Group14 TECHNOLOGIES, LLC

Data Sheet
QSFP Breakout

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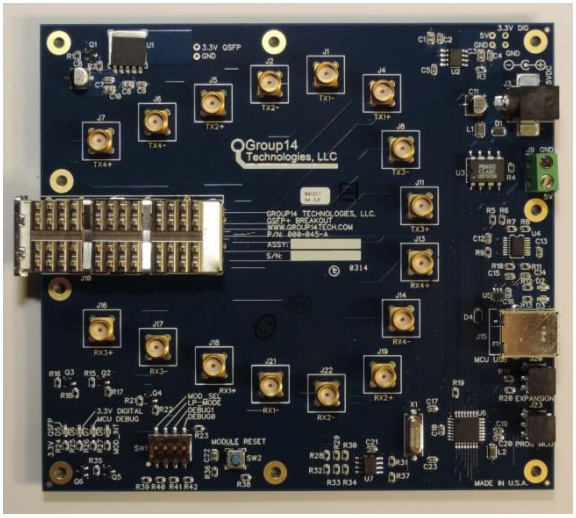
1 Overview

The QSFP Breakout is an interface board designed to connect the high speed lines of a QSFP module to SMA connectors for test and evaluation. In addition to high speed breakout, the unit can be controlled via a powerful command line interface which can control all aspects of the QSFP module per SFF-8635 and SFF-8685. Physical switches and LED status indicators are also on board for when a PC is not convenient or available. The QSFP device's power is supplied externally but the on board microcontroller may be powered via its USB connection or with a 5V supply.

2 Features

- QSFP SFF-8635 (QSFP10) and SFF-8685 (QSFP14) MSA Compliant
- >10Gbps signal capable: uses FR-408 Dielectric
- SMA connections to length matched high speed lines
- USB control with CLI support (FTDI USB RS232 transceiver)
- Manual board level control and status
- Fully scriptable CLI
- Windows and Linux Support
- 5V Powered, supply included
- USB Power supported for microcontroller operation
- RoHS compliant



QSFP Breakout Board

3 Getting Started

The QSFP Breakout is a static sensitive device.

Exercise caution when handling!

To get up and running with the QSFP Breakout, the user need only insert a QSFP module and apply power. Microcontroller power may come from the USB port or external power, which is auto selected by the board. This facilitates testing the microcontroller interface without an external supply. The module power must come from an external 5V supply which can be powered through J4 or J10. An external 5V wall adapter is included with the QSFP Breakout.

After power is applied, the board may be controlled via switch SW1 as described in 5.4 or through PC based software control per section 6.

Note that the current draw of the QSFP Breakout is dependent on the user's QSFP module being tested and will draw approximately 60mA in addition to the QSFP module power draw.

4 Electrical Description

4.1 Power Supply Requirements

Parameter	Min	Typ	Max	Unit
Supply power	4	5	5.5	V
Supply current*		60		mA

*Supply current is dependent on QSFP device used. The board supply current given may be added to the QSFP module supply requirements

4.2 Temperature Characteristics

Parameter	Min	Typ	Max	Unit
Operating Temperature*	0	27	70	C

*Operating temperature is dependent on QSFP device used.

4.3 High Speed IO

The QSFP high speed IO (RX[4:1]+/- and TX[4:1]+/-) are 50 Ohm single ended lines. The high speed dielectric used (Isola FR-408) ensures data rate compatibility above 10.5Gbps. Connections are 50 ohm SMA.

S-Parameter plots of the QSFP2SMA high speed lines are shown in. For the test a 0 dB QSFP loopback was used and the port0 +/- line of the QSFP2SMA board tested on a VNA. The results given include both transmit and receive paths.

