

## DAC-QSFP28-100G-xM

### 100GBase QSFP28 Direct Attach Cable

Copper, Passive, 0.5m to 5m Lengths, Commercial Temperature

#### FEATURES

- Enhanced EMI / EMC performance
- 25Gbps data transfer rate per channel, up to 100Gbps
- Compliant with the IEEE 802.3bj standard and InfiniBand EDR specifications
- Meets QSFP+ MSA and SFF-8661 / SFF-8665 standards
- Support serial ID function through EEPROM
- 30AWG to 26AWG cable available
- RoHS and halogen-free options
- Commercial Operating Temperature Range: 0°C to 70°C

#### APPLICATIONS

- Switch / router / HBA / SAN / NIC card
- 40G / 100G Ethernet
- Storage, data centre, network centre
- InfiniBand, QDR / EDR

#### DESCRIPTION

DAC-QSFP28-100G-xM 100G QSFP28 Direct Attach Cable (DAC) is a 4-channel parallel passive copper cable for storage, data centres and high-performance computing connections. Each channel is capable of transmitting data at 25 Gbps, enabling a total data rate of 100Gbps up to 5 metres.

## WIRING DIAGRAM

| X1                                                   | X2                                                   | REMARKS | X1                                            | X2                                            | REMARKS                         |
|------------------------------------------------------|------------------------------------------------------|---------|-----------------------------------------------|-----------------------------------------------|---------------------------------|
| 18(RX1-)                                             | 37(TX1-)                                             | pair    | 37(TX1-)                                      | 18(RX1-)                                      | pair                            |
| 17(RX1+)                                             | 36(TX1+)                                             |         | 36(TX1+)                                      | 17(RX1+)                                      |                                 |
| 15(RX3-)                                             | 34(TX3-)                                             | pair    | 34(TX3-)                                      | 15(RX3-)                                      | pair                            |
| 14(RX3+)                                             | 33(TX3+)                                             |         | 33(TX3+)                                      | 14(RX3+)                                      |                                 |
| 6 (TX4+)                                             | 25(RX4+)                                             | pair    | 25(RX4+)                                      | 6 (TX4+)                                      | pair                            |
| 5 (TX4-)                                             | 24(RX4-)                                             |         | 24(RX4-)                                      | 5 (TX4-)                                      |                                 |
| 3 (TX2+)                                             | 22(RX2+)                                             | pair    | 22(RX2+)                                      | 3 (TX2+)                                      | pair                            |
| 2 (TX2-)                                             | 21(RX2-)                                             |         | 21(RX2-)                                      | 2 (TX2-)                                      |                                 |
| 1, 4, 7, 13,<br>16, 19, 20,<br>23, 26, 32,<br>35, 38 | 1, 4, 7, 13,<br>16, 19, 20,<br>23, 26, 32,<br>35, 38 | GND     | 8, 9, 10,<br>11, 12, 27,<br>28, 29, 30,<br>31 | 8, 9, 10,<br>11, 12, 27,<br>28, 29, 30,<br>31 | EEPROM<br>point at<br>both ends |

