



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

Features

- Full-Duplex 4 Channel parallel breakout active optical cable, supporting 42 Gbps links
- Up to 10.5 Gbps Data rate per channel (breakouts)
- Maximum link length of 30m available
- High Reliability 850nm VCSEL technology
- Electrically hot-pluggable
- Electrical interface compliant to SFF8436 (QSFP+) and SFF-8431 (SFP+)
- Case operating temperature range: 0°C to 70°C
- Power dissipation < 1.5W per QSFP+ end
- Power dissipation < 1.0W per SFP+ end

Applications

- 40G Ethernet Data Center Intra-Rack and Inter-Rack links
- Infiniband QDR
- 10G Fibre Channel
- HPC Interconnections

Description

The AOCQSP40-020 is an active optical breakout cable designed for use in 40Gigabit Ethernet links. The QSFP+ (40Gbps) interface is electrically compliant and mechanically compliant with the SFF-8436. The SFP+ (10Gbps) interface is electrically compliant with SFF-8431 and mechanically compliant with SFF-8432. The AOCQSP40-020 is utilized in the aggregation of 10Gbps interfaces in a 40Gbps environment.

QSFP+ Absolute Maximum Ratings

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|----------------------|--------|---------|------|---------|------|------|
| Storage Temperature | Ts | -40 | - | 85 | °C | |
| Relative Humidity | RH | 5 | - | 95 | % | |
| Power Supply Voltage | VCC | -0.3 | - | 4 | V | |
| Signal Input Voltage | | Vcc-0.3 | - | Vcc+0.3 | V | |

SFP+ Absolute Maximum Ratings

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|----------------------|--------|---------|------|---------|------|------|
| Storage Temperature | Ts | -40 | - | 85 | °C | |
| Relative Humidity | RH | 5 | - | 95 | % | |
| Power Supply Voltage | VCC | -0.3 | - | 4 | V | |
| Signal Input Voltage | | Vcc-0.3 | - | Vcc+0.3 | V | |

QSFP+ Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|----------------------------|--------|------|---------|------|------|------------------|
| Case Operating Temperature | Tcase | 0 | - | 70 | °C | Without air flow |
| Power Supply Voltage | VCC | 3.14 | 3.3 | 3.46 | V | |
| Power Supply Current | ICC | - | | 450 | mA | per cable end |
| Data Rate | BR | | 10.3125 | | Gbps | Each channel |

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

SFP+ Recommended Operating Conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|----------------------------|--------|------|---------|------|------|------------------|
| Case Operating Temperature | Tcase | 0 | - | 70 | °C | Without air flow |
| Power Supply Voltage | VCC | 3.14 | 3.3 | 3.46 | V | |
| Power Supply Current | ICC | - | | 300 | mA | per cable end |
| Data Rate | BR | | 10.3125 | | Gbps | |

QSFP+ General Product Characteristics

| Parameter | Value | Unit | Notes |
|-----------------------------------|----------------------------------------------------------------------|--------|-------------------------------------|
| Module Form Factor | QSFP+ | | |
| Number of Lanes | 4 Tx /Rx | | |
| Maximum Aggregate Data Rate | 42.0 | Gb/s | |
| Maximum Data Rate per Lane | 10.5 | Gb/s | |
| Standard Cable Lengths | 3, 5, 7, 10, 50, 100 | meters | Other lengths, please contact sales |
| Protocols Supported | Typical applications include Infiniband, Fiber Channel, 40G Ethernet | | |
| Electrical Interface and Pin-out | 38-pin edge connector | | Pin-out as defined by the QSFP+ MSA |
| Standard Optical Cable Type | Multimode ribbon fiber cable assembly, riser-rated | | |
| Maximum Power Consumption per End | 1.5 | W | |
| Management Interface | Serial, I2C-based, 400 kHz maximum frequency | | As defined by the QSFP+ MSA |

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

SFP+ General Product Characteristics

| Parameter | Value | Unit | Notes |
|-----------------------------------|----------------------------------------------------------------------|--------|-------------------------------------------------------|
| Module Form Factor | SFP+ | | |
| Maximum Data Rate | 11.1 | Gb/s | |
| Standard Cable Lengths | 3, 5, 7, 10, 50, 100 | meters | Other lengths may be available upon request (<= 300m) |
| Protocols Supported | Typical applications include Infiniband, Fibre Channel, 10G Ethernet | | |
| Electrical Interface and Pin-out | 20-pin edge connector | | Pin-out as defined by the SFP+ MSA |
| Standard Optical Cable Type | Multimode ribbon fiber cable assembly | | |
| Maximum Power Consumption per End | 1.0 | W | per cable end |
| Management Interface | Serial, I2C-based, 400 kHz maximum frequency | | As defined by the SFP+ MSA |

