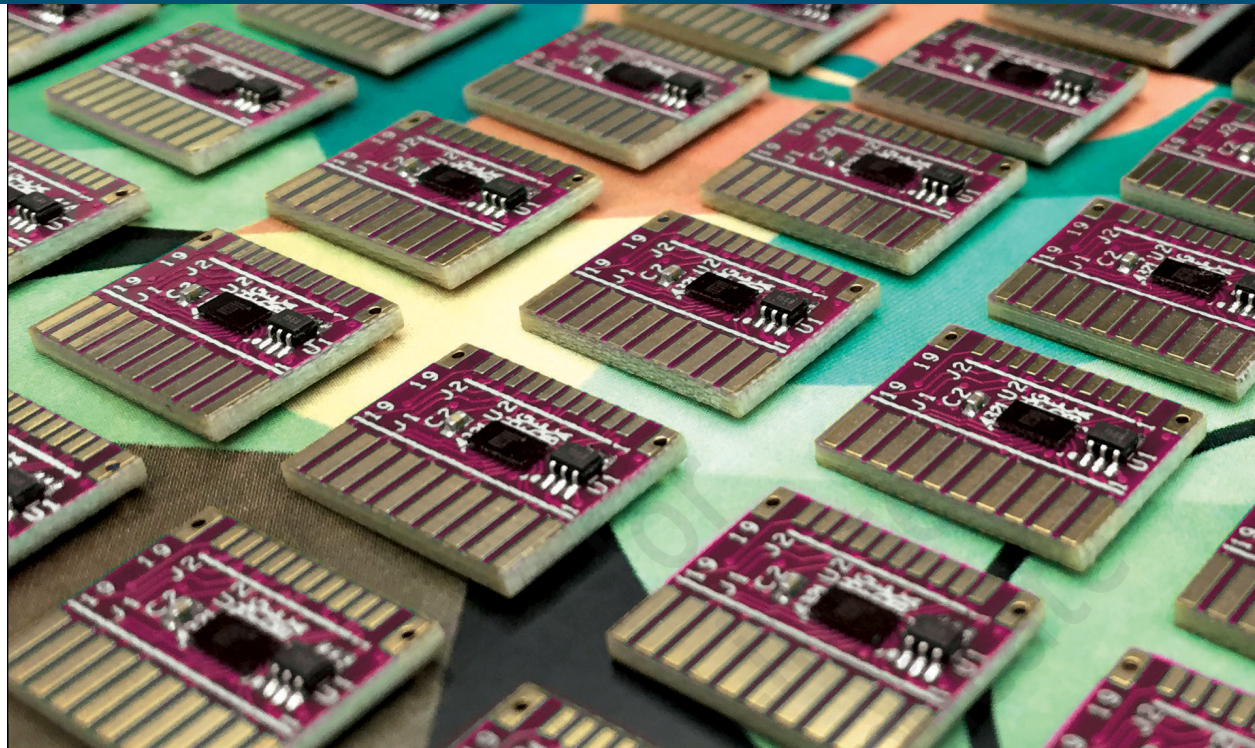




Features

- Optimized for super-thin, extra-long cable designs capable of recovering losses up to 22dB when used with an HDMI 2.0 compliant receiver
- Linear output drivers ensure superior audio and video performance
- Enhanced, patented power harvesting technology. No external power required.
- Supports data rates up to 18Gbps (6Gbps per TMDS Channel) for 4k 60fps 4:4:4 performance
- Integrated equalizers, linear output drivers, voltage regulators, control, and input terminations allowing for a compact module design
- Sophisticated RT8000™ production test system ensures 18Gbps performance and HDMI 2.0 interoperability