## ELECTRICAL CHARACTERISTICS

| ITEM                                                                       |                             | REQUIREMENT                                                                                                                                                                                         |           |        |        |        |        |           | TEST<br>CONDITION              |
|----------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|--------|--------|--------|-----------|--------------------------------|
| Differential Impedance                                                     | Cable Impedance             | 100+5/-10Ω                                                                                                                                                                                          |           |        |        |        |        |           | Rise time of 25ps (20% - 80%). |
|                                                                            | Paddle Card Impedance       | 100±10Ω                                                                                                                                                                                             |           |        |        |        |        |           |                                |
|                                                                            | Cable Termination Impedance | 100±15Ω                                                                                                                                                                                             |           |        |        |        |        |           |                                |
| Differential (Input/Output) Return loss $S_{DD11}/S_{DD22}$                |                             | $16.5-2\sqrt{f}$ $0.05 \leq f < 4.1$<br>$10.66-14\log_{10}(f/5.5)$ $4.1 \leq f \leq 19$<br>Where f is the frequency in GHz<br>Return loss (f) is the return loss at frequency f                     |           |        |        |        |        |           | 10MHz≤f ≤19GHz                 |
| Differential to common-mode (Input/Output) Return loss $S_{CD11}/S_{CD22}$ |                             | $22-(20/25.78)f$ $0.01 \leq f < 12.89$<br>$15-(6/25.78)f$ $12.89 \leq f \leq 19$<br>Where f is the frequency in GHz<br>Return_loss(f) is the Differential to common-mode return loss at frequency f |           |        |        |        |        |           | 10MHz≤f ≤19GHz                 |
| Common-mode to Common-mode (Input/Output) Return loss $S_{CC11}/S_{CC22}$  |                             | $Return\_loss(f) \geq 2\text{dB}$ $0.2 \leq f \leq 19$<br>Where f is the frequency in GHz<br>Return_loss(f) is the common-mode to common-mode return loss at frequency f                            |           |        |        |        |        |           | 10MHz≤f ≤19GHz                 |
| Differential Insertion Loss ( $S_{DD21}$ Max.)                             |                             | (Differential Insertion Loss Max. For TPa to TPb Excluding Test fixture)                                                                                                                            |           |        |        |        |        |           | 10MHz≤f ≤19GHz                 |
|                                                                            |                             | F AWG                                                                                                                                                                                               | 1.25GHz z | 2.5GHz | 5.0GHz | 7.0GHz | 10Ghz  | 12.89G hz |                                |
|                                                                            |                             | 30(1m) Max.                                                                                                                                                                                         | 4.5dB     | 5.4dB  | 6.3dB  | 7.5dB  | 8.5dB  | 10.5dB    |                                |
|                                                                            |                             | 30/28(3 m)Max.                                                                                                                                                                                      | 7.5dB     | 9.5dB  | 12.2dB | 14.8dB | 18.0dB | 21.5dB    |                                |
|                                                                            |                             | 26(3m) Max.                                                                                                                                                                                         | 5.7dB     | 7.2dB  | 9.9 dB | 11.9dB | 14.1dB | 16.5dB    |                                |
|                                                                            |                             | 26/25(5 m)Max.                                                                                                                                                                                      | 7.8dB     | 10.0dB | 13.5dB | 16.0dB | 19.0dB | 22.0dB    |                                |

## CONTINUED

|                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                          |                                         |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Insertion Loss Deviation</b>                                                                                                 | $-0.176 \cdot f - 0.7 \leq \text{ILD} \leq 0.176 \cdot f + 0.7$                                                                                                                                                                                                                                                                                 |                                                                                                                          | $50\text{MHz} \leq f \leq 19\text{GHz}$ |
| <b>Differential to common-mode Conversion Loss-Differential Insertion Loss (<math>S_{\text{CD21}} - S_{\text{DD21}}</math>)</b> | $\text{Conversion\_loss}(f) - \text{IL}(f) \geq \begin{matrix} 10 & 0.01 \leq f < 12.89 \\ 27-(29/22)f & 12.89 \leq f < 15.7 \end{matrix}$ <p>Where f is the frequency in GHz<br/>           Conversion_loss(f) is the cable assembly differential to common-mode conversion loss<br/>           IL(f) is the cable assembly insertion loss</p> |                                                                                                                          | $10\text{MHz} \leq f \leq 19\text{GHz}$ |
| <b>MDNEXT (multiple disturber near-end crosstalk)</b>                                                                           | $\geq 35\text{dB} @ 12.89\text{GHz}$                                                                                                                                                                                                                                                                                                            |                                                                                                                          | $10\text{MHz} \leq f \leq 19\text{GHz}$ |
| <b>Intra Skew</b>                                                                                                               | 15ps/m                                                                                                                                                                                                                                                                                                                                          |                                                                                                                          | $10\text{MHz} \leq f \leq 19\text{GHz}$ |
| <b>Low Level Contact Resistance</b>                                                                                             | 70milliohms Max. From initial.                                                                                                                                                                                                                                                                                                                  | EIA-364-23: Apply a maximum voltage of 20mV and a current of 100 mA.                                                     |                                         |
| <b>Insulation Resistance</b>                                                                                                    | 10Mohm (Min.)                                                                                                                                                                                                                                                                                                                                   | EIA364-21:AC 300V 1 minute                                                                                               |                                         |
| <b>Dielectric Withstanding Voltage</b>                                                                                          | NO disruptive discharge.                                                                                                                                                                                                                                                                                                                        | EIA-364-20: Apply a voltage of 300 VDC for 1minute between adjacent terminals and between adjacent terminals and ground. |                                         |

