Enhanced Performance HDMI®/DVI Level Shifter with Voltage Regulator, Dongle Detect Support and Active DDC Buffer

PTN3381BBS

Archived

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The PTN3381B is a high-speed level shifter device which converts four lanes of low-swing AC-coupled differential input signals to DVI v1.0 and HDMI® v1.3a compliant open-drain current-steering differential output signals, up to 1.65 Gbit/s per lane. Each of these lanes provides a level-shifting differential buffer to translate from low-swing AC-coupled differential signaling on the source side, to TMDS-type DC-coupled differential current-mode signaling terminated into 50 to 3.3 V on the sink side. Additionally, the PTN3381B provides a single-ended active buffer for voltage translation of the HPD signal from 5 V on the sink side to 3.3 V on the source side and provides a channel with active buffering and level shifting of the DDC channel (consisting of a clock and a data line) between 3.3 V source-side and 5 V sink-side. The DDC channel is implemented using active I²C-bus buffer technology providing capacitive isolation, redriving and level shifting as well as disablement (isolation between source and sink) of the clock and data lines.

To provide the highest level of integration in external adapter (or: dongle) applications, PTN3381B includes an onboard 5 V DC regulator. Its output is designed to provide the required 5 V power supply to the DVI or HDMI connector, thereby eliminating the need for a separate external regulator. The on-board regulator needs only two external capacitors to operate, and its output is active whenever a valid 3.3 V is applied to the PTN3381B VDD pins.

The low-swing AC-coupled differential input signals to the PTN3381B typically come from a display source with multi-mode I/O, which supports multiple display standards, e.g., DisplayPort, HDMI and DVI. While the input differential signals are configured to carry DVI or HDMI coded data, they do not comply with the electrical requirements of the DVI v1.0 or HDMI v1.3a specification. By using PTN3381B, chip set vendors are able to implement such reconfigurable I/Os on multi-mode display source devices, allowing the support of multiple display standards while keeping the number of chip set I/O pins low. See Figure 1.

