

Product Specification

200GBASE-FR4 QSFP56 1310nm 2km DOM
Duplex LC/UPC Optical Transceiver Module

PN: Q56-200G-FR4



Features

- Hot Pluggable QSFP56 form factor
- Operating data rate 212.5Gb/s
- Single +3.3V power supply
- LC duplex connector
- Max power dissipation 6.5W
- Up to 2km transmission on single mode fiber
- PIN receivers
- Built-in digital diagnostic function
- Commercial temperature range 0°C to 70°C

Compliance

- QSFP56 MSA
- Compliant with QSFP Electrical MSA SFF-8636
- Compliant with QSFP Mechanical MSA SFF-8665
- IEEE 802.3bm
- RoHS

Applications

- Switches with QSFP56 ports
- Router with QSFP56 Ports
- Server or Network Adapter Card
- Optical Transmission System
- Other devices with QSFP56 Ports

Description

The Q56-200G-FR4 is a QSFP56 transceiver compliant with the IEEE 802.3bs 200GBASE-FR4 standard, engineered for 2km single-mode fiber (SMF) transmission. It converts 4x50Gb/s PAM4 electrical lanes into 4 CWDM optical channels, multiplexed into a single 200Gb/s PAM4 stream. Reverse operation demultiplexes incoming 200G signals into 4 electrical outputs, enabling bidirectional 200G data transfer. Designed for metro-edge and data center interconnects, it features a duplex LC connector for optical interface and a 38-pin QSFP56 MSA-compliant electrical interface.

Leveraging CWDM technology and SMF compatibility, the module minimizes chromatic dispersion over 2km distances. Host Forward Error Correction (FEC) ensures error-free transmission, critical for long-haul applications. Integrated digital diagnostics monitoring (DDM) via I2C enables real-time tracking of temperature, voltage, and optical power, optimizing network reliability and maintenance.

Built to QSFP56 MSA specifications, the module ensures seamless integration with high-density switches and routers. Its robust construction withstands harsh operating conditions, including extreme temperatures, humidity, and EMI interference. With RoHS compliance and low power efficiency, the Q56-200G-FR4 delivers a scalable, future-proof solution for 200G Ethernet, cloud networks, and carrier-grade infrastructure.

Product performance Specifications

1、 Basic Product Characteristics

| Parameter | Symbol | Min | Typ. | Max | Unit |
|--------------------------------------|-----------------|-------|-------|-------|------|
| Storage Temperature | T _s | -40 | - | +85 | °C |
| Supply Voltage | V _{CC} | -0.5 | - | 4.0 | V |
| Relative Humidity | RH | 5 | - | 85 | % |
| Operating Case Temperature | T _c | 0 | - | 70 | °C |
| Power Supply Voltage | V _{CC} | 3.135 | 3.3 | 3.465 | V |
| Data Rate | | | 212.5 | | Gbps |
| Power Consumption | P | | | 6.5 | W |
| Transceiver Power-on Initialize Time | | | | 2000 | ms |

2、 Product Optical and Electrical Characteristics

| Parameter | Symbol | Min | Typ. | Max | Unit |
|--------------------|--------|--------|------|--------|------|
| Transmitter | | | | | |
| Center Wavelength | WL | 1264.5 | 1271 | 1277.5 | nm |
| | | 1284.5 | 1291 | 1297.5 | |
| | | 1304.5 | 1311 | 1317.5 | |
| | | 1324.5 | 1331 | 1337.5 | |

