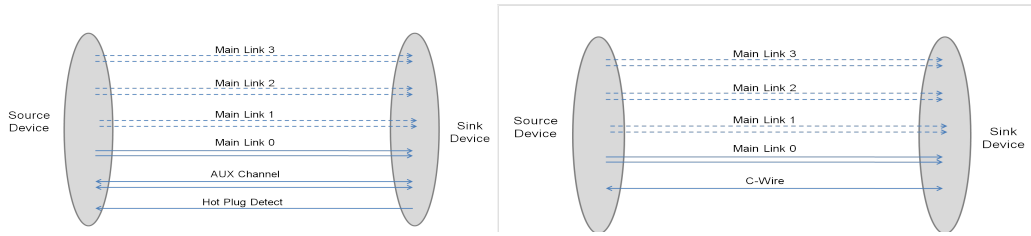# 3 What Is Inside SlimPort Technology?

Figure 7 Pin Comparison between DisplayPort (Left) and SlimPort (Right)

As shown in Figure 7, the essential difference between SlimPort and DisplayPort is that the 2 AUX channel pins and 1 HPD pin of DisplayPort is merged into 1 pin (C_WIRE) in SlimPort. Therefore SlimPort can use as few as 5 pins (including power and ground pins) when 1 main link lane (2 pins) showed in Figure 7 is used. This advantage makes SlimPort feature can be directly added to current mobile devices without adding more pins or connectors because the existing micro USB connector on the mobile devices can be shared by SlimPort application. Similarly as DisplayPort, SlimPort main link is uni-directional for transmitting video and audio info from TX to RX that can run at 1.62, 2.7, or 5.4 Gbps, and SlimPort C_WIRE is bi-directional (half-duplex) for side band control that runs at 1 Mbps.

The conceptual scheme to share microUSB connector with SlimPort (SlimPort over microUSB) is shown in Figure 8. When SlimPort accessories are connected to the micro USB connector of the mobile devices, then the specific impedance associated with SlimPort accessories at the ID pin (pin 4) of micro USB connector is detected by the mobile device, so the mobile device will work at SlimPort mode (D+ pin 3 of micro USB connector will be shared by pin ML_0(p) of SlimPort, D- pin 2 of micro USB connector will be shared by pin ML_0(n) of SlimPort, and the ID pin 4 of the micro USB connector carries the C_WIRE signal of SlimPort). When USB accessories are connected to the micro USB connector of the mobile devices, the specific impedance associated with USB accessories at the ID pin (pin 4) of micro USB connector can be detected by the mobile device, so the mobile device also works in USB mode.
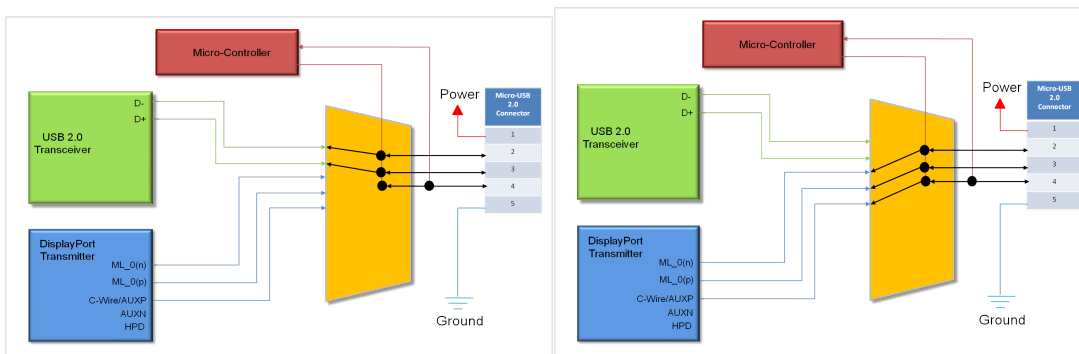

Figure 8 - Conceptual Scheme of SlimPort over Micro USB on Mobile Device:
USB mode (Left Side) and SlimPort mode (Right Side)

4 Summary

Since its introduction in early 2010, the SlimPort technology has gained industry recognition and market acceptance. In summary, the main features of SlimPort products are:

- 5-wire interface, i.e. SP_PWR, GROUND, SP_DP, SP_DN and C_WIRE.

- One high-speed differential link with speed up to 5.4Gbps.

- One C-wire single-ended half-duplex communication channel.

- SlimPort cable vs. normal USB cable automatic detection

- High-speed link compatible with DisplayPort 1.2 main link PHY spec.

- Link layer compatible with DisplayPort 1.1a link spec.

- HDCP content protection enabled.

Analogix offers both the transmitter that sits in the mobile device and the receiver embedded in the cable adapter. The transmitter chip is ANX7805, the receiver chip is ANX7730. For more details regarding SlimPort products, visit www.analogix.com .

5 References

[1] Analogix: www.analogixsemi.com (for more info related to SlimPort)

[2] VESA: www.vesa.org (for more info related to DisplayPort)

[3] DisplayPort Specification v1.2

[4] HDMI Specification v1.4a

[5] Micro USB Specification v1.01

Analogix Semiconductor, Inc. designs and manufactures high-performance analog and mixed-signal semiconductors for the Digital Media market. Surpassing 2 million devices sold, Analogix is the leader in providing semiconductor solutions for DisplayPort, the most common digital interconnect for the PC. Analogix also provides HDMI transmitter and receiver solutions for the distribution of high-definition video and audio in other CE devices.

Analogix has developed a world-class sales and support team to assist its customers with their design efforts. Using a blend of direct sales, distributors and applications engineers, Analogix can ensure the highest degree of customer responsiveness. Please visit www.analogix.com for more information.

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