

TS-C24LL292H40PC

200G CFP2 ER4

Features

- Supports 200GBASE-ER4;
- Lane signaling rate 53.125 Gb/s with PAM4;
- Up to 40km transmission on SMF;
- LAN WDM laser and APD receiver;
- High speed I/O electrical interface (200GAUI-8);
- I2C interface with integrated Digital Diagnostic monitoring;
- CFP2 MSA package with duplex LC connector;
- Single +3.3V power supply;
- Maximum power consumption 12 W;
- Operating case temperature: 0 to +70 °C;
- Compliant to IEEE802.3cn and CFP2 MSA hardware specification;
- Complies with EU Directive 2015/865/EU;

Application

- 200GBASE-ER4;
- 200G Ethernet.

Order Information

Table 1- order information

| Part No. | Data Rate | Laser | Fiber Type | Distance | Optical Interface | Temp | DDMI |
|------------------|-----------|---------|------------|----------|-------------------|-------|------|
| TS-C24LL292H40PC | 212.5Gb/s | LAN WDM | SMF | 40km | LC | 0~70C | Y |

Absolute Maximum Ratings

Table 2-Absolute Maximum Ratings

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|-----------------------------|-----------------|------|---------|------|------|-------|
| Storage Temperature | T _S | -40 | - | +85 | °C | |
| Supply Voltage | V _{CC} | -0.5 | - | +3.6 | V | |
| Operating Relative Humidity | RH | - | - | +85 | % | |

Recommended Operating Conditions

Table 3-Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|----------------------------|--------------------|------|---------|------|------|-----------|
| Operating Case Temperature | T _C | 0 | - | +70 | °C | |
| Power Supply Voltage | V _{CC} | 3.14 | 3.3 | 3.47 | V | |
| Power Supply Current | I _{CC} | - | - | 3.6 | A | |
| Maximum Power Dissipation | P _D | - | - | 12 | W | |
| Aggregate Bit Rate | BR _{AVE} | - | 212.5 | - | Gb/s | With PAM4 |
| Lane Bit Rate | BR _{LANE} | - | 53.125 | - | Gb/s | With PAM4 |
| Transmission Distance | TD | - | - | 40 | km | Over SMF |

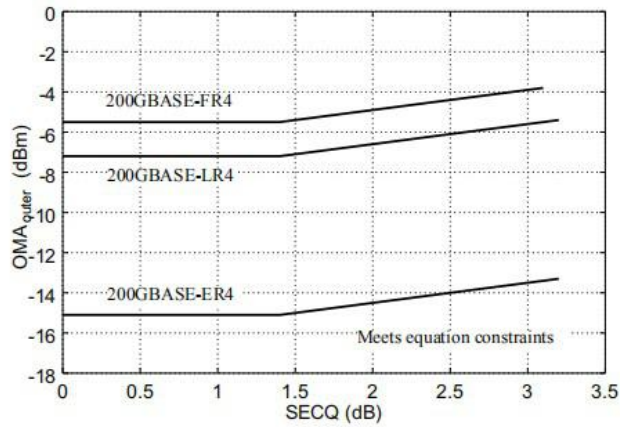
Optical Characteristics

Table 4-Optical Characteristics

| Transmitter | | | | | | |
|-------------------------------------------------------------------|-----------------------|---------|---------|---------|------|-----------------------|
| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
| Center Wavelength Lane 0 | λ_0 | 1294.53 | 1295.56 | 1296.59 | nm | |
| Center Wavelength Lane 1 | λ_1 | 1299.02 | 1300.05 | 1301.09 | nm | |
| Center Wavelength Lane 2 | λ_2 | 1303.54 | 1304.58 | 1305.63 | nm | |
| Center Wavelength Lane 3 | λ_3 | 1308.09 | 1309.14 | 1310.19 | nm | |
| Total Launch Power | P_{ALL} | - | - | 12.63 | dBm | Note 1 |
| Average Launch Power per Lane | P_{TX_LANE} | 0.4 | - | 6.63 | dBm | Note 1 |
| Outer Optical Modulation Amplitude per Lane | OMA | 3.4 | - | 7.4 | dBm | Note 2 |
| Launch power in OMA minus TDECQ, per lane For ER \geq 4.5dB | OMA - TDECQ | 2 | - | - | dB | Note 3 |
| Transmitter and dispersion eye closure for PAM4 (TDECQ), per lane | TDECQ | - | - | 3.2 | dB | |
| Difference in launch power between lanes | $P_{TX_DELTA_LANE}$ | - | - | 4 | dB | |
| Average Output Power (Laser Turn off) | $P_{OUT-OFF}$ | - | - | -30 | dBm | |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Extinction Ratio | ER | 6 | - | - | dB | |
| Receiver | | | | | | |
| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
| Center Wavelength Lane 0 | λ_0 | 1294.53 | 1295.56 | 1296.59 | nm | |
| Center Wavelength Lane 1 | λ_1 | 1299.02 | 1300.05 | 1301.09 | nm | |
| Center Wavelength Lane 2 | λ_2 | 1303.54 | 1304.58 | 1305.63 | nm | |
| Center Wavelength Lane 3 | λ_3 | 1308.09 | 1309.14 | 1310.19 | nm | |
| Damage threshold, per lane | P_{damage} | -2.37 | - | - | dBm | Note 4 |
| Average Rx Power per Lane | P_{RX_LANE} | -17.6 | - | -3.37 | dBm | Note 5 |
| Receive power(OMAouter) per lane, max | Roma | - | - | -2.6 | dBm | |
| Difference in receive power between any two lanes (OMA) | $P_{RX_DELTA_LANE}$ | - | - | 4.6 | dB | |
| Receiver sensitivity _OMA, per lane | SEN_OMA | - | - | -15.1 | dBm | @BER 2.4E-5 Note 6 |
| Receiver Reflectance | Ref | - | - | -26 | dBm | |