| | | | | | |
|---|-----------|--------|-------|------------------|-------|
| Signaling Speed per Lane | SMSR | 30 | | | dB |
| Average Launch Power per Lane | P_{AVG} | -4.2 | | 4.7 | dBm |
| Tx OMA per lane | P_{OMA} | -1.2 | | 4.5 | dBm |
| Optical Extinction Ratio | ER | 3.5 | | | dB |
| Transmitter and dispersion eye closure for PAM4 per Lane | TDECQ | | | 3.3 | dB |
| Optical return loss tolerance | ORL | | | 16.5 | dB |
| Relative Intensity Noise | RIN | | | -132 | dB |
| Signaling Speed per Lane | | | | 26.5625 | dB |
| Modulation format | | | PAM4 | | dB/Hz |
| Differential peak-to-peak input voltage tolerance | | 900 | | | mV |
| Differential termination mismatch | | | | 10 | % |
| Differential input return loss(SDD11) | | | | SeeCEI-56G-VSR | dB |
| Common-mode to differential conversion and differential tocommon-mode conversion(SCD11,SDC11) | | | | SeeCEI-56G-VSR | dB |
| Receiver | | | | | |
| Center Wavelength | WL | 1264.5 | 1271 | 1277.5 | nm |
| | | 1284.5 | 1271 | 1297.5 | |
| | | 1304.5 | 1311 | 1317.5 | |
| | | 1324.5 | 1331 | 1337.5 | |
| Damage Threshold | DT | 5.7 | | | dBm |
| Average receive Power per Lane | RXPx | -8.2 | | 4.7 | dBm |
| Receiver reflectance | Rfl | | | -26 | dB |
| Difference in receive power between any two lanes | | | | 4.1 | dB |
| Receiver sensitivity (OMAouter) | | | | -8.2 | dBm |
| Stressed receiver sensitivity (OMAouter) | | | | -3.6 | dBm |
| Differential peak-to-peak output voltage | | | | 900 | mV |
| DC Common Mode Voltage | Vcm | -0.35 | -0.35 | 2.85 | mV |
| AC Common Mode Noise, RMS | | | | 17.5 | mV |
| Differential termination mismatch | | | | 10 | % |
| Differential output return loss(SDD22) | | | | See CEI- 56G-VSR | dB |
| Common-mode to differential conversion and differential to common-modeconversion(SCD22,SDC22) | | | | See CEI- 56G-VSR | dB |

