WAVESPLITTER™ TECHNOLOGIES, INC.

Data Sheet

# 100G QSFP28 ER1 BIDI 40km Transceiver
# P/N: WST-QS28-BE4-xC

## Applications:

- Data Center
- 100 Gigabit Ethernet

## Standard:

- Compliant with industry standards 100G-ER1-30 MSA
- Compliant with SFF-8679 MSA hardware specification
- Compliant with SFF-8636、SFF-8661

## Features:

- Lane signaling rate 53.125 GBd with PAM4
- Up to 40km transmission on SMF
- Maximum power consumption 4.5 W
- EML laser and APD receiver
- 4x25.78Gb/s with NRZ electrical interface (CAUI-4)
- High speed I/O electrical interface
- I2C interface with integrated Digital Diagnostic monitoring
- QSFP28 MSA package with simplex LC connector
- Single +3.3V power supply
- Operating case temperature: 0 to +70 °C
- Compliant with RoHS

### *Absolute Maximum Ratings*

| Parameter | Symbol | Min | Max | Units | Notes |
|---|---|---|---|---|---|
| Storage Temperature | $T_S$ | -40 | 85 | °C | |
| Power Supply Voltage | $V_{CC}$ | -0.5 | 3.6 | V | |
| Relative Humidity (non-condensation) | RH | 15 | 85 | % | |

### *Recommended Operating Conditions*

| Parameter | Symbol | Min | Typical | Max | Units | Notes |
|---|---|---|---|---|---|---|
| Operating Case Temperature | $T_{OP}$ | 0 | | 70 | °C | |
| Power Supply Voltage | $V_{CC}$ | 3.135 | 3.3 | 3.465 | V | |
| Data Rate(optical) | DRo | | 106.25 | | Gb/s | |
| Bit Error Rate | BER | | | 2.4E-4 | | 1 |
| Transmission Distance | TD | | | 40 | km | 2 |

Notes:

1. Tested with a PRBS31Q test pattern for 53.125 GBd operation.
2. Distances are based on FC-PI-6 Rev. 3.1 and IEEE 802.3 standards, with FEC.

## *Electrical Characteristics*

| Parameter | Symbol | Min | Typical | Max | Units | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Module Supply Current | Icc | | | 1435 | mA | |
| Power Dissipation | PD | | | 4.5 | W | |
| Input Differential Impedance | Rin | 90 | 100 | 110 | Ω | |
| Differential Data Input Amplitude | VIN,P-P | 180 | | 900 | mVpp | |
| **Receiver** | | | | | | |
| Output Differential Impedance | Rout | 90 | 100 | 110 | Ω | |
| Differential Data Output Amplitude | VOUT,P-P | 300 | | 900 | mVpp | |