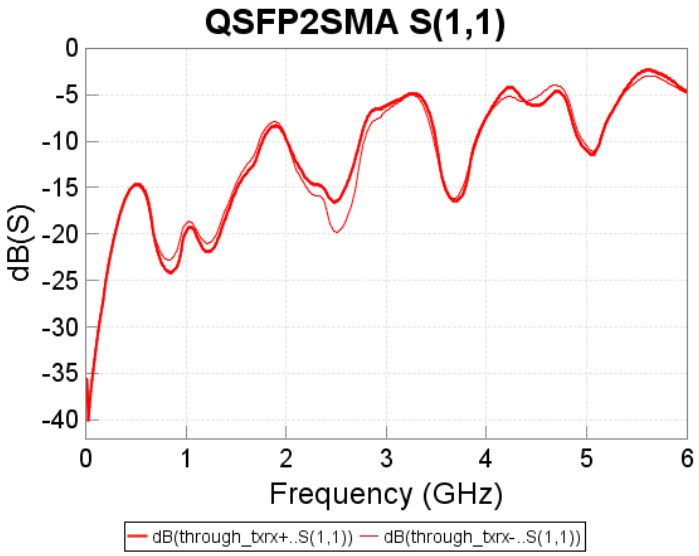
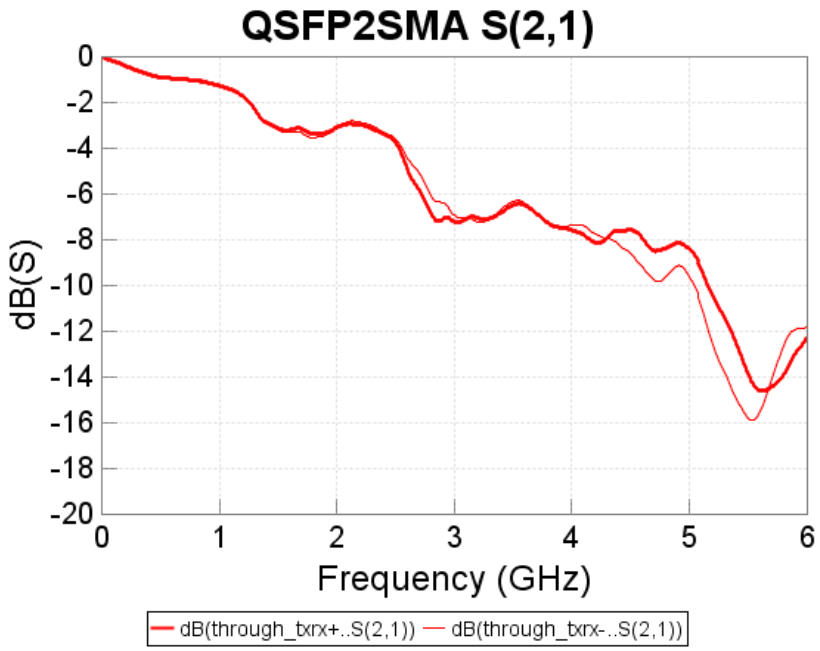


Figure 1 - QSFP2SMA S(1,1)



4.4 Functional Overview

A block diagram of the electrical functions of the QSFP Breakout is given in Figure 2. Connectors and indicators are described in section 5.