Recommended Host Board Power Supply Circuit

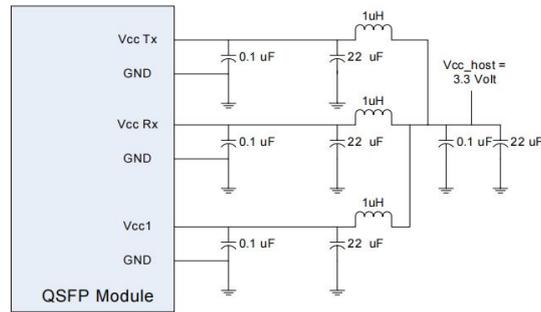


Figure 1: Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

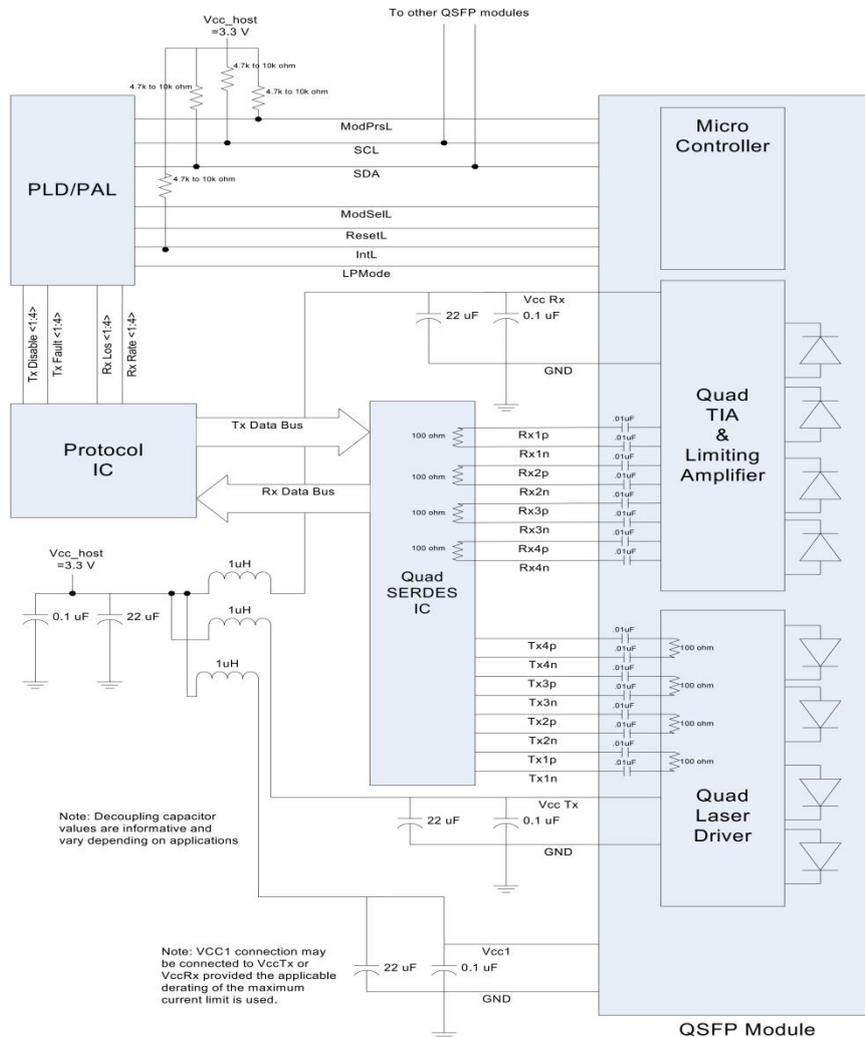


Figure 2: Recommended Interface Circuit

Optical Interface

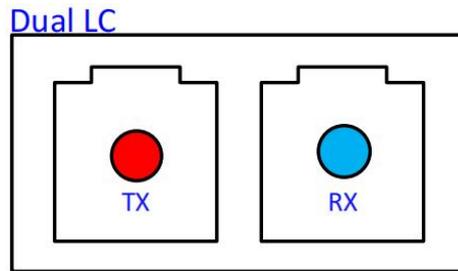


Figure3:Optical Lane Sequence

Pin-out Definition

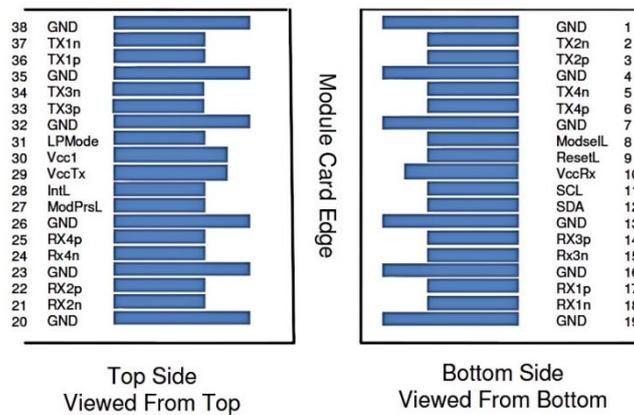


Figure4:Pin view

Pin Function Definitions

| Pin | Logic | Symbol | Description | Note |
|-----|-------------|---------|-------------------------------------|------|
| 1 | | GND | Ground | 1 |
| 2 | CML-I | Tx2n | Transmitter Inverted Data Input | 3 |
| 3 | CML-I | Tx2p | Transmitter Non-Inverted Data Input | 3 |
| 4 | | GND | Ground | 1 |
| 5 | CML-I | Tx4n | Transmitter Inverted Data Input | 3 |
| 6 | CML-I | Tx4p | Transmitter Non-Inverted Data Input | 3 |
| 7 | | GND | Ground | 1 |
| 8 | LVTTL-I | ModSelL | Module Select | 4 |
| 9 | LVTTL-I | ReSelL | Module Select | 4 |
| 10 | | Vcc Rx | +3.3V Power Supply Receiver | 2 |
| 11 | LVC MOS-I/O | SCL | 2-wire serial interface clock | 4 |
| 12 | LVC MOS-I/O | SDA | 2-wire serial interface data | 4 |
| 13 | | GND | Ground | 1 |
| 14 | CML-O | Rx3p | Receiver Non-Inverted Data Output | 3 |