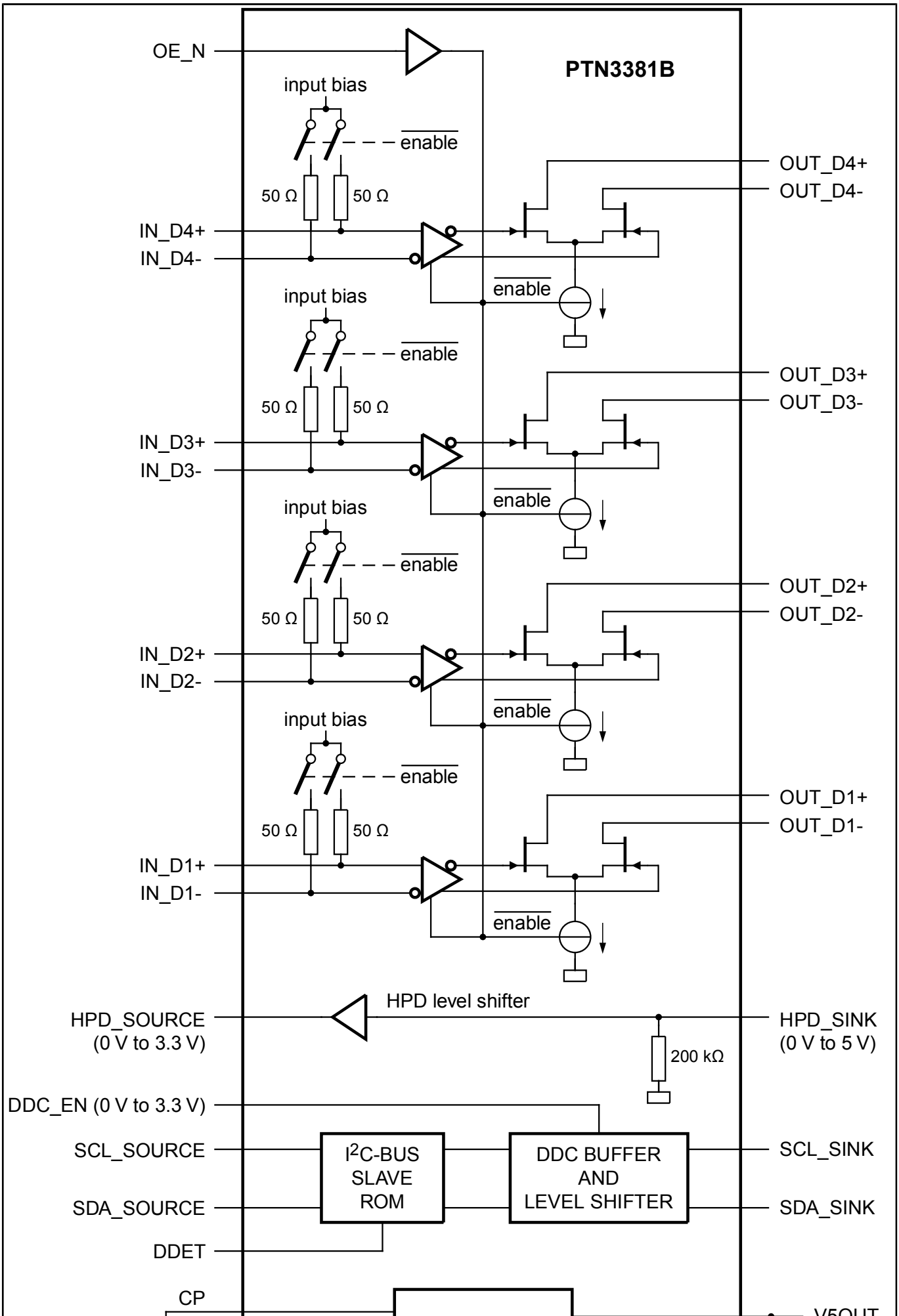
The PTN3381B main high-speed differential lanes feature low-swing self-biasing differential inputs which are compliant to the electrical specifications of DisplayPort Standard v1.1 and/or

PCI Express Standard v1.1, and open-drain current-steering differential outputs compliant to DVI v1.0 and HDMI v1.3a electrical specifications. The I²C-bus channel actively buffers as well as level-translates the DDC signals for optimal capacitive isolation. Its I²C-bus control block also provides for optional software HDMI dongle detect by issuing a predetermined code sequence upon a read command to an I²C-bus specified address. The PTN3381B also supports power-saving modes in order to minimize current consumption when no display is active or connected.

The PTN3381B is a fully featured HDMI as well as DVI level shifter. It is functionally equivalent to PTN3361B but provides an onboard 5 V regulator.

PTN3381B is powered from a single 3.3 V power supply consuming a small amount of power (100 mW typical without load at 5 V regulator output) and is offered in a 48-terminal HVQFN48 package.

PTN3381B Block Diagram


PTN3381B
OE_N
input bias
enable
50 Ω
50 Ω
IN_D4+
IN_D4-
OUT_D4+
OUT_D4-
IN_D3+
IN_D3-
OUT_D3+
OUT_D3-
IN_D2+
IN_D2-
OUT_D2+
OUT_D2-
IN_D1+
IN_D1-
OUT_D1+
OUT_D1-
HPD level shifter
HPD_SOURCE
(0 V to 3.3 V)
HPD_SINK
(0 V to 5 V)
200 kΩ
DDC_EN (0 V to 3.3 V)
SCL_SOURCE
SDA_SOURCE
I2C-BUS
SLAVE
ROM
DDC BUFFER
AND
LEVEL SHIFTER
SCL_SINK
SDA_SINK
DDET
CP

View additional information for Enhanced Performance HDMI®/DVI Level Shifter with Voltage Regulator, Dongle Detect Support and Active DDC Buffer.

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