QSFP+ Electrical Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | NOTE |
|--------------------------------------|---------------------|------|-----|------|------|------|
| Supply Voltage | Vcc1, VccTx, VccRx | 3.14 | 3.3 | 3.46 | V | |
| Supply Current | Icc | | | 450 | mA | |
| Transmitter | | | | | | |
| Differential data input swing | V _{in,pp} | 180 | | 1000 | mV | 1 |
| Single ended input voltage tolerance | V _{inT} | -0.3 | | 4.0 | V | |
| Receiver | | | | | | |
| Differential data output swing | V _{out,pp} | 300 | | 850 | mV | 2 |
| Single-ended output voltage | | -0.3 | | 4.0 | V | |

Notes:

1. AC coupled internally. See Figure 1 for input eye mask requirements. Self-biasing 100Ω differential input.
2. AC coupled with 100Ω differential output impedance. See Figure 2 for output eye mask.

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

SFP+ Electrical Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit | NOTE |
|--------------------------------------|------------|------|-----|------|------|------|
| Supply Voltage | VccT, VccR | 3.14 | 3.3 | 3.46 | V | |
| Supply Current | Icc | | | 300 | mA | |
| Transmitter | | | | | | |
| Differential data input swing | Vin,pp | 180 | | 1000 | mV | 1 |
| Single ended input voltage tolerance | VinT | -0.3 | | 4.0 | V | |
| Receiver | | | | | | |
| Differential data output swing | Vout,pp | 300 | | 850 | mV | 2 |
| Single-ended output voltage | | -0.3 | | 4.0 | V | |

Notes:

1. AC coupled internally. Self-biasing 100Ω differential input.
2. AC coupled with 100Ω differential output impedance.

QSFP+ High-speed Electrical Characteristics per Lane

| Parameter-Inputs | Symbol | Min | Typ | Max | Unit | NOTE |
|----------------------------------------|--------|-----|-----|------|----------|-------------------|
| Reference Differential Input Impedance | Zd | | 100 | | Ω | |
| Termination Mismatch | ΔZM | | | 5 | % | 1 |
| Input AC Common Mode Voltage | | | | 25 | mV (RMS) | |
| Differential Input Return Loss | SDD11 | | | | dB | 2 , 0.01-4.1 GHz |
| | | | | | dB | 3, 4.1 – 11.1 GHz |
| Differential to Common Mode Loss | SCD11 | | | -10 | dB | 0.01-11.1 GHz |
| Jitter Tolerance (Total) | TJ | | | 0.40 | UI | |
| Jitter Tolerance (Deterministic) | DJ | | | 0.15 | UI | |

Notes:

1. See SFF-8431 section D.15 Termination Mismatch for definition & test recommendations
2. Reflection coefficient given by equation $SDD11(dB) < -12 + 2 * \sqrt{f}$, with f in GHz. See Figure 3.
3. Reflection coefficient given by equation $SDD11(dB) < -6.3 + 13 \log_{10}(f/5.5)$, with f in GHz. See Figure 3

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

QSFP+ High-speed Electrical Characteristics per Lane

| Parameter-Outputs | Symbol | Min | Typ | Max | Unit | NOTE |
|-----------------------------------------|----------|-----|-----|------|----------|--------------------|
| Reference Differential Output Impedance | Zd | | 100 | | Ω | |
| Termination Mismatch | ΔZM | | | 5 | % | |
| Output AC Common Mode Voltage | | | | 15 | mV (RMS) | |
| Differential Output Return Loss | SDD22 | | | | dB | 4 , 0.01-4.1 GHz |
| | | | | | dB | 5 , 4.1 – 11.1 GHz |
| Common Mode Output Return Loss | SCC22 | | | | dB | 6, 0.01-2.5 GHz |
| | | | | | dB | 2.5-11.1 GHz |
| Output Rise and Fall time (20% to 80%) | tRH, tFH | 24 | | | ps | |
| Deterministic Jitter | DJOUT | | | 0.38 | UI | 7 |
| Total Jitter | TJOUT | | | 0.64 | UI | 7 |

Notes:

4. Reflection coefficient given by equation $SDD22(dB) < -12 + 2 * \sqrt{f}$, with f in GHz. See Figure 3.
5. Reflection coefficient given by equation $SDD22(dB) < -6.3 + 13 \log_{10}(f/5.5)$, with f in GHz. See Figure 3.
6. Reflection coefficient given by equation $SCC22(dB) < -7 + 1.6 * f$, with f in GHz.
7. When transmitter input jitter specs are met.

