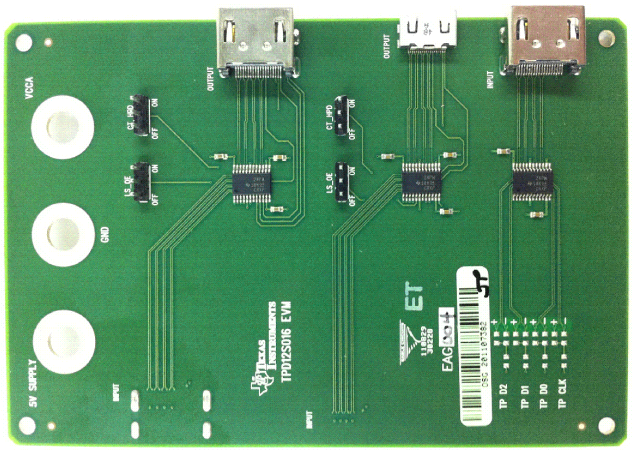
TPD12S016 Evaluation Module

1 Features

- Confirms to HDMI Compliance Tests without any External Components
- Supports HDMI1.4 Data Rate
- Match Class D and Class C pin mapping
- Eight channel ESD lines for four differential pairs with ultra-low differential capacitance matching (0.05pF)
- On-chip load switch with 55mA current limit feature at the HDMI 5V_OUT pin.
- Auto-direction sensing I2C level shifter with one-shot circuit to drive long HDMI cable (750pF Load)
- Back-drive protection on HDMI connector side ports
- Integrated pull-up and pull-down resistors per HDMI specification
- IEC61000-4-2 (Level 4) ESD Performance at all external pins
- Space Saving 24-pin RKT Package (2mm x 4mm) and 24-TSSOP Package

2 Applications

- Cell Phones
- eBook
- Portable Media Players
- Set-top Box



3 EVM Description

The TPD12S016 is a single-chip HDMI interface device with auto-direction sensing I2C voltage level shift buffers, load switch, and integrated high-speed ESD protection clamps. The device pin mapping matches the HDMI Type D connector with four differential pairs. This device offers eight low-capacitance ESD clamps, allowing HDMI 1.4 data rates. The integrated ESD circuits provide good matching between each differential signal pair, which allows an advantage over discrete ESD solutions where variations between ESD protection clamps degrade the differential signal quality. The TPD12S016 provides a current limited 5 V output (5V_OUT) for sourcing the HDMI power line. The current limited 5 V output supplies up to 55 mA to the HDMI receiver. The control of 5V_OUT and the hot plug detect (HPD) circuitry is independent of the LS_OE control signal and is controlled by the CT_HPD pin. This independent control enables the detection scheme (5V_OUT + HPD) to be active before enabling the HDMI link. An internal 3.3V node powers the CEC pin eliminating the need for an onboard 3.3V supply.

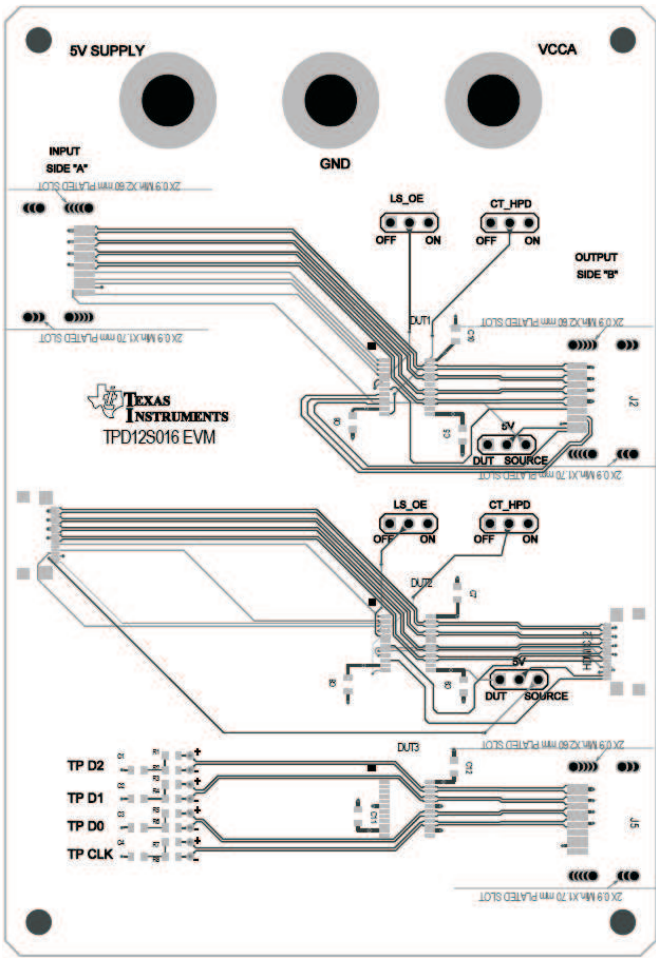
The TPD12S016 integrates all the external termination resistors at the HPD, CEC, SCL, and SDA lines. There are three non-inverting bi-directional translation circuits for the SDA, SCL, and CEC lines. Each have a common power rail (VCCA) on the A side from 1.1 V to 3.6V. On the B side, the SCL_B and SDA_B each have an internal 1.75 kΩ pullup connected to the regulated 5 V rail (5V_OUT). The SCL and SDA pins meet the I2C specification and drive up to 750 pF capacitive loads exceeding the HDMI1.4 specifications. The CEC_B pin has an internal 27 kΩ pullup to the internal 3.3 V supply rail. The HPD_B port has a glitch filter to avoid false detection due to plug bouncing during the HDMI connector insertion.

