

CFP4.100G.LR4

CFP4, 100G, LR4, 10km, 2xLC



Особенности:

- Supports 103Gbps and 112Gbps aggregate bit rates
- Single 3.3V Power Supply and Power dissipation < 6W
- Up to 10km transmission on SMF
- Hot-Pluggable CFP4 Footprint Duplex LC Connector Interface
- Compliant with CFP4 MSA Specification
- MDIO interface with integrated Digital Diagnostic Monitoring

Области применения:

- 100GBASE-LR4 Ethernet
- OTU4 4I1-9D1F

| Part No. | Data Rate ^{*note2} | Distance ^{*note1} | Interface | Temp. | DDMI |
|---------------|-----------------------------|----------------------------|-----------|----------|------|
| CFP4.100G.LR4 | 112Gbps | 10km | LC | Standard | Yes |

Note1: 9/125µm SMF

Note2: Switching between 100GBASE-LR4 and OTU4 4I1-9D1F through MDIO.

Absolute Maximum Ratings^{*note3}

| Parameter | Symbol | Min. | Max. | Unit |
|-----------------------------|-----------------|------|------|------|
| Storage Temperature | T _s | -40 | +85 | °C |
| Supply Voltage | V _{cc} | -0.5 | 3.6 | V |
| Operating Relative Humidity | RH | 5 | 85 | % |
| ESD ^{*note4} | | | 500 | V |

Note3: Exceeding any one of these values may destroy the device immediately.

Note4: Human body model.

Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|----------------------------|-----------------|------|---------|------|------|
| Operating Case Temperature | T _c | 0 | | 70 | °C |
| Power Supply Voltage | V _{cc} | 3.2 | 3.3 | 3.4 | V |
| Power Supply Noise | DC-1MHz | | 2 | | % |
| | 1-10MHz | | 3 | | |
| Power Consumption | P | MAX | | 6 | W |

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| | | | | | | |
|--|--|----------------|--|---------------------|---|-----|
| | | Low Power Mode | | | 1 | |
| Time of Power-On sequence & Reset Sequence | | | | TBD | | sec |
| Modulation Format | | | | NRZ, Mark Ratio 50% | | |

Performance Specifications - Electrical

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|---------------------------------|--------------------------------|------|------|------|------|----------------------------------|
| Transmitter | | | | | | |
| Input Amplitude (Differential) | V _{in} | 150 | | 1000 | mVpp | AC coupled inputs*(Note7) |
| Input Impedance (Differential) | Z _{in} | 85 | 100 | 115 | ohms | R _{in} > 100 kohms @ DC |
| Receiver | | | | | | |
| Output Amplitude (Differential) | V _{out} | 360 | | 900 | mVpp | AC coupled outputs*(Note7) |
| Output Impedance (Differential) | Z _{out} | 85 | 100 | 115 | ohms | |
| Output Rise/Fall Time | t _r /t _f | 9.5 | | | ps | 20%~80% |

1.2V MDIO Interface Specifications

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|------------------------------------|-------------------------|------|------|-------|------|-------|
| Input Voltage | V _{IH} | 0.84 | | 1.5 | V | |
| | V _{IL} | -0.3 | | 0.36 | V | |
| Input Leak current | I _{IN} | -100 | | 100 | uA | |
| Output Voltage | V _{OH} | 1.0 | | 1.5 | V | |
| | V _{OL} | -0.3 | | 0.2 | V | |
| Input Capacitance | C _I | | | 10 | pF | |
| Input MDC Clock | f _{MDC} | 0.1 | | 4 | MHz | |
| MDC Clock Period | T _{MDC} | 250 | | 10000 | ns | |
| MDIO Hold Time | T _{hold} | 10 | | | ns | |
| MDIO SetupTime | T _{setup} | 10 | | | ns | |
| Clock to output delay from the MMD | T _{dely} | 0 | | 300 | ns | |
| GLB_ALM | T _{glb_alm_as} | | | 150 | ms | |
| | T _{glb_alm_de} | | | 150 | ms | |
| MDC High time | T _{high} | | | 160 | ns | |
| MDC Low time | T _{low} | | | 160 | ns | |

Optical and Electrical Characteristics

OTU4 411-9D1F Operation

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--------------------|--------|------|---------|------|------|
| Transmitter | | | | | |

