

**PI3HDMI412FT-A**  
**TMDS Sink Current of Pericom's PI3HDMI412FT-A**

**Pericom's Switch PI3HDMI412-A**

PI3HDMI412FT and PI3DHMI412FT-A are two high performance TMDS switches in the industry today. Figure 1 and 2 show the setups of PI3HDMI412FT-A for video and PC graphics applications, respectively.

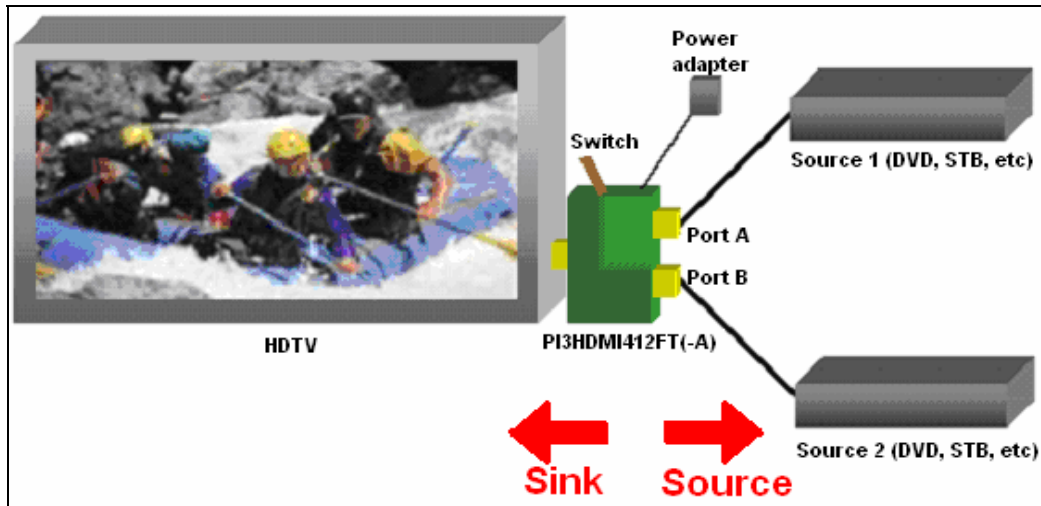


Figure 1: Setup of PI3HDMI412FT-A for Video Applications

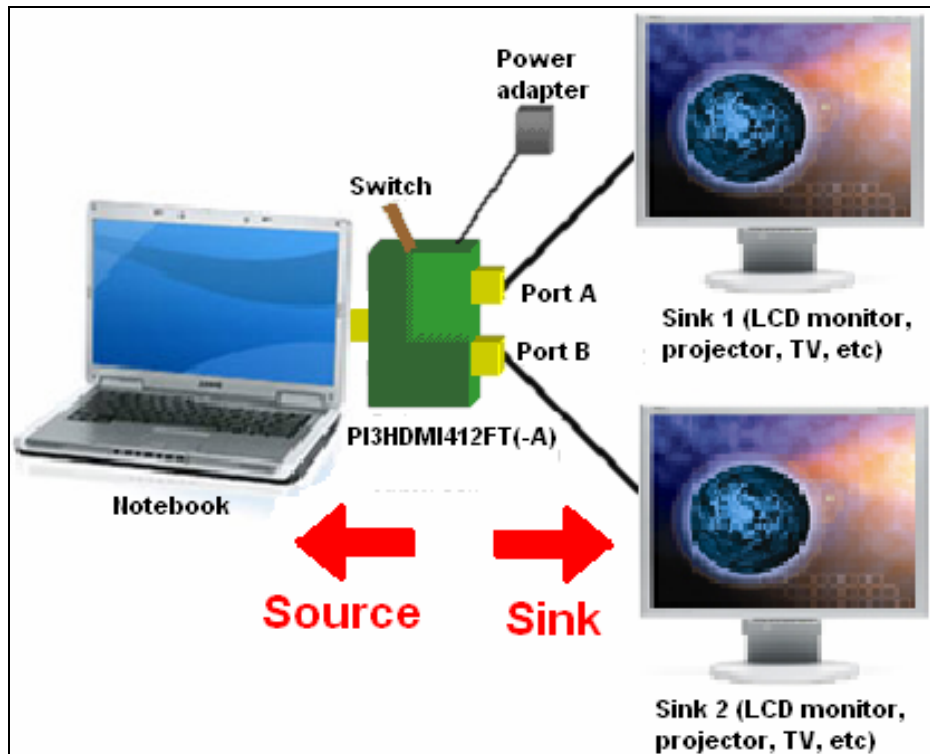


Figure 2: Setup of PI3HDMI412FT-A for PC Graphics Applications

### Max Current Limitation for TMDs Driver

A unique power supply of 3.3V<sub>dd</sub> with a biased 1.5V<sub>ss</sub> is designed in PI3HDMI412FT-A switches. This implementation introduces operation voltage of Single-ended Differential signal swinging between 1.0V and 3.6V, which covers the signal range from (AV<sub>cc</sub>-V<sub>swing</sub>) to AV<sub>cc</sub>±10mV where AV<sub>cc</sub>=3.3V±5% and 0.4≤V<sub>swing</sub>≤0.6V as specified in HDMI Specification v1.3. Video application is used as an example below.

When TMDs Source driver is in standby mode or Sink is not connected to Source, the outputs of PI3HDMI412FT shall be at high impedance with sink current, I<sub>SINK</sub>, less than 50mA as specified in Test ID 8-12 of HDMI Compliance Test Specification v1.3a. However, some