## ENVIRONMENTAL CHARACTERISTICS

| ITEM                                                   | REQUIREMENT                                                         | TEST CONDITON                                                                    |
|--------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <b>Operating Temperature Range</b>                     | 0°C to +70°C                                                        | Cable operating temperature range.                                               |
| <b>Storage Temperature Range (in packed condition)</b> | -40°C to +80°C                                                      | Cable storage temperature range in packed condition.                             |
| <b>Thermal Cycling Non-Powered</b>                     | No evidence of physical damage                                      | EIA-364-32D, Method A, -25 to 90C, 100 cycles, 15 min. dwells                    |
| <b>Salt Spraying</b>                                   | 48 hours salt spraying after shell corrosive area less than 5%.     | EIA-364-26                                                                       |
| <b>Mixed Flowing Gas</b>                               | Pass electrical tests per 3.1 after stressing. (For connector only) | EIA-364-35 Class II, 14 days.                                                    |
| <b>Temperature Life</b>                                | No evidence of physical damage                                      | EIA-364-17C w/ RH, Damp heat 90°C at 85% RH for 500 hours then return to ambient |
| <b>Cable Cold Bend</b>                                 | 4H, No evidence of physical damage                                  | Condition: -20°C ± 2°C, mandrel diameter is 6 times the cable diameter.          |

## MECHANICAL & PHYSICAL CHARACTERISTICS

| ITEM                                | REQUIREMENT                                    | TEST CONDITON                                                                                                                                                                                                           |
|-------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Vibration</b>                    | Pass electrical tests per 3.1 after stressing. | Clamp & vibrate per EIA-364-28E, TC-VII, test condition letter – D, 15 minutes in X, Y & Z axis.                                                                                                                        |
| <b>Twist</b>                        | No evidence of physical damage                 | Twist cable 180° ( $\pm 90^\circ$ from nominal position) for 100 cycles at 30 cycles per minute with a 0.5kg load applied to the cable jacket. Clamp position: 300mm                                                    |
| <b>Cable Flex</b>                   | No evidence of physical damage                 | Flex cable 180° for 20 cycles ( $\pm 90^\circ$ from nominal position) at 12 cycles per minute with a 1.0kg load applied to the cable jacket. Flex in the boot area 90° in each direction from vertical. Per EIA-364-41C |
| <b>Cable Plug Retention in Cage</b> | 90N Min.<br>No evidence of physical damage     | Force to be applied axially with no damage to cage. Per SFF 8661 Rev 2.1<br>Pull on cable jacket approximately 1 ft behind cable plug. No functional damage to cable plug below 90N.<br>Per SFF-8432 Rev 5.0            |
| <b>Cable Retention in Plug</b>      | 90N Min.<br>No evidence of physical damage     | Cable plug is fixtured with the bulk cable hanging vertically. A 90N axial load is applied (gradually) to the cable jacket and held for 1 minute. Per EIA-364-38B                                                       |
| <b>Mechanical Shock</b>             | Pass electrical tests Per 3.1 after stressing. | Clamp and shock per EIA-364-27B, TC-G,3 times in 6 directions, 100g, 6ms.                                                                                                                                               |
| <b>Cable Plug Insertion</b>         | 40N Max. (QSFP28)                              | Per SFF8661 Rev 2.1                                                                                                                                                                                                     |
| <b>Cable Plug Extraction</b>        | 30N Max. (QSFP28)                              | Place axial load on de-latch to de-latch plug. Per SFF8661 Rev 2.1                                                                                                                                                      |
| <b>Durability</b>                   | 50 cycles, No evidence of physical damage      | EIA-364-09, perform plug & unplug cycles: Plug and receptacle mate rate: 250 times/hour. 50 times for QSFP28/SFP28 module (CONNECTOR TO PCB)                                                                            |

## MECHANICAL DIMENSIONS (UNITS: mm)