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| | | | | | |
|--|-------------------|-------------------|---------|---------|------|
| Signaling Speed per Lane | BR _{AVE} | | 27.95 | | Gbps |
| Data Rate Variation | | -20 | | +20 | ppm |
| Lane_0 Center Wavelength | λ_{C0} | 1294.53 | 1295.56 | 1296.59 | nm |
| Lane_1 Center Wavelength | λ_{C1} | 1299.02 | 1300.05 | 1301.09 | nm |
| Lane_2 Center Wavelength | λ_{C2} | 1303.54 | 1304.58 | 1305.63 | nm |
| Lane_3 Center Wavelength | λ_{C3} | 1308.09 | 1309.14 | 1310.19 | nm |
| Total Average Output Power*(Note5) | P _o | | | 8.9 | dBm |
| Average Launch Power per Lane | P _{each} | -2.5 | | 2.9 | dBm |
| Maximum channel power difference | | | | 5 | dB |
| Channel spacing | | | 800 | | GHz |
| Maximum spectral excursion | | -184 | | 184 | GHz |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB |
| Optical Return Loss Tolerance | | | | 20 | dB |
| Extinction Ratio*(Note6) | ER | 7 | | | dB |
| Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}*(Note6) | | G.959.1 Compliant | | | |
| TX Disable Assert Time | t _{off} | | | 100 | us |
| Receiver | | | | | |
| Signaling Speed per Lane | BR _{AVE} | | 27.95 | | Gbps |
| Data Rate Variation | | -20 | | +20 | ppm |
| Damage threshold | R _{dam} | 5.5 | | | dBm |
| Lane_0 Center Wavelength | λ_{C0} | 1294.53 | 1295.56 | 1296.59 | nm |
| Lane_1 Center Wavelength | λ_{C1} | 1299.02 | 1300.05 | 1301.09 | nm |
| Lane_2 Center Wavelength | λ_{C2} | 1303.54 | 1304.58 | 1305.63 | nm |
| Lane_3 Center Wavelength | λ_{C3} | 1308.09 | 1309.14 | 1310.19 | nm |
| Average Receive Power per Lane | R _{pow} | -8.8 | | 2.9 | dBm |
| Equivalent Receive Sensitivity per Lane*(Note8) | P _{min} | | | -10.3 | dBm |
| Maximum channel power difference | | | | 5.5 | dB |
| Maximum optical path penalty | | | | 1.5 | dB |
| Optical Return Loss | ORL | | | -26 | dB |
| LOS Assert | LOSA | -21.3 | | | dBm |
| LOS De-Assert | LOSD | | | -11.3 | dBm |
| LOS Hysteresis | | 0.5 | | | dB |

100GBASE-LR4 Operation

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--------------------------|-------------------|---------|---------|---------|------|
| Transmitter | | | | | |
| Signaling Speed per Lane | BR _{AVE} | | 25.78 | | Gbps |
| Data Rate Variation | | -100 | | +100 | ppm |
| Lane_0 Center Wavelength | λ_{C0} | 1294.53 | 1295.56 | 1296.59 | nm |
| Lane_1 Center Wavelength | λ_{C1} | 1299.0 | 1300.05 | 1301.09 | nm |