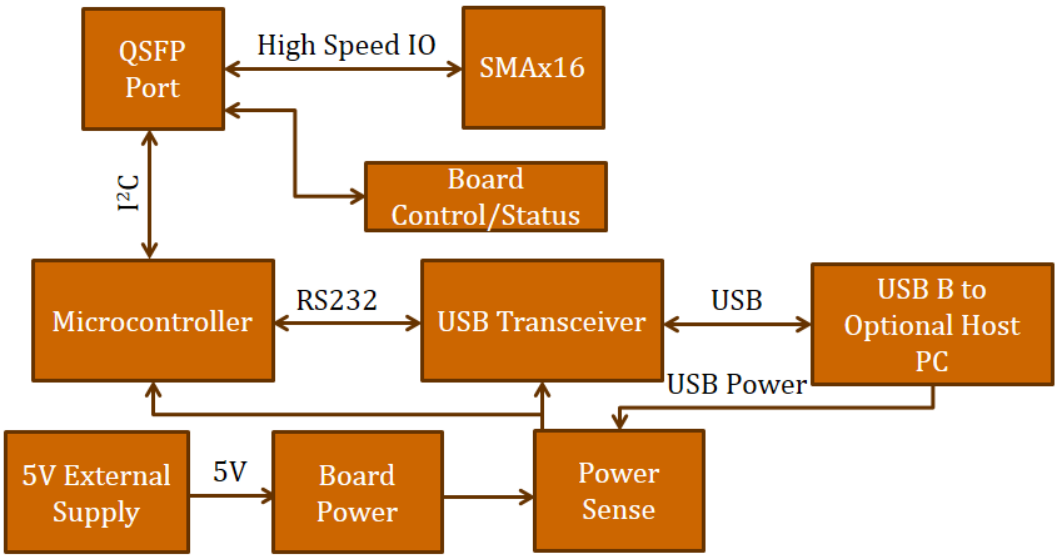


Figure 2 - QSFP Breakout Block Diagram

5 Physical Description

5.1 Board Size & Locations

The QSFP Breakout board is a .063" thick PCB measuring 5.5"x5.0". It has nine .120" mounting holes with dimensions as shown in Figure 3. Rubber feet come applied below mounting holes on rear of board by default, however they may be removed with minor pressure if another mounting style is more convenient.

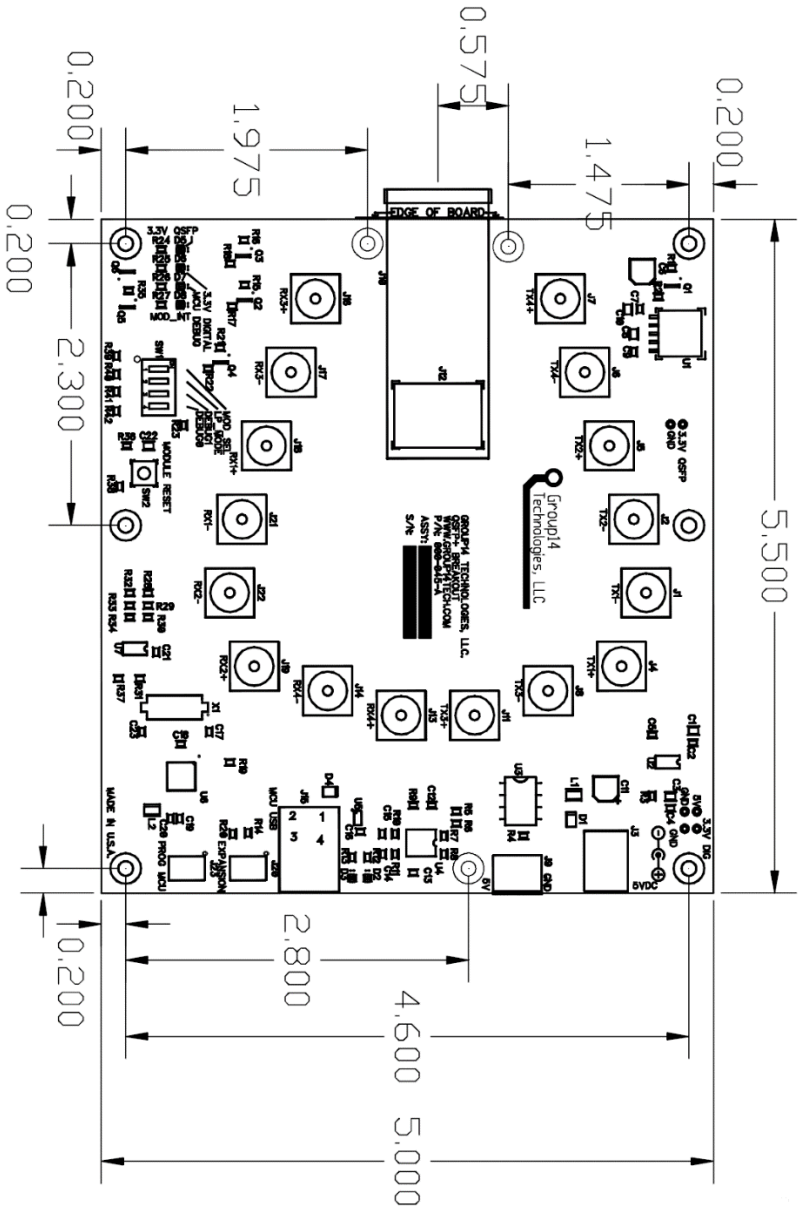


Figure 3 – QSFP Breakout Physical Dimensions & Connections (Dimensions are in Inches)

