

Quarch Technology Ltd

DisplayPort 1.2 Physical Layer Switch

Technical Manual

For use with:

QTL1530 - DisplayPort 1.2 Physical Layer Switch

Using Quarch firmware version 4.0 and above

Monday, 27 February 2012



Change History

1.0	02 December 2011	Initial Release
1.1	27 February 2012	Updated MUX commands section

Contents

Introduction	4
Technical Specifications	4
Main Link Electrical Characteristics:	4
AUX Channel Characteristics:	5
HPD Electrical Characteristics:	5
CONFIG1 and CONFIG2 Electrical Characteristics:	5
DP_PWR Electrical Characteristics:	6
Mechanical Characteristics:	6
Usage Overview	7
Terminology	7
Front Panel LEDs	7
Control Interfaces	8
Voltage Measurements	9
Default Startup State	10
Controlling the Module	11
Serial Command Set	11
SCPI Style Commands	11
Display Port Switch Signal Names	14
Display Port Switch Commands	14
Display Port Config Commands	15
Control Register Map	17

Introduction

The DisplayPort 1.2 Physical Layer Switch has 1 mini DisplayPort Source port and 8 mini DisplayPort Sink ports. The source connection can be automatically and remotely routed to any one of the eight Sink ports. This provides an automated solution for performing cable swaps between a source and multiple Sinks. The duration between disconnecting and reconnecting can be varied from 1s to 10s in 1s intervals.

Main Link data rates of up to 5.4Gbps per lane are supported and AUX channel data rates up to 720Mbps. The switch is a DisplayPort Cable Extending Output Switch which makes and breaks the electrical connections between connectors without decoding the incoming signal. Details of the electrical connections can be found below.

Technical Specifications

Main Link Electrical Characteristics:

All four main link lanes are switched with the same characteristics. The incoming signal is redriven but not retimed. This gives high signal quality whilst preserving timing characteristics of the original signal. An incoming main link lane can be routed to any or multiple Sinks main link lanes.

Parameter	Min	Typical	Max
Maximum Data Rate	6 GBps		
Input differential voltage swing	200mV	-	2000mV
Output differential voltage swing (Programmable)	350mV	-	1750mV
Output rise/fall time (20%-80%)		60 pS	
Deterministic output jitter	-	0.1UI	0.2UI
Random output jitter	-	6 mUI RMS	8 mUI RMS
Propagation delay	-	1 nS	-
Channel to channel skew	-	300 pS	-

AUX Channel Characteristics:

The Source AUX channel can be selected to connect to one of the eight Sink AUX channels. When connected a channel passes the original signal including DC bias with minimal signal loss and no active modification to the signal.

Parameter	Min	Typical	Max
Maximum Data Rate	-	720Mbps	-
Switch On Resistance	-	6.5Ohm	12Ohm
Propagation delay	-	300pS	-
Off Isolation	-	-27Db	-
Absolute Maximum Voltage Rating		+4V	
Peak Current Rating (10% duty cycle)		120mA	

HPD Electrical Characteristics:

The source HPD signal can be connected to one of the eight Sink HPD signals. These signals are switched using a passive analog multiplexer IC.

Parameter	Min	Typical	Max
Switch On Resistance	-	30 Ohm	-
Off Isolation	-	-78dB	-
Absolute Maximum Voltage Rating		13.5V	
Continuous Current Rating		100mA	

CONFIG1 and CONFIG2 Electrical Characteristics:

The source connector CONFIG1 and CONFIG2 signals can be connected to any one of the eight Sink CONFIG1 and CONFIG2 signals respectively. These signals are switched using passive analog switches.

Parameter	Min	Typical	Max
Switch On Resistance	-	1.8 Ohm	-
Off Isolation	-	-56dB	-
Absolute Maximum Voltage Rating		13V	
Continuous Current Rating		100mA	

DP_PWR Electrical Characteristics:

The source connector DP_PWR signal can be connected to any one of the eight Sink connectors DP_PWR signal.

Paramter	Min	Typical	Max
Switch On Resistance @ 3.8A	-	0.11 Ohm	-
Continuous Current Rating	-	3.8A	-
Minimum DP_PWR Voltage		0.8V	

Mechanical Characteristics:

Width 169.8mm.

Length 164.50mm.

Height 53.3mm.

Usage Overview

Terminology

Quarch Multiplexer and Switching products refer to Host connectors with letters and Device connectors with numbers. On the DisplayPort 1.2 Switch the one Source connection is lettered 'a' and the eight Sink connectors are numbered from 1 to 8.

