HDMI™ v1.4: New Opportunities for Active Cables with Embedded RM1689

Application Notes

Rev 1.1

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Table of Contents

Introduction 3

New Features with Version 1.4 3

HDMI™ Cable Classifications 3

High Speed HDMI™ Cables 4

High Speed HDMI™ Cables with Ethernet 4

Conclusion 5

Introduction

Version 1.4 of the HDMI™ specification brings some powerful new features to the video and audio communications market. This paper looks at what opportunities the new HDMI™ specification presents to cable manufacturers, focusing particularly on the high speed consumer applications market.

New Features with Version 1.4

A new high-speed bi-directional channel called HEAC (HDMI™ Ethernet and Audio Return Channel) has been introduced which facilitates 100Mbps Ethernet capability. The same high-speed channel also includes Audio Return functionality which means that audio can be streamed directly to an A/V receiver over the HDMI™ cable. These two feature additions alone allow consumers to further enhance their digital video and audio without the overhead of additional cabling. There are clearly 'green' environmental and aesthetic marketing advantages introduced with these additions.

The highest data rate supported by the specification remains unchanged, i.e. 3.4Gbps, but support for new features has been introduced which will push the demand for cables which are certified to function at this rate, i.e. category 2. These new features include support for 3D and resolutions such as 4K x 2K, i.e. up to four times 1080p.

Thinner cables are now also a must with the introduction of the new Micro HDMI™ (D-type) connector which is targeting the portable market. This new connector is approximately 50% smaller than the existing HDMI™ Mini Connector. To avail of the smaller connector footprint and to reliably connect to it, conductor gauges of 34 AWG and higher are being considered. Outer diameters of the finished cables of less than 3.0 mm are desirable. The finished cable should also be flexible and easy to roll up to match the compact sizes of products such as mobile phones, MP3 players, digital still cameras, portable gaming consoles, etc.

HDMI™ Cable Classifications

Consumers now have three new HDMI™ cables to select from in addition to those introduced with version 1.3 of the specification:

The new cable types introduced by version 1.4:

- Category One: Standard HDMI™ Cable with Ethernet (up to 1080i/60Hz, 74.25MHz)
- Category Two: High Speed HDMI™ Cable with Ethernet (from 1080p/60Hz and above, 340MHz)
- Automotive HDMI™ Cable: For connection of external HDMI™ device to in-vehicle HDMI™ device

The two cable types which were introduced in version 1.3 and **remain unchanged** in version 1.4:

- Category One: Standard HDMI™ Cable (up to 1080i/60Hz, 74.25MHz)
- Category Two: High Speed HDMI™ Cable (from 1080p/60Hz and above, 340MHz)

High Speed HDMI™ Cables

The specification of Version 1.4 High Speed Cables is the same as for version 1.3 High Speed Cables with the additional support of the new D-type connector. Cables which passed v1.3c category 2 HDMI™ cable tests with A and/or C type connectors will pass version 1.4 cable compliance tests.

By definition in version 1.3 of the HDMI™ Specification, High Speed HDMI™ Cables, or HDMI™ category 2 cables, are required for applications operating above 1080i/8-bit/60Hz. This means that even the standard 1080p/8-bit/60Hz (148.5MHz) applications require category 2 cables (340MHz) which can function at data rates up to 3.4Gbps. Cables which function at only 1080p/12-bit/60Hz (222.75MHz) or below can at best be certified only as category one (74.25MHz).

This fact has not changed with the introduction of version 1.4, but with the introduction of new applications (3D and higher resolution TV) which drive the content data rates up towards 3.4Gbps, certified category two cables become more desirable. Future-proofing becomes more important particularly as the price differential between category one and category two cables decreases.

The biggest challenge with meeting the category 2 specifications is the high data rate required for the three data channels, i.e. 3.4Gbps due to physical cable limitations. Embedding an RM1689 HDMI™ Cable Equalizer IC inside a cable assembly (see Fig 1.) allows manufacturers to compensate for high attenuation and pass the eye diagram compliance test (test ID 5-3) with thinner, longer and cheaper cables which would otherwise fail. The RM1689 solution also allows manufacturers to guarantee performance on all cables coming off the production line.

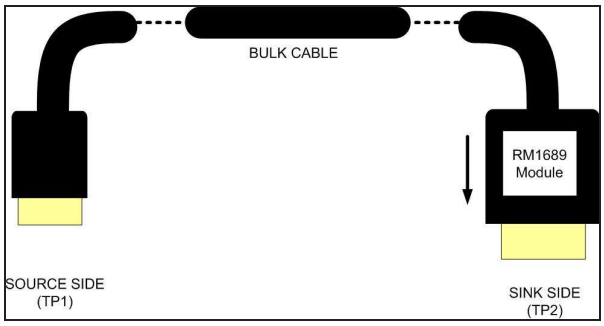

Fig 1. HDMI™ Active Cable Solution

The IC is mounted on a small module which fits inside the sink side casing of a cable. This type of solution is called an ‘active’ cable because it contains active circuit components with equalizer functionality.