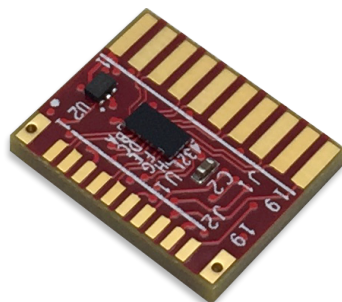
HT8181

HDMI 2.0 Embedded Cable Processor Module

UP TO
18Gbps

With the HT8181 module, you can now enjoy your favorite premium content from your phone, PC or tablet on your large screen HDTV while sitting on your couch or arm chair. By embedding Spectra7's patented high-speed active signal processing silicon technology in the cable, the HT8181 allows an HDMI cable to be up to 4 times thinner than current HDMI cables. At lengths up to 20m, the HT8181 module enables maximum flexibility in positioning flat panel displays away from source equipment.

Spectra7's patented high-speed, active signal processing enables super-thin, ultra-long cables and compact connectors capable of delivering up to 18Gbps — a key performance attribute of HDMI 2.0. The HT8181 utilizes patented power delivery technology for increased power regulation efficiency — no additional power cable required. The HT8181 module achieves up to 4K 60p, 4:4:4 resolutions (600MHz pixel clock rate) required by the latest Ultra-HD 4K Displays. Only one module is required per cable.