Notes:

1. Average launch power(min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1dB, the OMA (min) must exceed this value.
3. TDECQ is the Transmitter and Dispersion eye closure for PAM4.
4. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
5. Average received power(min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
6. RS=max(-15.1,SECQ-16.5)dB, refer to below diagram of receiver sensitivity for 200GBASE-ER4.



Electrical Characteristics

High-Speed Signal: Compliant to 200GAUI-8 (IEEE 802.3bs)

Low-Speed Signal: Compliant to CFP2 MSA Hardware Specification

Table 5-Electrical Characteristics

| Transmitter (Module Input) | | | | | | |
|------------------------------------------|----------------------|-----------------|----------------------|------|----------------------|-------|
| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
| Input Differential Impedance | R _{in} | - | 100 | - | Ohm | |
| Differential Data Input Amplitude | V _{IN,P-P} | 80 | - | 900 | mVpp | |
| Differential Termination Mismatch | Diff | - | - | 10 | % | |
| Transition time (min, 20% to 80%) | Tr Tf | 10 | | | ps | |
| Tx_Disable | Normal Operation | V _{IL} | -0.3 | - | 0.8 | V |
| | Laser Disable | V _{IH} | 2.0 | - | V _{CC} +0.3 | V |
| Receiver (Module Output) | | | | | | |
| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
| Output Differential Impedance | R _{out} | - | 100 | - | Ohm | |
| Differential Data Output Amplitude | V _{OUT,P-P} | - | - | 900 | mVpp | |
| Differential Termination Mismatch (1MHZ) | | - | - | 10 | % | |
| Rx_LOS | Normal Operation | V _{OL} | 0 | - | 0.4 | V |
| | Lose Signal | V _{OH} | V _{CC} -0.5 | - | V _{CC} +0.3 | V |

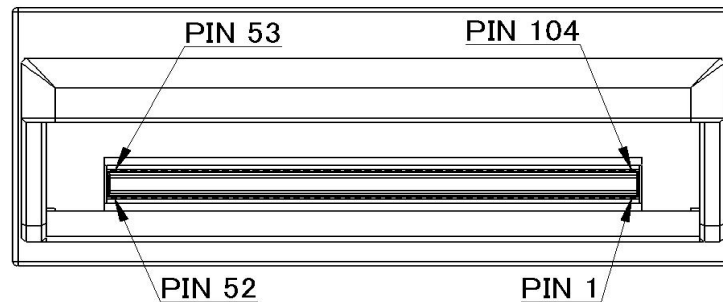
Digital Diagnostics

Table 6-Digital Diagnostics

| Parameter | Range | Accuracy | Unit | Calibration |
|--------------------------|----------------------|----------|------|-------------|
| Temperature | 0 to 70 | ±3 | °C | Internal |
| Voltage | 0 to V _{CC} | ±3% | V | Internal |
| Tx Bias Current Per Lane | 0 to 100 | ±10% | mA | Internal |
| Tx Output Power Per Lane | 0.4 to 6.63 | ±2 | dB | Internal |
| Rx Power (Each Lane) | LOS A to -2.3 | ±2 | dB | Internal |

Pin Definitions

The CFP2 connector has 104 pins which are arranged in Top and Bottom rows. The CFP2 connector supports the eight (8) 25Gbit/s TX lanes plus eight (8) 25Gbit/s RX lanes configurations.