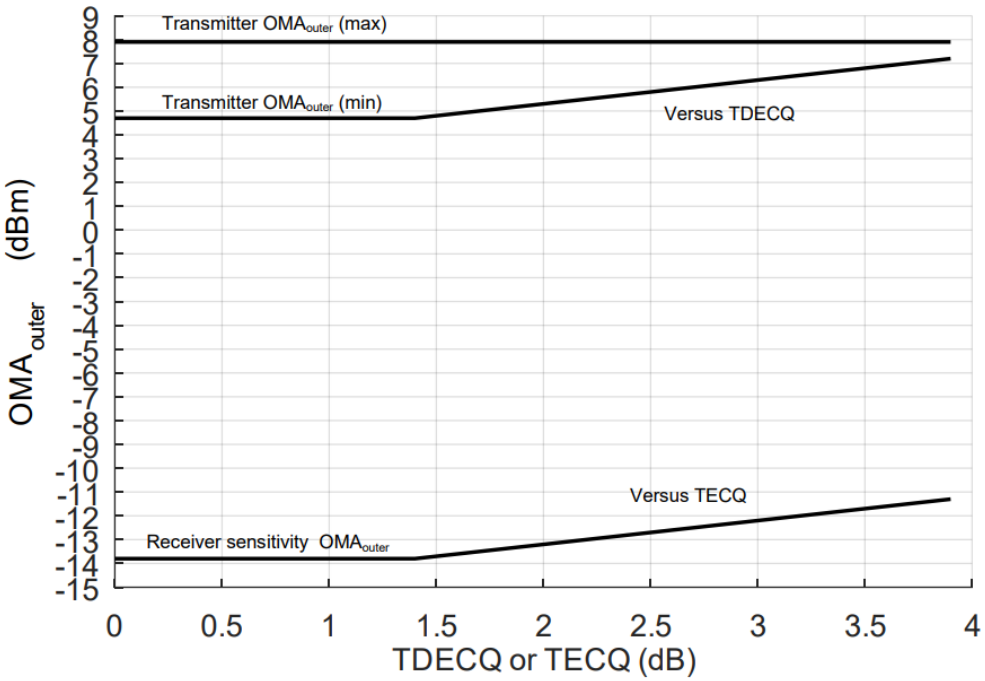
## *Optical Characteristics*

| Parameter | Symbol | Min | Typical | Max | Units | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Center Wavelength | CW | 1304.06 | 1304.58 | 1305.1 | nm | |
| | | 1308.61 | 1309.14 | 1309.66 | | |
| Average launch power | $P_{avg}$ | 1.7 | | 7.1 | dBm | 1 |
| Outer Optical Modulation Amplitude (OMA) | $OMA_{outer}$ | 4.7 | | 7.9 | dBm | TDECQ＜1.4 |
| | | 3.3+TDECQ | | | | TDECQ＞1.4 |
| Transmitter and dispersion eye closure for PAM4 (TDECQ) (max) | TDECQ | | | 3.9 | dBm | |
| \|TDECQ-TECQ\| | | | | 2.7 | dB | |
| Average Output Power (Laser Turn off) | $P_{OUT-OFF}$ | | | -15 | dBm | |
| Extinction ratio | ER | 5 | | | dB | |
| **Receiver** | | | | | | |
| Center Wavelength | CW | 1308.61 | 1309.14 | 1309.66 | nm | |
| | | 1304.06 | 1304.58 | 1305.1 | | |
| Damage threshold | Pdamage | -2.4 | | | dBm | 2 |
| Average Rx Power | $P_{RX}$ | -16 | | -3.4 | dBm | 3 |
| Receive power_OMAouter | $P_{OMA}$ | | | -2.6 | dBm | |

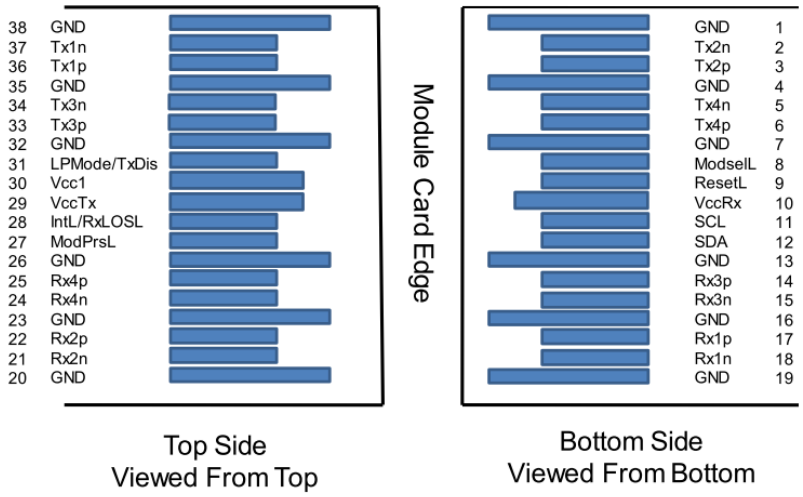
| | | | | | | |
|---|---|---|---|---|---|---|
| Receiver sensitivity_OMAouter | $SEN_{OMA}$ | | | -13.8 | dBm | TECQ < 1.4 dB,1 |
| | | | | -15.2 + TECQ | | 1.4 ≤ TECQ ≤ 3.9 dB |
| Los Assert | LosA | -24 | | | dBm | |
| Los De-Assert | LosDA | | | -18 | dBm | |
| Loss Hysteresis | LosH | 0.5 | | | dBm | |

Notes:

1. Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
2. Measured with PRBS31Q test pattern, 53.125GBd, BER< $2.4x10^{-4}$.