Front Panel LEDs

Each Sink has an LED to indicate the state of the Source connection to that Sink:

LED State	Connection State
Off	No Connection
Green	Full Connection
Orange	Partial Connection (e.g. Main Link Only)

Control Interfaces

All Torridon Control Modules are designed to be used with a Torridon Array Controller (QTL1079) or a single Torridon Interface Card (QTL1144).

The control cable is an ultra-thin Flex cable.

Control Interface	Form Factor	Torridon Module Ports	Control Methods Available	Interfaces
Torridon Array Controller	1U 19" Rack Mounted unit	24 at the front, 4 at the rear	Serial Scripting Script Generation through TestMonkey GUI	Serial via DB9 or RJ45 Ethernet
Torridon Interface Card	102mm x 26mm PCB	1 port	Serial Scripting Script Generation through TestMonkey GUI Real-time USB Control via TestMonkey GUI	Serial via DB9 or RJ45 USB

Voltage Measurements

The modules are capable of measuring various voltages both for self test and to assist in the testing of a customer's system. The following measurement points are available:

Measurement Command	Description	Resolution / Accuracy
MEASure:VOLTage:SELF 1v2?	Returns the voltage of the modules internal 1.2v power rail	64mV / 5%
MEASure:VOLTage:SELF 2v5?	Returns the voltage of the modules internal 2.5v power rail	64mV / 5%
MEASure:VOLTage:SELF 3v3?	Returns the voltage of the modules internal 3.3v power rail	64mV / 5%
MEASure:VOLTage:SELF 12v?	Returns the voltage of the modules internal 12v power rail	64mV / 5%

Default Startup State

On power up or reset, the control modules enter a default state. Each host port is connected to a device port, and hosts and devices may be plugged into these ports and will be instantly connected

Host Port	Default Device Port
A	1

Controlling the Module

The module can be controlled either by:

- Serial ASCII terminal (such as HyperTerminal)
This is normally used with scripted commands to automate a series of tests. The commands are normally generated by a script or user code (PERL, TCL, C, C# or similar).
- Telnet Terminal (Only when connected to an Array Controller). This mode uses exactly the same commands as the serial ASCII terminal
- USB
Quarch's TestMonkey application can control a single module via USB, this allows simple graphical control of the module.

Serial Command Set

When connected via a serial terminal, the module has a simple command line interface

SCPI Style Commands

These commands are based on the SCPI style control system that is used by many manufacturers of test instruments. The entire SCPI specification has NOT been implemented but the command structure will be very familiar to anyone who has used it before.

- SCPI commands are NOT case sensitive
- SCPI commands are in a hierarchy separated by ':' (LEVe11:LEVe12:LEVe13)
- Most words have a short form (e.g. 'register' shortens to 'reg'). This will be documented as REGister, where the short form is shown in capitals.
- Some commands take parameters. These are separated by spaces after the main part of the command (e.g. "meas:volt:self 3v3?" Obtains the 3v3 self test measurement)
- Query commands that return a value all have a '?' on the end
- Commands with a preceding '*' are basic control commands, found on all devices
- Commands that do not return a particular value will return "OK" or "FAIL". Unless disabled, the fail response will also append a text description for the failure if it can be determined.

[comments]

Any line beginning with a # character is ignored as a comment. This allows commenting of scripts for use with the module.

***RST**

Triggers a reset, the module will behave as if it had just been powered on

***CLR**

Clear the terminal window and displays the normal start screen. Also runs the internal self test. The same action can be performed by pressing return on a blank line.

***IDN?**

Displays a standard set of information, identifying the device. An example return is shown below

Family:	Torridon System	[The parent family of the device]
Name:	Ethernet Cable Pull Module	[The name of the device]
Part#:	QTL1271-01	[The part number of the hardware]
Processor:	QTL1159-01,3.50	[Part# and version of firmware]
Bootloader:	QTL1170-01,1.00	[Part# and version of bootloader]
FPGA 1:	1.0	[Version of FPGA core]

***TST?**

Runs a set of standard tests to confirm the device is operating correctly, these tests are also performed at start up. Returns 'OK' or 'FAIL' followed by a list of errors that occurred, each on a new line.

CONFig:MODE BOOT

Configures the card for boot loader mode (to update the firmware), requires an update utility on the PC.