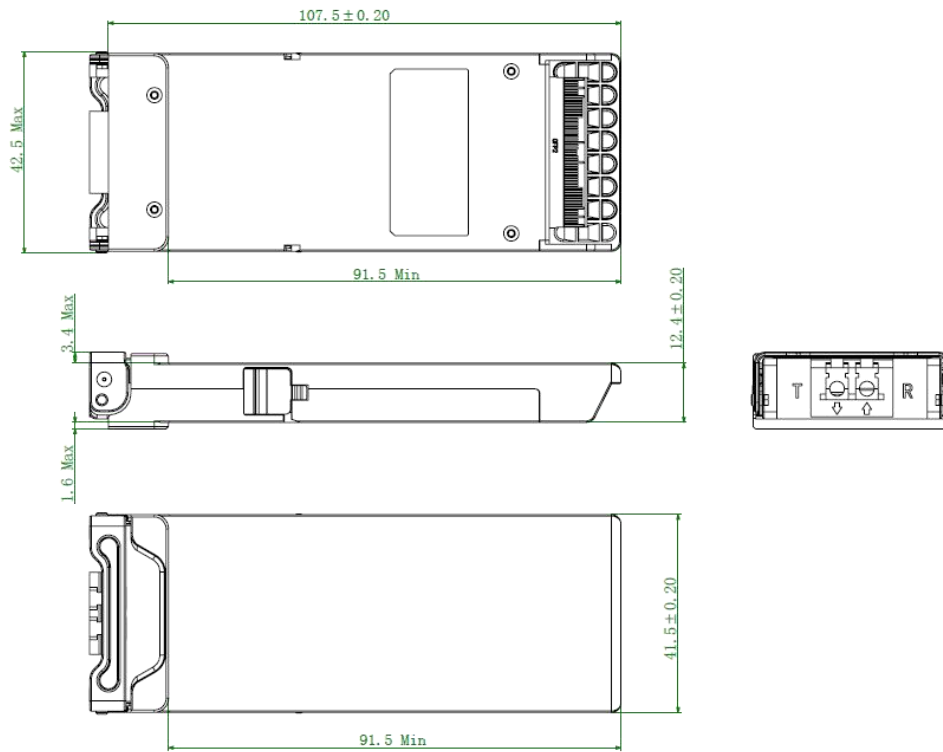


| Bottom | | Top | | | | | |
|--------|-----------|-----|---------|----|-----------|----|---------|
| 1 | GND | 104 | GND | 27 | MOD_ABS | 78 | REFCLKp |
| 2 | TX_MCLKn | 103 | TX7n | 28 | MOD_RSTn | 77 | GND |
| 3 | TX_MCLKp | 102 | TX7p | 29 | GLB_ALRMn | 76 | RX7n |
| 4 | GND | 101 | GND | 30 | GND | 75 | RX7p |
| 5 | N.C. | 100 | TX6n | 31 | MDC | 74 | GND |
| 6 | N.C. | 99 | TX6p | 32 | MDIO | 73 | RX6n |
| 7 | 3.3V_GND | 98 | GND | 33 | PRTADR0 | 72 | RX6p |
| 8 | 3.3V_GND | 97 | TX5n | 34 | PRTADR1 | 71 | GND |
| 9 | 3.3V | 96 | TX5p | 35 | PRTADR2 | 70 | RX5n |
| 10 | 3.3V | 95 | GND | 36 | VND_IO_C | 69 | RX5p |
| 11 | 3.3V | 94 | TX4n | 37 | VND_IO_D | 68 | GND |
| 12 | 3.3V | 93 | TX4p | 38 | VND_IO_E | 67 | RX4n |
| 13 | 3.3V_GND | 92 | GND | 39 | 3.3V_GND | 66 | RX4p |
| 14 | 3.3V_GND | 91 | TX3n | 40 | 3.3V_GND | 65 | GND |
| 15 | VND_IO_A | 90 | TX3p | 41 | 3.3V | 64 | RX3n |
| 16 | VND_IO_B | 89 | GND | 42 | 3.3V | 63 | RX3p |
| 17 | PRG_CNTL1 | 88 | TX2n | 43 | 3.3V | 62 | GND |
| 18 | PRG_CNTL2 | 87 | TX2p | 44 | 3.3V | 61 | RX2n |
| 19 | PRG_CNTL3 | 86 | GND | 45 | 3.3V_GND | 60 | RX2p |
| 20 | PRG_ALRM1 | 85 | TX1n | 46 | 3.3V_GND | 59 | GND |
| 21 | PRG_ALRM2 | 84 | TX1p | 47 | N.C. | 58 | RX1n |
| 22 | PRG_ALRM3 | 83 | GND | 48 | N.C. | 57 | RX1p |
| 23 | GND | 82 | TX0n | 49 | GND | 56 | GND |
| 24 | TX_DIS | 81 | TX0p | 50 | RX_MCLKn | 55 | RX0n |
| 25 | RX_LOS | 80 | GND | 51 | RX_MCLKp | 54 | RX0p |
| 26 | MOD_LOPWR | 79 | REFCLKn | 52 | GND | 53 | GND |

