4-Port HDMI™ Signal Switch with I²C Control

Features

- 4:1 HDMI Switch Mux
- Non-Blocking EQ path for ideal EQ control in main Receiver chipset
- -3dB bandwidth up to 5Gbps to support HDMI 1.3a (16-bit color depth per channel)
- HDMI 1.4 data rate ready
- DDC active signal buffer or passive switch selectable
- I²C Register control for switch configuration
- Automatic HDCP reset circuitry for quick communication when switching from one port to another
- HPD polarity control and signal trigger through I²C register setting
- Connector Plug-in detection and Interrupt Flag setting
- Selectable HPD 5V signal level shifter with open drain output stage or output buffer
- 3.3V power supply and standby power supply
- TMDS output enable control
- Low power consumption to support Energy Star Compliance
- ESD protection on all I/O pins
  - 8kV contact per IEC61000-4-2, level 4
- Packaging (Pb-free & Green available):
  - 80-contact LQFP

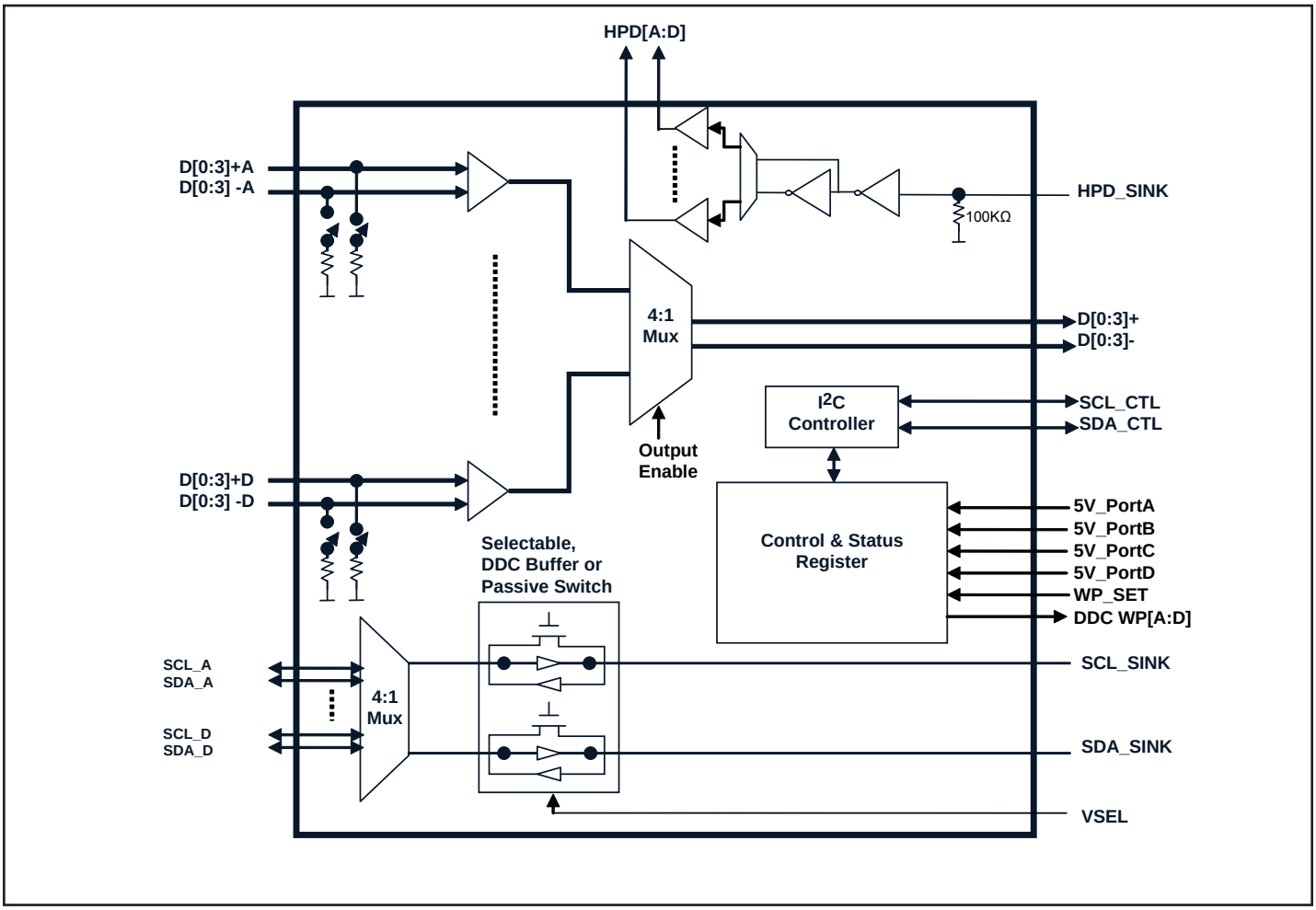
Description

Pericom Semiconductor's PI3HDMI series of switch circuits are targeted for high-resolution video networks that are based on DVI/HDMI™ standards. The PI3HDMI2410 is a 4-to-1 HDMI Mux/DeMux signal switch. It is designed for low bit-to-bit skew and high channel-to-channel noise isolation. The maximum data rate support is up to 5Gbps which can meet HDMI 1.3a standard and support the resolution requirement of next generation HDTV and PC graphics.

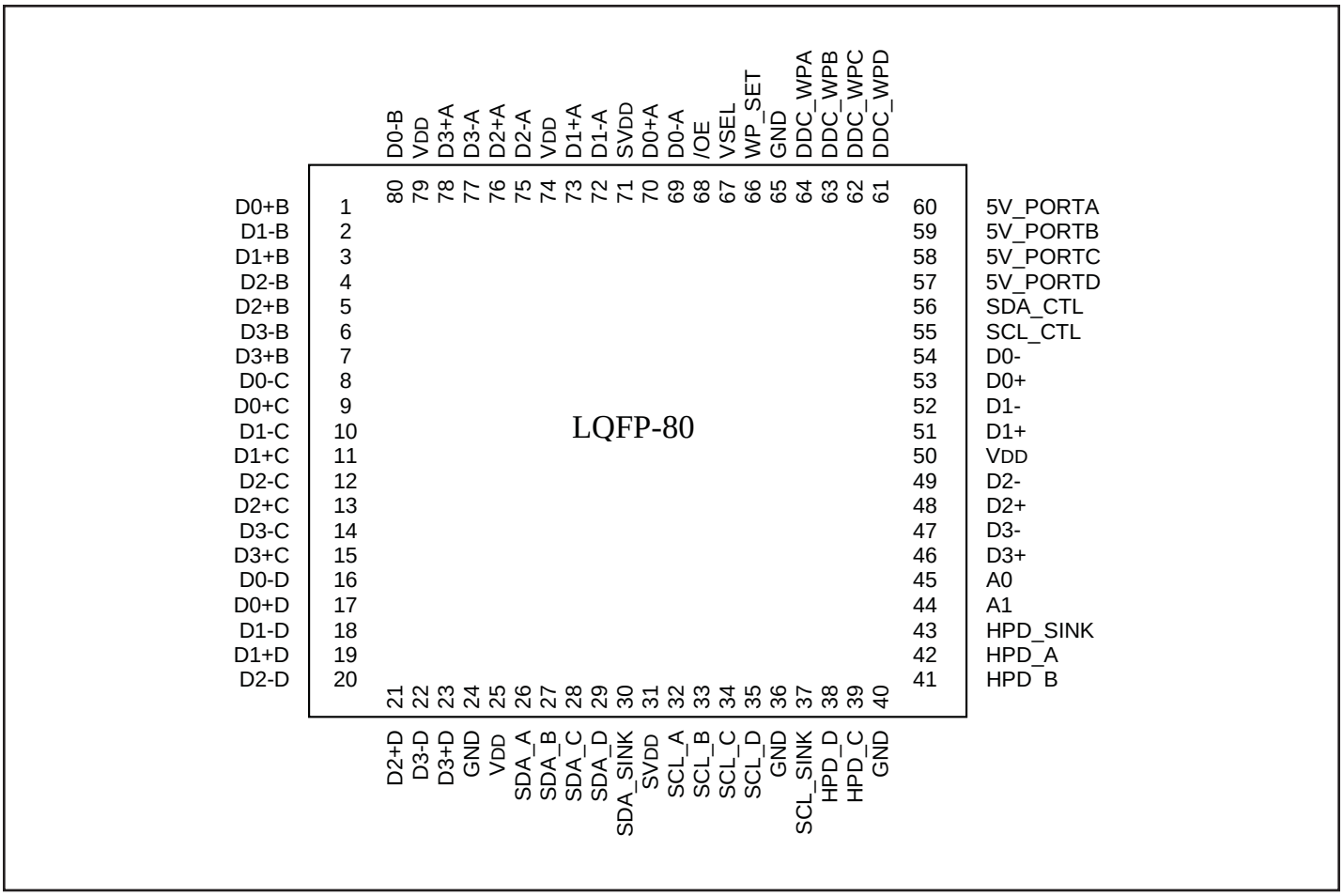
PI3HDMI2410 is designed specifically for ATC-Sink requirements. All switch control settings are through I²C bus to provide flexible design and reducing peripheral components. Selectable active signal buffer for DDC bus can optimize the bi-directional data transmission for long trace or cable applications.