Functional Diagram

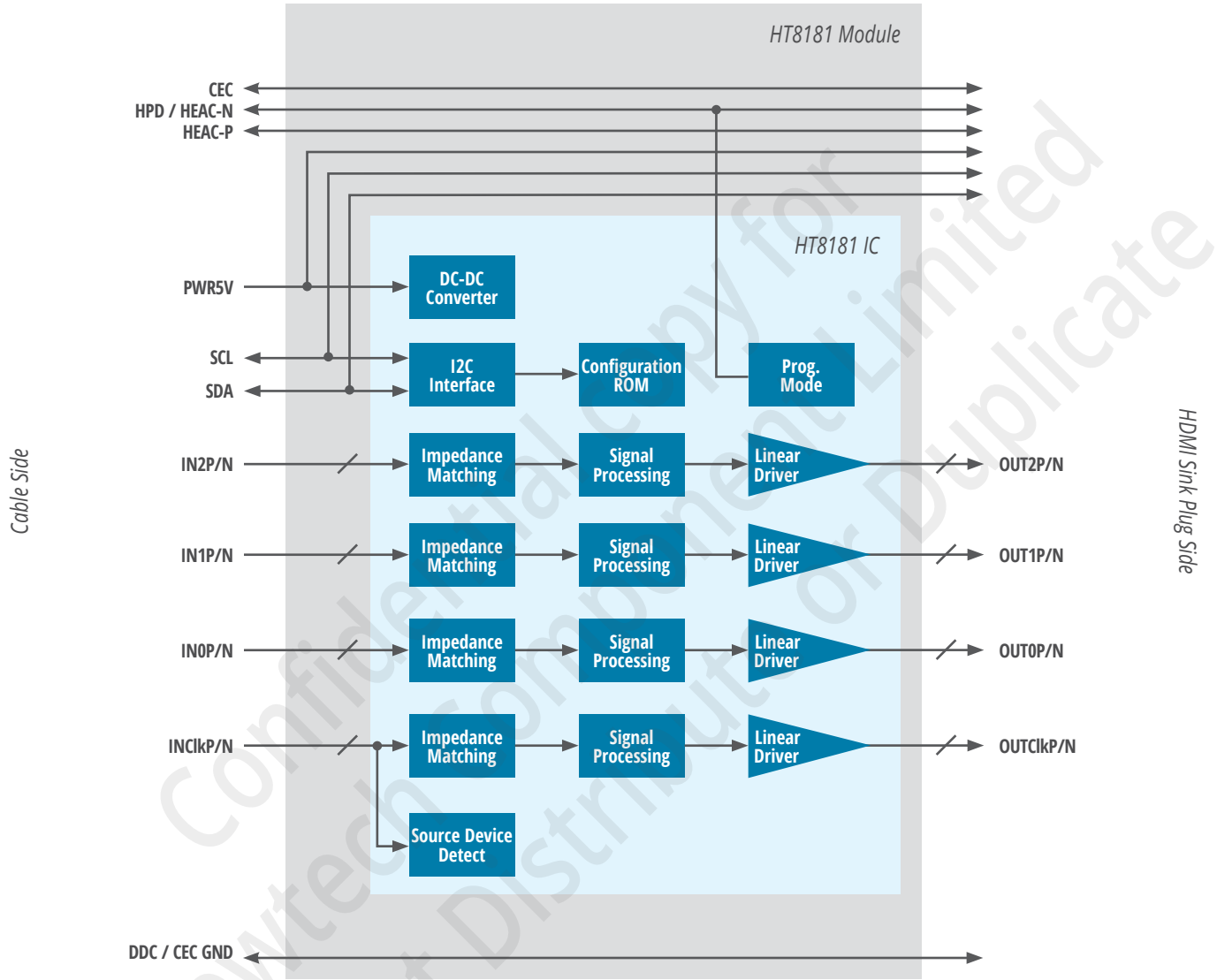


Figure 1

Block Diagram of the HT8181 Module

Functional Overview

The HT8181 includes a 4-channel linear equalizer for HDMI systems with TMDS line rates of up to 6Gb/s. Being a linear equalizer (in contrast to one that limits or saturates its output), the HT8181 works in conjunction with the sink's Rx-EQ, so that much higher cable loss can be compensated (up to 22dB at 6Gb/s). Furthermore, the linear nature of the equalizer will fully preserve the sink's ability to adapt its settings and optimize the signal integrity. Thus, while the HT8181 can be configured to optimally compensate the cable, by preserving the receiver's flexibility to adapt to the transmitter's specific characteristics, the HT8181 enables the sink receiver to then further enhance total link signal integrity.

A diagram showing the major blocks in the HT8181 are shown in Figure 1. The chip is powered from both the HDMI 5V Pwr line and via Spectra7's patented power harvesting off the DC coupled TMDS lines. This approach allows an active cable with the HT8181 to comply with the HDMI compliance test for <5mA power draw off the 5V line while also obviating the need for external power.

The CTLE equalizer for each channel in the HT8181 provides up to 15dB of boost, which when combined with the 12dB provided by the sink equalizer, allows for cables with greater than 22dB of loss at 3GHz to be compensated. Furthermore, the CTLE transfer response hits its peak above 4.1GHz to not only support HDMI2's 6Gb/s line rates but to also ensure the cable assembly presents a proper Category 2 loss profile.

OTP memory is used to hold post-cable-assembly trimmed values of the HT8181. When used with the Spectra7 RT8000 tester/programmer, the HT8181 is both optimized and verified at speed on every cable assembly thus compensating the manufacturing variances that normally plague high-speed cables. The OTP memory is programmed via I2C, which is only responsive when connected to the RT-Tester and never responsive during typical consumer use.

Absolute Maximum Ratings

| Parameter | Value |
|---------------------------------------|----------------|
| Storage temperature | -40°C to 150°C |
| Supply voltage (Pwr5V) | -0.3V to 5.3V |
| Voltage on DDC_SDA, DDC_SCL, /Prog_En | -0.3V to 5.3V |
| Voltage on TMDS inputs and outputs | -0.3V to 3.6V |
| ESD rating (all pins) | 2kV HBM |

Note: Permanent damage can be caused to the device if it is stressed above the ratings set out above. Exposure to absolute maximum rated conditions for extended periods may affect device reliability. These ratings are for stress only and functional operation of the device beyond those indicated under 'Normal Operating Conditions' is not implied.