TMDs sources drive their outputs to 0V; as a result, this 0V input of PI3HDMI412FT will turn on the off-channels which are biased at 1.5V<sub>ss</sub> and leakage current exists from 1.5V<sub>ss</sub> to input pins of PI3HDMI412FT.

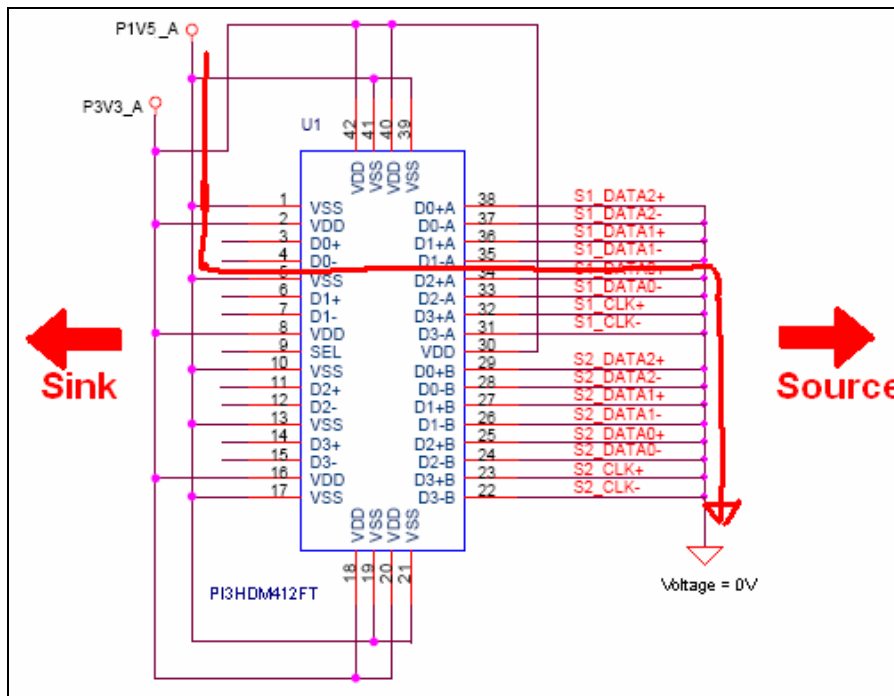


Figure 3: Leakage issue with outputs of PI3HDMI412FT being pulled low by Source

Adding external 200Ω pull-ups at inputs of PI3HDMI412FT or using PI3HDMI412F-A in which built-in PMOS pull-ups are employed is the recommended solution. The pull-ups will pull the input signals above the minimum operation voltage of 1.0V. Consequently, when the PI3HDMI412FT-A switch is turned off, the sink current is limited by the pull-ups.

The limitation of Sink current is determined in two conditions: (1) when Pericom’s switch is turned off and (2) when switch is on. If supplied current is larger than the limitation, issues such as crosstalk and current leakage may be encountered.

#### Condition 1

- a. When PI3HDMI412FT is turned off, 3.3V<sub>dd</sub> and 1.5V<sub>ss</sub> will be applied to the switch to pull each input signal to high impedance. The TMDs sink current is determined by the flow through 200Ω external pull up at input side of PI3HDMI412FT switch. The nominal current is calculated as  $(3.3V - 1.5V) / 200\Omega = 9mA$ .