All input pins are protected with Pericom's ESD protection circuits supporting ESD damage as high as 8kV contact per IEC61000-4-2 Level 4 specification.

Block Diagram



Pin Assignment – 80-Contact LQFP



Pinout Table

Pin Name	I/O Type	Description
V_{DD}	I/O	3.3V power supply. When V_{DD} is off, the TMDS channels will be powered down.
SV_{DD}	I/O	3.3V standby power supply. SV_{DD} is for all side band signals, I²C register and I²C bus.
HPD_SINK	I	Sink side hot plug detector input. High: 5-V power signal asserted from source to sink and EDID is ready. Low: No 5-V power signal asserted from source to sink, or EDID is not ready.
HPD_A	O	Port A HPD output
HPD_B	O	Port B HPD output
HPD_C	O	Port C HPD output
HPD_D	O	Port D HPD output
D0+A D0-A D1+A D1-A D2+A D2-A D3+A D3-A	I	Port A TMDS inputs
D0+B D0-B D1+B D1-B D2+B D2-B D3+B D3-B	I	Port B TMDS inputs
D0+C D0-C D1+C D1-C D2+C D2-C D3+C D3-C	I	Port C TMDS inputs

Pin Name	I/O Type	Description
D0+D D0-D D1+D D1-D D2+D D2-D D3+D D3-D	I	Port D TMDS inputs
D0+ D0- D1+ D1- D2+ D2- D3+ D3-	O	TMDS outputs
SCL_A	I/O	Port A DDC Clock
SCL_B	I/O	Port B DDC Clock
SCL_C	I/O	Port C DDC Clock
SCL_D	I/O	Port D DDC Clock
SDA_A	I/O	Port A DDC Data
SDA_B	I/O	Port B DDC Data
SDA_C	I/O	Port C DDC Data
SDA_D	I/O	Port D DDC Data
SCL_SINK	I/O	Sink side DDC Clock
SDA_SINK	I/O	Sink side DDC Data
SCL_CTL	I/O	I²C Clock
SDA_CTL	I/O	I²C Data
WP_SET	I	WP_SET = 0 (Default), Set B1b[1] as INT Flag. WP_SET = 1, DDC_WP[A:D] is programmable by B1b[1].
DDC_WPA, DDC_WPB, DDC_WPC, DDC_WPD,	O	Open drain output. When WP_SET = 1, general purpose logic configured by B1b[1]
$\overline{OE}$	I	Output Enable control. Active low.
A1	I	I²C Address 1
A0	I	I²C Address 0

Pin Name	I/O Type	Description
5V_PortA, 5V_PortB, 5V_PortC, 5V_PortD	I	Connector 5V port.
VSEL	I	DDC buffer V_{IL} selection. VSEL = 0V, V_{IL} = 0.5V VSEL = 0.5 V_{DD}, V_{IL}=0.45V VSEL = V_{DD}, V_{IL}=0.6V

Truth Table

WP_SET	B1_b[1]	DDC_WP[A:D]
1	0	Hi_Z
1	1	0
0	X	Hi_Z

I²C Control Register

	b7	b6	b5	b4	b3	b2	b1	b0
Address Byte	1	0	1	0	1	A1 Hardware Selectable	A0 Hardware Selectable	0/1 *

* 0:Write; 1:Read

Data Byte 0: Control Register

Bit	Description	Type	Power Up Condition	Logic Settings
7	HDMI input port selection	R/W	0	00 = Port A 01 = Port B 10 = Port C 11 = Port D
6	HDMI input port selection	R/W	0	
5	HPD Logic Selection	R/W	1	0 = Inverted 1 = Non Inverted
4	HPD Input Selection	R/W	0	0 = HPD_SINK 1 = I²C Register Setting B0b[3:0]
3	HPD Port D Logic Setting	R/W	0	I. Byte0 b[4] = 1 HPD Port D Register setting II. Byte0 b[4] = 0 Test mode
2	HPD Port C Logic Setting	R/W	0	I. Byte0 b[4] = 1 HPD Port C Register setting II. Byte0 b[4] = 0 Test mode
1	HPD Port B Logic Setting	R/W	0	I. Byte0 b[4] = 1 HPD Port B Register setting II. Byte0 b[4] = 0 Test mode
0	HPD Port A Logic Setting	R/W	0	I. Byte0 b[4] = 1 HPD Port A Register setting II. Byte0 b[4] = 0 Test mode