Electrical Characteristics

Normal Operating Conditions

| Parameter | Description | Min | Typ | Max | Unit | Notes |
|-------------------|--|------|-----|-----|------|-------|
| Pwr5V | HDMI 5V supply voltage line | 4.7 | 5 | 5.3 | V | |
| AVcc | Sink termination voltage on TMDS lines | 3.1 | 3.3 | 3.5 | V | |
| T _A | Ambient temperature | 0 | - | 70 | °C | |
| f _{Baud} | Data rate on TMDS lines | 0.25 | - | 6 | Gb/s | |

Power Specifications

| Parameter | Description | Min | Typ | Max | Unit | Notes |
|-------------------------|---|-----|-----|-----|------|-------|
| I _{Pwr5V_Comp} | Current drawn off the Pwr5V line when configured as defined in the HDMI Compliance Test Specification Version 1.4b. | - | 4.2 | 5 | mA | |

Termination Specifics

| Parameter | Description | Min | Typ | Max | Unit | Notes |
|-----------------------|---|-----|-----|-----|-----------|-------|
| Z _{In_Diff} | Differential input impedance | 80 | 100 | 120 | Ohms-Diff | |
| Z _{Out_Diff} | Differential output impedance | 80 | 100 | 120 | Ohms-Diff | |
| Z _{I2C_PU} | Internal pull-up resistance to Pwr5V on DDC_SDA and DDC_SCL pins. | 47 | - | - | kOhm | |

High-Speed Channel Characteristics (Clk, D0, D1, and D2) measured from chip input to chip output

| Parameter | Description | Min | Typ | Max | Unit | Notes |
|-----------------------|--|------|------|------|-------|-------|
| f _{Peak} | Frequency at which the transfer function peaks | - | 4.1 | - | GHz | 1 |
| Gain _{3GHz} | Differential gain at 3GHz (relative to 10MHz gain) | 15 | 18 | - | dB | 1 |
| Gain _{10MHz} | Differential gain at 10MHz | -5.5 | -3.5 | -1.5 | dB | 2 |
| P _{1dB} | Output 1dB compression point. | 500 | - | - | mVppd | 1, 3 |
| CMRR | Common-mode rejection ratio measured as SCC21/SDD21. | - | - | -20 | dB | 4 |
| DJ _{Resid} | Residual deterministic jitter introduced by cable assembly with a cable having 18dB of loss at 3GHz. | - | 0.18 | - | UI | 5 |

Notes

1. This characteristic is measured at the maximum gain setting
2. This characteristic is after trimming is programmed into OTP
3. Measured over the frequency range 10MHz to 3GHz
4. Measured over the frequency range 100MHz to 4.1GHz
5. Measured with a 6Gb/s PRBS-7 signal launched into the cable at 800mVppd