| | | | | |
|----|---------|---------|--|---|
| 15 | CML-O | Rx3n | Receiver Inverted Data Output | 3 |
| 16 | | GND | Ground | 1 |
| 17 | CML-O | Rx1p | Receiver Non-Inverted Data Output | 3 |
| 18 | CML-O | Rx1n | Receiver Inverted Data Output | 3 |
| 19 | | GND | Ground | 1 |
| 20 | | GND | Ground | 1 |
| 21 | CML-O | Rx2n | Receiver Inverted Data Output | 3 |
| 22 | CML-O | Rx2p | Receiver Non-Inverted Data Output | 3 |
| 23 | | GND | Ground | 1 |
| 24 | CML-O | Rx4n | Receiver Inverted Data Output | 3 |
| 25 | CML-O | Rx4p | Receiver Non-Inverted Data Output Ground | 3 |
| 26 | | GND | Ground | 1 |
| 27 | LVTTL-O | ModPrsL | Module Present | 4 |
| 28 | LVTTL-O | IntL | Interrupt | 4 |
| 29 | | Vcc Tx | +3.3V Power supply transmitter | 2 |
| 30 | | Vcc1 | +3.3V Power supply | 2 |
| 31 | LVTTL-I | LPMMode | Low Power Mode | 4 |
| 32 | | GND | Ground | 1 |
| 33 | CML-I | Tx3p | Transmitter Non-Inverted Data Input | 3 |
| 34 | CML-I | Tx3n | Transmitter Inverted Data Input | 3 |
| 35 | | GND | Ground | 1 |
| 36 | CML-I | Tx1p | Transmitter Non-Inverted Data Input | 3 |
| 37 | CML-I | Tx1n | Transmitter Inverted Data Input | 3 |
| 38 | | GND | Ground | 1 |

Note1:GND is the symbol for signal and supply (power) common for the QSFP+ module. 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.

Note2:Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in Table. Recommended host board power supply filtering is shown in Host board power supply circuit. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP module in any combination. The connector pins are each rated for a maximum current of 500 mA.

Note3:High-speed signal interfaces require differential pairs (e.g. TX1+/TX1-) with tightly matched impedances (typically 100Ω).

Note4:The management and control signals are based on LVTTL level logic and are used for functions such as module selection and reset.