## *Pin Assignment*




**MSA compliant Connector**

| PIN | Logic | Symbol | Name/Description | Note |
|---|---|---|---|---|
| 1 | | GND | Ground | 1 |
| 2 | CML-I | Tx2n | Transmitter Inverted Data Input | |
| 3 | CML-I | Tx2p | Transmitter Non-Inverted Data output | |
| 4 | | GND | Ground | 1 |
| 5 | CML-I | Tx4n | Transmitter Inverted Data Input | |
| 6 | CML-I | Tx4p | Transmitter Non-Inverted Data output | |
| 7 | | GND | Ground | 1 |
| 8 | LVTLL-I | ModSelL | Module Select | 2 |
| 9 | LVTLL-I | ResetL | Module Reset | 2 |
| 10 | | VccRx | + 3.3V Power Supply Receiver | |
| 11 | LVCMOS-I/O | SCL | 2-Wire Serial Interface Clock | 2 |
| 12 | LVCMOS-I/O | SDA | 2-Wire Serial Interface Data | 2 |
| 13 | | GND | Ground | 1 |
| 14 | CML-O | Rx3p | Receiver Non-Inverted Data Output | |
| 15 | CML-O | Rx3n | Receiver Inverted Data Output | |
| 16 | | GND | Ground | 1 |
| 17 | CML-O | Rx1p | Receiver Non-Inverted Data Output | |
| 18 | CML-O | Rx1n | Receiver Inverted Data Output | |
| 19 | | GND | Ground | 1 |
| 20 | | GND | Ground | 1 |
| 21 | CML-O | Rx2n | Receiver Inverted Data Output | |

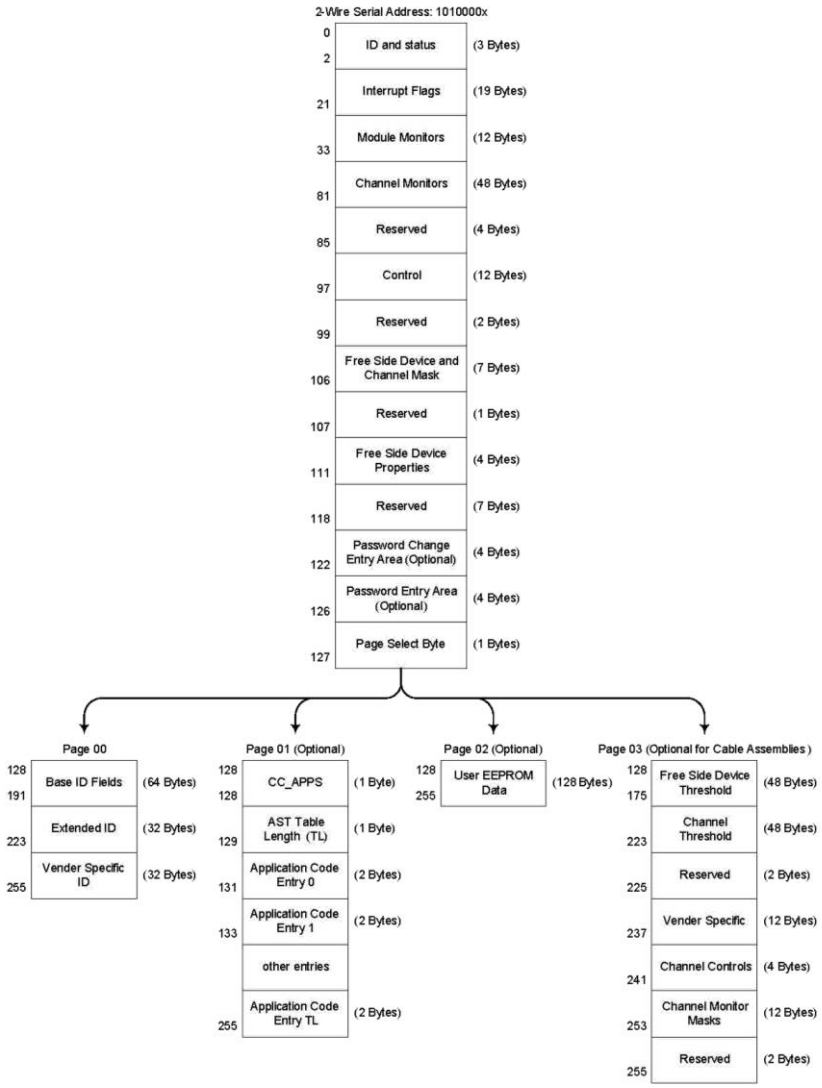
| | | | | |
|---|---|---|---|---|
| 22 | CML-O | Rx2p | Receiver Non-Inverted Data Output | |
| 23 | | GND | Ground | 1 |
| 24 | CML-O | Rx4n | Receiver Inverted Data Output | |
| 25 | CML-O | Rx4p | Receiver Non-Inverted Data Output | |
| 26 | | GND | Ground | 1 |
| 27 | LVTTL-O | ModPrsL | Module Present | |
| 28 | LVTTL-O | IntL/RxLOSL | Interrupt Optionally configurable as RxLOSL via the management interface(SFF-8636). | 2 |
| 29 | | VccTx | +3.3 V Power Supply transmitter | |
| 30 | | Vcc1 | +3.3 V Power Supply | |
| 31 | LVTTL-I | LPMode/ TxDis | Low Power Mode Optionally configurable as TxDis via the management interface(SFF-8636). | 2 |
| 32 | | GND | Ground | 1 |
| 33 | CML-I | Tx3n | Transmitter Inverted Data Input | |
| 34 | CML-I | Tx3p | Transmitter Non-Inverted Data output | |
| 35 | | GND | Ground | 1 |
| 36 | CML-I | Tx1p | Transmitter Non-Inverted Data Input | |
| 37 | CML-I | Tx1n | Transmitter Inverted Data Output | |
| 38 | | GND | Ground | 1 |