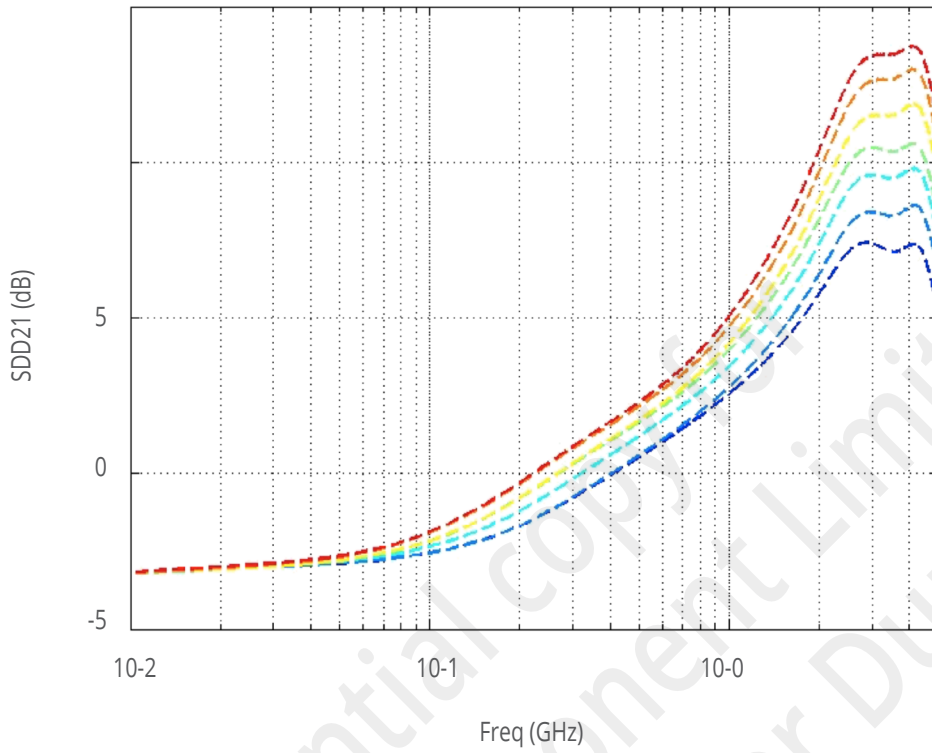


Figure 2
Measured EQ responses from a subset of the boost settings.

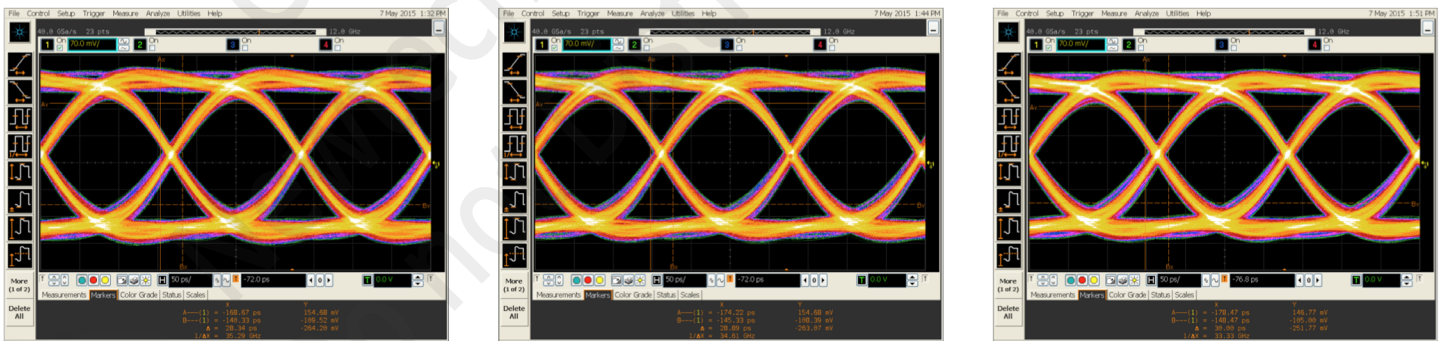
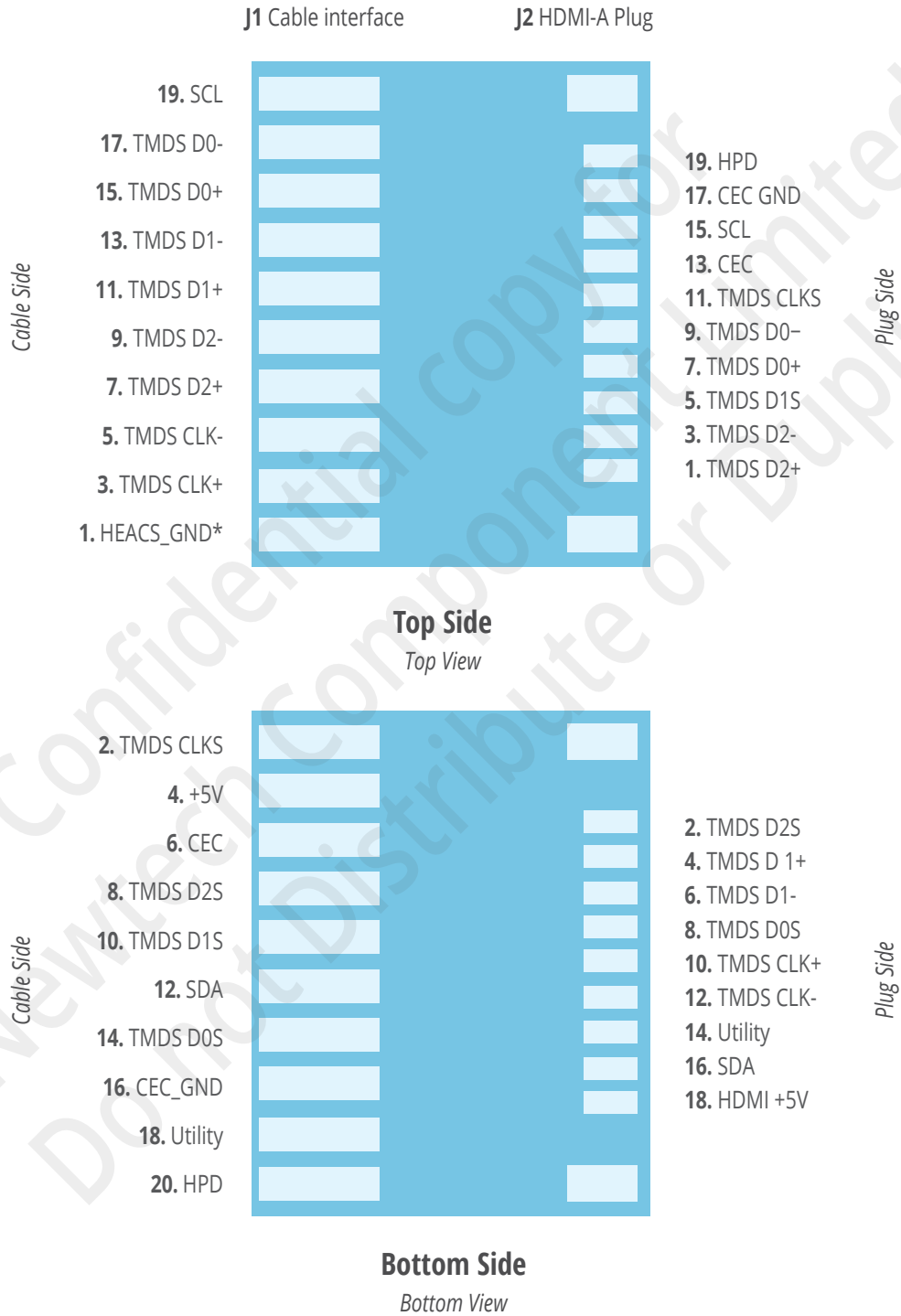