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

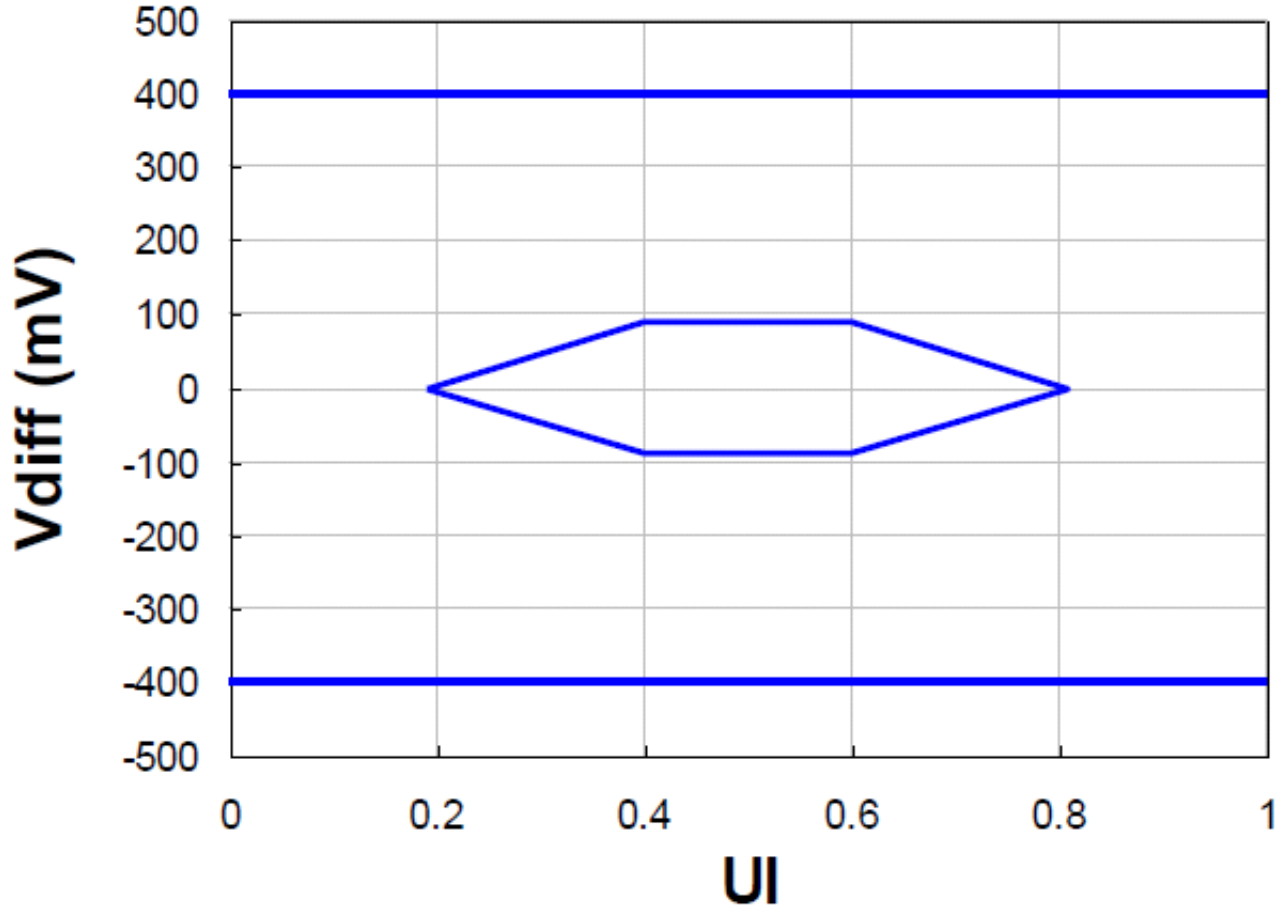


Figure 1 – QSFP+ Transmitter Input Differential Signal Mask

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

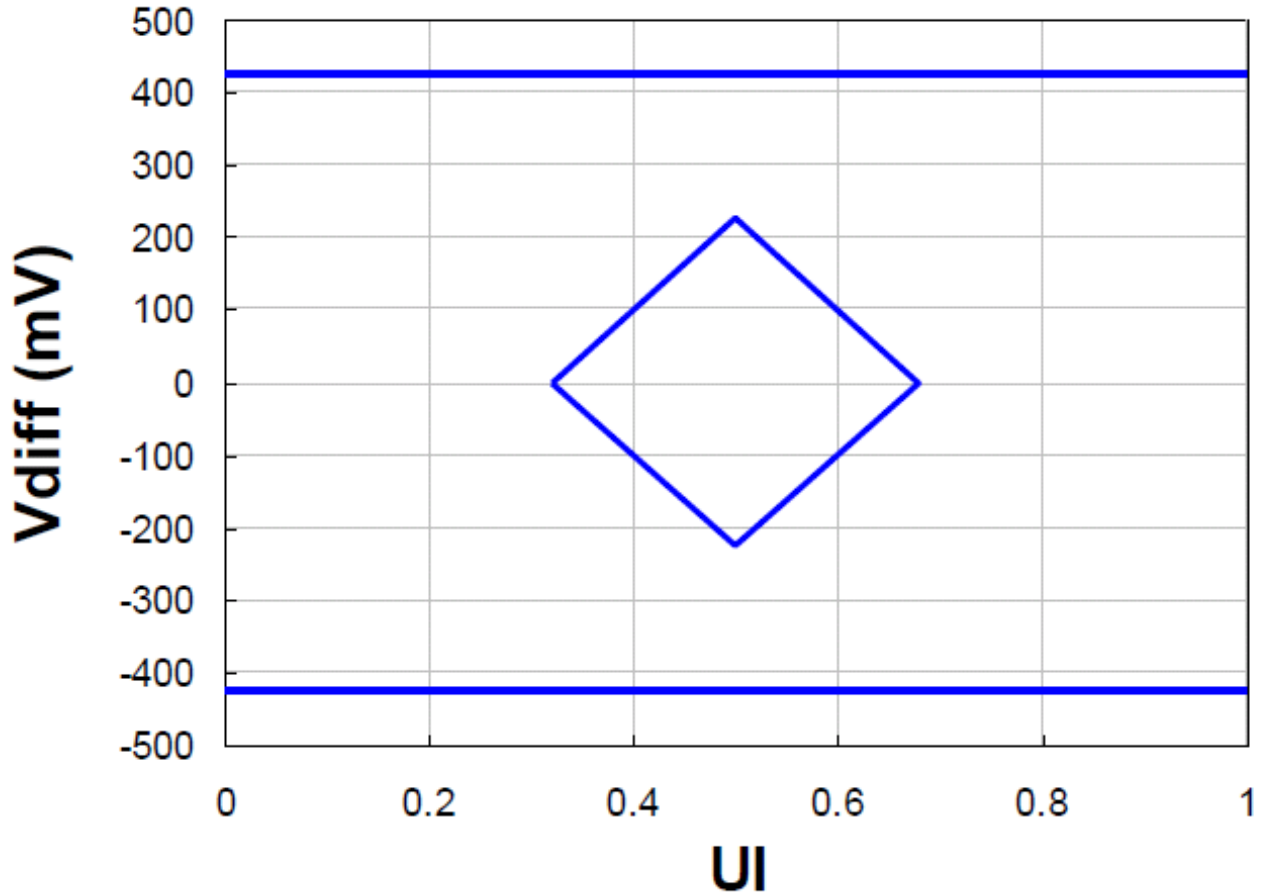


Figure 2 – QSFP+ Receiver Output Differential Signal Mask

Mechanical Specifications

Length 787.4 in [20 m]

Environmental Specifications

QSFP+
 Temperature (Operational) +0C to +70C
 Temperature (Storage) -40C to +85C
 Relative Humidity 5% to 95%
 SFP+

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



an INFINITE® brand



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

| | |
|---------------------------|---------------|
| Temperature (Operational) | +0C to +70C |
| Temperature (Storage) | -40C to +85 C |
| Relative Humidity | 5% to 95% |

Compliance Certifications

RoHS Compliant Yes

All trademarks, service marks, registered marks, or registered service marks are the property of their respective owners, and do not imply any affiliation with L-com or Infinite Electronics

Our portfolio includes cable assemblies, connectors, adapters and custom products, as well as their wireless product line which includes antennas, RF amplifiers, coaxial lightning and surge protectors, and NEMA rated enclosures.

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](https://www.l-com.com/active-optical-cable-breakout-qsfp-40-20m-msa-compatible-aocqsp40-020)

URL: <https://www.l-com.com/active-optical-cable-breakout-qsfp-40-20m-msa-compatible-aocqsp40-020-p.aspx>

The information contained in this document is accurate to the best of our knowledge and representative of the part described herein. It may be necessary to make modifications to the part and/or the documentation of the part, in order to implement improvements. L-com reserves the right to make such changes as required. Unless otherwise stated, all specifications are nominal. L-com does not make any representation or warranty regarding the suitability of the part described herein for any particular purpose, and L-com does not assume any liability arising out of the use of any part or documentation.