Notes:

1. GND is the symbol for signal and supply (power) common for the module. All are common within the 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 applied concurrently and may be internally connected within the module in any combination. Vcc contacts in SFF-8662 and SFF-8672 each have a steady state current rating of 1 A.

## *Memory Map*

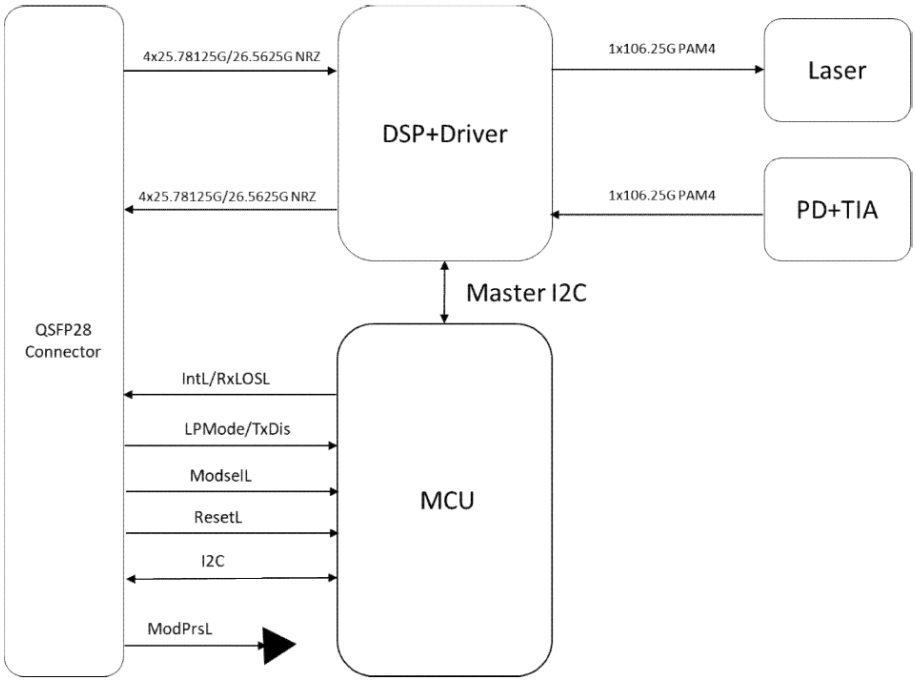
The memory map is structured as a single address and multiple page approaches, according to the QSFP SFF-8436 SNIA specification as shown in the below. For more detailed description of this memory map or lower pages, please see our Memory Map document with flexible customization settings.