5.2 Board Connections

Connector	Pin	Description
J10	1	Board 5V in bench power (terminal block)
J10	2	GND (terminal block)
J2	1	Microcontroller programming – MISO
J2	2	Microcontroller programming – SCK
J2	3	Board 3.3V out
J2	4	Microcontroller programming – MOSI
J2	5	Microcontroller programming – Reset#
J2	6	GND
J4	Center	5V in bench power (wall adapter)
J4	Shield	GND bench power (wall adapter)
J14	Signal	TX1+
J15	Signal	TX1-
J1	Signal	TX2+
J3	Signal	TX2-
J12	Signal	TX3+
J13	Signal	TX3-
J16	Signal	TX4+
J17	Signal	TX4-
J20	Signal	RX1+
J21	Signal	RX1-
J22	Signal	RX2+
J23	Signal	RX2-
J8	Signal	RX3+
J11	Signal	RX3-
J18	Signal	RX4+
J19	Signal	RX4-
J27	1	Board 3.3V out
J27	2	Microcontroller GPIO1
J27	3	TWI Off board SDA
J27	4	TWI Off board SCK
J27	5	Microcontroller GPIO0
J27	6	GND
J7	N/A	PC USB data & power
J5	N/A	QSFP Cage
J6	N/A	QSFP Connector

5.3 Board Indicators

Indicator	Description
D1	QSFP Interrupt
D2	Microcontroller 3.3V present
D3	Debug (reserved)
D4	RS232 TXD
D5	RS232 RXD
D6	Module 3.3V present

5.4 Board Controls

Switch	On Description	Off Description
SW1.1	QSFP Module select asserted	QSFP Module select de-asserted
SW1.2	QSFP Low power mode asserted (active low)	QSFP Low power mode de-asserted
SW1.3	Reserved	Reserved
SW1.4	Microcontroller Program mode enable	Microcontroller Program mode disable
SW2	Reset module	Module operation normal

6 Serial Interface Guide

The serial interface to the QSFP Breakout Board supplies the user a text based interface to the EEPROMs and GPIO of the QSFP module installed in the breakout board.

Serial communication is accomplished via FTDI drivers and a terminal program of your choice. The installation of the FTDI driver is discussed in Sections 6.1. Communication via a terminal program is discussed in Section 6.2. User control is provided by set of command described in Section 6.3.

6.1 Installation

Use of the serial interface to the QSFP Breakout Board requires installation of the FTDI Virtual COM Port (VCP) driver. Downloads and installation guides are provided on the FTDI website:

Installation Guides: http://www.ftdichip.com/Support/Documents/InstallGuides.htm
VCP Downloads: http://www.ftdichip.com/Drivers/VCP.htm

The driver for the Windows OSes is the Combined Driver Model (CDM). This includes the VCP and D2XX direct driver. This is covered in the FTDI installation guides.

6.1.1 Verifying Installation – Windows 7 Example

Verifying the installation of the FTDI drivers can be done through the Windows Device Manger. Figure 4 shows a portion of the Device Manger listing after plugging in the USB connection of the SFP+ Breakout Board *before* installing the FTDI drivers. The QSFP Breakout Board is shown as an unknown USB Serial Port device.

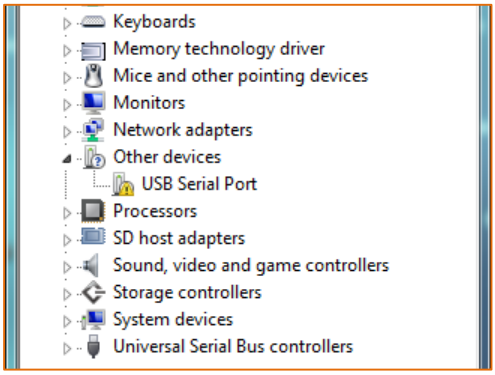


Figure 4 - SFP+ Breakout Board Before FTDI Driver Installation

Figure 5 shows a protion of the Device Manger listing *after* the installation of the FTDI drivers while the QSFP Breakout Board is connected to the host PC. The QSFP Breakout Board is shown under the *Ports (COM & LPT)* listing as a USB Serial Port device with an assigned COM port.

Using the Windows Device Manager is also the suggested method to determine the COM port assigned to the QSFP Breakout Board (COM4 in Figure 5).