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](https://www.l-com.com/active-optical-cable-breakout-qsfp-40-20m-msa-compatible-aocqsp40-020)



an INFINIT® brand

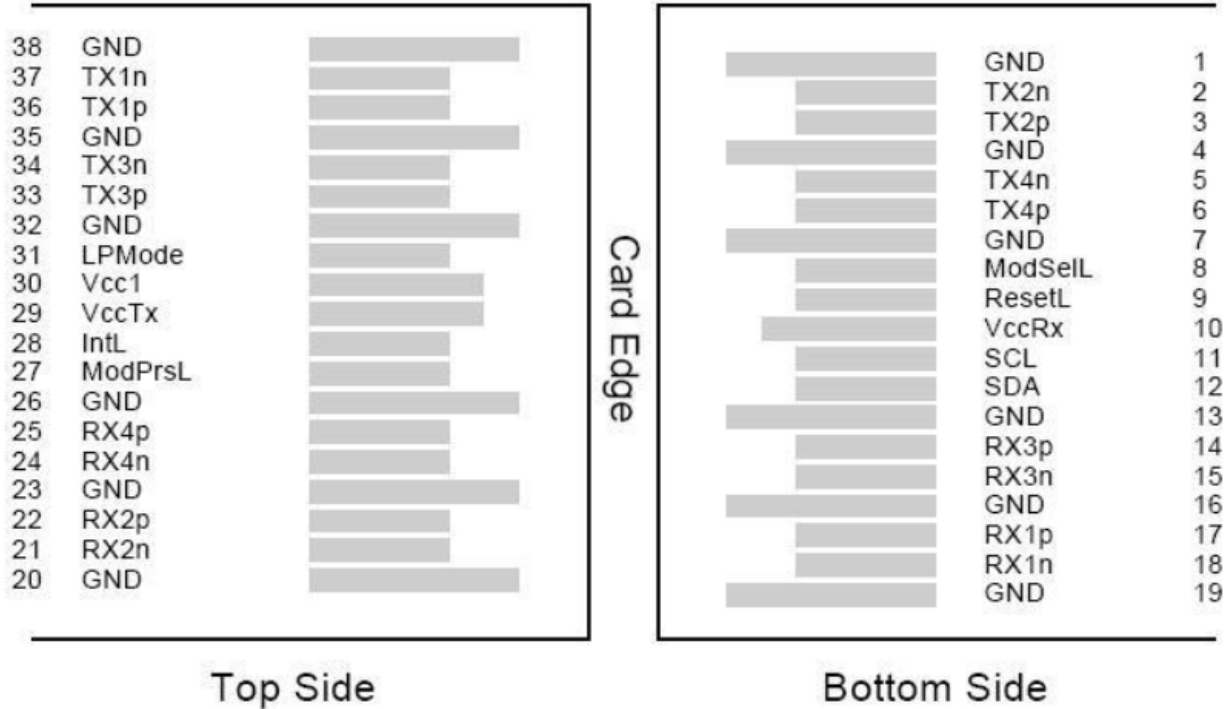


Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

QSFP+ Pin Assignment



Pin out of Connector Block on Host Board

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

QSFP+ Pin Assignment Table

| Pin | Symbol | Name/Description | NOTE |
|-----|---------|--------------------------------------------------|------|
| 1 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | Tx2n | Transmitter Inverted Data Input | |
| 3 | Tx2p | Transmitter Non-Inverted Data output | |
| 4 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 5 | Tx4n | Transmitter Inverted Data Input | |
| 6 | Tx4p | Transmitter Non-Inverted Data output | |
| 7 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 8 | ModSelL | Module Select | |
| 9 | ResetL | Module Reset | |
| 10 | VccRx | 3.3V Power Supply Receiver | 2 |
| 11 | SCL | 2-Wire serial Interface Clock | |
| 12 | SDA | 2-Wire serial Interface Data | |
| 13 | GND | Transmitter Ground (Common with Receiver Ground) | |
| 14 | Rx3p | Receiver Non-Inverted Data Output | |
| 15 | Rx3n | Receiver Inverted Data Output | |
| 16 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 17 | Rx1p | Receiver Non-Inverted Data Output | |
| 18 | Rx1n | Receiver Inverted Data Output | |
| 19 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 20 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 21 | Rx2n | Receiver Inverted Data Output | |
| 22 | Rx2p | Receiver Non-Inverted Data Output | |
| 23 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 24 | Rx4n | Receiver Inverted Data Output | 1 |
| 25 | Rx4p | Receiver Non-Inverted Data Output | |
| 26 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 27 | ModPrsl | Module Present | |
| 28 | IntL | Interrupt | |
| 29 | VccTx | 3.3V power supply transmitter | 2 |
| 30 | Vcc1 | 3.3V power supply | 2 |
| 31 | LPMODE | Low Power Mode, not connect | |
| 32 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 33 | Tx3p | Transmitter Non-Inverted Data Input | |
| 34 | Tx3n | Transmitter Inverted Data Output | |
| 35 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |
| 36 | Tx1p | Transmitter Non-Inverted Data Input | |
| 37 | Tx1n | Transmitter Inverted Data Output | |
| 38 | GND | Transmitter Ground (Common with Receiver Ground) | 1 |

Notes:

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.