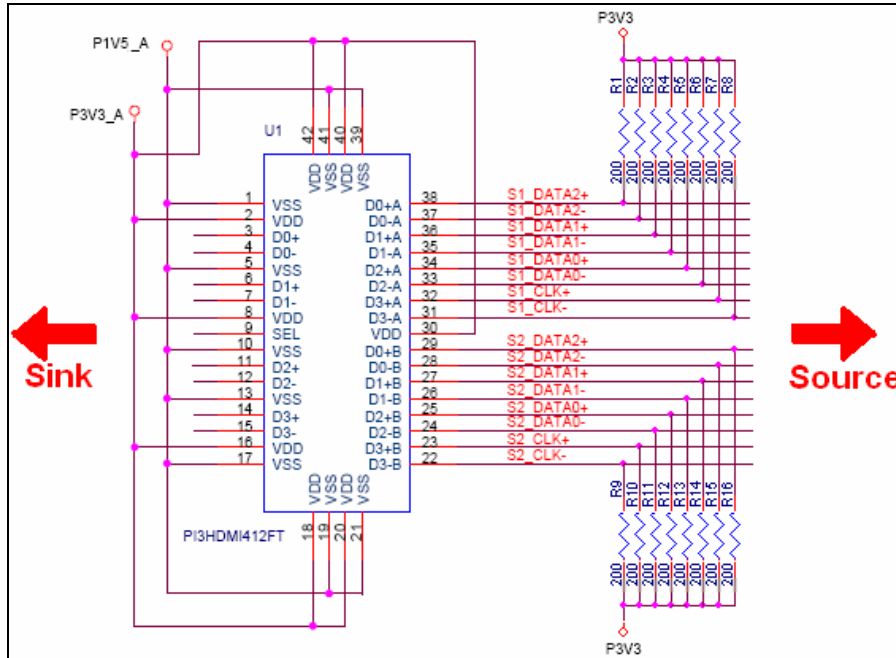


Figure 4: TMDs Current when PI3HDMI412FT is turned off

- b. As PI3HDMI412FT-A has internal PMOS pull up which will be turned on when the switch is powered off, the TMDs current is limited by the internal pull up. The sink current is 18mA which is shown in Figure 6.