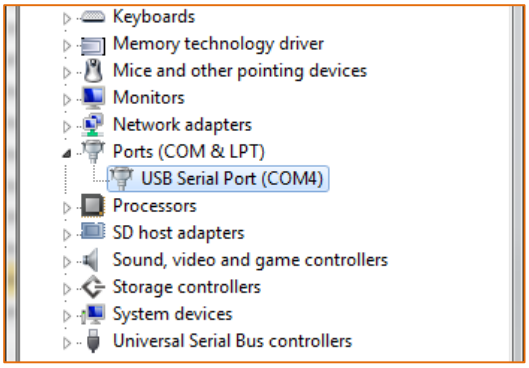


Figure 5 - SFP+ Breakout Board After FTDI Driver Installation

6.2 Serial Communication

Serial communication utilizes the values in Table 1, below.

Table 1 - Serial Communication Parameters

Parameter	Value
Baud	230400
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None

In Windows, the COM port of the QSFP Breakout Board is determined by examining the Device Manger, as shown in the previous section.

Communication has been tested with Putty[1] and Termite[2] on Windows OS and Minicom on Linux OS.

6.3 Serial Interface Commands

Commands for use with the breakout board via the serial interface are given next.

6.3.1 Overview

Given next is a quick overview of topics common to the set of serial interface commands.

Syntax Convention

The syntax of each command is given in the following sections. The convention used to define the command syntax is as follows:

`cmd`	command, text is literal text required
`<parameter>`	parameter, text is descriptive of value required
`[<parameter>]`	optional parameter

[1] http://www.chiark.greenend.org.uk/~sgtatham/putty/
[2] http://www.compuphase.com/software_termite.htm

TWI Addresses

Several of the serial interface commands require a Two Wire Interface (TWI) address. Valid address and the corresponding device on the QSFP Breakout Board are listed in Table 2.

Table 2 - TWI Addresses

Addresses	Device
0xA0	QSFP Interface
0xAE	Board PROM

Toggle Value

Many serial interface commands accept a toggle or tri-state toggle value. These values are used to set or display the current state of a corresponding signal.

Toggle values are either 0 or 1. The meaning is command dependent.

Tri-state values are only used for signals with a hardware switch on the QSFP Breakout Board; module select (MODE_SEL) and low power mode (LP_MODE). Tri-state toggle values are either 0, 1, or 2.

Supplying 0 or 1 to command requiring a tri-state toggle sets the corresponding signal to 0 or 1, independent of the current hardware switch state. Supplying a 2 to a command requiring a tri-state toggle set the corresponding signal to be controlled by the hardware switch state.

All values displayed by commands are either 0 or 1, never 2. If the hardware switch currently controls the signal state, the current signal state, as determined by the switch position, is displayed.

Active High

All commands return a value of 1 for the active value. This differs from the convention used by some of the pins of the QSFP module, which use active low logic.

For example, the QSFP MOD_PRESENT_L pin is active low. However the module present command (`mprs`) return a value of 1 when the module is present.

6.3.2 About

Syntax

```
about
```

Description

Display version information of the embedded software.

6.3.3 Help

Syntax

```
help
```

Description

Display a list of available commands.

6.3.4 LED

Syntax

```
led [<toggle>]
```

Description

If no value is given, display the state of the MCU Debug LED. A value of 0 is off. A value of 1 is on.

If a toggle value is given, turn on or off the MCU Debug LED.

The board power on state of the LED is on.

6.3.5 Module Interrupt

Syntax

```
mint
```

Description

Display the state of the module interrupt, corresponding to the IntL pin. 0 is inactive. 1 is active.

6.3.6 Module Low Power Mode

Syntax

```
mlp [<tri-state toggle>]
```

Description

If no value is given, display the value of state of the module low power mode, corresponding to the LPMODE pin. 0 is inactive, 1 is active.

If a tri-state toggle value is given, 0 turns off low power mode and 1 turns on low power mode. A value of 2 sets control of the module low power mode to the LP_MODE switch (switch bank 1, switch 2).

The module low power signal defaults to the LP_MODE switch on power up.

6.3.7 Module Present

Syntax

```
mprs
```

Description

Displays 0 if the module is absent, or 1 if the module is present. The module present state is determined by examining the MODPRS_L pin.