Data Byte 1: Control Register

Bit	Description	Type	Power Up Condition	Logic Settings
7	HPD Output Stage selection	R/W	0	0 = Open Drain 1 = Output Buffer
6	Output Enable	R/W	1	0 = Output Disable (also drives switch into power down mode) 1 = Output Enable
5	5V_Port D connect	R	0	0 = Disconnected 1 = Connected; Set INT Flag
4	5V_Port C connect	R	0	0 = Disconnected 1 = Connected; Set INT Flag
3	5V_Port B connect	R	0	0 = Disconnected 1 = Connected; Set INT Flag
2	5V_Port A connect	R	0	0 = Disconnected 1 = Connected; Set INT Flag
1	INT Flag	R/W	0	When WP_SET = 0, B1b[1] is configured as INT flag. 0 = INT Flag Clear 1 = INT Flag Set When WP_SET = 1, B1b[1] is configured as DDC_WP input setting.
0	DDC channel selection	R/W	0	0 = Passive switch 1 = Active switch buffer

* External hardware control pin WP_SET will set B1b1 to be INT Flag or DDC_WP[0:3] input.

Bus transactions

Data transfers follow the format shown in Fig.1. After the START condition (S), a slave address is sent. This address is 7 bits long followed by an eighth bit which is a data direction bit (R/W) - a 'zero' indicates a transmission (WRITE), a 'one' indicates a request for data (READ). A data transfer is always terminated by a STOP condition (P) generated by the master. However, if a master still wishes to communicate on the bus, it can generate a repeated START condition (Sr) and address another slave without first generating a STOP condition. Various combinations of read/write formats are then possible within such a transfer.