Monitoring Specification

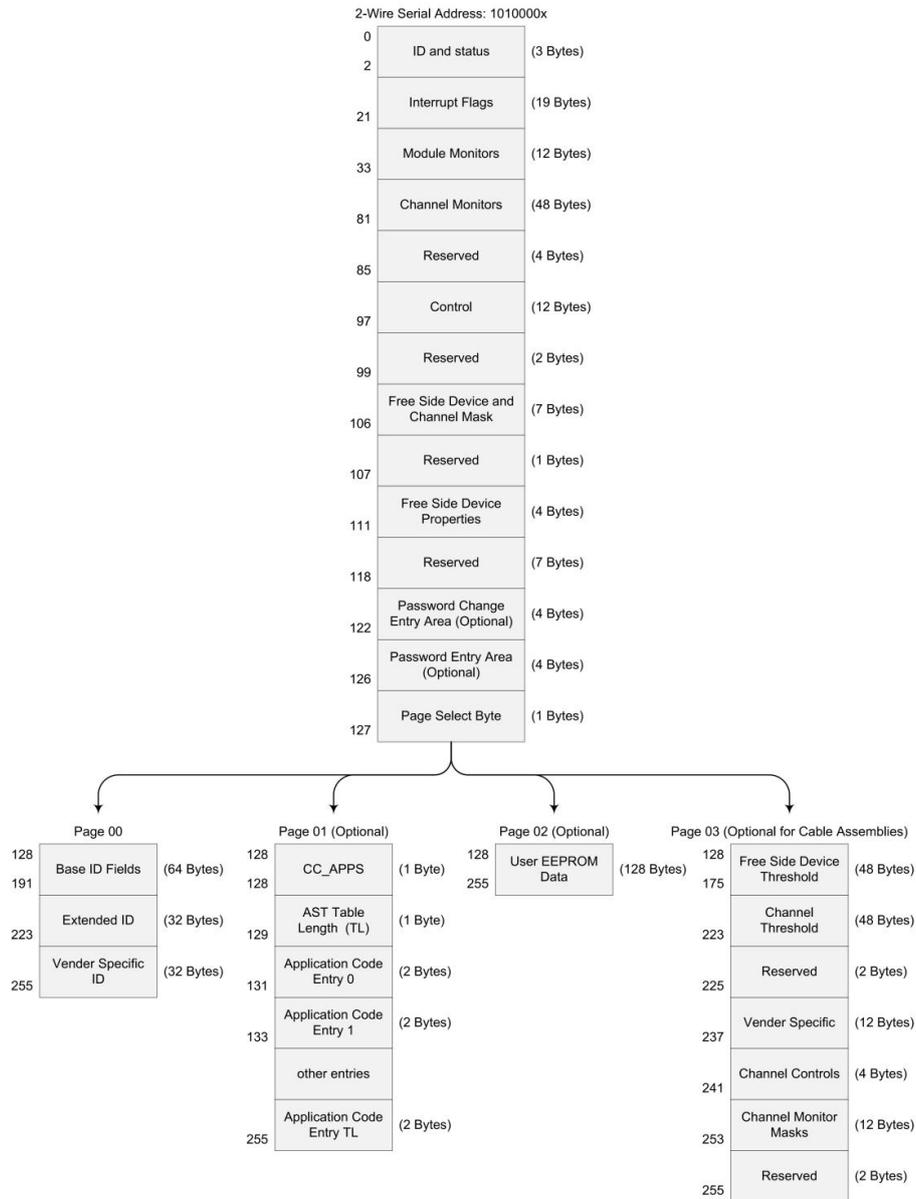


Figure5:Memory map

Memory map Table

| Byte | Unit | Name | Description |
|-----------------------|------|------------|---|
| Lower Page 00h | | | |
| 0 | 1 | Identifier | Type of transceiver, Page 00h Byte 0 and Page 00h Byte 128 shall contain the same parameter values. |
| 1 | 1 | Status | Revision Compliance |
| 2 | 1 | Status | Status indicators |

| | | | |
|---------|----|------------------------------------|--|
| 3-21 | 19 | Interrupt Flags | Consist of interrupt flags for LOS, Tx Fault, warnings and alarms. The non-asserted state shall be 0b. |
| 22 | 1 | Temperature MSB | Internally measured temperature (MSB) |
| 23 | 1 | Temperature LSB | Internally measured temperature (LSB) |
| 24-25 | 2 | Reserved | Reserved |
| 26 | 1 | Supply Voltage MSB | Internally measured supply voltage (MSB) |
| 27 | 1 | Supply Voltage LSB | Internally measured supply voltage (LSB) |
| 28-29 | 2 | Reserved | Reserved |
| 30-33 | 4 | Vendor Specific | Vendor Specific |
| 34 | 1 | Rx1 Power MSB | Internally measured Rx1 input power |
| 35 | 1 | Rx1 Power LSB | |
| 36 | 1 | Rx2 Power MSB | Internally measured Rx2 input power |
| 37 | 1 | Rx2 Power LSB | |
| 38 | 1 | Rx3 Power MSB | Internally measured Rx3 input power |
| 39 | 1 | Rx3 Power LSB | |
| 40 | 1 | Rx4 Power MSB | Internally measured Rx4 input power |
| 41 | 1 | Rx4 Power LSB | |
| 42 | 1 | Tx1 Bias MSB | Internally measured Tx1 bias |
| 43 | 1 | Tx1 Bias LSB | |
| 44 | 1 | Tx2 Bias MSB | Internally measured Tx2 bias |
| 45 | 1 | Tx2 Bias LSB | |
| 46 | 1 | Tx3 Bias MSB | Internally measured Tx3 bias |
| 47 | 1 | Tx3 Bias LSB | |
| 48 | 1 | Tx4 Bias MSB | Internally measured Tx4 bias |
| 49 | 1 | Tx4 Bias LSB | |
| 50 | 1 | Tx1 Power MSB | Internally measured Tx1 Power |
| 51 | 1 | Tx1 Power LSB | |
| 52 | 1 | Tx2 Power MSB | Internally measured Tx2 Power |
| 53 | 1 | Tx2 Power LSB | |
| 54 | 1 | Tx3 Power MSB | Internally measured Tx3 Power |
| 55 | 1 | Tx3 Power LSB | |
| 56 | 1 | Tx4 Power MSB | Internally measured Tx4 Power |
| 57 | 1 | Tx4 Power LSB | |
| 58-65 | 8 | Reserved | Reserved channel monitor set 4 |
| 66-73 | 8 | Reserved | Reserved channel monitor set 5 |
| 74-81 | 8 | Vendor Specific | Vendor Specific |
| 82-85 | 4 | Reserved | Reserved |
| 86-99 | 14 | Control | Control |
| 100-106 | 7 | Free Side Device and Channel Masks | Free Side Device and Channel Masks |
| 107-110 | 4 | Free Side Device Properties | Free Side Device Properties |