6.3.8 Module Power

Syntax

```
mpwr[<toggle>]
```

Description

If a toggle value is given, a value of 0 will disable the 3.3V power supplied to the module. A value of 1 will enable the 3.3V power supplied to the module.

If no value is given, the current state of the module power will be displayed.

The module power is enabled by default on power up of the QSFP breakout board.

6.3.9 Module Reset

Syntax

```
mreset
```

Description

Reset the module by toggling the RESET_L pin. The reset signal will remain active for approximately 1 ms.

6.3.10 Module Select

Syntax

```
msel [<tri-state toggle>]
```

Description

If no value is given, display the value of state of the module select, corresponding to the MODSEL_L pin. 0 is inactive, 1 is active.

If a tri-state toggle value is given, 0 turns off module select and 1 turns on module select. A value of 2 sets control of the module select to the MOD_SEL switch (switch bank 1, switch 1).

The module select signal defaults to the MOD_SEL switch on power up.

6.3.11 Status

Syntax

```
status
```

Description

Display a human readable list of the current state of several signals of interest.

Example

```
:> status
Module Interrupt: 0
Module Low Power: 1
Module Present: 1
Module Power: 1
Module Select: 1
V3.3: 1
```

6.3.12 TWI Dump

Syntax

```
twidmp <device addr> <byte addr> <byte count - 1>
```

Description

Dump the selected memory contents from a two-wire-interface memory location. Each line of the memory dump is in the following format: `<byte addr> <value>`. Notice that the byte count given in the command is subtracted by one.

Example

The following example is a dump of the first 12 bytes of the upper page of a QSFP module.

```
:> twidmp 0xa0 128 11
0x80 0x0D
0x81 0x00
0x82 0x0C
0x83 0x04
0x84 0x00
0x85 0x00
0x86 0x00
0x87 0x40
0x88 0x40
0x89 0x02
0x8A 0xD5
0x8B 0x05
```

6.3.13 TWI Force Dump

Syntax

```
twifdmp <device addr> <byte addr> <byte count - 1>
```

Description

Dump the selected memory contents from a two-wire-interface memory location. Each line of the memory dump is in the following format: `<byte addr> <value>`. Notice that the byte count given in the command is subtracted by one. The device address and byte address is not validated.

6.3.14 TWI Read

Syntax

```
twird <device addr> <byte addr>
```

Description

Read a single byte value from a two-wire-interface memory location.

Example

Read the page select byte (byte 127) from the lower page of a QSFP module.

```
:> twird 0xA0 0x7F
0x7F 0x01
```

6.3.15 TWI Force Read

Syntax

```
twifrd <device addr> <byte addr>
```

Description

Read a single byte value from a two-wire-interface memory location. The device address and byte address is not validated.

6.3.16 TWI Write

Syntax

```
twiwr <device addr> <byte addr> <byte value>
```

Description

Write a single byte value to a two-wire-interface memory location. Can only write to “safe” device addresses as shown in Table 3.

Table 3 - TWI Writable Addresses

Addresses	Device
0xA0	QSFP Interface
0xAE	Board PROM

6.3.17 TWI Force Write

Syntax

```
twifwr <device addr> <byte addr> <byte value>
```

Description

Write a single byte value to a two-wire-interface memory location. Will write to any device and byte address. Care must be taken by the user when using this command.

6.3.18 Voltage - 3.3V Power

Syntax

```
v33
```

Description

Display the status of the 3.3V power supply for the microcontroller. A value of 1 indicates no error. A value of 0 indicates an error as determined by of the low-dropout (LDO) regulator on the QSFP breakout board. Error occurs when the 3.3V output voltage is out-of-tolerance.

7 Ordering Information

- QSFP Breakout part number: Q*SFP2SMA*
- Sales phone: (937) 985-4140
- Sales email: contactus@group14tech.com
- Website: http://www.group14tech.com

8 Disclaimer & Warranty

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All Group14 Technologies, LLC products carry a one year warranty from date of purchase. Product support will be provided for one year from date of purchase with further support provided on an "as available" basis.

9 Revision History

Date	Revision	Description
2014-06-03	DS102.0	Initial release