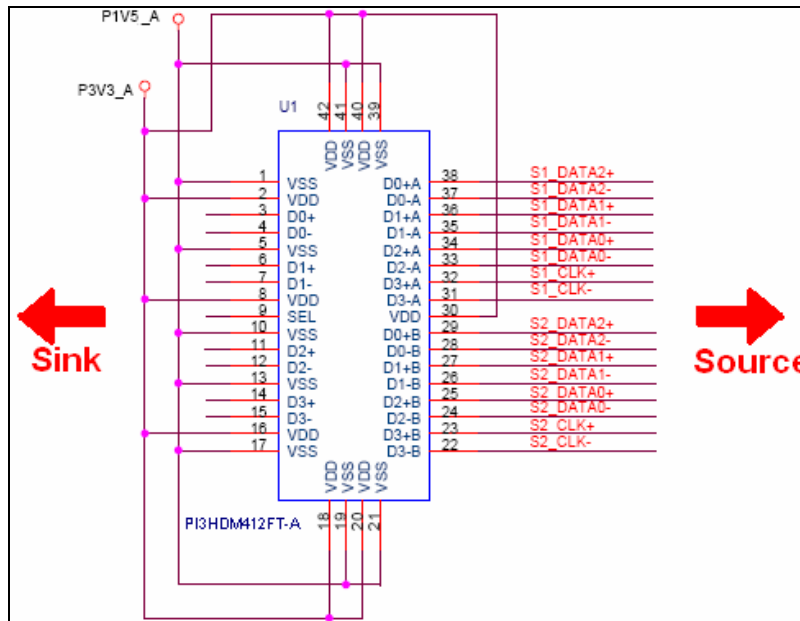


Figure 5: TMDs Current when PI3HDMI412FT-A is turned off

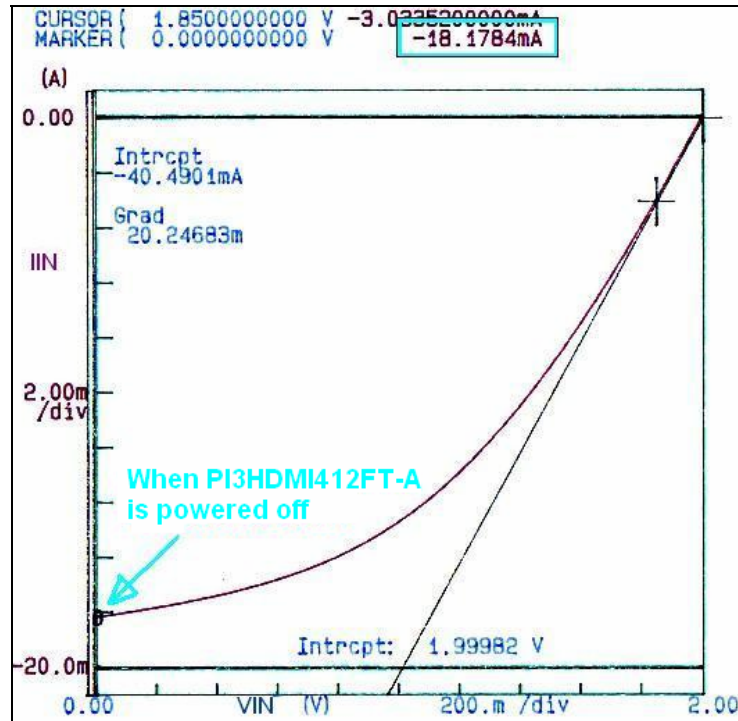


Figure 6: IV Curve of Input of PI3HDMI412FT-A with Internal PMOS pull-up

### Condition 2

When PI3HDMI412FT-A is turned on, the TMDS sink current depends on the termination resistor  $R_{term}$ , which is pulled up by the Termination Supply Voltage  $AV_{cc}$  at Sink. As the required operating  $AV_{cc}$  and  $R_{term}$  are specified as  $3.3V \pm 5\%$  and  $50\Omega \pm 10\%$ , respectively, in HDMI Specification Ver1.3, the nominal TMDS current at 3.3V supply is  $(3.3V - 1.8V) / 50\Omega = 36mA$ . In parallel, the current drawn through the +5V power pin by the Sink cannot be larger than 10mA as specified in Test ID 8-12 of HDMI Compliance Test Spec v1.3.

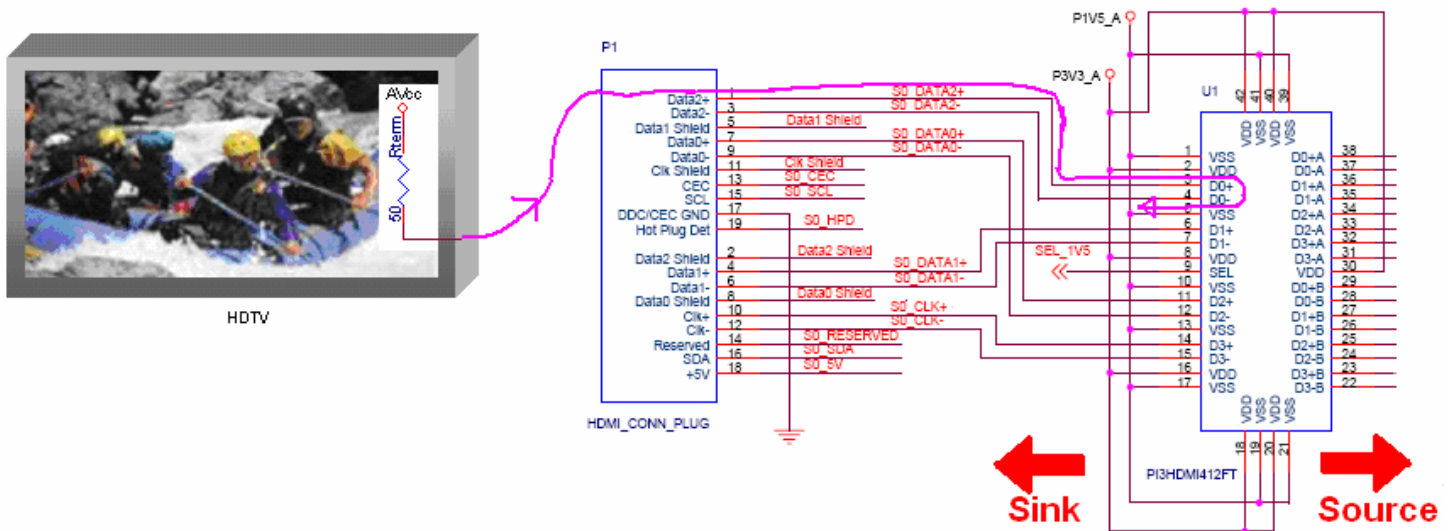


Figure 7: TMDS Current when PI3HDMI412FT-A is turned On

### Preventing Leakage in Standby Mode

For PC graphics applications, it is found that when Source is in standby mode while HDMI cable is plugged between switch and Sink device, leakage from Sink to PI3HDMI412FT-A switch Vdd pin exists. The leakage path is created because the internal 50Ω-pull-ups at Sink forward bias the ESD diodes in the protection architecture of PI3HDMI412FT-A switches.