| | | | |
|-----------------------|----|--|---|
| 111-112 | 2 | Assigned for use by PCI Express | Used for: |
| | | | - The PCI Express External Cable Specification |
| | | | - The PCI Express OcuLink Specification |
| 113-117 | 4 | Free Side Device Properties | Free Side Device Properties |
| 118 | 1 | Reserved | Reserved |
| 119-122 | 4 | Password Change Entry Area | Password Change Entry Area |
| 123-126 | 4 | Password Entry Area | Password Entry Area |
| 127 | 1 | Page Select Byte | Page Select Byte |
| Upper Page 00h | | | |
| 128 | 1 | Identifier | Identifier Type of free side device.(See SFF-8024 Transceiver Management) |
| 129 | 1 | Ext. Identifier | Extended Identifier of free side device. Includes power classes, CLEI codes, CDR capability. |
| 130 | 1 | Connector Type | Code for media connector type. (See SFF-8024 Transceiver Management) |
| 131-138 | 8 | Specification Compliance | Code for electronic or optical compatibility. |
| 139 | 1 | Encoding | Code for serial encoding algorithm. (See SFF-8024 Transceiver Management) |
| 140 | 1 | Signaling rate, nominal | Nominal signaling rate, units of 100 MBd. For rate > 25.4 GBd, set this to FFh and use Byte 222. |
| 141 | 1 | Extended Rate Select Compliance | Tags for extended rate select compliance. |
| 142 | 1 | Length (SMF) | Link length supported at the signaling rate in byte 140 or page 00h byte 222, for SMF fiber in km *. A value of 1 shall be used for reaches from 0 to 1 km. |
| 143 | 1 | Length (OM3 50 um) | Link length supported at the signaling rate in byte 140 or page 00h byte 222, for EBW 50/125 um fiber (OM3), units of 2 m * |
| 144 | 1 | Length (OM2 50 um) | Link length supported at the signaling rate in byte 140 or page 00h byte 222, for 50/125 um fiber (OM2), units of 1 m * |
| 145 | 1 | Length (OM1 62.5 um) or Copper | Link length supported at the signaling rate in byte 140 or page 00h byte 222, for 62.5/125 um fiber (OM1), units of 1 m *, or copper cable attenuation in dB at 25.78 GHz. |
| | | Cable Attenuation | |
| 146 | 1 | Length (passive copper or active cable or OM4 50 um) | Length of passive or active cable assembly (units of 1 m) or link length supported at the signaling rate in byte 140 or page 00h byte 222, for OM4 50/125 um fiber (units of 2 m) as indicated by Byte 147. See 6.3.12. |
| 147 | 1 | Device technology | Device technology |
| 148-163 | 16 | Vendor name | Free side device vendor name (ASCII) |
| 164 | 1 | Extended Module | Extended Module codes for InfiniBand. |
| 165-167 | 3 | Vendor OUI | Free side device vendor IEEE company ID. |
| 168-183 | 16 | Vendor PN | Part number provided by free side device vendor(ASCII) |
| 184-185 | 2 | Vendor rev | Revision level for part number provided by the vendor(ASCII) |