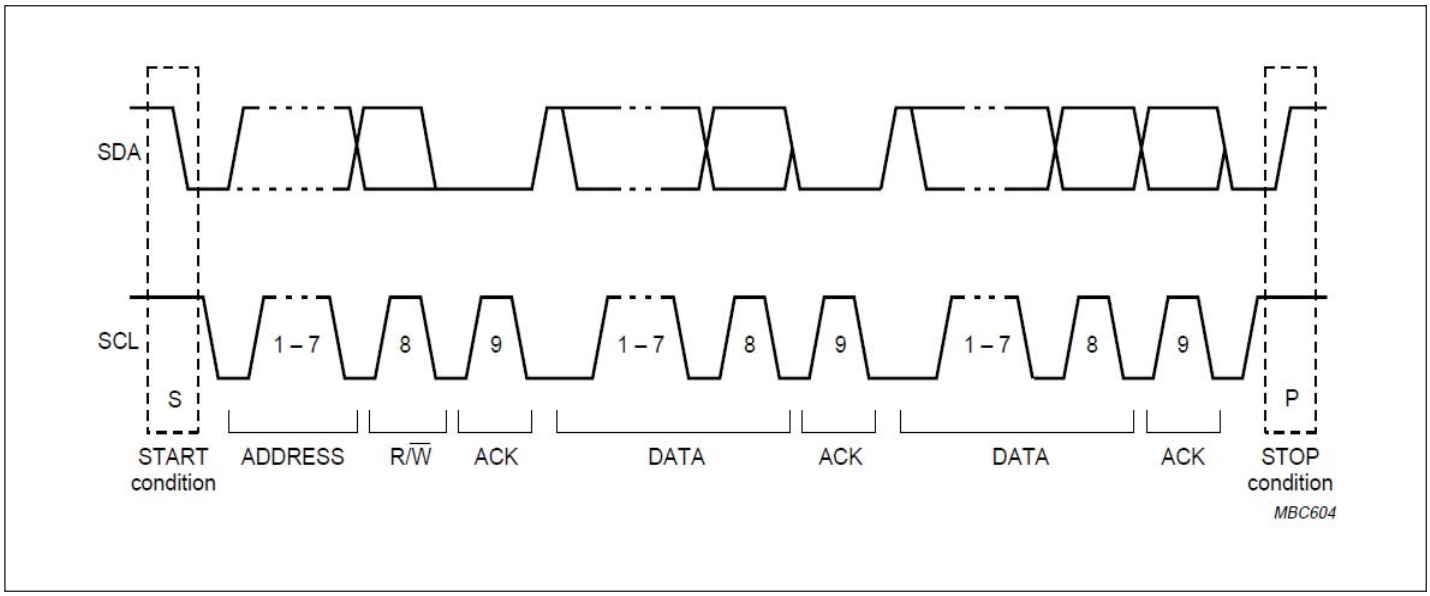


Figure 1: A Complete Data Transfer

Data is transmitted to the PI3HDMI2410 registers using the Write mode as shown in Figure 2. Data is read from the PI3HDMI2410 registers using the Read mode as shown in Figure 3.