4 EVM Configuration

The TPD12S016 EVM has three separate sections, the TOP, MIDDLE, and BOTTOM sections. Each section includes a TPD12S016, input/output (IO) ports, and jumper switches for enabling or disabling the TPD12S016's Level Shifter (LS), Hot Plug Detect and 5VOUT. VCC can be powered by either an HDMI input or a 5V SUPPLY banana clip.

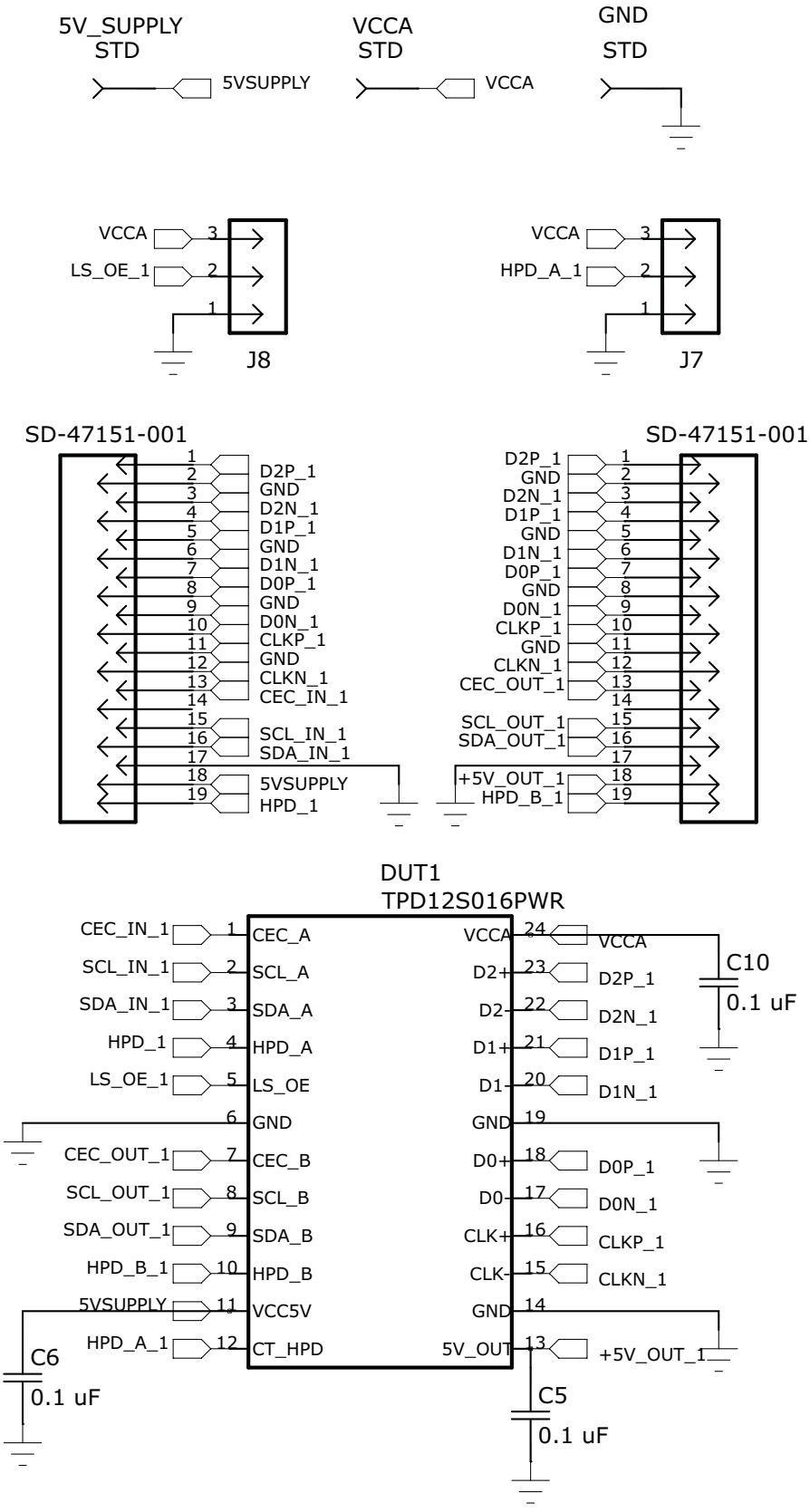
OUTPUT is side B; INPUT is side A. TOP, MIDDLE, and BOTTOM sections are all supplied with power using VBAT, VCCA, and GND.

1. The TOP section has Type-A HDMI male connectors for IO.
2. The MIDDLE section has Type-C HDMI male connectors for IO.
3. The BOTTOM section has a Type-A male connector as input for the four differential pair signals only. For probe testing of the high-speed differential signals, test points are provided on the board. Configurable output loads using R1-R8 & C1-C4 are provided. This configuration provides a means for developing eye diagrams under no load or loaded conditions



Jumper Switch Configurations		
LS (LS_OE)	disabled	enabled
CT_CP_HPD	disabled	enabled
5V Selects source of output's +5 Power Signal (Pin 18)	Using the +5Vout of TPD12S016	Bypass +5VOUT of TPD12S016

5 TPD12S016EVM Schematic



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It is important to operate this EVM within the input voltage range of –0.3 V to 4 V and the output voltage range of –0.3 V to 6 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85 °C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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