2. VccRx, Vcc1 and VccTx are the receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)

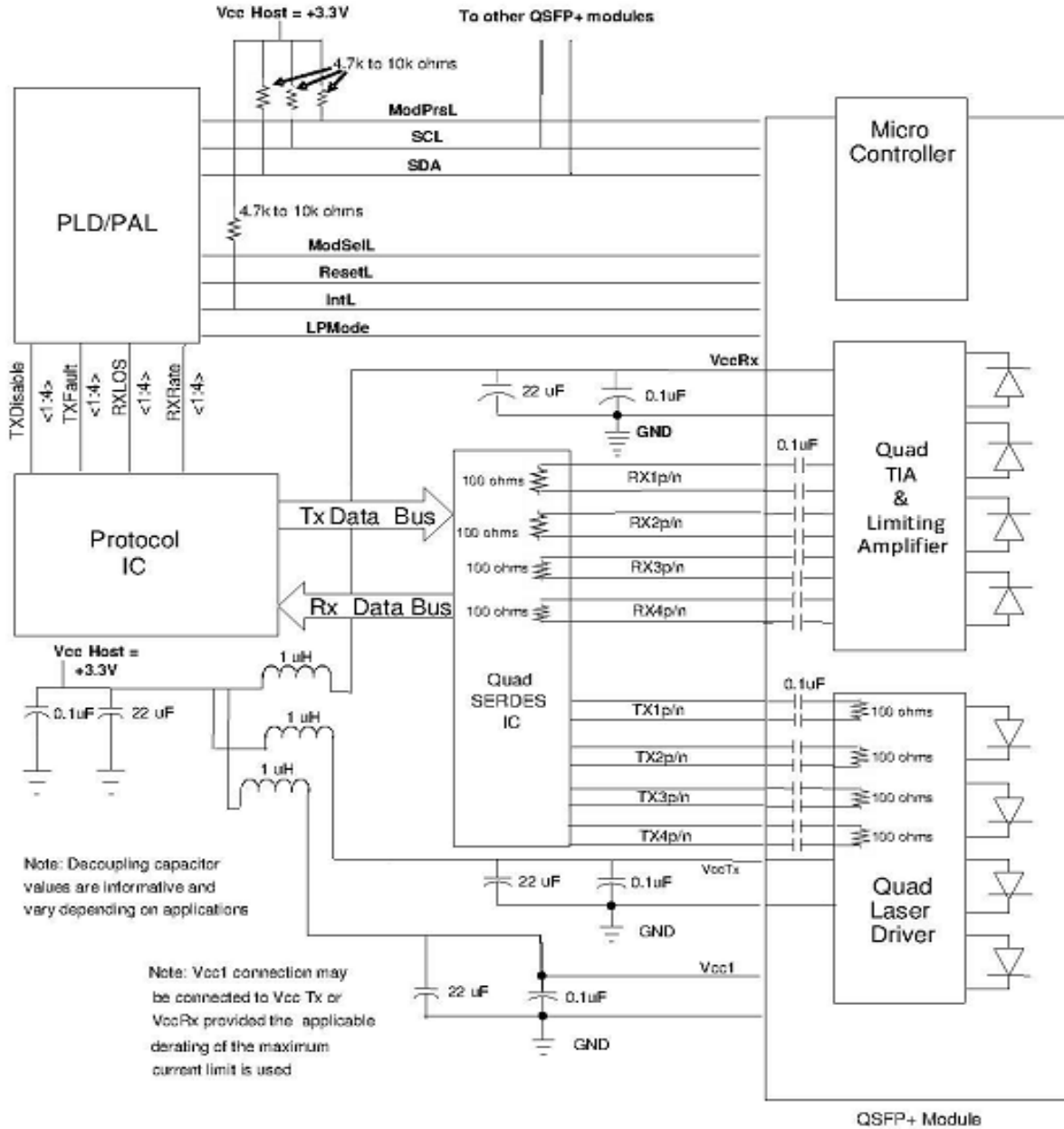


Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

QSFP+ Host - Transceiver Interface Block Diagram



Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



an INFINIT® brand

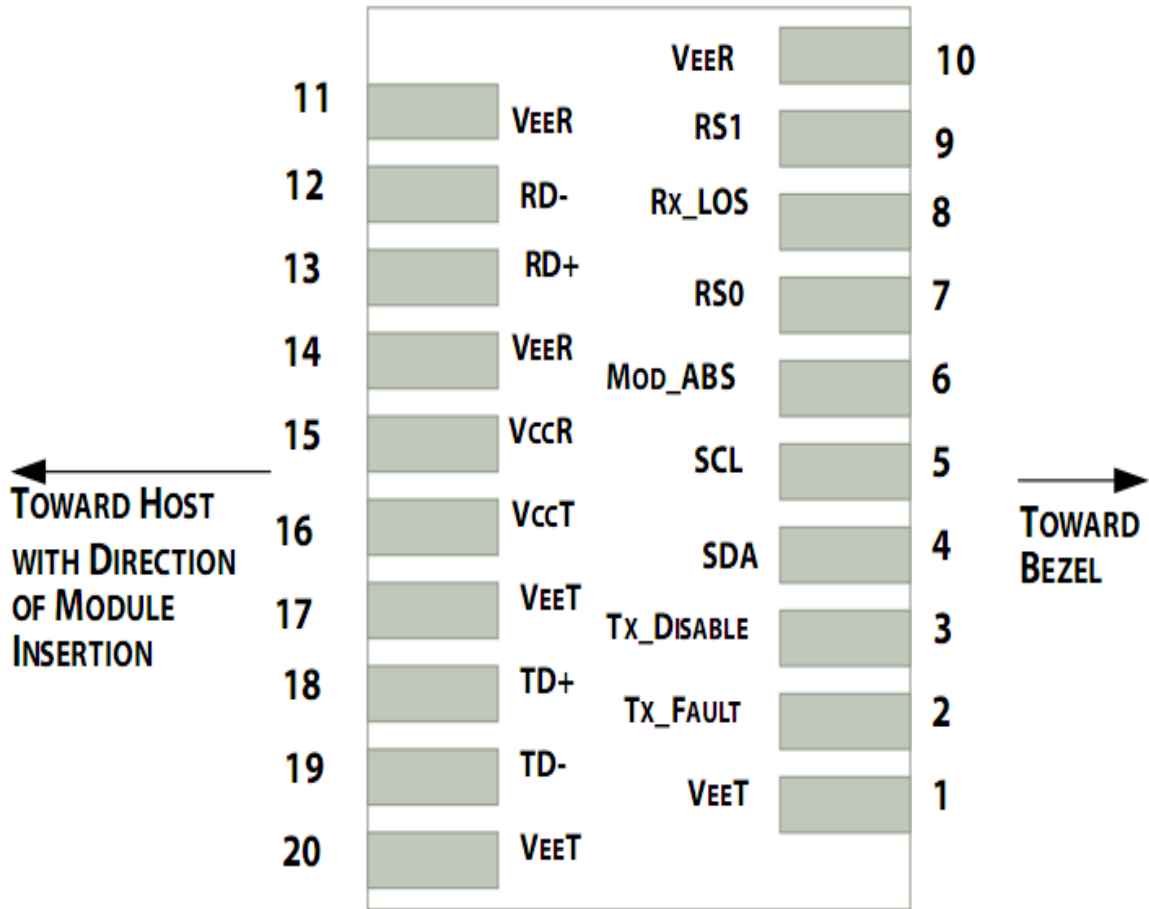


Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

SFP+ Pin Assignment



Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)



Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

SFP+ Pin Assignment Table

| Pin | Symbol | Name/Description | NOTE |
|-----|--------------------|----------------------------------------------------------------|------|
| 1 | V _{EET} | Transmitter Ground (Common with Receiver Ground) | 1 |
| 2 | T _{FAULT} | Transmitter Fault. | 2 |
| 3 | T _{DIS} | Transmitter Disable. Laser output disabled on high or open. | 3 |
| 4 | SDA | 2-wire Serial Interface Data Line | 4 |
| 5 | SCL | 2-wire Serial Interface Clock Line | 4 |
| 6 | MOD_ABS | Module Absent. Grounded within the module | 4 |
| 7 | RS0 | Rate Select 0 | 5 |
| 8 | LOS | Loss of Signal indication. Logic 0 indicates normal operation. | 6 |
| 9 | RS1 | No connection required | 1 |
| 10 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 11 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 12 | RD- | Receiver Inverted DATA out. AC Coupled | |
| 13 | RD+ | Receiver Non-inverted DATA out. AC Coupled | |
| 14 | V _{EER} | Receiver Ground (Common with Transmitter Ground) | 1 |
| 15 | V _{CCR} | Receiver Power Supply | |
| 16 | V _{CCT} | Transmitter Power Supply | |
| 17 | V _{EET} | Transmitter Ground (Common with Receiver Ground) | 1 |
| 18 | TD+ | Transmitter Non-Inverted DATA in. AC Coupled. | |
| 19 | TD- | Transmitter Inverted DATA in. AC Coupled. | |
| 20 | V _{EET} | Transmitter Ground (Common with Receiver Ground) | 1 |

Notes:

1. Circuit ground is internally isolated from chassis ground.
2. T_{FAULT} is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to V_{cc} + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on T_{DIS} >2.0V or open, enabled on T_{DIS} <0.8V.
4. Should be pulled up with 4.7kΩ- 10kΩ host board to a voltage between 2.0V and 3.6V. MOD_ABS pulls line low to indicate module is plugged in.
5. Internally pulled down per SFF-8431 Rev 4.1.
6. LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

Click the following link (or enter part number in "SEARCH" on website) to obtain additional part information including price, inventory and certifications: [Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible AOCQSP40-020](#)

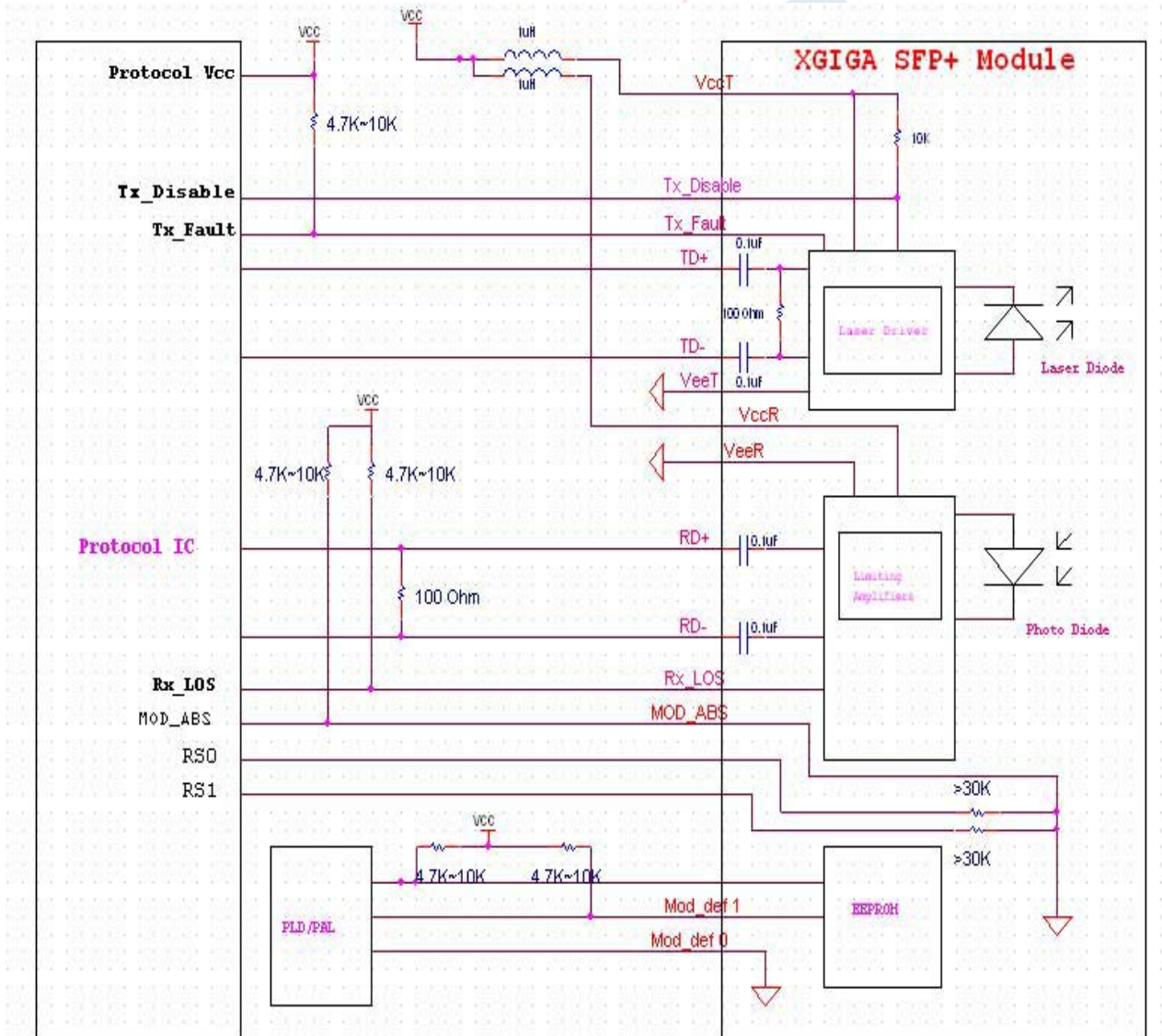


Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

Active Optical Cables Technical Data Sheet

AOCQSP40-020

SFP+ Host - Transceiver Interface Block Diagram



AOCQSP40-020 CAD Drawing

Active Optical Cable Breakout QSFP+ 40Gbps to 4x10G SFP+, 20m, MSA Compatible