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| | | | | | |
|---|----------------|--|---------|---------|------|
| | | 2 | | | |
| Lane_2 Center Wavelength | λ_{C2} | 1303.5 4 | 1304.58 | 1305.63 | nm |
| Lane_3 Center Wavelength | λ_{C3} | 1308.0 9 | 1309.14 | 1310.19 | nm |
| Total Average Output Power*(Note5) | P_o | | | 10.5 | dBm |
| Average Launch Power per Lane | P_{each} | -4.3 | | 4.5 | dBm |
| Difference in launch power between any two lanes | | | | 5 | dB |
| Average launch power of OFF transmitter per lane | | | | -30 | dBm |
| Optical Return Loss Tolerance | | | | 20 | dB |
| Transmitter reflectance | | | | -12 | dB |
| Extinction Ratio*(Note11) | ER | 4 | | | dB |
| Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}*(Note11) | | IEEE 802.3 Clause 88 100Gbase-LR4 {0.25, 0.4, 0.45, 0.25, 0.28, 0.4} | | | |
| TX Disable Assert Time | t_{off} | | | 100 | us |
| Receiver | | | | | |
| Signaling Speed per Lane | BR_{AVE} | | 25.78 | | Gbps |
| Data Rate Variation | | -100 | | +100 | ppm |
| Damage threshold | R_{dam} | 5.5 | | | dBm |
| Lane_0 Center Wavelength | λ_{C0} | 1294.5 3 | 1295.56 | 1296.59 | nm |
| Lane_1 Center Wavelength | λ_{C1} | 1299.0 2 | 1300.05 | 1301.09 | nm |
| Lane_2 Center Wavelength | λ_{C2} | 1303.5 4 | 1304.58 | 1305.63 | nm |
| Lane_3 Center Wavelength | λ_{C3} | 1308.0 9 | 1309.14 | 1310.19 | nm |
| Average Receive Power per Lane | R_{pow} | -10.6 | | 4.5 | dBm |
| Receive Sensitivity in OMA per Lane*(Note13) | P_{min} | | | -8.6 | dBm |
| Stressed Sensitivity per lane | SRS | | | -6.8 | dBm |
| Optical Return Loss*(Note12) | ORL | | | -26 | dB |
| LOS Assert | LOSA | -20.6 | | | dBm |
| LOS De-Assert | LOSD | | | -10.6 | dBm |
| LOS Hysteresis*(Note10) | | 0.5 | | | dB |

Note5: Output is coupled into a 9/125 μ m single-mode fiber.

Note6: Filtered, measured with a PRBS 2³¹-1 test pattern @27.95Gbps

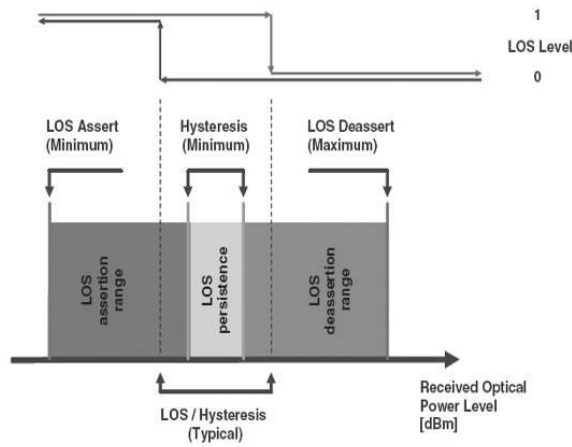
Note7: High speed I/O, internally AC coupled.

Note8: Minimum average optical power measured at BER less than 1E-5, with a 2³¹-1 PRBS without FEC. The Maximum bit error ratio for this application code of 1E-12 is only after error correction has been applied.

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Note9: Minimum average optical power measured at BER less than 1E-12, with a 2³¹-1 PRBS.