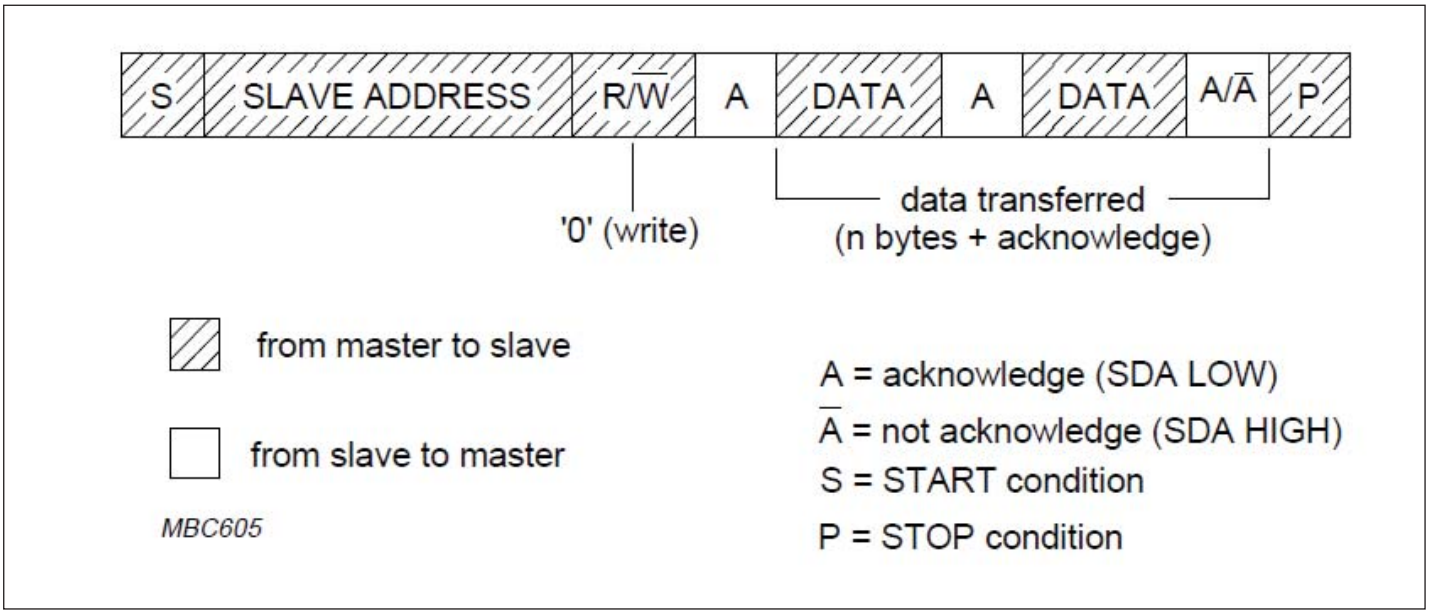


Figure 2 : Write to Control Register

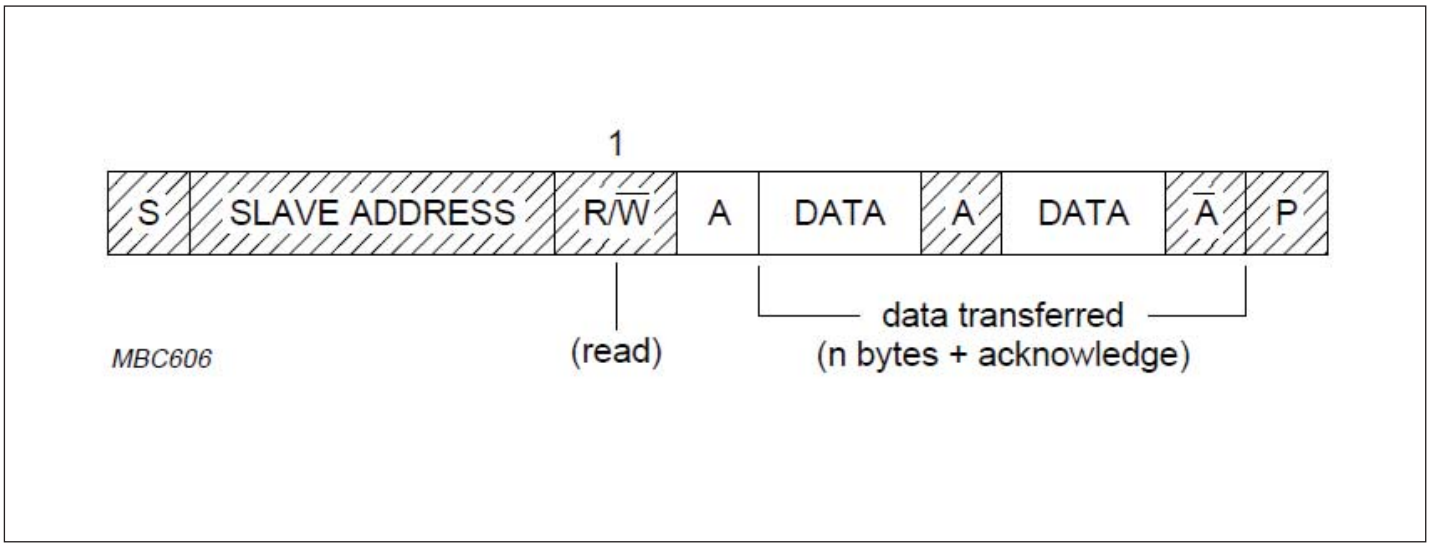
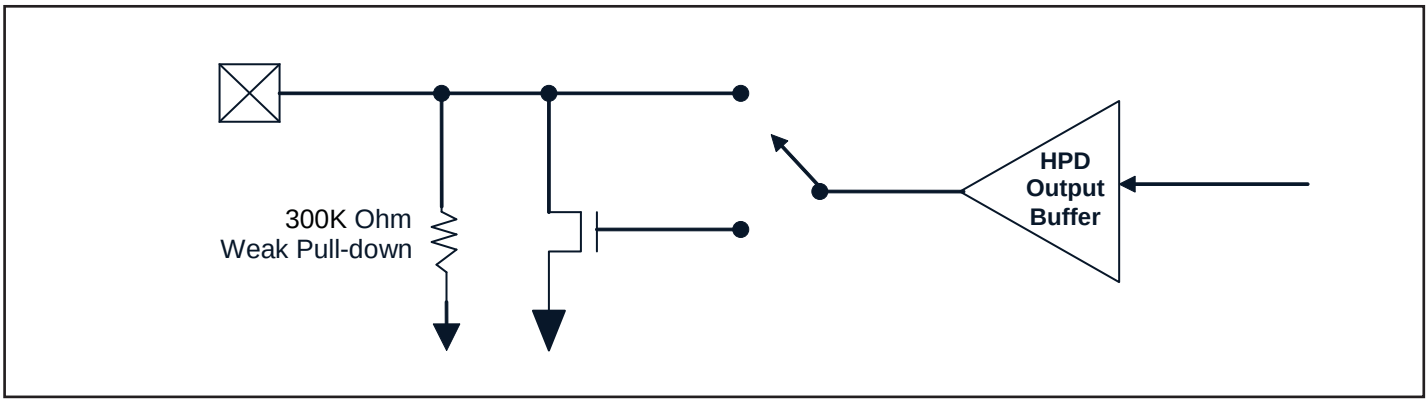


Figure 2 : Read to Control Register

HPD Output Buffer



Data Channel Pull-down Resistor Control

Pull-down resistor active conditions:

1. The Data Channel is unselected
2. Output enable control /OE is disable(/OE=High) or B1b[6]=Low, pull down on all channels
3. No normal operation voltage input (but standby voltage SVDD is still On), pull down on all channels

Output Enable control

Output Disable can be asserted through external $\overline{OE}$ pin or through I²C.