Figure 3
Eye diagrams of fully equalized signal by the HT8181 after 20dB loss 3.5m 36AWG STP reference cable. Channels D0 (left), D1 (middle), and D2 (right) with a 6Gb/s PRBS-7 pattern.

HDMI 2.0 Interface – HT8181-M-01W

HDMI Type A plug is signal assignment is shown. Cable interface signal assignment is shown.

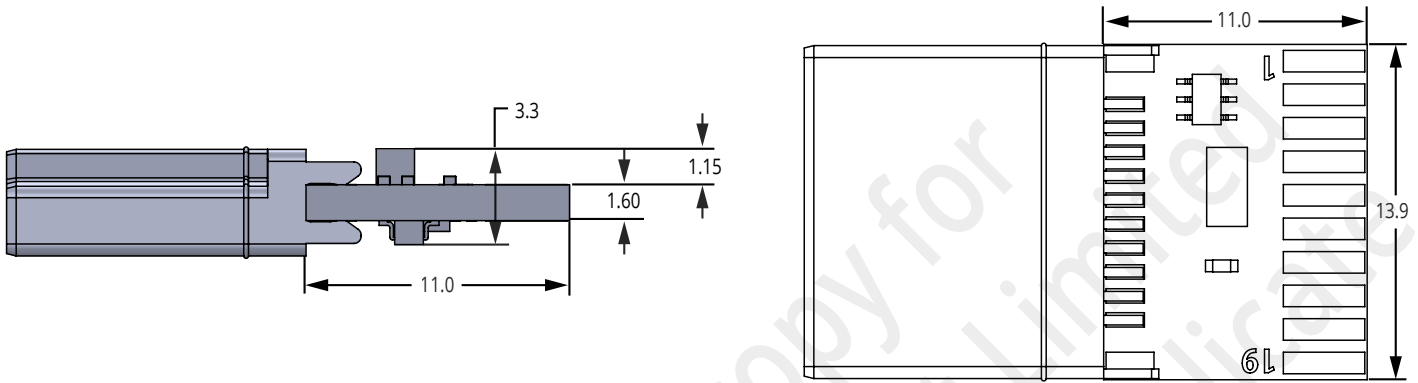
- J1 – Cable connection
- J2 – HDMI type-A plug
- For J1 pad positions, 2D dimensioned drawing, DXF or 3D CAD file is available