| | | | |
|----------------------------|-----|--|---|
| 186-187 | 2 | Wavelength or Copper Cable Attenuation | Nominal laser wavelength (wavelength=value/20 in nm) or copper cable attenuation in dB at 2.5 GHz (Byte 186) and 5.0 GHz (Byte 187) |
| 188-189 | 2 | Wavelength tolerance or Copper Cable Attenuation | The range of laser wavelength (+/- value) from nominal wavelength. (wavelength Tol. =value/200 in nm) or copper cable attenuation in dB at 7.0 GHz (Byte 188) and 12.9 GHz (Byte 189) |
| 190 | 1 | Max case temp | Maximum case temperature |
| 191 | 1 | CC_BASE | Check code for base ID fields (Bytes 128-190) |
| 192 | 1 | Link codes | Extended Specification Compliance Codes (See SFF-8024) |
| 193-195 | 3 | Options | Optional features implemented. |
| 196-211 | 16 | Vendor SN | Serial number provided by vendor.(ASCII) |
| 212-219 | 8 | Date Code | Vendor's manufacturing date code. |
| 220 | 1 | Diagnostic Monitoring Type | Indicates which type of diagnostic monitoring is implemented (if any) in the free side device. Bit 1,0 Reserved. |
| 221 | 1 | Enhanced Options | Indicates which optional enhanced features are implemented in the free side device. |
| 222 | 1 | CC_EXT | Check code for the Extended ID Fields (Bytes 192-222) |
| 224-255 | 32 | Vendor Specific | Vendor Specific EEPROM |
| Page 02h (Optional) | | | |
| 128-255 | 128 | User EEPROM Data | |
| Page 03h (Optional) | | | |
| 128-129 | 2 | Temp High Alarm | MSB at lower byte address |
| 130-131 | 2 | Temp Low Alarm | MSB at lower byte address |
| 132-133 | 2 | Temp High Warning | MSB at lower byte address |
| 134-135 | 2 | Temp Low Warning | MSB at lower byte address |
| 136-143 | 8 | Reserved | Reserved |
| 144-145 | 2 | Vcc High Alarm | MSB at lower byte address |
| 146-147 | 2 | Vcc Low Alarm | MSB at lower byte address |
| 148-149 | 2 | Vcc High Warning | MSB at lower byte address |
| 150-151 | 2 | Vcc Low Warning | MSB at lower byte address |
| 152-159 | 8 | Reserved | Reserved |
| 160-175 | 16 | Vendor Specific | Vendor Specific |
| 176-177 | 2 | Rx Power High Alarm | MSB at lower byte address |
| 178-179 | 2 | Rx Power Low Alarm | MSB at lower byte address |
| 180-181 | 2 | Rx Power High Warning | MSB at lower byte address |
| 182-183 | 2 | Rx Power Low Warning | MSB at lower byte address |
| 184-185 | 2 | Tx Bias High Alarm | MSB at lower byte address |
| 186-187 | 2 | Tx Bias Low Alarm | MSB at lower byte address |
| 188-189 | 2 | Tx Bias High Warning | MSB at lower byte address |
| 190-191 | 2 | Tx Bias Low Warning | MSB at lower byte address |
| 192-193 | 2 | Tx Power High Alarm | MSB at lower byte address |
| 194-195 | 2 | Tx Power Low Alarm | MSB at lower byte address |
| 196-197 | 2 | Tx Power High Warning | MSB at lower byte address |

| | | | |
|---------|----|--|---|
| 198-199 | 2 | Tx Power Low Warning | MSB at lower byte address |
| 200-207 | 8 | Reserved | Reserved thresholds for channel parameter set 4 |
| 208-215 | 8 | Reserved | Reserved thresholds for channel parameter set 5 |
| 216-223 | 8 | Vendor Specific | Vendor Specific |
| 224 | 1 | Tx EQ & Rx Emphasis Magnitude ID | Tx EQ & Rx Emphasis Magnitude ID |
| 225 | 1 | Rx output amplitude support indicators | Rx output amplitude support indicators |
| 226-229 | 4 | Control options advertising | Control options advertising |
| 230-241 | 12 | Optional Channel Controls | Optional Channel Controls |
| 242-247 | 6 | Channel Monitor Masks | Channel Monitor Masks |
| 248-249 | 2 | Reserved | Reserved channel monitor masks set 4 |
| 250-251 | 2 | Reserved | Reserved channel monitor masks set 5 |
| 252-255 | 4 | Reserved | Reserved |

Mechanical Dimension