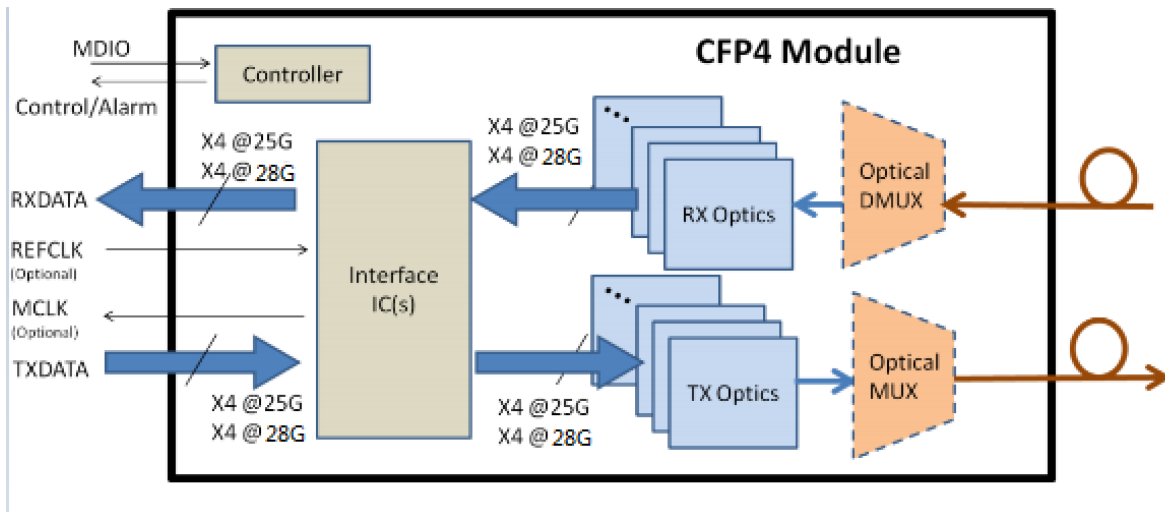
Note10: LOS Hysteresis



Note11: Filtered, measured with a PRBS 2³¹-1 test pattern @25.78Gbps

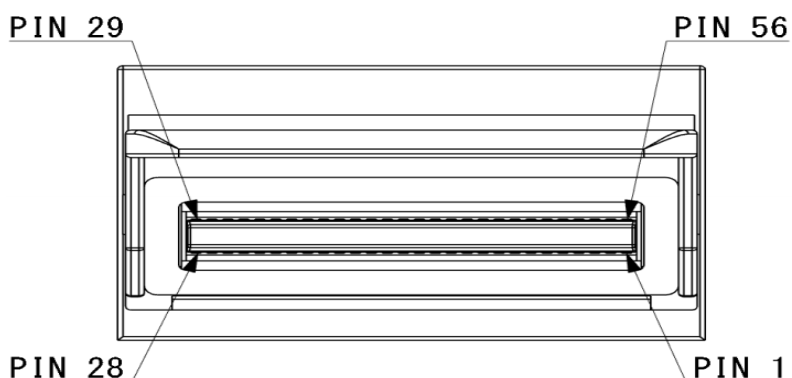
Note12: Conditions of stressed receiver sensitivity test at 1.8 dB vertical eye closure penalty per lane, 0.2 UI stressed eye J2 Jitter per lane, 0.47UI stressed eye J9 Jitter per lane.

Functional Description of Transceiver



CFP4 Transceiver Electrical Pad Layout

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Pin Function Definitions

| CFP4 Top | |
|-------------|-----------|
| 56 | GND |
| 55 | TX3n |
| 54 | TX3p |
| 53 | GND |
| 52 | TX2n |
| 51 | TX2p |
| 50 | GND |
| 49 | TX1n |
| 48 | TX1p |
| 47 | GND |
| 46 | TX0n |
| 45 | TX0p |
| 44 | GND |
| 43 | (REFCLKn) |
| 42 | (REFCLKp) |
| 41 | GND |
| 40 | RX3n |
| 39 | RX3p |
| 38 | GND |
| 37 | RX2n |
| 36 | RX2p |
| 35 | GND |
| 34 | RX1n |
| 33 | RX1p |
| 32 | GND |
| 31 | RX0n |
| 30 | RX0p |
| 29 | GND |

| CFP4 Bottom | |
|----------------|---------------------|
| 1 | 3.3V_GND |
| 2 | 3.3V_GND |
| 3 | 3.3V |
| 4 | 3.3V |
| 5 | 3.3V |
| 6 | 3.3V |
| 7 | 3.3V_GND |
| 8 | 3.3V_GND |
| 9 | VND_IO_A |
| 10 | VND_IO_A |
| 11 | TX_DIS (PNG_CNTL1) |
| 12 | TX_LOS (PNG_ALARM1) |
| 13 | GLB_ALRMn |
| 14 | MOD_LOPWR |
| 15 | MOD_ABS |
| 16 | MOD_RSTn |
| 17 | MDC |
| 18 | MDIO |
| 19 | PRTADR0 |
| 20 | PRTADR1 |
| 21 | PRTADR2 |
| 22 | VND_IO_C |
| 23 | VND_IO_D |
| 24 | VND_IO_E |
| 25 | GND |
| 26 | (MCLKn) |
| 27 | (MCLKp) |
| 28 | GND |

Bottom Row Pin Descriptions

| Pin Num. | Name | Function | Notes |
|----------|------|----------|-------|
|----------|------|----------|-------|