With the introduction of the minute D-type connector, matching ultra-thin bulk cable with outer diameters of less than 3.0mm are desirable. Using the RM1689 allows cables with gauges as high as 42 AWG to pass version 1.4 compliance.

High Speed HDMI™ Cables with Ethernet

Version 1.4 HDMI™ has introduced a new type of High Speed HDMI™ cable, i.e. with Ethernet. These cables support the same type of connectors as the High Speed HDMI™ Cables, i.e. types A, C and the new D-type. To facilitate the bi-directional Ethernet and Audio Return Channel function, three pins on the standard connectors are assigned to perform this function. These three lines are independent of the TMDS data and clock channels.

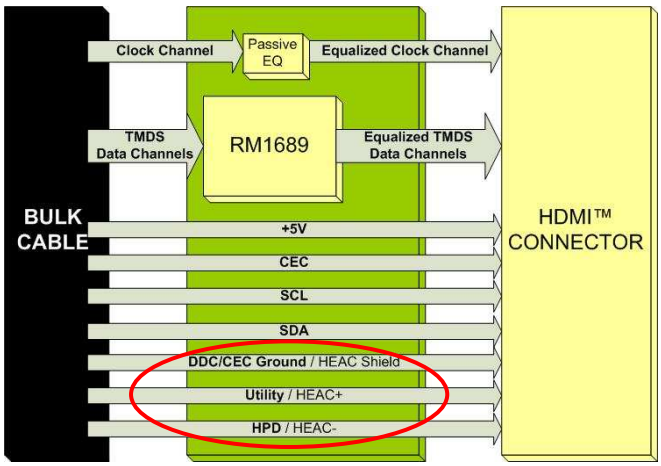

Fig 2. HDMI™ Active Cable Block Diagram

The three HEAC lines are shown above in Fig 2 (circled in red). The Utility (formerly RSVD) and HPD conductors form a differential pair which uses the DDC/CEC Ground as its shield. The target data rate for this channel is 100Mbps. Previously these three conductors were assembled as three individually insulated conductors. To implement the HEAC Channel, they should now be constructed as a Shielded Twisted Pair.

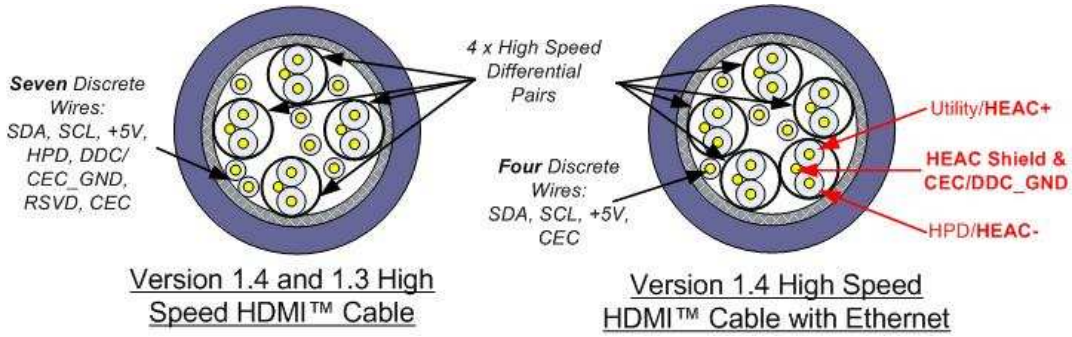

Fig 3. Cross-section of High Speed HDMI™ Cables

The specification for this channel is not as challenging as for the higher speed 3.4Gbps TMDS pair and performance can be achieved by managing the physical cable design with particular consideration to the attenuation, common mode impedance and differential impedance of this channel. For more details on the channel performance targets, refer to the HEAC1 Supplement to the HDMI™ Specification.

Independently of how the HEAC channel is constructed, the RM1689 can be used to improve high speed performance on these lines in exactly the same manner as for the High Speed HDMI™ Cables **without** Ethernet.

Conclusion

Version 1.4 of the HDMI™ specification supports important innovations such as 3D formats, Ethernet connectivity, smaller connectors and other features which further broaden the market for HDMI™ cables. Higher data rates for new resolutions and 3D support further validate the requirements for category 2 compliant cables. The new Micro HDMI™ connector combined with ultra thin bulk cable will increase HDMI's penetration into the portable market.

The RM1689 device is available now to enable version 1.4 HDMI™ active cables for high speeds with and without Ethernet support.