*Note: See wiring diagram on following page for HEACS_GND wiring connection in the module.

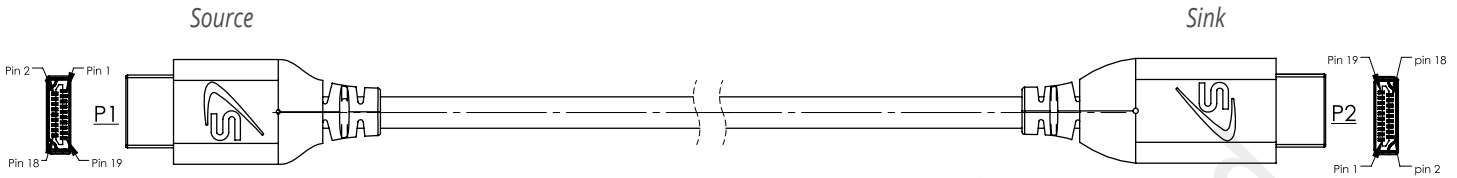
Module Dimensions

All dimensions in millimeters. Dimensions are nominal – for complete information, contact Spectra7 for the current drawing. Module does not include HDMI plug as shown. Refer to DXF file for nominal dimensions and engineering drawing for dimensions with full tolerances. Note that customer is responsible for tolerance analysis of the module with the connector of choice.