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| | | | |
|----|-----------------------|----------------------------|---|
| 1 | 3.3V_GND | Ground | 3.3V Module Supply Ground, Internally connected to Signal Ground |
| 2 | 3.3V_GND | | |
| 3 | 3.3V | 3.3V Module Supply Voltage | 3.3V ± 5% |
| 4 | 3.3V | | |
| 5 | 3.3V | | |
| 6 | 3.3V | | |
| 7 | 3.3V_GND | Ground | 3.3V Module Supply Ground, Internally connected to Signal Ground |
| 8 | 3.3V_GND | | |
| 9 | VND_IO_A | I/O | Module Vendor I/O A. NC |
| 10 | VND_IO_B | I/O | Module Vendor I/O B, NC |
| 11 | TX_DIS (PNG_CNTL1) | I | "1" or NC = transmitter disabled, "0" = transmitter enabled |
| 12 | TX_LOS (PNG_ALRM1) | O | "1" = loss of signal (low optical signal), "0" = normal condition |
| 13 | GLB_ALRMn | O | "0" = alarm condition in any MDIO Alarm register, "1" = no alarm condition, |
| 14 | MOD_LOPW R | I | "1" or NC = module in low power (safe) mode, "0" = power-on enabled |
| 15 | MOD_ABS | O | "1" or NC = module absent, "0" = module present |
| 16 | MOD_RSTn | I | "0" = resets the module, "1" or NC = module enabled |
| 17 | MDC | 1.2V COMS I | Management Data Clock |
| 18 | MDIO | 1.2V COMS I/O | Management Data I/O bi-directional data |
| 19 | PRTADR0 | 1.2V COMS I | MDIO Physical Port address bit 0 |
| 20 | PRTADR1 | 1.2V COMS I | MDIO Physical Port address bit 1 |
| 21 | PRTADR2 | 1.2V COMS I | MDIO Physical Port address bit 2 |
| 22 | VND_IO_C | I/O | Module Vendor I/O C. NC |
| 23 | VND_IO_D | I/O | Module Vendor I/O D. NC |
| 24 | VND_IO_E | I/O | Module Vendor I/O E. NC |
| 25 | GND | Ground | Signal Ground |
| 26 | (MCLKn) | CML O | For optical waveform testing |
| 27 | (MCLKp) | CML O | For optical waveform testing |
| 28 | GND | Ground | Signal Ground |

Top Row Pin Descriptions

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| Pin Num. | Name | Function | Notes |
|----------|-----------|-----------------------|-----------------------|
| 56 | GND | Ground | Signal Ground |
| 55 | TX3n | Lane 3 Tx Input I | CML Input |
| 54 | TX3p | | |
| 53 | GND | Ground | Signal Ground |
| 52 | TX2n | Lane 2 Tx Input I | CML Input |
| 51 | TX2p | | |
| 50 | GND | Ground | Signal Ground |
| 49 | TX1n | Lane 1 Tx Input I | CML Input |
| 48 | TX1p | | |
| 47 | GND | Ground | Signal Ground |
| 46 | TX0n | Lane 0 Tx Input I | CML Input |
| 45 | TX0p | | |
| 44 | GND | Ground | Signal Ground |
| 43 | (REFCLKn) | Reference Clock I | Reference Clock Input |
| 42 | (REFCLKp) | | |
| 41 | GND | Ground | Signal Ground |
| 40 | RX3n | Lane 3 Rx Output O | CML Output |
| 39 | RX3p | | |
| 38 | GND | Ground | Signal Ground |
| 37 | RX2n | Lane 2 Rx Output O | CML Output |
| 36 | RX2p | | |
| 35 | GND | Ground | Signal Ground |
| 34 | RX1n | Lane 1 Rx Output O | CML Output |
| 33 | RX1p | | |
| 32 | GND | Ground | Signal Ground |
| 31 | RX0n | Lane 0 Rx Output O | CML Output |
| 30 | RX0p | | |
| 29 | GND | Ground | Signal Ground |

Mechanical Specifications

| Parameter | Symbol | Max. | Unit | Spec |
|-----------|--------|------|------|---|
| Weight | | 90 | g | |
| Flatness | | 0.12 | mm | CFP MSA CFP4 HW spec Rev.0.1_5.3.1=0.12mm(class=4) |
| Roughness | Ra | 1.6 | μm | CFP MSA CFP4 HW spec Rev.0.1_5.3.1=0.16mm(class=4) |

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