| PIN No. | Name | I/O | Logic | Description |
|---------|-----------|-----|-------------|---------------------------------------------------|
| 2 | TX_MCLKn | O | CML | For optical waveform testing. Not for normal use. |
| 3 | TX_MCLKp | O | CML | For optical waveform testing. Not for normal use. |
| 15 | VND_IO_A | O | 3.3V LVCMOS | No Connects |
| 16 | VND_IO_B | I/O | 1.8V LVCMOS | No Connects |
| 17 | PRG_CNTL1 | I | 3.3V LVCMOS | Programmable Control 1 set over MDIO |
| 18 | PRG_CNTL2 | I | 3.3V LVCMOS | Programmable Control 2 set over MDIO |
| 19 | PRG_CNTL3 | I | 3.3V LVCMOS | Programmable Control 3 set over MDIO |

| | | | | |
|-----|------------|-----|----------------------|------------------------------------------------------------------------------------------------------------------------------|
| 20 | PRG_ALARM1 | O | 3.3V LVCMOS | Programmable Alarm 1 set over MDIO |
| 21 | PRG_ALARM2 | O | 3.3V LVCMOS | Programmable Alarm 2 set over MDIO |
| 22 | PRG_ALARM3 | O | 3.3V LVCMOS | Programmable Alarm 3 set over MDIO |
| 24 | TX_DIS | I | 3.3V LVCMOS | Transmitter Disable for all lanes, "1" or NC=transmitter disabled,"0"=transmitter enabled |
| 25 | RX_LOS | O | 3.3V LVCMOS | Receiver Loss of Optical Signal, "1": low optical signal, "0": normal condition |
| 26 | MOD_LOPWR | I | LVCOMS | Module Low Power Mode. "1" or NC: module in low power (safe) mode, "0": power-on enabled |
| 27 | MOD_ABS | O | 3.3V LVCMOS | Module Absent. "1" or NC: module absent, "0": module present, Pull Up Resistor on Host |
| 28 | MOD_RSTn | I | 3.3V LVCMOS | Module Reset. "0" resets the module, "1" or NC = module enabled, Pull Down Resistor in Module |
| 29 | GLB_ALRMn | O | 3.3V LVCMOS | Global Alarm. "0": alarm condition in any MDIO Alarm register, "1": no alarm condition, Open Drain, Pull Up Resistor on Host |
| 31 | MDC | I | 1.2V LVCMOS | Management Data Clock (electrical specs as per IEEE Std 802.3-2012) |
| 32 | MDIO | I/O | 1.2V LVCMOS | Management Data I/O bi-directional data (electrical specs as per IEEE Std 802.3-2012) |
| 33 | PRTADR0 | I | 1.2V LVCMOS | MDIO Physical Port address bit 0 |
| 34 | PRTADR1 | I | 1.2V LVCMOS | MDIO Physical Port address bit 1 |
| 35 | PRTADR2 | I | 1.2V LVCMOS | MDIO Physical Port address bit 2 |
| 36 | VND_IO_C | I/O | 1.8V LVCMOS | No Connects |
| 37 | VND_IO_D | O | 3.3V LVCMOS | MSA_BER_Threshold,Connect to FPGA |
| 38 | VND_IO_E | I/O | 3.3V LVCMOS | No Connects |
| 50 | RX_MCLKn | O | CML | For optical waveform testing.Not for normal use. |
| 51 | RX_MCLKp | O | CML | For optical waveform testing.Not for normal use. |
| 78 | REFCLKp | I | See electrical specs | Internally AC Coupled, Terminated and Biased |
| 79 | REFCLKn | I | | Internally AC Coupled, Terminated and Biased |
| N/A | TX0-7(n/p) | I | See electrical specs | Please refer to PINOUT for each lane and polarity |
| N/A | RX0-7(n/p) | O | | Please refer to PINOUT for each lane and polarity |
| N/A | N.C. | | | No Connects |

Mechanical Dimension



Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.