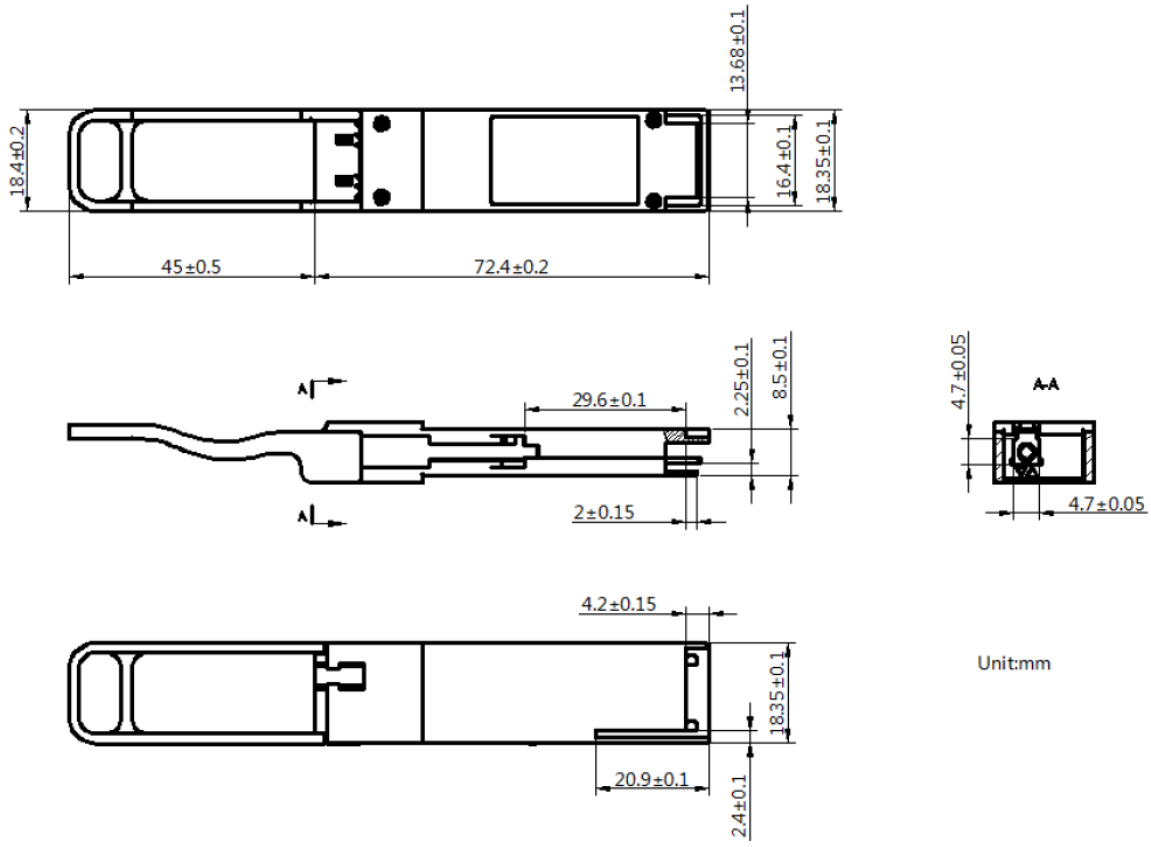

## *Digital Diagnostic Monitor Characteristics*

| Parameter | Accuracy | Unit |
|---|---|---|
| Transceiver Internal Temperature | ±3.0 | °C |
| Vcc Internal Supply Voltage | ±10.0 | % |
| Laser Bias Current | ±10 | % |
| Tx Output Power | ±3.0 | dBm |
| Rx Input Power | ±3.0 | dBm |

## *Block Diagram*




## *Mechanical Drawing*



## *Ordering Information*

| P/No. | Package | Bit Rate (Gb/s) | Laser | Optical Power (OMA) | Detector | Sensitivity (OMA) (dBm) | Case Temp (℃) | Distance (km) | Application | Pull Ring color |
|---|---|---|---|---|---|---|---|---|---|---|
| WST-QS28-BE4-UC | QSFP28 | 106.25 | 1304 nm EML | 4.7~7.9 dBm | APD | -13.8 | 0 to 70 | 40 | 100GBASE-ER1-40 BIDI | Blue |
| WST-QS28-BE4-DC | QSFP28 | 106.25 | 1309 nm EML | 4.7~7.9 dBm | APD | -13.8 | 0 to 70 | 40 | 100GBASE-ER1-40 BIDI | Green |

## *Modification History*

| Revision | Date | Description | Originator | Review | Approved |
|---|---|---|---|---|---|
| V1.0 | 08-Jun-2023 | New Issue | ShaoYu Lee | Ken Cheng | Wayne Liao |

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