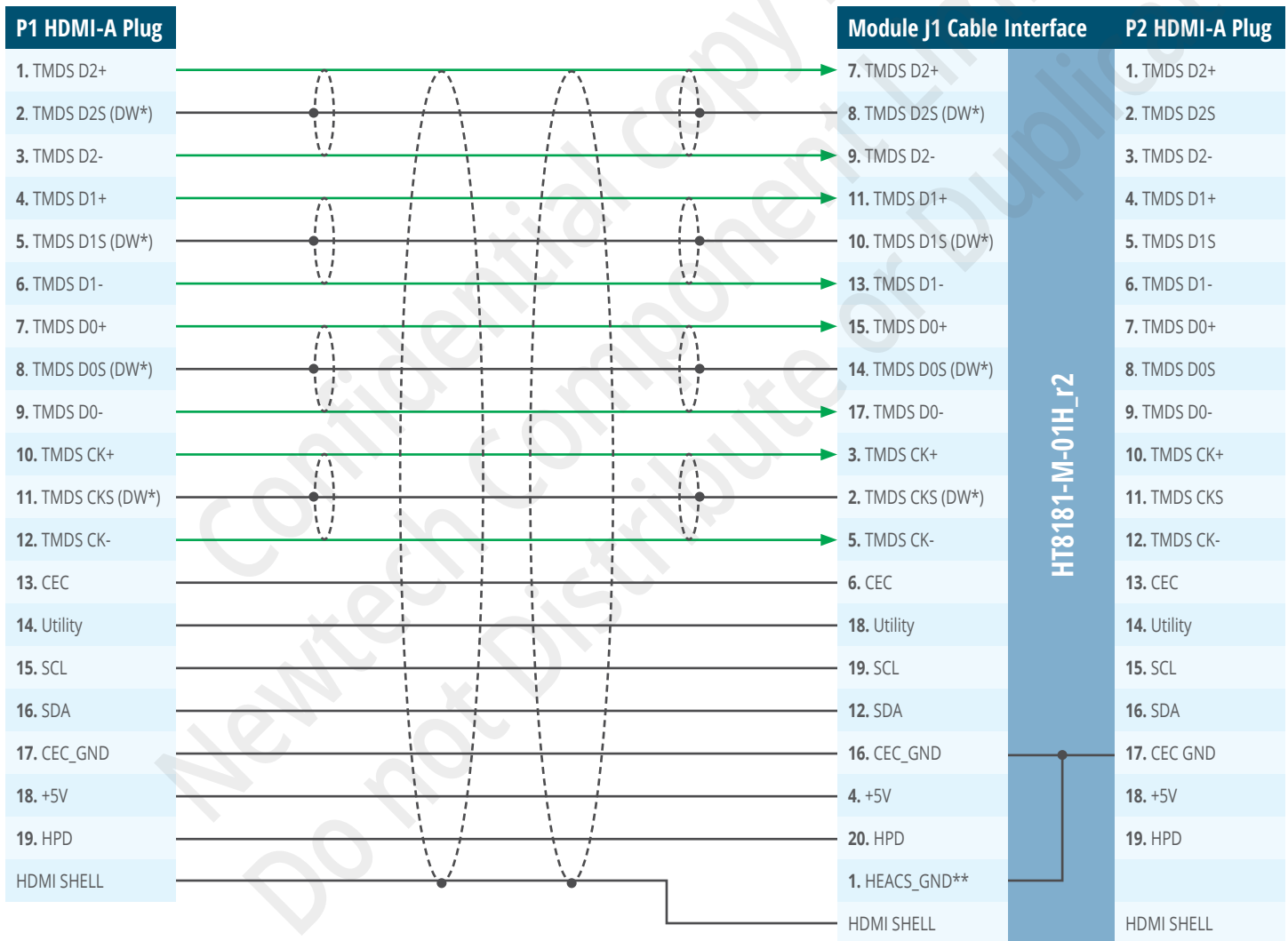


HDMI 2.0 Type-A to A Active Cable Assembly – Reference Wiring Diagram

- P1 HDMI type-A passive plug
- P2 HDMI 2.0 type-A active cable module



Wiring Diagram



*Note: DW – Drain wire for each shielded twisted pair

**Note: Connect J1 pin 1 to HEAC drain wire on cables supporting HEAC. Leave pin 1 floating if not using HEAC or there is no drain wire / shield.

Performance

Spectra7's HT8181 enables cables with up to 22dB of loss to interoperate with HDMI 2.0 600MHz pixel clock rate systems. The HT8181 works in conjunction with the increased EQ provided in HDMI 2.0 6G phy to provide much higher performance at 6Gbps while still meeting all requirements at 10.2Gbps.

| TMDS Conductor AWG | 36 | 34 | 32 | 30 | 28 | 26 | 24 |
|-----------------------------------|----|----|----|----|----|----|----|
| Approximate Active Reach (meters) | 4 | 5 | 6 | 8 | 10 | 12 | 15 |

HDMI 2.0 Interop Tested

Spectra7 maintains an extensive interop lab with the latest HDMI 2.0 sources and displays. Correlation with RT8000™ programing and test system insures robust margin and manufacturing tolerance.

Production Cable Test System

Spectra7's RT8000™ Production Test System ensures that each cable is optimized and tested at 18Gbps. Advanced production features of the RT8000 include performance tracking database, yield monitoring and real-time production monitoring.



Ordering Information

| Part Number | Description |
|-----------------|--|
| HT8181-M-01H_r2 | HDMI 2.0 Embedded Cable Processor Module |