CONFig:MESSages [SHORT|USER]**CONFig:MESSages?**

Gets or sets the mode for messages that are returned to the user's terminal

Short: Only a "FAIL" or "OK" will be returned

User: Full error messages are returned to the user on failure

CONFig:TERMinal USER

Sets the terminal response mode to the default 'User' setting. This is intended for use with HyperTerminal or similar and manually typed commands

CONFig:TERMinal SCRIPT

Sets the terminal response mode for easier parsing. Especially useful from a UNIX/LINUX based system. Characters sent from the PC are not echoed by the device and a <CR><LF> is sent after the cursor to force a flush of the USART buffer.

CONFig:TERMinal ?

Returns the current terminal mode

CONFig:DEFault:STATE

Resets the state of the module. This will set all source/signal/glitch etc logic to its default power-on values. Terminal setting will not be affected. This command allows the module to be brought back to a known state without resetting it.

Display Port Switch Signal Names

The switch allows full connections between the Source and Sink and also partial connections. The Source connector is referred to as 'A' and each Sink with a number from 1-8.

Port Name	Description
A	Every pin of the Source Connector
[PORT] (where PORT is a number from 1-8)	Every pin of Sink Connector [PORT]
A.AUX	All sideband signals of the Source (AUX, HPD, DP_PWR, CONFIG)
'A.0', 'A.1', 'A.2', 'A.3'	Specific Lane on the Source Connector
'N.0', 'N.1', 'N.2', 'N.3'	Specific Lane on the Sink Connector

Display Port Switch Commands

MUX:CONnect A [PORT]

Creates a bidirectional connection of all signals between the Source and Sink [PORT], any other connections or forwards to/from the Source or Sink are turned off. [PORT] must be a number from 1 to 8.

MUX:CONnect A.[LANE] [PORT].[LANE]

Connects Source Lane [Lane] to Sink [Port].[Lane]. [Port] must be a number from 1 to 8 and [Lane] must be a number from 0 to 3. Any previous connection to either lane is removed.

MUX:CONnect A.aux [PORT]

Connects all of the Source sideband signals to Sink [Port]. Any previous sideband connection to a different port is disconnected. [Port] must be a number from 1 to 8.

MUX:FORward A [PORT]

Forwards all Source Lanes to Sink [PORT]. This differs from MUX:CONnect A [PORT] because it does not remove existing connections or forwards to other ports.

MUX:FORward A.[LANE] [PORT].[LANE]

Forwards Source Lane [Lane] to Sink [Port] Lane [Lane] . This differs from MUX:CONnect A.[LANE] [PORT].[LANE] because it does not remove existing connections or forwards to other ports.

It is not possible to forward the sideband signals.

MUX:[PORT]:SOURce?

Returns the ports or lanes that [PORT] is receiving data from

MUX:[PORT].[LANE]:SOURce?

Returns the lane that [PORT].[LANE] is receiving data from

MUX:OFF [PORT|ALL]

Turns off the receiver and transmitter for [Port], or if ALL is used, it turns off all ports

MUX:OFF [Port].[Lane]

Turns off the receiver and transmitter for the specified [Lane] on the specified [Port].

MUX:OFF A.aux

Turns off all sideband signals.

Display Port Config Commands

CONFig:MUX:DELAy #

Set the duration in seconds between disconnecting and reconnecting when making a connection. CONFig:MUX:Delay 0 gives approx 1ms switching time.

CONFig:MUX:DELAy ?

Return the current delay.

CONFig:MUX:[PORT]:PREEmphasis #

CONFig:MUX:[PORT]:PREEmphasis ?

Set the level of transmit de-emphasis for the Superspeed transmitter [PORT] according to the following table:

0	No De-Emphasis
1	Approximately 2dB output de-emphasis
2	Approximately 4dB output de-emphasis
3	Approximately 6dB output de-emphasis

CONFig:MUX:[PORT]:EQUAlisation #

CONFig:MUX:[PORT]:EQUAlisation ?

Set the level of receiver equalization on [PORT] from 0 (minimum) to 15 (maximum)

CONFig:MUX:[PORT]:AMPlitude #

CONFig:MUX:[PORT]:AMPlitude ?

Set the transmitter differential amplitude for [PORT] from 0 (minimum) to 15 (maximum)

Control Register Map

Access to the FPGA registers should not be required normal operation and customers are encouraged to use the command set in order to maintain compatibility with future firmware versions. To obtain a full register map for your product please email support@quarch.com.