$\overline{OE}$	OE_I²C B1b[6]	Operation
Low	High	Enable
Low	Low	Disable
High	X	Disable

Default value: $\overline{OE}$ = Low ; Byte 1 b[6] = High

Absolute Maximum Ratings (Over operating free-air temperature range)

Item	Rating
Supply Voltage to Ground Potential	5.5V
All Inputs and Outputs	-0.5V to V_{DD}+0.5V
Ambient Operating Temperature	-40 to +85°C
Storage Temperature	-65 to +150°C
Junction Temperature	150°C
Soldering Temperature	260°C

Stress beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operation Conditions

Parameter	Min.	Typ.	Max.	Unit
Ambient Operating Temperature	-40		+85	°C
Power Supply Voltage (measured in respect to GND)	+3.0		+3.6	V

DC Specifications

V_{DD} = 3.3V ±10%, Ambient Temperature 0 to +70°C

Symbol	Parameter	Conditions	Min	Nom	Max	Units
V_{DD}	Operating Voltage		3.0	3.3	3.6	V
I_{DD}	Supply Current	Output Enable		5.0	6	mA
I_{DDQ}	Quiescent Supply Current	Output Disable		1.7	2	
V_{OH_DDC}	DDC passive switch Output High Voltage	Test condition as I_O = 0 (open load), V_I = 5.5V	SV_{DD}-1.0			V
V_{OL_DDC}	DDC Buffer Output Low Voltage	Source side, I_{OL} = 3mA External pull-up to 3.3V from 1.5kΩ to 4.7kΩ			0.4	
		Sink side, I_{OL} = 3mA	0.65	0.75	0.95	

Symbol	Parameter	Conditions	Min	Nom	Max	Units
V_{IH_DDC}	DDC Buffer Input High Voltage	Source side (VSEL = 0)		1.7		V
		Sink side (VSEL = 0)		0.5		
V_{IL_DDC}	DDC Buffer Input Low Voltage	Source side			0.8	
		Sink side (VSEL = 0)	0.45	0.5	0.6	
$V_{IH\_V5\_A}$' $V_{IH\_V5\_B}$' $V_{IH\_V5\_C}$' $V_{IH\_V5\_D}$'	Input High Voltage of 5V ports		2.4			
$V_{IL\_V5\_A}$' $V_{IL\_V5\_B}$' $V_{IL\_V5\_C}$' $V_{IL\_V5\_D}$'	Input Low Voltage of 5V ports				0.8	
V_{OL_HPD}	Buffer Output Low Voltage	I_{OL} = 4 mA			0.4	
	Open Drain Output Low Voltage	I_{OL} = 4 mA	0		0.4	
V_{OH_HPD}	Buffer Output High Voltage	I_{OH} = 3 mA	2.4			
$I_{OFF\ (HPD)}$	Off Leakage Current	V_{DD} = 0V, V_{IN} = 3.6V		12	20	µA
		V_{DD} = 0V, V_{IN} = 5.5V		20	35	
I_{OZ_HPD}	Open Drain Output Leakage Current	V_{DD} = 3.6V, V_{IN} = 3.6V		12	15	
		V_{DD} = 3.6V, V_{IN} = 5.5V		21	38	
$V_{OL\_DDC\_WP}$	Open Drain Output Low Voltage	I_{OL} = 4 mA			0.4	V
C_{IO}[1]	Input/output capacitance (Passive Switch)	V_{DD} = 0V or 3.0V, Frequency = 100kHz		6	9	pF

Note:

1. Measured at Vbias = 0V or 5V, Vrms = 0.2V;
Vbias = 1.65V, Vrms = 0.9V;
Vbias = 2.5V, Vrms = 1.2V.

Dynamic Specifications

V_{DD} = 3.3V ±10%, T_A -40 to +85°C, GND = 0V

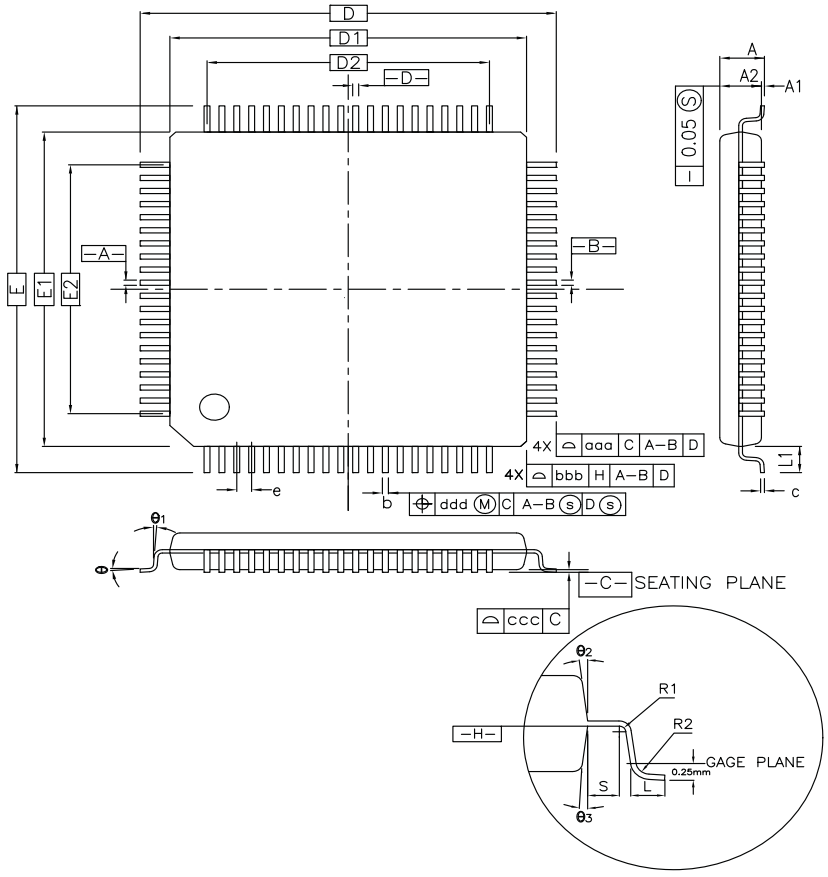
Parameter	Description	Conditions	Min	Typ	Max	Units
X_{TALK}	Crosstalk on High-speed Channels	f = 1.13 GHz		-34		dB
		f = 825 GHz		-36		
O_{IRR}	OFF Isolation on High-speed Channels	f = 1.13 GHz		-28		
		f = 825 GHz		-32		
I_{LOSS}	Defferential Insertion Loss on High-speed Channels	DR = 1.65Gbps DR = 2.0Gbps DR = 2.25Gbps DR = 3.0Gbps DR = 3.4Gbps		-1.5 -1.73 -1.82 -1.99 -2.08		dB
BW	-3dB BW for TMDS channels			2.5		GHz

Capacitance Measurement (V_{DD} = 3.3V, T_A =25°C)

Test Condition	Capacitance	Units
SDA_CTL	3.0	pF
SCL_CTL	2.3	
HPD_Sink	1.7	

Vbias=0.6V

Packaging Mechanical: 80-Contact LQFP (FF)



COTROL DIMENSIONS ARE IN MILLIMETERS.

SYMBOL	MILLIMETER			INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	—	—	1.60	—	—	0.063
A1	0.05	—	0.15	0.002	—	0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
D	14.00 BSC.			0.551 BSC.		
D1	12.00 BSC.			0.472 BSC.		
E	14.00 BSC.			0.551 BSC.		
E1	12.00 BSC.			0.472 BSC.		
R2	0.08	—	0.20	0.003	—	0.008
R1	0.08	—	—	0.003	—	—
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°	—	—	0°	—	—
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°
c	0.09	—	0.20	0.004	—	0.008
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF			0.039 REF		
S	0.20	—	—	0.008	—	—
b	0.17	0.20	0.27	0.007	0.008	0.011
e	0.50 BSC.			0.020 BSC.		
D2	9.50			0.374		
E2	9.50			0.374		
TOLERANCES OF FORM AND POSITION						
aaa	0.20			0.008		
bbb	0.20			0.008		
ccc	0.08			0.003		
ddd	0.08			0.003		

NOTE :
1. ALL DIMENSION IN MM
2. Refer JEDEC MS–026/BDD
3. Package Outline Exclusive of Mold Flash and Metal Burr

PERICOM® Enabling Serial Connectivity

DATE: 03/18/09

DESCRIPTION: 80-contact, Low Profile Quad Flat Package (LQFP)

PACKAGE CODE: FF (FF80)

DOCUMENT CONTROL #: PD-2064 REVISION: A

07-0100

Note:

- **For latest package info, please check: http://www.pericom.com/products/packaging/mechanicals.php**

Ordering Information

Ordering Code	Package Code	Package Type
PI3HDMI2410FFE	FF	Pb-free & Green, 80-Contact, LQFP

1. Thermal characteristics can be found on the company web site at www.pericom.com/packaging/

2. E = Pb-free and Green

3. Adding an X suffix = Tape/Reel