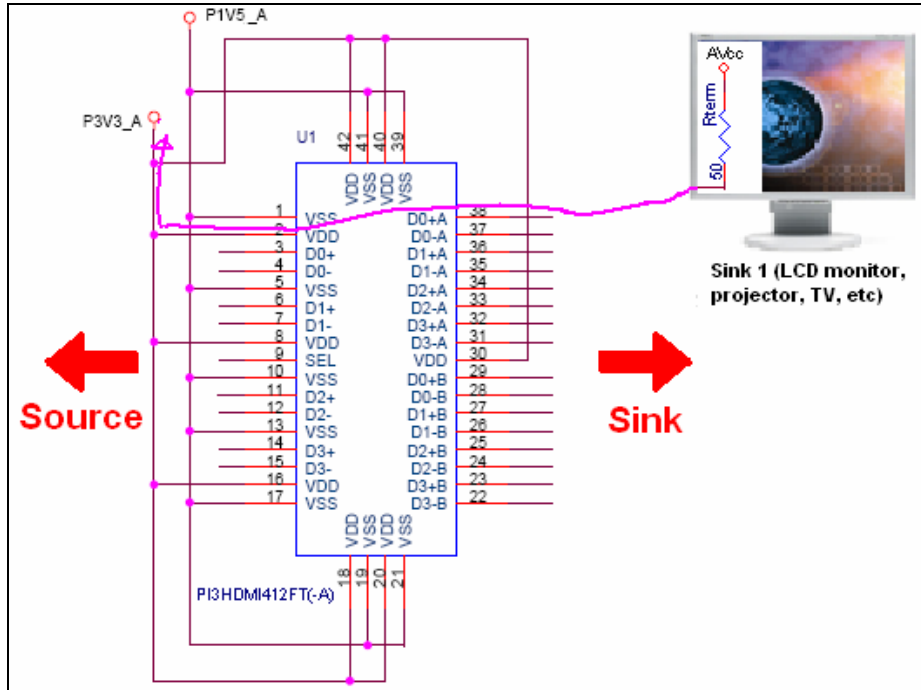


Figure 8: TMDS Current when PI3HDMI412FT-A is turned on

An external low voltage drop diode, 30BQ015 in Block A for instance, can be added from Source's Vdd supply to Vdd pin of PI3HDMI412FT-A to block the leakage path.

Supplier: Internal Rectifier, <http://www.irf.com/indexsw.html>

Datasheet: <http://www.irf.com/product-info/datasheets/data/30bq015.pdf>

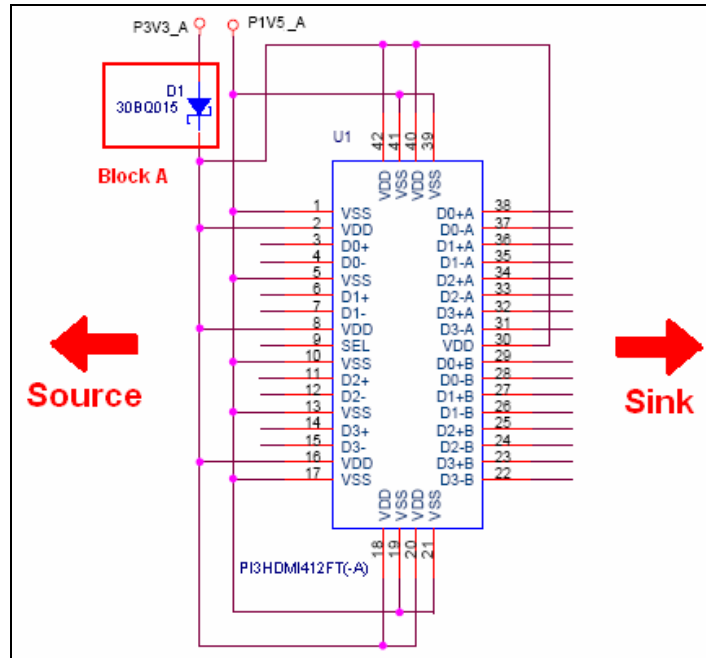


Figure 9: Leakage Solution for PI3HDMI412FT-A